A STUDY OF FASHION AESTHETICS AND EVOLUTION USING WEB-BASED 3D MODELS

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A Study of Fashion Aesthetics and Evolution Using Web-Based 3D Models

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CERTIFICATE OF ORIGINALITY

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Xing TU

MARCH 2017

Dedicated to my family

ABSTRACT

Fashion styles often catch on and become popular, but very rarely know about why and how styles of fashion clothes die out or disappear. Some fashion styles may come back in the future and some of them may die out. It seems intuitive that changes in adverting, technology, celebrity or institution lead old fashion style to be replaced with new ones (Rogers, 1995; Pesendorfer, 1995).

These factors make it temping to infer that the decline of the old style to be replaced by the new one. Fashion cycle and evolution similar to vacancy chains (White, 1970), where new or popular items fill the vacuum left when old or unpopular items go off.

To analyse the internal and external principle for fashion evolution, fashion evolution data have been taken from VOGUE magazine by counting different fashion styles appearance frequency. After data collected, survival analysis was applied to detect the relationship between adoption velocity and fashion evolution. The result shows that fashion adoption velocity quickly increased in popularity die faster. Fashion adoption velocity generally increased in popularity maintain their evolution cycle longer.

To analyse the correlation with different fashion styles, factor analysis was applied, this analysis can categorized different fashion styles by common factors. From this study, it’s clear that fashion style evolution can be categorized as different evolution models. The result shows that fashion styles might classified into 5 types of fashion evolution.

External factors: function, sexual attractiveness, beauty and comfort are contribute to the fashion evolution. By using computer evolution system, the viewers were asked to rate for those external factors. According to the factor analysis, function and comfort are common in wearing factor; attractiveness and beauty are common in appearance factor.

The data have been used for correlation analysis to find the correlation between wearing factor and appearance factor. The result shows those correlation highly influence on the popularity of certain types of clothes.

PUBLICATIONS

Referred Journal Publications

1. **X. Tu**, *Product Semiotic Design and Emotion.* Art Observation, 2015.02.

2. **X. Tu**, *Velocity Adoption and Fashion Evolution.* Design Research. 2014. 10.

3. B. Q. Xiao, **X. Tu**, W. Ren and Z.C. Wang, *Modeling For Hydraulic Permeability and Kozeny-Carman Constant of Porous Nanofibers Using a Fractal Approach.* Fractals, 2015. 23

Conference papers

1. **X. Tu**, W.S. Liu, *A Semiotic and Aesthetic Study in Fashion Evolution.* Conference of the International Journal of Arts & Sciences, 2015 Volume 08, Number 01, 2 – 5 Dec 2014, Freiburg, Germany.

Design Works

1. **X. Tu,** *3D Model.* Art Research, 2013. 219

2. **X. Tu,** *Model.* Art Observation, 2011. 137

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CHAPTER 1

INTRODUCTION

1.1 Background

Fashion styles often catch on and become popular, but very rarely know about why and how styles of fashion clothes die out or disappearing. Some fashion styles may come back in the future and some of them may die out. What leads fashion evolution/cycle to be long-term or short-term? Researchers have long been interested in understanding why such fashion styles succeed.

It seems intuitive that changes in adverting, technology, celebrity or institution lead old fashion style to be replaced with new ones (Rogers, 1995; Pesendorfer, 1995). These factors make it temping to infer that the decline of the old style is replaced by the new one. Fashion cycle and evolution similar to vacancy chains (White, 1970), where new or popular items fill the vacuum left when old or unpopular items go off.

But different fashion styles have their own rules in fashion trend. Each single style has its own rate to become popular and die off. Some of them may come into fashion again in the future, while some of them appear in fashion market just like “flash in the pan”.

In addition, focusing on external factors neglects the possibility internal dynamics, consumer psychology and emotional behavior may lead the fashion trend. Because people prefer some differentiation, fashion styles that become too popular may be abandoned or disappeared due to lack of uniqueness. (Lieberson & Lynn, 2003; Leibenstein, 1950; Snyder, 1980) Psychology of consumer emotional behavior may influence fashion aesthetics and fashion evolution. Function, beauty, comfort and sexual attractiveness are considered as the key features related to consumer emotional behavior.

1.2 Research Methods

Through classifying, assessing, analysing the data of different clothes styles frequency of appearance in 20 years’ Vogue magazines (French Edition, 1987-2006), this research initially found out that clothes styles which adopted quickly will die faster. The Vogue magazine has been popular over a century, the first edition of Vogue magazine was published on Dec. 17, 1892. (Hill, 2004) It could be the van of fashion trend.

To further demonstrate this finding, this research introduced the method of 3D female body model creation. Through a series of calculation by using Survival

Analysis and related assessments to find out the internal relations between velocity of adoption in fashion evolution and psychology of consumer emotional behaviour.

Survival analysis gives a descriptive overview of the data analytic approach. It is a popular approach adopted in certain kinds of data analysis. (Kleinbaum & Klein, 2011) This paper tries to use Survival Analysis to analyse the data collected in the fashion evolution research.

