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Investigation of Style and Design Characteristics of Women's Outerwear with a User-Centered Design Approach

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ABSTRACT

This study aims to develop a design process model within the scope of the Design Thinking approach with Kansei Engineering support and to experientially apply this model. Additionally, another aim of the research is to investigate the affective/emotional preferences of female users regarding visual and functional aspects of outerwear designs, and subsequently develop alternative design model proposals in alignment with users' preferences. In this study, the 'Stanford d.school Design Thinking Model' was utilized. Research data was obtained through a survey consisting of two sections, involving the opinions of female consumers aged between 18 and 60 residing in Istanbul. The first section includes a Likert-type scale to examine users' outerwear design preferences. In the second section, a semantic differential scale was prepared to evaluate jacket, coat, and overcoat designs using Kansei words. The reliability of the measurement instrument was established through calculated Cronbach's Alpha coefficients, presented after each scale, confirming the reliability of both scales for this sample. The Kansei evaluation shows that the Design Thinking process model makes it possible to create designs that meet users' emotional needs.

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KEYWORDS

Design, fashion design, Design Thinking, Kansei Engineering, outerwear

1. INTRODUCTION

In the contemporary context, consumers demonstrate a heightened interest not solely in the fulfillment of product-related requirements, but also in the congruence between the visual and functional attributes of a product and their emotional and affective states. At this point, design is approached as addressing the current need as a problem. The design aims to solve an existing or anticipated problem that the designers first try to identify the problem, following which they conduct numerous studies to ascertain the solution [1]. To understand the consumer closely and meet their needs and desires in the best possible way, organizations engage in various pursuits. This is because, for all units offering products and services to the consumer, knowing the consumption habits of the customer who will purchase the new product is highly crucial. A product that can meet the expectations and needs of the consumer and is liked and accepted by the consumer, achieves success [2]. In this way, the designer can offer products that touch the user's eyes, heart, and of course, needs by using their knowledge, experience, observations, empathy, and making correct decisions [3]. However, solutions created solely based on observation or intuition tend to remain superficial in capturing the consumer and the user cannot establish a connection with the product. Therefore, beyond traditional disciplines, design-based practices need to be adopted to protect the investments made, the effort expended, and the idea that has turned into a product. At this point, the "Design Thinking (DT)" approach comes into play to correctly perceive the problems and solve them with appropriate methodologies.

DT is an interdisciplinary thought system located at the intersection of business, design, engineering, and social sciences [4], and it is used for various purposes [5]. This situation has made it difficult to reach a consensus on the definition of DT and to agree on a single definition [6]. In general, DT provides a systematic and collaborative approach to overcoming 'wicked problems' and finding desirable solutions for users [7, 8, 9, 10, 11].

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In wicked problems, even defining the problem itself can be difficult, let alone finding a solution. Therefore, there is a need for answers that anticipate how the problem may evolve and change, rather than seeking a single answer [3], and solutions are sought through the components of empathy, collaboration, optimism, and experimentation. In this process, external stakeholder perspectives such as users, customers, engineers, producers, and employees who decide on the feasibility of the solution are considered [12]. The DT approach employs a cognitive strategy in the process [13]. Here, a way of thinking is mentioned where the coordinated inclusion of information and stakeholder perspectives is required to transform the acquired knowledge into a new idea. This way of thinking is "moving creativity", arguing that designers not only rely on facts but also act based on intuition and assumptions [8]. Designers consider discipline and methodology as the essence of design and problem-solving processes [3]. Based on this point, DT addresses two different discourses in research [14]. The first one is "designerly thinking," and the second one is "design thinking." The "designerly thinking" discourse aims to develop a theoretical framework for transferring the practices and competencies of designers to the literature of the field. DT on the other hand, has been used to describe the characteristics of design practice that extend beyond the design context (including art and architecture) and is particularly used by those who do not have an academic background in design, especially in the field of management.

According to Tim Brown, one of the founders of the famous design firm IDEO popularized the concept of DT, it is not necessary to have professional design education to apply this approach [15]. Brown believes that individuals who possess a natural ability that can be uncovered through proper development and experience, and who are empathic, observant, curious, experimental, and optimistic, can apply this methodology. Schmiedgen et al. confirmed Brown's views by stating that DT is applied in organizations of all sizes and industries [16]. Many researchers have examined how DT provides a competitive advantage through innovation. For instance, in his study, Martin emphasized how DT facilitates knowledge development and enables businesses to generate innovative solutions, ultimately leading to a competitive advantage [17]. On the other hand, Balakrishnan views DT as a strategy that fosters creativity and suggests that effective learning practices should be developed in institutions that include design education [18].

As emphasized by most researchers, the DT approach is not only effective in stimulating students' creative abilities but also an effective strategy for generating creative solutions in the public or private sector.

In the literature, various DT approaches utilized by different disciplines can be found [5]. Herbert Simon examined the DT Process in seven stages: 1. Empathize, 2. Define, 3. Ideate, 4. Prototype, 5. Test, 6. Implement, 7. Learn [19]. Dunne and Martin evaluate the process in an iterative structure, arguing that the process starts with ideation, continues with deduction, and the idea is put into practice with testing and the results achieved with induction can be generalized [21]. As can be seen here, regardless of the number or name of the design process steps, a similar path that starts with problem definition and ends with problem-solving is followed [21]. This study benefits from the design thinking process model developed by the Hasso Plattner Institute of Design at Stanford University (d.school).

The Stanford d.school, "is a place where people use design to develop their creative potential" and it is a leader in teaching and applying DT [22, 23]. Since 2005, when it added DT courses to its engineering curriculum, the university has been teaching students how the approach works on a scientific basis and what factors ultimately contribute to the success of such innovation [24, 25, 26]. In recent years, design institutes such as d.school have become more widespread, and there have been discussions at academic institutions such as Postdam, Harvard, and MIT about how this approach can be integrated into non-design fields. Stanford School has developed a methodology for creative problem-solving that is based on Simon's (1969) proposed model. This methodology encourages creative, multidisciplinary teamwork through the DT approach [25, 27]. The model consists of six stages and as shown in Figure 1, these steps are not placed in a linear sequence. The steps can be repeated and moved forward and backward between stages based on the requirements of the findings obtained from each step. The responsibility for deciding when to move on to which stage and how the entire design process will be conducted lies with the design team [28].

