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Fashion pattern recommendation system based on Kansei evaluation and cognition

Mengyun Zhang

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Par

Mengyun ZHANG

DOCTORAT délivré par CENTRALE LILLE

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**Fashion Pattern Recommendation System
Based on Kansei Evaluation and Cognition**

*Système de recommandation de modèles de mode
basé sur l'évaluation Kansei et la cognition*

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Système de recommandation de modèles de mode basé sur l'évaluation Kansei et la cognition

Résumé

Avec le développement rapide de l'industrie du vêtement et de la demande des consommateurs, l'industrie de la mode passe progressivement de la production de masse à la personnalisation, passant d'une approche centrée sur les produits de base à une approche centrée sur le consommateur. Les consommateurs accordent plus d'attention à la personnalisation des produits de mode pour répondre à leurs besoins perceptifs. Le motif de mode est un élément d'expression important de la personnalisation de la mode intégrant les préférences perceptuelles des consommateurs.

Le travail de recherche présenté a pour objectif de mettre en place un système de recommandation de motif personnalisé utilisable pour recommander un motif selon les préférences du consommateur. Le fait que les consommateurs aient une image perceptive vague et incertaine des motifs est prise en compte dans le système afin de fournir une recommandation de motif en accord avec leurs besoins perceptuels. Le travail se répartit en quatre phases. Il a tout d'abord été nécessaire de réaliser un premier classement des motifs en différents groupes. Ceux-ci étant très divers, ils ont été classés en fonction de leurs attributs en se fondant sur des articles scientifiques et des magazines de mode, puis dans un second temps des groupes ont été conçus par des experts du domaine. Les attributs Kansei des différents motifs ont également été étudiés. Une méthode d'exploration de texte a ensuite été appliquée pour extraire les mots Kansei nécessaires à l'évaluation Kansei des motifs. Dix paires de mots ont été extraites afin de réaliser une évaluation sensorielle quantitative. L'apprentissage automatique a permis d'explorer l'image perceptive et sa relation avec les motifs de mode. Plusieurs modules de caractérisation des différents ensembles de données perceptuelles issues des expériences de l'évaluation sensorielle ont alors pu être proposés. La force de ce travail est la pluridisciplinarité du sujet, mettant en parallèle des notions subjectives de style et de mode, ainsi que de ressenti du consommateur et le développement d'un

système de traitement de données automatisé. Un tel système permet d'intégrer la notion d'émotion dans le processus de création et peut constituer un service d'accompagnement efficace aux consommateurs lors de leurs achats. Ce manuscrit de 163 pages est rédigé de façon à ce que ça soit le plus claire et soignée possible. Vous y trouverez des illustrations pertinentes et de bonne qualité pour appuyer les propos développés. Les hypothèses sont expliquées clairement et validées par des cas pratiques. Le document commence par un état de l'art des travaux traitant des recommandations sur la mode et les motifs. J'y ai tout d'abord introduit les concepts de mode, de création et de tendances, avant de détailler les notions de motif et de l'image perceptive associée puis présente ensuite les travaux récents dans ces domaines et analyse les inconvénients des méthodes et procédés de recommandation actuels. J'y conclu en présentant des objectifs de recherche ainsi que de l'importance de développer un système de recommandation basé sur la connaissance. Tout est fait en sorte que l'ensemble soit présenté de manière la plus logique et claire possible, avec des références bibliographiques nombreuses (près de 200 références), issues de sources très variées. Hormis pour quelques références plus anciennes, les travaux recensés se concentrent sur les vingt dernières années (de 2000 à aujourd'hui), ce qui devient cohérent lorsque l'on introduit un facteur mode à mon sens. L'ensemble est fait en sorte que ça soit détaillé tout en restant centré sur les notions qui seront essentielles à la suite de l'étude, en mettant notamment en avant le lien de chacun des concepts avec le motif.

Le chapitre 2 présente la méthodologie de sélection et de définition des différentes classes de motifs. Les différentes classes ont tout d'abord été recherchées dans la littérature et les magazines de mode. Les 62 motifs retenus ont été envoyés à un groupe de 35 experts qui les ont triées selon leurs connaissances professionnelles. Le classement a ensuite été affiné grâce à plusieurs séances de brainstorming. Cette première phase a été réalisée en suivant une approche systématique selon un protocole défini. Pour le classement final, 35 experts et 161 étudiants ont été invités à choisir des modèles de mode parmi les classes de modèles présélectionnées en leur attribuant une note fonction de leurs préférences et habitudes de création. Cette dernière étape a permis de définir les 9 classes retenues pour la suite de l'étude : animal, nourriture,

plante, géométrie, paysage, humain, national, texte et ustensile.

Le chapitre 3 présente le concept et les outils d'ingénierie Kansei qui seront utilisés dans la suite de l'étude pour extraire les données à partir des évaluations Kansei. La méthode d'exploration de texte a été appliquée pour extraire les mots Kansei de différents sites internet représentatifs du domaine de la mode. Le rapport entre la fréquence des termes et la fréquence des paragraphes a été utilisé pour construire des données textuelles structurées pour l'analyse quantitative et réduire le nombre d'adjectifs. 10 paires de mots Kansei ont ainsi été extraites pour l'évaluation Kansei, « Traditionnel – Moderne », « Stable – Vivant », « Peu attrayant – Attrayant », « Dur – Doux », « Simple – Fantaisie », « Kitsch – Élégant », « Rugueux – Lisse », « Décontracté – Formel », « Conservateur – Radical », « Masculin – Féminin ». Les mots Kansei ont ensuite été validés grâce à une étude de cas sur la classe de motif « animal ». Je vous démontre ici que les cognitions d'une même classe de motif tendent à s'uniformiser même si le style est différent et que l'évaluation Kansei est une approche efficace pour relier les mondes physique et émotionnel.

Le chapitre 4 est consacré aux techniques utilisées dans le système de recommandation de motif proposé, à savoir les ensembles flous, les nombres triangulaires flous, l'enquête par questionnaire et analyse des données, ainsi que le réseau de neurones utilisé dans l'apprentissage automatique. J'essaie de vous démontrer ici que même en combinant les méthodes de machine learning et d'évaluation subjective, il reste difficile de recommander précisément un motif donné car les perceptions sont multiples, complexes et floues. J'ai ainsi développé une « valeur d'utilité » permettant de mapper les mots Kansei et de corrélérer tous les motifs aux paires de mots Kansei. Les recommandations peuvent alors être personnalisées en fonction des profils et des préférences perceptuelles d'un utilisateur tout en améliorant leur précision.

Enfin, le chapitre 5 propose un système de recommandation permettant à la fois de répondre aux besoins personnalisés des utilisateurs et de construire un module de recommandation collaboratif entre experts et utilisateurs basé sur les données des utilisateurs. Un module de recommandation fondé sur les connaissances y a été

développé à partir des données collectées lors des évaluations Kansei menées aux chapitres 2 et 3. Les bases de connaissance ont été créées à partir des préférences du consommateur (entrées) et des profils de motifs (sorties). La combinaison permet de prédire le motif souhaité. J'ai ensuite mené une étude de cas afin de vérifier l'efficacité du système de recommandation. Les résultats expérimentaux obtenus montrent que les utilisateurs sont satisfaits du motif qui leur est proposé (à plus de 80%) et que le système est également utilisable par les designers.

Pour finir je termine le chapitre en indiquant les problèmes restant à résoudre pour améliorer le système.

Ce mémoire se termine par une conclusion générale mettant en avant les principales contributions de cette étude, à savoir, une classification systématique des motifs, la définition de mots Kansei pour une étude sensorielle, la cognition des motifs et la création d'un système de recommandation de motif intelligent.

En raison de contrainte de temps, il reste encore beaucoup d'améliorations et de progrès à apporter dans notre travail future: Le nombre d'échantillons de motifs impliqués dans l'étude n'est pas assez étendu, les résultats et conclusions sont essentiellement basé sur les motifs sélectionnés. Dans la pratiques les résultats proposé seront plus fiable avec un panel de données dataset supplémentaire par conséquent, à l'avenir en améliorant la base de connaissances du système on obtiendra des résultats plus complet.

Dans le context de la création de contenu généré par l'intelligence artificielle (AIGC), La méthode d'identification automatique ou de génération de motifs peut être utilisée afin d'étendre la base de données, améliorer la précision du système et élargir les possibilités d'application des différent scénarios.

Mots clés: Système de recommandation, Motif de mode, Évaluation Kansei, Cognition, Ingénierie Kansei

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General Introduction

With the rapid development of the apparel industry and personality-consumer demand, the fashion industry is gradually changing from mass production to personalized customization, changing from commodity-centered to consumer-centered.

In this context, it is necessary to develop a personalized consumer-oriented recommendation system that is capable of selecting relevant products from vague and uncertain consumers' functional and fashion requirements. Like sales advisors which exist in many real fashion shops, this system can effectively provide accompaniment services to consumers during their purchasing activities.

Recommendation systems have become extremely common in recent years [1, 2], and have been applied in a variety of applications. The most popular ones are probably movies, music, news, books, and academic literature searching [3, 4]. There are also recommendation systems for experts, jokes, restaurants, financial services, life insurance, and so on [4-7].

To improve the sense of participation of consumers in the personalized customization of fashion, we conclude that it was necessary to implement and improve an intelligent fashion pattern recommendation system. It should be capable of understanding consumers' vague and uncertain emotional demands and giving them, beyond their personal observations, advanced suggestions for fashion design.

The consumer's emotion is an important factor in the consumption of fashion products, it is necessary to integrate emotions into the current fashion design and recommendation systems [8-10].

For dealing with these requirements that involve uncertainty, we use fuzzy sets and fuzzy operations to formalize concerned data and model the relationship between a consumer profile and a product profile.

This thesis is organized as follows:

Chapter 1: State-of-the-Art and Fashion Patterns

This chapter stated the state-of-the-art of fashion and fashion pattern

recommendation related research. It also introduced the basic concepts of fashion and fashion design, fashion trends, the fashion industry, fashion patterns, the perceptual image of fashion patterns, and general recommendation systems about fashion. Then, we presented recent research progress in these fields in detail and analyze the disadvantages of the current fashion recommendation systems methods and processes. Finally, we raised the research purposes, significance, and methods for the development of a knowledge-based fashion pattern recommendation system.

Chapter 2: Fashion Pattern Class Selection

We summarized fashion patterns into various classes according to their natural attributes from research papers and fashion magazines. The Kansei attributes of different fashion patterns were then investigated more clearly through a series of experiments involving both experts and students. In one experiment, 35 experts and 161 students were asked to choose fashion patterns from the preselected pattern classes. The selected classes should be paratactic without inclusion and repetition among different classes.

The final 9 fashion pattern classes were set as Animal, Food, Plant, Geometry, Landscape, Human, National, Text, and Utensil. By understanding the Kansei attributes associated with different fashion patterns, designers can create products that appeal to consumers' emotions and preferences, ultimately leading to increased sales and customer satisfaction.

Chapter 3: Kansei Evaluation of Fashion Patterns

To explore the perceptual image of fashion patterns, we conducted the Kansei evaluation using the extracted Kansei words. In this chapter, the text mining method was applied to extracting Kansei words for Kansei evaluation. T/P value is proposed to construct structured text data for quantitative analysis, 10 pairs of Kansei words were extracted for Kansei evaluation, “Traditional – Modern”, “Steady – Lively”, “Unattractive – Attractive”, “Hard – Soft”, “Simple – Fancy”, “Tawdry – Elegant”, “Rough – Smooth”, “Casual – Formal”, “Conservative – Radical”, “Masculine –

Feminine”, which can be used for Kansei evaluation of fashion patterns or other fashion items. These Kansei words are effective to lead accurate percipient cognitions in the Kansei study. It is apparent that the cognitions of the same pattern object tend to be consistent even for different styles, and familiar pattern objects are more effective to connect the design intents of designers and the percipient cognitions of consumers. The findings of this study suggest that fashion designers have better used familiar pattern objects to effectively transmit design intents in fashion items for consumers; also, Kansei evaluation is a new approach to connect the physical world and emotion to study the percipient cognitions of fashion patterns.

Chapter 4: Techniques Used in The Proposed Fashion Pattern Recommendation System

In this chapter, we introduced the main techniques used in the proposed fashion pattern recommendation system, such as fuzzy set theory and its application, the triangular fuzzy number used for the Kansei evaluation, the formalization method of involved data in the Kansei evaluations, questionnaire investigation of perceptual image for fashion patterns and the data process method. We also introduced the DenseNet and BP neural network model for fashion pattern recommendation in this study.

We used these methods to make the correlation analysis and variance analysis to analyze the perceptual images of fashion patterns, including the perceptual images of patterns in the same pattern class, and the perceptual images of different pattern classes. Also, we analyzed the cognitive differences of different populations and the cognitive differences between consumers and designers, which can be used as the basis for a fashion pattern recommendation system.

Chapter 5: Knowledge-based Recommendation System for Fashion Pattern

Based on the investigation of cognitive differences of different populations and the cognitive differences between consumers and designers, and the knowledge-based recommendation module, this chapter presents the development of the recommendation

system for personalized products according to the specific consumer preference, especially the perceptual preference for patterns. This knowledge-based module has been developed by exploiting the knowledge of the relationship between consumer preference and product attributes. We also conducted a case study using the proposed recommendation system, and verified its effectiveness, the satisfaction is 8.3 out of 10.

The knowledge updating module enables to adjust of the knowledge base according to the feedback information of consumers to improve the satisfaction degree of recommendation. The knowledge base can also be updated by changing or adding elements of consumer preference. This module makes the whole recommendation system more flexible and more adapted to changes in fashion trends and consumers' perceptions and preferences.

The general framework of the research work and proposed recommendation system are shown in Figure 0-1.

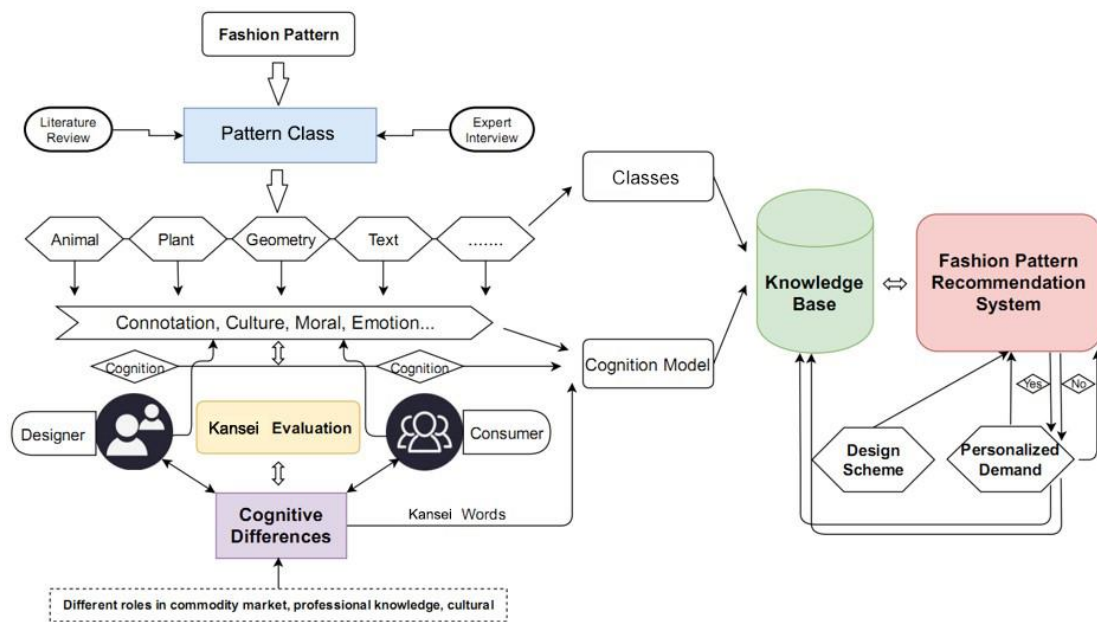


Figure 0-1. Framework of this study

All the modules and rules developed in Chapter 3, Chapter 4, and Chapter 5 are combined and constitute a knowledge-based system for the fashion pattern recommendation system.

The results of the fashion pattern recommendation system will improve a sense of participation in fashion design for consumers and provide useful support for suggesting

the most appropriate decision support for fashion design. It also has a self-learning capacity by progressively integrating both consumers' and designers' perceptions and knowledge into the system. With this learning capacity on fashion patterns, Kansei images, and consumer profiles, the efficiency of the proposed system will be enhanced in order to propose more relevant patterns in the process of fashion design.

This study establishes a valuable framework for capturing consumers' subjective perceptions. The proposed method not only assists consumers and designers in choosing fashion patterns in a collaborative design, but also supports the development of other fashion products that align with consumers' perceptual needs.

Chapter 1 State-of-the-Art

In this chapter, we provide an overview of fundamental concepts in the realm of fashion and fashion design, including fashion trends, the fashion industry, fashion patterns, the perceptual image of fashion patterns, and general recommendation systems related to fashion. Subsequently, we delve into a comprehensive examination of recent advancements in these areas, while also scrutinizing the drawbacks associated with the existing methods and processes employed in fashion recommendation systems. Finally, we outline the research objectives, significance, and methodologies pertaining to the development of a knowledge-based fashion pattern recommendation system.

1.1 Fashion and Fashion Design

Fashion is a form of self-expression and autonomy at a particular period and place and in a specific context, of clothing, footwear, lifestyle, accessories, makeup, hairstyle, and body posture[11]. This term implies a look defined by the fashion industry as that which is trending. Everything that is considered fashion is available and popularized by the fashion system.

The French word “mode”, meaning “fashion”, dated as far back as 1482, while the English word denoting something in style dated only to the 16th century. Other words exist related to concepts of style and appeal that precede mode. In the 12th and 13th-century, the concept of elegance begins to appear in the context of aristocratic preferences to enhance beauty and display refinement, the idea of making oneself more attractive to others by style or artifice in grooming and dress, appears in the 13th-century poem by Guillaume de Lorris advising men that “handsome clothes and handsome accessories improve a man a great deal” [12].

Fashion can signify the latest trends, but it may often reference the fashions of the previous era and integrate ideas, art, and life of the current era, leading to new fashions from a different period.

Whereas a trend often connotes a peculiar aesthetic expression, often lasting shorter than a season and being identifiable by visual extremes, fashion is a distinctive and industry-supported expression traditionally tied to the fashion season and collections [13]. Style is an expression that lasts over many seasons and is often connected to cultural movements and social markers, symbols, class, and culture.

Even though the terms fashion, clothing and costume are often used together, fashion differs from the others. Clothing describes the material and the technical garment, devoid of any social meaning or connections; costume has come to mean fancy dress or masquerade wear. Fashion, by contrast, describes the social and temporal system that influences and “activates” dress as a social signifier in a certain time and context. Philosopher Giorgio Agamben connects fashion to the qualitative Ancient Greek concept of Kairos, meaning “the right, critical, or opportune moment”, and clothing to the quantitative concept of Chronos, the personification of chronological or sequential time[14].

In its most common use, the term fashion refers to the current expressions on sale through the fashion industry. The global fashion industry is a product of the modern age. Before the mid-19th century, most clothing was custom-made. It was handmade for individuals, either as home production or on order from dressmakers and tailors. By the beginning of the 20th century, with the rise of new technologies such as the sewing machine, the rise of global trade, the development of the factory system of production, and the proliferation of retail outlets such as department stores, clothing became increasingly mass-produced in standard sizes and sold at fixed prices.

Fashion is a popular style, especially existing in garments, footwear, accessories and makeup [15]. Fashion is a larruping and constant trend in the style in which a person dresses. It is the prevailing style and the newest creations of designers.

Fashion essentially involves changes, defined as a succession of short-term trends and fads. From this view, there can be fashions in almost any human activity [16]. Fashion terms and activities as shown in Figure 1-1.



Figure 1-1. Fashion terms and activities

1.1.1 Fashion Concepts

The concept of fashion refers to the prevailing styles, trends, and aesthetics that are popular and widely accepted in a particular time and culture. It encompasses clothing, accessories, hairstyles, makeup, and other elements of personal appearance. Fashion is a dynamic and ever-changing phenomenon that reflects societal attitudes, values, and influences from various sources such as art, music, technology, and subcultures [17].

Fashion serves multiple purposes, including self-expression, cultural identification, and social communication. It allows individuals to showcase their unique style, personality, and creativity through the way they dress and present themselves. Fashion also plays a role in social differentiation, as different groups or subcultures may adopt distinct fashion styles to express their shared values, beliefs, or affiliations. In addition to personal expression, fashion is influenced by and influences various industries such as design, retail, media, and advertising [18]. Fashion designers create new collections and innovative designs, while fashion houses and brands market and distribute these creations to consumers. The media and social media platforms play a crucial role in disseminating fashion trends and influencing consumer preferences.

However, it's important to note that fashion can have both positive and negative

impacts. On the one hand, it promotes creativity, self-confidence, and cultural diversity, on the other hand, it can contribute to excessive consumerism, body image issues, and environmental concerns due to fast fashion and wasteful practices [19].

Ultimately, fashion is a complex and multifaceted concept that reflects the ever-changing tastes, values, and aspirations of individuals and society as a whole. It is a powerful form of expression and a reflection of our collective cultural identity [20].

In this study, fashion is specifically referring to the items people wear on their bodies to protect themselves, cover intimate areas, and showcase personal style and social status. It encompasses various garments and accessories such as shirts, pants, dresses, jackets, shoes, hats, gloves, scarves, and more [21]. e concepts are shown in Figure 1-2. The primary function of fashion is to provide protection and coverage, while also carrying symbolic significance in social and cultural contexts [22]. By selecting different types and styles of clothing, individuals can express their personality, group affiliation, occupational identity, and fashion preferences.



Figure 1-2. Fashion concepts

Fashion not only serves practical purposes but also plays a significant role in cultural expression and communication. It reflects the traditions, values, and aesthetics of different societies and can convey messages about an individual's identity, beliefs, and social standing. Fashion choices are influenced by factors such as personal taste, societal norms, climate, occasion, and trends. Fashion designers and brands play a crucial role in shaping and influencing clothing styles, as they continuously create

innovative designs that resonate with the evolving preferences of consumers [23]. Overall, fashion is a form of self-expression and a means of establishing social identity in addition to its functional aspects.

1.1.2 Fashion Design

Fashion design is the creative process of conceptualizing, creating, and producing original clothing and accessory designs. It involves combining artistic vision, technical skills, and knowledge of fashion trends to develop unique and aesthetically pleasing garments [24].

Fashion designers draw inspiration from various sources, such as art, culture, nature, historical eras, and personal experiences. They begin by creating initial sketches or mood boards to visualize their design concepts [25]. These sketches capture the overall silhouette, details, and desired style of the garments. Fashion design sketches are shown in Figure 1-3.

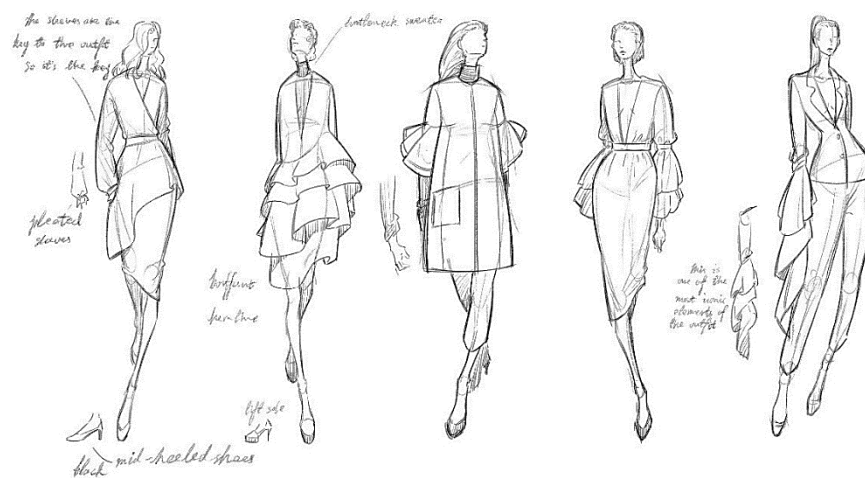


Figure 1-3. Fashion design sketches

Once the design concept is established, fashion designers move on to the process of selecting fabrics, colors, patterns, and trims that will bring their vision to life. They consider the characteristics and properties of different materials and their suitability for the intended design [26]. This stage involves researching and sourcing appropriate fabrics and accessories from suppliers. After finalizing the design and fabric choices,

fashion designers create technical drawings or specifications that outline the construction details, measurements, and proportions of the garments. These specifications serve as a guide for pattern-making and sample production. Pattern-making is a crucial aspect of fashion design. It involves creating templates or patterns that determine the shape and size of each garment piece. Fashion designers may create patterns manually or use computer-aided design (CAD) software to digitize and refine their designs [27]. Once the patterns are prepared, prototypes or samples are made to test the design and fit. Adjustments and alterations are made as necessary to ensure the desired look and proper fit. Fashion designers work closely with skilled pattern-makers, sample makers, and seamstresses to bring their designs to life. Figure 1-4 shows a flowchart of fashion design.



Figure 1-4. Flowchart of fashion design

Throughout the design process, fashion designers often collaborate with a team of professionals, including stylists, photographers, models, and makeup artists, to present their collections in fashion shows or marketing campaigns [28].

Fashion design is not limited to clothing. It also includes accessory designs, such as shoes, handbags, jewelry, and hats. Many fashion designers specialize in specific areas, while others create complete collections that encompass various garment types and accessories.

Fashion designers play a crucial role in shaping and influencing trends, as their creations can set new directions for the industry and inspire other designers. Their

designs can be sold directly to consumers through their fashion brands or licensed to manufacturers and retailers [29-31].

Overall, fashion design is a dynamic and artistic field that requires a combination of creativity, technical skills, and industry knowledge. It is a process that involves translating concepts and ideas into wearable and visually appealing garments and accessories that reflect the designer's unique vision and resonate with consumers.

1.1.3 Fashion Trends

Fashion patterns play a significant role in fashion trends. Designers use them to express their creativity and ideas, and they are also an important factor for consumers when choosing clothing. In this section, we will explore the role of fashion patterns in fashion trends and how they influence the fashion industry [32].

Firstly, fashion patterns can express a designer's intent through color, shape, lines, and patterns. For example, some geometric patterns or lines can be used to express a modern or futuristic feel, while some floral patterns can be used to express a vintage or romantic style [33, 34]. Additionally, fashion patterns can convey information through specific themes or concepts, such as environmentalism, social issues, or cultural themes. Through fashion patterns, designers can express their concepts and values, allowing consumers to better understand the brand's characteristics and differences [35].

Secondly, fashion patterns are also a way for designers to create brand recognition and personalization. Each brand has its unique brand image and style, and fashion patterns can add personality to these brands. For example, Louis Vuitton's floral patterns, Gucci's snake pattern, and Burberry's plaid pattern have become brand logos and part of the brand. Through these patterns, consumers can easily recognize the brand, while also feeling the brand's personalization and culture.

Finally, the popularity of fashion patterns in the fashion industry is also essential. With the changes in time and people's aesthetics, fashion patterns are constantly changing and developing. Some popular fashion patterns can become fashion trends as popular elements for a season or a year. For example, this year's popular floral and animal patterns can be seen in many fashion shows. The popularity of fashion patterns

can not only attract consumers but also influence the design styles and directions of other designers [18].

In conclusion, fashion patterns play a crucial role in shaping fashion trends. They can express a designer's intent and brand characteristics while also influencing the development and trends within the fashion industry. Therefore, when designing clothing, careful consideration should be given to the selection and use of fashion patterns. For instance, sustainable fashion has become a prominent trend, with an increasing focus on eco-friendly and ethically produced clothing. The sustainable fashion trend is shown in Figure 1-5. Consumers actively seek out sustainable brands and opt for garments made from recycled materials or organic fabrics. By designing thoughtful fashion patterns, we can promote sustainable fashion, protect the environment, and reduce the wastage of resources to preserve our planet.



Figure 1-5. Sustainable fashion trend

1.1.4 Fashion Industry

With the rapid development of the apparel industry and personality-consumer demand, the fashion industry is gradually changing from mass production to personalized customization, changing from commodity-centered to consumer-centered [36]. Furthermore, with the development of economic and social culture, consumers no longer only focus on the protective functionalities of garments but are mainly interested in their fashion and social attributes in order to emphasize their personalities and tastes

in their garments [37-39]. In this situation, how to identify the individual demands of each consumer and how to recommend an appropriate garment to a specific consumer, has become a crucial problem for designers and consumers.

With the rise of digital technology, the fashion industry is moving towards a more personalized and customized approach to production. This shift is driven by consumer demand for unique and personalized products, as well as the desire to reduce waste and increase sustainability in the industry [40].



Figure 1-6. Personalized fashion service

One example of this trend is the rise of made-to-measure and bespoke clothing. Made-to-measure clothing involves creating a garment to a customer's specific measurements, while bespoke clothing is entirely customized to the customer's preferences and requirements [41]. This approach allows for a higher level of personalization and a better fit, as the garment is tailored to the individual's body and preferences. Personalized fashion service is shown in Figure 1-6.

The collaborative design for fashion between consumers and designers is a growing trend in the industry, as more and more consumers demand personalized and customized products.

It allows consumers to work directly with designers to create custom clothing or accessories that meet their specific needs and preferences. This can include everything from choosing fabrics and colors to providing input on design details and features [42-

44]. In the fashion industry, it is co-creation, where consumers are invited to participate in the design process for a particular product. This can involve everything from providing input on design elements to voting on the final product. The collaborative design for fashion between consumers and designers is a growing trend in the industry, driven by consumer demand for personalized and customized products [45].

In the process of collaborative design for fashion, patterns, colors, styles, and other factors will become key elements co-created by designers and consumers. In order to improve efficiency, there are numerous recommendation systems in the future to facilitate collaborative design. Currently, there have been many reports on fashion style recommendation systems and fashion color recommendation systems, but there are few studies on fashion pattern recommendation. This thesis research will focus on the affective cognition and recommendation of fashion patterns.

1.2 Fashion Patterns

In the context of fierce international competition and the development of high technologies, the fashion industry is gradually changing from a commodity-centered mass production structure to mass customization to meet various consumers' personalized requirements and cognitions in terms of functionality and fashion. In fashion design, the pattern is a very important element influencing the fashion style of the product. In addition, the pattern is an important component of semiotics, it is a connection of the physical world, language and emotion[46]. Different patterns represent different emotions and design intentions including the cognition of designers.

A pattern is a form of visual art of great decorative beauty. It is the image of life through artistic processing to make its shape, structure, composition, and so on [47-49]. The elements such as color, size, etc. follow certain decorative art laws and rules, according to the designer's aesthetic concept and the practicality of the combination of patterns, to produce a pattern. Fashion patterns are decorative images for improving aesthetics and appreciation of the beauty of clothing, which is an important part of fashion design work. They are the basis for learning and expressing decorative arts,

which have been used widely in packaging, decorating, ceramics, architecture, interior design, clothing design, environmental art, signs and many other fields. Especially, a pattern is a very important design element for fashion and an important embodiment of clothing aesthetics. Everything can be used as a fashion pattern, so the forms of patterns are diverse. Different types of fashion patterns represent different meanings, and different consumers may have different cognitions of the same pattern. According to the literature [50-52], patterns in the same category usually represent the same meaning and cognition, but there is no widely recognized classification of fashion patterns. There are countless types of fashion patterns used in fashion. Some common examples include floral prints, animal prints, stripes, polka dots, plaids, checks, paisley, geometric designs, abstract motifs, and tie-dye patterns are shown in Figure 1-7. Each fashion pattern has its own unique aesthetic and can evoke different moods or styles.

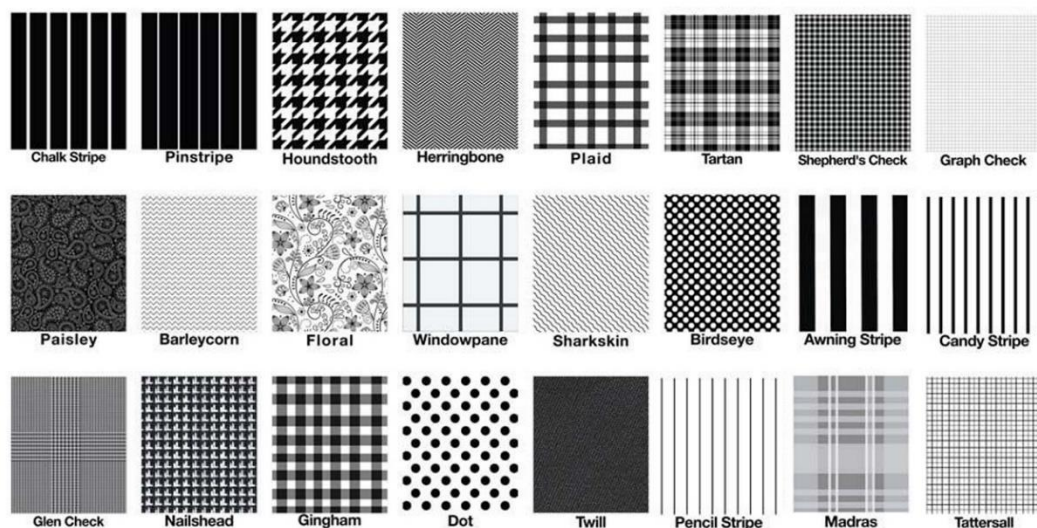


Figure 1-7. Examples of topic fashion patterns

Different pattern images have different meanings, including different cultural and spiritual connotations. Designers transmit their design intention to consumers through patterns, which arouse consumers' attention and resonance, to stimulate consumers' purchase decisions [53, 54]. Zhou examined the contributions of fashion patterns to aesthetic judgment by behavioral trials and showed that figurative patterns are more beautiful than abstract ones and patterns in clothing look more attractive than patterns alone [55]. Other researchers studied the unique decorative value and profound cultural

connotation of some specific patterns, such as cloud patterns in China [56], Lucky patterns in modern fashion [57], and Chinese Pottery [58]. Product images have gained increasing attention in clothing marketing and recommendation since the visual appearance of clothing products has a significant impact on consumers' purchase decisions [59]. Most of the existing work focuses on fashion patterns in a specific type or domain without systematic classification in a large sense.

To further expand the application of fashion pattern recommendation in the field of fashion design, we need to systematically classify fashion patterns. In the process of design and consumption of fashion products, the perceptual image of the pattern is a key factor influencing consumer decision-making. Therefore, it is important to classify fashion patterns and explore their perceptual images.

1.2.1 Fashion Patterns in Fashion Products

Fashion patterns play a significant role in creating visually appealing and unique fashion products. Here's some information about how fashion patterns are utilized in different fashion products:

(1) Clothing: Fashion patterns are widely used in clothing, ranging from dresses and tops to trousers and skirts. Patterns can transform a plain garment into a statement piece or add subtle details to enhance its overall design. Common pattern applications include floral prints, stripes, polka dots, animal prints, and geometric designs.

(2) Accessories: Fashion patterns are also incorporated into various accessories to enhance their aesthetic appeal. Patterns can be found in scarves, hats, bags, shoes, and even jewelry. They can add a pop of color, texture, or visual interest to these items, making them stand out and complementing the overall style of an outfit.

(3) Textiles and Fabrics: Fashion patterns are often used in the creation of textiles and fabrics themselves. Textile designers use various techniques such as printing, weaving, or knitting to incorporate patterns directly into the fabric. These patterned fabrics can then be used to create garments, accessories, and even home décor items.

(4) Print-on-Demand Products: With the advent of print-on-demand services, fashion patterns can be easily applied to a wide range of products. Customers can

choose patterns and have them printed on items such as t-shirts, leggings, tote bags, phone cases, and more. This allows for personalized and customized fashion products.

(5) Surface Design: Fashion patterns are often applied through surface design techniques such as screen printing, digital printing, or embroidery. These techniques allow for precise and intricate pattern placement on garments or accessories. Designers can experiment with different colors, scales, and placements to create unique and eye-catching fashion products.

(6) Pattern Mixing and Patchwork: Fashion products can also feature pattern mixing or patchwork, where multiple patterns are combined to create a visually dynamic and eclectic look. This technique is often used in garments like dresses, skirts, or jackets to create a bold and fashion-forward statement.

(7) Trend Influence: Fashion patterns are influenced by trends and can reflect the current fashion aesthetics. Designers and brands incorporate popular patterns or reinterpret classic patterns in new and innovative ways to align with the latest fashion trends. This allows fashion products to stay relevant and appealing to consumers.

In summary, fashion patterns are utilized across various fashion products, from clothing to accessories and textiles. They add uniqueness, style, and visual interest, allowing designers and consumers to express their creativity and create fashion products that stand out in the crowd. As shown in Figure 1-8, Mondrian's famous paintings are being used as fashion patterns in various fashion products.



Figure 1-8. Examples of fashion patterns in fashion products

1.2.2 Fashion Patterns for Designers

To create a fashion pattern, designers draw inspiration from various sources such as nature, culture, art, or other elements. They develop feasible design concepts that encompass pattern style, color palette, repetition, proportion, and more [18]. Color selection is crucial, considering the overall scheme and fashion trends to create appropriate combinations [60]. Repetition techniques like symmetrical, offset, or rotational repetition contribute to balance and appeal. The texture is added through techniques like embroidery, appliqué, or laser cutting [61].

In the digital age, digital design plays a significant role. It allows designers to create complex patterns, offer customization services, and explore production methods like 3D printing and digital printing. Fashion patterns enhance visual appeal, and contribute to brand identity and competitiveness [62]. Designers consider multiple elements like color, repetition, proportion, texture, and digital design to create successful patterns that add value to the brand.

The pattern design process involves a mix of traditional and digital techniques, including sketching, painting, digital manipulation, screen printing, digital printing, and embroidery. Designers research trends, consider pattern placement, scale, and proportion, experiment with pattern mixing, and ensure patterns align with brand identity. Technical considerations involve replication consistency, fabric width, repeat patterns, and production requirements [63].

Fashion patterns are instrumental in creating visually captivating and distinctive designs. Designers utilize their creativity, technical skills, and trend awareness to develop patterns that enhance the overall aesthetic and resonate with consumers. Here's some information about fashion patterns for designers:

(1) Inspiration and Concept Development: Fashion designers often draw inspiration from various sources, including nature, art, architecture, and culture, to create unique fashion patterns. Examples of fashion pattern design inspiration from natural animals are shown in Figure 1-9. They may research and explore different motifs, colors, and textures to develop their design concepts.



Figure 1-9. Examples of fashion pattern design inspiration from natural animals

(2) Pattern Design Process: Designers use a combination of traditional and digital techniques to create fashion patterns. They sketch, paint, or digitally manipulate designs, experimenting with different shapes, lines, and color combinations. Not only should fashion pattern designs look good, but they should also break the rules, bring forth new ideas, and create new and appealing fashion patterns as shown in Figure 1-10. They may also explore techniques like screen printing, digital printing, or embroidery to bring their patterns to life.

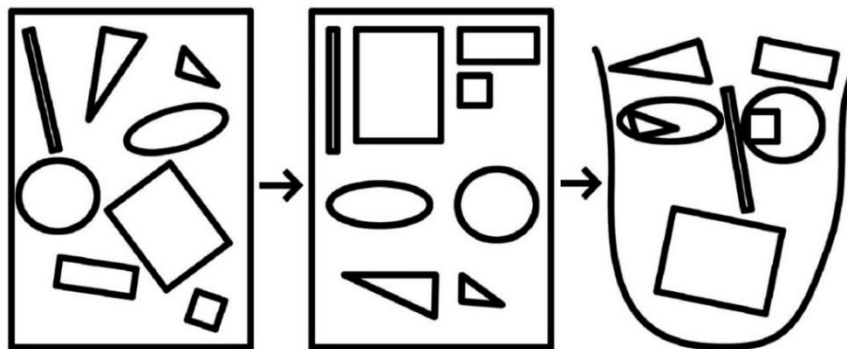


Figure 1-10. Example of fashion pattern design process

(3) Trend Research: Designers stay updated on current fashion trends to create patterns that resonate with the market. They analyze trends in color, pattern styles, and overall aesthetics to ensure their patterns are relevant and appealing to consumers.

(4) Pattern Placement: Designers carefully consider the placement of patterns on

garments or accessories. They determine how the pattern will flow across different garment panels, seams, or specific areas of focus. This requires an understanding of garment construction and the ability to create harmonious compositions.

(5) Scale and Proportion: Choosing the right scale and proportion of patterns is crucial. Designers consider the size of the garment or accessory and the desired visual impact. They experiment with scaling patterns up or down to achieve the desired effect and ensure the patterns complement the overall design.

(6) Pattern Mixing: Designers may also explore the trend of pattern mixing, combining different patterns within a single design. They consider color palettes, contrast, and balance to create visually appealing and cohesive pattern combinations.

(7) Brand Identity: Fashion patterns can contribute to a brand's identity and distinguish it from others in the market. Designers work to develop unique and recognizable patterns that align with the brand's aesthetic and ethos. Consistency in pattern choices across collections helps establish a brand's signature style.

(8) Technical Considerations: Designers need to consider technical aspects when creating fashion patterns. They ensure patterns can be replicated consistently during production, taking into account fabric width, repeat patterns, and any specific requirements for printing or manufacturing.

Fashion patterns play a vital role in creating visually captivating and distinctive designs. Designers utilize their creativity, technical skills, and trend awareness to develop patterns that enhance the overall aesthetic of their collections and resonate with consumers.

1.2.3 Fashion Pattern for Consumers

Fashion patterns are not only essential for designers but also for consumers as they significantly enhance the visual appeal of garments and allow individuals to express their unique style and personality. With a wide range of options available, including floral prints, stripes, animal prints, and geometric designs, fashion patterns offer consumers variety and choice in the world of fashion [64]. These patterns add visual appeal and depth to garments and accessories, serving as focal points that make outfits

stand out and elevate the overall look.

Consumers have the freedom to choose from a diverse selection of patterns, such as stripes, polka dots, floral prints, animal prints, and more, each with its own aesthetic appeal. By carefully selecting patterns that resonate with their personality and style, individuals can make distinct and personalized fashion statements. Following fashion patterns enable consumers to stay up to date with the latest trends, showcasing their fashion-forwardness and alignment with the current fashion zeitgeist [65].

When selecting the right pattern, consumers should consider factors such as garment type, occasion, body type, and personal preferences. The versatility of fashion patterns empowers consumers to experiment and create various fashion looks [66]. They can mix and match patterns, layer them, or use them as statement pieces to create unique and personalized outfits. Patterns also have the ability to evoke different moods and emotions, with bright and vibrant patterns conveying energy and playfulness, while muted or abstract patterns create a subdued and sophisticated look. Different consumers have different perceptual cognitions of the same fashion pattern as shown in Figure 1-11.



Figure 1-11. Different perceptual cognitions for fashion pattern

Consumers should also consider the color scheme of the pattern, as it significantly impacts the overall aesthetic appeal of the garment. The right color scheme can enhance the pattern's impact and create a cohesive look. Additionally, patterns offer consumers styling options, allowing them to strategically highlight features or create visual

illusions. The texture is another aspect to consider, as it adds depth and interest to the garment [67]. With the advancement of digital technology, consumers now have access to personalized fashion pattern design services, enabling them to create custom patterns and choose their color scheme for garment printing.

In summary, fashion patterns play a crucial role in expressing personal style and enhancing the aesthetic appeal of garments for consumers. By considering various elements such as pattern type, color scheme, repetition, texture, and digital design, individuals can choose patterns that suit their preferences and occasions. Fashion patterns offer consumers the opportunity to express their style, experiment with looks, and stay in tune with trends while showcasing their individuality and personal taste. By embracing fashion patterns, consumers can create captivating outfits that reflect their personality and fashion preferences, staying fashionable and true to themselves.

1.2.4 Consumer Involvement in Fashion Design

Consumer involvement in the fashion industry is a critical aspect that has evolved over the years. It refers to the level of engagement that consumers have with the fashion products they purchase, including their attitudes, preferences, and behaviors. Consumers' involvement in fashion can significantly affect the industry's trends, dynamics, and sales [68].

Today, consumers have become more involved in the fashion industry than ever before. They are no longer passive recipients of fashion products but active participants in the design, production, and distribution processes. With the rise of social media and e-commerce, consumers have become more informed, connected, and empowered to express their opinions and preferences [69].

One of the main ways consumers get involved in fashion is through trendsetting. Consumers play a significant role in setting fashion trends by influencing the styles, colors, and designs that become popular. With the power of social media, consumers can share their fashion choices, opinions, and preferences with a global audience, influencing fashion trends worldwide [70].

Another way consumers get involved in fashion is through customization.

Customization enables consumers to personalize their fashion products according to their preferences, tastes and needs [71]. This approach provides consumers with a sense of ownership and involvement in the product design process.

Consumer feedback also plays a significant role in the fashion industry. Designers and manufacturers often rely on consumer feedback to improve their products' quality, design, and functionality. Social media platforms provide a platform for consumers to share their opinions and experiences with fashion products, which can influence the industry's future direction. Consumer involvement in the fashion industry has significantly evolved over the years. Consumers' active participation in the design, production, and distribution processes has helped shape fashion trends and promote customization. Another aspect of consumer involvement is the rise of user-generated content and influencer collaborations. Social media platforms have given consumers a platform to showcase their personal style and creativity. Brands often collaborate with influencers and consumers to co-create content, such as designing limited-edition collections or launching collaborative campaigns. This enables consumers to actively contribute to the fashion design process and fosters a sense of inclusivity and ownership.

Additionally, technology has played a significant role in enabling consumer involvement in fashion design. Customization and personalization tools allow consumers to customize various aspects of fashion products, such as selecting patterns, colors, and even contributing to the design process through digital platforms. This level of involvement empowers consumers to create unique and personalized garments that align with their individual styles and preferences.

Consumer involvement in fashion design has also been fueled by the demand for sustainable and ethical fashion. Consumers are increasingly concerned about the environmental and social impact of the fashion industry. As a result, brands are involving consumers in the design process to address these concerns. Collaborative efforts in sustainable design, such as upcycling initiatives or clothing repair workshops, allow consumers to actively participate in creating more environmentally conscious fashion.

Overall, consumer involvement in fashion design is transforming the industry by

placing consumers at the center of the design process. It fosters a sense of inclusivity, personalization, and sustainability, allowing consumers to actively shape the fashion products they consume. This shift towards consumer involvement not only meets the evolving demands of consumers but also strengthens brand-consumer relationships and drives innovation in the fashion industry. For example, consumers participate in some of their own drawing and making fashion pattern activities on the T-shirt as shown in Figure 1-12.



Figure 1-12. Consumer involvement in the fashion pattern making

1.3 Cognition of Fashion Pattern

The textile product can be interpreted as physical evidence of human thought and actions [72], and fashion is one of the important ways to express cognition of beauty. According to the process of design, production and sales of fashion products, designers use fashion patterns to transfer their design intents to design work, including color, style, pattern and material [73]. Since the fashion pattern is an important factor to express the beauty of fashion, designers integrate their cognition of fashion patterns into products as shown in Figure 1-13. However, consumers may not be able to understand designers' applications of patterns because of the cognitive difference in fashion patterns between consumers and designers, which is strongly related to their personalized experiences, psychological status and emotions. Since the fashion industry is typically consumer-centered, designers should adequately understand the needs of their consumers, especially psychological and emotional needs. Understanding consumers' cognition is an effective way to understand their psychological needs. Therefore, it is very important to reduce the cognitive differences between designers and consumers [74].



