

Systematic Arrangement of the Concepts in a Professional Apparel Design Process: A case study

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Abstract

디자이너의 직관과 경험에 의존한 분석을 최소화하고 논리적인 방법으로 디자인 지식을 체계화하려는 노력이 여러 다른 디자인 분야에서 1960년대부터 계속되어 왔다. 반면 어패럴 디자인 분야에서는 디자인 행위, 실제 디자이너의 작업 과정, 디자이너의 사고 방법에 관한 연구는 아직 미흡한 실정이다. 본 연구는 전문가 어패럴 디자이너의 아이디어가 반영되어 있는 스케치 과정을 면밀히 조사하여, 창작 과정 중 아이디어 고안의 핵심인 디자인 컨셉의 발전 경로를 관찰하고자 한다. 연구의 방법으로는 디자이너가 실제 디자인 아이디어를 고안하듯 자연스러운 상황에서 실험에 임할 수 있도록, 디자인 프로세스 분야에서 널리 이용되고 있는 유사 실험 방식을 채택하였다. 먼저, 전문가 디자이너에게 6개의 영감을 주는 자극물 중 1개의 이미지를 선택한 후, 컨템퍼러리 여성복 라인 디자인을 4시간 동안 스케치, 완성하도록 하였다. 실험자는 관찰실에서 모든 디자인 과정을 관찰하였고, 디자이너의 인지 과정을 파악하기 위한 개방형 질문을 완성하여, 디자인 프로젝트가 끝난 직후 인터뷰 하였다. 분석 방법으로는 1)디자인 컨셉을 도출해 내기 위해, 디자이너 본인이 인터뷰에서 보고한 '디자인 특징'을 표현하는 단어들을 추출해 내고, 2) 아이디어의 최종 목표를 보여주는 최종 디자인 6벌을 언급한 디자인 특징들을 중심으로 분석하였다. 각각의 특징은 n-차원으로 분류하여, 의복 디자인 부분에 따른 디자인 특징의 그룹을 표기하였다. 3)같은 방법으로 17장의 아이디어 발전 과정 (디자인 초안들)에 그룹으로 나타나는 디자인 특징들을 표기하고 디자이너의 디자인 컨셉 생각의 흐름에 대하여 분석하였다. 그 결과 전문가 디자이너는 17장의 아이디어 컨셉 발전 과정 통해 다양한 디자인 특징들의 조합을 실험해보는 시행착오를 겪었으며, 이 과정으로 말미암아 본인이 만족해 하는 조합을 이끌어 내고 마지막 컨셉을 얻게 되는 것을 관찰할 수 있었다.

Keywords : Design process, Design concept, Professional Designer, Idea development process

주제어 : 디자인 프로세스, 디자인 컨셉, 전문적인 디자이너, 아이디어 발전 단계.

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1. 서론

How do designers design? What designers think during the process has been largely unexplained and considered an exclusively innate talent. It is probably because most designers seemingly rely on their instinct and keen sense of aesthetics, and often describe their ideas simply coming from the inspiration, lifestyle, or personal feelings. Designing entails "systematic thinking" (Lawson, 2006), not just feeling. Since design researchers have claimed that designing involves systematic thinking process in 1960s (Archer, 1965; 1969), the process research has emerged and flourished in all domains of design (Akin, 1994; Casakin & Goldschmidt, 1999; Nagai, et al., 2009; Tovey, et al., 2003).

The design process research, however, is relatively new

area in the field of apparel design. Thus far, only a few studies have investigated with the perspective of cognitive process in our field. In our field, much has been written about observing final products: for instance, how culture affects design; how historical garments have influenced their respective periods; fashion trends; fashion marketing; size issues; and social implications of apparel.

More recently, researchers of apparel design who themselves also design fashion garment have share their own design process with academia based on self report. Some have described their own process of art-wear. Harr(2004) has documented the design process of five art wears, and described the unique techniques and applications in detail as well as the background research of her inspiration. Jennings(2007) has presented the unique pattern making work

of her art wear with visual images, and shared the specific flat pattern techniques to embrace the female silhouette. Other researchers have examined how fashion designers develop ideas. Rothenberg and Sobel (1990) have analyzed designer's ideas revealed in costume designs (historic garments), and Petre, et al.(2006) has reported the exploration of knit design process influenced by the source inspiration. Even with these several attempts at the process research, what apparel designers think in developing creative ideas remains largely inaccessible.