In 2009 and 2010, the six-stage model was developed and transformed into a five-stage DT process model (Figure 2). This model consists of the following steps: 1. Empathize, 2. Define, 3. Ideate, 4. Prototype, and 5. Test.

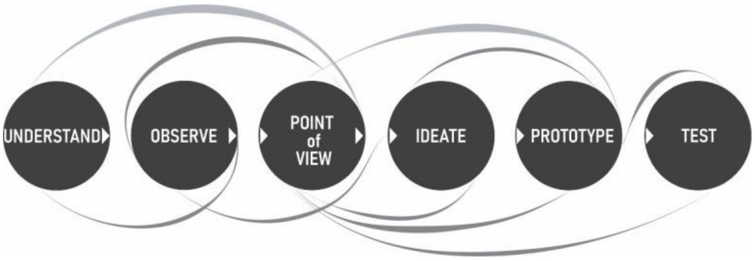

Figure 1. The Six-Stage DT Model Proposed by The Stanford d.school [29].

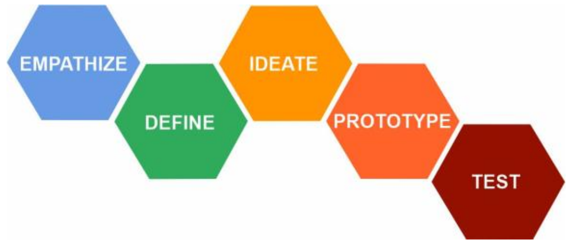

Figure 2. The Five-Stages of DT [30]

The first stage of the DT process model is related to understanding the consumer's perspective. In this stage, the designer interacts with the consumer using techniques such as observation, interviews, and others to gain common insights and develop empathy for the stakeholders of the design problem [31, 3]. In the define stage, the collected data is analyzed and shared with team members to form a perspective on the design problem. In the ideate stage, creative and feasible ideas are developed for the problem at hand. In the subsequent process, a prototype is carried out, which involves transforming ideas and concepts into tangible representations and enables feedback from users or other stakeholders. Test processes are conducted to collect this feedback and further improvements and revisions are made based on it. At this point, information is obtained about the design's ability to meet consumer expectations through user feedback, and this information is taken into consideration to achieve a better design. However, that viewing design only as a problem-solving approach may lead to a narrow perspective, states that the psychological impact of design is also significant [1]. While the designer uses the design language to add meaning to the product, the consumer also expects the design to be in harmony with their emotional expectations, along with meeting their physiological needs.

While it is unclear which technical features of the designs that are compatible with the emotions and feelings of the consumers will evoke the desired emotions and feelings, Kansei Engineering (KE) makes the human mind and heart more visible by offering a new approach to new product development [32, 33]. KE, developed by Mitsuo Nagamachi, offers a consumer-oriented approach to new product development [34, 32, 35, 36, 37]. Kansei, which has its roots in Japanese culture, refers to the impression formed in the human mind because of interaction with an object, such as emotions, feelings, thoughts, and attitudes. KE is a methodology that combines the fields of Kansei and engineering to integrate human Kansei into product design to produce products that consumers will enjoy and be satisfied with [38, 32, 39, 40].

KE utilizes customer emotions as input and seeks to find the relationship between these emotions and product features [41]. In this methodology, the design product is initially evaluated with Kansei words based on the consumer's emotional expectations. Therefore, all adjectives in the relevant field are thoroughly researched and accumulated in a pool of words. Synonymous words are grouped, and the words that best express the meaning are selected. These identified words are paired with their antonyms. The word pairs are then used in a scale prepared for data collection in the research process [36]. The consumer rates the product image on the scale according to the values between contrasting words [42, 43, 44]. The collected data is analyzed through multivariate analysis. As a result of the analysis, statistical relationships between Kansei words and design elements can be observed. This enables the determination of the qualities and categories of design that evoke positive emotions in the consumer, thus informing the design of future products with these attributes taken into account [32].

Nowadays, most designs remain weak in achieving sufficient compatibility with consumers' needs, habits, emotions and feelings, behaviors, and preferences. Therefore, there is a need for new and improved approaches for participation in design development or new product design processes.

This study aims to develop a design process model that can be utilized for design in various fields within the context of design thinking, supported by the Kansei Engineering product design methodology. The model is intended to be experientially tested and any shortcomings identified during the process were aimed to be addressed. The advantage of this model is the testing of the compatibility of prototypes with consumer expectations. Additionally, the feelings and emotions aroused by these expectations are measured to determine which technical parameters of the product influence these emotions. As a result, designers and manufacturers can direct themselves toward creating designs that evoke desired emotions in consumers and generate new images in harmony with these emotions. In pursuit of these objectives, the research explored outerwear season trends, identified consumer expectations, and developed contemporary designs based on this information. Digital prototypes were created to examine the alignment of these designs with consumer preferences, and the Kansei Engineering product design methodology was utilized during the testing process. As a result of the findings, design elements influencing emotional expression in consumers were determined. Accordingly, alternative design model suggestions were formulated using design elements that elicit positive emotions to create products that are in complete alignment with consumer preferences.

2. MATERIAL AND METHOD

2.1 Material

In this research, a design process model was developed to identify the emotions and sentiments of consumers related to jacket, coat, and overcoat models within the category of outerwear. The aim was to demonstrate how these expectations could be incorporated into the design process.

The effectiveness of the model was then tested through practical application. The main aim of selecting outerwear in the proposed model is that the style and design differences applied to outerwear models are more long-lasting compared to other types of garments, and certain criteria dominate in terms of functionality in every season. At the same time, while certain basic technical criteria remain fixed in clothing belonging to the outerwear type, modular attachments emphasizing functionality are included. Detachable and adjustable features such as length or width can enhance product versatility and expand the range of uses for the garment. In the study, it was paid attention to reflecting current preferences and fashion trends when creating designs for jackets, coats, and overcoats.