Figure 1-13. Examples of fashion patterns and their applications on T-shirts

Perceptual image refers to the psychological response and emotional expression of users to the stimulation of their multiple sensory organs caused by factors such as product shape, material, color, etc. under their specific cultural background and life experience, which reflects users' preference and evaluation criteria for products. It is a combination of user intuition and thinking response, and is the basic way for people to recognize products, involving Kansei engineering, design psychology, and linguistics knowledge in fields such as industrial design, aesthetics, human factors engineering, and neuroscience[75, 76]. Perceptual image is an important factor that affects people's cognition of things. Examples of different perceptual images for the same pattern are shown in Figure 1-14.



Figure 1-14. Different perceptual images for the same pattern

Cognition of a pattern is a very perceptual and subjective psychological activity, which will affect the commodity cognitive and purchase decisions of consumers.

However, many factors may affect the cognition of the perceptual images of fashion patterns.

(1) Culture: Different cultures have different preferences for fashion patterns, and certain patterns may be associated with specific cultural or symbolic meanings.

(2) Age: Different age groups may have varying perceptions of fashion patterns. For example, younger consumers may prefer more vibrant and bold patterns, while older consumers may prefer more classic and traditional patterns.

(3) Gender: Men and women may have different preferences for fashion patterns, with women generally being more receptive to patterns than men.

(4) Personal style: Consumers' personal style and fashion preferences can also affect their perceptions of fashion patterns.

(5) Context: The context in which the fashion pattern is presented can also affect consumers' perceptions.

(6) Emotions: Consumers' emotions can influence their perceptions of fashion patterns. These factors highlight the complex and subjective nature of fashion pattern perception, which designers must consider when creating and promoting fashion patterns.

Kansei evaluation is a common method used in wide fields for studying human sense emotion [77, 78]. To explore pattern cognition, Kansei evaluation is an effective method for understanding the psychological cognition of humans [79]. The semantic differential (SD) method is the basic method of Kansei evaluation in Kansei Engineering for the classification of Kansei attributes using Kansei words [80-82]. In the SD method, Kansei words are a critical factor for specific research objects. For the Kansei evaluation of fashion and fashion patterns, the Kansei words should be extracted firstly from the fashion domain.

1.3.1 Perceptual Image

The concept of perceptual image encompasses the subjective interpretation and visual representation of various objects, patterns, or designs. It involves the way individuals mentally construct an image based on their sensory experiences, cognitive

processes, and personal perspectives. Perceptual images go beyond physical objects and can extend to abstract concepts, including emotions, ideas, and aesthetic impressions [83].

Within the fashion context, the perceptual image of a fashion pattern refers to how individuals perceive and interpret the visual elements present in a specific fashion design. This includes factors such as color, shape, texture, and pattern [84]. The perceptual image encompasses the overall aesthetic impression and emotional response evoked by the pattern, as well as the subjective meaning and associations it holds for the observer [85]. The human brain has different perceptual images for different things as shown in Figure 1-15.

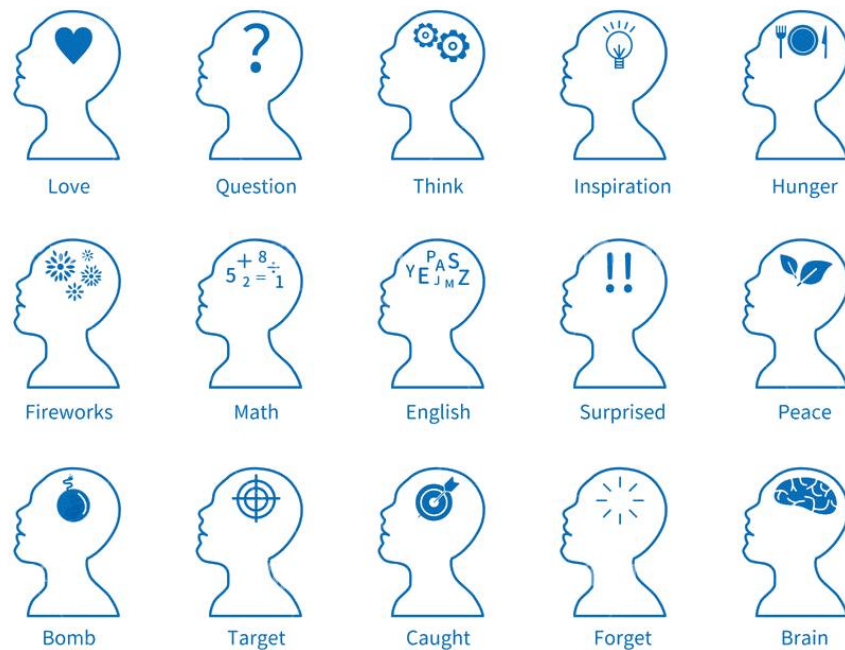


Figure 1-15. Different perceptual images for different things

Understanding the perceptual image of fashion patterns holds great importance for designers, marketers, and researchers. It allows them to create designs that effectively resonate with the target audience and evoke the desired emotional and aesthetic responses [86]. By taking the perceptual image into account, designers can successfully communicate their artistic vision and establish deeper connections with consumers.

1.3.2 Cultural Factor

Fashion patterns are an important element in fashion design, and cultural factors play a significant role in their selection and design. Cultural factors can include traditional culture, religious beliefs, folk customs, and more. In this thesis, we will explore the role of cultural factors in fashion patterns and how they influence the fashion industry [87].

Firstly, cultural factors can provide inspiration and direction for the selection and design of fashion patterns. Different cultural backgrounds have different aesthetic concepts and artistic forms of expression, which can be a source of inspiration for designers. For example, traditional Chinese culture's landscape painting and Jingtailan crafts can be elements that designers can use in fashion patterns. Also, specific religious beliefs and folk customs can provide inspiration for fashion patterns [88]. For example, Indian mythology and totems can be sources of inspiration for designers.

Secondly, cultural factors can add unique features and cultural connotations to fashion patterns. The costumes and patterns of different cultures have their unique styles and meanings, which can be cultural elements that designers can incorporate into fashion patterns. For example, traditional Chinese patterns such as dragons and phoenixes have rich cultural connotations and symbolic meanings, which designers can use to express their creativity and ideas. At the same time, symbols and patterns in some religious beliefs and folk customs can also add a sense of mystery and cultural connotation to fashion patterns [89].

Finally, the use of cultural factors in fashion patterns can also help promote cultural heritage and development. As an element of fashion design, fashion patterns can convey the cultural values of designers and brands and help people understand and appreciate different cultures. By promoting and disseminating fashion patterns, we can help promote cultural heritage and development while letting more people understand and appreciate culture [90].

In summary, cultural factors play a significant role in fashion patterns. They can provide inspiration and direction for the selection and design of fashion patterns, add

unique features and cultural connotations, and help promote cultural heritage and development. When designing clothing, designers need to consider the influence of cultural factors to create fashion patterns that have cultural connotations and brand characteristics.

1.3.3 Individual Factor

Individual factors play a significant role in fashion patterns, allowing individuals to express their personal style and preferences. These factors encompass various aspects of an individual's characteristics and choices, influencing their selection and interpretation of fashion patterns.

One key individual factor is personal taste. Each person has their own unique preferences when it comes to fashion patterns. Some individuals may gravitate towards bold and vibrant patterns, while others may prefer subtle and understated designs. Personal taste is shaped by factors such as cultural background, personality, and aesthetic sensibilities [91, 92].

Another individual factor is body type. Different patterns can have varying effects on the visual perception of the body. For example, individuals with a slim figure may choose patterns that create the illusion of curves or add volume, while those with a fuller figure may opt for patterns that flatter their shape or provide a slimming effect. Understanding one's body type and how patterns can enhance or minimize certain features is essential in selecting the most flattering fashion patterns.

Individual lifestyles and occasions also influence pattern choices. Individuals may choose patterns based on the activities they engage in or the specific occasions they are dressing for. For example, someone attending a formal event may opt for more elegant and sophisticated patterns, while someone going to a casual outing may choose fun and playful patterns. Lifestyle and occasion considerations ensure that patterns align with the practicality and appropriateness of the situation.

Additionally, personal values and self-expression play a role in pattern selection. Some individuals may be drawn to patterns that align with their values or cultural heritage, while others may use patterns as a means of self-expression and creativity.

Fashion patterns can be a powerful tool for individuals to communicate their identity, beliefs, and personal narratives through their clothing choices.

Overall, individual factors such as personal taste, body type, lifestyle, occasion, values, and self-expression significantly impact the selection and interpretation of fashion patterns. By considering these factors, individuals can choose patterns that reflect their unique style, flatter their bodies, and align with their personal preferences and values.

1.3.4 Psychological Factor

The psychological factors that influence the cognition of perceptual images of fashion patterns are diverse and encompass several elements. One such element is perceptual organization, which refers to how the brain organizes visual information to create a meaningful image. The way in which individuals perceive and interpret fashion patterns can be influenced by their perceptual organization [93].

Memory is another psychological factor that affects the cognition of fashion patterns. It involves the ability to retain and retrieve information over time. Memory plays a role in how individuals remember and recognize fashion patterns, contributing to their overall perception [94].

Emotion is a significant psychological factor that influences the perception and response to fashion patterns. The emotional state of individuals can shape how they perceive and emotionally connect with different patterns, thus affecting their overall response.

The perception of beauty is a complex psychological construct that impacts how individuals perceive and respond to fashion patterns. Cultural norms, personal preferences, and various other factors contribute to the perception of beauty. The way individuals perceive beauty can greatly influence their perception and response to different fashion patterns.

Cognitive style, another psychological factor, refers to an individual's preferred way of processing information. Different cognitive styles can lead to varying perceptions and interpretations of fashion patterns, as individuals process and analyze

visual stimuli in their own unique ways.

These psychological factors interact with individual factors such as age, gender, and culture to shape how individuals perceive and respond to fashion patterns. The combination of psychological and individual factors creates a nuanced understanding of how individuals cognitively process and interpret fashion patterns [95].

Psychological cognition of fashion patterns extends beyond mere perception and interpretation. It encompasses the associations that people make between specific patterns and emotions or meanings [46]. These associations contribute to how individuals perceive the wearer of certain patterns and how they feel when wearing those patterns themselves.

Attention and memory also come into play, as certain patterns capture more attention and are more memorable than others. Bold stripes or intricate designs, for instance, may leave a stronger impression on individuals. Designers can leverage these patterns to make their clothing stand out and be remembered by potential customers.

Moreover, the psychological cognition of fashion patterns incorporates cultural and social meanings associated with different patterns. Certain patterns may hold significance in specific cultures or social groups, signifying membership or affiliation. Designers who aim to resonate with particular audiences must understand their cultural and social meanings to create clothing that effectively connects with their target market.

In conclusion, the psychological cognition of fashion patterns is a multifaceted topic influenced by individual and cultural factors. It encompasses the way individuals perceive, interpret, and emotionally respond to fashion patterns. Understanding these psychological factors is essential for designers, as it helps them create clothing that resonates with individuals and aligns with cultural and social contexts.

1.3.5 Perceptual Image Expression by Kansei Words

Perceptual image expression by Kansei words in the fashion pattern field refers to the use of descriptive words to capture and communicate the subjective sensory experiences and emotions evoked by fashion patterns. Kansei words are a set of terms derived from the Japanese language that are specifically chosen to express the

emotional and aesthetic qualities associated with a particular pattern.

In the context of fashion patterns, Kansei words enable designers, researchers, and consumers to articulate and understand the emotional and sensory aspects of patterns beyond their visual appearance. These words help convey the feelings, moods, and impressions that a pattern elicits when observed or worn.

By utilizing Kansei words, fashion professionals can effectively communicate and discuss the desired emotional or aesthetic qualities of a pattern during the design process. These words provide a common language to express and share subjective perceptions and preferences, facilitating collaboration and understanding among designers, manufacturers, and consumers.

Kansei words also play a crucial role in market research and consumer analysis. They allow researchers to explore consumers' emotional responses and preferences towards different patterns, aiding in the development of products that resonate with the target market. Understanding the Kansei words associated with fashion patterns helps designers create collections that align with consumers' desires and aspirations.

Additionally, Kansei words can enhance the communication and marketing of fashion products. They provide a rich vocabulary to describe the sensory and emotional experience that a pattern offers, enabling brands to craft compelling narratives and connect with consumers on a deeper level. By using Kansei words in product descriptions, advertisements, and promotional materials, fashion brands can create an emotional connection and differentiate their products in the market. The utilization of Kansei words in the fashion pattern field allows for the expression and understanding of the subjective sensory experiences, emotions, and aesthetic qualities associated with patterns. These words facilitate communication, collaboration, market research, and product marketing, ultimately enhancing the overall perception and appeal of fashion patterns.

Kansei words are related fields that focus on understanding and describing sensory experiences. In the sensory study, they are used to evoke sensory experiences of sensory and engage customers' senses [68].

Kansei words are always used as the “vocabulary” to express Kansei attitude

toward patterns. They are critical and necessary for Kansei evaluation. Different Kansei words are used to evaluate different items. In this study, a text mining method was proposed for word collection and Kansei word extraction for the evaluation of fashion information related to fashion patterns and fashion style [96].

1.3.6 Human Cognition of Fashion Pattern

Feeling, thinking and imagining are all processes that human may take for granted, as human see the world through our own eyes. Human cognition related to a fashion product is mainly based on aesthetics, comfort, functionality, structure, and so on. Therefore, visual perception and tactile perception are regarded as two key human perceptions in garment design [97]. Especially, visual perception is the first key factor of human cognition for a fashion product.

Fashion patterns are typical visual designs for fashion products. The human cognition of fashion patterns involves various cognitive processes, including feeling, perception, memory, thought, imagination and language [98], human take the process of identifying, organizing and interpreting sensory information and finally express their feeling using language, the process is shown in Figure 1-16.

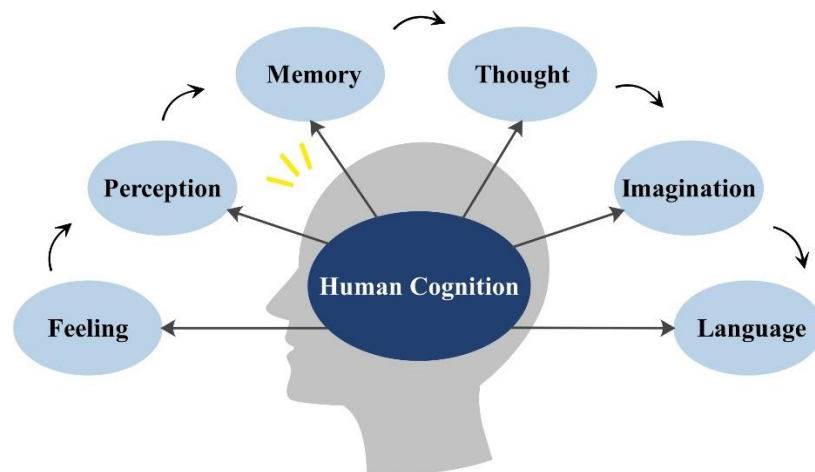


Figure 1-16. The cognition process of human

To guide users to accurately express their feelings in language, in this thesis, text mining has been applied to extracting Kansei words for expressing users' feeling of fashion patterns. Kansei words about fashion and fashion patterns often appear in fashion information websites, journal articles, and fashion magazines, etc. A similar

language for aesthetic design or emotional design is not readily available due to the lack of first principles for affect or emotion. Often, when a design turns to the sensory aspect, diversity in words to describe sensory or emotions among people is very large. Therefore, how to find a set of words that can be used to specify the customer's emotional requirement for a product (fashion pattern in this study) is a challenging problem [99].

1.4 General Notions of Fashion Recommendation Systems

Fashion recommendation systems are a type of recommender system that suggests fashion items to users based on their preferences. They can be used by fashion retailers to help customers find the perfect outfit, or by fashion designers to create collections that appeal to their target audience.

1.4.1 Various Recommendation Systems

With the development of the Internet big data, online marketing and sales of fashion products are becoming more and more popular for quickly identifying fashion market trends and behaviors of fashion consumers. In this context, many researchers have been working on the development of fashion recommendation systems to provide online advisory services to consumers and facilitate the understanding of consumers on fashion products. Some researchers developed recommendation systems for garment fitting [100-104], and personalized relevancy to fashion styles [105, 106]. Also, knowledge-based recommendation systems with intelligent search engines have been developed [107-111]. Some researchers introduced Kansei Engineering tools to support the clothing design process connecting the consumers and designers [77, 99, 112]. Yu et al introduced the aesthetic information of fashion images, which is highly relevant to user preference, into clothing recommender systems, to capture the aesthetic preference of users [59], Barros Costa et al used the potential of the systematic influence that clothes have on wearers' psychological process, to seek the relationship between

clothing, psychology, and cognitive and behavioral response [113]. Despite their key role in fashion design processes, fashion patterns have rarely been characterized systematically. However, the existing work mainly focuses on technical issues of garment products and their relations with consumer fashion requirements, and only a very few studies are related to fashion patterns and the cognition of consumers. Consumers make a purchase decision heavily dependent on their psychological cognition of fashion items including fashion patterns. To study the psychological cognition of consumers, adjective words are usually used to express their perceptual images of different fashion patterns or other items, in the Kansei engineering field, these words are called Kansei words or Kansei words used for Kansei evaluation. Kansei words should be selected scientifically and accurately for expressing accurate psychological cognition of consumers.

To enhance aesthetic issues in fashion recommendation systems and fashion design systems beyond technical consideration, we propose a new approach for classifying fashion patterns and extracting relevant Kansei words by using the techniques of sensory evaluation and text mining. This study aimed to extract the Kansei words for Kansei evaluation, and use the Kansei words to study the perceptual image of different fashion patterns and human cognition in future research [114].

1.4.2 Fashion Pattern Recommendation

General fashion pattern recommendation refers to providing guidance and suggestions for selecting and incorporating fashion patterns into outfits. These recommendations are aimed at helping individuals make informed choices and create visually appealing and stylish looks.

When it comes to fashion pattern recommendation, several factors are typically considered:

(1) Body Type: Different patterns can have varying effects on the appearance of body proportions. Recommendations are often tailored to suit different body types, such as suggesting vertical stripes for elongating the silhouette or using patterns strategically to create visual illusions that flatter specific body features.

(2) Occasion: The appropriateness of patterns depends on the occasion or event. Formal occasions may call for subtle or sophisticated patterns, while casual settings allow for more playful and vibrant patterns. Recommendations take into account the context in which the outfit will be worn to ensure patterns align with the event's tone.

(3) Color Palette: Patterns are often accompanied by specific color schemes. Recommendations consider the individual's skin tone, personal preferences, and the overall color harmony of the outfit. Balancing colors within a pattern and coordinating with other garments and accessories are crucial aspects of pattern recommendation.

(4) Style and Personality: Fashion patterns can help individuals express their personal style and showcase their personality. Recommendations take into account the individual's style preferences, such as suggesting bold and abstract patterns for those who like to make a statement or subtle and classic patterns for those with a more minimalistic aesthetic.

(5) Trend and Season: Fashion patterns are influenced by seasonal trends and can vary in popularity over time. Recommendations may highlight current pattern trends and suggest ways to incorporate them into outfits, allowing individuals to stay fashion-forward and up-to-date.

(6) Coordination and Balance: Pairing patterns with other elements of an outfit, such as solid colors or complementary patterns, is crucial for achieving a cohesive and balanced look. Recommendations provide guidance on how to mix and match patterns effectively, ensuring a harmonious and visually appealing ensemble.

(7) Personal Comfort: Ultimately, individual comfort and confidence are essential in wearing fashion patterns. Recommendations consider the individual's comfort level with patterns and suggest options that align with their preferences, allowing them to feel at ease and confident in their outfit choices.

Overall, general fashion pattern recommendations aim to provide individuals with guidance on selecting and styling patterns that enhance their personal style, flatter their body type, and create visually appealing outfits. These recommendations consider factors such as body type, occasion, color palette, style, trends, coordination, and personal comfort to help individuals make informed choices and create fashionable

looks.

1.4.3 General Structure of The Proposed Recommendation System

A knowledge-based recommendation system is made up of several components, one of which is the knowledge-based recommendation module. The knowledge-based recommendation module is responsible for generating recommendations based on the features and attributes of the item being recommended and the user's preferences. The knowledge-based recommendation module is an important component of a knowledge-based recommendation system since it is responsible for generating recommendations based on the user's preferences and the features of the item being recommended.

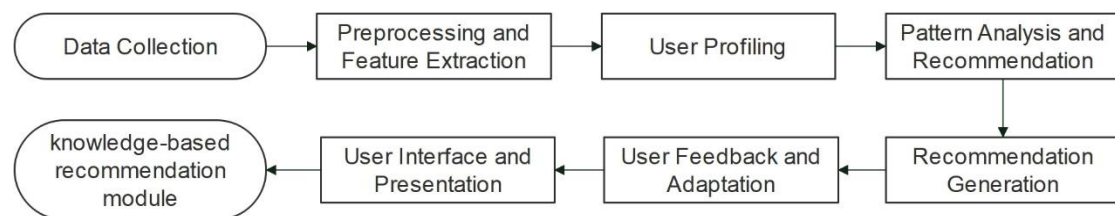


Figure 1-17. The general structure of the proposed recommendation system

The proposed fashion pattern recommendation system follows a structured framework to provide personalized pattern suggestions to users as shown in Figure 1-17. Here is a brief overview of its general structure:

(1) Data Collection:

Gather a comprehensive dataset of fashion patterns from various sources, including fashion magazines, online platforms, and designer collections.

Acquire data on user preferences, such as style, body type, color preferences, and occasion requirements.

Collect information on fashion trends, seasonal influences, and cultural aspects.

(2) Preprocessing and Feature Extraction:

Clean and preprocess the collected data to remove noise, inconsistencies, and redundancies.

Extract relevant features from the pattern dataset, such as color palettes, pattern types, motifs, and design elements.

Represent patterns in a suitable format for further analysis and recommendation.

(3) User Profiling Integration:

Create user profiles based on the collected user preference data, including style preferences, body type, and occasion requirements.

Analyze user preferences to identify patterns, trends, and individual fashion characteristics.

Incorporate user feedback and rating systems to enhance the accuracy of recommendations.

(4) Pattern Analysis and Recommendation:

Apply data mining and machine learning techniques to analyze patterns and user profiles.

Utilize algorithms to match user preferences with suitable patterns based on style, body type, color palette, occasion, and other relevant factors.

Employ collaborative filtering, content-based filtering, or hybrid approaches to generate personalized pattern recommendations.

(5) Recommendation Generation:

Generate a list of recommended patterns based on the analysis and matching algorithms.

Rank the recommended patterns according to their relevance and suitability to the user's preferences.

Provide additional information about each recommended pattern, such as designer, brand, availability, and styling suggestions.

(6) User Feedback and Adaptation:

Allow users to provide feedback on the recommended patterns to refine future recommendations.

Continuously update and adapt the recommendation system based on user's feedback, new fashion trends, and changes in user preferences.

Incorporate techniques like reinforcement learning to improve the recommendation accuracy over time.

(7) User Interface and Presentation:

Design an intuitive and user-friendly interface for the recommendation system.

Present the recommended patterns to users in an appealing and visually informative manner.

Provide options for users to explore additional details, compare patterns, and customize their preferences if desired.

The proposed fashion pattern recommendation system aims to leverage data-driven techniques and user profiling to offer personalized and relevant pattern suggestions, helping users discover new styles, enhance their fashion choices, and stay up-to-date with the latest trends.

1.5 Conclusion

The fashion pattern recommendation system represents an innovative approach in the fashion industry, leveraging technology and data-driven algorithms to provide personalized pattern suggestions to users. Here is a brief overview of its innovation and importance:

(1) **Personalized Fashion Choices:** The recommendation system offers personalized pattern suggestions based on user preferences, body type, style, and occasion requirements. It helps users discover patterns that align with their individual tastes and enhances their fashion choices. By providing tailored recommendations, the system enables users to explore new styles and create unique and personalized outfits.

(2) **Time and Effort Saving:** With the vast array of fashion patterns available, it can be overwhelming and time-consuming for users to search for the right patterns that suit their preferences. The recommendation system streamlines the process by presenting curated options, saving users' time and effort in finding suitable patterns. It simplifies the fashion selection process and makes it more efficient.

(3) **Access to Trending Patterns:** Fashion trends change rapidly, and staying up-to-date can be challenging. The recommendation system keeps users informed about the latest fashion trends by suggesting trending patterns. It enables users to embrace current styles and maintain their fashion-forwardness.

(4) **Discovering New Styles:** The system exposes users to a broader range of fashion patterns, allowing them to explore new styles and designs they may not have considered before. It introduces users to patterns they might have overlooked, encouraging them to step out of their comfort zone and experiment with different looks.

(5) **Enhanced User Experience:** By providing personalized recommendations, the system enhances the overall user experience in the fashion domain. It helps users feel more confident in their fashion choices, promotes self-expression, and reduces decision-making anxiety. Users can trust the system to offer relevant and suitable pattern suggestions, improving their satisfaction and enjoyment of the fashion selection process.

(6) **Promoting Sustainability:** The recommendation system can also contribute to promoting sustainability in the fashion industry. By suggesting patterns that align with users' preferences and body types, it reduces the likelihood of purchasing clothing items that will be discarded or unused. This promotes mindful consumption and reduces fashion waste.

(7) **Data-Driven Insights:** The recommendation system generates valuable insights from user data, such as preferences, feedback, and purchasing behavior. These insights can be utilized by designers, manufacturers, and marketers to better understand consumer needs, trends, and market demands. It facilitates data-driven decision-making and innovation in the fashion industry.

Overall, the fashion pattern recommendation system brings innovation and convenience to the fashion domain by offering personalized suggestions, simplifying the fashion selection process, and keeping users in tune with trends. Its importance lies in providing a seamless and tailored fashion experience, promoting sustainability, and driving data-driven insights for industry stakeholders.

Chapter 2 Fashion Pattern Class Selection

Fashion patterns can be used to enhance the aesthetics of a garment by adding an artistic or design touch. Designers must use patterns creatively to make garments more artistic and design-oriented. Patterns can also help reinforce design themes by adding an additional dimension to a garment. However, different patterns have different perceptual images, and the emotions expressed in fashion design vary. Especially in personalized fashion design, designers need to fully consider the perceptual image of users toward different patterns

In this chapter, we conduct a systematic pattern class selection (Figure 2-1) to study their perceptual image and users' cognition of fashion patterns.

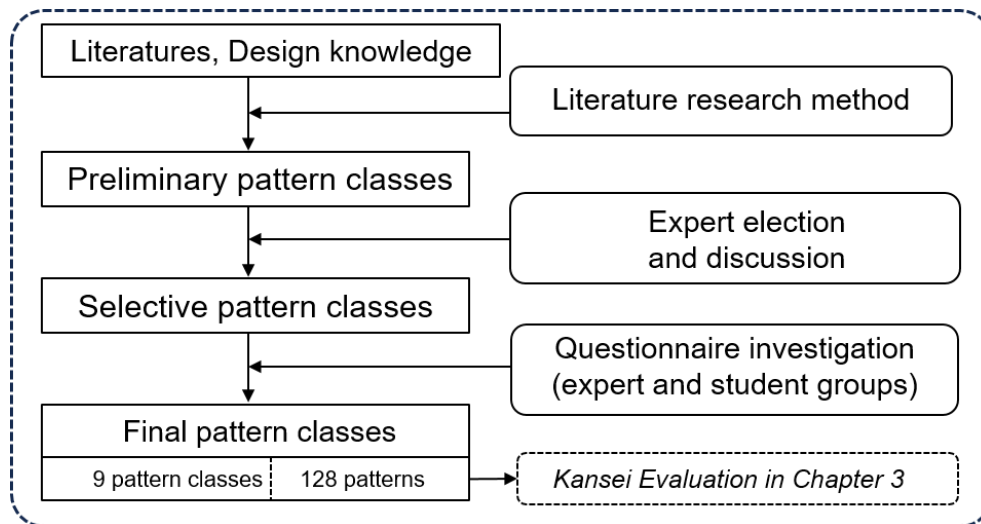


Figure 2-1. Flowchart of Chapter 2

Different visual images have different perceptual images according to their attributes [115]. To study the perceptual image of fashion patterns and their cognition, it is necessary to classify fashion patterns. We clustered fashion patterns into various classes according to their natural attributes from research papers and fashion magazines. The Kansei attributes of different fashion patterns were then investigated through experiments to select the fashion pattern class, such as Figure 2-2. By understanding the Kansei attributes associated with different patterns, designers can create products that appeal to consumers' emotions and preferences, ultimately leading to increased sales and customer satisfaction.



Figure 2-2. Examples of fashion patterns

2.1 Fashion Pattern Class Selection: Significance

Fashion patterns, which include prints, embroideries, and fabric designs, play a crucial role in fashion design [116]. They not only enhance the visual fashion but also convey a designer's creative vision, cultural background, and zeitgeist. The significance and role of fashion patterns for fashion design are as follows and Figure 2-3:

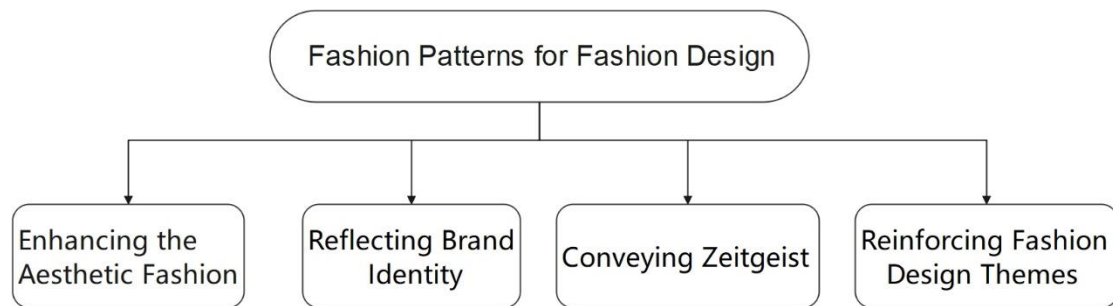


Figure 2-3. Fashion pattern for fashion design

(1) Enhancing the Aesthetic Fashion

Fashion patterns play a vital role in enhancing the aesthetic of fashion. By creatively using patterns, designers can make clothes more vibrant and visually appealing, thereby making them more attractive to consumers. For example, adding intricate floral patterns to a white dress can make it more lively and captivating.

(2) Reflecting Brand Identity

Fashion patterns are also used to reflect brand identity. Each brand has its own unique cultural background and design philosophy, and by incorporating specific patterns, designers can help consumers better understand the brand's culture and design philosophy [117]. For instance, Louis Vuitton's iconic print features elegant floral motifs that evoke the romantic and elegant culture of France, which is at the core of the brand's identity.

(3) Conveying Zeitgeist

Fashion patterns can also convey the zeitgeist, or spirit of the times. Every era has its own unique cultural characteristics and aesthetic tendencies, and patterns can be used to reflect these features [118]. For example, modern consumers tend to prefer a minimalistic, contemporary, and personalized lifestyle, and patterns can reflect this aesthetic through simple lines, bright colors, and trendy motifs.

(4) Reinforcing Fashion Design Themes

Fashion patterns are used to reinforce fashion design themes. Fashion design themes can be based on different styles, cultures, stories, and so on, and patterns can be used to enhance the expression of these themes. For example, clothing with Chinese traditional themes may incorporate Chinese elements such as dragons, phoenixes, and flowers, to strengthen the cultural ambiance of the fashion design [119].

In conclusion, fashion patterns play a vital role in fashion design. They enhance the visual appeal of fashion, convey brand identity, reflect zeitgeist, and reinforce fashion design themes. Designers must use fashion patterns creatively to make clothes more artistic and design-oriented.

Fashion pattern classification is a crucial aspect of studying fashion patterns as it helps to understand the characteristics, applications, and trends associated with different patterns. Various methods are employed to classify fashion patterns, each illustrating the significance of pattern classification in the field.

The significance of fashion pattern classification lies in its ability to organize and categorize patterns systematically, enabling researchers, designers, and fashion enthusiasts to analyze, compare, and predict patterns' characteristics, trends, and applications. It provides a foundation for understanding the historical, cultural, and visual aspects of patterns, allowing for informed decision-making in the creation and interpretation of fashion designs.

2.2 Class Selection of Fashion Patterns: Technical Details

To study fashion patterns and their perceptual image, we conducted several

experiments to select fashion pattern classes, and extract the Kansei words for Kansei evaluation of fashion patterns using the text mining method. The text analysis tools, Hierarchical Cluster Analysis and Semantic-based analysis were applied to realize the text mining process for the extraction of Kansei words. A case study was conducted to verify the validity of pattern class and Kansei words for Kansei evaluation of fashion patterns. We systematically cluster clothing patterns and extract Kansei evaluation words to study the perceptual images and cognitions of fashion patterns from a Kansei evaluation, which can be used for fashion design and fashion recommendation.

2.2.1 Preliminary Knowledge for Pattern Class Selection

Fashion pattern classification is an important aspect of clothing design that involves categorizing patterns into different types based on their design elements, shape, size, and use. Understanding fashion pattern classes is crucial for fashion designers to create innovative and unique designs that stand out in the fashion industry.

Firstly, it is essential to understand the different types of fashion patterns. There are several types of fashion patterns, including geometric patterns, floral patterns, abstract patterns, animal patterns, and others. Geometric patterns are created using lines, shapes, and angles and can include patterns such as stripes, polka dots, and checks. Floral patterns are always created using various floral motifs, such as flowers, leaves, and vines. Abstract patterns are created using various abstract shapes and forms [120], such as circles, squares, and triangles, and can include patterns such as tie-dye and splatter prints. Animal patterns are created using various animal motifs, such as leopard prints and zebra stripes. The different types of fashion patterns are shown in Figure 2-4.

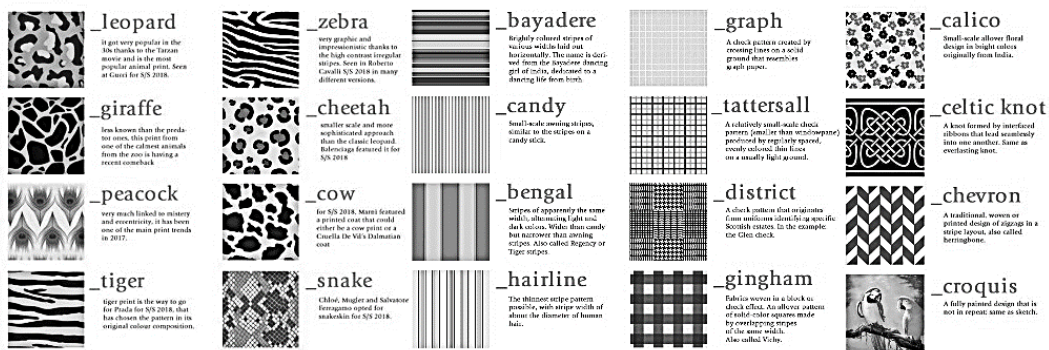


Figure 2-4. Examples of different types of fashion patterns

Secondly, it is essential to understand the design elements that are used to create fashion patterns. These design elements include color, shape, texture, and size. Color is one of the most critical design elements and can be used to create different moods and emotions in the pattern [121]. The shape is another essential design element that can be used to create different visual effects in the pattern. The texture is used to create tactile effects in the pattern, while the size is used to create visual interest and balance in the pattern.

Thirdly, it is essential to understand the significance of fashion pattern classes in clothing design. Clear fashion pattern class helps designers to identify the different types of patterns and use them in innovative and creative ways to create new designs [122]. It also helps designers to identify the different trends in pattern design and use them to create relevant and up-to-date fashion items for consumers.

Fashion pattern classes involve categorizing patterns into different types based on their design elements, shape, size, and use. Understanding the different types of patterns and their design elements is crucial for designers to create unique and innovative designs that stand out in the fashion industry.

Pattern classification methods that consider culture, region, history, and other factors involve analyzing patterns within specific contexts. Pattern classification takes into account these aspects such as culture, region, history, socioeconomic, fashion trend, function, structure, theme, material, color and so on [123, 124]. There is no unified standard for pattern classification [125], however, the natural attribute of a fashion pattern based on its material is the basic classification methods [126], it is the key factor associated with the psychological cognition of fashion patterns extends.

2.2.2 Fashion Pattern Class Selection Experiments

Different fashion patterns represent different meanings and perceptual images, but there are no widely recognized classes of fashion patterns, which will arouse consumers' attributes to a product and affect consumers' purchase decisions. Scientific classes of fashion patterns are conducive to in-depth research on its perceptual image and Kansei attributes. In this study, we clustered fashion patterns into various classes according to

their natural attributes from literature research. In different literature materials, the methods and content of pattern research vary, and different scholars use different methods to study patterns in different research projects. These literature materials were sent for an expert interview. Experts were asked to choose pattern classes in a different vision, referring to their professional knowledge independently to get the preliminary classes of fashion patterns, and then discussed the preliminary pattern classes in a brainstorming, finally, a ranking evaluation experiment was conducted to determine the final fashion classes. The processing flow is shown in the following Figure 2-5.

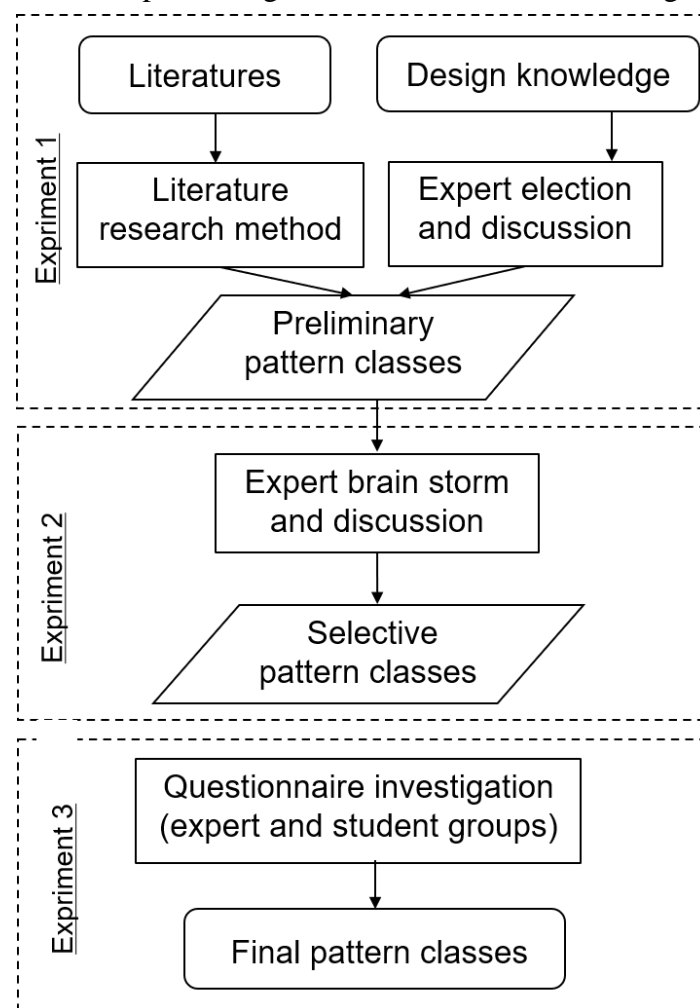


Figure 2-5. The processing flow of pattern class selection

Experiment 1

To investigate the Kansei attributes of different fashion patterns more clearly, in our study, we used the literature research method to analyze the patterns according to their natural attributes from research papers and fashion magazines. These pattern

classes are made from different topics and perspectives as long as they appeared in the fashion related literatures without limit, such as food, animal, cartoon, etc. The selected pattern classes were sent to a panel of 35 experts composed of 19 university design teachers, 10 fashion designers from the industry, and 6 independent designers. These experts were asked to choose pattern classes in their personal vision, referring to their professional knowledge to get the preliminary classes of fashion patterns.

The procedure of the experiment is as follows:

(1) Define search keywords: Determining the keywords related to pattern classification and natural attributes. Examples include “fashion patterns”, “pattern classification”, “pattern categorization”, “pattern attributes”, “natural attributes”, “pattern analysis”, etc.

(2) Research databases: Utilizing academic research databases such as Web of Science, IEEE Xplore, Google Scholar, and fashion-focused databases like WGSN, Vogue Archive, and CNKI to search for relevant research papers and fashion magazines.

(3) Search Strategy: Using a combination of the defined keywords to perform searches in the selected databases. Modify the search queries based on the specific attributes you are interested in, such as color, shape, motif size, motif density, or arrangement.

(4) Article selection: Reviewing the search results and select research papers and fashion magazines that focus on pattern classification, pattern attributes, or pattern analysis. Prioritize recent publications to ensure you capture the latest developments in the field.

(5) Article analysis: Reading and analyzing the selected articles, paying attention to the methods, techniques, and criteria used for pattern class based on natural attributes. Take note of the different classes or categories that emerge from the literature and the attributes associated with each class.

(6) Summarization: Summarizing the findings from the literature in a structured manner. And then create a categorized list of pattern classes based on their natural attributes, highlighting the specific attributes that define each class.

Experiment 2

A brainstorm discussion was organized by another panel of 10 experts included in the previous 35 experts to refine the fashion pattern classes. The selected classes should be paratactic without inclusion and repetition among them. The selected pattern classes were used for a ranking evaluation to determine the final pattern classes.

The procedure of the experiment is as follows:

(1) Introduction: Beginning the session by introducing the purpose and objectives of the brainstorm discussion. Explain that the goal is to explore different methods of fashion classification based on various criteria.

(2) Presentation of criteria: Presenting a set of predetermined criteria for fashion classification, such as cultural relevance, functionality, structural features, theme, material, or color. Explaining each criterion briefly to ensure everyone has a clear understanding. The pattern classes should be paratactic without inclusion and repetition among them.

(3) Idea generation: Encouraging participants to generate ideas for fashion classes based on the presented criteria. The experts wrote their ideas individually on notes or directly on the whiteboard freely expressing their thoughts and encourage a lively discussion.

(4) Group discussion: Facilitating a discussion where participants can present and explain their ideas. As ideas are presented, group similar ideas together and create categories or clusters on the whiteboard. Once all ideas have been shared and categorized, facilitate a discussion to evaluate and refine the generated ideas.

(5) Determine the selected pattern classes: Summarizing the key ideas and methods discussed during the session to get the selected pattern classes.

Experiment 3

Furthermore, a ranking evaluation was conducted within the previous panel of 35 experts in experiments 1 and another 161 students from art or fashion design departments of different universities in China to determine the final pattern classes. Subjects were asked to give a score of 0 or 1 (0 means “non-selected” and 1 means “selected”) for each class based on their design practices. The final score of each pattern class is calculated as the sum of expert and student scores. Because of different

knowledge backgrounds and professional levels, the weight coefficients were set to 0.7 for experts, and 0.3 for students in the ranking evaluation method [127, 128]. Finally, a ranking list of pattern classes was established by the descent order of the final score. The classes with a score higher than 0.67 ($\geq 2/3$) were considered the final classes in this research [129, 130], which means the pattern classes in commonly accepted by most subjects.

The procedure of the experiment is as follows:

(1) Participant selection: Inviting 35 experts with relevant experience and knowledge in the field of pattern design and 161 students from art or fashion design departments in various universities in China. And ensuring the participants have an understanding of pattern design and represent a range of backgrounds and experiences.

(2) Scoring instruction: Making an instruction to both experts and students regarding the purpose and procedure of the experiment. Explaining the scoring system, where 0 represents “non-selected” and 1 represents “selected” for each pattern class.

(3) Individual scoring: The participants independently score the selected pattern classes in Experiment 2 based on their design practices and preferences. Emphasizing that the scores should reflect their expert knowledge or design insights.

(4) Weight coefficients: Applying weight coefficients of 0.7 for experts and 0.3 for students to account for their different levels of expertise and knowledge backgrounds. This adjustment acknowledges the varying influence each group has in determining the final pattern classes.

(5) Score calculation: Calculating the final score for each pattern class by summing the scores from experts and students. This will provide an overall assessment of the acceptance and preference for each class among the participants.

(6) Ranking list: Establishing a ranking list of pattern classes based on the descending order of the final scores. This list will provide an understanding of the relative acceptance and popularity of different pattern classes among the participants.

(7) Final class determination: Considering pattern classes with scores higher than 0.67 ($\geq 2/3$) as the final classes, indicating their acceptance by the majority of participants.

By following this experimental procedure, the researchers were able to gather expert and student perspectives, evaluate pattern classes, and determine the final classes based on their acceptance among the participants.

In this study, all fashion patterns are considered as much as possible to make a selection of fashion patterns, the rule is defined as that the final selected pattern classes should be independent with each other.

2.2.3 Results of Fashion Pattern Class Selection

We sent 62 pattern and pattern classification related literatures to the 35 experts, after the literature analysis, the experts pre-selected 40 preliminary pattern classes according to their natural attributes as shown in Table 2-1.

Table 2-1. 40 Preliminary pattern classes

No.	Class Name	No.	Class Name	No.	Class Name	No.	Class Name
1	3D	11	Continuous	21	Geometry	31	Palace
2	Abstract	12	Deformation	22	Graffiti	32	Plane
3	Animal	13	Eastern	23	Human	33	Plant
4	Astronomy	14	Ecology	24	Industrial	34	Printing
5	Brocade	15	Exaggeration	25	Landscape	35	Realistic
6	Cartoon	16	Figurative	26	Life	36	Sketch
7	Character	17	Food	27	Modern	37	Text
8	Colored	18	Freestanding	28	National	38	Tools
9	Colorless	19	Furniture	29	Natural	39	Utensil
10	Combination	20	Geography	30	Ocean	40	Western

35 design experts selected pattern classes in a brainstorming based on their professional knowledge and design practice. 16 classes of fashion patterns were preliminarily clustered for further investigation. They are the common pattern classes in the design practice and widely recognized classes by experts from different perspectives.

However, the preselected 16 classes in not mutually independent pattern classes, in order to accurately study the perceptual attribute of different classes of fashion patterns,

we should get the independent pattern classes. The same 35 experts and another 161 students were asked to choose fashion patterns from the 16 preselected pattern classes. In this phase, the selected classes should be paratactic without inclusion and repetition among different classes. The participants were asked to select and mark the reasonable pattern classes based on this rule, according to their own experience, knowledge, and design practice. The result of the experiment 2 and the ranking evaluation result of experiment 3 were shown in Table 2-2.

Table 2-2. 16 Selected pattern classes

Ranking	Class	Average Score			Remark
		Experts	Students	Total	
1	Animal	0.971	0.950	0.965	Determined
2	Food	0.857	0.969	0.891	Determined
3	Plant	0.886	0.851	0.876	Determined
4	Geometry	0.857	0.907	0.872	Determined
5	Landscape	0.886	0.801	0.861	Determined
6	Human	0.886	0.783	0.855	Determined
7	National	0.771	0.882	0.804	Determined
8	Text	0.800	0.758	0.787	Determined
9	Utensil	0.743	0.764	0.749	Determined
10	Astronomy	0.457	0.870	0.581	
11	Abstract	0.286	0.752	0.426	
12	Tools	0.429	0.391	0.418	
13	Figurative	0.314	0.621	0.406	
14	Geography	0.286	0.248	0.275	
15	Colored	0.200	0.236	0.211	
16	Colorless	0.171	0.255	0.196	

The top 9 classes were selected by more than 2/3 subjects (≥ 0.667) shown as Animal, Plant, Geometry, Landscape, National, Human, Utensil, Text, and Food. And the selected 9 classes were discussed in the expert group and they were unanimously accepted. The 9 classes contain the most different types of fashion patterns and are used as the final classifications in this research as shown in Table 2-3. The final 9 pattern classes are Animal, Food, Plant, Geometry, Landscape, Human, National, Text and

Utensil, named as A, B, ..., I.

Table 2-3. 9 Fashion pattern classes

No.	Classification	No.	Classification	No.	Classification
A	Animal	D	Geometry	G	National
B	Food	E	Landscape	H	Text
C	Plant	F	Human	I	Utensil

2.3 Conclusion

Fashion patterns are key elements in clothing design. They can be used to enhance the aesthetics of a garment, reflect brand identity, reflect the spirit of the times, and reinforce design themes. Patterns can be created from a variety of sources, including animals, plants, geometries, landscapes, national cultures, humans, utensils, and even food.