1.3 Statement of the Problem

This research collected the fashion evolution data by counting the clothes appearance frequency from VOGUE magazines. The data shows that every single fashion style has their own rate to become fashionable or die out. Fashion items adoption velocity may imply the internal principle of fashion items evolution. Survival analysis helps us find the internal principle between fashion evolution and adoption velocity.

After data collection from the VOGUE, we realized that fashion data should have enough popularity appearance each year, the quantity of valid data must be guaranteed. We did not count the fashion data if their average proportion of data are less than 0.5% of the total image we collected as they may cost inaccurate results.

In the previous research, we found that some fashion clothes may have similar fashion cycles. Some of the clothes fashion cycle alternated with another.

The fashion items involved in this research may have common factors which will help find out the relations with evolution of different styles of clothes.

Psychology of consumer emotional behavior is the important aspect affecting fashion consumption and fashion evolution. Function, comfort, sexual attractiveness and beauty are the key elements highly related to consumer emotional behavior. 634 people were involved in this research and rated based on four indexes: function, sexual attractiveness, comfort and beauty. The statistical results were used to evaluate how consumer emotional behavior affected fashion evolution.

1. 4 Research Objectives

The objectives of this research are two folds. The first is to find out the inner principle of fashion evolution. The second is to investigate internal relations between the principle of fashion evolution and psychology of consumer behavior.

The specific objectives of the study are as following:

- Create a fashion clothes database through collecting images from Vogue magazine in 20 years for survival analysis to get the velocity of adoption in fashion styles.
- Collect data for assessment to evaluate the feasibility of the method. Invite a selected group of people; ask them to mark the four indexes: function, beauty, comfort, sexual attractiveness in random selected single fashion clothes pictures.

- Develop 3D female model assessment platform for rating to collect accurate and rational data for survival analysis.

- Analyse the internal relations between velocity of adoption in fashion evolution.

- Classify the different fashion style evolution

- Psychology of consumer emotional behavior research by correlation analysis

1.5 Scope of Research

The scope of this research is to investigate the internal relations between velocity of adoption in fashion evolution and psychology of consumer emotional behavior. Collect data of fashion clothes pictures in 20 years' Vogue fashion magazines for surviving analysis to obtain the velocity of adoption. In the pre-assessment phase, 634 viewers from Shenzhen University involved in this research to assess pictures of fashion clothes and mark the four indexes: function, beauty, sexual attractiveness and comfort. Computer generated 3D female body models with varying body parameters and clothes will be the stimuli of this study.

These computer-generated models will be viewed and assessed by the same group of viewers in the pre-assessment phase. Same four indexes: function, beauty, sexual attractiveness and comfort will be marked and data will be collected.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

Relevant to the research, the literature review focused on the fundamentals of fashion related elements, as fashion clothes classification, fashion evolution, body proportion, and body shape measurement. Survival analysis, psychology of consumer, and consumer emotional behavior are reviewed as the key parts in the study.

In this Chapter, the literatures are reviewed and grouped in the following:

- Fashion clothes classification
- Fashion evolution study
- Body proportion and body shape measurement (Golden Ratio, WHR, BMI, and VHI)
- Velocity of adoption research (Survival analysis, Kaplan–Meier

estimator, Cox regression, Confidence interval (CI)), Hazard Ratio (HR))

- Psychology of consumer emotional behavior

2.2 Fashion Clothes Classification

One of the main objectives in this research is to investigate the adoption speed of different fashion clothes. Loschek (2009) pointed out in a similar way to art, in fashion means the attention of the viewer is captured. Clothing is a 'second skin' and fashion is the dressing of clothing. Fletcher (2008) demonstrated fashion clothes are used to signal who and what we are, to attract or repel others. There are plenty of varied fashion clothes in the industry. Sumathi (2010) listed in the fashion terminology that modern clothing can be categorized as jeans, pullover, sweater, lingerie, sailor, pants, top, wrap coat… etc. In the 2001 CEX Purchase Events and Category Share for Adult Clothing Category Expenditures, Clothing is classified as coat, jacket, sports coat, suit, vest, sweater, pants, jeans, short, dress, skirt, shirt, blouse, top…etc. (Cho 2007) Stalder (2008) explores different clothing items in categories of Tops, Pants, Skirts, Dresses and Coats. Combined the clothing category published by the International Textile and Apparel Association, in this research, clothes are classified into four main categories: top, bottom, skirt and dress.