2.2 Method

Within the scope of the research, a descriptive (survey) method was employed. This method allows for the collection of information from a broad sample group using data collection tools such as surveys and interviews [42, 43, 44]. Within this context, the study's population comprises female consumers aged between 18 and 60 residing in Istanbul, chosen due to the researcher's ease of access. According to information obtained from the 2022 address-based population registration system, the number of women aged 18-60 residing within the borders of Istanbul is 5.107.629 [45]. However, reaching the entire population of the province would be challenging, so a sample group representing the population has been determined. The sample size of the study (Figure 3) has been calculated according to the following formula [46]:

n = Population: 5.107.629

z = Confidence Coefficient (for a 90% confidence interval): 1,645

SE = Standard error: 0,05

The variance of the variable: 0,5

Applying the data to the formula resulted in a required sample size of 270 individuals for the desired confidence interval. For this study, a snowball sampling method was employed, reaching 347 female consumers residing in different neighborhoods of Istanbul. After excluding incomplete surveys, 342 data points were included in the analysis.

In this study, a process model applicable in the field of design was developed within the framework of the DT model with the support of KE and was presented in Figure 4.

$$\frac{n.z^2.(0.5)^2}{(n-1).SE^2+z^2.(0.5)^2} = \frac{5.107.629.(1.645)^2.(0.5)^2}{(5.107.629-1).\ (0.05)^2+(1.645)^2.(0.5)^2} = 270$$

Figure 3. The formula to calculate the sample size in research

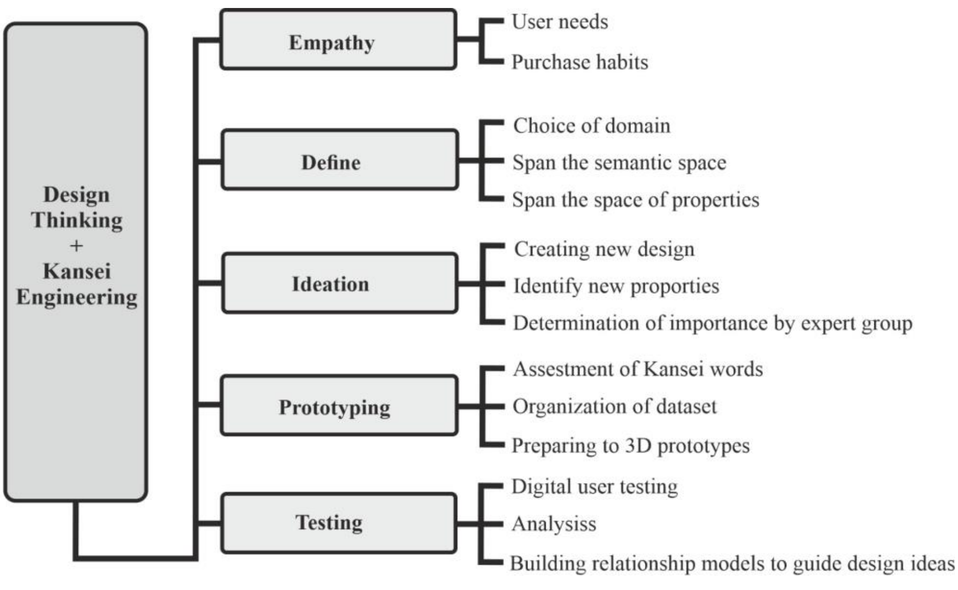

Figure 4. The general flowchart of the model

The steps of the design process model presented in Figure 4 are explained in detail in the following sections:

Phase 1: Empathy

In this stage, alongside the literature review, the preferences, expectations, and encountered issues of the female consumers comprising the target group of the research were investigated concerning outerwear. Women's outerwear models present in the fashion market were examined. These models were categorized into three main headings: jackets, coats, and overcoats. These categories formed the design focus of the research. To measure consumers' emotional expectations towards outerwear models and ensure that the developed designs reflect current preferences and seasonal trends, the research incorporated visual and written materials from trend seminars, fabric, and accessory swatches obtained from fashion and textile fairs, fashion trend catalogs, and fashion magazines. In this context, trends in terms of outerwear colors, fabrics, and main patterns were thoroughly investigated.

Phase 2: Define

The outerwear categories of jackets, coats, and overcoats themselves comprise numerous fundamental design attributes, and each of these design attributes further contains a multitude of subcategories. These attributes that should be present in any outerwear product generate emotions and sentiments in the consumer towards the product, subsequently influencing their preferences. Therefore, national, and international visual and written sources, fashion magazines and catalogs, as well as websites were utilized to explore the common fundamental design features and subcategories related to outerwear. These were compiled and presented in Table 1.

Phase 3: Ideation

During this stage of creating sketches for outerwear designs, the number of sketches to be generated for each type of garment was initially determined. The number of sketches was decided while considering the final number of products that would be included in the research scale. It is believed that by creating a significantly larger number of design sketches than the products included in the scale, there will be a wider range of design alternatives to choose from, increasing the chance of incorporating a diverse set of models in the study. It has been decided to create an equal quantity of jacket, coat, and overcoat models for each of the three different types of outerwear. Guided by this notion, considering consumer expectations and seasonal trends, the researcher prepared preliminary design sketches for each type of outerwear, including 15 jackets, 15 coats, and 15 overcoats. To broaden the scope of usage for the products, modular details that allow for personalization were added in addition to visual characteristics. The modular features, which can be attached or removed and have adjustable length or width, were provided by zippers, buttons, and snaps.

Table 1. Design features and parameters for outerwear

Attributes	Categories
Garment type	Jacket, Coat, Overcoat
Form/cut	Slim fit, regular fit, classic fit, oversized fit
Length	Crop, short, regular, long, extra long
Modular (length)	Basic, detachable, adjustable length
Collar design	Crew neck, stand, turnover, shawl collar, lapel neckline, v-necked
Fiber-filled	Yes, No
Hoodie	Yes, No
Shoulder pad	Yes, No
Shoulder epaulettes	Yes, No
Shoulder design	Dropped shoulder, standard structured shoulder
Sleeve model	Set-in sleeve, raglan sleeve, batwing sleeve, sleeve with gathered sleeve head, kimono sleeve, dolman sleeve
Sleeve length	Full length, bracelet, three-quarter
Modular (sleeve)	Detachable, basic, adjustable length or width
Sleeve cuffs	Standard blazer sleeve with vent and buttons closed cuff with topstitching, straight/cuffless, classic shirt cuff, classic trench coat cuff with strap, double/french, wing, circular, roll-up, ribbed/knitted, piping, button tab, sports cuff with zip
Closure type	Single-breasted button closure, Double-breasted button closure, Zipper, double-breasted zipper closure, button closure, and removable belt, snap button closure
Pocket number	Multipocket, pocketless
Pocket model	Fleto, patch, pocketless
Flap-pocket	Yes, No
Modular (pocket)	Detachable, basic
Flap-pocket design	Angled, oval
Belt	Removable belt, unbelted
Hemline	Straight, gathered, fringed
Side seam	Basic, two-side slit/zippered/snap-on