Patterns can be used to enhance the aesthetics of a garment by adding an artistic or design touch. Designers must use patterns creatively to make garments more artistic and design-oriented. Patterns can also help reinforce design themes by adding an additional dimension to a garment.

Patterns can also be used to reflect brand identity. Each brand has its own unique culture and design philosophy, and by incorporating specific patterns into their designs, designers can help consumers better understand the brand's culture and design philosophy. Patterns also reflect the spirit of the times by incorporating current trends into their designs. Designers must be aware of current trends in the fashion world in order to effectively use patterns to reflect these trends.

We clustered fashion patterns into various classes according to their natural attributes from research papers and fashion magazines. These pattern classes were made from different topics such as food, animal, cartoon, etc. A group of 40 fashion pattern classes was selected by a panel of 35 experts composed of 19 university design teachers, 10 fashion designers from the industry, and 6 free-job designers. These experts were

asked to choose pattern classes in their personal vision, referring to their professional knowledge.

The Kansei attributes of different fashion patterns were then investigated more clearly through a series of experiments involving both experts and students. In one experiment, 35 experts and 161 students were asked to choose fashion patterns from the preselected pattern classes. The selected classes should be paratactic without inclusion and repetition among different classes.

The final 9 pattern classes were set as Animal, Food, Plant, Geometry, Landscape, Human, National, Text, and Utensil (Class A to Class I). By understanding the Kansei attributes associated with different patterns, designers can create products that appeal to consumers' emotions and preferences, ultimately leading to increased sales and customer satisfaction.

Chapter 3 Kansei Evaluation of Fashion Patterns

In this chapter, we mainly present the concept and tools of Kansei engineering which will be used in my study for the acquisition of Kansei evaluation data from the Kansei evaluations. The main methods and tools used are organized in the following Figure 3-1.

To explore the perceptual image of fashion patterns, referring to the human cognition process as shown in Figure 1-16, we will guide the users using the language to express feelings about the fashion pattern presented to them. In this chapter, we use text mining methods to extract the Kansei words for Kansei evaluation of fashion patterns selected in Chapter 2.

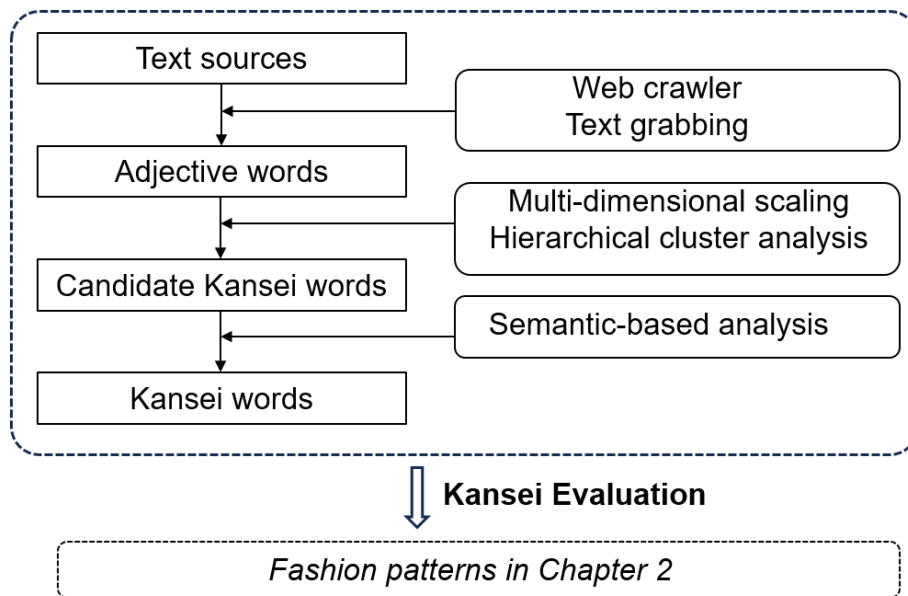


Figure 3-1. Flowchart of Chapter 3

Kansei evaluation is a method of assessing the subjective fashion of a product or service. It is based on the idea that people’s feelings and emotions can be measured and quantified. Kansei evaluation can be used to assess a wide variety of products and services, including fashion patterns.

To conduct Kansei evaluation, specific words or adjectives are used to describe these emotional states. In the field of Kansei Engineering, Kansei evaluation is usually

expressed by some specific words reflecting user emotions and feelings, these words are called *Kansei words*. These words can be used to solicit subjective responses and evaluate emotional reactions toward different aspects of a product or experience.

Text mining, also known as text analytics or natural language processing (NLP), is a field of study that involves extracting meaningful information and insights from textual data. Text mining is an efficient method that can be employed to extract Kansei words from textual data.

In this chapter, we present the methods mentioned above to collect the Kansei words to conduct the Kansei evaluation of fashion patterns.

There are several different methods that can be used to conduct Kansei evaluation. One common method is to use a questionnaire. The questionnaire will ask the respondent to rate their feelings and emotions about the product or service on a scale. The ratings can then be used to create a Kansei profile for the product or service.

Another common method for conducting Kansei evaluation is to use a semantic differential scale. The semantic differential scale is a scale that measures the respondent's feelings about the product or service on several different dimensions. The dimensions can include things like pleasantness, excitement, and sophistication.

3.1 Kansei Engineering and Kansei Evaluation

Kansei Engineering is a discipline within the field of product design and development that focuses on incorporating human emotions and subjective feelings into the design process. It originated in Japan and is rooted in the concept of “Kansei” which refers to the intuitive and emotional responses that individuals have towards products, services, or experiences [131].

Kansei Evaluation is a key component of Kansei Engineering and involves assessing and quantifying human emotional responses to design elements. It aims to understand how different design attributes, such as colors, shapes, textures, or patterns, evoke specific emotions or sensory experiences in users [132].

The process of Kansei Evaluation typically involves collecting data through

various methods, such as surveys, interviews, or physiological measurements, to capture individuals' emotional responses to specific design stimuli [133]. This data is then analyzed and interpreted to identify patterns and relationships between design elements and emotional experiences.

By incorporating Kansei Evaluation into the design process, designers can gain insights into users' emotional needs, preferences, and expectations. This helps them create products and experiences that not only fulfill functional requirements but also evoke positive emotional responses in users. It allows for the design of products that resonate with users on a deeper level, leading to increased user satisfaction, engagement, and loyalty.

Kansei Engineering and Kansei Evaluation have applications in various industries, including product design, automotive design, user interface design, and even marketing. By considering the emotional aspect of design, companies can differentiate their products in the market, establish stronger emotional connections with customers, and ultimately create more successful and desirable products and experiences.

3.1.1 Kansei Engineering

Kansei Engineering is a design methodology that aims to incorporate human emotions and subjective experiences into the product development process. It originated in Japan and has been widely used in various industries to create products that elicit specific emotional responses and enhance user satisfaction [134]

The word "Kansei" refers to the human ability to perceive and interpret sensory information, such as emotions, feelings, and aesthetics. Kansei Engineering recognizes that user satisfaction and preference are not solely based on functional aspects but also on the emotional and aesthetic qualities of a product [135-137].

The process of Kansei Engineering involves several steps:

(1) Kansei Data Collection: This step involves gathering data on user emotions, preferences, and perceptions related to a specific product or design. Various methods such as surveys, interviews, and observations are used to collect data on how users feel and what attributes they associate with their experiences.

(2) Kansei Data Analysis: The collected data is analyzed to identify patterns, correlations, and relationships between user emotions and design elements. Statistical techniques and data mining methods are often employed to extract meaningful insights from the data.

(3) Design Implementation: Based on the findings from data analysis, designers utilize the identified emotional and aesthetic attributes to inform their design decisions. These attributes may include color schemes, shapes, materials, textures, and other design elements that are known to evoke specific emotional responses.

(4) Evaluation and Refinement: Once the design incorporating Kansei elements is implemented, it is evaluated through user feedback and testing. This feedback helps identify areas for improvement and refinement to further enhance the emotional and aesthetic qualities of the product.

By considering the emotional and subjective aspects of user experience, Kansei Engineering aims to create products that resonate with users and evoke positive emotional responses. It enhances user satisfaction, brand loyalty, and market competitiveness by going beyond purely functional considerations and incorporating the human element into the design.

In the context of fashion, Kansei Engineering seeks to understand the subjective emotional responses individuals have towards different patterns and translate those responses into design elements. This approach involves analyzing the psychological and physiological aspects of pattern perception, such as color, shape, and texture, to create patterns that elicit desired emotional states in consumers.

For example, a fashion designer using Kansei Engineering might conduct surveys, interviews, or experiments to gather data on how different patterns are perceived and associated with specific emotions. By understanding the emotional responses that different patterns evoke, designers can create garments with patterns that align with the desired emotional experience or brand image.

Overall, Kansei Engineering applied to fashion patterns aims to create a deeper connection between the garment and the wearer, enhancing the overall aesthetic appeal and emotional experience of the fashion product.

3.1.2 Human Perception

Human perception is the intricate process through which individuals interpret and derive meaning from sensory information they receive from the environment. This process encompasses the acquisition, organization, and interpretation of sensory stimuli captured by the senses of sight, hearing, touch, taste, and smell [138].

Perception is a multifaceted and dynamic phenomenon that integrates sensory input with prior knowledge, past experiences, and cognitive processes, thereby enabling individuals to construct a coherent understanding of the world surrounding them. It relies on the brain's remarkable capacity to receive and process sensory information, extract relevant patterns and cues, and generate perceptions, interpretations, and mental representations of the external stimuli encountered [107].

Numerous factors exert influence on human perception, including attentional mechanisms, memory systems, individual expectations, cultural backgrounds, and unique individual differences. Additionally, perceptual experiences can be subject to biases, illusions, and errors, emphasizing the subjective nature and inherent limitations of perception.

The study of human perception encompasses diverse disciplines, such as psychology, neuroscience, cognitive science, and philosophy. It seeks to investigate how individuals perceive and interpret various aspects of the world, spanning objects, events, emotions, and relationships. Understanding human perception is crucial, as it plays a fundamental role in shaping our daily interactions, guiding decision-making processes, and facilitating our overall comprehension of the world we inhabit [138].

3.1.3 Kansei Evaluation

Sensory study plays a crucial role in studying user perception because it provides a scientific and objective method of measuring how users perceive and respond to various sensory stimuli, such as sight, sound, touch, taste, and smell.

Kansei evaluation is the most effective means of sensory study. By using sensory evaluation techniques, researchers can measure and analyze users' perceptions and preferences of different sensory attributes of products and services. This information

can then be used to improve the sensory appeal of products and services and create better customer experiences.

Kansei Evaluation is a method used to assess and measure the emotional and subjective responses evoked by a product or design [139]. It focuses on understanding how individuals perceive and emotionally react to specific attributes, such as appearance, color, texture, or overall aesthetic qualities. Kansei Evaluation aims to gather data and insights that help guide the design process and create products that elicit desired emotional experiences in users.

Kansei Evaluation is a technique used in the field of Kansei Engineering to assess and measure the emotional and subjective responses evoked by fashion patterns. It aims to understand how individuals perceive and emotionally react to different patterns in clothing and accessories [140].

Kansei evaluation can be used to study user perception in various contexts, including product development, marketing, and customer engagement [141]. Sensory evaluation can help identify the sensory characteristics that customers find appealing in a product. This information can then be used to develop products that better meet customers' needs and desires.

Overall, the role of Kansei evaluation in studying user perception is to provide objective and scientific insights into how users perceive and respond to sensory stimuli. This information can be used to create better products and services that meet customers' sensory needs and preferences.

Sensory study and Kansei engineering are two related but distinct fields that both focus on understanding and improving the human experience of products, services, and environments.

Kansei evaluation study is one of the common methods used in Kansei Engineering [142]. It involves examining the ways in which people perceive and respond to various sensory stimuli, such as sight, sound, touch, taste, and smell. By understanding how these stimuli affect people's perceptions and behaviors, researchers can develop products and environments that are more engaging, appealing, and effective.

Furthermore, the Kansei evaluation study provides a scientific and objective method of measuring how users perceive and respond to sensory stimuli. By using sensory evaluation techniques, researchers can measure and analyze users' perceptions and preferences of different sensory attributes of products and services. This information can then be used to improve the sensory appeal of products and services and create better customer experiences.

In the context of fashion patterns, Kansei evaluation helps designers create fashion patterns that resonate with customers, evoke specific emotional responses, and enhance the overall aesthetic experience. By incorporating the emotional aspect of pattern perception, designers can make informed decisions about design elements, colors, shapes, and textures, ultimately creating fashion products that cater to the desires and preferences of their target market.

3.2 Kansei Evaluation and Its Features

In the field of industrial design, knowledge can be divided into explicit knowledge and implicit knowledge based on the way of its acquisition [143]. Explicit knowledge, referring to knowledge that can be explicitly expressed, can be acquired from oral instructions, textbooks, references, periodicals, patents, software and database and so on [144]. Explicit knowledge can be propagated through languages, books, text, and databases, and can be easily learned by human.

Implicit knowledge refers to tacit knowledge possessed by human experts in terms of skills and recognition, including not only skills and experiences that are informal and hard to express, but also insights, intuitions, inspirations, etc. Implicit knowledge exists in human brains, which dominate its various applications by human [145].

Knowledge originates from books, electronic data, expertise, and so on. The knowledge engineers can acquire knowledge from three sources:

(1) Indirect knowledge: experts provide their empirical and non-structured knowledge related to their past experiences by responding to a well-organized questionnaire in some real scenarios.

(2) Direct knowledge: experts directly express their well-structured and formalized knowledge under the forms of generalized rules and relations.

(3) Knowledge from data: knowledge can be automatically and progressively learned from data.

This thesis mainly deals with indirect knowledge and knowledge from data.

For an accurate and objective expression of knowledge of garments, it is important to analyze the characteristics of knowledge of garments [146], which can be summarized by a number of semantic statements as follows:

Fuzziness: human perception is fuzzy, and cannot be easily expressed. Thus, it is difficult to give quantitative results with traditional theories and methods when evaluating the perception of a garment. Also, the evaluation rules cannot be understood and stated with Boolean logic [147]. The Kansei information expressed by a certain evaluation subject is not only uncertain but also multiple. Consequently, in practice, the Kansei information on garments can be expressed by utilizing fuzzy sets.

Complexity: garments are the most commonly-used consumer goods. However, its information is very complicated and rich. The complexity of a garment is not only embodied in its own structure and aesthetic perception, but also highlighted in the relationship between the garment and body shapes. For example, the same garment fitting with different consumer sizes, usually leads to a big difference in vision. This is the so-called Kansei attraction of garments, which is difficult to understand.

Integrity: for garment products, design elements include a number of Kansei information, such as patterns, details, fabrics and so on [148]. These elements are independent but interconnected between them, in order to show one specific identity. The perception of garments is related to the overall sensory effects on the combination of these elements. So, the evaluation of garments is performed with respect to the overall perception.

The main computational tools used in this thesis are selected for modeling and analysis of professional knowledge and human perceptions at different levels by taking into account the previous characteristics.

3.2.1 Kansei Evaluation and Kansei Words

Kansei evaluation and Kansei words are concepts originating from Japan that are used in the field of product design and marketing. They are related to the subjective assessment and understanding of the emotional and aesthetic qualities of products or designs.

Kansei evaluation refers to the process of evaluating and analyzing the emotional responses, impressions, and preferences that individuals associate with a particular product or design. It focuses on capturing and understanding the intangible and subjective aspects of user experiences, such as the feelings, emotions, and sensory perceptions evoked by the product.

Kansei words, also known as “emotional words” or “affective words” are linguistic expressions used to describe and communicate the emotional and sensory qualities associated with a product or design. These words are specifically chosen to capture and convey the subjective and experiential aspects of the product, reflecting the feelings, moods, and impressions it elicits.

In practice, Kansei evaluation involves conducting user studies, surveys, or interviews to gather qualitative data on users’ emotional responses and impressions. Participants are asked to express their feelings and perceptions using Kansei words, which help designers and marketers understand and translate those emotional qualities into tangible design elements, such as shape, color, texture, or sound.

By integrating Kansei evaluation and Kansei words into the design process, designers can create products or designs that align with the desired emotional and aesthetic experiences of the target audience. It allows for a more user-centered approach, focusing on fulfilling users’ emotional needs and enhancing the overall user experience.

3.2.2 Perceptual Image of Fashion Pattern

The perceptual image of a fashion pattern refers to the subjective interpretation and visual representation of a specific pattern within the realm of fashion. It encompasses how individuals perceive and mentally construct an image based on the visual elements, such as color, shape, texture, and pattern, present in a fashion design.

When it comes to fashion patterns, the perceptual image involves the way individuals perceive, interpret, and respond to the visual elements within the pattern. It encompasses their overall aesthetic impression, emotional response, and subjective meaning associated with the pattern. This includes how individuals perceive the pattern's visual appeal, its suitability for different occasions or contexts, and the symbolic or cultural significance it may hold.

Understanding the perceptual image of fashion patterns is crucial for designers, marketers, and researchers in the fashion industry. By comprehending how individuals perceive and interpret patterns, they can create designs that resonate with the target audience, evoke desired emotional responses, and align with their aesthetic preferences. Additionally, considering the perceptual image helps designers effectively communicate their creative vision and establish a deeper connection with consumers.

3.3 Kansei Word Extraction by Text Mining

Kansei words are related fields that focus on understanding and describing sensory experiences. In the sensory study, they are used to evoke sensory experiences of sensory and engage customers' senses[149].

Kansei words are always used as the “vocabulary” to express Kansei attitude toward patterns. They are critical and necessary for Kansei evaluation. Different Kansei words are used to evaluate different items. In this study, a text mining method was proposed for word collection and Kansei word extraction for evaluation from fashion information related to fashion patterns and fashion style.

In our approach, text mining has been applied to extracting Kansei words for Kansei evaluation of fashion patterns. Kansei words about fashion and fashion patterns often appear in fashion information websites, journal articles, and fashion magazines, etc. A similar language for aesthetic design or emotional design is not readily available due to the lack of first principles for affect or emotion. Often, when a design turns to the sensory aspect, diversity in words to describe sensory or emotions among people is very large. Therefore, how to find a set of words that can be used to specify the customer's

emotional requirement for a product (fashion pattern in this study) is a challenging problem.

Text is one of the most common data types within databases, which is always unstructured data [150]. Text mining, also known as text data mining, is the process of transforming unstructured text into a structured format to identify meaningful patterns and new insights. By applying advanced computational techniques, such as Support Vector Machines (SVM), and other deep learning algorithms, companies of data mining and analysis can explore and discover hidden relationships within their unstructured data [151]. Researchers use the text mining method to analyze online shopping experiences [152, 153], fashion design trends [35], and global fashion sustainability practices [154].

Semantic-based analysis is applicable to dealing the text data, researchers proposed a new approach of cognitive semantic learning and graph theory for semantically clustering text documents [155]. The semantic-based analysis is one of the most important methods to organize and make use of the gigantic amounts of information that exist in unstructured textual format [156].

The general approach for dealing with this problem is text mining or the knowledge discovery technique [157-160]. In this study, we used a text mining technology for the extraction of Kansei words, by applying an open-source software for text mining and quantitative content analysis named KH Coder [161, 162].

The proposed text mining method consists of text data source collection, text data gathering, adjective word reduction, word clustering, semantic-based analysis and sensory word determination. The process of Kansei word extraction is as following steps shown in Figure 3-2.

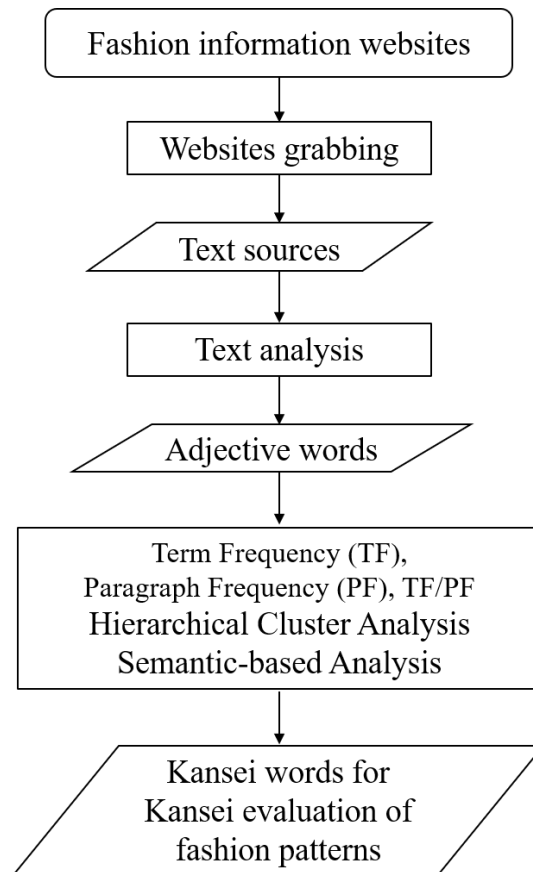


Figure 3-2. Procedure of Kansei word extraction

3.3.1 Finding Text Data Source

Fashion-related text information is the original text data source for Kansei word extraction. Fashion information websites like “vogue.com” and “wwd.com” contend kinds of Kansei words describing various perceptions of fashion items, which are mainly adjectives and nouns. In this study, we focused on taking adjectives as the candidate Kansei words. After several interviews with fashion designers, several well-known and commonly used fashion information websites were selected as text data sources. On these websites, the words used to express the Kansei attitude toward fashion items are comprehensive, and of course including those for representing fashion patterns. These text sources will be used to collect text data.

After interviews with fashion designers, 16 well-known and commonly used fashion information websites were selected as text data sources as shown in Table 3-1. (Accessed between May 10th - 18th, 2020)

Table 3-1. The websites selected for text data sources

No.	Website Name	Uniform Resource Locator
1	Vogue	http://www.vogue.com/
2	WWD	http://www.wwd.com/
3	ELLE	http://www.elle.com/
4	Stylist	http://www.stylist.co.uk/
5	WGSN	http://www.wgsn.com/
6	Style Forum	http://www.styleforum.net/
7	Fashion	http://www.fashionmagazine.com/
8	Notjustalabel	http://www.notjustalabel.com/
9	Impression	http://theimpression.com
10	Karennicol	http://www.karennicol.com/
11	Dazed	http://www.dazeddigital.com/fashion
12	Ifashion	http://www.ifashion.co.za/
13	Tangentmag	http://www.tangentmag.com/
14	Purplediary	http://purple.fr/
15	Mystyle	http://www.mystyle.com/
16	Fashionista	http://fashionista.com/

3.3.2 Collecting Text Data

After determining the text data sources, a web crawler coded by Python grabs the text contents from previously selected websites to gather a big database of texts. For example, we analyzed the website structure of “Vogue.com”, which contains sections on Fashion, Beauty, Runway, Culture and others. Through the web crawler, an unstructured text database was generated. This text database was imported into a text data analysis tool named KH Coder to differentiate into nouns, verbs, adjectives, prepositions and other words. In this study, adjectives are the main words to express Kansei attitude toward fashion patterns. Therefore, only the adjectives are focused on as candidate words for further use.

The text contents were grabbed from the websites about the sections of fashion,

runway, fashion reviews and other fashion-related sections. A large unstructured text data including 4,011 paragraphs from 396 pages on 16 websites. 338,468 words were collected for text data mining and 1,143 adjectives were identified by KH Coder.

3.3.3 Reducing Adjectives

The collected adjective words in previous step contain various adjectives, including recurring adjectives such as big, new..., rarely occurring adjectives such as bottled, sticky..., which may be eliminated. In order to quantitatively analyze the text data and reduce candidate adjectives, Term Frequency (TF) and Paragraph Frequency (PF) are introduced to construct structured text data for reducing candidate adjectives. We calculate the TF according to the number of occurrences of each target word in the entire text database containing all web page text crawled and the PF according to the number of paragraph cases containing each target word. Adjectives with high TF are dense terms occurring frequently in different paragraphs and documents, and adjectives with low TF implicate they are sparse terms that are not commonly used words. These words usually have no specific Kansei attitude toward fashion items and should be eliminated.

The T/P value is defined as the ratio of TF/PF, which can be used to confirm the data scale and threshold for reducing adjectives [163]. An adjective word with a high T/P value tends to be a “dense term”, which should be considered as a general adjective word (GAW) [164], such as “new”, “good” and others. Contrarily, it is a “sparse term”, the sparse items are always the not commonly used adjectives and consumers may not be familiar with its application in the fashion field. The dense terms are always the general adjective word without specific meaning to express emotions. Thus, the sparse and dense items should be removed. For removing sparse and dense terms in text mining, the value is usually set in the range of 0.9-1.0.

According to the numbers of cumulative adjectives collected from the data sources websites shown in Figure 3-3, we can find that the number of adjectives remains almost invariant when the collected webpages are more than 320. Therefore, we consider that the selected 1,143 adjectives from 396 pages are enough to describe all designed

patterns and it is not necessary to introduce additional text sources, the text sources are enough for analysis.

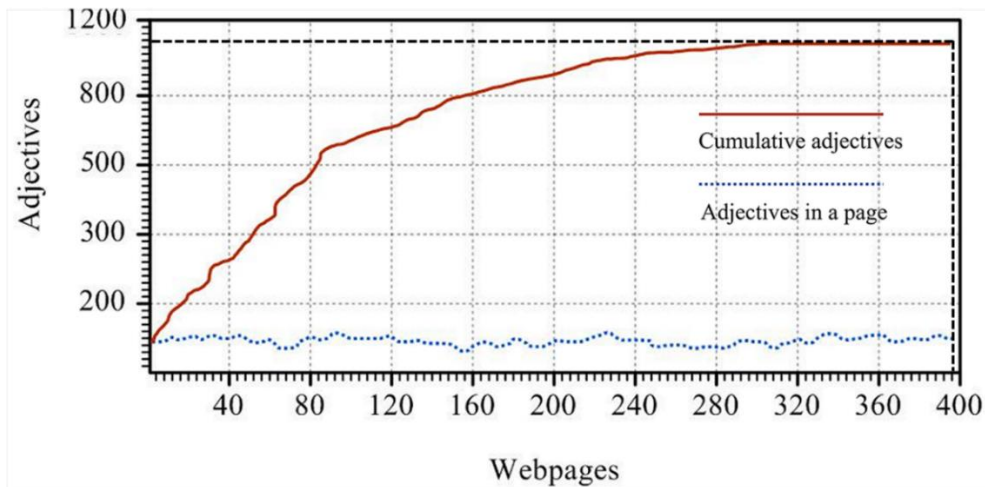


Figure 3-3. Collected adjectives from data sources websites

By applying TF and PF options can filter out words that seldom appear, as well as words that appear too frequently. The threshold of T/P value was set as 1.0, correspondingly, the threshold of PF is $PF=58.14$ shown in Figure 3-4. According to the threshold of T/P value, 642 sparse terms and 69 dense terms [164] were removed from the list of 1,143 adjective words, and only 432 adjective words were retained as the candidate Kansei words.

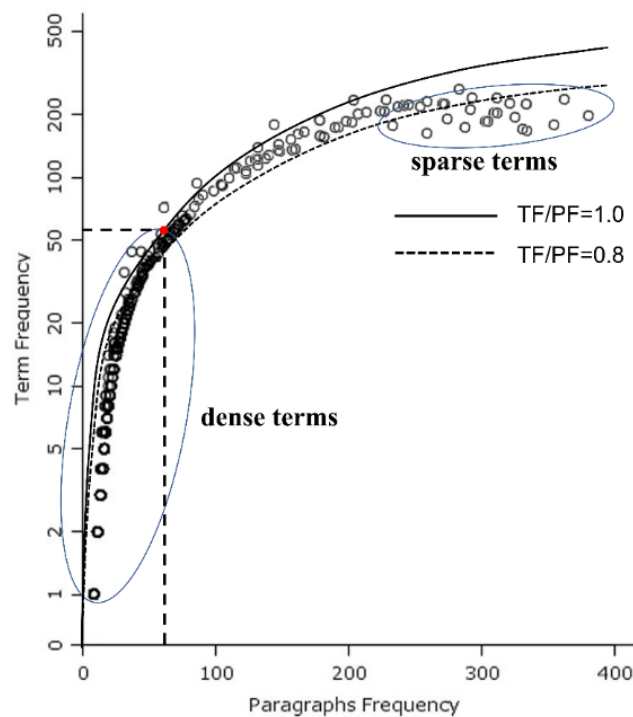


Figure 3-4. Term Frequency and Paragraph Frequency

These 432 candidate Kansei words were analyzed using Multidimensional scaling (MDS) to find their combinations or groups of words that have similar appearances and then clustered into 10 clusters as shown in Figure 3-5. These clusters will be of benefit to semantic-based analysis.

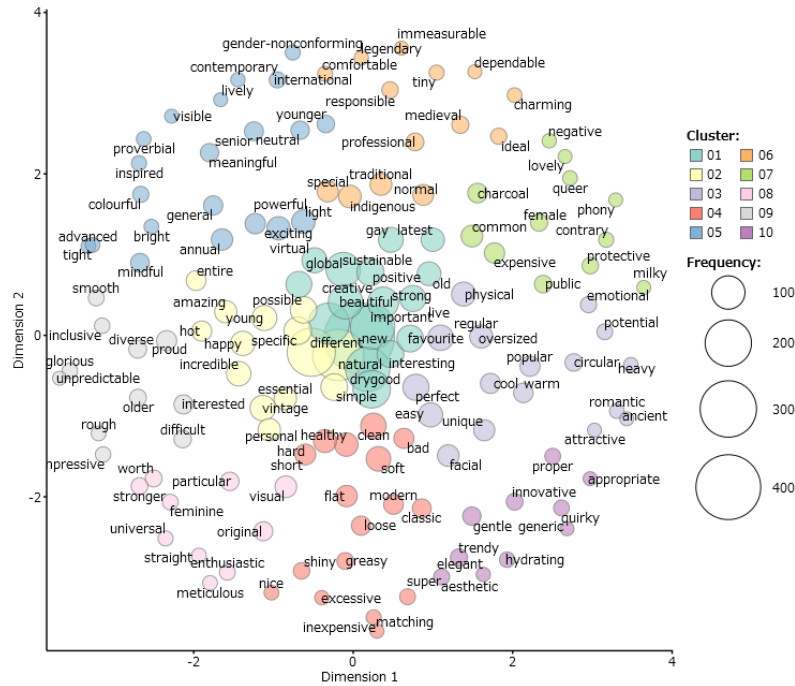


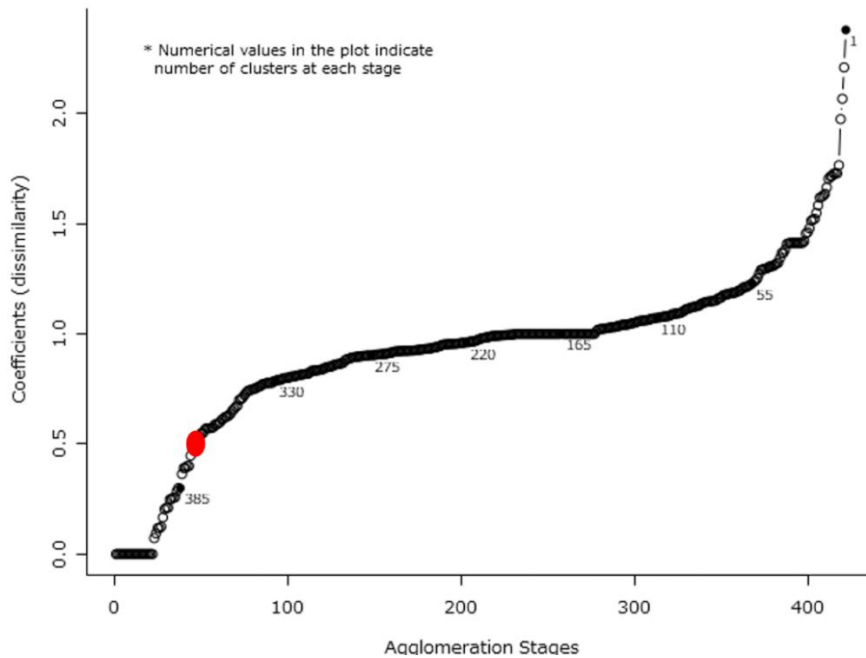
Figure 3-5. Multidimensional scaling of words

3.3.4 Clustering Adjective Words

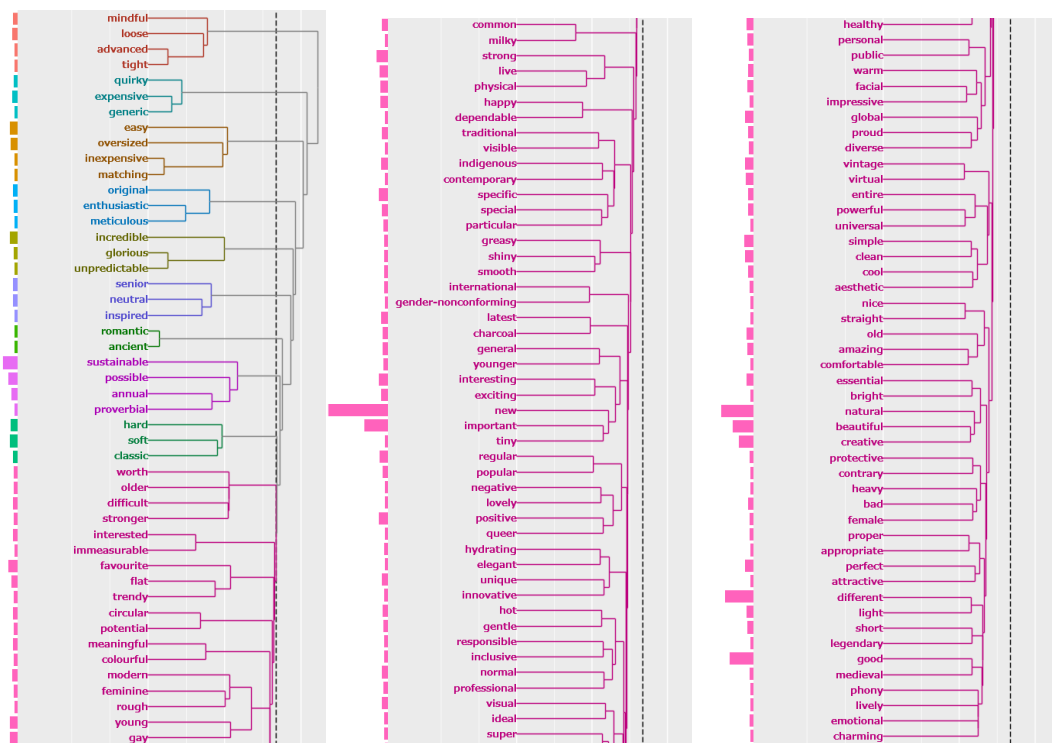
To further reduce the candidate adjectives in *step 3*, MDS is applied to make word clusters with Ward's method based on Euclidian distance, which evaluates the distances between clusters using an analysis of variance. Ward's method is the most widely used amalgamation rule because it has the advantage of generating clusters of moderate size in the preliminary screening of adjectives, it is thought to be an effective method for exploring data with an unknown group or category structure. MDS enables us to find combinations or groups of words that have similar appearances. Hierarchical Cluster Analysis (HCA) is used to plot words cluster based on the combinations or groups of words. Words plotting close to each other are classified in the same cluster. The clustering can assist to extract a database of desired candidate Kansei words.

Jaccard coefficients are calculated for all possible combinations of target words by flitting out sparse terms and dense terms. HCA uses the Jaccard coefficient to determine

the associations between words, and uses the Wards method to cluster candidate Kansei words into 42 clusters shown on an agglomeration (Figure 3-6 (a)) and dendrogram (Figure 3-6 (b)) automatically. The number of candidates Kansei words was reduced to 42 words as shown in Table 3-2.



(a) Agglomeration plot



(b) Hierarchical cluster

Figure 3-6. Hierarchical Cluster Analysis of words

Table 3-2. 42 candidate Kansei words

42 candidate Kansei words					
attractive	modern	classic	live	popular	simple
creative	smooth	conservative	masculine	positive	special
elegant	soft	emotional	natural	powerful	specific
fancy	amazing	exciting	neutral	professional	tight
feminine	appropriate	hard	original	romantic	traditional
formal	casual	interesting	perfect	rough	trendy
lively	charming	international	personal	senior	young

After quantitative analysis, the word list contains some synonyms which should be merged, such as “charming” (17 times) and “attractive” (15 times). It was necessary to further reduce the adjectives based on the sensory expression of words. Also, there are 6 pairs of Kansei words with opposite senses in the 42 candidate Kansei words. Actually, the adjectives have been streamlined to 36 candidate Kansei words, they should be further extracted.

3.3.5 Semantic-Based Analysis

In order to extract the key sensory words from the database of candidate Kansei words, semantic-based analysis was used to analyze the candidate Kansei words. After quantitative analysis and clustering, there were still some synonyms that should be merged. Meanwhile, some words were not appropriate in the fashion domain for the sensory study of fashion patterns such as sticky and bottled, which are difficult for subjects to evaluate objects accurately. These words were removed from the database of candidate Kansei words according to their semantics.

3.3.6 Determining Kansei Words

To obtain the final Kansei word list, the validation of the candidate Kansei words was performed with a human factor experiment. This step aimed to observe the subjects on their affective expressions for a fashion product and to check if the words can capture the subjects’ expressions.

Expert subjects evaluated candidate Kansei words using the Likert scale to judge

the applicability of Kansei evaluation of the candidate Kansei words. In this experiment, the confidence level (two-tailed) was assumed to be 95% to confirm the consistency test, which is usually adopted in the human factor research community. By satisfying this criterion, it means all the subjects have a consensus that the Kansei word is appropriate for effective expressions of a fashion product. As a result, this Kansei word could be used as a final Kansei evaluation word.

Expert subjects evaluated candidate Kansei words using a 5-scale form to finally determine the Kansei words. By the t-test ($p=0.05$), all the experts should be a consensus on the extraction of the Kansei words. We finally extracted 10 pairs words of Kansei evaluation words, such as “Traditional – Modern”, ..., “Masculine – Feminine”, the 10 pairs of the Kansei words were coded as KW-1 to KW-10 to simplify the descriptions in the questionnaire of Kansei evaluation, they were shown in Table 3-3. These words will be used as Kansei words for fashion pattern evaluation.

Table 3-3. 10 pairs of Kansei words

No.	Kansei Words	Code	No.	Kansei Words	Code
1	Traditional - Modern	KW-1	6	Tawdry - Elegant	KW-6
2	Steady - Lively	KW-2	7	Rough - Smooth	KW-7
3	Unattractive - Attractive	KW-3	8	Casual - Formal	KW-8
4	Hard - Soft	KW-4	9	Conservative - Radical	KW-9
5	Simple - Fancy	KW-5	10	Masculine - Feminine	KW-10

3.4 Kansei Evaluation for Fashion Patterns

Kansei evaluation is often used in the field of design and marketing to understand the emotional and psychological responses elicited by products, including fashion patterns. It focuses on capturing and analyzing the subjective feelings and impressions that individuals experience when interacting with a particular design. Kansei evaluation is a valuable tool for fashion designers. It can help designers to create patterns that are more likely to be applied to consumers. the study can also help designers to understand the factors that influence consumers’ choices when it comes to fashion patterns.

In this thesis, Kansei evaluation is applied to studying the psychological cognition of fashion patterns, it aims to uncover how these patterns evoke various emotions, moods, and perceptions in individuals.

3.4.1 Preliminary Knowledge

3.4.1.1 Trainees

In this study, the Kansei evaluations are carried out by professionals specialized in students randomly selected and experts. Student trainees consist of 48 female and 13 male members, aged between 19 and 25 years. The trainees fall into 2 classes, students; experts in the textile industry (working mainly on design and fashion design). These trainees have previously participated in the tests.

3.4.1.2 Standardized sensory methods

10 pairs of Kansei words are determined as the standardized evaluation criteria in our study for describing fashion patterns.

For each pair of Kansei words, a detailed explanation (see Table 3-4) is initially obtained from Oxford English Dictionary. If there exist several explanations for one word, the final word will be selected by the fashion experts according to the level of comprehension by the trainees.

These 10 pairs of normalized Kansei evaluation criteria are different from other neutral and non-hedonic sensory descriptors describing products. Instead of describing the basic nature of products, these normalized sensory criteria are more emotional and abstract, and deal with social-cultural context of products. In fact, they are closer to consumers' expectations and preferences than classical sensory descriptors describing products only. We consider that a relationship between consumers and products can be set up based on these 10 pairs of sensory criteria.

Table 3-4. The Kansei evaluation criteria and their explanations

No.	Evaluation Criteria	Explanation
1	Traditional - Modern	Traditional: being part of the beliefs, customs or way of life of a particular group of people, that have not changed for a long time Modern: of the present time or recent times
2	Steady - Lively	Steady: developing, growing, etc. gradually and in an even and regular way Lively: full of life and energy; active and enthusiastic
3	Unattractive - Attractive	Unattractive: not good, interesting or pleasant Attractive: pleasant to look at, especially in a sexual way
4	Hard - Soft	Hard: solid or stiff and difficult to bend or break Soft: smooth and pleasant to touch
5	Simple - Fancy	Simple: not complicated; easy to understand or do Fancy: used to show that you are surprised or shocked by something
6	Tawdry - Elegant	Tawdry: involving low moral standards; extremely unpleasant or offensive Elegant: attractive and showing a good sense of style
7	Rough - Smooth	Rough: having a surface that is not even or regular Smooth: even and regular, without sudden stops and starts
8	Casual - Formal	Casual: not formal Formal: very correct and suitable for official or important occasions
9	Conservative - Radical	Conservative: opposed to great or sudden social change; showing that you prefer traditional styles and values Radical: new, different and likely to have a great effect
10	Masculine - Feminine	Masculine: having the qualities or appearance considered to be typical of men; connected with or like men Feminine: having the qualities or appearance considered to be typical of women; connected with women

3.4.1.3 Evaluation scales

During the evaluation procedure, the trained trainees should describe the features of the fashion pattern using a set of normalized Kansei words. All the subjects use the same keywords during their evaluations and receive a training session in order to understand the meaning of these descriptors. The method of semantic differential scale is used for representing the evaluation scores of these descriptors. It is a widely used technique in sensory evaluation [165].

In the method of semantic differential scale, a series of bipolar (opposite) adjectives of descriptive phrases are presented to the respondent at opposite ends of a 5 or 7 scale.

Evaluators are asked to indicate which grade scale best describes their feelings toward the object.

In the end, these 10 normalized pairs of emotional descriptors constitute the intermediate layer connecting both the inputs (consumer’s profile) and outputs (recommended product).

A general example is shown in Table 3-5. “very simple - very fancy” is a pair of adjectives that is evaluated using a semantic differential scale. It has five intensity levels or evaluation scores represented by $\{C_1, C_2, C_3, C_4, C_5\}$, corresponding to the linguistic values $\{\text{“very simple (VS)”}, \text{“simple (S)”}, \text{“medium (M)”}, \text{“fancy (F)”}, \text{“very fancy (VF)”}\}$. Each subject has to give an evaluation score from this set.

Table 3-5. General semantic differential scale of “Simple - Fancy”

Very Simple	VS	S	M	F	VF	Very Fancy
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3.4.2 Preliminary Kansei Evaluation

In order to assess the validity of the extracted Kansei evaluation words, a case study of Kansei evaluation was carried out to validate these words using the “Animal” pattern class to test if the Kansei words express accurate and consistent psychological cognition of consumers in a fashion pattern evaluation.

3.4.2.1 Preliminary experiment

Fashion patterns are extremely diverse in very many ways, all items can be used as fashion patterns in different ways, abstract and figurative, different shapes, different sizes and colors, and so on, such as Figure 3-7. Even the same item, it differs from a different designer, a different fashion item. To explore this issue, we launched a preliminary experiment, and selected pattern classifications A (Animal).

A group of “Animal” patterns was illustrated by a designer with a comparison group illustrated by another designer with different styles to test the influence of illustration style in a fashion pattern evaluation. They illustrated 12 given animal patterns with their style as shown in Figure 3-8 (a) and (b). To remove the influence of the color factor on the Kansei evaluation, all fashion patterns were processed as black and white on T-

shirts.

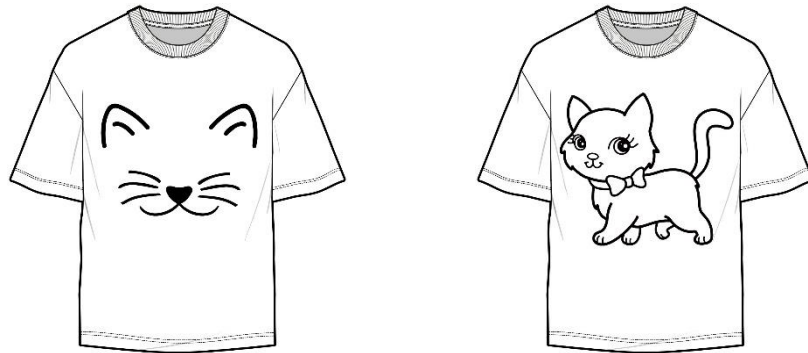
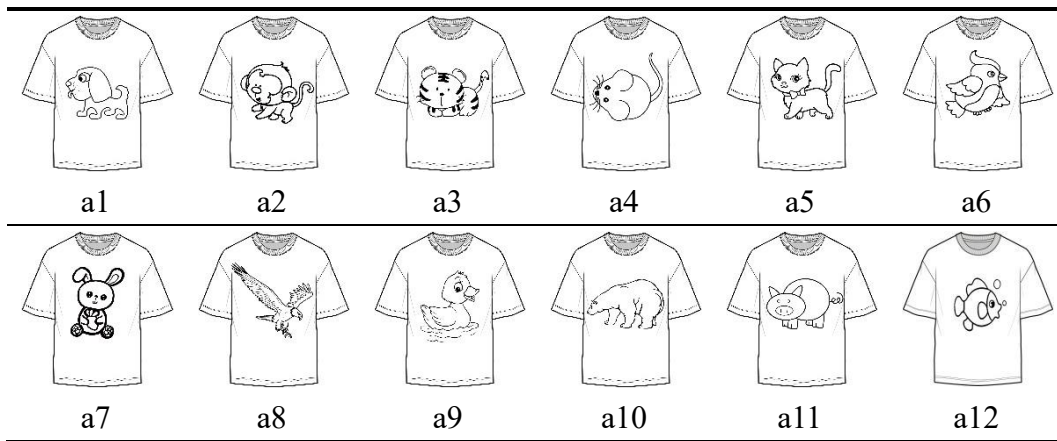
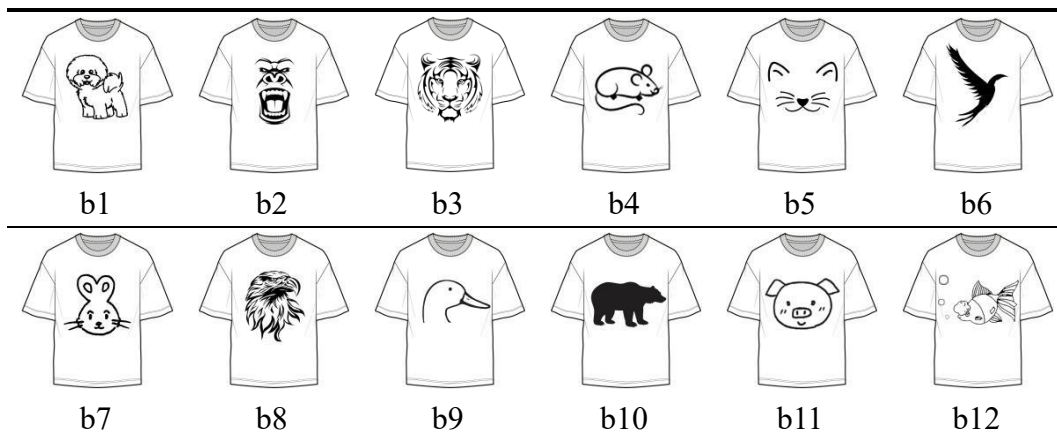


Figure 3-7. Pattern illustration



(a) 12 patterns illustrated by designer I



(b) 12 patterns illustrated by designer II

Figure 3-8. Designated animal patterns illustrated with different styles (a) designer I;

(b) designer II

65 student volunteers participated in the experiment as the subjects (39 females and 26 males, aged 21 ± 2), and 24 objects were shown randomly on a computer screen in

the Kansei evaluation Figure 3-9). The Semantic Difference (SD) method was applied to a questionnaire investigation using the Kansei evaluation words (Table 3-4) on a professional questionnaire design and distribution platform. Each T-shirt with a different pattern and 10 pairs of Kansei words was set as an object as shown in Figure 3-9 (24 sets total). The evaluation option is a matrix of 10 pairs of Kansei words with 5-scale scores (-2 to +2) as Table 3-5.