2.3 Fashion Evolution Study

Fashion has been considered a product of social class can be traced back to 18th century. Individuals of lower social status copied those of perceived upper status in any aspects. A fashion therefore arises. When a certain traits became prevailing, the upper class abandoned the trait quickly to differentiate themselves from the lower class. In consequence, lower class quickly followed, and abandoned the traits too, bring an end to the fashion cycle. (Acerbi, Ghirlanda, Enquist, 2012) Stecker agrees on that due to wealth and positions of influence, the wealthy class generally was the first to establish and spread new trend but some trends were simplified to suit the practical requirements of working class. (Stecker, 1996)

In relation to this research, the literature review of fashion evolution mainly focused on between 1980s to 2000s. The fashion of 1980s was diverse and changeable; no single specific style dominated the industry. This decade starts with Punk, and around the same time, a multi-layered look of Japanese started to emerge as a new force. The style of Italian was another strong influence carried on into the 1990s while numerous new styles of dressing were created and picked up by different groups. Lady Diana Spencer's short hair, ruffled collar, flat shoes style once became fashionable for a time among people. Step into the 21st century, the nervousness about the end of century, combined the worldwide economic recession of the early 1990s, a new conservatism came out. People tend to dress in simple and innocent. (Stecker, 1996)

2.4 Body Proportion and Body Shape Measurement

Body proportion is widely used in art, measurement, or medicine. It is a significant variation in describing the ideal body figure. Horn (1981) described the 'average' figure in terms of a classical ideal figure as: approximately 7 1/2 heads high, with the fullest part of the hipline at wrist level dividing the total length exactly in half. The neck is about one-third the length of the head, and the shoulder line slops a distance of a half head length from the level of the chin. The fullest part of the bust or chest is located 2 head lengths from the crown, and the smallest part of the waist (Which coincides with the bend of the elbow) is two and two-thirds heads from the crown.

The Greek nude female figure was regarded as the classical ideal figure. This figure was defined as perfection of proportion, with the same unit distance between breasts, from breasts to navel and from navel to division of the legs. (Roach & Eicher, 1973).

Evolutionary psychologists focus on body shape which measured by the waist-to-hip-ratio, or body mass index. The evidence pointed that these indexes being the dominant cue for female physical attractiveness. (Kindes, 2006)

2.4.1 Golden Ratio

In mathematics, gold ratio is an irrational number defined to be (1+√5)/2. It also called golden mean, the golden section, the golden cut, the divine proportion. The first known book devoted to the golden ratio is published in 1509, illustrated by Leonardo da Vinci. (Dunlap, 1997)

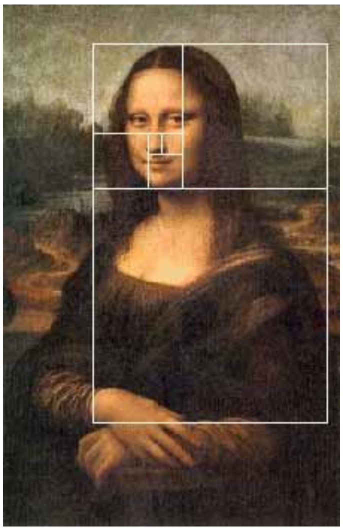
The definition states the golden ratio is 'In arts and mathematics, two quantities are in the golden ration if the ration of the sum of the quantities to the larger quantity is equal to the ration of the larger quantity to the smaller one.' Expressed algebraically as following:

$$\frac{a+b}{a} = \frac{a}{b} \stackrel{\text{def}}{=} \varphi$$

The Greek letter phi φ represent the golden ration, the proportions were expressed as a mathematical formula that divided the perfect face into a ratio of 1:1.618 (Bates & Cleese, 2001)

$$\varphi = \frac{1+\sqrt{5}}{2} = 1.6180339887\ldots$$

Many artists and architects have noticed that golden ratio is the idea linear perspective to the aesthetically pleasing and proportioned their works approximate to this figure. Leonardo da Vinci (1451-1519) who founded the golden ratio gave the painting a more appealing look. In his most famous painting ‘Mona Lisa’, (Picture 1) the elements of her face and upper torso show the principle of golden ratio.



Picture 1 Mona Lisa Leonardo da Vinci c.1504

Source: Walser (2001) The Golden Section

The Vitruvian man (Picture 2) is a drawing by Leonardo da Vinci in 1458. It is another perfect example of golden ratio illustration. This image shows that Leonardo combined art and science during his time and provided the perfect example of his keen interest in body proportion.

Picture 2 The Vitruvian Man (c. 1485) Accademia, Venice

Source: www.transpersonal-web.com

Golden ratio was developed by mathematicians, and has been used in many different social activities, such as painting, scripture, and architecture, etc. This formula was also widely used to present body proportion of human in art and printing because it stands for balance and beauty in the history of Greek. (Wizardry M., 1995). However, Golden ratio is a linear measurement that may not identify and explain whole women body proportion. For deeper understanding women physical shape, the figures of breast, waist, and hip are also need to be considered.

2.4.2 Waist – Hip Ratio (WHR)

The concept and significance of waist-hip ratio (WHR) as an indicator of attractiveness was first theorized by evolutionary psychologist Devendra Singh at University of Texas in 1993. (Buss, 2003). WHR is the ratio of the circumference of the waist to that of the hips. (Singh, 1995)

WHR originally used as an indicator to measure the human health. The researcher discovered that people who carry more fat on waist may face more health risk than the people who carry fat on hips. (Buss, 2003)

Singh (1995) who found the waist-hip ratio offers a significant measurement of female attractiveness. In his research, women with a 0.7 WHR are usually rated as more attractive by men in European culture.