This paper will examine the idea development in design process by tracing every step of a professional designer's sketches. This study primarily focuses on the development of design concept since the design concept is the core of the product. This case study intends, in its minute detail, to capture the nature of an individual designer's concept development process as reflected in his sketches. In addition, displaying and analyzing the professional designer's whole process can allow practitioners as well as educators to vicariously experience another designer's process.

II. Literature Review

1. Research about Design Process

Design research, by definition (Archer, 1981), is "systematic inquiry whose goal is knowledge of, or in, the embodiment of configuration, composition, structure, purpose, value and meaning in man-made things and systems". The design research focuses on investigation of design knowledge, and the sources of the design knowledge can be designers (people), processes, and final products. Among these three, research on processes is the dominant area in design research, and many studies have focused on modeling the design process.

The research on design process started to be formalized based on the creative problem solving process of the field of psychology, and the apparel design process itself is adapted from previous design process developed in other design fields which stems from theoretical framework of creative process (Kato, 1994).

Several design process frameworks of various scopes have been examined in the field of apparel design. Watkins(1998) has proposed seven design process model: accept, analyze,

define, ideate, select, implement, and evaluate. Her process oriented on functional apparel design project. Lamb and Kallal(1992) have organized an integrated frame work which can apply to all types of apparel design. This model includes problem identification, preliminary ideas, design refinement, prototype development, evaluation, and implementation. Similar to two design processes above, more design processes are proposed (Labat & Sokolowski, 1999; Frings, 2002). Overall these models provide an overview of the entire design process, and sometimes useful tool to analyze the process stages. However, these proposed models describe a macro view of the design process, and therefore do not manifest a designer's cognitive process in generating ideas of clothing design in detail.

Since the research movement about design process started, design researchers have tried to understand how designers think through the empirical evidences. So far, much of design process research has investigated in the field of architectural design and has evolved around industrial and product design. For instance, Akin(1994) has examined how designer approaches to the architectural design task specifically in early stage, and Tovey et al.(2003) have observed automotive design process based on CAD system development. Many theories and findings about design process are based on other design fields, and may not perfectly fit the fashion field. But to some extent, the way in which a designer deals with a design task are similar across fields.

2. Case study method

Many follow the case study method for design research similar to other creative process research. The characteristic of design process is to derive from a unique personal and environment. The case study method has suitable to understand in-depth and individual creative process, and maybe only approach to thoroughly capture both situation in which the creation evolves and also the unique quality of creator (Gruber & Wallace, 1999). In this reason, many design researchers have adapted the case study method exclusively to penetrate the entire design process (Oxman & Oxman, 1992; Schon, 1983).

3.Hierarchy of Concepts and Design Concepts

How concepts are formed and developed during the idea

development process are one of the topics in the cognitive science. The main theory accepted in the field is that the brain learns concepts by efficiently categorizing the list of attributes. These categorizing actions are performed based on the relevancy of the situation at hand. Also, these categorizations always come with the hierarchy levels which extend and get complex over time. In other words, first a human brain perceives certain attributes and then categorizes them based on the relations between perceived attributes. And the categorization is constructed from the highest and to the lowest, namely the form of hierarchy (Edelman, 2004).

Design concept takes the similar form with concept in general. Simon Herbert, a pioneer of design researcher from the field of architectural design, explains design problem is structured in a hierarchy, or a form similar to other complex system in nature such as molecules-atoms-nuclei-and electrons. In design thinking, designers rapidly travel these levels of hierarchy and constantly search for new ideas on each level (Simon, 1969).

In the field of design, the term “design concept often with an emotional or abstract terms such as romantic, classy, or modern. Designers sometimes use as a substitute for “inspiration” or “atmosphere” of the whole visual image. We consider that a design concept is manifested in integrated images what various design elements make. Accordingly, those images evoke a certain feeling. Therefore, the design concept would be technically generated from the combination of design elements used for the design product.

4. Sketching reflects design thinking process

Sketches are the language of a designer. Designers utilize sketches to not only represent the final outcome to others but also develop their ideas through so-called draft sketches. A final sketch tends to be drawn accurately, and a draft sketch is often hard to be recognized by others without a designer’s additional explanation because it is used to communicate with a designer himself rather than others.