Please evaluate the pattern on the T-shirt according to the following evaluation words



	-2	-1	0	+1	+2	
Traditional	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Modern
Steady	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Lively
Unattractive	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Attractive
Hard	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Soft
Simple	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Fancy
Tawdry	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Elegant
Rough	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Smooth
Casual	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Formal
Conservative	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Radical
Masculine	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Feminine

Figure 3-9. Demonstration of Kansei evaluation of patterns

Kansei evaluation of all the patterns was conducted from different aspects using the 10 pairs of Kansei words. The one-way Analysis of Variance (ANOVA) method was used to analyze two groups of evaluation data to determine the variability between the two independent groups of patterns to determine whether there are any statistically significant differences.

3.4.2.2 Results and discussion of the preliminary experiment

The results of ANOVA for different pattern styles of the “Animal” class are shown in Table 3-6. The difference with no significance indicates that the Kansei evaluation of that pair of Kansei words is consistent between different pattern groups, it also reveals this pair of Kansei words can be used to express accurate percipient cognition without ambiguity. The results suggest that most of the evaluations have no significant difference between the same pattern illustrated with different styles except for a few pairs of Kansei words. The following evaluations of Tawdry – Elegant for the pattern (monkey) a2 and b2 ($p=0.008$), Unattractive - Attractive for pattern (tiger) a3 and b3 ($p=0.010$), Hard – Soft for pattern (bird) a6 and b6 ($p=0.000$), Rough – Smooth for pattern (eagle) a8 and b8 ($p=0.010$), Steady – Lively for pattern (eagle) a8 and b8 ($p=0.005$), Hard - Soft for pattern (bear) a10 and b10($p=0.001$), and other 6 evaluations show significant differences of ANOVA between different pattern styles, other 90.0% Kansei evaluations has no significant differences. Evaluation between the two groups of patterns showed high consistency using the extracted Kansei words. The results indicate that even for different pattern styles, usually, there is no significant difference in a Kansei evaluation. Respondents can express their psychological cognitions about fashion patterns. It reveals that the text mining method for word extraction and the extracted Kansei words are valid for Kansei evaluation of fashion patterns. Appropriate Kansei words express more accurate percipient cognition, pattern style possesses little influence on the Kansei evaluation using the 10 pairs of Kansei words.

Through comparative analyses it was found that, in the “Animal” pattern class, if a common animal usually appears in human life, like a cat and dog, the results of these patterns converged in a Kansei evaluation; contrarily, the results showed inconsistently, such as the pattern of monkey, tiger and eagle, it presented a little differential percipient cognition. Only if the styles are significantly different and some uncommon animals, such as pattern 2 (monkey), pattern 6 (bird) and pattern 8 (eagle). Humans connect feelings through physical associations [46], and the patterns of common animals are easier to express an accurate emotional meaning, on the contrary, the patterns of common animals will give different emotional cognitions based on various associations, because of the unfamiliarity to these pattern subject (like monkey, tiger, and eagle).

Table 3-6. Significant differences of ANOVA for different pattern styles ((a), (b))

Kansei word	pattern 1	pattern 2	pattern 3	pattern 4	pattern 5	pattern 6
Traditional - Modern	0.483	0.282	0.389	0.133	0.462	0.180
Steady - Lively	0.144	0.433	0.340	0.533	0.414	0.163
Unattractive - Attractive	0.136	<u>0.048*</u>	<u>0.010**</u>	0.310	0.523	0.478
Hard - Soft	0.731	0.235	0.309	0.260	0.685	<u>0.000**</u>
Simple - Fancy	0.452	0.183	0.250	0.166	0.150	0.167
Tawdry - Elegant	0.674	<u>0.008**</u>	0.202	0.300	0.634	0.687
Rough - Smooth	0.390	0.693	0.119	<u>0.033*</u>	0.428	0.378
Casual - Formal	0.209	0.130	0.516	0.480	0.225	0.115
Conservative - Radical	0.086	0.368	<u>0.030*</u>	0.239	0.898	<u>0.029*</u>
Masculine - Feminine	0.330	0.360	0.645	0.632	0.068	0.563
Kansei word	pattern 7	pattern 8	pattern 9	pattern 10	pattern 11	pattern 12
Traditional - Modern	0.399	0.446	0.085	0.557	0.630	0.122
Steady - Lively	0.491	<u>0.005**</u>	0.797	0.190	0.493	<u>0.017*</u>
Unattractive - Attractive	0.138	0.445	0.059	0.539	0.849	0.324
Hard - Soft	0.520	0.380	0.169	<u>0.001**</u>	0.340	0.156
Simple - Fancy	0.266	0.232	0.630	0.666	0.754	0.369
Tawdry - Elegant	0.438	0.342	0.512	0.860	0.150	0.693
Rough - Smooth	0.579	<u>0.010**</u>	0.460	0.106	0.518	<u>0.012*</u>
Casual - Formal	0.432	0.059	0.056	0.424	0.473	0.202
Conservative - Radical	0.281	0.244	0.789	0.521	0.488	0.158
Masculine - Feminine	0.830	0.640	0.510	0.271	0.254	0.655

*: p values ≤ 0.05 , **: p values ≤ 0.01

Based on the results of the Kansei evaluation, it can be declared that Kansei words are important to do a Kansei evaluation for expressing accurate percipient cognition. The different styles of animal patterns have little effect on cognition. The cognitions of the same pattern object tend to be unified regardless of its illustrated style. The cognition of patterns is based on the association of patterns imagery, familiar pattern objects are more beneficial to express accurate percipient cognitions for fashion design.

Other pattern classes may have similar results, which will be verified in our subsequent studies. The Pattern perceptual images and cognitions can be used for fashion design and recommendation in future works.

3.4.3 Kansei Evaluation of Fashion Patterns

Fashion patterns were classified as 9 classes systemically as shown in Table 3-7, the pattern classes were set as A to I. 12 typical patterns were selected for each class by experts mentioned above, finally we got 108 patterns from A1, A2, ..., I11, I12 in Table 3-7. Because the different combinations of fashion patterns and colors will lead to an uncertain change of perceptual image, in this study, the fashion pattern is treated to colorless to focus on the pattern itself. Then, the pattern is overlapped to a T-shirt for Kansei evaluations as shown in Figure 3-10.

To abstract the perceptual image of fashion patterns, we extract 10 pairs of Kansei words using text mining method to conduct the Kansei evaluation of fashion patterns using a questionnaire method, which was usually used to explore human cognition in the field of Kansei engineering. The Kansei evaluation criteria and their explanations are shown in Table 3-4 and the demonstration of Kansei evaluation is shown in Figure 3-9. The Kansei evaluations were carried out in a climate chamber with comfort conditions of $21\pm 1^{\circ}\text{C}$ and $65\pm 5\%\text{RH}$ after the 124 examinee subjects were well explained and trained. A five-level scale was applied to collect the Kansei evaluation value as shown in Table 3-5.

Table 3-7. 9 fashion pattern classes and pattern number

Classification No	Pattern Class	Pattern (12*9=108)
A	Animal	A1, A2, ... A12
B	Food	B1, B2, ... B12
C	Plant	...
D	Geometry	...
E	Landscape	...
F	Human	...
G	National	...
H	Text	...
I	Utensil	I1, I2, ...I12

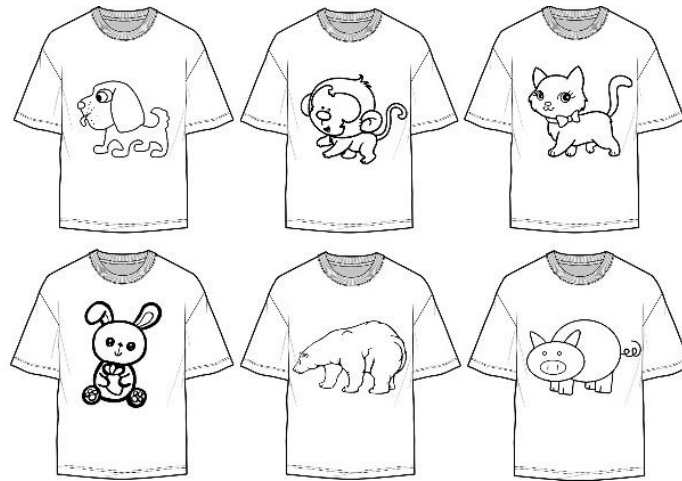


Figure 3-10. Sample fashion pattern in class A (Animal)

3.5 Conclusion

This study processed a fashion pattern classification using the literature research method and ranking evaluation method, fashion patterns were classified into 9 classes: Animal, Plant, Geometry, Landscape, National, Human, Utensil, Text, and Food. The systematical pattern classification is helpful for fashion pattern evaluation.

For Kansei evaluation of fashion patterns, Kansei words are critical. In this study, the text mining method was applied to extracting Kansei words for Kansei evaluation. T/P value is proposed to construct structured text data for quantitative analysis, 10 pairs of Kansei words were extracted for Kansei evaluation, “Traditional – Modern”, “Steady – Lively”, “Unattractive – Attractive”, “Hard – Soft”, “Simple – Fancy”, “Tawdry – Elegant”, “Rough – Smooth”, “Casual – Formal”, “Conservative – Radical”, “Masculine – Feminine”, which can be used for Kansei evaluation of fashion patterns or other fashion items.

Based on the case study of a Kansei evaluation, the text mining method for Kansei word extraction and they are valid for Kansei evaluation of fashion patterns. These Kansei words are effective to lead accurate percipient cognitions in Kansei study. It is apparent that the cognitions of the same pattern object tend to be unified even for different styles, and familiar pattern objects are more effective to connect the design

intents of designers and the percipient cognitions of consumers. The findings of this study suggest that fashion designers have better use familiar pattern objects to effectively transmit design intents in fashion items for consumers; also, Kansei evaluation is an efficient approach to connect the physical world and emotion.

For future works, the elected fashion pattern classes and the extracted Kansei words will be used to make a Kansei evaluation study to explore the consumers' cognition and designers' cognition of fashion patterns, and then find out their cognition differences to help to establish a fashion pattern recommendation system for collaborative design between consumer and designer.

Chapter 4 Techniques Used in the Proposed Fashion Pattern Recommendation System

In this chapter, we present the techniques used in the proposed fashion pattern recommendation system, including the fuzzy set, Triangular Fuzzy Number, questionnaire investigation of perceptual images for fashion patterns, and its data analysis, also, the neural network used in machine learning, such as DenseNet and back propagation (BP) neural network. These techniques are used to deal with the data acquired in the previous chapter of Kansei evaluation of fashion patterns. They are applied to mining the data for revealing the perceptual image of fashion patterns and the cognition difference between users and designers. The framework of this chapter is shown in Figure 4-1.

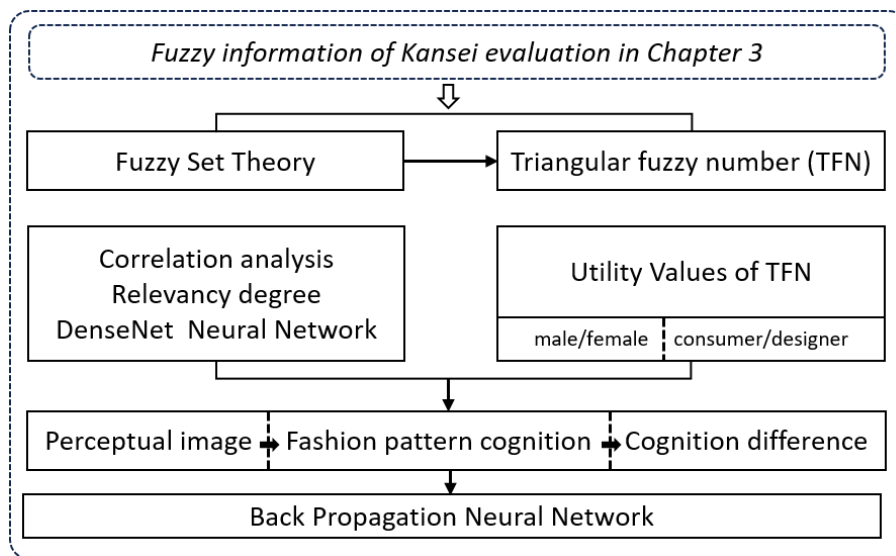


Figure 4-1. Framework of Chapter 4

In this thesis, we attempt to explore users' cognition of fashion patterns. Different users' cognition of fashion patterns has fuzziness, which needs to be mined through scientific methods. Fuzzy techniques are effective methods to deal with the uncertain data of human cognition. Machine learning is an effective method for data mining and exploring potential correlations in the data. In this chapter, because of the advantages of DenseNet enhancing gradient backpropagation, and the advantages of BP neural network realizing complex nonlinear mapping making the network easier to train,

DenseNet and BP neural networks are used in this chapter as the machine learning tools.

Machine learning is a branch of artificial intelligence that allows computers to learn from data and make predictions or decisions without being explicitly programmed. Machine learning has been used in a wide variety of applications, including spam filtering, web search engines, fraud detection, and self-driving cars. In the fashion industry, machine learning has been used for a variety of tasks, including design and consumer recommendation systems [166, 167], Fraud detection [168], Inventory optimization [169], Price optimization [170], and Product design [171, 172]. Compared with subjective recommendations by individual designers of fashion specialists, machine learning has several advantages for fashion pattern recommendation. First, it can help to personalize recommendations by taking into account a user's past behavior and preferences [173]. Second, it can help to increase the accuracy of recommendations by integrating users' historic data-based prediction [174]. Third, it can help to reduce the time it takes to make recommendations by automating the process of finding the best patterns for each user [175].

For fashion pattern recommendation, there are many factors that can affect what patterns a person might like, such as their personal style, body type, and the occasion for which they need the pattern [101]. Additionally, the definition of what constitutes a "good" pattern is subjective. Some people might prefer patterns that are easy to follow, while others might prefer patterns that are more creative and challenging.

There are several different ways to approach fashion pattern recommendation. One approach is to use machine learning algorithms to learn from past data and make recommendations based on what patterns people have previously purchased or rated [176]. Another approach is to use human experts to curate patterns and recommend them to users based on their personal style preferences [177].

Both approaches have their own advantages and disadvantages. Machine learning algorithms can be very effective for supporting recommendations, but the proposed solutions are usually biased towards patterns that have been purchased or rated by many people, which is not favorable for original fashion pattern generation. Human experts can be more accurate in their recommendations, but it is a time-consuming and

expensive process.

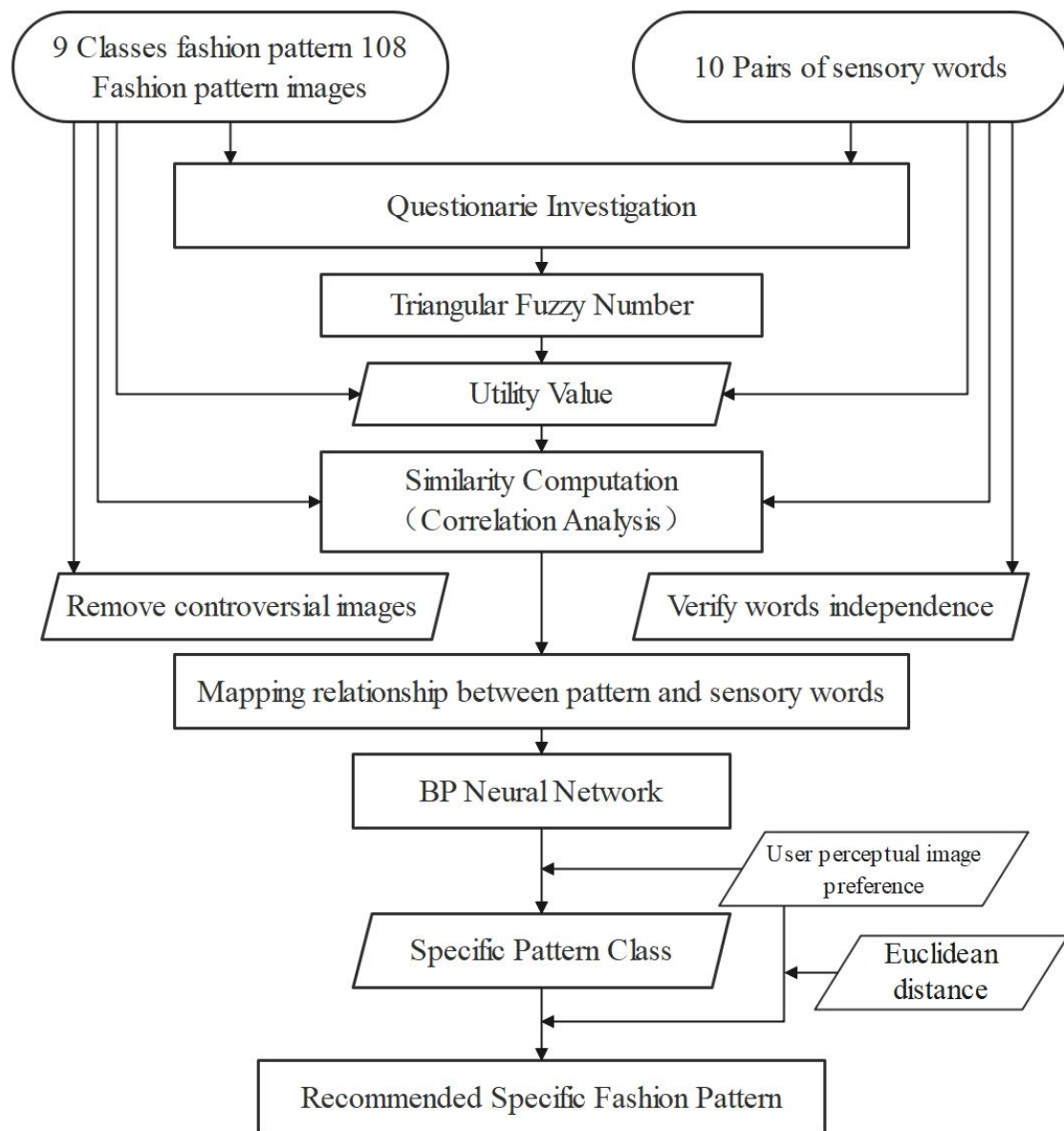


Figure 4-2. Flow chart of the machine learning-based fashion pattern recommendation

In this study, we try to combine the advantages of human evaluation and machine learning-based methods to improve the accuracy of fashion pattern recommendation. However, due to the multiplicity, complexity, and fuzziness in the designers' and consumers' perceptions of clothing patterns, it is difficult to accurately set up a relevant model for recommending fashion patterns. It is for this reason that I introduce fuzzy logic to process uncertainties in the modeling procedure and build an intelligent fashion pattern recommendation system. The flow chart of this chapter is shown in Figure 4-2.

4.1 Fuzzy Theory and Related Technique

The real world is complex and its complexity arises from vagueness. When the complexity of a problem exceeds a certain threshold, the system must become vague in nature. As complexity increases, our ability to make precise judgments about the behavior of the system diminishes [178]. Traditional mathematical models are limited in their ability to provide information due to their insistence on precision.

The real world contains a vast amount of human knowledge, which is often vague, imprecise, uncertain, ambiguous, or probabilistic. Human thinking and reasoning frequently involve fuzzy information derived from vague concepts. Humans can provide satisfactory answers that are likely true. Expressions such as “young”, “good”, “tall”, and “high” are also fuzzy, with no universal quantitative standard for defining these terms.

However, most automated systems are based on classical two-valued logic and struggle to handle unreliable or incomplete information and provide expert opinions. In these situations, fuzzy techniques have demonstrated their unique ability to handle both human knowledge and uncertain information.

Fuzzy techniques have several strengths compared to traditional system modeling and analysis techniques as the following.

(1) Fuzzy technique can handle uncertainty and imprecision usually encountered in physical scenarios, especially for those involving human factors by using fuzzy numbers.

(2) Fuzzy technique can deal with vagueness and ambiguity existing in real physical systems by using fuzzy rules, in order to support decision making at all levels.

(3) Fuzzy technique can be used to model complex systems involving strongly nonlinear relations between inputs and outputs.

According to these features, we consider that fuzzy techniques are relevant for modeling in the proposed fashion pattern recommendation, including plenty of uncertainties related to human perceptions of designers and consumers.

4.1.1 Fuzzy Set Theory

The foundation of fuzzy techniques is fuzzy set theory. Fuzzy sets, introduced in 1965 by Lotfi A. Zadeh and Dieter Klaua, are an extension of the classical concept of sets [179]. Sali defined a more general structure called an L-relation [180], which he studied in an abstract algebraic context. Fuzzy relations are used in various areas, such as linguistics, clustering, and decision-making. These applications are the special cases of L-relations when L is the unit interval $[0,1]$.

In the classical set theory, element membership in a set is determined in binary terms according to a bivalent condition: an element either belongs or does not belong to the set. In contrast, fuzzy set theory is applicable to the gradual assessment of element membership in a set using a membership function valued in the unit interval $[0,1]$. Fuzzy sets generalize classical sets because the indicator functions of classical sets are the special cases of fuzzy membership functions if the latter only take values of 0 or 1.

In fuzzy set theory, the classical bivalent sets are often referred to as crisp sets. Fuzzy set theory can be applied in many domains where information is incomplete or vague, such as bioinformatics.

Definition of a Fuzzy Set

In a fuzzy set A, according to its membership function, each element is mapped to $[0,1]$ as follow,

$$\mu_A: X \rightarrow [0,1]$$

it means that the membership function takes real values within the range of $[0, 1]$.

Therefore, a fuzzy set is a “vague boundary set” of a crisp set, and the difference between “crisp set” and “fuzzy set” is discriminated by their fuzzy membership functions.

For example, if we define a fuzzy set A = “two or so” on the universe X of positive real numbers, $X = \{1,2,3,4,5,6, \dots\}$, the membership function of this fuzzy set can be represented by a series of discrete real numbers:

$$\mu_A(1) = 0, \mu_A(2) = 1, \mu_A(3) = 0.5, \mu_A(4) = 0, \dots$$

Consider the statements “this pattern is casual” or “that pattern is formal”. The

terms “casual” and “formal” are vague in this context. To accurately represent the concept of “vague,” we would need to define its membership function as shown in Figure 4-3. When we refer to a pattern as “casual” or “formal,” we are evaluating its perceptual image on a scale between “casual” and “formal.” If we set a range of [1,9], we can measure the “degree of casualness (formality)” within this range as a continuous set.

The horizontal axis represents the degree of casualness (formality), while the vertical axis represents the numerical values of the membership function. The line in the figure shows the likelihood (value of the membership function) of belonging to the fuzzy set “degree of casualness (formality)”.

We can also manipulate a similar statement, such as “this pattern is very casual.” To be included in the set of “very casual,” the degree of casualness must be lowered, as if the line were shifted to the left, as shown in Figure 4-3. If we define a fuzzy set in this way, only fashion patterns with a degree of casualness below 5 can be included in the set of “casual.” The probability of a fashion pattern with an evaluation of 3 being included in this set is 0.5. In other words, if we denote A= “very casual,” B= “casual,” C= “formal,” and D= “very formal.

We have $\mu_A(1)=1.0$, “very casual”, $\mu_B(3)=0.5$, “casual”, $\mu_C(7)=0.5$, “very formal”, $\mu_D(9)=1.0$, “very formal”.

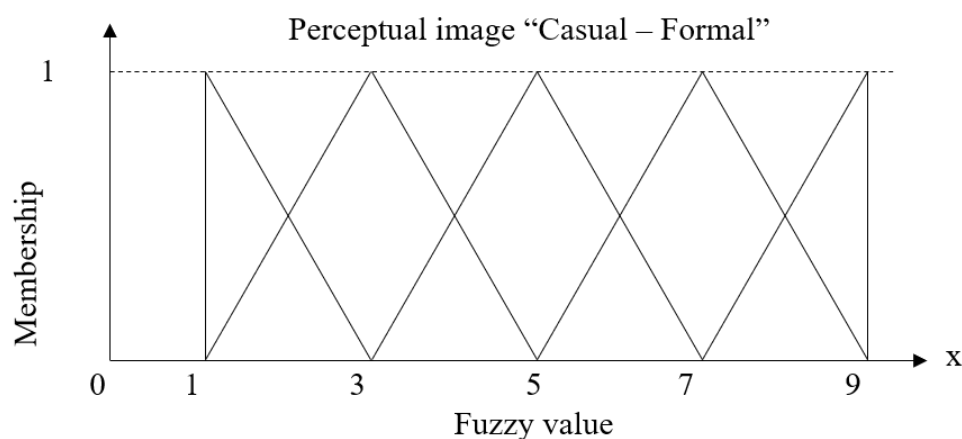


Figure 4-3. Fuzzy sets

4.1.2 Basic Operations of Fuzzy Sets

Complement

The membership function of the complement set \bar{A} of a fuzzy set A is defined as follows.

$$U_{\bar{A}}(x) = 1 - U_A(x), \quad \forall x \in X$$

Union

In the union of two fuzzy sets A and B , the membership value of an element x is determined by the greater of its membership degrees in A and B .

$$U_{A \cup B}(x) = \text{Max}[U_A(x), U_B(x)], \quad \forall x \in X$$

Intersection

In the intersection of two fuzzy sets A and B , the membership function takes on the smaller value of the membership functions of A and B .

$$U_{(A \cap B)}(x) = \text{Min}[U_A(x), U_B(x)], \quad \forall x \in X$$

4.1.3 Properties of Fuzzy Sets

When we simultaneously consider three fuzzy sets A , B and C defined in the universe X , the properties of classical sets are also applicable to fuzzy sets. These properties include follows:

Commutativity:

$$A \cup B = B \cup A,$$

$$A \cap B = B \cap A.$$

Associativity:

$$A \cup (B \cup C) = (A \cup B) \cup C,$$

$$A \cap (B \cap C) = (A \cap B) \cap C.$$

Distributivity:

$$A \cup (B \cap C) = (A \cup B) \cap (A \cup C),$$

$$A \cap (B \cup C) = (A \cap B) \cup (A \cap C)$$

Identity:

$$A \cup \emptyset = A \quad \text{and} \quad A \cap X = A,$$

$$A \cap \emptyset = \emptyset \quad \text{and} \quad A \cup X = X.$$

Transitivity:

If $A \subset B \subset C$ then $A \subset C$.

Involution:

$$\overline{\overline{A}} = A$$

4.1.4 Operations on Fuzzy Relations

Given a fuzzy relations R and T defined on a Cartesian space $X \times Y$. Then we can define the following operators:

Union

The union of the two fuzzy relations R and T can be defined as:

$$\forall (x,y) \in X \times Y$$

$$\begin{aligned} \mu_{R \cup T}(x,y) &= \max(\mu_R(x,y), \mu_T(x,y)) \\ &= \mu_R(x,y) \vee \mu_T(x,y) \end{aligned}$$

In practical applications, “ \vee ” is typically implemented using a MAX operation.

For n relations, this can be extended to the following form:

$$\mu_{R_1 \cup R_2 \cup \dots \cup R_n}(x,y) = \bigvee_{R_i} \mu_{R_i}(x,y)$$

Intersection

The intersection of the two fuzzy relations R and T can be defined as:

$$\forall (x,y) \in X \times Y$$

$$\begin{aligned} \mu_{R \cap T}(x,y) &= \min(\mu_R(x,y), \mu_T(x,y)) \\ &= \mu_R(x,y) \wedge \mu_T(x,y) \end{aligned}$$

“ \wedge ” is typically implemented using a MIN operation. In the same manner, the intersection relation for n fuzzy relations is defined as:

$$\mu_{R_1 \cap R_2 \cap \dots \cap R_n}(x,y) = \bigwedge_{R_i} \mu_{R_i}(x,y)$$

Complement

The complement relation \overline{R} of the fuzzy relation R can be defined by:

$$\forall (x,y) \in X \times Y$$

$$\mu_{\overline{R}}(x,y) = 1 - \mu_R(x,y)$$

Composition of fuzzy relations

Let R be a fuzzy relation defined on a Cartesian space $X \times Y$, S a fuzzy relation on $Y \times Z$, and T a fuzzy relation on $X \times Z$. The MAX-MIN composition is the common method for linking two fuzzy relations. Thus, we have

$$T = R \circ S \\ = \left\{ (x,z), \max_y \left\{ \min(\mu_R(x,y), \mu_S(y,z)) \right\} \mid x \in X, y \in Y, z \in Z \right\}$$

The above form is the set-theoretic notation. In function-theoretic form, it is

$$\mu_T(x,z) = \bigvee_{y \in Y} (\mu_R(x,y) \wedge \mu_S(y,z))$$

4.1.5 Similarity Degree of Fuzzy Sets

The similarity degree of two fuzzy sets is a measure of how similar they are. It is a number between 0 and 1, where 0 means that the two fuzzy sets are not similar at all, and 1 means that they are completely similar.

There are many different ways to define the similarity degree of fuzzy sets. Some of the most common methods include Hamming similarity, Euclidean similarity, Max-min similarity and Arithmetic averaged similarity. The similarity degree of two fuzzy sets can be defined as below [181].

Let X be the universe.

Let $F(X)$ be the set of all fuzzy sets on X .

Let A , B , and C be three fuzzy sets defined on $F(X)$.

Let N be a mapping function that maps $F(X) \times F(X) \rightarrow [0,1]$.

Then, $N(A,B)$ is called the similarity degree of fuzzy sets A and B if it satisfies the following conditions:

- (1) $N(A,B)=N(B,A)$
- (2) $N(A,A)=1, N(X, \emptyset)=0$
- (3) if $A \subseteq B \subseteq C$, then $N(A,C) \leq N(A,B) \wedge N(B,C)$

The similarity degree of fuzzy sets can be used in a variety of applications, such as pattern recognition, data mining, and machine learning. It can also be used to measure the similarity of documents, images, and data. In this thesis, it is used to measure the similarity of the Kansei evaluation data for fashion patterns.

4.1.6 Triangular Fuzzy Number

There are various forms of fuzzy numbers in fuzzy sets, triangular fuzzy number (TFN) is the most popular one [182]. TFN is a fuzzy number represented by three points, i.e., $A = \text{TFN}(a, b, c)$. Correspondingly, its membership function (Figure 4-4) is defined by follows (equation 4-1)

$$\mu_{(A)}(x) = \begin{cases} 0, & x < a \\ \frac{x-a}{b-a}, & a \leq x \leq b \\ \frac{c-x}{c-b}, & b \leq x \leq c \\ 0, & x > c \end{cases} \quad (4-1)$$

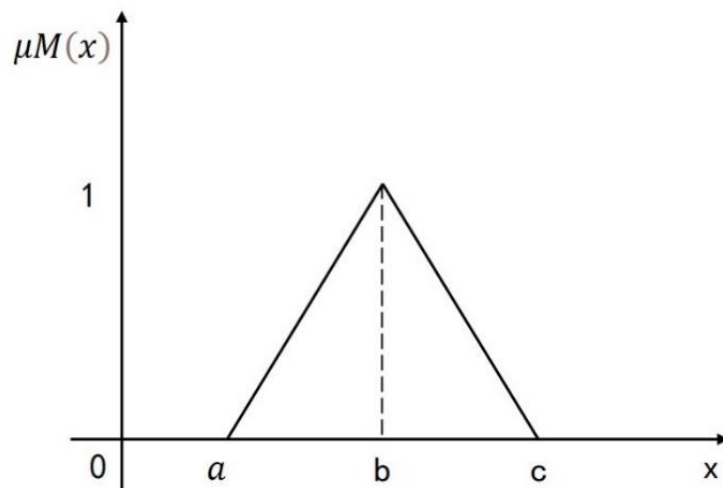


Figure 4-4. The triangular fuzzy number $A = \text{TFN}(a, b, c)$

The TFN can be used to do various operations, the basic operations of TFNs are as follows:

Addition and Subtraction: The addition and subtraction of TFN are commutative and associative. The resulting fuzzy number is also triangular, with the peak at the

midpoint of the sum or difference of the peaks of the two input fuzzy numbers.

Multiplication: The multiplication of TFN is not commutative, but it is associative. The resulting fuzzy number is also triangular, with the peak at the product of the peaks of the two input fuzzy numbers.

Division: The division of TFN is not commutative, but it is associative. The resulting fuzzy number is also triangular, with the peak at the quotient of the peaks of the two input fuzzy numbers.

Negation: The negation of a TFN is also triangular, with the peak at the negation of the peak of the input fuzzy number.

For example, triangular fuzzy numbers of A and B are defined as $A = \text{TFN}(a_1, b_1, c_1)$, $B = \text{TFN}(a_2, b_2, c_2)$, we have

(1) Addition

$$\begin{aligned} A + B &= \text{TFN}(a_1, b_1, c_1) + \text{TFN}(a_2, b_2, c_2) \\ &= \text{TFN}(a_1 + a_2, b_1 + b_2, c_1 + c_2) \end{aligned}$$

(2) Subtraction

$$\begin{aligned} A - B &= \text{TFN}(a_1, b_1, c_1) - \text{TFN}(a_2, b_2, c_2) \\ &= \text{TFN}(a_1 - a_2, b_1 - b_2, c_1 - c_2) \end{aligned}$$

(3) Symmetric image

$$-(A) = \text{TFN}(-c_1, -b_1, -a_1)$$

4.2 Formalization of Involved Data

Data formalization is the process of converting raw data into a structured format that can be easily processed by computers. This can be done by defining a data model, which is a set of rules that define the structure of the data. The data model can then be used to create a database, which is a collection of data that is stored in a structured format.

In this chapter, a triangular fuzzy number was used to formalize the Kansei evaluation data. And the utility value was introduced to utility value was used to quantify the triangular fuzzy number to extract the perceptual image of fashion patterns.

4.2.1 Utility Values for Triangular Fuzzy Number

The degree of correlation between fashion patterns and perceptual images is uncertain or fuzzy. The fuzziness refers to the indistinctness of the differences between objective things in the intermediate transition process, such as the fuzzy concepts of youth, beauty, and height of people, without clear boundary distinctions. This kind of fuzzy information can be quantified by fuzzy mathematics. Triangular fuzzy number is a branch of fuzzy mathematics, which can be used to deal with Kansei evaluations. In the questionnaire investigation shown in Figure 3-9, subjects were asked to choose the proximity of a pair of evaluation words. It is a linguistic/qualitative comparison between fashion patterns and perceptual images and then quantitatively represented by triangular fuzzy numbers, which can be finally transformed into a crisp value by using the maximum membership degree method, center of gravity method, weighted average method, or maximizing set and minimizing set method [183]. In this study, we choose the maximizing set and minimizing set method for the defuzzification of Kansei evaluation data keeping more original information.

In the Kansei evaluation, for each pair of preselected Kansei words, a subject chooses one grade value from the five-level scale $\{-2, -1, 0, 1, 2\}$ to express his/her impression of the relevancy of this pair of sensory words to one specific pattern. This grade value is then transformed into a triangular fuzzy number (a_i, b_i, c_i) as shown in Table 4-1, where, (a_i, b_i, c_i) is the triangular fuzzy number that needs to be quantified.

Table 4-1. The correspondence between grade values and triangular fuzzy numbers (Casual-Formal)

Grade Value	Semantics	Code	Triangular fuzzy number
-2	Very Casual	VC	(1, 1, 3)
-1	Casual	C	(1, 3, 5)
0	Medium	M	(3, 5, 7)
1	Formal	F	(5, 7, 9)
2	Very Formal	VF	(7, 9, 9)

Let $A_1, A_2, A_3, \dots, A_n$ be n triangular fuzzy numbers, $\tilde{A}_i = (a_i, b_i, c_i), i = 1, 2, \dots,$

n , as shown in Figure 4-5. The membership function of the minimal set is G and the membership function of the maximal set is M respectively as:

$$\mu_G(x) = \begin{cases} \frac{x-x_{max}}{x_{min}-x_{max}}, & x_{min} \leq x \leq x_{max} \\ 0, & \text{Others} \end{cases} \quad (4-2)$$

$$\mu_M(x) = \begin{cases} \frac{x-x_{min}}{x_{max}-x_{min}}, & x_{min} \leq x \leq x_{max} \\ 0, & \text{Others} \end{cases} \quad (4-3)$$

where, $\mu_G(x)$ is the minimal set membership function as equation (4-2), and $\mu_M(x)$ is the maximal set membership function as equation (4-3), x_{max} , x_{min} are the maximum and minimum values of the triangular fuzzy number set in the Kansei evaluation as shown in Figure 4-5.

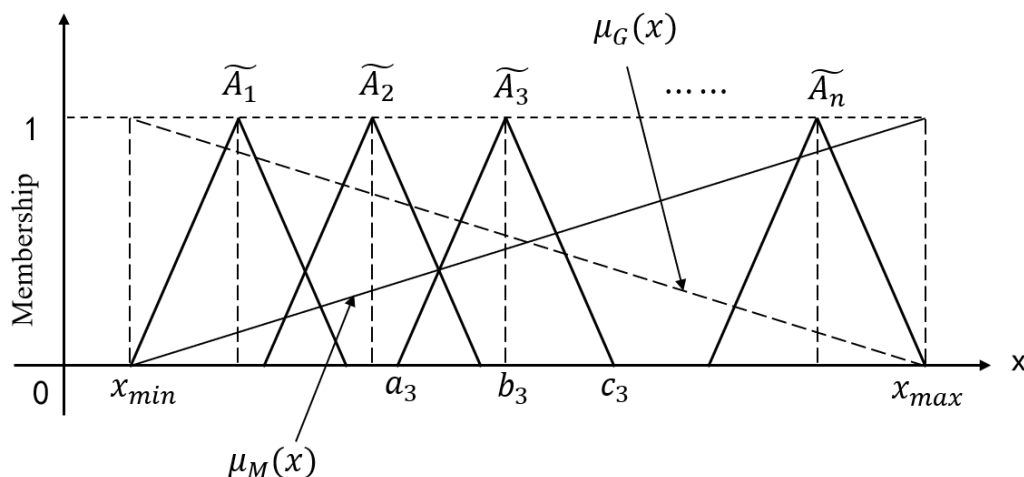


Figure 4-5. Minimum set membership function $\mu_G(x)$ and maximal set membership function $\mu_M(x)$

Utility Value (UV) is introduced to indicate the proximity of two triangular fuzzy numbers. In this study, it represents the proximity of the total aggregated evaluation value (perceptual needs) and the sensory scale of $\{-2, -1, 0, 1, 2\}$. It reflected the mapping relationship between them as shown in Table 4-1.

The utility value $U_G(A_i)$ and utility value $U_M(A_i)$ are determined by the minimum set G and the maximum set M as following equations (4-4) and (4-5):

$$U_G(\tilde{A}_i) = \sup(\mu_{\tilde{A}_i}(x) \wedge \mu_G(x)) = \frac{x_{max}-a_i}{(x_{max}-x_{min})+(b_i-a_i)} \quad (4-4)$$

$$U_M(\tilde{A}_i) = \sup(\mu_{\tilde{A}_i}(x) \wedge \mu_M(x)) = \frac{c_i-x_{min}}{(x_{max}-x_{min})-(b_i-c_i)} \quad (4-5)$$

The Overall Utility Value (OUA) of the fuzzy number A_i is:

$$\begin{aligned}
U_T(\tilde{A}_i) &= (U_M(\tilde{A}_i) + 1 - U_G(\tilde{A}_i))/2 \\
&= \left[\frac{c_i - x_{min}}{(x_{max} - x_{min}) - (b_i - c_i)} + 1 - \frac{x_{max} - a_i}{(x_{max} - x_{min}) + (b_i - a_i)} \right] / 2 \\
&\quad i=1, 2, \dots, n
\end{aligned} \tag{4-6}$$

In this study, the OUA is improved based on Tsai and Hsiao method [184], and equation (4-7) is used to quantify the fuzzy semantics

$$U_T(\tilde{A}_i) = \frac{b_i - x_{min}}{x_{max} - x_{min}} + \frac{1}{2} \left(\frac{c_i - b_i}{(x_{max} - x_{min}) + (c_i - b_i)} - \frac{b_i - a_i}{(x_{max} - x_{min}) + (b_i - a_i)} \right) \tag{4-7}$$

4.2.2 Formalization of The Kansei Evaluation Data

The Kansei evaluation of the relevancy of 10 pairs of sensors words to the 108 preselected representative fashion patterns (9 classes, and 12 patterns in each class), named from A1, A2, ..., A12 to I1, ... I12, has been realized using the Semantic Difference method [185]. The questionnaire has been distributed to 124 subjects for collecting their evaluations. The triangular fuzzy number (TFN) and Utility value (UV) for three specific pairs of Kansei words: “Traditional - Modern”, “Steady - Lively”, and “Unattractive - Attractive” are shown in Table 4-2.

For example, the user gives a Kansei evaluation value for the pattern A1 with 2 (Very Formal), its TFN is (7, 9, 9) according to Table 4-1, and the UV is 1.0 calculated by the equations above. All the participants evaluated the pattern A1, its average TFN is (5.4, 7.3, 8.5), and correspondingly, the UV is 0.753, which means pattern A1 has a formal impression between formal and very formal as shown in Table 4-2.

The UV of the A1 pattern for the sensory words of “Steady – Lively” is 0.818, which means the A1 pattern has a strong perceptual image of “Lively”. According to this method, we can learn the mapping relationship between all fashion patterns and 10 pairs of sensory words.

All the data of Kansei evaluation is formalized using the proposed method above, and the utility value (UV) is calculated to characterize the relevancy of perceptual images, represented by Kansei words, to fashion patterns. The utility value (UV) is transformed into a range of [0, 1].

Table 4-2. Relevancy of sensory words and perceptual image

Pattern No.	(TFN) \ UV (Traditional – Modern)	(TFN) \ UV (Steady – Lively)	(TFN) \ UV (Unattractive – Attractive)
A1	(5.4, 7.3, 8.5) \ 0.753	(5.9, 7.9, 8.9) \ 0.818	(3.4, 5.2, 6.9) \ 0.520
A2	(4.9, 6.7, 7.8) \ 0.680	(6.6, 8.6, 9.0) \ 0.872	(4.2, 6.1, 7.5) \ 0.618
A3	(4.5, 6.3, 7.5) \ 0.635	(6.5, 8.5, 9.0) \ 0.864	(4.9, 6.8, 8.2) \ 0.704
A4	(4.6, 6.5, 7.8) \ 0.661	(5.1, 7.1, 8.5) \ 0.734	(3.1, 4.9, 6.6) \ 0.485
A5	(3.8, 5.4, 6.8) \ 0.537	(3.5, 5.2, 6.9) \ 0.528	(2.7, 4.5, 6.4) \ 0.439
A6	(5.3, 7.2, 8.3) \ 0.743	(6.2, 8.2, 8.9) \ 0.836	(4.5, 6.4, 7.9) \ 0.656
A7	(4.5, 6.4, 7.6) \ 0.642	(5.7, 7.7, 8.9) \ 0.804	(3.2, 5.1, 6.8) \ 0.505
A8	(4.8, 6.6, 8.0) \ 0.681	(5.9, 7.9, 8.8) \ 0.812	(4.1, 6.0, 7.6) \ 0.614
A9	(4.5, 6.3, 7.7) \ 0.641	(3.7, 5.6, 7.4) \ 0.571	(3.2, 5.1, 6.9) \ 0.513
A10	(4.3, 6.2, 7.6) \ 0.626	(5.8, 7.8, 8.8) \ 0.806	(4.0, 5.9, 7.7) \ 0.611
A11	(4.9, 6.8, 8.0) \ 0.693	(5.8, 7.8, 8.8) \ 0.810	(3.8, 5.7, 7.3) \ 0.573
A12	(4.6, 6.5, 7.8) \ 0.666	(5.8, 7.8, 8.9) \ 0.808	(3.1, 5.1, 7.0) \ 0.508

The value reflects the strength of the relationship between the perceptual image and the Kansei words about fashion patterns. The closer the value of UV is to 0, the stronger the relevancy of the perceptual image to the corresponding fashion pattern (the closer the Kansei words are to the left). On the contrary, the closer the value of UV is to 1, the stronger the relevancy of the perceptual image to the fashion pattern (the closer the Kansei words are to the right).

4.3 Questionnaire Investigation of Perceptual Image for Fashion Pattern

In the Kansei engineering research fields, questionnaire investigation is always used to evaluate fashion style, or other perceptual attributes of fashion items. In the past research, the same fashion style showed alike perceptual images [186, 187]. Researchers use correlation analysis to find the similarity of perceptual images of evaluation objects.

In this study, to abstract the perceptual cognition of fashion patterns, correlation analysis of utility value for Kansei evaluations has been applied to analyze the similarity of the perceptual images of the patterns in the same classes. The perceptual image in the same pattern class showed consistency in general. It has been proved in our previous study. Correspondingly, the perceptual images were inconsistent in different pattern classes. The results could be used to extract some patterns whose perceptual images were significantly different from other patterns in the same class.

4.3.1 Perceptual Image of Fashion Pattern Classes

To explore the perceptual image of pattern classes, correlation analysis was applied to analyze the results of Kansei evaluations of 9 classes of fashion patterns. Fashion patterns in the same pattern class always have a consistent perceptual image, and also have some relevance with each other, except few patterns in the same class with different perceptual images.

The utility value of 10 pairs of Kansei words in the Kansei evaluation within the same pattern classes is analyzed using the Pearson correlation to check the relevance of the perceptual image, the results are shown in Table 4-3.

Table 4-3. Pearson correlation among 10 pairs of Kansei words for patterns in class A

Pairs	KW-1	KW-2	KW-3	KW-4	KW-5	KW-6	KW-7	KW-8	KW-9	KW-10
KW-1	1									
KW-2	<u>0.64</u>	1								
KW-3	0.38	<u>0.69</u>	1							
KW-4	<u>-0.71</u>	<u>-0.86</u>	<u>-0.69</u>	1						
KW-5	0.26	0.43	0.25	0.39	1					
KW-6	0.31	0.38	<u>0.72</u>	0.29	-0.11	1				
KW-7	0.51	<u>0.80</u>	<u>0.88</u>	<u>-0.75</u>	0.25	0.46	1			
KW-8	-0.23	<u>-0.91</u>	0.36	<u>0.82</u>	0.24	0.31	-0.66	1		
KW-9	-0.35	-0.15	-0.24	-0.17	0.37	0.29	0.45	0.44	1	
KW-10	0.32	0.70	<u>0.63</u>	<u>-0.76</u>	0.48	0.33	0.37	-0.31	-0.12	1

In Table 4-3, it showed the Pearson correlation between 10 pairs of Kansei words for patterns in Class A, Kansei words “Traditional - Modern” and “Steady - Lively” Pearson correlation of 0.64, with “Hard - Soft” Pearson correlation of -0.71; perceptual pattern “Steady - Lively” and “Unattractive - Attractive” Pearson correlation 0.69, with “Soft” Pearson correlation of “Hard - Soft” Pearson -0.86, with “Hard - Soft” Pearson correlation 0.80, with “Casual - Formal” Pearson correlation -0.91, and so on.