Beauty icons Marilyn Monroe and Sophia Loren have or had ratios close to 0.7, even though they have different weight and height, their WHR figures reflect idea body attractiveness. In other cultures, preferences appear to vary according to Fisher & Voracek (2006) and Marlowe & Wetsman (2001) studies, ranging from 0.6 in China to 0.8 or 0.9 in parts of South America and Africa.

From the above research and analysis, it is obvious that the Waist-Hip Ratio (WHR) is a significant measurement of female body proportion. It seems that women with 0.7 WHR are usually considered as the most attractiveness figure, while it may have slightly different depending on the areas people live in.

2.4.3 Body Mass Index (BMI)

Body mass index (BMI) is a traditional technique for estimating overall body weight. (Ferrera, 2005) It is widely used to identify weight problems within a wide range of population. It is easy to define underweight, overweight or obese. It has been found between 1830 and 1850 by the Belgian polymath Adolphe Quetelet during the course of developing “social physics”, which is mainly focused on medical. (Eknoyan & Garabed 2007) The formula below set by the WHO explains that body mass index is divided by the square of the height. Recent research pointed out body mass index also determines the body physical attractiveness. (Kindes, 2006)

$$BMI = \frac{\text{weight (kg)}}{\text{height}^2 \ (\text{m}^2)}$$

Source: www.molium.blogspot.com

The international Classification of adult underweight, overweight and obesity according to BMI (Table 2.1) published by the World Health Organization showed that BMI less than 18.5 is underweight, while BMI more than 25 is considered overweight and above 30 is obese. The figures are indication of health problem, as well as body physical attractiveness preference.

Classification	BMI(kg/m²)	
	Principal cut-off points	Additional cut-off points
Underweight	<18.50	<18.50
Severe thinness	<16.00	<16.00
Moderate thinness	16.00 - 16.99	16.00 - 16.99
Mild thinness	17.00 - 18.49	17.00 - 18.49
Normal range	18.50 - 24.99	18.50 - 22.99
		23.00 - 24.99
Overweight	≥25.00	≥25.00
Pre-obese	25.00 - 29.99	25.00 - 27.49
		27.50 - 29.99
Obese	≥30.00	≥30.00
Obese class I	30.00 - 34.99	30.00 - 32.49
		32.50 - 34.99
Obese class II	35.00 - 39.99	35.00 - 37.49
		37.50 - 39.99
Obese class III	≥40.00	≥40.00

Table 2.1 The International Classification of adult underweight, overweight and obesity according to BMI

Source: http://apps.who.int/bmi/index.jsp?introPage=intro_3.html

The health BMI figure changed in recent years. Women with BMI around 16 were considered more attractive than the normal figure. There is another research done by Swami invited 8000 participants from different countries, asked them which body shape they think is the most attractiveness from the eight women body silhouettes. Women with “slender” and “very slender” bodies were rated as the most attractive. (Swami, 2008)

2.4.4 Volume Height index (VHI)

In a study by Fan et al, 3D images of 31 Caucasian females with varying body weights and BMI ranged from 16-35, were showed to 29 male and 25 female viewers. These viewers were asked to rate their physical attractiveness. The results showed that the body volume divided by the square of the height, defined as volume height index (VHI). (Fan, Yu, Hunter, 2004)

$$\text{VHI} = \frac{Total \quad volume \quad (L)}{Height^2 \, (m^2)}$$

Source: Fan, Yu, Hunter, 2004, Clothing appearance and fit: Science and technology

Volume Height Index (VHI) might be an alternative measure to BMI, which is the most important and direct visual deciding factor of female physical attractiveness. (Cash, 2012, Fan, Yu, Hunter, 2004)

2.5 Velocity of Adoption Research

2.5.1 Survival Analysis

Survival analysis is a collection of statistical procedures for data analysis for which the outcome variable of interest is time until an event occurs.

(Kleinbaum & Klein, 2011). Precisely, it is an analysis of data that correspond to the time from a well-defined time origin until the occurrence of some particular event or end-point. (Collett, 1994) In short, survival analysis typically focuses on time to event data. Cox regression (or proportional hazards regression) analysis and Kaplan–Meier estimator are key calculation methods applied in survival analysis.