To narrow down the selection from the preliminary design sketches for each type of outerwear and determine the designs to be included in the research data collection scale, the opinions of fashion designers were sought. For this purpose, the preliminary design sketches for each garment type were numbered from 1 to 15. The fashion designers responsible for the selection were required to have active experience working as fashion designers in the design departments of established companies and possess a minimum of 5 years of experience. The views of 7 fashion designers, denoted as 'D,' who met the specified criteria, were taken into consideration. In the study, the personal information of the designers was kept confidential and coded as D1, D2, ..., and D7 with designer and distinctive serial numbers. Designers were asked to make five selections for each type of outerwear and the three most preferred jacket, coat, and overcoat designs were included in the research scale. Table 2 shows the preferences of each designer, with the code representing the designer in the row corresponding to the garment type.

Numbers have been used as labels for the outer garment design sketches prepared in the study. Additionally, colored columns have been utilized to indicate the frequencies of the jacket, coat, and jacket models proposed by the designers for use in the study.

As shown in Table 2, most designers recommended the 2nd, 8th, and 10th jacket models. For coat models, since designer opinions converged on the 2nd and 10th models, these designs were used in the study. As for the last coat model, as designer opinions were evenly distributed, the researcher selected a design that was perceived to be distinct. For women's overcoat models, it can be observed that designers primarily recommended the 9th and 10th models. In the last overcoat model, since the vote counts were evenly distributed among different models, the researcher chose a model with distinct features to be used in the study.

Phase 4: Prototyping

The 3D digital prototypes of the three most preferred jacket, coat, and overcoat designs in line with the designers' views were prepared using the CLO 6.0 software, which offers true-to-life 3D garment simulation (Figure 5). Since the color factor is considered to have a variable effect on consumer perception, only plain beige color was used in all models.

Table 2. Designer opinions on 3D outerwear designs

	Jacket					Coat					Overcoat				
D1	2	4	6	7	8	2	3	5	13	14	1	3	5	9	10
D2	1	2	5	8	11	1	8	10	11	15	2	3	6	10	11
D3	2	8	10	14	-	2	5	8	12	13	7	9	10	15	-
D4	1	2	8	10	11	1	2	8	10	14	2	6	9	10	11
D5	2	4	8	9	13	2	5	10	12	15	1	4	7	8	9
D6	2	4	8	10	13	2	5	8	10	12	2	8	9	10	15
D7	2	5	8	10	14	3	6	10	12	13	1	9	10	12	15

Figure 5. 3D view of determined outerwear models

At this stage, the researcher extensively investigated adjectives expressing the emotions and sensations evoked by clothing in users, utilizing a diverse range of sources. Various sources such as magazines, user forums, and shopping websites, catalogs as well as articles, theses, and conference papers, were used for this purpose. The collected words were examined, and identical or synonymous words were excluded from the pool. Next, all Kansei words were categorized into two different semantic set as visually and functionally. Each word were paired by matching them with their opposites found in their respective word groups and Kansei word pairs (i.e. multiple emotional attributes) were created. Due to the large number of Kansei word pairs, the word pairs to be used in the study were determined with expert opinions *(The expert group consists of 5 academics who are affiliated with different universities in the field of fashion design.).* A total of 14 pairs of Kansei words representing visual meanings and 12 pairs representing functional meanings are included in the final semantic scale, as shown in Table 3.

Phase 5: Testing

Within the scope of the research, a scale was developed to measure the perceptions and emotions evoked by the created outerwear designs in consumers. The scale consists of two parts. The first part includes a Likert-type 5-point scale measuring the users' personal information and outerwear design preferences. In the second part, the perceptions and emotions evoked by the outerwear designs in participants are measured. For this purpose, a 7-point semantic differential scale (SD) has been used.

1. ***Evaluate the jacket design in the image according to your emotions and feelings using adjectives representing visual and functional meanings and assign scores in a way that best aligns with your preferences.***

Table 3. The selected pairs of Kansei words

Visual assessments		Functional assessments	
K01	Random - Meticulous	**K01**	Unpractical - Practical
K02	Exaggerated - Simple	**K02**	Uncomfortable - Comfortable
K03	Classic - Modern	**K03**	Non-durable - Durable
K04	Similar - Unconventional	**K04**	Single - Multi-functionality
K05	Meaningless - Meaningful	**K05**	Hard to maintain - Easy
K06	Ordinary - Interesting	**K06**	Disturbing - Satisfying
K07	Unstylish - Stylish	**K07**	Incompatible - Compatible
K08	Dull - Cool	**K08**	Undiversifiable - Diverse
K09	Complex - Simple	**K09**	Mass-produced - Personalized
K10	Rough - Elegant	**K10**	Non-customizable - Customizable
K11	Ugly - Aesthetic	**K11**	Not suitable for the need - Suitable
K12	Serious - Sincere	**K12**	Restrictive of movement - Mobility
K13	Not my style - Totally me		
K14	Not worth the high price - Worth		

Visual assessments								
Kansei words (-)	3	2	1	0	1	2	3	**Kansei words (+)**
Random						**X**		Meticulous
Exaggerated								Simple
Functional assessments								
Unpractical								Practical
Uncomfortable								Comfortable

Figure 6. The Kansei question corresponding to the jacket model.