There are some correlations between different pattern classes which can be used as a reference for fashion pattern recommendation. Pearson correlation between 10 pairs of Kansei words in pattern Class A is shown in Table 4-3, it shows the correlation coefficients greater than 0.6. In particular, some values are greater than 0.8, showing highly relevant, which may have implicit perceptual image association.

4.3.2 Perceptual Image and Cognition of Fashion Pattern

Different factors affect the perceptual image and cognition of fashion patterns. These factors include the visual characteristics of the pattern, the wearer’s body type and shape, the wearer’s personal style, and the social context in which the pattern is worn.

The visual characteristics of a fashion pattern can have a significant impact on how it is perceived. For example, patterns with large, bold shapes can be seen as more eye-catching and attention-grabbing, while patterns with small, intricate details can be seen as more sophisticated and elegant. The color of a pattern can also play a role in how it is perceived. For example, bright colors can be seen as more youthful and playful, while muted colors can be seen as more classic and timeless.

The wearer’s body shape, personal style and social context can also affect how a fashion pattern is perceived.

The perceptual image and cognition of fashion patterns are a complex process that is influenced by a number of different factors. By understanding these factors, fashion designers can create patterns that are more likely to be perceived in a positive way by consumers.

4.3.3 Relevancy Degree of Cognition to Fashion Pattern

Perceptual image of fashion patterns refers to the psychological response and emotional expression of users, it reflects users' preference and evaluation for fashion patterns affecting users' cognition of fashion patterns. According to previous researches [186, 187], the perceptual images of the same pattern class have similarities. If a pattern shows different perceptual images, its classification may not be appropriate. To improve the accuracy of fashion pattern recommendations, these patterns should be removed from their classes.

Table 4-4. Pearson correlation between patterns in class A

No.	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	A11	A12
A1	1											
A2	0.95	1										
A3	0.88	0.98	1									
A4	0.98	0.93	0.87	1								
A5	0.40	0.22	0.12	0.30	1							
A6	0.84	0.91	0.93	0.86	-0.08	1						
A7	0.95	0.91	0.86	0.97	0.26	0.88	1					
A8	0.89	0.93	0.92	0.92	0.02	0.98	0.94	1				
A9	0.93	0.89	0.82	0.88	0.42	0.76	0.80	0.77	1			
A10	0.92	0.96	0.95	0.93	0.12	0.96	0.96	0.99	0.80	1		
A11	0.98	0.95	0.89	0.99	0.36	0.84	0.97	0.91	0.88	0.93	1	
A12	0.92	0.93	0.91	0.91	0.12	0.92	0.93	0.95	0.82	0.96	0.90	1

As shown in Table 4-4, taking pattern Class A as an example, the perceptual image of A9 was significantly unrelated to the other patterns in Class A. Pearson correlation between 10 pairs of Kansei words for pattern class A is shown in Table 4-4, it shows the correlation coefficients greater than 0.6. In particular, some values are greater than 0.8, showing highly relevant, which may have implicit perceptual image association. For the pattern Class A (Animal), it can be obtained that its perceptual image word "Steady - Lively" and "Hard - Soft" Pearson correlation is -0.86, and the correlation

with “Casual - Formal” is - 0.91, which means that for pattern Class A, the Steady pattern is generally Hard and Formal, and the Lively pattern is generally Soft and Casual.

The same method was used to extract the pattern in the same class with different perceptual images. According to the correlation between the Kansei words of the patterns in these groups, we can provide a variety of alternatives for the corresponding Kansei words in the pattern recommendation of the same class. As a result, A5, C7, D2, E8, F12, F10, G3, G7, G10, H11, H10, I1, I10 and I12 showed significantly different perceptual image in their pattern classes.

4.3.4 Perceptual Images of Different Pattern Classes

For pattern Class B (Food), it can be obtained that its Kansei words “Unattractive - Attractive” and “Simple - Fancy” Pearson correlation are 0.84, which means that for pattern Class B, an unattractive pattern is generally unpretentious, the captivating pattern is generally gorgeous.

For the pattern Class C (Plant), the Pearson correlation between the Kansei words “Unattractive - Attractive” and “Tawdry - Elegant” is 0.88, and the Kansei words “Hard - Soft” Pearson correlation of “Rough - Smooth” is -0.93, and the Pearson correlation of the Kansei words “Simple - Fancy” and “Conservative - Radical” is 0.93, which means that for pattern Class C, unattractive pattern They are generally tacky, attractive pattern is generally elegant, soft pattern is generally smooth, tough pattern is generally hard, simple pattern is generally restrained, and gorgeous pattern is generally exaggerated.

For pattern Class D (geometric), its Kansei words “Hard - Soft” and “Hard - Soft” Pearson correlation - 0.89, and “Masculine - Feminine” Pearson correlation Sex - 0.93, which means that for pattern Class D, a soft pattern is generally smooth and feminine, and tough pattern is generally hard and masculine.

For pattern Class E (Landscape and Architecture), it is possible to obtain a Pearson correlation of 0.84 for its Kansei words “Unattractive - Attractive” and “Hard - Soft”, “Simple - Fancy” and “Tawdry - Elegant” Pearson correlation of 0.87, which means

that for pattern Class E, a dull pattern is generally hard, attractive pattern is generally smooth, an earthy pattern is generally tacky, and the gorgeous pattern is generally elegant.

For the pattern Class F (Human), one can get its sensual pattern “Hard - Soft” and “Hard - Soft” Pearson correlation - 0.89, the sensual pattern “Tawdry - Elegant” and “Feminine-feminine” Pearson correlation 0.89, which means that for pattern Class F, soft images are generally smooth, tough images are generally hard, tacky images are generally masculine, and elegant images are generally feminine.

For the pattern Class G (traditional ethnicity), it can be derived that its Kansei words “Steady - Lively” and “Casual - Formal” Pearson correlation - 0.87, “Hard - Soft” and “Masculine” The Pearson correlation of “Feminine” is -0.83, which means that for pattern Class G, the stable pattern is generally formal, the lively pattern is generally casual, and the soft pattern is generally feminine and tough. The pattern is also generally masculine.

For the pattern Class H (Text), it can be concluded that the Pearson correlation between the Kansei words “Traditional - Modern” and “Unattractive - Attractive” is 0.86, which means that for the pattern Class H, the traditional pattern is generally unattractive, a modern pattern is generally attractive.

For pattern Class I (Utensil), it can be derived that its perceptual pattern word “Unattractive - Attractive” has a Pearson correlation of 0.8 with “Tawdry - Elegant” and “Hard - Soft” Pearson Sexuality 0.83, which means that for pattern Class I, a dull pattern is a generally tacky and blunt, and attractive pattern is generally elegant and smooth.

According to the correlation between the Kansei words of the patterns in these groups, we can provide a variety of alternatives for the corresponding Kansei words in the pattern recommendation of the same class.

4.3.5 Correlation Analysis of Perceptual Image Between Different Pattern Classes

In order to explore and analyze the correlation and difference of perceptual images between different pattern classes, correlation analysis and ANOVA method were used

to analyze the Kansei evaluation data. Through the correlation analysis of the perceptual images of patterns in different classes, the perceptual cognition of fashion patterns can be further grasped at a macro level, which improves the fault tolerance rate for the recommendation of pattern classes based on perceptual images; The one-way ANOVA of the utility value of Kansei evaluation of the Kansei words can obtain the pattern Class with the largest difference in the utility value of Kansei evaluation of each pair of Kansei words. The pattern Class that has the greatest impact on each pair of perceptual image spaces provides a further perfect supplement for our pattern Class recommendation based on the perceptual image space.

Table 4-5. Pearson correlation between Kansei words

No.	KW-1	KW-2	KW-3	KW-4	KW-5	KW-6	KW-7	KW-8	KW-9	KW-10
KW-1	1									
KW-2	0.32	1								
KW-3	0.25	0.61	1							
KW-4	-0.35	-0.58	0.77	1						
KW-5	-0.32	0.39	0.35	-0.35	1					
KW-6	0.42	0.46	0.41	0.36	0.63	1				
KW-7	0.49	0.18	-0.21	-0.79	0.43	-0.24	1			
KW-8	-0.28	0.80	-0.09	-0.35	0.49	0.21	0.30	1		
KW-9	-0.15	-0.34	0.49	0.34	0.33	-0.11	-0.42	-0.24	1	
KW-10	0.29	0.26	0.34	-0.78	-0.44	-0.10	-0.60	0.18	0.08	1

In this experiment, the correlations of 10 pairs of Kansei words in 9 classes of patterns were analyzed, the data in Table 4-5 showed that the Kansei words “Steady - Lively” and “Unattractive - Attractive” had a Pierson correlation of 0.61, Pearson correlation is with “Hard - Soft” -0.57, Pearson correlation is with “Casual - Formal” - 0.80; Kansei words “Unattractive - Attractive” and “Hard - Soft” Pearson correlation is 0.77; Kansei words “Hard - Soft” and “Rough – Smooth” Pearson correlation is -0.79; Kansei words “Rough - Smooth” and “Masculine - Feminine” Pearson correlation is -0.78; The Kansei words “Simple - Fancy” and “Tawdry - Elegant” Pearson correlation

is 0.63; Kansei words “Hard - Soft” and “Masculine - Feminine” Pearson correlation is 0.60; and the Pearson correlation is between the Kansei words listed above are all 0.01 (two-tailed) significant correlation, the above results provide us with more choices for pattern recommendation based on the perceptual image space, that is, the alternatives of the corresponding Kansei words are given according to the relevance.

As can be seen from the above data, the “Stable” patterns are also more “Formal”, and the “Lively” patterns are also more “Casual”; the “Unattractive” patterns are generally “Hard” and the “Attractive” patterns are generally more “Casual”. More “Smooth”; “Soft” patterns are more “Feminine”, “Hard” patterns are more “Masculine”, etc.

By conducting the results of one-way ANOVA, we can conclude that there are significant differences in the mean utility values of the 9 classes of patterns for each pair of words in the 10 pairs of perceptual patterns.; According to the test table for the homogeneity of variance and multiple comparisons, the two pairs of Kansei words “Unattractive - Attractive” and “Hard - Soft” were evaluated The utility value passed the test of homogeneity of variance, and it can be concluded that for the “Traditional - Modern” Kansei words, there is a significant difference in the mean value of the utility value of Kansei evaluation between pattern A and patterns C, D, and G, while that of pattern A is significantly different from that of patterns B and E., F, H, and I have no significant difference; there is a significant difference in the mean value of utility value of Kansei evaluation between pattern B and pattern D, G. It indicates that there is a 0.05 -level significant difference in the mean utility value of Kansei evaluation between the two pattern classes.

By comparison, it can be concluded that: for the pair of Kansei words “Traditional - Modern”, the mean value of the utility value of Kansei evaluation of pattern column G is significantly different from that of each other class of patterns, and at the same time from its average value. It can be seen from the figure that the average value of the utility value of Kansei evaluation of pattern G is 0.22 among the 9 classes, which means that for the pair of Kansei words “Traditional - Modern”, especially for the perceptual “Traditional” In space, the evaluation sensitivity of pattern Class G (National) is higher,

that is when recommending patterns containing “Traditional” styles, the supplementary pattern Class G can be perfected.

For the pair of Kansei words “Conservative - Radical”, pattern classes A and F have the most significant difference in the utility value of Kansei evaluation of other patterns. From its average value, it can be seen that the average value of the utility value of Kansei evaluation of pattern F. The maximum value is 0.65 among the 9 classes, and the average value of the utility value of Kansei evaluation of A is 0.59, which means that for the Kansei words “Conservative - Radical”, especially for the perceptual image of “Radical”, the evaluation sensitivity of pattern Class F (Human) is higher, followed by pattern Class A (Animal), that is, when making “Radical” style pattern recommendation, it can be perfect to supplement Class F, followed by A.

The correlations of perceptual images between different pattern classes are shown in Figure 4-6.

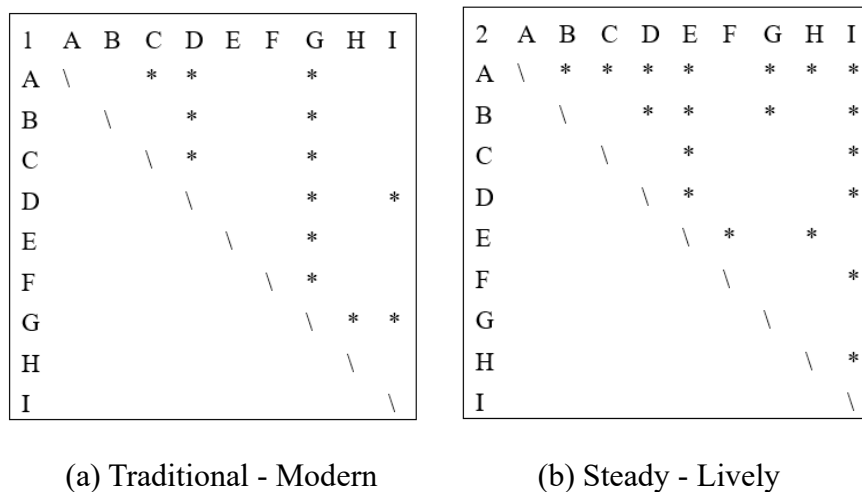


Figure 4-6. Significant differences of utility values between different patterns class with different Kansei words (*: $p \leq 0.05$)

For different Kansei evaluation words, most of the different pattern classes do not have a correlation, there are a few patterns or classes that have a correlation. This is because people’s cognition of patterns is based on life experiences and experiences. Although different pattern classes have different natural attributes, they may generate the same associations. These correlations can be used in pattern recommendation systems for pattern recommendation between different classes.

4.4 Analysis of Cognitive Differences in Fashion Patterns Based on DenseNet

Deep learning has been widely applied in the field of image recognition and classification, and convolutional neural networks (CNN) are one of the most popular and effective techniques [188]. While CNNs perform well in many image recognition tasks, their performance can be limited in complex scenes and problems involving multiple objects with different attributes. In such cases, new model structures and techniques have been proposed, such as DenseNet.

DenseNet [189] is a dense connection network that allows information to flow between different levels, improving model performance compared to traditional CNNs. In clothing pattern attribute classification tasks, each image typically has multiple attributes, including patterns, colors, and shapes. Therefore, we need an effective method to handle these attributes, particularly in modeling the correlations between different attributes.

In this chapter, we used the DenseNet model to predict fashion pattern attributes as shown in Figure 4-7. We evaluated the performance and accuracy of the model by training and testing on pattern datasets. It aims to improve the accuracy of fashion pattern attributes and provide a foundation for pattern recommendation.

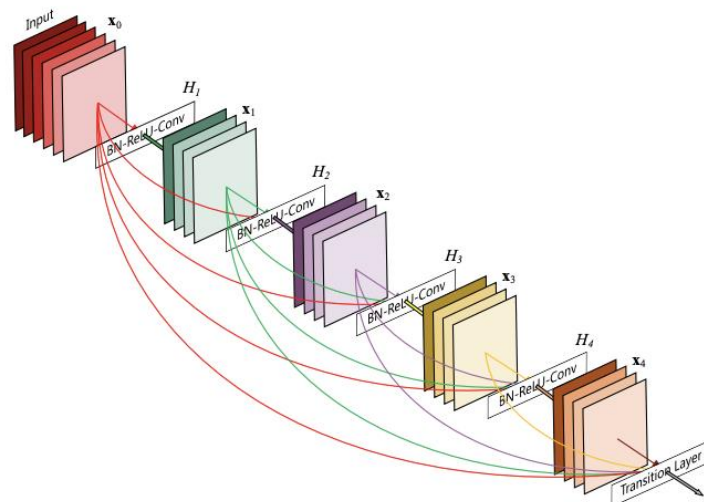


Figure 4-7. A 5-layer dense block

4.4.1 Structure of DenseNet Neural Network

In deep learning for computer vision, single label images often contain multiple semantic information by only containing one category of information. Therefore, the research on multi label image classification has more important practical significance.

Multi label classification refers to the precise classification of complex images through two major steps: feature extraction and representation, as well as classification and prediction. To achieve multi label classification of images, the first step is to extract image features. At present, with the development and progress of the deep learning model represented by Convolutional Neural Network (CNN) in the field of image vision, multi label image classification has important theoretical and technical support. Research has found that image classification is often applied to images where people have a clear definition of objective things, such as animals, buildings, food, etc. The classification of such things can be based on the similarity of local areas in the pattern. On this basis, this study classifies patterns based on their emotional imagery and assigns emotional imagery to the patterns. However, the difficulty of perceptual image classification lies in the similarity and differences in people's perceptual evaluations of the same pattern, which leads to semantic ambiguity on image labels and thus affects the effectiveness of image classification.

This study quantifies the emotional evaluation of clothing patterns by users and experts, establishes the emotional image of the pattern, and represents image features through the quantified emotional image proximity values of multi label clothing patterns, establishing a dataset.

To study the subjective evaluation of different populations on fashion patterns' perceptual image, and to analyze cognitive commonalities and differences, we conducted the Kansei evaluation in Chapter 3. However, the evaluation results are affected by the subjective psychology of the respondents, and exhibit a "multimodal" distribution in many patterns perceptual image, especially the data peaks formed by scores of 1 and 5. In the case of small sample size, this may cause the deep learning model to be unable to accurately judge the perceptual image of patterns, resulting in a

rapid decline in accuracy during the prediction phase of machine learning.

On the other hand, in the multi-pattern and multi-attribute scenario, the evaluation values of many subjects range from 1 to 5, with 3 as the center, and tend to form a data peak around 3, which conforms to the characteristics of a normal distribution.

To address this abnormal situation, we used the “capping method” [190, 191] to preprocess the evaluation data, correcting the extreme values on both ends to the nearest normal values and limiting the extreme values in the data to avoid their impact on the subsequent DenseNet model training. The capping method can balance the stability and integrity of the data.

The DenseNet [189] used in this experiment is a type of convolutional neural network that utilizes dense connections between layers, through Dense Blocks, where we connect all layers (with matching feature-map sizes) directly with each other. To preserve the feed-forward nature, each layer obtains additional inputs from all preceding layers and passes on its own feature-maps to all subsequent layers. It consists of the following layers (Table 4-6):

Input Layer: to unify the size of the input image, adaptive normalization of the input pattern is performed, and the input layer is designed as a (224, 224, 3) size vector of fashion pattern image.

Convolutional Layer: 7×7 convolutional kernel with a stride of 2.

Pooling Layer: 3×3 convolutional kernel, performing maximum pooling operation with a stride of 2.

DenseBlock: consisting of 6 1×1 convolutional kernels and 6 3×3 convolutional kernels.

Transition Layer: 1×1 convolutional kernel, 2×2 average pooling with a stride of 2.

Output Layer: to match the perceptual image of 10 dimensions of patterns, the output data is designed as a 10×1 dimensional vector, corresponding to the Kansei value of 10 Kansei words. The network structure is shown in Table 4-6.

Table 4-6. Structure of DenseNet network

Layers	Output Size	DenseNet 121
Input Layer	224 × 224	Original Pattern Image
Convolutional Layer	112 × 112	7 × 7 conv, stride 2
Pooling Layer	56 × 56	3 × 3 max pool, stride 2
Dense Block (1)	56 × 56	$\begin{bmatrix} 1 \times 1 \text{ conv} \\ 3 \times 3 \text{ conv} \end{bmatrix} \times 6$
Transition Layer (1)	56 × 56	1 × 1 conv
	28 × 28	2 × 2 average pool, stride 2
Dense Block (2)	28 × 28	$\begin{bmatrix} 1 \times 1 \text{ conv} \\ 3 \times 3 \text{ conv} \end{bmatrix} \times 12$
	28 × 28	1 × 1 conv
Transition Layer (2)	14 × 14	2 × 2 average pool, stride 2
	14 × 14	2 × 2 average pool, stride 2
Dense Block (3)	14 × 14	$\begin{bmatrix} 1 \times 1 \text{ conv} \\ 3 \times 3 \text{ conv} \end{bmatrix} \times 24$
	14 × 14	1 × 1 conv
Transition Layer 3)	7 × 7	2 × 2 average pool, stride 2
	7 × 7	2 × 2 average pool, stride 2
Dense Block (4)	7 × 7	$\begin{bmatrix} 1 \times 1 \text{ conv} \\ 3 \times 3 \text{ conv} \end{bmatrix} \times 16$
	7 × 7	2 × 2 average pool, stride 2
Classification/Output Layer	10 × 1	7 × 7 global average pool
		1000-D full-connected layer, SoftMax

The main function of cross entropy as the loss function is to evaluate the degree of difference between the predicted value and the real value in the training process. Generally, the smaller the Loss function, the better the model performance. After each batch of training data is sent into the model, the predicted value will be output through forward propagation. After the loss value is calculated by the Loss function, the model updates each parameter through backpropagation to reduce the loss between the real value and the predicted value, making the predicted value generated by the model close to the real value, to achieve the purpose of learning. The Loss function needs to be selected according to specific use scenarios and needs. It is mainly divided into empirical risk Loss function and structural risk Loss function. The empirical risk Loss function refers to the difference between the predicted results and the actual results. The structural risk Loss function is the empirical risk Loss function plus the regular term.

Common Loss function include 0-1 Loss function, absolute Loss function and Cross entropy Loss function. The specific formula is as follows:

(1) 0-1 Loss function: this function indicates that if the predicted value is different from the actual value, the output is 1, otherwise it is 0. The specific formula is as follows, where Y is the true value and $f(x)$ is the predicted value:

$$L(Y, f(x)) = \begin{cases} 0, & f(x) = Y \\ 1, & f(x) \neq Y \end{cases} \quad (4-8)$$

(2) Absolute value Loss function: this function is the absolute value of the difference between the predicted value and the actual value. The specific formula is as follows, where Y is the true value and $f(x)$ is the predicted value:

$$L(Y, f(x)) = |Y - f(x)| \quad (4-9)$$

(3) Cross entropy loss function: according to the probability distribution, calculate the difference between the probability distribution of the predicted value and the probability distribution of the actual value. The specific formula is as follows: Y is the true value, a is the predicted value, and n is the total number of statistical samples.

$$C = -\frac{1}{n} \sum [y \ln a + (1 - y) \ln(1 - a)] \quad (4-10)$$

Where “ a ” represents the predicted probability of the positive class (usually denoted as “1”), and “ y ” represents the true label (either 0 or 1). It is used to calculate the average cross-entropy loss across “ n ” sample. By summing the individual losses for each sample and dividing it by “ n ”, we obtain the average cross-entropy loss.

4.4.2 Training Process of DenseNet Neural Network

We set the training process as 6 stages as follows:

Input Layer: The input tensor is the pixel matrix of the input pattern.

Initial Convolution Layer: The convolution layer applies multiple convolution kernels on top of the input tensor to extract specific feature maps. These feature maps have a good local correlation.

Dense Block Stage: This stage consists of multiple dense connection layers, where the output of each connection layer is used as the input of the next connection layer. The dense connections allow the model to be very deep. The advantage is that the

previous feature maps are better preserved, and the transfer and extraction of the feature maps are enhanced. This stage can be repeated multiple times to gradually extract more advanced features from the image.

Transition Layer Stage: The transition layers added between Dense Blocks reduce the input channels and spatial resolutions, thereby reducing the computation and the number of parameters. Another purpose of this stage is to prevent overfitting.

Global Pooling Layer: When the feature maps are input into the global average pooling layer, they are compressed into a vector, which is then sent to the next fully connected layer for classification or regression.

Fully Connected Layer: The final fully connected layer maps the input vector to the desired output space through a softmax activation function and returns the corresponding prediction result.

The DenseNet process is simple and intuitive. Each stage from input to output has its unique function and purpose to improve the model's expressive power and performance in handling input images. In traditional convolutional neural networks, each layer only receives the output of the previous layer as input. In DenseNet, each layer receives the output of all previous layers as input, providing more paths for the flow of information in the network. This dense connection allows DenseNet to solve the problem of gradient vanishing and also reduce the number of network parameters, thereby reducing the risk of overfitting. Compared to other convolutional neural networks such as VGG and ResNet, DenseNet converges faster during training and achieves better classification performance.

The DenseNet model is constructed using the TensorFlow framework with 83% of the data as the training data. The input size is $224 \times 224 \times 3$, the output size is 10×1 , the batch size is set to 1, the epoch number is set to 30, the Adam optimizer is used to optimize the DenseNet model, and the learning rate is 0.0001. Other settings are set to default value of $\beta_1 = 0.9$, $\beta_2 = 0.999$, and $\epsilon = 1e - 8$. The DenseNet algorithm used in this study is DenseNet 121 as Table 4-6.

4.4.3 Analysis of Cognitive Differences in Fashion Patterns Based on DenseNet

The DenseNet network model was proposed by Huang *et al.* It is a deep convolutional network based on dense connections [189]. For the network of L-layer network, there are L-layer connections in the traditional Convolutional neural network model, while the DenseNet network contains $\frac{L(L+1)}{2}$ connections, and the input of each layer comes from the output of all previous layers, so that features are constantly used. DenseNet was inspired by ResNet to break away from the traditional mode of improving network performance by deepening the number of network layers and widening the network width. The feature maps learned by the model layer can be transmitted to all subsequent layers as input, and the number of network parameters can be reduced through feature reuse and bypass settings; By using a dense connection method, any two layers can be directly connected, which to some extent alleviates the impact of gradient disappearance. The structure of a DenseNet network with 5 dense blocks and a growth rate of 4 is shown in Figure 4-7 and Table 4-6.

In this study, the DenseNet network was used to analyze the cognitive differences in fashion patterns among different user groups by accuracy between predicted and true values of Kansei evaluation. Accuracy refers to the proportion of correctly classified samples to the total number of samples. In the formula, TP represents True Positive, which is the number of samples predicted to be positive and actually positive; TN represents True Negative, which is the number of samples predicted to be negative and actually negative; FP represents False Positive, which is the number of samples predicted to be positive but actually negative; FN represents False Negative, which is the number of samples predicted to be negative but actually positive; A_i is the accuracy of the i-th population dataset, $i=1,2,3$. Due to the availability of labeled data, and the simplicity of interpreting accuracy, in this case, we use the accuracy as the evaluation metric as show in equation 4-11.

$$A_i = \frac{TN+TP}{FP+TN+TP+FN} \quad (4-11)$$

4.4.4 Cognitive Differences of Pattern Classes

In order to facilitate the processing of the results, in this chapter, perceptual image evaluation and its prediction value of the pattern are processed as a 5-level scale value, and then converted into utility values in subsequent processing as Chapter 3.

The trained DenseNet model was used to test the indicators of different datasets. As the subjects rate the same intuitive image of the pattern in 5 levels, with each level differing by 1 point, half of the difference between two score values, 0.5, is taken as the threshold [192, 193]. If the absolute difference between the actual value (evaluation value) and the predicted value of the dataset is less than the threshold, it is considered as an accurate prediction. The accuracy is calculated using the counting method. The following analysis is performed:

- (1) The commonality and differences in cognition of the same pattern class

We set all the 9-class patterns as the test sets, in the same pattern class, we tested the 10-dimensional attributes (perceptual image), The accuracy was up to 86% - 95%. The test results for Class B (Food) were shown in Table 4-7 and Table 4-8. Table 4-7 showed the true values of the pattern (evaluation value) and Table 4-8 showed the predicted values. Their visualized analysis was shown in Figure 4-8.

Table 4-7. True values of pattern Class B (Food)

Pattern \Kansei Word	KW-1	KW-2	KW-3	KW-4	KW-5	KW-6	KW-7	KW-8	KW-9	KW-10
B1	3.11	3.57	2.79	2.37	2.22	2.70	3.48	2.07	2.74	3.22
B2	3.06	3.01	2.65	2.63	2.21	2.50	3.18	2.21	2.76	2.79
B3	3.78	3.59	3.19	2.43	2.49	2.82	3.53	2.17	2.94	3.02
B4	3.33	3.46	2.93	2.32	2.23	2.64	3.42	2.14	2.86	2.89
B5	3.16	3.56	3.08	2.31	2.31	2.89	3.44	2.11	2.74	3.24
B6	3.69	3.65	3.26	2.31	2.51	2.87	3.61	2.11	2.92	3.12
B7	3.59	3.25	2.96	2.53	2.31	2.67	3.31	2.17	2.78	3.04
B8	3.33	3.44	3.06	2.24	2.31	2.80	3.60	2.17	2.71	3.29
B9	3.57	3.64	3.15	2.63	2.37	2.58	3.26	2.16	3.05	2.83
B10	3.56	3.58	3.09	2.42	2.38	2.88	3.53	2.21	2.81	3.13
B11	3.76	3.52	3.23	2.44	2.50	2.88	3.48	2.16	2.73	3.09
B12	3.06	3.30	2.75	2.48	2.24	2.62	3.22	2.09	2.68	3.14

Table 4-8. Predicted values of pattern Class B (Food)

Pattern \Kansei Word	KW-1	KW-2	KW-3	KW-4	KW-5	KW-6	KW-7	KW-8	KW-9	KW-10
B1	3.18	3.40	3.12	2.41	2.59	2.92	3.57	2.24	2.92	3.36
B2	3.08	3.17	3.12	2.61	2.67	2.98	3.48	2.35	2.91	3.12
B3	3.04	3.21	3.17	2.60	2.70	3.02	3.50	2.39	2.97	3.19
B4	3.00	3.16	3.14	2.54	2.60	2.98	3.50	2.32	2.86	3.15
B5	3.02	3.24	3.17	2.51	2.65	3.01	3.54	2.34	2.90	3.24
B6	3.02	3.11	3.12	2.63	2.69	3.00	3.45	2.38	2.88	3.09
B7	3.01	3.10	3.12	2.64	2.70	2.98	3.42	2.34	2.88	3.05
B8	2.98	3.11	3.14	2.59	2.70	3.03	3.51	2.38	2.88	3.15
B9	3.09	3.28	3.17	2.54	2.65	2.98	3.55	2.30	2.93	3.26
B10	3.00	3.08	3.11	2.64	2.70	2.98	3.41	2.38	2.88	3.05
B11	2.97	3.03	3.09	2.68	2.72	3.00	3.40	2.41	2.86	3.02
B12	2.99	3.13	3.15	2.62	2.67	3.03	3.47	2.34	2.89	3.11

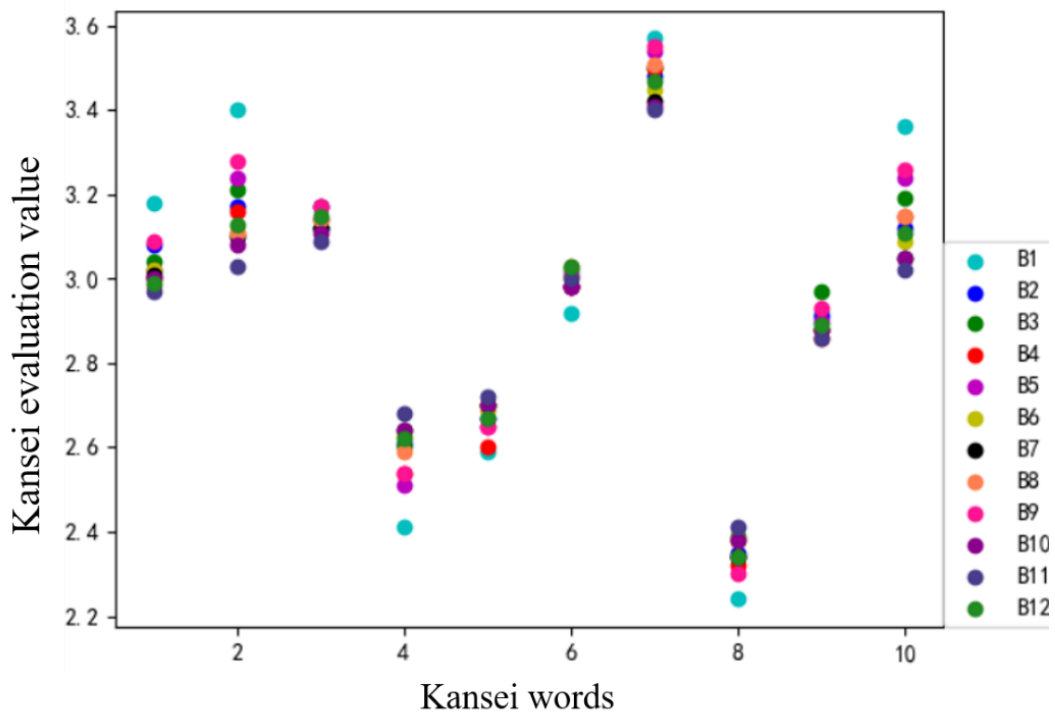


Figure 4-8. Visualization of the predicted value of pattern Class B (Food)

According to the results, taking the “Casual - Formal” attribute as an example, the perceptual image value of food patterns was around 2.3 on the Casual - Formal attribute,

it indicated that food patterns have a strong commonality of Casual perceptual image in the perception among different groups of subjects with different gender and educational background. However, the values for the “Steady - Lively” and “Masculine-Feminine” attributes were more dispersed, indicating that food patterns have less commonality in these perceptual images.

To verify the reliability of the method, we also randomly selected 5 patterns from Class E as a test set, and the accuracy was 93.33%.

Table 4-9. True values of pattern Class E (Landscape)

Pattern \Kansei Word	KW-1	KW-2	KW-3	KW-4	KW-5	KW-6	KW-7	KW-8	KW-9	KW-10
E1	3.49	2.69	3.06	3.55	3.29	3.20	3.06	2.83	3.18	2.67
E3	3.33	2.51	2.97	3.36	3.26	3.21	2.88	2.81	2.98	2.47
E5	3.36	2.48	2.98	3.35	3.32	3.24	2.99	2.79	2.99	2.68
E7	3.46	2.84	2.81	3.26	2.86	2.98	2.88	2.39	3.26	2.51
E12	2.98	2.25	2.80	3.47	2.80	3.01	2.83	2.82	2.76	2.44

Table 4-10. Predicted values of pattern Class E (Landscape)

Pattern \Kansei Word	KW-1	KW-2	KW-3	KW-4	KW-5	KW-6	KW-7	KW-8	KW-9	KW-10
E1	3.49	2.69	3.06	3.55	3.29	3.20	3.06	2.83	3.18	2.67
E3	3.33	2.51	2.97	3.36	3.26	3.21	2.88	2.81	2.98	2.47
E5	3.36	2.48	2.98	3.35	3.32	3.24	2.99	2.79	2.99	2.68
E7	3.46	2.84	2.81	3.26	2.86	2.98	2.88	2.39	3.26	2.51
E12	2.98	2.25	2.80	3.47	2.80	3.01	2.83	2.82	2.76	2.44

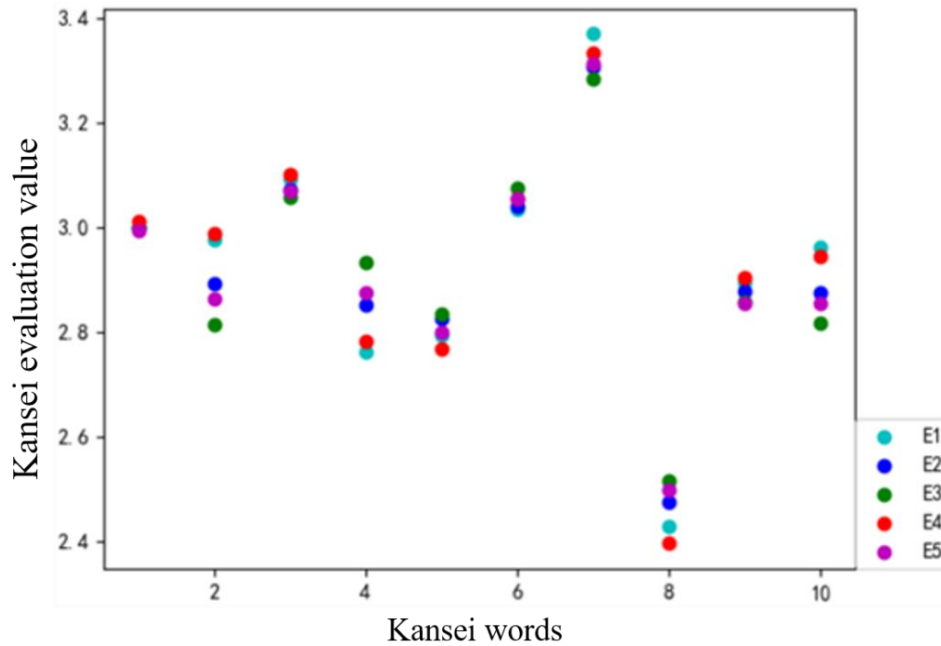


Figure 4-9. Random test of the predicted value in the same class (Class E Landscape)

According to the results, it can be seen that the perceptual image of patterns showed concentration and dispersion in different Kansei words reflecting different perceptual images. In other words, some perceptual image of patterns has commonality, also, it has cognitive differences. In the Class E, as for the “Conservative - Radical” attribute, the perception of all the landscape patterns showed a tendency towards Conservative, while in the “Hard - Soft” attribute, there were significant differences.

(2) The commonality and differences in cognition of the male and female participants

Table 4-11. True value of male participants

Pattern \\Kansei Word	KW-1	KW-2	KW-3	KW-4	KW-5	KW-6	KW-7	KW-8	KW-9	KW-10
D12	3.48	3.36	3.02	2.91	2.80	2.88	3.04	2.18	2.92	2.76
B12	3.03	3.29	2.77	2.49	2.23	2.60	3.22	2.09	2.68	3.16
I12	3.44	2.68	3.19	2.49	2.85	3.29	3.48	2.39	2.64	2.93
F12	2.67	2.44	2.73	3.03	2.68	2.98	3.27	2.61	3.12	2.31
G12	2.34	2.46	2.99	2.80	3.19	3.15	3.22	3.02	3.09	2.91
A12	3.54	3.95	2.98	2.32	2.37	2.50	3.57	2.15	3.04	3.44
E12	2.89	2.28	2.85	3.41	2.83	3.01	2.85	2.84	2.83	2.42
C12	3.35	3.24	3.07	2.28	2.46	2.98	3.66	2.31	2.63	3.28
H12	3.85	3.72	3.29	2.53	2.77	2.94	3.60	2.17	3.06	3.15

To study the influence of the genders on the perception image of fashion patterns, we divided the dataset according to the gender of the participants, and randomly selected 9 patterns to test the cognitive difference and the accuracy of the method. The results were shown in Table 4-11 to Table 4-14.

Table 4-12. Predicted value of male participants

Pattern \Kansei Word	KW-1	KW-2	KW-3	KW-4	KW-5	KW-6	KW-7	KW-8	KW-9	KW-10
D12	3.01	3.15	3.17	2.65	2.83	3.13	3.45	2.39	3.08	3.03
B12	2.95	3.13	3.19	2.59	2.72	3.06	3.48	2.35	3.01	3.07
I12	3.01	2.88	3.12	2.90	2.86	3.12	3.38	2.51	3.00	2.75
F12	3.00	2.89	3.11	2.90	2.86	3.12	3.37	2.50	2.99	2.75
G12	2.95	3.21	3.21	2.55	2.77	3.09	3.46	2.34	3.04	3.10
A12	3.07	3.25	3.19	2.60	2.72	3.04	3.46	2.35	3.04	3.09
E12	2.99	2.89	3.11	2.86	2.83	3.10	3.39	2.50	2.97	2.77
C12	2.99	2.90	3.11	2.84	2.82	3.08	3.38	2.48	2.97	2.77
H12	3.07	3.11	3.17	2.74	2.88	3.11	3.38	2.35	3.10	2.91

Table 4-13. True value of female participants

Pattern \Kansei Word	KW-1	KW-2	KW-3	KW-4	KW-5	KW-6	KW-7	KW-8	KW-9	KW-10
D12	3.48	3.36	3.02	2.91	2.80	2.88	3.04	2.18	2.92	2.76
B12	3.03	3.29	2.77	2.49	2.23	2.60	3.22	2.09	2.68	3.16
I12	3.44	2.68	3.19	2.49	2.85	3.29	3.48	2.39	2.64	2.93
F12	2.67	2.44	2.73	3.03	2.68	2.98	3.27	2.61	3.12	2.31
G12	2.34	2.46	2.99	2.80	3.19	3.15	3.22	3.02	3.09	2.91
A12	3.54	3.95	2.98	2.32	2.37	2.50	3.57	2.15	3.04	3.44
E12	2.89	2.28	2.85	3.41	2.83	3.01	2.85	2.84	2.83	2.42
C12	3.35	3.24	3.07	2.28	2.46	2.98	3.66	2.31	2.63	3.28
H12	3.85	3.72	3.29	2.53	2.77	2.94	3.60	2.17	3.06	3.15

Table 4-14. Predicted value of female participants

Pattern \\Kansei Word	KW-1	KW-2	KW-3	KW-4	KW-5	KW-6	KW-7	KW-8	KW-9	KW-10
D12	3.08	3.10	3.10	2.72	2.77	3.01	3.40	2.40	2.91	3.07
B12	3.01	3.12	3.11	2.62	2.68	3.00	3.43	2.34	2.87	3.12
I12	3.01	2.84	3.03	2.92	2.83	3.06	3.27	2.52	2.83	2.86
F12	3.00	2.85	3.04	2.91	2.83	3.05	3.27	2.52	2.83	2.85
G12	3.02	3.15	3.13	2.59	2.73	3.00	3.41	2.37	2.94	3.18
A12	3.14	3.22	3.14	2.65	2.63	2.95	3.46	2.30	2.92	3.14
E12	3.00	2.86	3.05	2.88	2.80	3.04	3.29	2.50	2.81	2.87
C12	3.00	2.88	3.04	2.86	2.79	3.02	3.28	2.48	2.82	2.87
H12	3.11	3.05	3.12	2.81	2.81	3.00	3.30	2.40	2.92	3.03

According to the results, the accuracy predicted value of different genders was 88.89%. The visualized predicted values for male and female participants was shown in Figure 4-10.

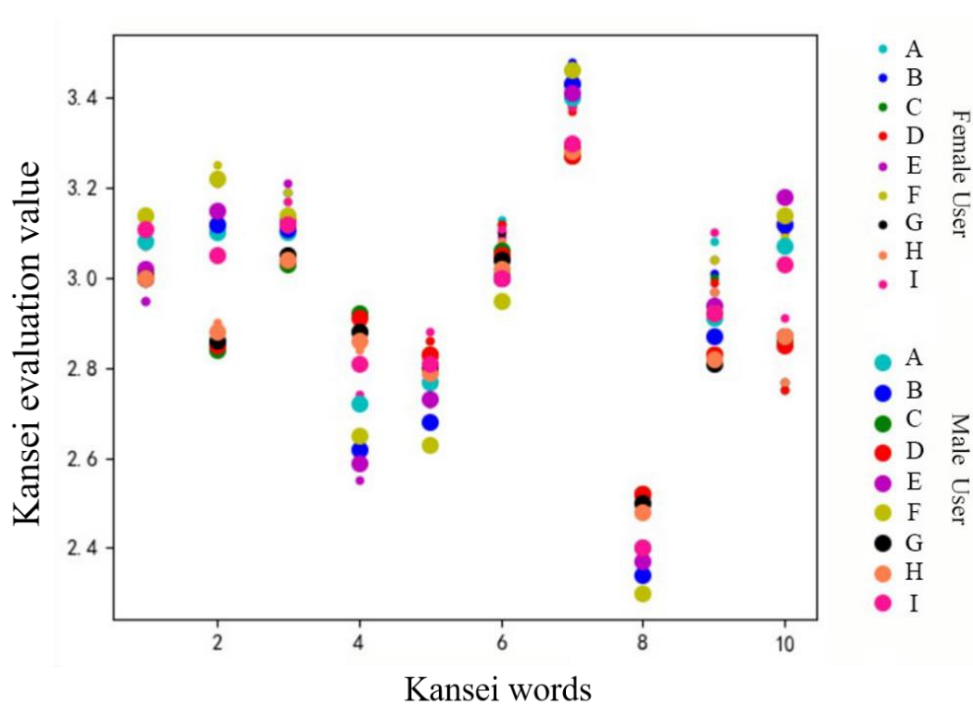


Figure 4-10. Visualization of predicted values of different genders

It can be seen that the scores for the “Conservative - Radical” attribute were discrete, and the cognitive differences between male and female participants were

significant. Male participants generally thought that the pattern is Radical, while female participants were more tolerant and tended to think that the pattern was Conservative; while in the “Casual – Formal” attribute, the value was concentrative, it indicated that the cognitions of male and female participants were relatively consistent.

(3) The commonality and differences in cognition of participants with different educational backgrounds

We also investigated if the educational background will affect the cognitive of the perceptual image of fashion patterns, the results (Figure 4-11) showed that the influence of educational background on the cognition of patterns can be ignored.

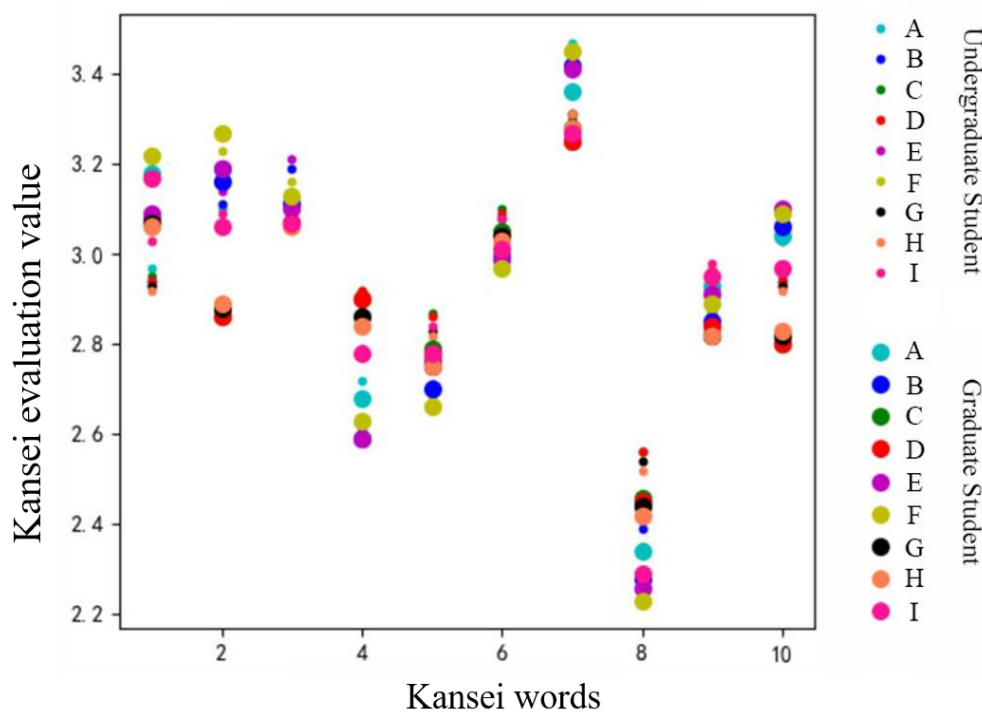


Figure 4-11. Visualized results of the undergraduate student and graduate students

These cognitive differences form a part of the recommendation system knowledge base for recommending and updating fashion patterns.