Sketching activities are known as a useful method for generating visual ideas. Goldschmidt(2002) has described the sketch as a “designer’s thinking tool.” Schon and Wiggins (1992) have empirically captured that a designer puts ideas down on the paper and observes them, and then he discovers satisfying new features of design idea. Along with that,

Goldschmidt(1991) has investigated the children’s sketch process and found that designers crystallize ideas through sketches, or has a conversation between sketches and self. Since sketches are a window of designer’s thinking process, many design researchers have tried to look into the sketch process to understand design process (Kavakli & Gero, 2002; Suwa, et al., 2001; Gero & Tang, 2001).

5. Design elements, principles, and features

Design elements and principles are fundamental rules for designers in all fields, and this also applies to an apparel designer. Basic elements and principles are often shared across most visual design disciplines, but sometimes the characteristics of each are vary depending on their own domain and categorized as needed. In the field of apparel design, Davis(1996) defines the theory of basic design elements for apparel design as space, line, form, light, color, texture, and pattern. Design principles for fashion design are repetition, parallelism, sequence, alternation, gradation, transition, radiation, concentricity, harmony, rhythm, contrast, emphasis, and proportion. When creating an apparel design, a designer constantly manipulates design elements in varying ways to based on design principles (Davis, 1996).

Rather than design elements and principles, the term design feature or design style feature may often used for the communication among apparel designers. Design feature is intriguing visual elements or combination of them in clothing. Ellinwood (2011) explained design features as five components: silhouette, fabric, color, looks, and detail. Design features could be a set of new elements and principles invented by a designer at the moment of idea generation, or existing style (i.e. empire style, A-line, draping, punk look, cowl neck line, and French cuffs).

Ultimately, designer often extensively juxtapose new and existing features, and create new designs using combinations of design elements and principles during the idea development process.

III. Research Methods

1. Research Aim

The aim of this research is to scrutinize how a professional apparel designer generates design concepts

through the process of exploratory hand sketches. The broader aim is to understand the creative process of apparel design.

2. Experimental Study

This research follows a quasi-experimental method in order to capture the full idea sketch process of apparel design as closely as possible what a designer would normally do in a studio. A stimuli-based design experiment was conducted with a professional designer in a design studio setting.

1) Participant designer

The participating designer is currently working as a director of the high-end luxury brand in New York City, and has with 4 years of formal fashion design education and 7 years of industry experience. The participant was not informed the details about the experiment except that this design experiment is to understand the creative process or apparel design, and how designers design.

2) Design task

The design task consisted of three parts: a pre-design interview, a design session, and a post-design interview. In the pre-design interview of about 10 minutes, designer responded to an open-ended questionnaire about his background information including the number of years of fashion design education, design classes taken, the number of years of industry experience, and current target customers at work. During the design session, the designer was asked to design, by hand sketching, a small contemporary womenswear collection containing five outfits in full color. At the beginning of the design task, the designer selected an image he found most interesting as a source of inspiration from among six options. These six images were carefully selected from the several visual images by soliciting design students' opinion prior to this design experiment. The designer was given 4 hours total and was told that time was flexible. Various drawing materials, such as a croquis of fashion figure, color pencils, markers, pens, and paper were provided. The experimental environment was kept as clean and simple as possible in order to prevent the designer from perceiving inspiration from the other sources. In addition, the designer also was told not to directly recall and apply anything he has seen in other fashion designers' collections,

and to focus as much as possible on selected visual source. He also asked to verbalize thoughts but was not required in order to minimize interruption of creative activities. There was no specific target market designated in order not to add further constriction for a designer's creative process. During the entire design process, the researcher closely observed from the computer screen in adjacent observation room. The camera was installed at the ceiling of the design task room and also connected to the computer screen in the observation room. While the designer was working on the design task, the researcher developed open-ended questions based on his sketch activities. In the post-design interview of about 30 minutes, the researcher asked the designer these open-ended questions, pointing out specific parts of sketches while referring to the draft and final sketches in front of him. This interview was conducted immediately after the design session to clarify the design sketches and the concept that emerged during the process while the experience was still fresh in the designer's mind.