2.5.2 Kaplan-Meier Estimator

The Kaplan–Meier estimator, also known as the product limit estimator, is an estimator for estimating the survival function from lifetime data. It is widely used in various industry researches. In economics, it is used to measure the time until failure of machine parts. In medical research, it is used to measure the fraction of patient living for a certain amount of time after treatment. (Kaplan & Meier, 1958)

2.5.3 Cox regression

Cox's proportional hazard regression model is one of the most popular and useful methods used in survival analysis, which was first described by Cox in 1972, and the phrase "Cox Regression" was first found being used in an article in medical literature, and became more widely used in the second half of the

1980s. It requires numerous matrix inversions and multiplication that make it impractical to do by hand even with a calculator. (Cantor, 1997)

2.5.4 Confidence Interval (CI)

Confidence interval (CI) is used in statistics to indicate the reliability of an estimate, which is a type of interval estimate of a population parameter. It is an observed interval, in principle different from sample to sample, that frequently includes the parameter of interest if the experiment is repeated. How frequently the observed interval contains the parameter is determined by the confidence level or confidence coefficient. (Cox & Hinkley, 1974, Kendall & Stuart, 1973)

2.5.5 Hazard Ratio (HR)

In survival analysis, the hazard ratio (HR) is the ratio of the hazard rates corresponding to the conditions described by two levels of an explanatory variable. Hazard ratios are fundamental and essential summaries of survival data, which are the natural summaries of an additive proportional hazard model. (Selvin, 2008)

2.6 Psychology of Consumer Emotional Behavior

2.6.1 Consumer Psychology

Consumer psychology is an interdisciplinary subject area link to psychology, advertising, marketing and sociology etc. And now highly applicable in every aspects of our life. It implies about why and how people engaged in consumer activities and is essential to understanding consumer behavior. (Jansson-Boyd, 2010)

Mullen and Johnson defined consumer psychology as “the scientific study of the behavior of consumers”. (Mullen & Johnson, 1990) Apruebo detailed consumer psychology as the study “deals with the activities involved in selecting, obtaining, and using products, services, and ideas to satisfy needs and desires”. Psychological factors as the internal influence that affect consumer behavior including: attitudes, beliefs, values, learning, perception, and personality. (Belk, et al., 1996) Psychology of consumer behavior study enable organizations to learn how consumers would react to product, service, advertising and promotion; and to understand why they would make the buying decision. (Apruebo, 2005)

Psychology of consumer emotional behavior may influence fashion aesthetics and fashion evolution. The research explored this idea by studying four aspects; function, sexual attractiveness, beauty and comfort which are the key factors in fashion evolution research.

The pursuit of beauty is also in the nature and development of human society; the function of clothing lies not only in protection but also in beauty. (Yang, 2004) Surviving texts from the early Middle Ages described recognizable components of fashion: style, innovation, and sexual attractiveness. Clothing can be used to emphase the wearer's sexual attractiveness. (Welter & Lillethun, 2011; Jones, 2002) Today comfort is considered as fundamental property when a textile product is valued. (Dhinakaran, Sundaresan, Dasaradan, 2007)Park agrees with that the impact of clothing on the wearer's comfort is enormous, and it's the most important consideration in finding a balance between comfort and function when implement more effective clothing design. (Park, 2012)

2.6.2 Emotion in Consumer Behavior

Consumer behavior involving studies of how and why consumers decide to buy products and services. (Chaudhuri, 2006) Contemporary definitions are broader and capture full range of consumer activities. Consumer behavior including all consumer activities associated with consumer's emotional, mental, and behavior responses that determine these activities. (Kaedes, Cronley, Cline, 2010)

The concept of emotion appears early in the psychological theory which is a major topic in James' (1980) and Freudian psychology (1925). Agres et al defined "The emotions are all those feelings that do so change men as to affect their judgments and that are also attended by pain or pleasure" (Hansen & Christensen, 2007) Hansen and Christensen mentioned in their work that early research shows feelings (emotions) actually influence consumer behavior where feelings are used as explanatory variables. Emotions are unconscious, inherited, responses to stimuli in the environment and changes with inner states of needs and cognitive activity. (Hansen & Christensen, 2007)

Penz and Hogg (2011) in their recent research specified mixed emotions play a central role in retailing. They found mixed emotions have an impact on consumers' intention to purchase.

2.7 Research Gap

Although considerable work has been carried out in fashion evolution, only limited work has been done on the relationship of velocity of adoption and fashion evolution. No research was found to investigate the internal relations between velocity of adoption in fashion evolution and psychology of consumer emotional behavior.

This research tries to find out the internal relation between velocity of adoption and fashion evolution by analysing the cumulative survival of fashion clothes through survival analysis in statistic. Meanwhile, by analysing data obtained from research on function, sexual attractiveness, beauty, comfort these consumer psychology related factors, to find out the internal relations between velocity of adoption in fashion evolution and psychology of consumer emotional behavior

CHAPTER 3

DEVELOPMENT OF NEW RESEARCH METHODOLOGY

3.1 Introduction

This chapter is dedicated to describe the collection of fashion clothes data for present research, the protocol for velocity of adoption in fashion clothes assessment and method for data analysis. The fashion clothes data collected from three studies were to ensure the method's feasibility and data rationality. In study 1, pictures of fashion clothes in 20 years' Vogue magazines were taken and classified to create a data base. Kaplan-Meier estimator was used to analyse the velocity of adoption in these fashion clothes' statistical data. In study 2, factor analysis was used to evaluate the data collected in previous research. It grouped the fashion items with similar evolution trend. In study 3, viewers were invited to rate randomly selected pictures based on four indexes related to consumer psychology; a 3D female standard body model with variate was created for evolution and plug in an assessment platform for rating by the same group of viewers. A new method introduced in this research is using fashion clothes appearance frequency data to find the internal principle of fashion evolution research. In this way, we try to investigate the internal relations between fashion evolution and psychology of consumer emotional behavior.