Figure 6 provides an overview of the semantic differential scale used in the study. As can be observed, the digital prototype front, side, and back views of each type of garment model are located at the top of the scale. In the bottom section, the Semantic Differential scale for visual and functional meanings is presented in two separate tables. There are a total of 14 pairs of Kansei words representing visual meanings and 12 pairs representing functional meanings. Figure 6 only illustrates two pairs of Kansei words, one for visual and one for functional meanings, to introduce the scale used in the study. Accordingly, the negative meaning of the word pair is placed on the left side, while the positive meaning is placed on the right side of the 7-point scale. Each interval in the table corresponds to a scoring system. The intervals closer to the word are evaluated starting from 3 and decreasing to 2, 1, and 0. Accordingly, the degree of participation in the attribute that the consumer evaluated the design in the visual is increased depending on the scoring. For scoring, first, the side is chosen from the opposite poles, and then the chosen side is marked with an "X". Each participant evaluated a total of 9 outerwear models, consisting of 3 jackets, 3 coats, and 3 overcoats, using the semantic differential scale.

The scale was administered to voluntary female consumers through both digital and face-to-face paper-based methods (mixed survey). The obtained data were examined, and answeras that were incomplete or had errors were removed from the study as they could lead to incorrect results. SPSS software version 22 was utilized for data analysis. Through data analysis, the impact of the design attributes of the designed outerwear models on consumers' emotions and sentiments was observed.

3. RESULTS AND DISCUSSION

The distributions of data related to participants' expectations and opinions regarding outerwear models are presented in this section.

3.1. The participants' characteristics

The research examined the emotional expectations of female consumers towards outerwear, and as such, the opinions of 342 female consumers were gathered. The data collected solely from female participants have been analyzed and interpreted in this section. As shown in Table 4, the age range of the female participants involved in the research was 51,2% (175 individuals) between the ages of 18-25, while the lowest percentage of 2,3% belonged to the participants aged between 51-60. 7% (24 individuals) of the participants have completed primary school, 2,6% (9 individuals) have completed middle school, 28,4% (97 individuals) have completed high school, 14,3% (49 individuals) have completed associate degree, 40,9% (140 individuals) have completed undergraduate education and 6,7% (23 individuals) have completed graduate education. When the employment status of the participants was examined, it was determined that 33,6% (115 individuals) were students and 22,5% (77 individuals) were not employed.

3.2. Participants' outerwear design preferences

Research data was obtained through a scale consisting of two sections. The first section includes a Likert-type scale to examine users' outerwear design preferences. The first section includes a Likert-type scale to examine users' outerwear design preferences. The reliability analyses of the questionnaire titled 'The Outerwear Design Preferences,' which was utilized in the research, have been conducted and are presented in Table 5.

Table 4. Descriptive statistics regarding the participants' characteristics (n=342) are as follows:

	%
Age	
18-25 yrs.	**175 (51,2%)**
26-30 yrs.	44 (12,9%)
31-40 yrs.	69 (20,2%)
41-50 yrs.	46 (13,5%)
51-60 yrs.	8 (2,3%)
Education	
Primary	24 (7%)
Middle	9 (2,6%)
High	97 (28,4%)
Associate	49 (14,3%)
University	**140 (40,9%)**
Graduate degree	23 (6,7%)
Job	
Jobless	77 (22,5%)
Official	70 (20,5%)
Worker	69 (20,2%)
Student	**115 (33,6%)**
Other	11 (2,3%)

Summary statistics for numerical data are presented as *mean ± standard deviation* and *median (minimum, maximum)*, while categorical data are presented as *number (percentage).*

Table 5. Reliability results for the measurement of outerwear design preferences

	Statistical analysis score	Number of items	Cronbach's Alpha
Clothing preferences			
mean±SD	3,91±0,48	14	0,857
M (*min-max*)	4 (2,57-4,93)		

Summary statistics are presented as *mean ± standard deviation* and *median (minimum, maximum)* values.

According to the reliability results of a 14-item Likert-type measurement tool assessing the design features preferred by participants in outerwear (Table 5), the average total score obtained from the 14 questions was found to be 3,91 ± 0,48 points. The lowest score was 2,57, while the highest score was 4.93. The Cronbach's alpha (α) reliability coefficient of the scale was found to be 0,857. Here, reliability is related to how accurately the test measures the property it intends to measure, and the reliability coefficient is expected to be at least 0,70 for an acceptable value between 0 and 1 [47, 48]. In this study, it was concluded that the value obtained from the "Outerwear Design Preferences" test was above 0,70, and therefore the test was found to be reliable for this sample.

Table 6. Descriptive statistics results for the measurement of outerwear design preferences

Clothing preferences	***mean***	***SD***
Price	3,83	0,88
Brand	2,97	1,01
Benefit	4,18	0,81
Quality	4,35	0,77
Trend	3,03	1,03
Colour	3,98	0,87
Visuality	4,13	0,81
Usability	4,39	0,76
Design elements	3,89	0,88
Material	4,01	0,88
Durability	4,28	0,77
Lifespan	4,09	0,89
Ease of movement	4,41	0,80
Customizable	3,21	1,13

According to Table 6, the average score for the Price criterion in the 14-item Likert-type questionnaire measuring outerwear design preferences was found to be 3,83±0,88. The average score for the Brand criterion was found to be 2,97±1,01. The average score for the Benefit criterion was found to be 4,18±0,81. The average score for the Quality criterion was found to be 4,35±0,77. The average score for the Trend criterion was found to be 3,03±1,03. The average score for the Colour criterion was found to be 3,98±0,87. The average score for the Visuality criterion was found to be 4,13±0,81. The average score for the Usability criterion was found to be 4,39±0,76. The average score for the Design elements criterion was found to be 3,89±0,88. The average score for the Material criterion was found to be 4,01±0,88. The average score for the Durability criterion was found to be 4,28±0,77. The average score for the Garment Lifespan criterion was found to be 4,09±0,89. The average score for the Ease of movement criterion was found to be 4,41±0,80 and the average score for the Customizable criterion was found to be 3,21±1,13. According to these obtained data, the highest average was found in Ease of Movement with 4,41 ± 0,80, while the lowest average was observed in the Brand criterion with 2,97 ± 1,01.

3.3. The statistical relations between Kansei words and outwears

In the second section of a scale consisting of two sections, participants evaluated the designs of jackets, coats, and overcoats using a semantic differential scale and in this step the relations between kansei words and outerwear designs was analyzed.