3) Discussion of This Research Method

(1) Recruiting a participant designer

An ideal participant for this study would be recruiting a master level of designer such as an internationally well-known designer in order to increase the validity of the design result. However, recruiting a participant designer is extremely hard. It is even more challenging if the designer asked to reserve five straight hours without compensation while working overtime and weekends is common in fashion industry. The master fashion designer is hard to involve this type of research with any reason. Furthermore, some professional designers are reluctant to share their design process and original sketches since those are valuable assets for them. Therefore, this study sets the parameter as 7 years of fashion design industry experiences, and we believe that 4 years of education and 7 years of industry experiences are enough time to be a professional level.

(2) Selecting the source of inspiration

Selecting the source of inspiration was one of critical issue in this experiment. The inspiration image needs to be interested enough the designer produce enough ideas that would lead to satisfying outcome without feeling the shortage

of ideas. Therefore, the source of inspiration was carefully selected. Six given images includes various categories such as an image of a historic building, a famous impressionist painting, human figure with an animal, nature, a modern building, and still object. These images were carefully chosen among several images by soliciting design students' options.

3. Analysis Procedure

The analysis was twofold: 1) the analysis of the final concept of finished collection, and 2) the analysis of concept developmental process of the idea sketches.

Examining the final concept of the finished collection tells us what the designer was trying to generate during the idea sketching process. The designer may not foresee or plan for the final result of collection at the time he starts this design task. However, he may envision the final result subconsciously or vaguely as proceeding the idea sketch process. The analysis of the final concept provides the guideline to categorize the each actions he made during the idea sketching process.

1) Final Design Concept

First of all, the researcher retrieved the salient design features (e.g. a diagonal line, strips, tight fit) used in the entire design process. It is significant that the description of design features is taken exactly from the designer's comments on his own sketches during the post-design interview. Secondly, the sketches of 6 finished outfits were described by these retrieved design features, and these design features were coded for the simplification. Third, these design features were categorized into three different types according to the dimensionality in which it existed (Table 1).

Table 1. Design features according to dimensionality

Situated	Dimension	Description	Examples
1D	Level 1 Line	A design featur without any enclosed space to define a shape	Diagonal line, V-line, Vertical line
2D	Level 3 Texture/Surface	A surface or texture of a shape	Print, Embroidery, Pleats, Color
	Level 2 Shape	A design feature for a flat space enclosed by a line, and a form represented in a two dimensional format in sketches	Square, Belt, Collar, Circle
3D	Level 4 Form /Silhouette	A design feature for a volume which described a tightness or looseness of design	Skin tight, Flare

2) Idea sketching process: developmental process of design concept

Based on the analysis of the final concept, a sequence of pencil draft sketches was examined. Each action of idea sketch process were carefully traced and described: The appearances and the changes of design features. Finally, the sequence of design concept development was illustrated and analyzed based on the linkage of the final concept of the finished collection from the analysis of 1).

IV. Result

The participant designer selected the image of Notre Dame Cathedral as a source of inspiration and drew a total of 17 draft sketches with a pencil and 6 final sketches using color markers. He spent approximately 3 hours to complete the given design task.

1) Analysis of Final Design Concept

The design features retrieved from the post-design interview were assigned to each outfit of final collection.

Table 2 presents six final designs of finished collection and design features which the designer mentioned to describe each design. These design features then categorized by the situated dimension. After categorizing by dimensions, the design features were again divided by the area of outfit (Table 3). In this table, the design features were coded into alphabets in order to easily recognize the difference between designs. From the categorization of final concept (Table 3), each design can be seen as combination of design features. The designer creates a certain visual image by manipulating each level of design features and the way to group them. For instance, the upper area of design 1 consists of horizontal stripes, fur plush, lace, brown and skin color, circular shape, voluminous, and uptight design features. This specific combination of these features composes his intended visual images. His intended visual images sometimes expressed as a feeling of the image such as "a melancholy girl" or "a cool girl" in his post-design interview. These feelings of the intended image may provide the guideline for him to navigate the idea. However, regardless with the feeling of the image, the combination of the features in areas reveals the systematic concept arranged within collection. If observed carefully one by one, certain set of combinations

are repeated, or changed as adding or deleting one or two features. For example, from the upper of design 1 to design 2, everything is same except that the circular shape(C) is changed to rectangular shape(R), and skin color lace (S, L) is added. Another example could be the bottom of design 5 and the upper of design 6. These two areas consist of exactly same design features except light blue color.