3.2 Fashion Clothes Data Collection

In order to analyse the relation between adoption velocity and fashion evolution, the research used statistical method by counting the yearly frequency of appearance of different fashion clothes in 20 years' Vogue magazine from 1987-2006. Pictures of fashion clothes were taken from every single page of the magazine for counting. Based on the fashion clothes classification reviewed in the literature, the pictures were concluded in four categories, each category contains 17-19 different fashion clothes. (See Table 3.1)

Table 3.1 Vogue fashion clothes category

Tops	Pants	Skirts	Dresses
Princess Vest	Straight	Straight	shift
Blouse	Skinny	Pencil	A Line
Jumper	Boot-cut	A Line	Sheath

Sweatshirt	Flare	Pegged	Bodycon
Military	Wide Leg	Slit	Tent
Peplum	Pegged	Cowl	Empire
Gypsy	Stirrup	Panel Gore	Strapless
Pin Tuck	Pocket Jeans	Godet	Halter Dress
Tuxedo	Bush Pants	Flounce	1- Shoulder
Ruffle Front	Cargo Pants	Trumpet	Apron Dress
Cossack	Sailor Pants	Pleat	Jumper Dress
Smock	Jodhpurs	Prairie	Sun Dress
Sailor	Hot Pants	Layered	Wrap Dress
Tunic	Short	Tulle	Pouf
Polo	Sweat Pants	Round	Slip Dress
Henley	Harem	Handkerchief	Qi Pao
Turtleneck	Palazzo	Wrap	Shirt Dress
	Jumpsuit	Pareo	Maxi
		Sarong	Ball Gown

There are 70 different styles of clothes have been counted their appearance frequency yearly from 1987 to 2006.

The yearly appearance frequency of 70 different styles of clothes (1987-2006 VOGUE) were counted for fashion evolution research. Pictures of fashion clothes were taken from every single page of the magazine for counting. Chart

3.1- Chart 3.70 demonstrate the 20 years' Vogue fashion clothes frequency of appearance.