4.4.5 Cognitive Differences of Consumer and Designer

In collaborative design for fashion, the cognitive difference between consumers and designers is strongly related to their personalized experiences, psychological status and emotions. Designers should adequately understand the needs of their consumers, especially psychological and emotional needs. Understanding consumers’ cognition is

an effective way to understand their psychological needs. Therefore, it is very important to understand the cognitive differences between designers and consumers. Using the proposed method, we investigated the cognition of consumers and designers. The results were shown in Table 4-12 to Table 4-18, and Figure 4-12.

Table 4-15. True value of consumers

Pattern \\Kansei Word	KW-1	KW-2	KW-3	KW-4	KW-5	KW-6	KW-7	KW-8	KW-9	KW-10
D12	3.48	3.36	3.02	2.91	2.80	2.88	3.04	2.18	2.92	2.76
B12	3.03	3.29	2.77	2.49	2.23	2.60	3.22	2.09	2.68	3.16
I12	3.44	2.68	3.19	2.49	2.85	3.29	3.48	2.39	2.64	2.93
F12	2.67	2.44	2.73	3.03	2.68	2.98	3.27	2.61	3.12	2.31
G12	2.34	2.46	2.99	2.80	3.19	3.15	3.22	3.02	3.09	2.91
A12	3.54	3.95	2.98	2.32	2.37	2.50	3.57	2.15	3.04	3.44
E12	2.89	2.28	2.85	3.41	2.83	3.01	2.85	2.84	2.83	2.42
C12	3.35	3.24	3.07	2.28	2.46	2.98	3.66	2.31	2.63	3.28
H12	3.85	3.72	3.29	2.53	2.77	2.94	3.60	2.17	3.06	3.15

Table 4-16. Predicted value of consumers

Pattern \\Kansei Word	KW-1	KW-2	KW-3	KW-4	KW-5	KW-6	KW-7	KW-8	KW-9	KW-10
D12	3.04	3.12	3.13	2.71	2.81	3.04	3.42	2.42	2.97	3.08
B12	2.97	3.17	3.15	2.64	2.70	3.02	3.48	2.35	2.93	3.11
I12	2.99	2.87	3.08	2.92	2.85	3.09	3.34	2.53	2.90	2.82
F12	2.99	2.86	3.08	2.92	2.85	3.09	3.33	2.53	2.90	2.83
G12	2.98	3.20	3.15	2.60	2.76	3.05	3.44	2.36	2.98	3.18
A12	3.11	3.26	3.18	2.68	2.66	2.99	3.48	2.32	2.98	3.13
E12	2.98	2.89	3.08	2.89	2.82	3.07	3.35	2.51	2.88	2.84
C12	2.98	2.90	3.08	2.86	2.80	3.06	3.33	2.50	2.88	2.85
H12	3.10	3.07	3.15	2.81	2.83	3.09	3.36	2.40	3.00	3.02

Table 4-17. True value of designers

Pattern \Kansei Word	KW-1	KW-2	KW-3	KW-4	KW-5	KW-6	KW-7	KW-8	KW-9	KW-10
D12	3.73	3.57	3.00	3.16	2.59	2.65	2.68	2.22	2.70	2.62
B12	3.16	3.32	2.68	2.46	2.27	2.68	3.22	2.11	2.65	3.05
I12	3.95	2.41	3.11	2.68	2.59	3.05	3.35	2.24	2.65	2.84
F12	2.84	2.49	3.03	2.76	2.84	3.14	3.05	2.92	3.11	2.16
G12	2.24	2.46	3.05	2.62	3.08	3.27	3.30	3.30	3.03	3.08
A12	3.78	3.86	3.05	2.27	2.38	2.70	3.46	2.14	3.19	3.46
E12	3.27	2.14	2.62	3.65	2.70	3.00	2.78	2.76	2.51	2.49
C12	3.68	3.32	3.24	2.35	2.46	3.35	3.54	2.43	2.70	3.43
H12	3.89	3.76	3.19	2.51	2.70	2.89	3.32	2.11	3.11	2.84

Table 4-18. Predicted value of designers

Pattern \Kansei Word	KW-1	KW-2	KW-3	KW-4	KW-5	KW-6	KW-7	KW-8	KW-9	KW-10
D12	3.12	3.10	3.05	2.70	2.73	2.96	3.34	2.36	2.85	3.03
B12	3.06	3.12	3.06	2.60	2.65	2.96	3.37	2.29	2.82	3.05
I12	3.05	2.80	3.00	2.90	2.77	3.00	3.17	2.46	2.76	2.78
F12	3.05	2.81	3.00	2.90	2.76	2.98	3.17	2.46	2.76	2.79
G12	3.06	3.15	3.05	2.53	2.71	2.97	3.38	2.29	2.92	3.10
A12	3.18	3.24	3.10	2.62	2.61	2.95	3.41	2.24	2.87	3.06
E12	3.05	2.83	3.01	2.87	2.72	2.99	3.19	2.45	2.74	2.80
C12	3.04	2.84	3.01	2.84	2.72	2.97	3.19	2.43	2.75	2.80
H12	3.13	3.05	3.03	2.78	2.77	2.96	3.23	2.32	2.91	2.91

According to the results, it can be seen that the value of consumers and designers were mostly in a discrete state in different attributes, only the value in the “Tawdry - Elegant” attribute concentrated about 3.0. The overall perceptual differences between consumers and designers were significant showing obvious cognitive differences.

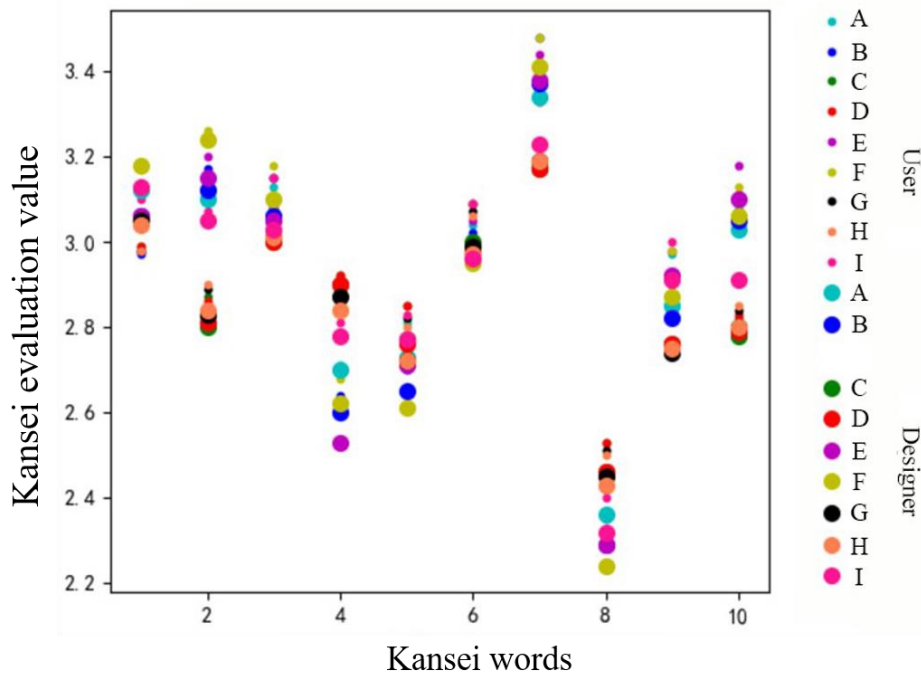


Figure 4-12. Visualized results of consumers and designers

After a depth-interview, we found that the consumer's cognitive model of fashion patterns mainly comes from the association of the real things (such as cat, dog in the real world) represented by the patterns (such as cat, dog pattern). In addition to the association with real things, designers also consider different expression form of the design of fashion patterns to express their perceptual cognition, which is the main reason for the cognition difference between the consumer's and designer's cognitive model.

4.5 BP Neural Network Model for Fashion Pattern Recommendation

A backpropagation neural network (BPNN) is a supervised learning algorithm for training feedforward artificial neural networks. It is one of the most widely used neural network algorithms. BP neural networks are a powerful tool that can be used to build and improve the accuracy of recommendation systems.

4.5.1 General Principle of BP Neural Network

BP neural network model used in this experiment is a typical three-layer BP neural

network, which consists of an input layer, a hidden layer and an output layer, and the layers are fully connected. The number of neurons in the input layer of this experiment is the utility value of 10 pairs of Kansei words for each pattern calculated above, which is a 10 -dimensional feature vector. The output layer is a one-hot 9-dimensional vector corresponding to 9 pattern classes.

The dimension of the middle layer is given by an Empirical equation (4-12) as follows:

$$h = \sqrt{m + n} + c \quad c \in [1,10] \quad (4-12)$$

where h is the number of neurons in the hidden layer, m is the number of neurons in the input layer, n is the number of neurons in the output layer, and c is a constant between 1 and 10. In practical applications, the value of c is determined according to the actual effect.

According to equation (4-5), we calculate that the optimal range of h is 5~15, and the number of neurons in the hidden layer is initially set to 10. During the model training process, the number of neurons in the hidden layer is adjusted according to the actual training results.

4.5.2 Structure of BP Neural Network

The structure of a backpropagation neural network (BPNN) is composed of three layers: the input layer, the hidden layer, and the output layer.

The input layer is the first layer of the network and it receives the input data.

The hidden layer is the middle layer of the network and it performs the bulk of the computation.

The output layer is the last layer of the network and it produces the output data.

The neurons in each layer are connected to the neurons in the next layer. The connections between the neurons are called synapses. The strength of the synapses is determined by the learning process.

The BPNN learns by adjusting the weights of the synapses. The weights are adjusted using a process called backpropagation. Backpropagation is an iterative process that starts with the output layer and works its way back to the input layer.

Step 1: The training sets and test sets were set as 7:3, Then, the utility value was normalized to [-1, 1], and the principle was as equation (4-13):

$$y = 2 \frac{x - x_{min}}{x_{max} - x_{min}} - 1 \quad (4-13)$$

where y is the transformed result, x is the original data, x_{max} is the maximum value of the dataset, x_{min} is the minimum value of the dataset.

Step 2: Establish a training model and set relevant parameters. Initialization randomly generates the connection weights and thresholds from the input layer to the hidden layer and the connection weights and thresholds from the hidden layer to the output layer. A series of parameter settings before training the created BP neural network are as follows:

The transfer function of the hidden layer was set as the hyperbolic tangent sigmoid transfer function, the transfer function of the output layer was the linear transfer function, and the training function was set as the Levenberg-Marquardt algorithm. The maximum number of iterations for training was set as 1000 times, and the minimum error for training was 10^{-6} . The threshold for the number of iterations to stop falling was 6.

Step 3: training and saving the network with the highest classification accuracy.

4.5.3 Training and Testing of BP Neural Network

According to the training results of the BP neural network model, the corresponding visual charts are analyzed, and the model with the highest classification accuracy rate of 69% is optimized. After removing some sample patterns that have significantly inconsistent perceptual images with other patterns in the same class (Section 3.4.2.2), such as the pattern “eagle” in “Animal” classes, the BP neural network model predicts that the classification accuracy rate reaches the highest up 83.3%.

Through the results of the experiment, it is found that the prediction classification accuracy of the test sets is not ideal. When the number of neurons in the hidden layer is set to 1 or 2 and trained multiple times, the highest classification accuracy of the test sets is obtained. 69 % BP neural network. Now analyze the results, as shown in Figure 4-13. The neural network structure is: the input layer has 10 neurons, the single-layer hidden layer contains 12 neurons, and the output layer has 9 neurons.

In the relationship between the mean square error and the number of iterations in Figure 4-13, the blue is the iteration error curve for the training set, the green is the iteration error curve for the validation set, and the red is the iteration error curve for the test set. Among these three pairs of samples, the training sets are responsible for training

the neural network; the validation set is used to verify whether the output error has decreased after each iteration, if it is 6 consecutive times, that is, the maximum number of failures is 6, the error has not decreased or instead, it rises, and training must be stopped to prevent overfitting. It can be seen from the figure that the error curve of the validation set does not decrease after the fifth generation, and the mean square error of the validation set at this time is 0.402. As for the error histogram of the training sets and test set shown in Figure 4-14, we can intuitively see the error of the trained network model. Most of the errors in the training sets and test sets are concentrated around 0, which is 0.175, but there are still some data errors that deviate from both sides. For example, the maximum deviation error is 6.675. The overall error distribution is more suitable for the classification accuracy rate of 69 %.

The results show the predicted classification and error size of the 29 samples in the test set. It can be seen that there are 29 test samples, and there are still 9 test samples that predict the wrong Class, indicating that the predicted classification accuracy of the trained BP neural network model needs to be improved.

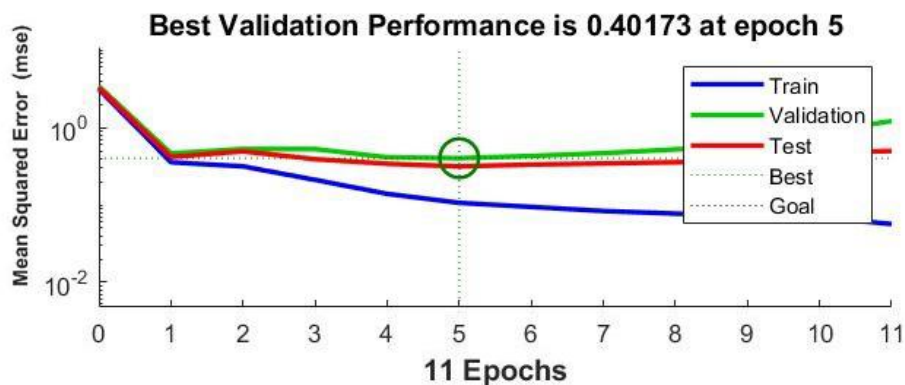


Figure 4-13. The relationship between the mean square error and iterations

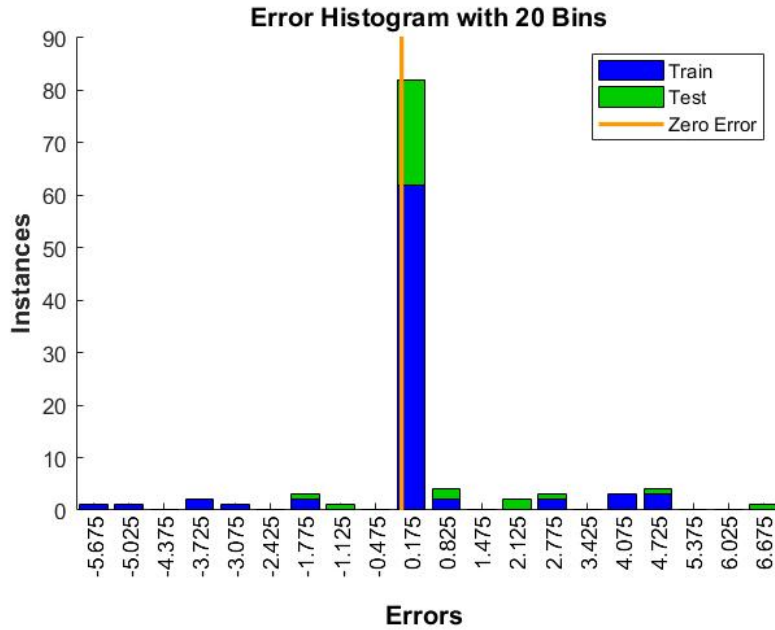


Figure 4-14. Error of training sets and test sets

4.5.4 Optimization of BP Neural Network Model

The classification accuracy rate of the test sets is 69%, and the pattern cannot be classified and predicted well, and the model needs to be further improved. In the original model, the difference in the utility value of the Kansei evaluation of 9 classes of patterns divided into 108 patterns samples is not obvious, that is, the model will identify some of the pattern classes incorrectly, and in turn 12 patterns within the 9 classes of patterns are 10. Approximation analysis of the utility value of perceptual pattern, for example, for the first type of pattern Class A, as shown in Table 4-4, it can be found that the correlation between 10 pairs of perceptual pattern word utility value of Kansei evaluation of pattern A5 and another 11 patterns. The correlation is very weak, and there is almost no correlation, indicating that the perceptual image of pattern sample A5 is significantly different from the perceptual image of other patterns in the same group, and cannot well represent the perceptual image represented by pattern Class A, so the pattern is excluded. Sample A5. Similarly, for the remaining 8 pattern classes, the correlation analysis of the 10 pairs of perceptual image utility value of Kansei evaluations of the 12 internal patterns is carried out in turn, and the sample patterns A5, C7, D2, E8, F12, F10, G3, G7, G10, H11, H10, I1, I10 and I12, 14 patterns were eliminated.

Validation of The Optimization

After removing the pattern samples with low internal correlation of each pattern

Class in turn, the remaining 94 pattern samples, according to the ratio of the training sets to the test set, divide the sample data with an approximate ratio of 7:3, and continue to use the parameters set above. Carry out BP neural network training, that is, 70 pattern samples in the training sets and 24 pattern samples in the test set. In the setting of training parameters, the transfer function of the hidden layer is still the hyperbolic tangent sigmoid transfer function, and the transfer function of the output layer is still the linear transfer function; the model training function is still the Levenberg-Marquardt back-propagation algorithm train NLM. Through the debugging of the empirical equation for the number of neurons in the hidden layer, and the repeated training according to the weights and thresholds of the randomly generated network connections, the final classification accuracy rate of the test sets reaches 83.3%. At this time, the neural network structure design is still determined. As shown in Figure 4-15, the number of neurons in the output layer is 10, the number of neurons in the hidden layer is 12, and the number of neurons in the output layer is 9. The training results are shown in the figure below.

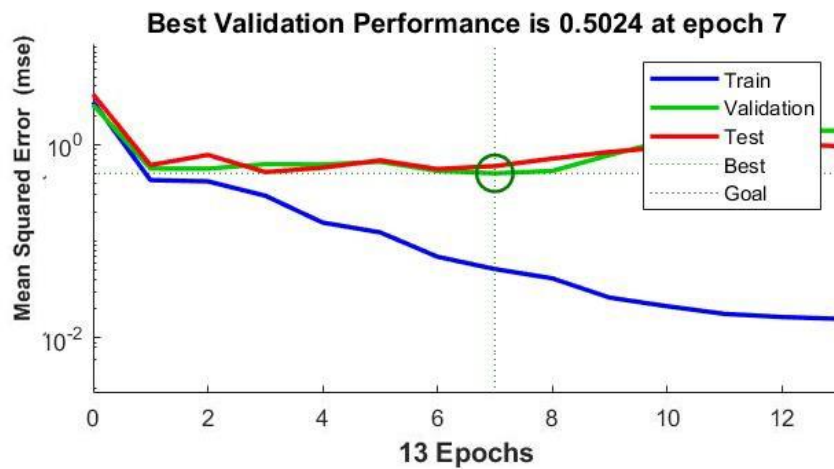


Figure 4-15. The relationship between the mean square error and iterations with optimization

From Figure 4-15, the curve change of the mean square error and the number of iterations of the training set, test set, and validation set on the left shows that the error change curve of the validation set no longer decreases in the seventh generation. The validation set mean squared error is 0.5024.

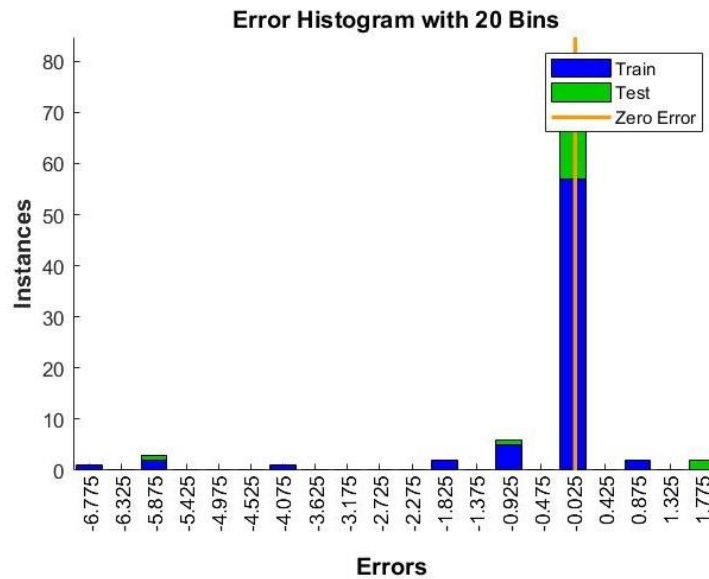


Figure 4-16. Error of training sets and test sets with optimization

As for the error histogram of the optimized training sets and test sets in Figure 4-16, it can be found that the error distribution is significantly better than the training results of the above 108 samples, where most of the errors in the training sets and test sets are concentrated at 0. Nearby, it is -0.025, and the absolute value is 0.025, which is significantly smaller than the above 0.175.

At the same time, the data distribution with errors deviating from 0 is significantly reduced, indicating that the training effect of this model has been significantly improved. It can be seen intuitively from Figure 4-15 that after removing some pattern samples with low correlation in the pattern classes, in the training model of the remaining 94 samples, the classification accuracy rate of the test sets can be increased to 83.3%. The optimized test sets classification error in Figure 4-16 shows that only 4 pattern samples are predicted incorrectly, and the overall prediction effect of the model is greatly improved compared with 108 samples. The training obtained 83.3% of the predicted classification accuracy of BP. The neural network is saved, including the connection weights, thresholds and other parameters between the corresponding network neurons, and applied to the fashion pattern recommendation in the next stage.

4.6 Conclusion

In this chapter, we introduced the techniques used for the data processing and for the fashion pattern recommendation system construction, such as the fuzzy theory and

related technique, formalization of involved data, relevancy degree of cognition to fashion pattern, BP neural network and DenseNet neural network.

We also discussed the use of machine learning in the fashion industry, specifically for fashion pattern recommendation. In the fashion industry, machine learning is used for tasks such as recommendation systems, fraud detection, inventory optimization, price optimization, and product design.

To improve the accuracy of fashion pattern recommendation, this study uses both subjective evaluation and machine learning methods. However, due to the multiplicity, complexity, and fuzziness of designers' and consumers' perceptions of clothing patterns, it is difficult to accurately recommend fashion patterns. To deal with this fuzzy information, fuzzy technology is applied to data analysis to build a fashion pattern recommendation system based on machine learning.

In this study, 10 Kansei words such as “lively”, and “elegant” to describe different patterns. These Kansei words are then mapped onto different patterns using a UV value that ranges from 0 to 1. The closer the UV value is to 1, the stronger the mapping relationship between the perceptual image of the pattern and the Kansei words on the right is.

Using these methods, we studied the mapping relationship between all fashion patterns and 10 pairs of Kansei words. This allows us to personalize recommendations based on a user's profiles and perceptual preferences while also improving their accuracy by using historical recommendation data.

We used correlation analysis and variance analysis to analyze the perceptual images of fashion patterns, including the perceptual images of patterns in the same pattern class, and the perceptual images of different pattern classes, which can be used as the basis for a fashion pattern recommendation system.

After the data analysis, we found that the consumers' cognitive model of fashion patterns is different from designers', consumers' cognition of fashion pattern in mainly come from the association with real things, and designers will also consider the expression form of the design of fashion patterns.

Chapter 5 Knowledge-based Recommendation System for Fashion Pattern

In this chapter, firstly, we set up the knowledge base about fashion patterns and their cognition, using ontologies, which is as powerful tools for knowledge base modeling and formalizing. Based on the fuzzy information of Kansei evaluation of fashion patterns in Chapter 3 and Chapter 4, by analyzing the fashion pattern classes, pattern attribute, perceptual cognition of fashion patterns and the users' profiles and perceptual preferences about fashion patterns, they were used as the database to consist the knowledge base for fashion pattern recommendations, we propose a fashion pattern recommendation system. Finally, some real cases are given for validating the proposed system. The flowchart of the recommendation system is shown in Figure 5-1.

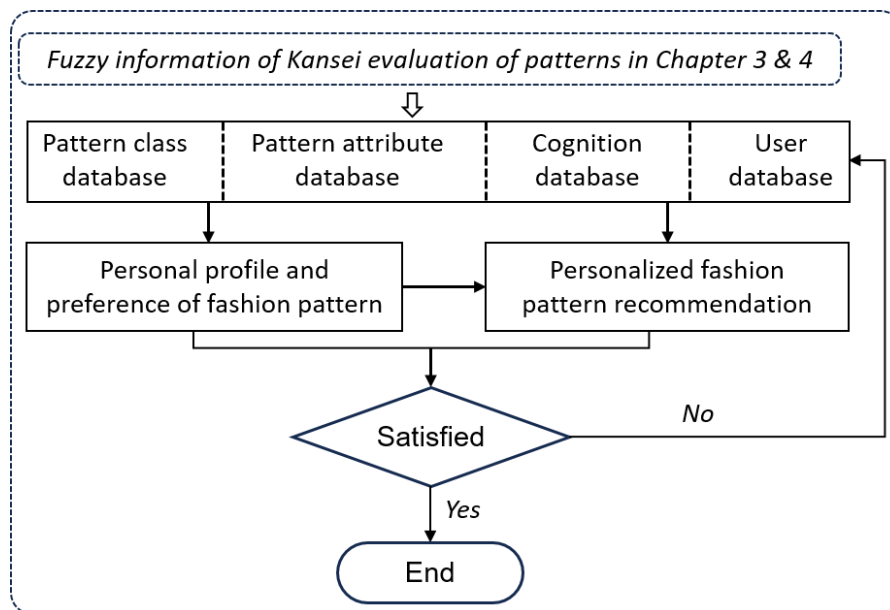


Figure 5-1. Flowchart of the proposed recommendation system

A knowledge-based recommendation system is a type of recommendation system that generates recommendations based on a user's preferences and an understanding of the item being recommended. It uses information about the user's profile and preferences to suggest new items that are likely to be of interest.

In a knowledge-based recommendation system, the recommendations are

generated based on the knowledge of the domain or the item being recommended. This could include information about the item's features, attributes, and other metadata such as genre, author, or brand. The system uses this knowledge to identify items that match the user's profiles and perceptual preferences. For example, a knowledge-based recommendation system for fashion patterns might recommend fashion patterns to users based on their preferences for specific pattern types, and perceptual images of patterns. The system will use its metadata for fashion patterns to recommend to users.

One of the benefits of knowledge-based recommendation systems is that they can generate recommendations even for new users or for items that have limited data available. However, they may not be as effective in generating diverse or unexpected recommendations, as they rely on the user's past behavior to generate suggestions.

5.1 Fashion Pattern Knowledge Base

At present, most ontology models in the apparel field only involve the classification knowledge of fashion and the relations are only parent-child relationships between concepts. Relevant entities such as fashion patterns, fashion styles, and complex relations are rarely concerned. However, it would be beneficial for the recommendation of design schemes with existing knowledge if we can clarify the related concepts and relations for fashion patterns by using ontology. In this section, we will introduce an ontology model for fashion patterns and its recommendation applications.

5.1.1 Ontology and Fashion Pattern Knowledge

We set up the fashion pattern ontology model (FPOM) by using tuples as the following Figure 5-2.

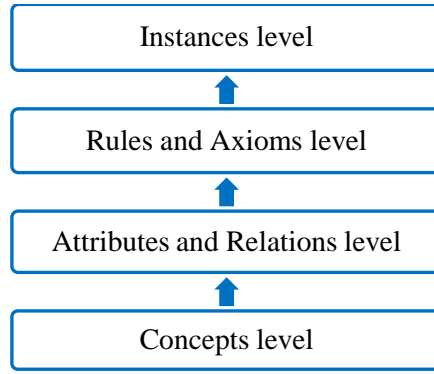


Figure 5-2. Hierarchical diagram of fashion pattern ontology

FPOM=((FD_Concept)⊔“concept”, (FD_Attribute)⊔“attribute”, (FD_Relation)⊔“relation”, (FD_Rule)⊔“rule”, (FD_Axiom)⊔“axiom”, (FD_Instance)⊔“instance”)

Figure 5-2 shows the hierarchical structure of the ontology model.

(1) Concept

FD_Concept in this thesis involves the pattern class and its Kansei. All of them are taken as the Concepts of fashion pattern ontology.

(2) Attribute

$$FD_Attribute = \{(c_1, c_2): c_1, c_2 \in FD_Concept\}$$

We also use the following descriptive language to give attributes between classes, user, designer, pattern, and pattern class.

(3) Relation

$$FD_Relation = \{(c_1, c_2): c_1, c_2 \in FD_Concept\}$$

In this thesis, it involves some common relations such as patterns and their perceptual image, difference pattern classes, and difference in perceptual image between consumer and designer.

(4) Rule

$$FD_Rule = \{S_1 \wedge \dots \wedge S_n \wedge C \rightarrow S: S \in FD_Concept \cup FD_Relation, S_1, \dots, S_n \in FD_Concept \cup FD_Relation \cup FD_Attribute, C \in FD_Concept\}$$

where C expresses a condition.

the rules for dealing with the fuzzy information of patterns in Chapter 4 are regarded as rules in design ontology

(5) Axiom

$$FD_Axiom = \{S_1 \wedge \dots \wedge S_n \rightarrow S: S \in FD_Concept \cup FD_Relation,$$

$$S_1, \dots, S_n \in FD_Concept \cup FD_Relation \cup FD_Attribute\}$$

FD_Axiom removes the condition C in FD_Rule , which shows whenever implications in FD_Axiom are true. There are the following axioms in the design ontology.

(6) Instance

$$FD_Instance = \{S: S \in FD_Concept \cup FD_Relation \cup FD_Attribute\}$$

5.1.2 Ontology-based Fashion Pattern Knowledge Base

The proposed design knowledge base has three layers as shown in Figure 5-3.

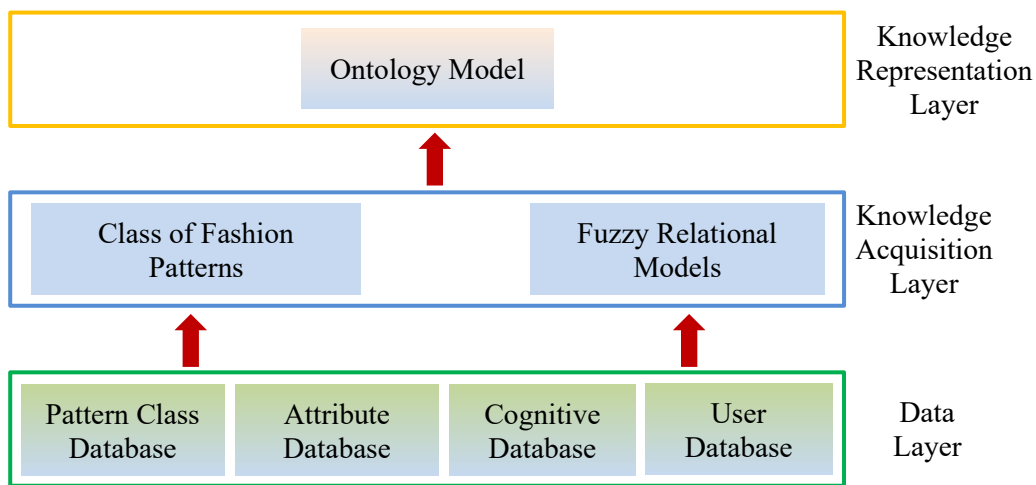


Figure 5-3. Hierarchical diagram of the fashion pattern knowledge base

This knowledge base is organized following a hierarchical structure. First, all the raw data collected in the different databases (pattern class, pattern attribute, cognition, users) will be analyzed and modeled using the methods mentioned in Chapter 4. Next, the relatively separated models are regrouped together using the ontology model in order to create a structured and complete knowledge base for further applications as a whole system.

Also, the created knowledge base can be automatically adjusted at any time by introducing new knowledge into the knowledge base.

5.2 Structure of the Proposed Recommendation System

The proposed recommendation system is aimed to provide both functional and personalized services for both production and consumption ends, narrowing the subjective cognitive gap between users and experts. The main demand of users for recommendation systems is whether they can provide personalized requirements. For experts (designers), their main requirement is to better understand user needs. On the other hand, experts also play the role of consumers in daily life. As consumers, experts also need to make personalized recommendations. Therefore, the construction of the recommendation system in this thesis mainly consists of two tasks: one is to meet the personalized needs of users, and the other is to build a collaborative recommendation module between experts and users based on user's data. Firstly, before the recommendation, we will obtain the basic information about registered users or experts, including the selection of users and experts, as well as the gender selection of the user population. Registration information helps to obtain the characteristic information of the registrant, meeting the personalized and functional needs of different populations. Secondly, by constructing a multi-dimensional retrieval method that meets the emotional imagery of fashion patterns for users and experts, allowing users and experts to customize search conditions, clarifying the needs for fashion patterns by inputting ten-dimensional numerical values, and ensuring pattern retrieval efficiency and recommendation quality.

Distinguish the user population in the experiment based on different gender user groups by inputting basic registration information. The user can directly input the close values of 10 pairs of emotional image words. According to the type of user group's pattern recognition data, the experts input the close values of 10 pairs of emotional image words. As a designer identity expert, the recommendation results are constructed based on user data and may differ from the expert's own cognition. Experts can design fashion patterns based on user cognitive information. The function of this

recommendation system is that users can directly obtain the pattern information they want, and experts can obtain the pattern cognitive information of users to understand their needs. Through this information, they can compensate for the cognitive differences between experts and users, which to some extent helps to narrow the cognitive gap between production and consumption ends and further meet the personalized needs of consumers. According to the preference weight range, input the desired level of perceptual imagery, and use the Euclidean distance formula to obtain the three fashion patterns closest to this level for recommendation, for users and experts. The basic structure of the recommendation system is shown in Figure 5-4.

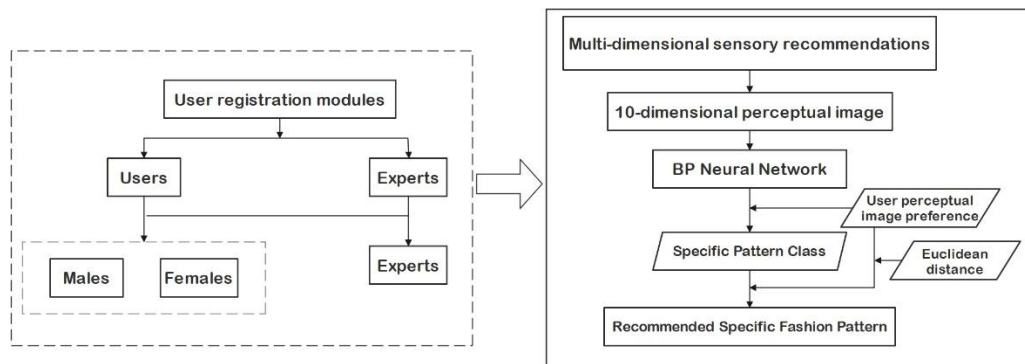


Figure 5-4. Structure of the proposed recommendation system

5.3 Knowledge-based Recommendation System

A knowledge-based recommendation system (KBRS) is a type of recommender system that uses explicit knowledge about the item assortment, user preferences, and recommendation criteria. These systems are applied in scenarios where alternative approaches such as collaborative filtering and content-based filtering cannot be applied.

Knowledge-based recommender systems typically work by first eliciting user requirements and preferences. This can be done through a variety of methods, such as questionnaires, interviews, or natural language processing. Once the user requirements and preferences are known, the KBRS can then use this information to recommend items that are likely to be of interest to the user.

There are a number of different ways to represent user requirements and preferences in a KBRS. One common approach is to use a rule-based system. In a rule-

based system, a set of rules is defined that specifies which items are recommended to which users.

5.3.1 Operations in the Knowledge-based Recommendation System

A knowledge-based recommendation system is made up of several components as shown in Figure 5-5. One of them is the knowledge-based recommendation module. The knowledge-based recommendation module is responsible for generating recommendations based on the features and attributes of the item being recommended and the user's preferences. The knowledge-based recommendation module is an important component of a knowledge-based recommendation system since it is responsible for generating recommendations based on the user's preferences and the features of the item being recommended.

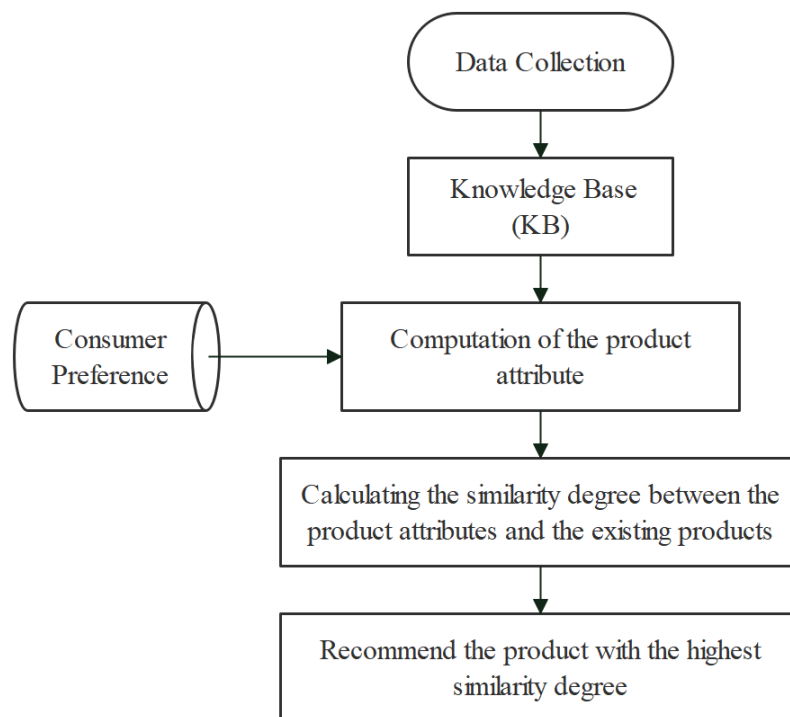


Figure 5-5. General structure of the knowledge-based recommendation module

The knowledge-based recommendation module is the core of the proposed overall consumer-oriented recommendation system. It works when the consumer has more personalized requirements or desired fashion preferences. It aims at proposing the most suitable fashion pattern to specific consumers according to their specific perceptual image by learning from the previous evaluation data.

The detailed procedure of the knowledge-based recommendation module is given as below.

The knowledge-based recommendation module is composed of the following steps:

(1) Data collection from the Kansei evaluation experiments

In Chapter 2 and Chapter 3, we made a pattern classification and designed Kansei evaluation experiments to obtain the perceptual image of patterns, through the data analysis, we captured the relationship between fashion patterns and perceptual image and the cognitive differences between consumers and designers, which constitute the knowledge elements and ultimately form a knowledge base.

(2) Creation of the knowledge bases

In order to characterize the relationship between the inputs (consumer's preference of perceptual image for fashion pattern) and outputs (fashion pattern profile), we have defined the knowledge matrices KB1 and KB2. KB1 is about the relationship between the inputs (consumer's preference) and the normalized evaluation criteria describing both consumers and patterns, while KB2 is about the relationship between the output (fashion pattern profile) and the same normalized evaluation criteria. By combining KB1 and KB2, we can effectively predict the output (desired fashion pattern) from the inputs (consumer's preference of perceptual image for fashion pattern).

(3) Recommendation process

By combining operations between consumer's preferences and knowledge bases, we can obtain the desired fashion pattern attribute. By ranking the similarity degrees of all the existing fashion pattern profiles in the database related to the desired product attribute, we recommend the fashion pattern with the highest similarity degree that matches the consumer's preference.

5.3.2 Feedback and Knowledge Updating

The BP neural network model with a classification accuracy rate of 83.3% was trained by 94 pattern samples in the experiment, and then output the corresponding pattern Class by inputting the utility value of 10 pairs of Kansei words, and

recommending the most suitable pattern class and the most suitable three patterns in this Class. The meaning of the utility value of the pattern here is extended to the preference weight of the pair of Kansei words, because the utility value of 1.0 for the perceptual image word itself is the defuzzification representation of the comprehensive triangular fuzzy value for the evaluation of the perceptual image, and the value range is [0, 1.0], in order to give users a more intuitive rating and recommendation, we use the code to convert the utility value, that is, the preference weight range, into [0, 1.0], an example of its meaning is shown in Figure 5-6.

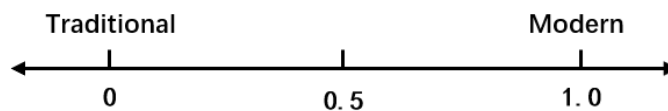


Figure 5-6. Schematic diagram of the “preference weight” of the Kansei word
(Traditional - Modern)

The user inputs their own preference weight for 10 pairs of Kansei words, and the input value range is between [0, 1.0]. After inputting according to the system prompt, the system will first evaluate the input according to the BP neural network. The output is one of 9 types of pattern classes, and then the Euclidean distance between the utility value of Kansei evaluation of the perceptual image of the pattern in this type of pattern Class and the perceptual image preference weight input by the user is calculated according to the Euclidean distance equation (5-1). The Euclidean distance is recommended. The three patterns with the smallest Euclidean distance, that is, the three patterns that best match the user’s perceptual needs, and finally the user chooses the pattern they want.

$$d(x, y) = \sqrt{\sum_{i=1}^n (x_i - y_i)^2} \quad (5-1)$$

where x_i represents the x -coordinates of the i -th Kansei word and y_i represents the y -coordinates of the i -th Kansei word, $n=10$ for Kansei words.

5.4 A Case Study of Fashion Pattern Recommendation

In this section, we conducted a case study of fashion pattern recommendation to introduce the operation of the recommendation system, also verify the effectiveness of

the recommendation system. Users input their preferences of fashion patterns, according to the user profile and preference, the recommendation system will give specific patterns and make a satisfaction test to meeting the personalized needs of users. The recommended flow chart is as follows in Figure 5-7.

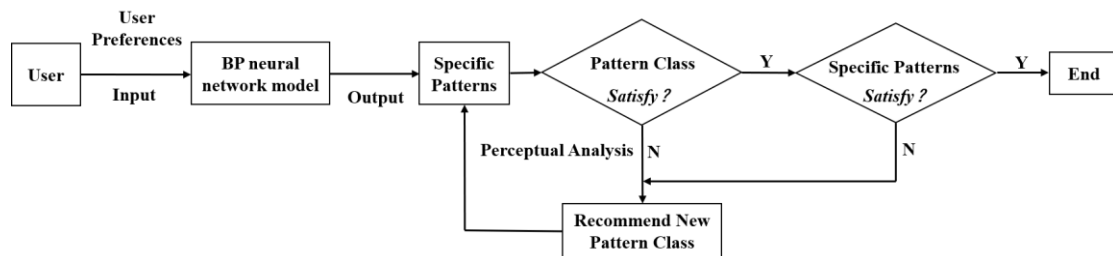


Figure 5-7. Pattern recommendation flowchart

5.4.1 Design of The Experiments

In the proposed fashion pattern recommendation system, users can set weights of perceptual images based on their own preferences to recommend clothing patterns. If users want a lively, casual, and more attractive style of fashion pattern, the recommended process is shown in Figure 5-8.

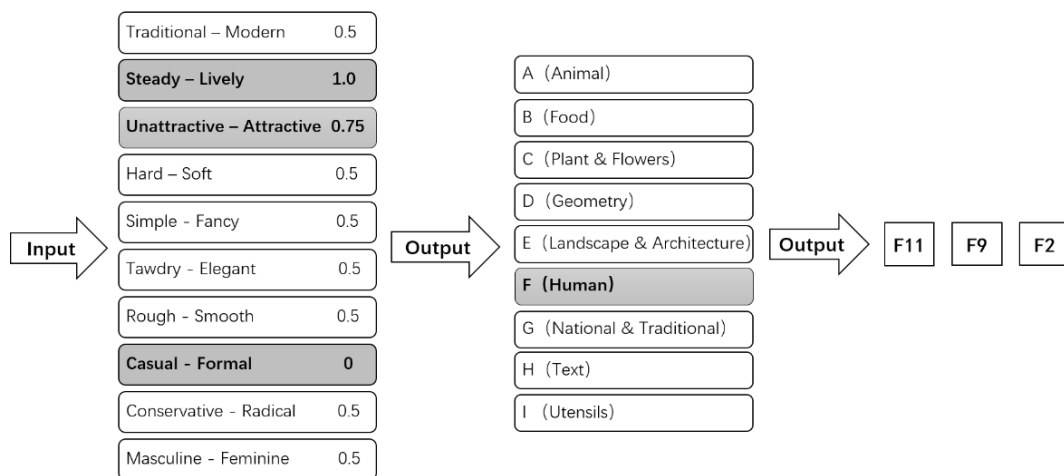


Figure 5-8. Pattern recommendation process

Firstly, users input 10 pairs of perceptual image preference weight scores in the system, of which “Steady - Lively” scored 1.0 for Kansei words, indicating that the style that emphasizes liveliness has the largest weight. Similarly, “Casual- Formal” scored 0 for sensual pattern words, indicating that the style that favored casual was the most weighted, and “Unattractive - Attractive” scored 0.75 for sensual pattern words, indicating that the style favored attractive with a medium weight of 0.75 points, as shown in Figure 5-8. Finally, according to the previously trained BP neural network

algorithm, the system gives my fashion pattern recommendation Class, which is Class F, that is, the character Class, and gives the three patterns with the smallest Euclidean distance, which are F11, F9, F2, at the same time show the pattern to the user as shown in Figure 5-9. For the user, because the classification accuracy rate of the BP neural network algorithm is 83.3%, the three patterns F11, F9, and F2 recommended by the system to me, the user was satisfied with the recommendation results, which conforms to my desired pattern style.

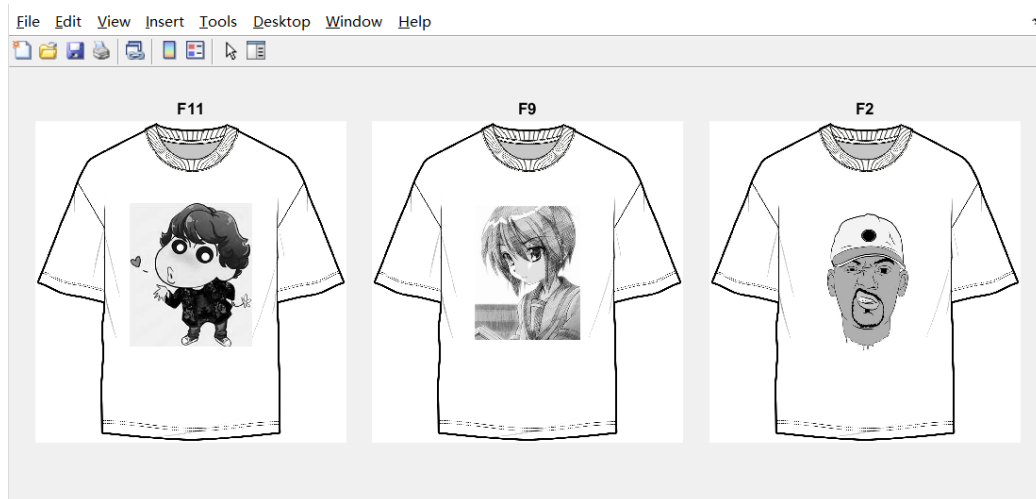


Figure 5-9. The three recommended patterns

In this section, the validation of these modules is realized from both individual perceptual preferences and statistical results for a target recommendation. In this study, 10 consumers randomly selected from the target population are invited to make personalized recommendation and evaluations for their desired fashion pattern preferences. Successfully verified the availability of the recommendation system.

5.4.2 Experimental Results

In order to verify the feasibility of the pattern recommendation system, in the verification experiment, 10 students were selected to test the pattern recommendation system. The experimental results are shown in Table 5-1. In the recommendation pattern satisfaction survey, the highest is 10 points, the lowest is 7.5 points, and the average satisfaction is 8.55 points, which shows that everyone is still satisfied with the recommended patterns of the recommendation system, and also shows that based on the BP neural network The pattern recommendation system constructed by the

algorithm is feasible, and can recommend patterns of desired styles for enterprise designers or users.