The Cronbach's Alpha reliability coefficients were examined for the semantic differential scale measuring emotional expectations towards outerwear designs in terms of positive and negative connotations of Kansei words related to visual and functional aspects for each model and are presented in Table 7. The lowest Cronbach's Alpha reliability coefficient for positive visual scores was found to be 0,917, and the highest was 0,956, for jackets, coats, and overcoats. For negative visual scores, the lowest Cronbach's Alpha reliability coefficient was 0,882, and the highest was 0,945, for jackets, coats, and overcoats. When the emotional expectations towards outerwear in the functional dimension were examined, the lowest Cronbach's Alpha reliability coefficient for positive functional score was found to be 0,923 and the highest was 0,958 for jackets, coats, and overcoats. For negative functional score, the lowest Cronbach's Alpha reliability coefficient was found to be 0,849 and the highest was 0,946 for jackets, coats, and overcoats.

Table 8 presents the values of the SD scale, in which participants evaluated each outerwear model, including jackets, coats, and overcoat, in terms of emotional words for their visual aspect.

Table 7. Reliability results of the scale of emotional expectations for outerwear designs (n=342)

Item		**Visual** *KW*(14)		**Functional** *KW*(12)	
		Positive (+)	**Negative (-)**	**Positive (+)**	**Negative (-)**
Jacket	Jacket 1.	0,917	0,857	0,923	0,849
	Jacket 2.	0,937	0,882	0,946	0,907
	Jacket 3.	0,939	0,904	0,941	0,902
Coat	Coat 1.	0,953	0,926	0,951	0,914
	Coat 2.	0,953	0,936	0,945	0,925
	Coat 3.	0,956	0,945	0,955	0,946
Overcoat	Overcoat 1.	0,944	0,911	0,953	0,902
	Overcoat 2.	0,952	0,917	0,958	0,920
	Overcoat 3.	0,955	0,941	0,955	0,936

Table 8. The comparison of the positive and negative visual scores of the three products

Aesthetic	Positive (+)		Negative (-)		Test Statistics †		
					F	*p*	η^2
Jacket							
Jacket 1.	1,24±0,85 [a]	1,14 (0-3)	0,47±0,55 [cd]	0,21 (0-3)	**128,610**	**<0,001**	**0,274**
Jacket 2.	1,42±0,92 [b]	1,43 (0-3)	0,42±0,57 [d]	0,21 (0-3)	**195,326**	**<0,001**	**0,364**
Jacket 3.	1,20±0,91 [a]	1,07 (0-3)	0,54±0,67 [c]	0,29 (0-3)	**74,717**	**<0,001**	**0,180**
Test Statistics ¥	***F*=13,214; *p*<0,001; η^2=0,072**		***F*=6,485; *p*=0,002; η^2=0,037**				
Coat							
Coat 1.	1,17±0,96 [a]	0,93 (0-3)	0,54±0,72 [d]	0,21 (0-3)	**61,738**	**<0,001**	**0,153**
Coat 2.	0,94±0,92 [b]	0,68 (0-3)	0,79±0,85 [bc]	0,5 (0-3)	3,085	0,080	0,009
Coat 3.	1,00±0,94 [b]	0,64 (0-3)	0,70±0,85 [c]	0,29 (0-3)	**12,146**	**0,001**	**0,034**
Test Statistics ¥	***F*=14,222; *p*<0,001; η^2=0,077**		***F*=16,150; *p*<0,001; η^2=0,087**				
Overcoat							
Overcoat 1.	1,63±0,96 [a]	1,79 (0-3)	0,36±0,60 [e]	0,14 (0-3)	**294,930**	**<0,001**	**0,464**
Overcoat 2.	1,31±0,97 [b]	1,14 (0-3)	0,45±0,66 [d]	0,14 (0-3)	**125,235**	**<0,001**	**0,269**
Overcoat 3.	0,94±0,93 [c]	0,5 (0-3)	0,77±0,88 [c]	0,43 (0-3)	3,632	0,058	0,011
Test Statistics ¥	***F*=82,431; *p*<0,001; η^2=0,327**		***F*=36,647; *p*<0,001; η^2=0,177**				

F: Two-way repeated measures ANOVA, Effect Size (η^2), ¥Comparison within Products, †Comparison within Opinions, Summary statistics are presented as *mean ± standard deviation* and *Median (Minimum, Maximum)* values. The bold sections indicate statistical significance (p<0,05). *a>b>c>d>e>f*: Different letters or letter combinations within the same row indicate statistically significant differences (*p*<0,05).

According to Table 8, there is a significant difference between the means of positive and negative visual scores for three different jacket models with F=12,108 and p=0,001 confidence levels. The average positive visual scores of the 1st, 2nd, and 3rd jacket models are statistically significantly higher than the average negative visual scores. The effect sizes were found to be 0,274, 0,364, and 0,180, respectively. According to the measurements, it has been determined that the visual score averages of the 2nd jacket model are higher than the other models, while the averages of negative visual scores are lower than the other models. Therefore, it was found that the participants expressed positive emotions and feelings visually, in other words, their favorite design was the 2nd jacket model. The least favorite model was identified as the 3rd jacket.

According to Table 8, the visual positive and negative score averages of three different coat models show a significant difference at the confidence level of p=0,001 with F=15,954. At the same time, while there is no statistically significant difference between the positive and negative visual scores of the 2nd coat model, the positive visual score averages of the 1st and 3rd coat models are significantly higher than the negative visual score averages. The effect sizes are determined as 0,153, 0,009, and 0,034, respectively. The first coat model, which received the highest positive visual score average, was the one that participants focused on the most, while the negative visual score averages were statistically higher in the 2nd and 3rd coat models. Thus, it can be concluded that the participant group preferred the 1st coat model the most visually, and the 2nd coat model the least.

When the participants' emotional expectation levels were examined visually through coat models, there was a statistically significant difference in the positive and negative visual score averages for three different coat models with F=93,965 and p=0,001. There is no statistically significant difference between the positive and negative visual scores in the 3rd coat model, while in the 1st and 2nd coat models, the average positive visual scores are significantly higher than the average negative visual scores at a statistically significant level of F=93,965 and p=0,001. The effect sizes are determined as 0,464, 0,269, and 0,011, respectively. Based on the obtained data, the visual score averages are higher for the 1st coat model, while the negative visual score averages are statistically higher for the 3rd coat model. Therefore, the most visually preferred model is the 1st coat model, while the least preferred one is the 3rd coat model (Table 8). These results indicate that participants have preferences for different design features in outerwear products and that these preferences show statistically significant differences. Additionally, these findings can assist designers in determining appropriate visual design features for a specific target audience.