Chart 3.1

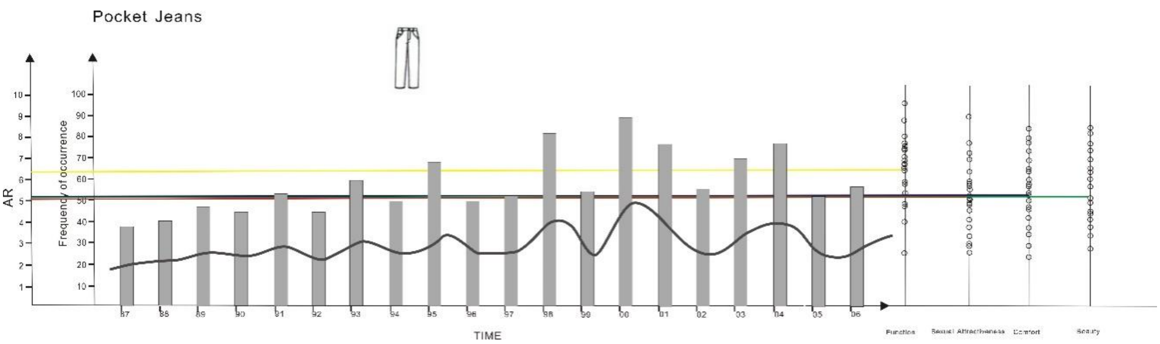


Chart 3.2

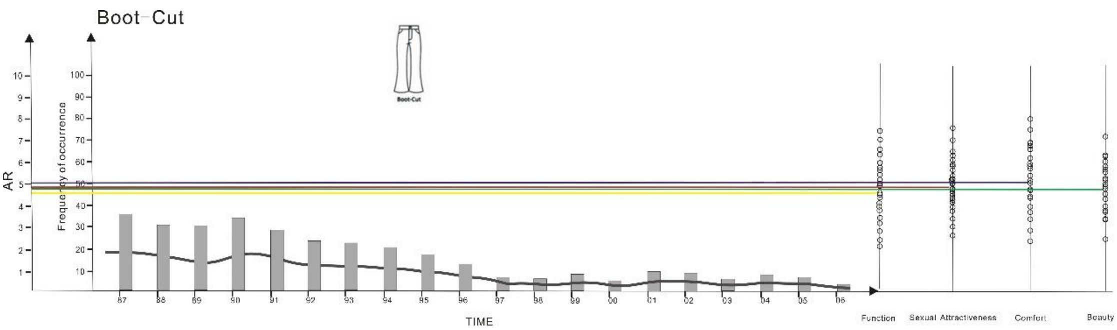


Chart 3.3

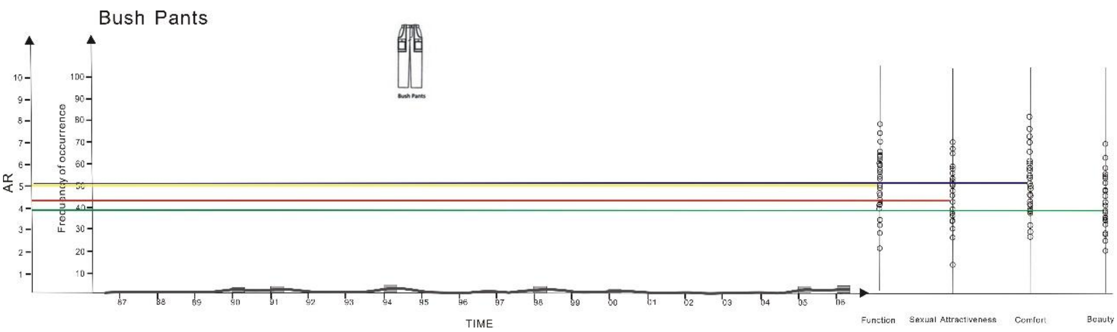


Chart 3.4

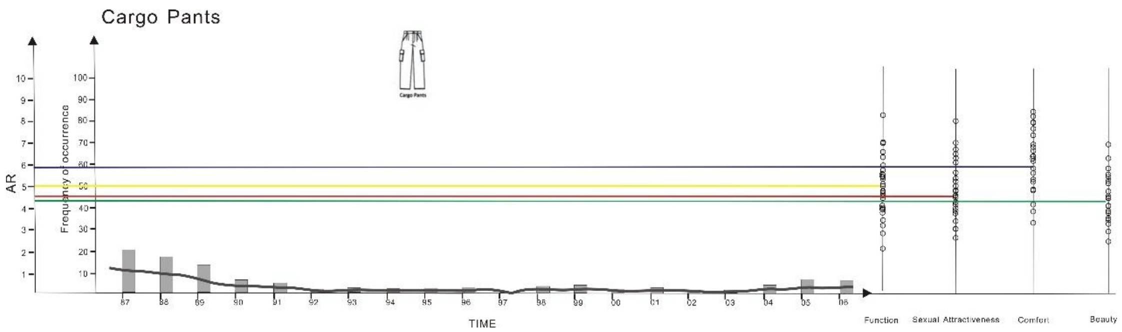


Chart 3.5

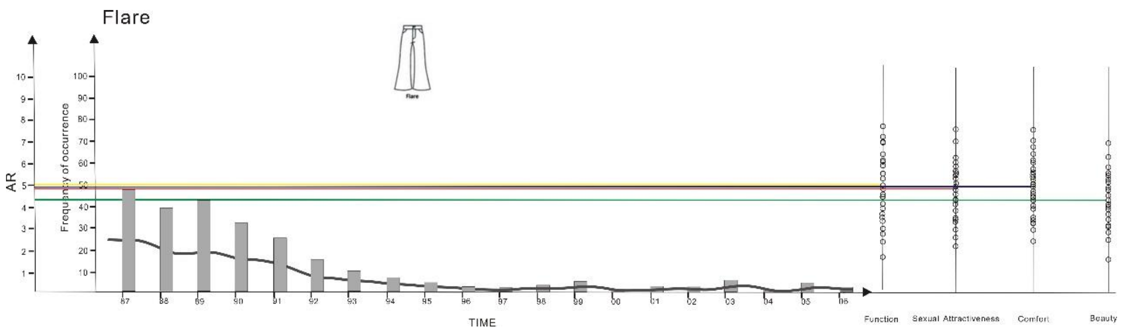


Chart 3.6

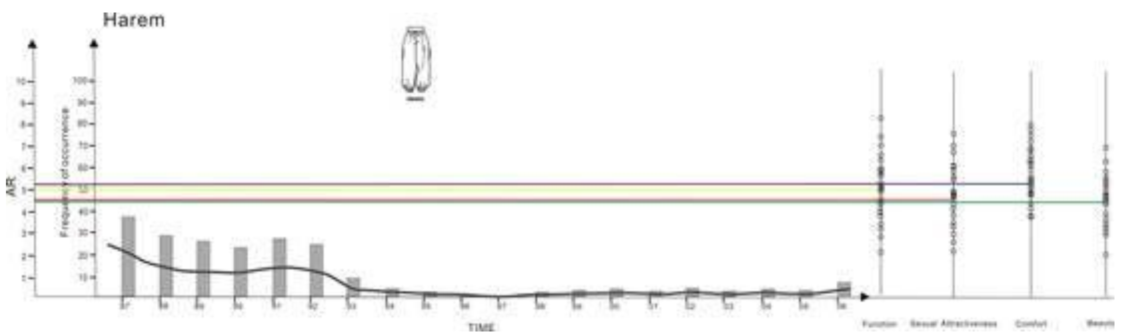