All features of design 5 repeatedly place in the upper area of design 6 except the color change. Many other examples can be found in table 3. Overall, the designer combines various design features situated in different levels to create an intended image, and he also systematically arranges these features in levels by editing and replacing the combinations to create the design concept.

Table 2. Design features which used as final concepts in finished collection

		Design 1	Design 2	Design 3	Design 4	Design 5	Design 6	
Finished Collection								
	Level 1	Line	Horizontal stripes Diagonal line	Horizontal stripes	Horizontal stripes Diagonal line	Horizontal stripes Diagonal line	Horizontal stripes Diagonal line	Horizontal stripes Diagonal line
	Level 2	Color/Texture	Lace, Fur plush, Flat/matte wool, Charmeuse Brown, Skin, Lt blue, Black.	Fur plush, Flat/matte wool, Charmeuse Brown, Black, Lt blue	Fur plush, Lace, Charmeuse Brown, Lt Blue, Skin	Fur plush, lace, Flat/matte wool, Charmeuse Brown, Lt Blue, Skin	Charmeuse, Lace Lt blue, Skin	Charmeuse, Lace Skin
	Level 3	Shape	Circular shape Under-wrapping	Rectangular shape (Grid) Repetitive shapes (Belt)	Circular shape (Donut) Under-wrapping Two-layers	Circular Shape (Donut) Inset Two-layers Rectangular shape (Belt) Under-wrapping	Two-layers Rectangular shape (Belt) Under-wrapping	Triple layers Under-wrapping
Level 4	Form	Volume Drapery Uptight (Cigarette slim) Looseness	Volume, Looseness	Volume, Looseness Drapery Asymmetry form	Volume, Uptight Drapery Asymmetry form	Uptight, Drapery, Asymmetry form	Uptight, Drapery Asymmetry form	

2) Analysis of Idea Sketching Process

During the idea sketching process (17 drafts in a pencil), the designer tests the various combination of design features. Before getting to the final concept of the finished collection, the designer constantly applies a new combination of design features as drawing new ideas, and evaluate whether this combination meets the intended feeling of image in his mind. Although it is unable to capture what the designer thought every minute of evaluation process, this idea sketching process reveals which combinations of design features are tested and navigated until the end of the design task.

Table 3. Categorizing coded design features by the area of outfits and the level of dimensions

Area of outfit	Design 1	Design 2	Design 3	Design 4	Design 5	Design 6	
Upper	L1	H	H	H, D	H,	D	H, D
	L2	F, L, B, S	F, B	F, L, CH	F, W, B, S	CH, LB	CH, L, S
	L3	C	R	C, U, T, B, S, LB	C, I	T, R, U	TR, U
	L4	V	V	V, UT, LS, DR, A	V, UT	LS, DR	UT, DR, A
Inner	L1	D					
	L2	CH, LB	CH, B				
	L3	U	RP				
	L4	LS	LS				
Bottom	L1				H, D	H, D	D
	L2	W, BL	W, LB	W, S	L, CH, LB, S	L, CH, LB, S	CH, S
	L3				T, U	T, U	TR, U
	L4	UT			UT, DR, A	UT, DR, A	DR, A, LS

(Level 1 - Line): H (Horizontal Stripes), D (Diagonal Line)
 L2 (Level 2 - Texture/Color): L (Lace), F (Fur Plush), W (Flat/matte Wool), CH (Charmeuse), B (Brown), S (Skin), LB (Lt Blue), BL (Black)
 L3 (Level 3 - Shape): C (Circular shape), RP (Repetitive shapes), U (Under-wrapping), R (Rectangular shape), T (Two-layers), I (Inset) TR (Triple-layers)
 L4 (Level 4 - Form): V (Volume), DR (Drapery), UT (Uptight), LS (Looseness), A (Asymmetry form)

*Design 5 and 6 are dresses (continuous form from top to bottom)

Table 4 represents the key design features tested in each idea sketch with idea sketch data, and Table 5 shows codes assigned to these features in order to recognize the trial and error process of combination. In Figure 1, several combination of design features are identified which also

appeared in the final concept (Circles in red). Among the red circles, some combinations of features are often partially appeared in the final concept, and other combinations such as sketch #10, #14, and #16 are exactly same with the final concept.