Table 9 shows the evaluation of models of three different outerwear types, namely jackets, coats, and overcoats, using words expressing positive and negative emotions from a functional perspective, and the obtained data is reflected in the table. Accordingly, the mean scores of positive and negative functional aspects were found to be significantly different for the three different jacket models with F=5,914 and p=0,016 confidence levels. As a result of the analysis, the mean positive functional scores in the first, second, and third jacket models were statistically significantly higher than the mean negative functional scores. The effect sizes were found to be 0,519, 0,447, and 0,368 respectively. Accordingly, it can be observed that the mean functional scores of the first jacket model are higher than the other models. Moreover, while there was no statistically significant difference in negative functional score averages among the jacket models, participants' preference for positive functional aspects was concentrated on the first and second jacket models. This result indicates that participants liked the first jacket model more in terms of functional aspects than the other models, and least preferred the third jacket model.

When looking at the data in Table 9, it can be observed that the average positive and negative functional scores show a significant difference in a confidence level of F=24,343 and p=0,001 for three different coat models. It was observed that the participants evaluated the coat models positively, with effect sizes found to be 0,330, 0,082, and 0,165, respectively. Accordingly, among the coat models that evoke positive emotions and feelings in terms of functionality, the first coat model had the highest average score, while in terms of negativity, the second coat model had the highest score. These results indicate that the participant group liked the first coat model the most in terms of functionality, and least liked the second coat model.

When examining the data regarding overcoat models that evoke positive and negative emotions and feelings in terms of functionality among the participants, it can be seen that the average positive and negative functional scores for three different overcoat models are significant at the level of F=56,872 and p=0,001. At the same time, the positive functional score averages in all overcoat models are statistically significantly higher than the negative score averages. The effect sizes were found to be 0,513, 0,368, and 0,127, respectively. The functional score averages of the 1st overcoat model are higher compared to the other models. The negative functional score averages, on the other hand, are higher for the 3rd overcoat model. From these results, it has been determined that the participant group liked the 1st coat model the most in terms of functionality, and the 3rd coat model the least (Table 9).

3.4. Design options to guide new design ideas for outerwear

Participants evaluated the outerwear models, consisting of three jackets, three coats, and three overcoats, determined based on designer opinions, using Kansei word pairs representing visual and functional meanings. The evaluation results, indicating the models most liked by consumers in terms of visual and functional aspects (Most positive +) and the least liked (Most negative -), are provided in Table 10.

When examining Table 10, it can be observed that consumers favored two different models in terms of both visual and functional aspects among the jacket designs. However, for both the coat and overcoat designs, the same models were favored the most in both visual and functional aspects within their respective categories. The differentiation between the model that consumers liked the most for its visual appeal and the one they liked the most for its functionality in the jacket designs can be explained by the functional aspect of the most favored jacket featuring a modular attachment with a detachable zipper at the waistline. This modular design provides versatile usage options [49], where the design concept moves from parts to a whole or from a whole to parts. Additionally, the researcher finds the field of modular design to be vast and worth exploring, particularly for its potential to contribute to environmental conservation and balance in today's fast fashion market. This expansion in design allows for the vitality of ready-to-wear production and the limitless potential of design [50].

Table 9. Comparison of positive and negative functional scores of three products

Functional	Positive (+)		Negative (-)		Test Statistics †		
					F	*p*	η^2
Jacket							
Jacket 1.	1,58±0,92 ^{a}	1,63 (0-3)	0,30±0,48 ^{c}	0,08 (0-2,8)	**368,537**	**<0,001**	**0,519**
Jacket 2.	1,57±0,99 ^{a}	1,67 (0-3)	0,33±0,59 ^{c}	0 (0-3)	**275,526**	**<0,001**	**0,447**
Jacket 3.	1,40±0,98 ^{b}	1,42 (0-3)	0,36±0,60 ^{c}	0,08 (0-3)	**198,410**	**<0,001**	**0,368**
Test Statistics ¥	**F=8,205; p<0,001; η^2=0,046**		F=1,463; p=0,233; η^2=0,009				
Coat							
Coat 1.	1,39±1,01 ^{a}	1,46 (0-3)	0,39±0,64 ^{f}	0,08 (0-3)	**167,766**	**<0,001**	**0,330**
Coat 2.	1,04±0,96 ^{c}	0,75 (0-3)	0,59±0,79 ^{d}	0,25 (0-3)	**30,647**	**<0,001**	**0,082**
Coat 3.	1,21±1,02 ^{b}	1 (0-3)	0,51±0,80 ^{e}	0,08 (0-3)	**67,267**	**<0,001**	**0,165**
Test Statistics ¥	**F=29,037; p<0,001; η^2=0,146**		**F=14,601; p<0,001; η^2=0,079**				
Overcoat							
Overcoat 1.	1,67±1,04 ^{a}	1,83 (0-3)	0,27±0,53 ^{e}	0 (0-3)	**359,722**	**<0,001**	**0,513**
Overcoat 2.	1,41±1,05 ^{b}	1,33 (0-3)	0,33±0,61 ^{e}	0 (0-3)	**198,790**	**<0,001**	**0,368**
Overcoat 3.	1,12±1,01 ^{c}	0,88 (0-3)	0,53±0,78 ^{d}	0,17 (0-3)	**49,623**	**<0,001**	**0,127**
Test Statistics ¥	**F=50,607; p<0,001; η^2=0,229**		**F=19,232; p<0,001; η^2=0,102**				

F: Two-way repeated measures ANOVA, Effect Size (**η^2**), ¥Comparison within Products, †Comparison within Opinions, Summary statistics are presented as *mean ± standard deviation* and *Median (Minimum, Maximum)* values. The bold sections indicate statistical significance (p<0,05). *a>b>c>d>e>f*: Different letters or letter combinations within the same row indicate statistically significant differences (*p*<0,05).