Table 5-1. Pattern recommended and its satisfaction

User	10 preference weight scores for Kansei words (Expected style)										Recommended patterns	Satisfaction	
Male	1	0.5	0.5	0.5	0	0.5	1.0	0.7	0.5	0.5	0.5	C3, C4, C12	9
	2	0.5	0.7	0.8	0.5	0.5	0.9	0.8	0.5	0.4	0.9	C3, C1, C4	10
	3	0.5	0.9	0.8	0.7	0.5	0.5	0.5	0.5	0.5	0.5	A9, A10, A7	8
	4	0.7	0.4	0.6	0.7	0.2	0.6	0.2	0.6	0.6	0	I6, I7, I11	9.5
	5	0.7	0.4	0.6	0.7	0.5	0.5	0.5	0.5	0.5	0.7	D5, D6, D9	8.5
Female	6	0.5	0.5	0.7	0.8	0.5	0.5	0.5	0.3	0.5	0.1	D8, D3, D7	7.5
	7	0.5	1.0	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	A7, A12, A9	8
	8	0.2	0.3	0.6	0.5	0.5	0.7	0.7	0.3	0.5	0.6	C8, C5, C3	9
	9	0.7	0.4	0.6	0	0.5	1.0	0.7	0.5	0.8	0.8	C4, C3, C5	8
	10	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	I3, I2, I11	8

Since the pattern classification accuracy rate of the neural network model of the pattern recommendation system is 83.3%, that is to say, there is still a chance that the recommended pattern is not what the user wants, and the feedback processing at this time is an important factor affecting the user experience and satisfaction. In this topic, we can use the above analysis of the perceptual attributes of fashion patterns to provide feedback on the user's dissatisfaction with the recommended patterns, that is, to make up and improve the recommendation process, and further improve the robustness of the system.

In this example, what we want is a lively, casual, and attractive pattern. The system recommends the F-class character pattern for us, and the most recommended pattern is based on the Euclidean distance. Suitable three patterns: F11, F9, F2. There are two cases here. One is that the user is satisfied with the recommended pattern Class, but is not satisfied with the three patterns given. At this time, the system can display the remaining patterns of the pattern according to the Euclidean distance, namely F1, F6, F7, F5, F3, F8, and F4, if the display is still dissatisfied, it is considered that the user is dissatisfied with the pattern of this Class, then the second case is turned; the second

case is that the user is not satisfied with the recommended pattern Class. If you are not satisfied, in the example, you are not satisfied with the F-class character pattern Class. At this time, the system needs to analyze the preference weights of the 10 pairs of Kansei words input by the user, and sort the absolute value of the weights, such as here, the weights The absolute value order is as follows: “Sedate - Lively” 1.0, “Casual - Formal” 0, “Unattractive - Attractive” 0.75.

According to the sorting size of the absolute value of the weight, the perceptual attribute analysis of the fashion pattern above is used to change the pattern Class for the user in turn. Here is the conclusion of the perceptual image correlation analysis of the different grouping patterns above. In this example, first look at the first pair of pattern words “Steady - Lively”. From the perceptual analysis of the pair of pattern words, we can get that pattern Class A is more sensitive to the perceptual image of “Lively”, that is, the most influential degree of the image word. Therefore, we first replace the pattern Class A, that is, animal patterns are recommended for users, and at the same time calculate the most suitable three patterns in the A Class according to the Euclidean distance and show them to the user. Here we return to the first case. If the user is satisfied with the recommended pattern, the recommendation ends; otherwise, we continue to sort the size according to the absolute value of the weight, change the next pattern Class according to the conclusion of the perceptual attribute analysis of the fashion pattern, and continue to recommend until the recommendation result is satisfied, and the feedback results are used for system update and improvement.

Through perceptual analysis of this dataset, we investigate the approximation of perceptual pattern of within-group patterns for 9 classes of patterns, and draw the following conclusions:

One-way analysis of variance on the utility value of Kansei evaluation of 10 pairs of Kansei words in 9 groups of patterns, we can get the pattern class with the largest difference in the utility value of Kansei evaluation of each pair of Kansei words, and then combine the effect of different pattern classes of the pair of image words. The average value map of the values can obtain the pattern class that has the greatest impact on the perceptual image space of each pair, which provides a further perfect supplement

for our pattern class recommendation based on the perceptual image space.

Using the BP neural network algorithm code to train and learn the data set, and we build a fashion pattern recommendation system, the optimized BP neural network model's prediction pattern classification accuracy rate reached 8.3 out of 10. The testers conducted verification tests on the recommendation system, and the testers' satisfaction with pattern recommendation was an average of 8.55 points (out of 10 points), indicating that the system has good recommendation accuracy.

However, the recommendation system still has shortcomings. Since the number of pattern samples, we collected in the early stage is only 108, the pattern demand for a large number of users is a bit small, and even the phenomenon of repeated recommendation of the same pattern Class occurs. Updating is also a problem that needs to be considered in the next step; secondly, there are only 108 pattern samples, but each pair of patterns needs to be evaluated on 10 pairs of Kansei words, so each questionnaire in the designed Kansei evaluation questionnaire needs to fill in 1080 questions. In addition, in the Kansei evaluation, the evaluator has a strong subjectivism color, resulting in the final prediction classification accuracy rate of the BP neural network model trained with the data analyzed by the questionnaire is 83.3%, and the classification accuracy rate needs to be further improved. Improvements have been made to make more accurate pattern recommendations and improve user satisfaction with the recommended patterns.

5.5 Conclusion

This chapter presents the knowledge-based recommendation system, permitting to recommend more personalized products according to the specific preference, especially the perceptual preference for patterns. The recommendation module has been developed by exploiting the knowledge of the relationship between consumer preference and product attributes.

The knowledge updating module enables to adjust the knowledge base according to the feedback information of consumers in order to improve the satisfaction degree of

recommendation. The knowledge base can also be updated by changing or adding elements of consumer preference. This module makes the whole recommendation system more flexible and more adapted to changes in fashion trends and consumers' perceptions and preferences.

General Conclusions and Prospects

With the rapid development of the apparel industry and personality-consumer demand, the fashion industry is gradually changing from mass production to personalized customization, changing from commodity-centered to consumer-centered.

In this context, we proposed a personalized fashion pattern recommendation system that can be used for recommendation with the consumer's preference of a fashion pattern. It has the ability of dealing with the consumer's vague and uncertain perceptual image of a fashion pattern, and then it can be used to recommend a fashion pattern to meet the perceptual needs of consumers.

6.1 General Conclusions

In this study, we proposed a personalized fashion pattern recommendation system based on our works of systematic classification of fashion patterns, Kansei word extraction by text mining method. It can be used to recommend fashion patterns with consumers' vague and their perceptual image preferences.

First, we introduced the latest development and research trends in fashion patterns and related recommendation systems, describe the importance of fashion patterns to clothing, and then analyze the perceptual cognition of patterns. (Chapter 1)

Then, we clustered fashion patterns into various classes according to their natural attributes from research papers and fashion magazines. experts were asked to choose pattern classes in their personal vision, referring to their professional knowledge. The Kansei attributes of different fashion patterns were then investigated more clearly through a series of experiments involving both experts and students. The final 9 pattern classes were selected as Animal, Food, Plant, Geometry, Landscape, Human, National, Text, and Utensil. (Chapter 2)

Next, for evaluating the fashion patterns by applying a Kansei evaluation, in Chapter 3, the text mining method was applied to extract Kansei words for Kansei evaluation. T/P value is proposed to construct structured text data for quantitative

analysis, 10 pairs of Kansei words were extracted for Kansei evaluation, “Traditional – Modern”, “Steady – Lively”, “Unattractive – Attractive”, “Hard – Soft”, “Simple – Fancy”, “Tawdry – Elegant”, “Rough – Smooth”, “Casual – Formal”, “Conservative – Radical”, “Masculine – Feminine”, which can be used for Kansei evaluation of fashion patterns or other fashion items. We also conducted a validation experiment to test the applicability of the Kansei words for Kansei evaluation of fashion patterns.

In Chapter 4, we discussed the use of machine learning in the fashion industry, specifically for fashion pattern recommendation and constructed a fashion pattern recommendation system. To improve the accuracy of fashion pattern recommendations, 10 Kansei words were then mapped onto different patterns using a UV value to characterize the mapping relationship between the perceptual image of the pattern and the Kansei words. Also, the consumers’ cognitive model of fashion patterns is different from designers’, consumers’ cognition of fashion pattern in mainly come from the association with real things, and designers will also consider the expression form of the design of fashion patterns. These relationship and difference are applied to constructing the fashion pattern recommendation system.

In Chapter 5, using the intelligent techniques presented in Chapter 3 and Chapter 4, we used the DenseNet to explore the cognitive of fashion patterns and propose several modules to characterize different perceptual data sets obtained from the Kansei evaluation experiments described in Chapter 3. These modules can be used to characterize the relationship between a consumer’s perceptual preference and the normalized sensory attributes of fashion patterns. From these modules, we obtained a set of rules, which can be used in the proposed recommendation system for recommending fashion patterns.

Finally, we conducted a validation experiment on the proposed recommendation system. Based on the results of the validation experiment of fashion pattern recommendation using the proposed system, the recommendation system provides useful support for suggesting the most appropriate fashion pattern to meet the perceptual need. It has the capacity of a knowledge base updating to improve the satisfaction of recommendations.

The summarized research framework of this thesis is shown in Figure 6-1. This work can be further extended to support other fashion products with perceptual needs such as fashion style, color, trends, and so on.

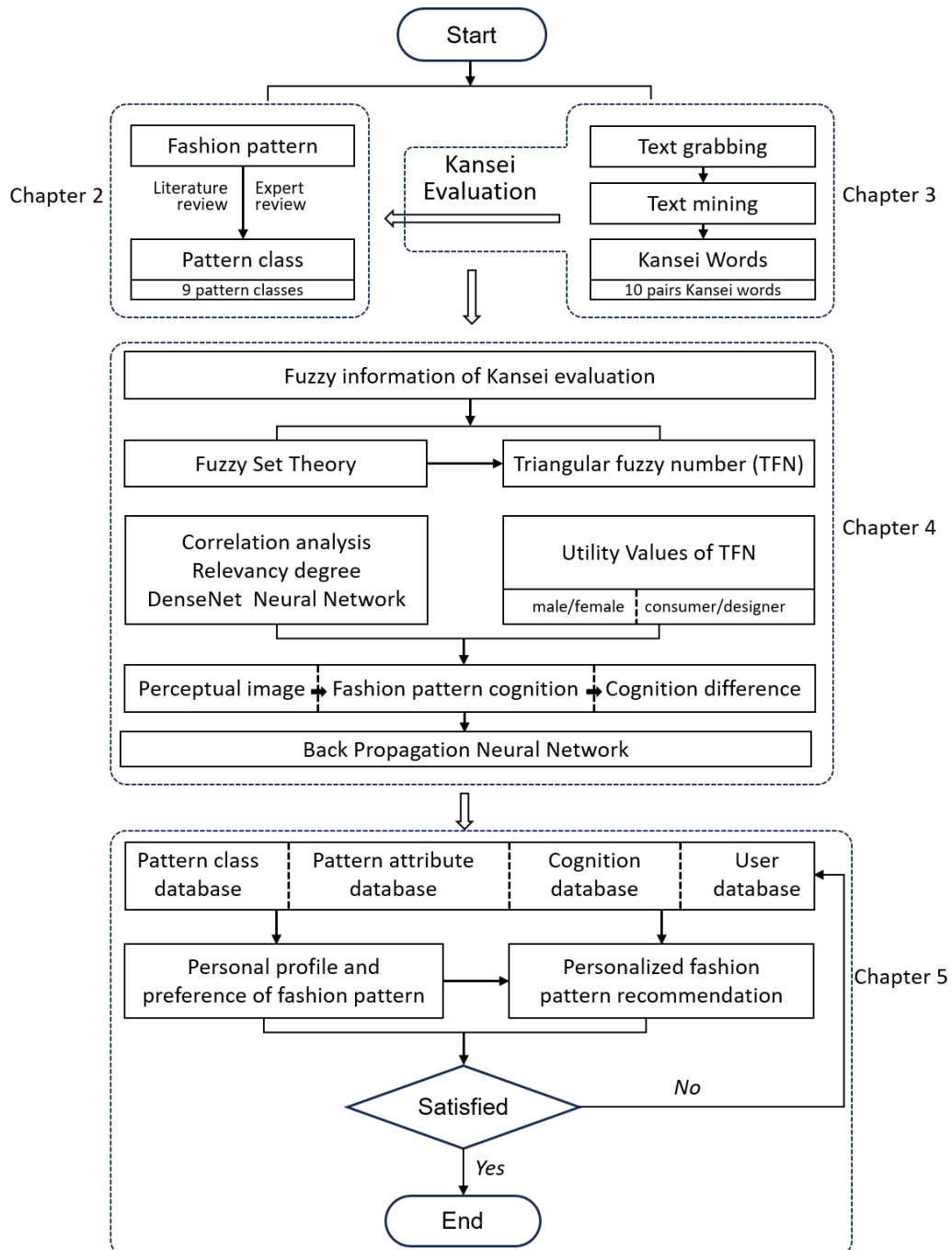


Figure 6-1. Summarized research framework of this thesis

6.2 Main Contributions

In this study, by the integration of Kansei evaluation, perceptual cognition, fashion

pattern and related techniques, a fashion pattern recommendation system was established to support the collaborative design in the fashion industry. The main contributions of this study are summarized as follows.

(1) Systematic classification of fashion patterns.

We systematically clustered fashion patterns. they were clustered into 9 classes according to their natural attributes by integrating users' and experts' knowledge. The final 9 pattern classes were selected as Animal, Food, Plant, Geometry, Landscape, Human, National, Text, and Utensil.

(2) Kansei words for sensory study using text mining method.

10 pairs of Kansei words for Kansei evaluation or sensory study were extracted by applying the text mining method as follows: “Traditional – Modern”, “Steady – Lively”, “Unattractive – Attractive”, “Hard – Soft”, “Simple – Fancy”, “Tawdry – Elegant”, “Rough – Smooth”, “Casual – Formal”, “Conservative – Radical”, “Masculine – Feminine”. They can not only be used to evaluate fashion patterns, but also for other Kansei evaluation or sensory study research.

(3) Cognition of fashion patterns.

Cognition of fashion patterns differs from different pattern classes, different user groups and different genders. the consumers' cognitive model of fashion patterns is different from designers', consumers' cognition of fashion patterns mainly comes from the association with real things, and designers will also consider the expression form of the design of fashion patterns.

(4) Personalized pattern recommendation system for fashion patterns.

Based on the fashion pattern classes Kansei words, and Kansei evaluation, an intelligent fashion pattern recommendation system was established considering cognitive differences between different user groups, and cognitive differences between users and designers.

In this study, we established a valuable framework for capturing consumers' subjective perceptions. It not only enhances the collaboration between consumers and designers, but also contributes to the development of products that address consumers' perceptual needs, thereby elevating the consumption experience in the fashion industry.

6.3 Research Prospects

Due to the time limitation, the current work is still far from being perfect. In future research, further work should be dedicated to the following aspects:

(1) The number of samples involved in the present study isn't widespread and the conclusions are drawn upon selected fashion patterns. In practice, reliable recommendation results depend on a big and comprehensive dataset. Therefore, in the future, more fashion patterns should be considered to obtain a more comprehensive perceptual image to improve the knowledge base.

(2) In the context of artificial intelligence generated content (AIGC), the method of automatically identifying or generating patterns can be referenced in the system to expand the database, improve the accuracy of the recommendation system, and expand application scenarios.

Published and Submitted Papers

1. Mengyun Zhang, Jun Zhang, Xuyuan Tao, Pascal Bruniaux, Xianyi Zeng. Fashion Pattern Class Selection and Sensory Words Extraction for Fashion Design, Expert Systems with Applications, Under review.
2. Mengyun Zhang, Jun Zhang, Xuyuan Tao, Pascal Bruniaux, Xianyi Zeng. Fashion Pattern Recommendation Based on Sensory Evaluation and ANN, Autex Research Journal, Pre-submit.

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I would like to express my sincerest gratitude to Dr. Xuyuan TAO, associate professor at ENSAIT, for his unselfish support as my thesis adviser. Thanks to his constant concern and patience, I am able to overcome all the difficulties during my study. He has walked me through all the stages of this thesis. From the beginning of the literature reading to the final draft, he helps me a lot as always. His rigorous attitude toward scientific research and creative personality have set an excellent example to my endeavor to not only grow as a qualified researcher but also as an independent thinker.

Special thanks are given to Dr. Xianyi ZENG, for her guidance in various aspects of my study. I benefited a lot from their profound professional knowledge and rigorous academic attitude, which gave me far-reaching influence on my further study and work.

I would express my great gratitude to professor Zhaofei XIONG and Dr. Jun ZHANG in Wuhan Textile University for their meticulous comments and helpful advice

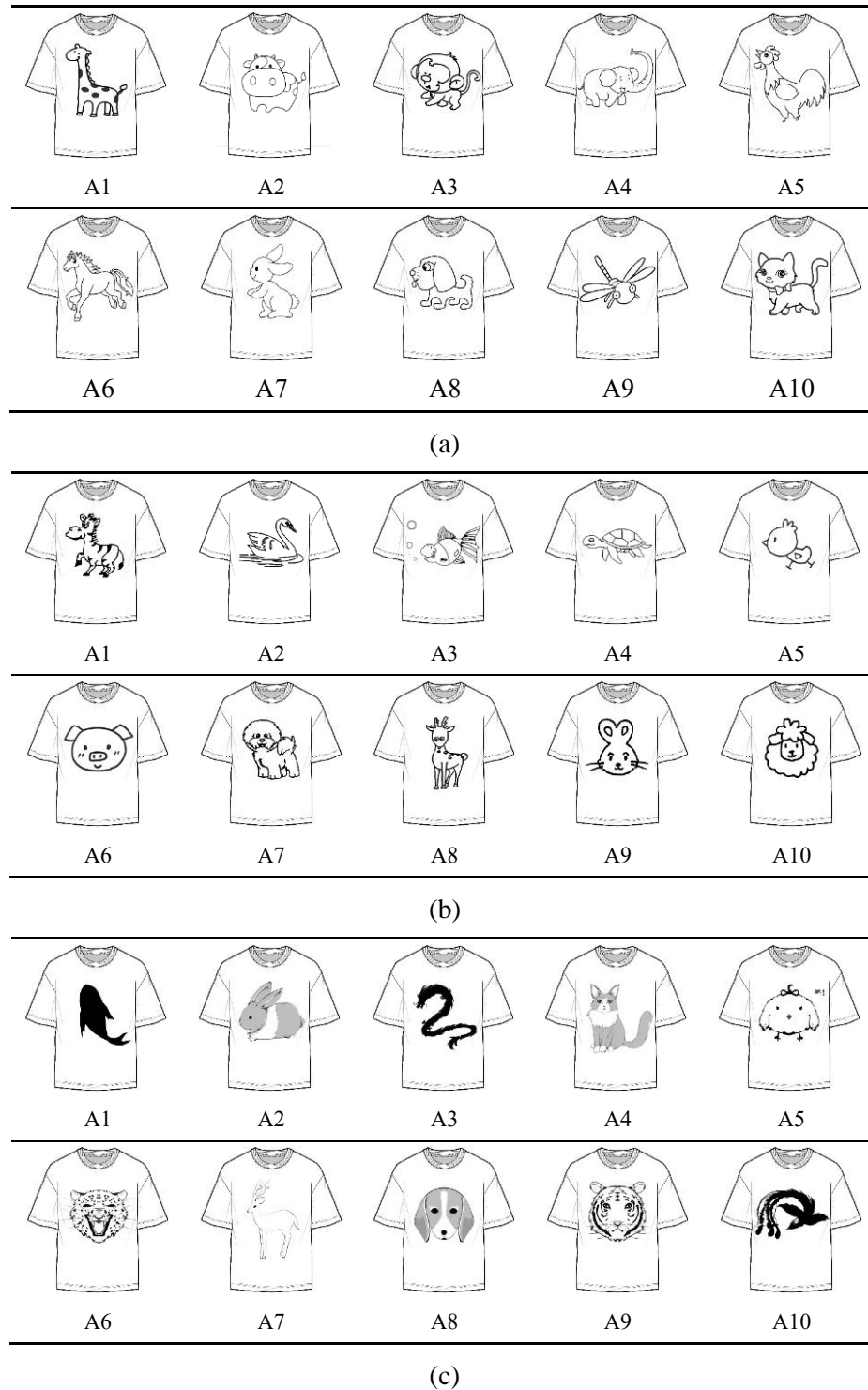
I also would like to thank my colleagues in GEMTEX Laboratory for their generous assistance, warm-hearted help and moral support in every aspect of my life and warm encouragement during my study at ENSAIT. And many thanks to the researchers and teachers.

My special thanks go to the individuals who have participated in my experiments. Thanks very much for all.

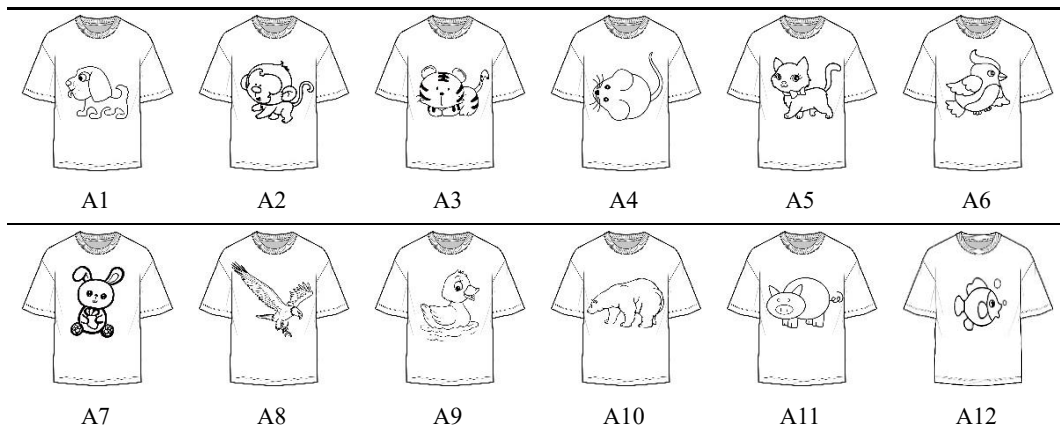
Finally, I would dedicate my greatest gratitude to my beloved family, my parents, for their unconditional love, unwavering support and limitless faith. They encourage me to move forward and make my life colorful and meaningful. Without their support, it is impossible to complete my Ph.D. study and this thesis. Thank you for being with me, at every tough and delightful moment.

Appendix

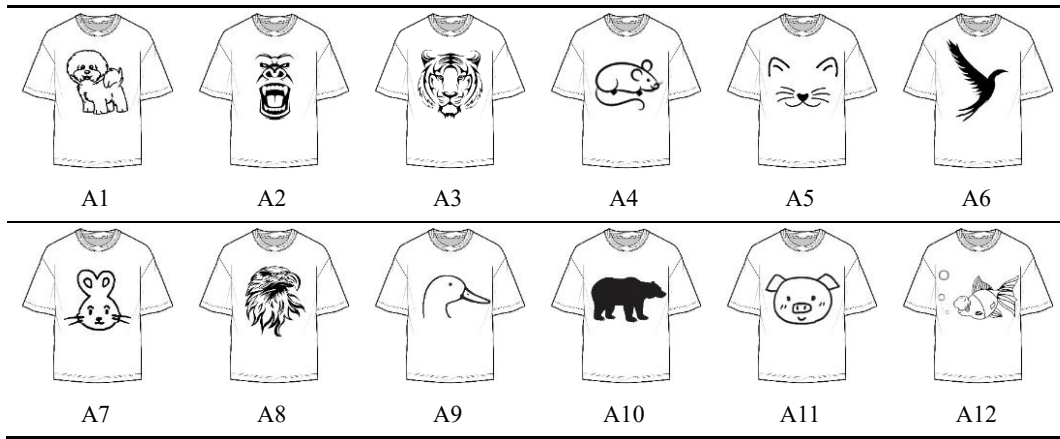
Appendix 1: Figures for Kansei evaluation



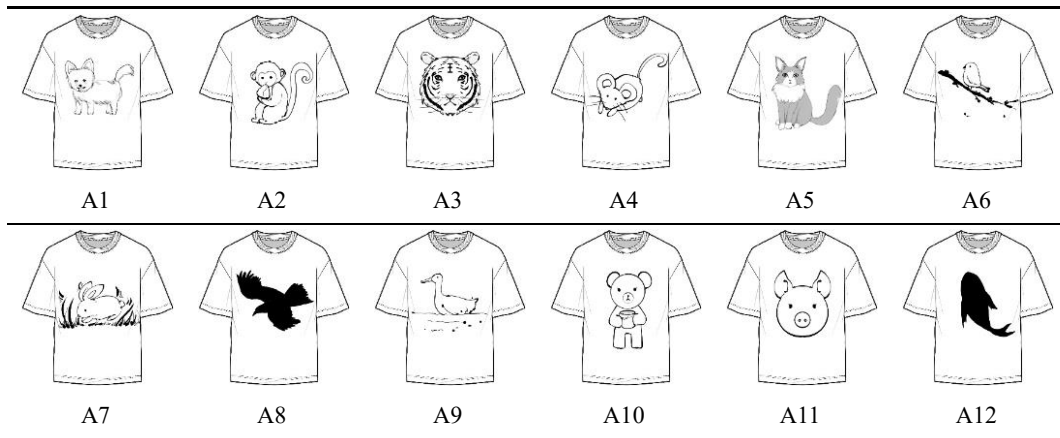
Appendix Figure 1. Animal patterns illustrated by 3 designers freely (Group I)



(a)

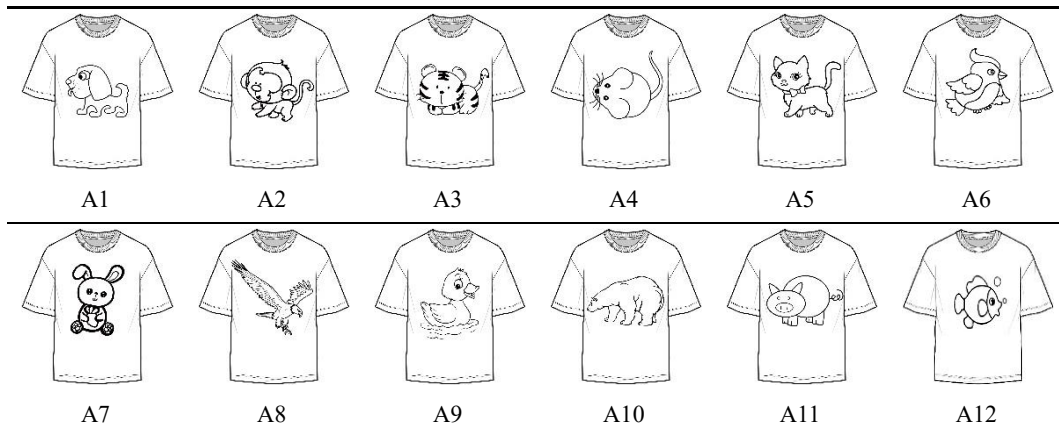


(b)

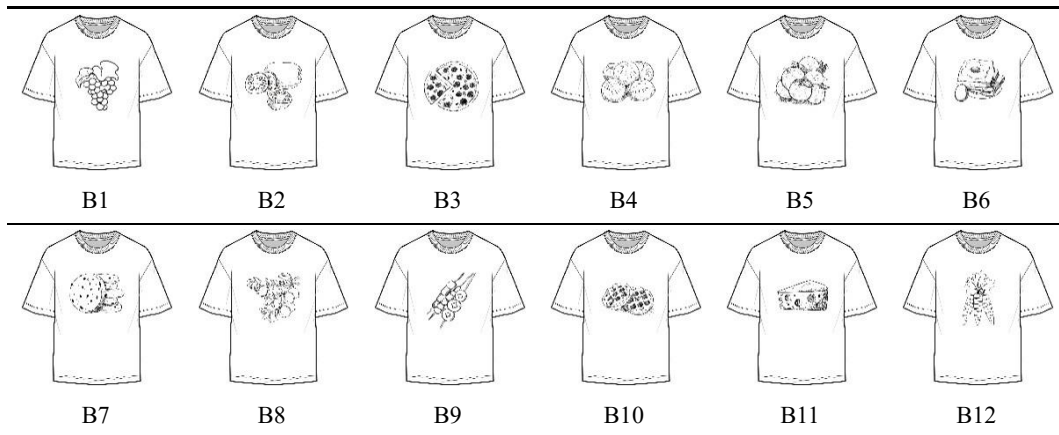


(c)

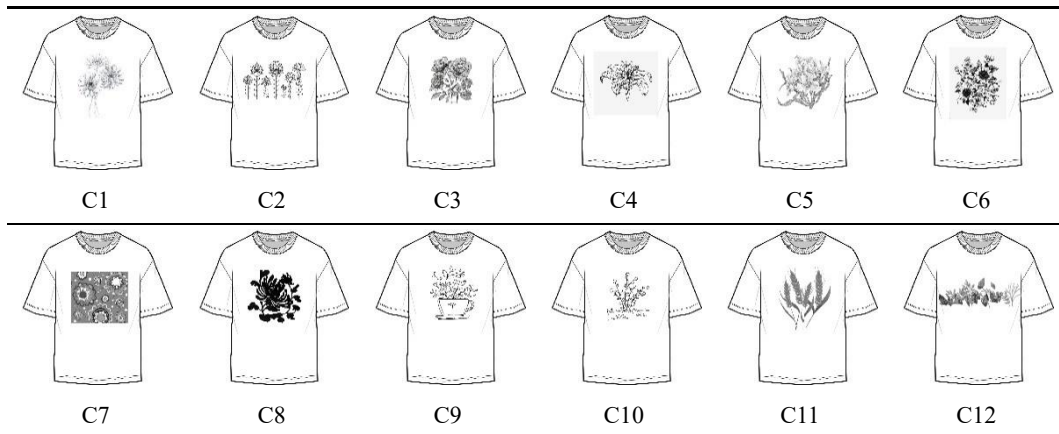
Appendix Figure 2. Designated animal patterns illustrated by 3 designers (Class A) (Group II)



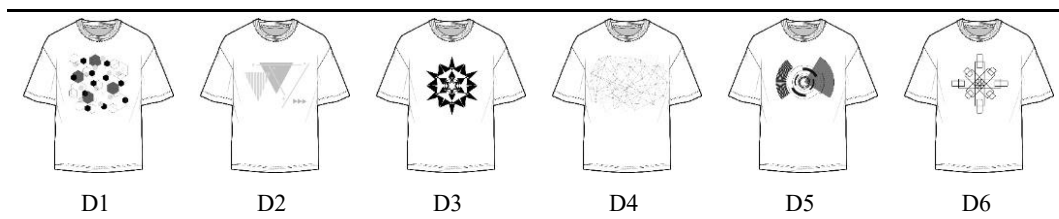
Appendix Figure 3. Animal patterns illustration (Class A)

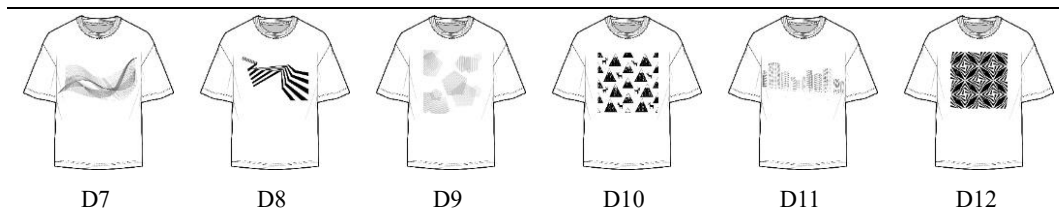


Appendix Figure 4. Food patterns illustration (Class B)

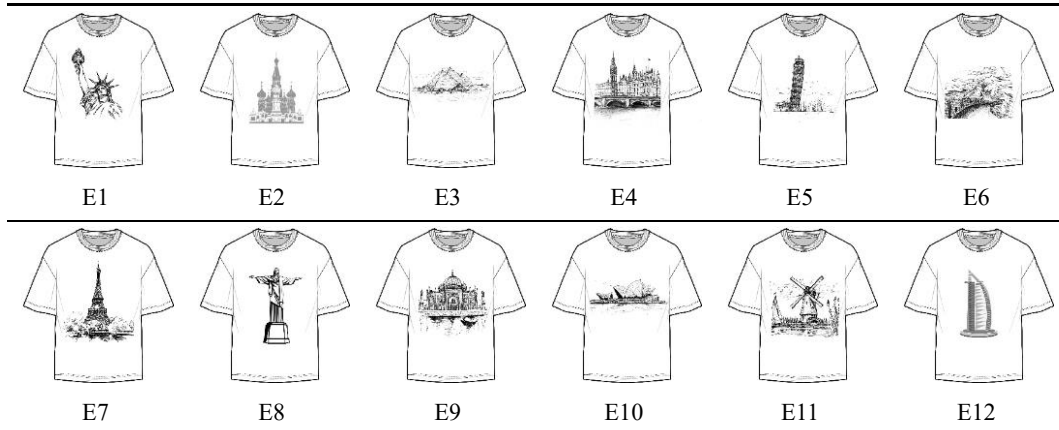


Appendix Figure 5. Plant patterns illustration (Class C)

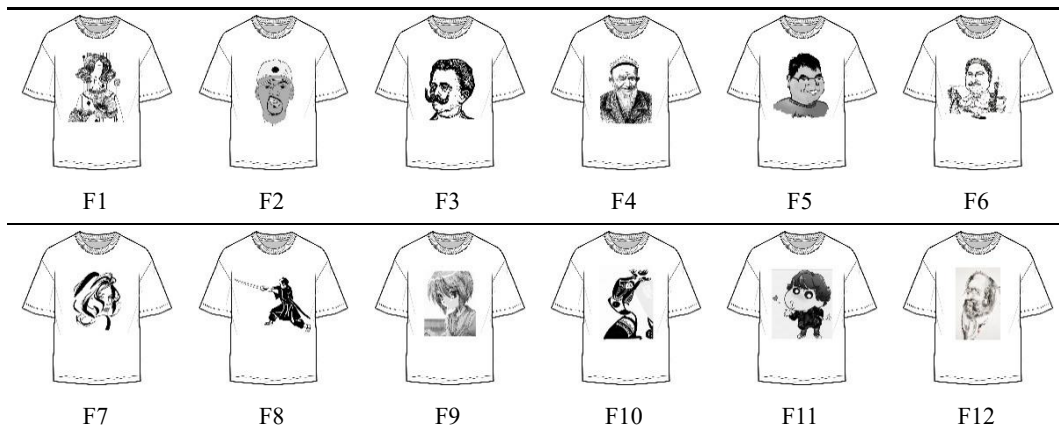




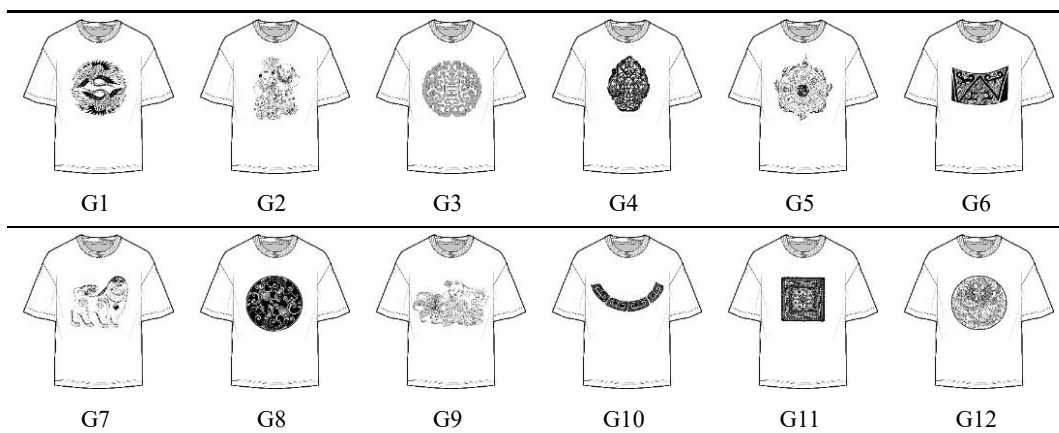
Appendix Figure 6. Geometry patterns illustration (Class D)



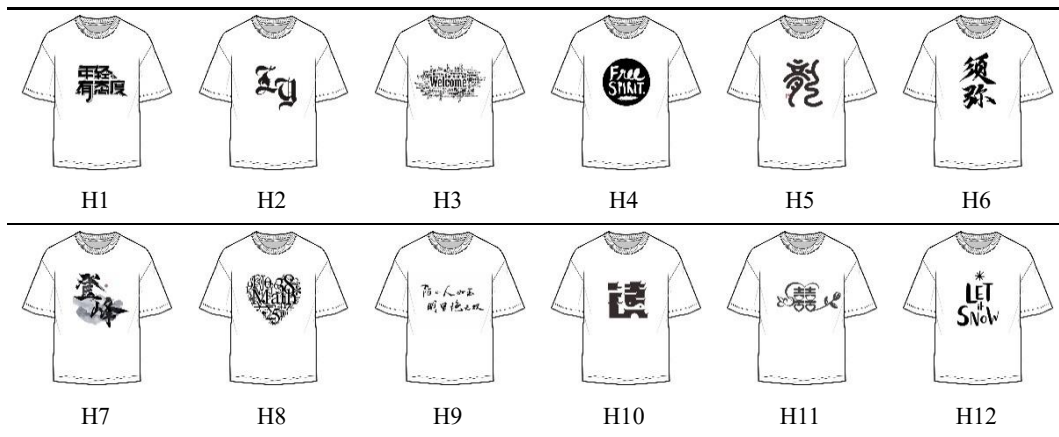
Appendix Figure 7. Landscape patterns illustration (Class E)



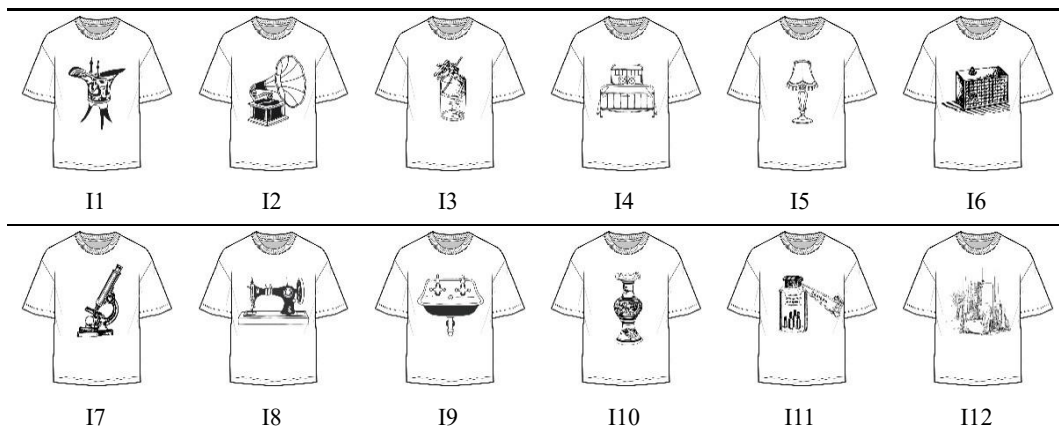
Appendix Figure 8. Human patterns illustration (Class F)



Appendix Figure 9. National patterns illustration (Class G)



Appendix Figure 10. Text patterns illustration (Class H)



Appendix Figure 11. Utensils patterns illustration (Class I)

Appendix 2: Kansei evaluation questionnaire

Kansei evaluation of Fashion Patterns

Hello, we are the research team of a fashion pattern Kansei evaluation. We are conducting an investigation study on the perceptual cognition of fashion patterns. Please select the appropriate value according to your impression of patterns and the correlation between the following adjectives. Thank you for your cooperation!

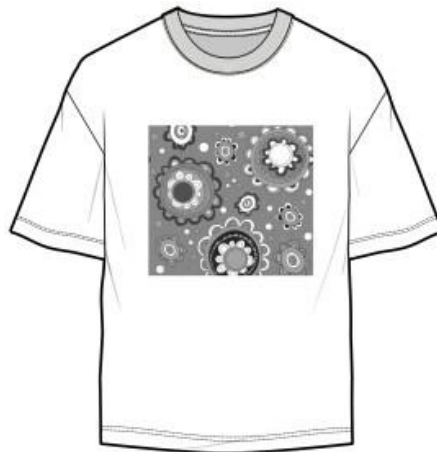
1. Your Gender:

- Male
- Female

2. Your Educational Background:

- Undergraduate
- Postgraduate
- Other

3. C7- Please evaluate the pattern on the T-shirt according to the evaluation words:



	-2	-1	0	1	2	
Traditional	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Modern
Steady	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Lively
Unattractive	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Attractive

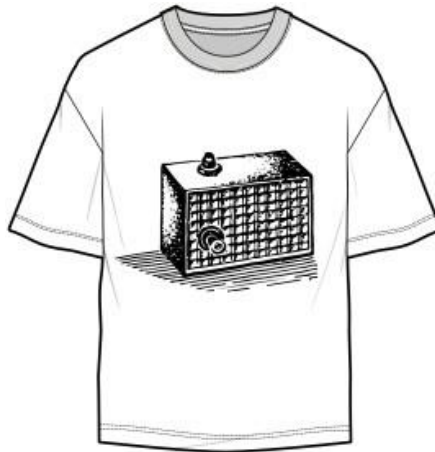
Soft	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Hard
Simple	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Fancy
Tawdry	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Elegant
Rough	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Smooth
Casual	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Formal
Conservative	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Radical
Masculine	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Feminine

4. G9- Please evaluate the pattern on the T-shirt according to the evaluation words:



	-2	-1	0	1	2	
Traditional	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Modern
Steady	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Lively
Unattractive	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Attractive
Soft	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Hard
Simple	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Fancy
Tawdry	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Elegant
Rough	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Smooth
Casual	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Formal
Conservative	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Radical
Masculine	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Feminine

5. I6- Please evaluate the pattern on the T-shirt according to the evaluation words:



	-2	-1	0	1	2	
Traditional	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Modern
Steady	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Lively
Unattractive	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Attractive
Soft	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Hard
Simple	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Fancy
Tawdry	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Elegant
Rough	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Smooth
Casual	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Formal
Conservative	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Radical
Masculine	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Feminine

6. H6- Please evaluate the pattern on the T-shirt according to the evaluation words:



	-2	-1	0	1	2	
Traditional	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Modern
Steady	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Lively

Unattractive	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Attractive
Soft	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Hard
Simple	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Fancy
Tawdry	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Elegant
Rough	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Smooth
Casual	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Formal
Conservative	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Radical
Masculine	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Feminine

7. E7- Please evaluate the pattern on the T-shirt according to the evaluation words:



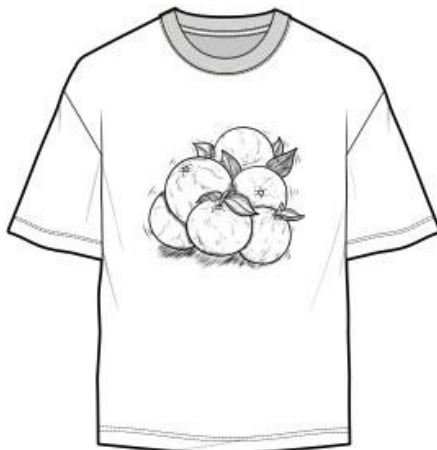
	-2	-1	0	1	2	
Traditional	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Modern
Steady	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Lively
Unattractive	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Attractive
Soft	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Hard
Simple	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Fancy
Tawdry	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Elegant
Rough	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Smooth
Casual	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Formal
Conservative	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Radical
Masculine	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Feminine

8. C11- Please evaluate the pattern on the T-shirt according to the evaluation words:



	-2	-1	0	1	2	
Traditional	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Modern
Steady	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Lively
Unattractive	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Attractive
Soft	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Hard
Simple	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Fancy
Tawdry	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Elegant
Rough	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Smooth
Casual	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Formal
Conservative	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Radical
Masculine	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Feminine

9. B5- Please evaluate the pattern on the T-shirt according to the evaluation words:



	-2	-1	0	1	2	
Traditional	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Modern
Steady	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Lively

Unattractive	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Attractive
Soft	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Hard
Simple	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Fancy
Tawdry	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Elegant
Rough	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Smooth
Casual	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Formal
Conservative	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Radical
Masculine	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Feminine

10. B1- Please evaluate the pattern on the T-shirt according to the evaluation words:



	-2	-1	0	1	2	
Traditional	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Modern
Steady	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Lively
Unattractive	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Attractive
Soft	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Hard
Simple	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Fancy
Tawdry	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Elegant
Rough	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Smooth
Casual	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Formal
Conservative	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Radical
Masculine	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Feminine

11. I8- Please evaluate the pattern on the T-shirt according to the evaluation words:



	-2	-1	0	1	2	
Traditional	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Modern
Steady	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Lively
Unattractive	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Attractive
Soft	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Hard
Simple	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Fancy
Tawdry	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Elegant
Rough	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Smooth
Casual	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Formal
Conservative	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Radical
Masculine	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Feminine

12. F11- Please evaluate the pattern on the T-shirt according to the evaluation words:



	-2	-1	0	1	2	
Traditional	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Modern
Steady	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Lively

Unattractive	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Attractive
Soft	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Hard
Simple	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Fancy
Tawdry	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Elegant
Rough	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Smooth
Casual	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Formal
Conservative	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Radical
Masculine	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Feminine

13. D8- Please evaluate the pattern on the T-shirt according to the evaluation words:



	-2	-1	0	1	2	
Traditional	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Modern
Steady	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Lively
Unattractive	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Attractive
Soft	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Hard
Simple	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Fancy
Tawdry	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Elegant
Rough	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Smooth
Casual	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Formal
Conservative	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Radical
Masculine	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Feminine

14. D12- Please evaluate the pattern on the T-shirt according to the evaluation words:



	-2	-1	0	1	2	
Traditional	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Modern
Steady	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Lively
Unattractive	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Attractive
Soft	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Hard
Simple	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Fancy
Tawdry	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Elegant
Rough	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Smooth
Casual	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Formal
Conservative	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Radical
Masculine	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Feminine

15. F6- Please evaluate the pattern on the T-shirt according to the evaluation words:



	-2	-1	0	1	2	
Traditional	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Modern
Steady	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Lively

Unattractive	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Attractive
Soft	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Hard
Simple	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Fancy
Tawdry	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Elegant
Rough	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Smooth
Casual	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Formal
Conservative	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Radical
Masculine	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Feminine

16. B12- Please evaluate the pattern on the T-shirt according to the evaluation words:



	-2	-1	0	1	2	
Traditional	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Modern
Steady	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Lively
Unattractive	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Attractive
Soft	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Hard
Simple	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Fancy
Tawdry	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Elegant
Rough	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Smooth
Casual	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Formal
Conservative	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Radical
Masculine	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Feminine

17. B6- Please evaluate the pattern on the T-shirt according to the evaluation words:



	-2	-1	0	1	2	
Traditional	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Modern
Steady	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Lively
Unattractive	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Attractive
Soft	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Hard
Simple	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Fancy
Tawdry	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Elegant
Rough	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Smooth
Casual	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Formal
Conservative	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Radical
Masculine	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Feminine

18. G8- Please evaluate the pattern on the T-shirt according to the evaluation words:



	-2	-1	0	1	2	
Traditional	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Modern
Steady	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Lively

Unattractive	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Attractive
Soft	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Hard
Simple	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Fancy
Tawdry	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Elegant
Rough	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Smooth
Casual	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Formal
Conservative	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Radical
Masculine	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Feminine