Figure 1. Concept Development Process

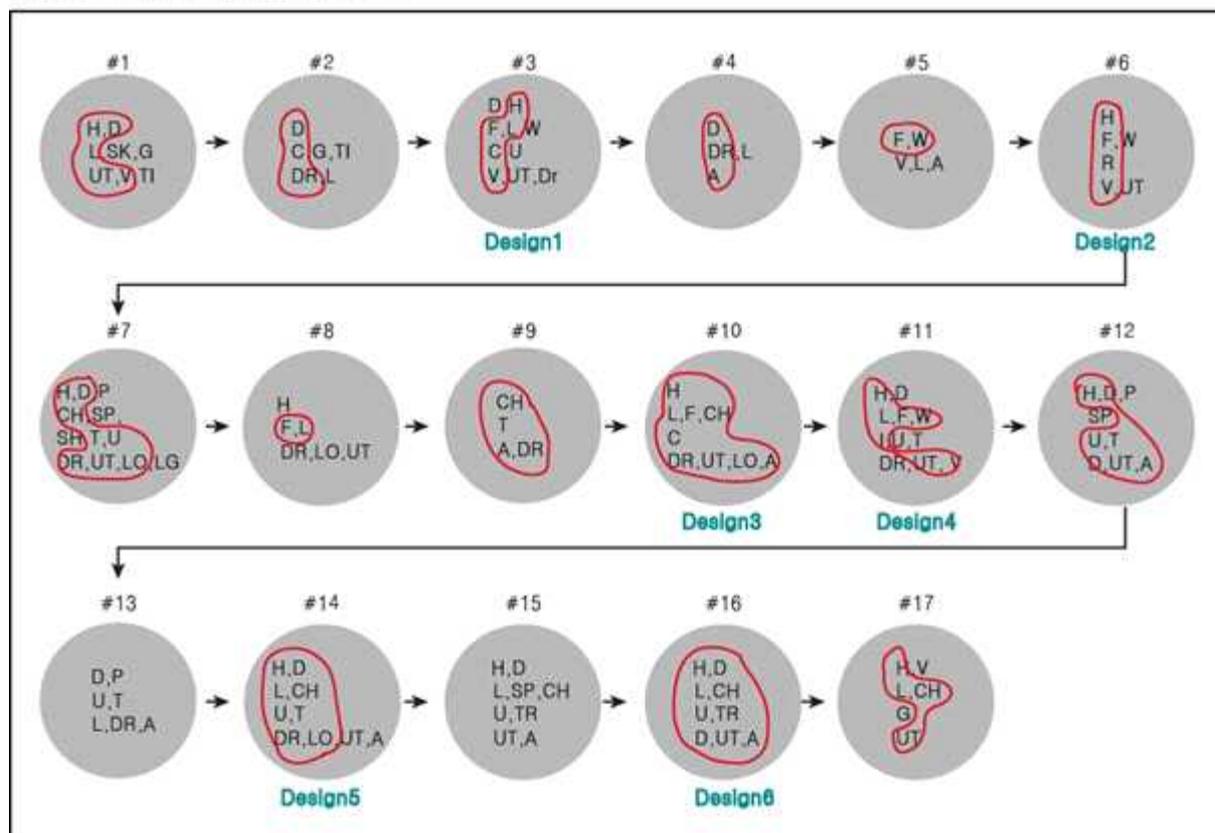
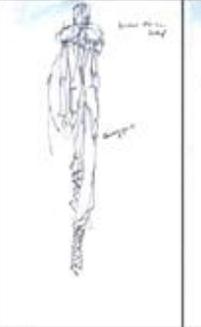
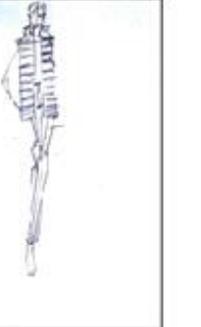
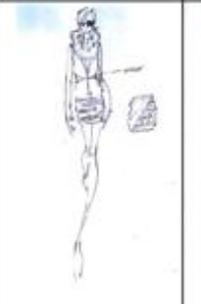
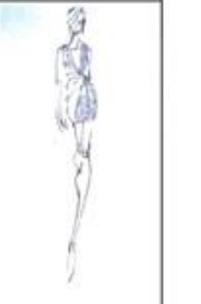
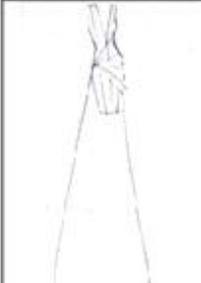