Table 10. The emotional state results of participants toward outerwear models

	Visual assessments		***Functional assessments***	
	Positive (+)	**Negative (-)**	**Positive (+)**	**Negative (-)**
Jacket				
Coat				
Overcoat				

Finally, the design features of the outerwear models that meet the participant's emotional expectations, or in other words, those visually and functionally favored, were compared with the Design Features and Parameters for Outerwear presented in Table 1. Using this table as a reference, the design features, and parameters of the models most favored by participants in terms of both visual and functional aspects were analyzed, resulting in the development of Table 10. In this table, since the visually most favored jacket and the functionally most favored jacket were different models, the design attributes of the visually favored jacket are listed under the 'Visual' column, while the design attributes of the functionally favored jacket are listed under the 'Functional' column. For the coat and overcoat models, since the same models were favored both visually and functionally within their respective categories, the design attributes of the most favored coat and overcoat models are provided under the 'Visual-Functional' column.

Table 11 shows that design features such as oversize fit, dropped shoulders, one-piece and long sleeves without modular features, ribbed cuffs, and multiple pockets with flaps are common preferences both visually and functionally for ***jacket*** models. Additionally, the adjustable length with a detachable feature for jackets received positive functional feedback, while non-modular designs were visually favored. Designs with adjustable lengths that offer versatility and personalization to consumers should incorporate modular elements without sacrificing aesthetics. Additionally, the attachment-detachment line of the piece should be designed to be concealed, maintaining the overall appearance of the garment.

When examining the consumer Kansei-oriented design combinations for ***coat*** models, it's evident that features such as classic/casual-fit, long length, dropped shoulders, one-piece long sleeves, hooded stand collar, fiber-filled, zipper closure, multiple flap-covered patch pockets are dominant. Therefore, it's anticipated that these features can satisfy the usable design characteristics for coat designs. Additionally, consumers have shown a positive response towards modular elements that emphasize functionality, such as the ability to extend the coat's length, detachable sleeves, and pockets. Looking at the general design details, it can be inferred that there is no positive sentiment towards models with shoulder pads, epaulets, sleeve vents, and cuffs, indicating a lack of favorable appreciation for these details among consumers.

Table 11. The features and parameters determined for the new outwear design

Features	Jacket		Coat	Overcoat
	Visual	**Functional**	**Visual-Functional**	**Visual-Functional**
Fit/form	Oversize	Oversize	Classic-fit	Classic-fit
Length	Regular	Long	Long	Extra long
Modular (length)	Basic	Detachable	Basic	Basic
Collar design	Stand	Turnover	Stand	Lapel collar
Fiber filled	No	No	Yes	No
Hoodie	No	No	Yes	No
Shoulder pads	No	No	No	No
Shoulder epaulettes	No	No	No	No
Shoulder design	Dropped	Dropped	Dropped	Dropped
Sleeve model	One-piece	One-piece	One-piece	One-piece
Sleeve length	Full length	Full length	Full length	Full length
Modular (sleeve)	Detachable	Basic	Detachable	Detachable
Sleeve cuffs	Ribbed	Ribbed	Cuffless	Cuffless
Closure type	Zipper	Single-breasted	Zipper and removable belt	Button closure and removable belt
Pocket number	Multipocket	Multipocket	Multipocket	Multipocket
Pocket model	Patch	Fleto	Patch	Fleto
Flap-pocket	Yes	Yes	Yes	Yes
Modular (pocket)	Detachable	Basic	Detachable	Basic
Flap-pocket design	Angled	Oval	Angled	Angled
Hemline	Gathered	Basic	Basic	Basic
Side seam	Basic	Two side slit	Basic	Basic

When analyzing the consumer Kansei-oriented design combinations for ***overcoat*** models, it's observed that features such as classic/casual-fit, extra long length, a lapel neckline, dropped shoulders, one-piece long sleeves, detachable modular sleeves, belted or tied with a sash, multiple flat pockets with flap covers, angular flap covers are generating a positive sentiment among consumers. Fiber-filled material, hood, shoulder pads and epaulets, shoulder slits, and cuffs, on the other hand, do not align with the consumer-preferred design combinations.

To incorporate consumer emotional expectations into the design process, consumer Kansei was determined and the design elements influencing these emotions were analyzed to create design combinations (shown in Table 11). The design parameters provided in this table, considering jacket, coat, and overcoat designs, are anticipated to positively fulfill consumer preferences in both visual and functional aspects when applied to newly designed outerwear. The products developed by considering user Kansei can enhance sales potential and lead to increased revenue within the applicable industry, as illustrated in this study [51].

4. CONCLUSION

In the product design process, finding suitable solutions for the consumer is essential, alongside the designer's intuition, skills, and thoughts. This is because the design process involves not only the aesthetic aspects of the product but also serves as a problem-solving method. The Design Thinking approach treats the expectations and needs of the consumer towards a product as a problem to be solved, aiming to generate suitable solutions for the consumer. Therefore, within the framework of the Design Thinking approach supported by the Kansei Engineering methodology, a design process model has been developed and its effectiveness has been tested in this study. The combination of these two methodologies presents a unified KE-DT framework that emphasizes the customer's emotional needs. The proposed model demonstrates the importance and effectiveness of user participation in creating a design that meets emotional expectations, as observed in Tables 8 and 9. Another significant contribution of the presented model is the creation of a new design dataset by analyzing the positive emotions and feelings of consumers, as shown in Table 11. During the redesign process, using this dataset, the emotional perception and product features between the designer and the user can be effectively narrowed down. Consequently, this enables the presentation of new designs that are responsive to consumer expectations and better satisfy the psychological needs of users.

In this study, the following results were found:

- The model developed in this study has been used to measure the emotional impression that outerwear designs create on consumers. This model is not only applicable to the fashion industry but can also be used in various sectors such as automotive, mobile devices, appliances, and household items. An important feature of this model is its flexibility, allowing for repeatable applications between stages. This involves testing ideas with user feedback early and frequently to identify any flaws or deficiencies in the product, aiming to enhance user satisfaction and cater to their expectations.

- This model incorporates the user's perspective into the design process, reducing the impact of the designer's subjective preferences and choices. Consequently, users can indirectly participate in the design process, allowing for the establishment of an effective emotional connection between the product and the user. This is a positive interaction for enterprises. Because this allows for the generation of effective solutions that cater to user satisfaction and their expectations. Additionally, in the garment industry, where consumer and market demands are constantly evolving, this model can establish a reliable foundation for continuous learning throughout the process. This can lead to a reduction in trial and error, resulting in time and cost savings.

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