19. E9- Please evaluate the pattern on the T-shirt according to the evaluation words:



	-2	-1	0	1	2	
Traditional	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Modern
Steady	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Lively
Unattractive	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Attractive
Soft	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Hard
Simple	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Fancy
Tawdry	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Elegant
Rough	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Smooth
Casual	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Formal
Conservative	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Radical
Masculine	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Feminine

20. D3- Please evaluate the pattern on the T-shirt according to the evaluation words:



	-2	-1	0	1	2	
Traditional	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Modern
Steady	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Lively
Unattractive	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Attractive
Soft	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Hard
Simple	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Fancy
Tawdry	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Elegant
Rough	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Smooth
Casual	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Formal
Conservative	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Radical
Masculine	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Feminine

21. F8- Please evaluate the pattern on the T-shirt according to the evaluation words:



	-2	-1	0	1	2	
Traditional	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Modern
Steady	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Lively

Unattractive	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Attractive
Soft	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Hard
Simple	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Fancy
Tawdry	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Elegant
Rough	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Smooth
Casual	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Formal
Conservative	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Radical
Masculine	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Feminine

22. H8- Please evaluate the pattern on the T-shirt according to the evaluation words:



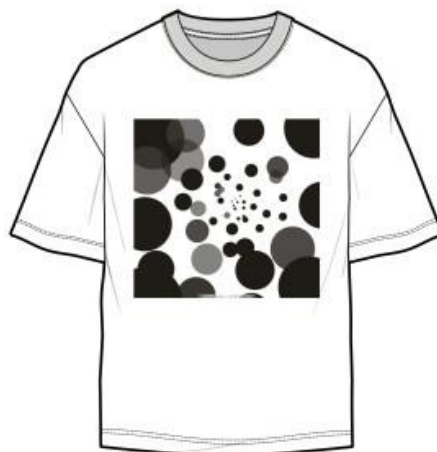
	-2	-1	0	1	2	
Traditional	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Modern
Steady	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Lively
Unattractive	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Attractive
Soft	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Hard
Simple	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Fancy
Tawdry	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Elegant
Rough	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Smooth
Casual	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Formal
Conservative	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Radical
Masculine	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Feminine

23. D2- Please evaluate the pattern on the T-shirt according to the evaluation words:



	-2	-1	0	1	2	
Traditional	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Modern
Steady	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Lively
Unattractive	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Attractive
Soft	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Hard
Simple	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Fancy
Tawdry	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Elegant
Rough	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Smooth
Casual	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Formal
Conservative	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Radical
Masculine	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Feminine

24. D11- Please evaluate the pattern on the T-shirt according to the evaluation words:



	-2	-1	0	1	2	
Traditional	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Modern
Steady	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Lively

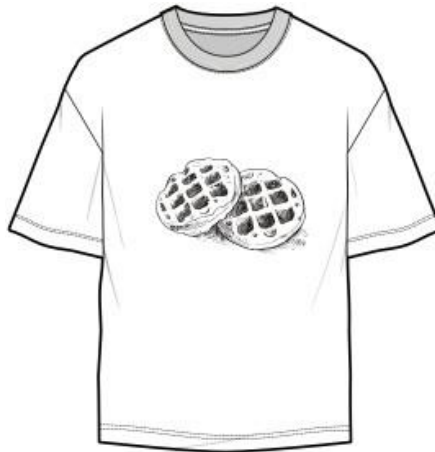
Unattractive	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Attractive
Soft	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Hard
Simple	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Fancy
Tawdry	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Elegant
Rough	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Smooth
Casual	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Formal
Conservative	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Radical
Masculine	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Feminine

25. I5- Please evaluate the pattern on the T-shirt according to the evaluation words:



	-2	-1	0	1	2	
Traditional	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Modern
Steady	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Lively
Unattractive	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Attractive
Soft	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Hard
Simple	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Fancy
Tawdry	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Elegant
Rough	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Smooth
Casual	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Formal
Conservative	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Radical
Masculine	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Feminine

26. B10- Please evaluate the pattern on the T-shirt according to the evaluation words:



	-2	-1	0	1	2	
Traditional	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Modern
Steady	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Lively
Unattractive	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Attractive
Soft	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Hard
Simple	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Fancy
Tawdry	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Elegant
Rough	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Smooth
Casual	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Formal
Conservative	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Radical
Masculine	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Feminine

27. I12- Please evaluate the pattern on the T-shirt according to the evaluation words:



	-2	-1	0	1	2	
Traditional	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Modern
Steady	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Lively

Unattractive	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Attractive
Soft	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Hard
Simple	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Fancy
Tawdry	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Elegant
Rough	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Smooth
Casual	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Formal
Conservative	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Radical
Masculine	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Feminine

28. E6- Please evaluate the pattern on the T-shirt according to the evaluation words:



	-2	-1	0	1	2	
Traditional	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Modern
Steady	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Lively
Unattractive	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Attractive
Soft	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Hard
Simple	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Fancy
Tawdry	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Elegant
Rough	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Smooth
Casual	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Formal
Conservative	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Radical
Masculine	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Feminine

29. A3- Please evaluate the pattern on the T-shirt according to the evaluation words:



	-2	-1	0	1	2	
Traditional	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Modern
Steady	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Lively
Unattractive	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Attractive
Soft	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Hard
Simple	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Fancy
Tawdry	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Elegant
Rough	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Smooth
Casual	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Formal
Conservative	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Radical
Masculine	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Feminine

30. A2- Please evaluate the pattern on the T-shirt according to the evaluation words:



	-2	-1	0	1	2	
Traditional	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Modern
Steady	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Lively

Unattractive	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Attractive
Soft	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Hard
Simple	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Fancy
Tawdry	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Elegant
Rough	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Smooth
Casual	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Formal
Conservative	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Radical
Masculine	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Feminine

31. F12- Please evaluate the pattern on the T-shirt according to the evaluation words:



	-2	-1	0	1	2	
Traditional	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Modern
Steady	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Lively
Unattractive	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Attractive
Soft	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Hard
Simple	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Fancy
Tawdry	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Elegant
Rough	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Smooth
Casual	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Formal
Conservative	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Radical
Masculine	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Feminine

32. I9- Please evaluate the pattern on the T-shirt according to the evaluation words:



	-2	-1	0	1	2	
Traditional	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Modern
Steady	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Lively
Unattractive	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Attractive
Soft	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Hard
Simple	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Fancy
Tawdry	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Elegant
Rough	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Smooth
Casual	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Formal
Conservative	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Radical
Masculine	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Feminine

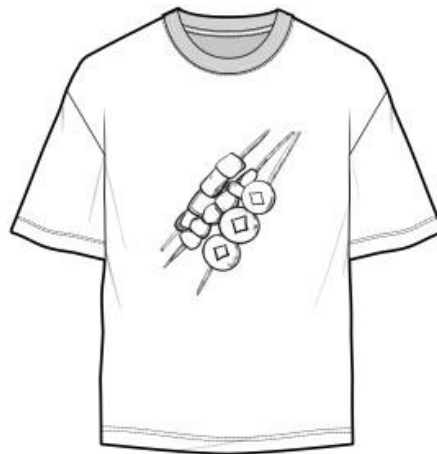
33. E8- Please evaluate the pattern on the T-shirt according to the evaluation words:



	-2	-1	0	1	2	
Traditional	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Modern
Steady	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Lively

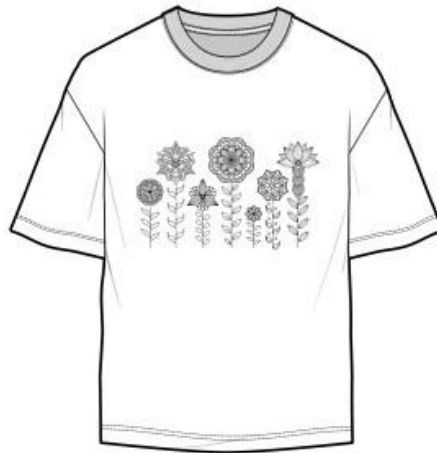
Unattractive	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Attractive
Soft	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Hard
Simple	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Fancy
Tawdry	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Elegant
Rough	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Smooth
Casual	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Formal
Conservative	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Radical
Masculine	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Feminine

34. B9- Please evaluate the pattern on the T-shirt according to the evaluation words:



	-2	-1	0	1	2	
Traditional	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Modern
Steady	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Lively
Unattractive	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Attractive
Soft	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Hard
Simple	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Fancy
Tawdry	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Elegant
Rough	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Smooth
Casual	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Formal
Conservative	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Radical
Masculine	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Feminine

35. C2- Please evaluate the pattern on the T-shirt according to the evaluation words:



	-2	-1	0	1	2	
Traditional	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Modern
Steady	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Lively
Unattractive	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Attractive
Soft	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Hard
Simple	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Fancy
Tawdry	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Elegant
Rough	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Smooth
Casual	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Formal
Conservative	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Radical
Masculine	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Feminine

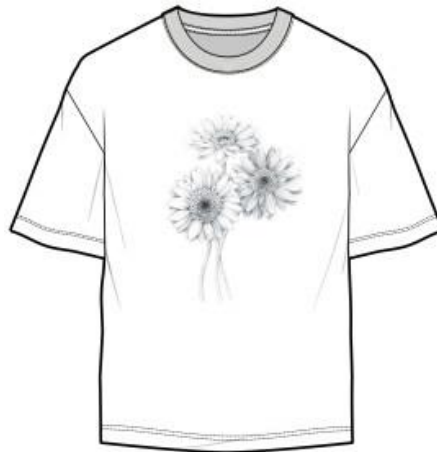
36. E5- Please evaluate the pattern on the T-shirt according to the evaluation words:



	-2	-1	0	1	2	
Traditional	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Modern
Steady	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Lively

Unattractive	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Attractive
Soft	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Hard
Simple	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Fancy
Tawdry	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Elegant
Rough	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Smooth
Casual	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Formal
Conservative	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Radical
Masculine	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Feminine

37. C1- Please evaluate the pattern on the T-shirt according to the evaluation words:



	-2	-1	0	1	2	
Traditional	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Modern
Steady	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Lively
Unattractive	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Attractive
Soft	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Hard
Simple	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Fancy
Tawdry	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Elegant
Rough	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Smooth
Casual	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Formal
Conservative	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Radical
Masculine	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Feminine

38. H11- Please evaluate the pattern on the T-shirt according to the evaluation words:



	-2	-1	0	1	2	
Traditional	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Modern
Steady	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Lively
Unattractive	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Attractive
Soft	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Hard
Simple	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Fancy
Tawdry	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Elegant
Rough	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Smooth
Casual	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Formal
Conservative	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Radical
Masculine	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Feminine

39. C3- Please evaluate the pattern on the T-shirt according to the evaluation words:



	-2	-1	0	1	2	
Traditional	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Modern
Steady	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Lively

Unattractive	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Attractive
Soft	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Hard
Simple	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Fancy
Tawdry	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Elegant
Rough	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Smooth
Casual	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Formal
Conservative	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Radical
Masculine	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Feminine

40. H2- Please evaluate the pattern on the T-shirt according to the evaluation words:



	-2	-1	0	1	2	
Traditional	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Modern
Steady	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Lively
Unattractive	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Attractive
Soft	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Hard
Simple	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Fancy
Tawdry	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Elegant
Rough	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Smooth
Casual	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Formal
Conservative	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Radical
Masculine	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Feminine

41. G3- Please evaluate the pattern on the T-shirt according to the evaluation words:



	-2	-1	0	1	2	
Traditional	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Modern
Steady	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Lively
Unattractive	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Attractive
Soft	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Hard
Simple	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Fancy
Tawdry	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Elegant
Rough	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Smooth
Casual	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Formal
Conservative	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Radical
Masculine	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Feminine

42. F7- Please evaluate the pattern on the T-shirt according to the evaluation words:



	-2	-1	0	1	2	
Traditional	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Modern
Steady	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Lively

Unattractive	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Attractive
Soft	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Hard
Simple	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Fancy
Tawdry	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Elegant
Rough	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Smooth
Casual	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Formal
Conservative	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Radical
Masculine	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Feminine

43. C5- Please evaluate the pattern on the T-shirt according to the evaluation words:



	-2	-1	0	1	2	
Traditional	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Modern
Steady	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Lively
Unattractive	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Attractive
Soft	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Hard
Simple	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Fancy
Tawdry	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Elegant
Rough	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Smooth
Casual	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Formal
Conservative	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Radical
Masculine	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Feminine

44. C8- Please evaluate the pattern on the T-shirt according to the evaluation words:



	-2	-1	0	1	2	
Traditional	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Modern
Steady	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Lively
Unattractive	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Attractive
Soft	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Hard
Simple	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Fancy
Tawdry	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Elegant
Rough	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Smooth
Casual	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Formal
Conservative	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Radical
Masculine	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Feminine

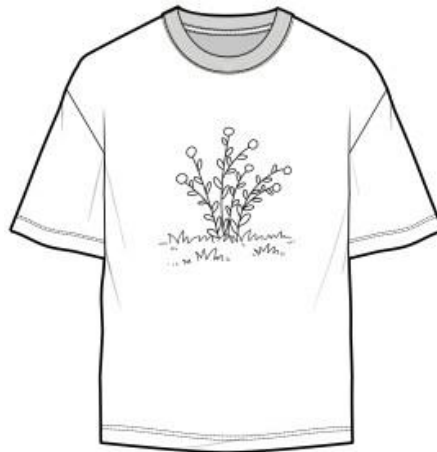
45. C6- Please evaluate the pattern on the T-shirt according to the evaluation words:



	-2	-1	0	1	2	
Traditional	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Modern
Steady	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Lively

Unattractive	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Attractive
Soft	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Hard
Simple	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Fancy
Tawdry	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Elegant
Rough	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Smooth
Casual	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Formal
Conservative	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Radical
Masculine	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Feminine

46. C10- Please evaluate the pattern on the T-shirt according to the evaluation words:



	-2	-1	0	1	2	
Traditional	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Modern
Steady	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Lively
Unattractive	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Attractive
Soft	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Hard
Simple	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Fancy
Tawdry	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Elegant
Rough	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Smooth
Casual	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Formal
Conservative	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Radical
Masculine	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Feminine

47. B11- Please evaluate the pattern on the T-shirt according to the evaluation words:



	-2	-1	0	1	2	
Traditional	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Modern
Steady	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Lively
Unattractive	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Attractive
Soft	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Hard
Simple	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Fancy
Tawdry	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Elegant
Rough	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Smooth
Casual	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Formal
Conservative	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Radical
Masculine	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Feminine

48. G7- Please evaluate the pattern on the T-shirt according to the evaluation words:



	-2	-1	0	1	2	
Traditional	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Modern
Steady	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Lively

Unattractive	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Attractive
Soft	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Hard
Simple	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Fancy
Tawdry	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Elegant
Rough	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Smooth
Casual	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Formal
Conservative	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Radical
Masculine	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Feminine

49. H9- Please evaluate the pattern on the T-shirt according to the evaluation words:



	-2	-1	0	1	2	
Traditional	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Modern
Steady	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Lively
Unattractive	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Attractive
Soft	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Hard
Simple	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Fancy
Tawdry	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Elegant
Rough	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Smooth
Casual	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Formal
Conservative	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Radical
Masculine	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Feminine

50. B2- Please evaluate the pattern on the T-shirt according to the evaluation words:



	-2	-1	0	1	2	
Traditional	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Modern
Steady	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Lively
Unattractive	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Attractive
Soft	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Hard
Simple	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Fancy
Tawdry	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Elegant
Rough	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Smooth
Casual	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Formal
Conservative	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Radical
Masculine	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Feminine

51. H4- Please evaluate the pattern on the T-shirt according to the evaluation words:



	-2	-1	0	1	2	
Traditional	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Modern
Steady	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Lively

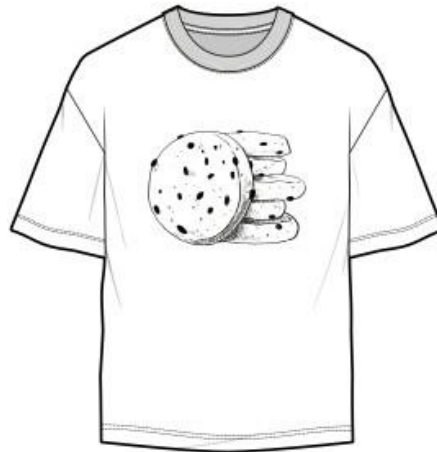
Unattractive	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Attractive
Soft	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Hard
Simple	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Fancy
Tawdry	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Elegant
Rough	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Smooth
Casual	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Formal
Conservative	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Radical
Masculine	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Feminine

52. A9- Please evaluate the pattern on the T-shirt according to the evaluation words:



	-2	-1	0	1	2	
Traditional	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Modern
Steady	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Lively
Unattractive	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Attractive
Soft	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Hard
Simple	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Fancy
Tawdry	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Elegant
Rough	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Smooth
Casual	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Formal
Conservative	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Radical
Masculine	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Feminine

53. B7- Please evaluate the pattern on the T-shirt according to the evaluation words:



	-2	-1	0	1	2	
Traditional	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Modern
Steady	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Lively
Unattractive	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Attractive
Soft	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Hard
Simple	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Fancy
Tawdry	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Elegant
Rough	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Smooth
Casual	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Formal
Conservative	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Radical
Masculine	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Feminine

54. I2- Please evaluate the pattern on the T-shirt according to the evaluation words:



	-2	-1	0	1	2	
Traditional	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Modern
Steady	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Lively

Unattractive	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Attractive
Soft	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Hard
Simple	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Fancy
Tawdry	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Elegant
Rough	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Smooth
Casual	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Formal
Conservative	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Radical
Masculine	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Feminine

55. H3- Please evaluate the pattern on the T-shirt according to the evaluation words:



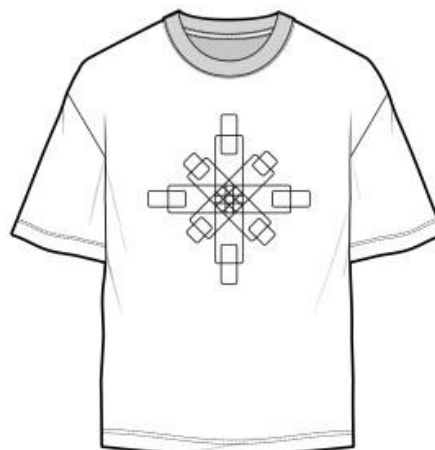
	-2	-1	0	1	2	
Traditional	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Modern
Steady	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Lively
Unattractive	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Attractive
Soft	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Hard
Simple	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Fancy
Tawdry	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Elegant
Rough	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Smooth
Casual	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Formal
Conservative	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Radical
Masculine	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Feminine

56. A10- Please evaluate the pattern on the T-shirt according to the evaluation words:



	-2	-1	0	1	2	
Traditional	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Modern
Steady	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Lively
Unattractive	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Attractive
Soft	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Hard
Simple	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Fancy
Tawdry	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Elegant
Rough	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Smooth
Casual	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Formal
Conservative	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Radical
Masculine	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Feminine

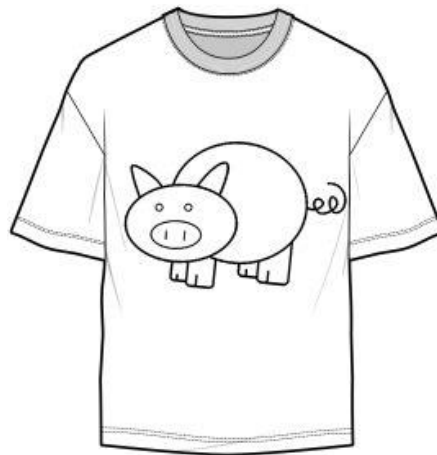
57. D9- Please evaluate the pattern on the T-shirt according to the evaluation words:



	-2	-1	0	1	2	
Traditional	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Modern
Steady	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Lively

Unattractive	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Attractive
Soft	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Hard
Simple	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Fancy
Tawdry	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Elegant
Rough	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Smooth
Casual	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Formal
Conservative	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Radical
Masculine	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Feminine

58. A11- Please evaluate the pattern on the T-shirt according to the evaluation words:



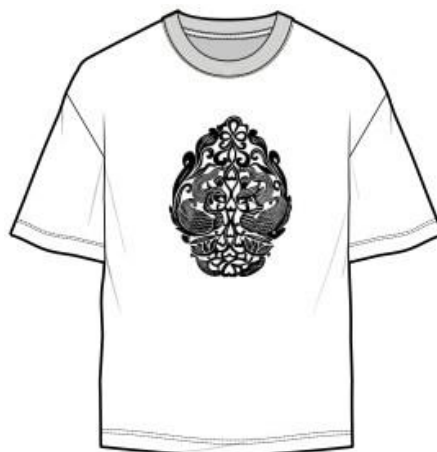
	-2	-1	0	1	2	
Traditional	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Modern
Steady	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Lively
Unattractive	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Attractive
Soft	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Hard
Simple	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Fancy
Tawdry	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Elegant
Rough	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Smooth
Casual	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Formal
Conservative	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Radical
Masculine	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Feminine

59. G5- Please evaluate the pattern on the T-shirt according to the evaluation words:



	-2	-1	0	1	2	
Traditional	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Modern
Steady	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Lively
Unattractive	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Attractive
Soft	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Hard
Simple	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Fancy
Tawdry	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Elegant
Rough	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Smooth
Casual	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Formal
Conservative	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Radical
Masculine	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Feminine

60. G12- Please evaluate the pattern on the T-shirt according to the evaluation words:



	-2	-1	0	1	2	
Traditional	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Modern
Steady	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Lively

Unattractive	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Attractive
Soft	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Hard
Simple	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Fancy
Tawdry	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Elegant
Rough	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Smooth
Casual	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Formal
Conservative	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Radical
Masculine	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Feminine

61. H1- Please evaluate the pattern on the T-shirt according to the evaluation words:



	-2	-1	0	1	2	
Traditional	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Modern
Steady	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Lively
Unattractive	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Attractive
Soft	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Hard
Simple	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Fancy
Tawdry	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Elegant
Rough	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Smooth
Casual	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Formal
Conservative	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Radical
Masculine	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Feminine

62. I3- Please evaluate the pattern on the T-shirt according to the evaluation words:



	-2	-1	0	1	2	
Traditional	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Modern
Steady	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Lively
Unattractive	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Attractive
Soft	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Hard
Simple	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Fancy
Tawdry	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Elegant
Rough	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Smooth
Casual	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Formal
Conservative	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Radical
Masculine	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Feminine

63. A7- Please evaluate the pattern on the T-shirt according to the evaluation words:



	-2	-1	0	1	2	
Traditional	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Modern

Steady	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Lively
Unattractive	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Attractive
Soft	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Hard
Simple	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Fancy
Tawdry	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Elegant
Rough	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Smooth
Casual	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Formal
Conservative	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Radical
Masculine	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Feminine

64. A8- Please evaluate the pattern on the T-shirt according to the evaluation words:



	-2	-1	0	1	2	
Traditional	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Modern
Steady	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Lively
Unattractive	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Attractive
Soft	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Hard
Simple	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Fancy
Tawdry	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Elegant
Rough	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Smooth
Casual	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Formal
Conservative	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Radical
Masculine	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Feminine

65. D10- Please evaluate the pattern on the T-shirt according to the evaluation words:



	-2	-1	0	1	2	
Traditional	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Modern
Steady	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Lively
Unattractive	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Attractive
Soft	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Hard
Simple	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Fancy
Tawdry	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Elegant
Rough	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Smooth
Casual	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Formal
Conservative	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Radical
Masculine	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Feminine

66. H5- Please evaluate the pattern on the T-shirt according to the evaluation words:



	-2	-1	0	1	2	
Traditional	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Modern
Steady	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Lively

Unattractive	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Attractive
Soft	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Hard
Simple	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Fancy
Tawdry	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Elegant
Rough	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Smooth
Casual	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Formal
Conservative	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Radical
Masculine	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Feminine

67. E4- Please evaluate the pattern on the T-shirt according to the evaluation words:



	-2	-1	0	1	2	
Traditional	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Modern
Steady	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Lively
Unattractive	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Attractive
Soft	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Hard
Simple	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Fancy
Tawdry	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Elegant
Rough	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Smooth
Casual	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Formal
Conservative	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Radical
Masculine	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Feminine

68. E2- Please evaluate the pattern on the T-shirt according to the evaluation words:



	-2	-1	0	1	2	
Traditional	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Modern
Steady	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Lively
Unattractive	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Attractive
Soft	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Hard
Simple	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Fancy
Tawdry	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Elegant
Rough	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Smooth
Casual	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Formal
Conservative	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Radical
Masculine	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Feminine

69. D7- Please evaluate the pattern on the T-shirt according to the evaluation words:



	-2	-1	0	1	2	
Traditional	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Modern
Steady	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Lively

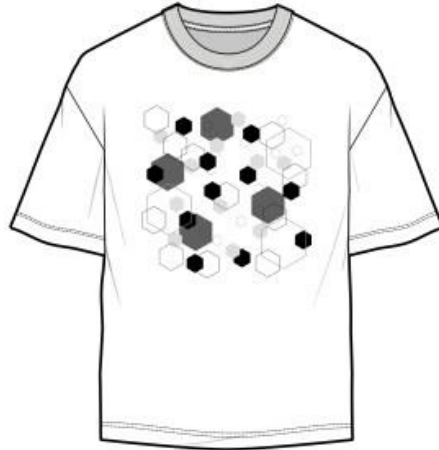
Unattractive	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Attractive
Soft	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Hard
Simple	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Fancy
Tawdry	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Elegant
Rough	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Smooth
Casual	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Formal
Conservative	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Radical
Masculine	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Feminine

70. C4- Please evaluate the pattern on the T-shirt according to the evaluation words:



	-2	-1	0	1	2	
Traditional	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Modern
Steady	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Lively
Unattractive	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Attractive
Soft	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Hard
Simple	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Fancy
Tawdry	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Elegant
Rough	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Smooth
Casual	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Formal
Conservative	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Radical
Masculine	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Feminine

71. D5- Please evaluate the pattern on the T-shirt according to the evaluation words:



	-2	-1	0	1	2	
Traditional	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Modern
Steady	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Lively
Unattractive	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Attractive
Soft	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Hard
Simple	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Fancy
Tawdry	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Elegant
Rough	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Smooth
Casual	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Formal
Conservative	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Radical
Masculine	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Feminine

72. E3- Please evaluate the pattern on the T-shirt according to the evaluation words:



	-2	-1	0	1	2	
Traditional	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Modern
Steady	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Lively

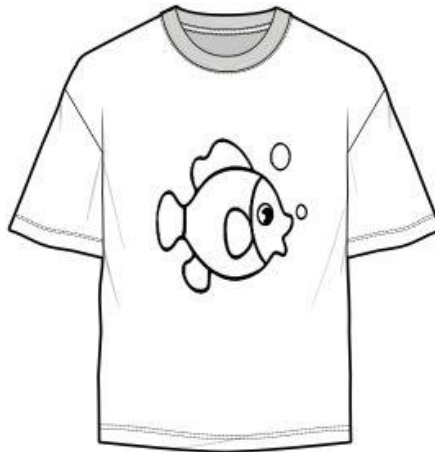
Unattractive	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Attractive
Soft	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Hard
Simple	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Fancy
Tawdry	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Elegant
Rough	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Smooth
Casual	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Formal
Conservative	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Radical
Masculine	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Feminine

73. I7- Please evaluate the pattern on the T-shirt according to the evaluation words:



	-2	-1	0	1	2	
Traditional	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Modern
Steady	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Lively
Unattractive	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Attractive
Soft	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Hard
Simple	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Fancy
Tawdry	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Elegant
Rough	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Smooth
Casual	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Formal
Conservative	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Radical
Masculine	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Feminine

74. A12- Please evaluate the pattern on the T-shirt according to the evaluation words:



	-2	-1	0	1	2	
Traditional	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Modern
Steady	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Lively
Unattractive	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Attractive
Soft	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Hard
Simple	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Fancy
Tawdry	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Elegant
Rough	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Smooth
Casual	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Formal
Conservative	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Radical
Masculine	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Feminine

75. I10- Please evaluate the pattern on the T-shirt according to the evaluation words:



	-2	-1	0	1	2	
Traditional	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Modern
Steady	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Lively

Unattractive	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Attractive
Soft	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Hard
Simple	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Fancy
Tawdry	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Elegant
Rough	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Smooth
Casual	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Formal
Conservative	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Radical
Masculine	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Feminine

76. E12- Please evaluate the pattern on the T-shirt according to the evaluation words:



	-2	-1	0	1	2	
Traditional	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Modern
Steady	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Lively
Unattractive	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Attractive
Soft	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Hard
Simple	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Fancy
Tawdry	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Elegant
Rough	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Smooth
Casual	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Formal
Conservative	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Radical
Masculine	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Feminine

77. A6- Please evaluate the pattern on the T-shirt according to the evaluation words:



	-2	-1	0	1	2	
Traditional	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Modern
Steady	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Lively
Unattractive	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Attractive
Soft	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Hard
Simple	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Fancy
Tawdry	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Elegant
Rough	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Smooth
Casual	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Formal
Conservative	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Radical
Masculine	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Feminine

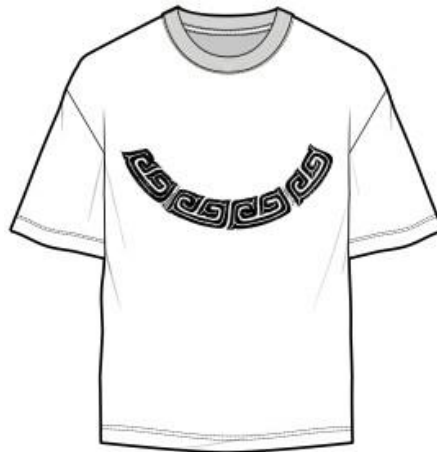
78. F9- Please evaluate the pattern on the T-shirt according to the evaluation words:



	-2	-1	0	1	2	
Traditional	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Modern
Steady	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Lively

Unattractive	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Attractive
Soft	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Hard
Simple	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Fancy
Tawdry	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Elegant
Rough	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Smooth
Casual	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Formal
Conservative	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Radical
Masculine	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Feminine

79. G11- Please evaluate the pattern on the T-shirt according to the evaluation words:



	-2	-1	0	1	2	
Traditional	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Modern
Steady	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Lively
Unattractive	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Attractive
Soft	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Hard
Simple	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Fancy
Tawdry	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Elegant
Rough	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Smooth
Casual	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Formal
Conservative	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Radical
Masculine	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Feminine

80. C9- Please evaluate the pattern on the T-shirt according to the evaluation words:



	-2	-1	0	1	2	
Traditional	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Modern
Steady	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Lively
Unattractive	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Attractive
Soft	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Hard
Simple	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Fancy
Tawdry	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Elegant
Rough	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Smooth
Casual	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Formal
Conservative	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Radical
Masculine	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Feminine

81. G6- Please evaluate the pattern on the T-shirt according to the evaluation words:



	-2	-1	0	1	2	
Traditional	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Modern
Steady	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Lively

Unattractive	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Attractive
Soft	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Hard
Simple	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Fancy
Tawdry	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Elegant
Rough	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Smooth
Casual	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Formal
Conservative	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Radical
Masculine	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Feminine

82. C12- Please evaluate the pattern on the T-shirt according to the evaluation words:



	-2	-1	0	1	2	
Traditional	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Modern
Steady	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Lively
Unattractive	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Attractive
Soft	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Hard
Simple	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Fancy
Tawdry	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Elegant
Rough	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Smooth
Casual	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Formal
Conservative	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Radical
Masculine	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Feminine

83. F2- Please evaluate the pattern on the T-shirt according to the evaluation words:



	-2	-1	0	1	2	
Traditional	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Modern
Steady	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Lively
Unattractive	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Attractive
Soft	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Hard
Simple	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Fancy
Tawdry	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Elegant
Rough	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Smooth
Casual	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Formal
Conservative	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Radical
Masculine	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Feminine

84. F10- Please evaluate the pattern on the T-shirt according to the evaluation words:



	-2	-1	0	1	2	
Traditional	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Modern
Steady	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Lively

Unattractive	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Attractive
Soft	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Hard
Simple	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Fancy
Tawdry	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Elegant
Rough	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Smooth
Casual	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Formal
Conservative	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Radical
Masculine	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Feminine

85. I11- Please evaluate the pattern on the T-shirt according to the evaluation words:



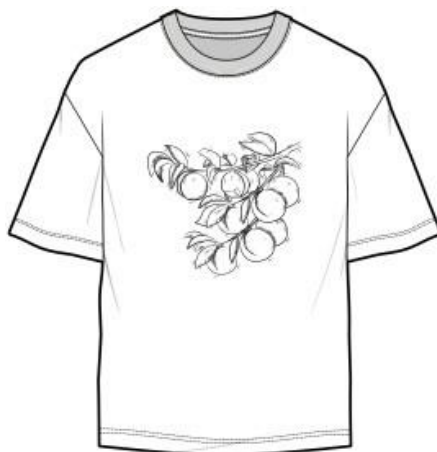
	-2	-1	0	1	2	
Traditional	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Modern
Steady	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Lively
Unattractive	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Attractive
Soft	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Hard
Simple	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Fancy
Tawdry	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Elegant
Rough	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Smooth
Casual	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Formal
Conservative	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Radical
Masculine	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Feminine

86. I1- Please evaluate the pattern on the T-shirt according to the evaluation words:



	-2	-1	0	1	2	
Traditional	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Modern
Steady	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Lively
Unattractive	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Attractive
Soft	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Hard
Simple	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Fancy
Tawdry	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Elegant
Rough	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Smooth
Casual	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Formal
Conservative	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Radical
Masculine	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Feminine

87. B8- Please evaluate the pattern on the T-shirt according to the evaluation words:



	-2	-1	0	1	2	
Traditional	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Modern
Steady	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Lively

Unattractive	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Attractive
Soft	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Hard
Simple	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Fancy
Tawdry	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Elegant
Rough	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Smooth
Casual	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Formal
Conservative	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Radical
Masculine	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Feminine

88. F5- Please evaluate the pattern on the T-shirt according to the evaluation words:



	-2	-1	0	1	2	
Traditional	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Modern
Steady	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Lively
Unattractive	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Attractive
Soft	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Hard
Simple	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Fancy
Tawdry	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Elegant
Rough	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Smooth
Casual	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Formal
Conservative	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Radical
Masculine	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Feminine

89. G2- Please evaluate the pattern on the T-shirt according to the evaluation words:



	-2	-1	0	1	2	
Traditional	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Modern
Steady	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Lively
Unattractive	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Attractive
Soft	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Hard
Simple	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Fancy
Tawdry	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Elegant
Rough	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Smooth
Casual	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Formal
Conservative	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Radical
Masculine	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Feminine

90. F1- Please evaluate the pattern on the T-shirt according to the evaluation words:



	-2	-1	0	1	2	
Traditional	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Modern
Steady	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Lively

Unattractive	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Attractive
Soft	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Hard
Simple	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Fancy
Tawdry	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Elegant
Rough	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Smooth
Casual	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Formal
Conservative	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Radical
Masculine	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Feminine

91. G4- Please evaluate the pattern on the T-shirt according to the evaluation words:



	-2	-1	0	1	2	
Traditional	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Modern
Steady	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Lively
Unattractive	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Attractive
Soft	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Hard
Simple	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Fancy
Tawdry	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Elegant
Rough	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Smooth
Casual	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Formal
Conservative	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Radical
Masculine	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Feminine

92. E11- Please evaluate the pattern on the T-shirt according to the evaluation words:



	-2	-1	0	1	2	
Traditional	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Modern
Steady	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Lively
Unattractive	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Attractive
Soft	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Hard
Simple	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Fancy
Tawdry	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Elegant
Rough	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Smooth
Casual	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Formal
Conservative	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Radical
Masculine	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Feminine

93. F4- Please evaluate the pattern on the T-shirt according to the evaluation words:



	-2	-1	0	1	2	
Traditional	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Modern
Steady	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Lively

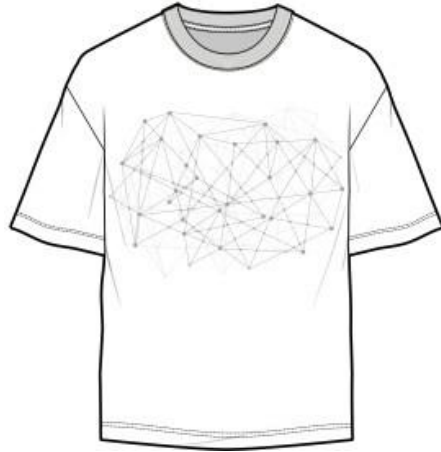
Unattractive	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Attractive
Soft	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Hard
Simple	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Fancy
Tawdry	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Elegant
Rough	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Smooth
Casual	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Formal
Conservative	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Radical
Masculine	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Feminine

94. D1- Please evaluate the pattern on the T-shirt according to the evaluation words:



	-2	-1	0	1	2	
Traditional	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Modern
Steady	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Lively
Unattractive	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Attractive
Soft	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Hard
Simple	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Fancy
Tawdry	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Elegant
Rough	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Smooth
Casual	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Formal
Conservative	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Radical
Masculine	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Feminine

95. D4- Please evaluate the pattern on the T-shirt according to the evaluation words:



	-2	-1	0	1	2	
Traditional	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Modern
Steady	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Lively
Unattractive	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Attractive
Soft	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Hard
Simple	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Fancy
Tawdry	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Elegant
Rough	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Smooth
Casual	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Formal
Conservative	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Radical
Masculine	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Feminine

96. A5- Please evaluate the pattern on the T-shirt according to the evaluation words:



	-2	-1	0	1	2	
Traditional	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Modern

Steady	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Lively
Unattractive	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Attractive
Soft	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Hard
Simple	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Fancy
Tawdry	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Elegant
Rough	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Smooth
Casual	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Formal
Conservative	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Radical
Masculine	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Feminine

97. I4- Please evaluate the pattern on the T-shirt according to the evaluation words:



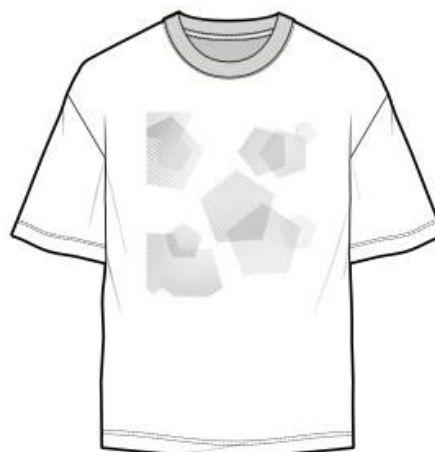
	-2	-1	0	1	2	
Traditional	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Modern
Steady	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Lively
Unattractive	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Attractive
Soft	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Hard
Simple	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Fancy
Tawdry	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Elegant
Rough	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Smooth
Casual	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Formal
Conservative	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Radical
Masculine	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Feminine

98. A1- Please evaluate the pattern on the T-shirt according to the evaluation words:



	-2	-1	0	1	2	
Traditional	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Modern
Steady	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Lively
Unattractive	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Attractive
Soft	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Hard
Simple	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Fancy
Tawdry	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Elegant
Rough	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Smooth
Casual	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Formal
Conservative	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Radical
Masculine	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Feminine

99. D6- Please evaluate the pattern on the T-shirt according to the evaluation words:



	-2	-1	0	1	2	
Traditional	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Modern
Steady	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Lively

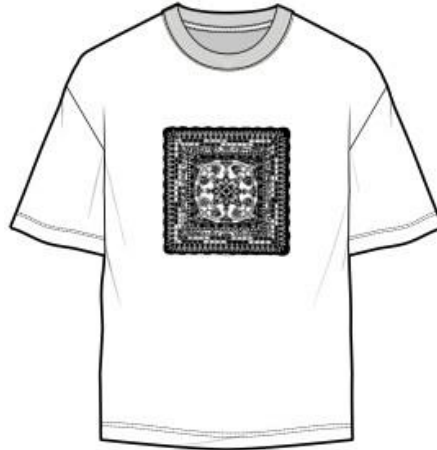
Unattractive	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Attractive
Soft	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Hard
Simple	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Fancy
Tawdry	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Elegant
Rough	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Smooth
Casual	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Formal
Conservative	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Radical
Masculine	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Feminine

100. H10- Please evaluate the pattern on the T-shirt according to the evaluation words:



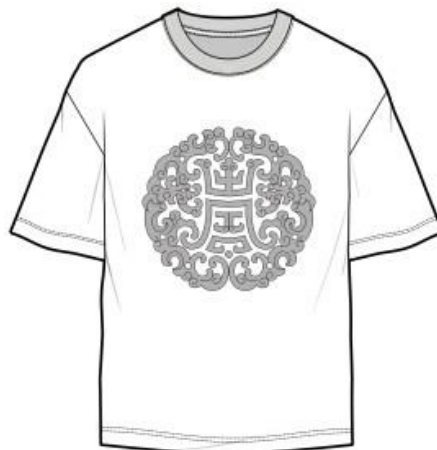
	-2	-1	0	1	2	
Traditional	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Modern
Steady	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Lively
Unattractive	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Attractive
Soft	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Hard
Simple	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Fancy
Tawdry	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Elegant
Rough	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Smooth
Casual	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Formal
Conservative	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Radical
Masculine	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Feminine

101. G10- Please evaluate the pattern on the T-shirt according to the evaluation words:



	-2	-1	0	1	2	
Traditional	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Modern
Steady	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Lively
Unattractive	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Attractive
Soft	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Hard
Simple	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Fancy
Tawdry	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Elegant
Rough	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Smooth
Casual	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Formal
Conservative	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Radical
Masculine	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Feminine

102. G1- Please evaluate the pattern on the T-shirt according to the evaluation words:



	-2	-1	0	1	2	
Traditional	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Modern
Steady	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Lively

Unattractive	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Attractive
Soft	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Hard
Simple	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Fancy
Tawdry	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Elegant
Rough	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Smooth
Casual	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Formal
Conservative	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Radical
Masculine	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Feminine

103. H7- Please evaluate the pattern on the T-shirt according to the evaluation words:



	-2	-1	0	1	2	
Traditional	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Modern
Steady	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Lively
Unattractive	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Attractive
Soft	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Hard
Simple	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Fancy
Tawdry	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Elegant
Rough	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Smooth
Casual	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Formal
Conservative	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Radical
Masculine	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Feminine

104. H12- Please evaluate the pattern on the T-shirt according to the evaluation words:



	-2	-1	0	1	2	
Traditional	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Modern
Steady	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Lively
Unattractive	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Attractive
Soft	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Hard
Simple	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Fancy
Tawdry	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Elegant
Rough	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Smooth
Casual	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Formal
Conservative	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Radical
Masculine	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Feminine

105. A4- Please evaluate the pattern on the T-shirt according to the evaluation words:



	-2	-1	0	1	2	
	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	

Traditional	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Modern
Steady	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Lively
Unattractive	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Attractive
Soft	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Hard
Simple	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Fancy
Tawdry	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Elegant
Rough	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Smooth
Casual	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Formal
Conservative	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Radical
Masculine	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Feminine

106. E1- Please evaluate the pattern on the T-shirt according to the evaluation words:



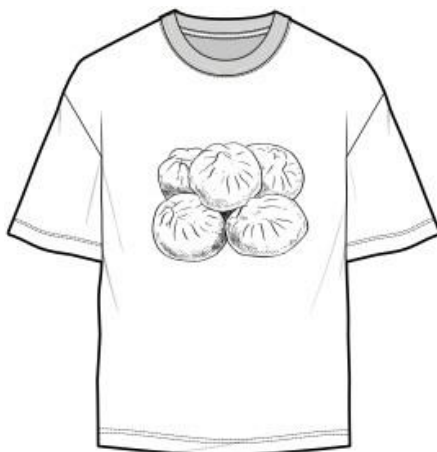
	-2	-1	0	1	2	
Traditional	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Modern
Steady	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Lively
Unattractive	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Attractive
Soft	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Hard
Simple	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Fancy
Tawdry	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Elegant
Rough	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Smooth
Casual	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Formal
Conservative	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Radical
Masculine	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Feminine

107. E10- Please evaluate the pattern on the T-shirt according to the evaluation words:



	-2	-1	0	1	2	
Traditional	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Modern
Steady	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Lively
Unattractive	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Attractive
Soft	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Hard
Simple	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Fancy
Tawdry	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Elegant
Rough	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Smooth
Casual	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Formal
Conservative	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Radical
Masculine	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Feminine

108. B4- Please evaluate the pattern on the T-shirt according to the evaluation words:



	-2	-1	0	1	2	
Traditional	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Modern
Steady	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Lively

Unattractive	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Attractive
Soft	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Hard
Simple	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Fancy
Tawdry	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Elegant
Rough	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Smooth
Casual	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Formal
Conservative	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Radical
Masculine	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Feminine

109. F3- Please evaluate the pattern on the T-shirt according to the evaluation words:



	-2	-1	0	1	2	
Traditional	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Modern
Steady	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Lively
Unattractive	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Attractive
Soft	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Hard
Simple	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Fancy
Tawdry	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Elegant
Rough	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Smooth
Casual	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Formal
Conservative	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Radical
Masculine	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Feminine

110. B3- Please evaluate the pattern on the T-shirt according to the evaluation words:



	-2	-1	0	1	2	
Traditional	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Modern
Steady	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Lively
Unattractive	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Attractive
Soft	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Hard
Simple	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Fancy
Tawdry	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Elegant
Rough	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Smooth
Casual	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Formal
Conservative	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Radical
Masculine	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Feminine

Fashion Pattern Recommendation System Based on Kansei Evaluation and Cognition

Abstract

Fashion pattern is an important expression element of fashion personalization with consumers' perceptual preferences. In this study, we proposed a personalized fashion pattern recommendation system considering users' perceptual preference.

Due to the diversity of fashion patterns, we clustered fashion patterns into 9 classes according to their natural attributes. Text mining method was applied to extracting Kansei words for the Kansei evaluation of fashion patterns, 10 pairs of Kansei words were extracted to study the perceptual images of fashion patterns by the Kansei evaluation. Statistical methods such as correlation analysis and analysis of variance, as well as the machine learning methods of fuzzy techniques and DenseNet were used to mining the users' cognition of fashion patterns.

Finally, we presented the knowledge-based recommendation system, it can be used to recommend personalized fashion patterns according to the perceptual preferences for patterns.

Keywords: Recommendation system, Fashion pattern, Kansei evaluation, Cognition, Kansei Engineering

Système de recommandation de modèles de mode basé sur l'évaluation Kansei et la cognition

Résumé

Le motif de mode est un élément d'expression important de la personnalisation de la mode intégrant les préférences perceptuelles des consommateurs. Dans cette étude, nous avons proposé un système de recommandation de motifs de mode personnalisé tenant compte de la préférence perceptuelle des utilisateurs.

En raison de la diversité des motifs de mode, il a été primordial de les préclasser en 9 groupes en fonction de leurs attributs naturels. La méthode d'exploration de texte a alors été appliquée afin d'extraire les mots Kansei nécessaires à l'évaluation Kansei des motifs de mode, 10 paires de mots Kansei ont été extraites pour étudier les images perceptives des motifs de mode par l'évaluation Kansei. Ensuite, différentes méthodes statistiques telles que l'analyse de corrélation et l'analyse de variance, ainsi que les méthodes d'apprentissage automatique des techniques floues et DenseNet ont été utilisées pour exploiter la cognition des utilisateurs des motifs de mode.

Enfin, nous avons mis en place un système de recommandation basé sur ces diverses connaissances, il peut être utilisé pour recommander des motifs de mode personnalisés en fonction des préférences perceptuelles des consommateurs.

Mots clés: Système de recommandation, Motif de mode, Évaluation Kansei, Cognition, Ingénierie Kansei