Table 4. Idea Sketching Process

					
#1 L1: Diagonal, Horizontal. L2: Lace, Silk Tulle, Gathers L3: Tie-up, Under-wrapping L4: Uptight, Volume	#2 L1: Diagonal L2: Charmuese, Gathers L3: Tie-up L4: Drapery, Long, Asymmetry, Looseness	#3 L1: Diagonal, Horizontal L2: Fur, Lace, Wool L3: Circular Shape, Volume, Uptight, Drapery, Under-wrapping.	#4 L1: Diagonal L4: Drapery, Looseness, Asymmetry	#5 L2: Fur, Wool L4: Volume, Looseness, Asymmetry	#6 L1: Horizontal L2: Fur, Wool L3: Rectangular, L4: Volume, Uptight
					
#8 L1: Diagonal, Horizontal, Princess L2: Small pleats, Charmuese L3: Sweat heart, Two-layers, Under-wrapping L4: Drapery, Uptight, Looseness, Long	#8 L1: Horizontal L2: Fur, Lace L4: Long, Drapery, Uptight	#9 L2: Charmuese L3: Two-layers L4: Asymmetry, Drapery	#10 L1: Horizontal Stripe, L2: Lace, Fur, Charmuese, L3: Circular shape L4: Drapery, Uptight, Looseness, Asymmetry	#11 L1: Diagonal, Horizontal L2: Lace, Fur, Wool L3: Inset, Under-wrapping, Two-layers L4: Drapery, Uptight, Volume	#12 L1: Diagonal, Horizontal, Princess L2: Small pleats, L3: Under-wrapping, Two-layer L4: Drapery, Uptight, Asymmetry
					
#13 L1: Diagonal, Princess L3: Under-wrapping, Two-layers L4: Long, Drapery, Asymmetry	#14 L1: Diagonal, Horizontal L2: Lace, Charmuese L3: Under-wrapping, Two-layers L4: Drapery, Looseness, Uptight,	#15 L1: Diagonal, Horizontal L2: Lace, Small pleats, Charmuses L3: Under-wrapping, Triple-layers L4: Uptight,	#16 L1: Diagonal, Horizontal L2: Lace, Charmuese, L3: Under-wrapping, Triple-layers L4: Drapery, Uptight, Asymmetry	#17 L1: Vertical, Horizontal L2: Lace, Charmuese L3: Grid L4: Uptight	

V. Conclusion

This paper attempts to reveal how a professional designer develops a design concept in creative apparel design process through experimental study method. Although an apparel designer often describes “a design concept” with the vague term, we consider that a design concept is manifested in integrated images what design elements make. Accordingly, how design elements are generated and developed during the idea development process and in the final designs was examined in detail in this paper.

Firstly, from the empirical data, we observed that the final design concept is organized in hierarchical order. The final design concept could be categorized by the situated dimensionality, and with this analysis we recognized that the designer subconsciously arrange the set of design elements in particular order. These findings are consistent with a concept development theory in the field of the cognitive science. The way human thinks or learns about concept in general is to organize the related sub-elements under the condition of the hierarchical relation. Secondly, from the idea sketch process (drafts), we found that the designer constantly explored the various options of design elements resigned in each level of the hierarchy. The designer tested the several combinations of design elements by adding and deleting to the sketches, and navigated the direction to go depending on the evaluation of the sketch in hand until arriving at the end concepts. To sum, the designer generates the various combinations of design elements organized in hierarchy sketch by sketch, tests as editing these elements, and evaluate the suitability for the final design concept.

It is significant that this study investigates the creative process of apparel design while only little research has been studied with this topic in the field of apparel. The research method was adapted from other design field and modified suitable to the fashion design process. In addition, this study uniquely captures the design strategies which a professional fashion designer employs from the beginning to the end, and analyzed how designer solve the design task in minute detail. This could provide the experiences to researcher as well as practitioners as if they directly observe the design task.

This study is intended as a pilot study for the further research. The primary value of this study is to define a set of issues to be explored for the future research. Therefore,

this study limited with one case in order to observe as detail as possible. The future work which could improve this study includes study with larger number of participant designers, and aligns participants' concepts side by side to compare the differences and similarity in developing ideas. Furthermore, the quantitative research and statistical analysis could be possible if an experiment strategically designed for the certain part of design process.

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