Chart 3.7

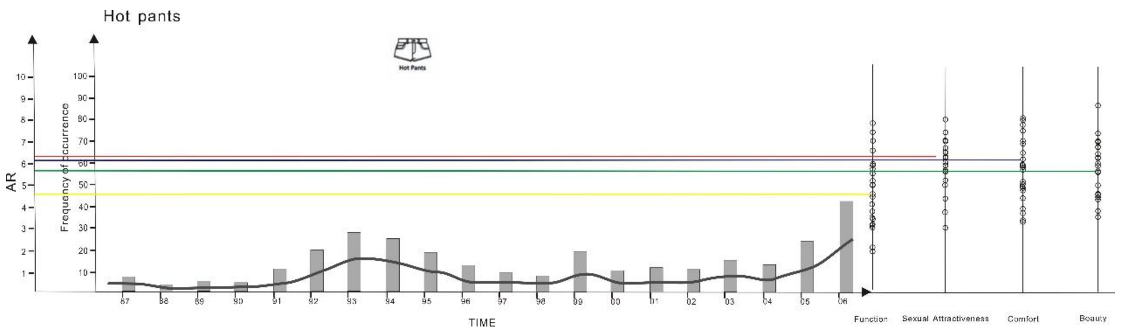


Chart 3.8

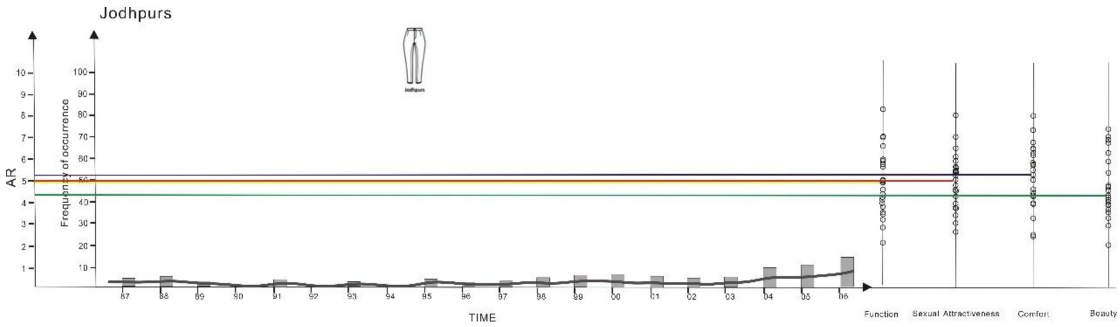
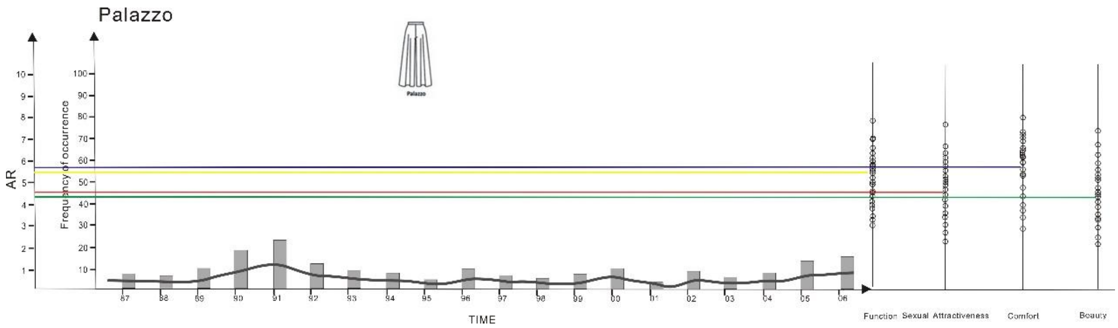


Chart 3.9



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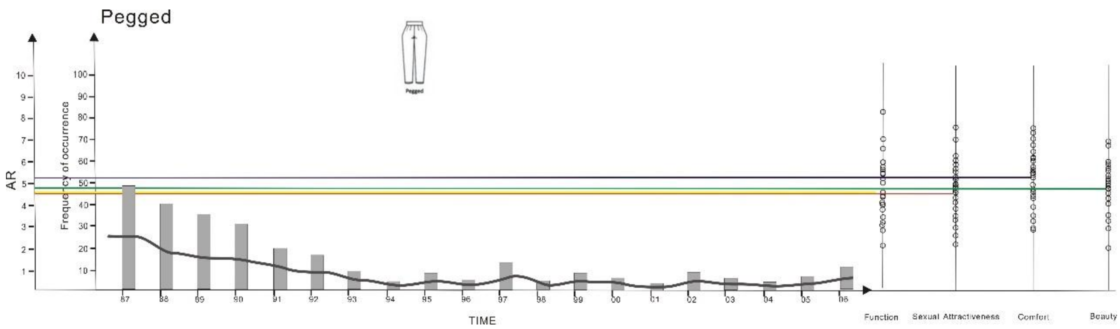

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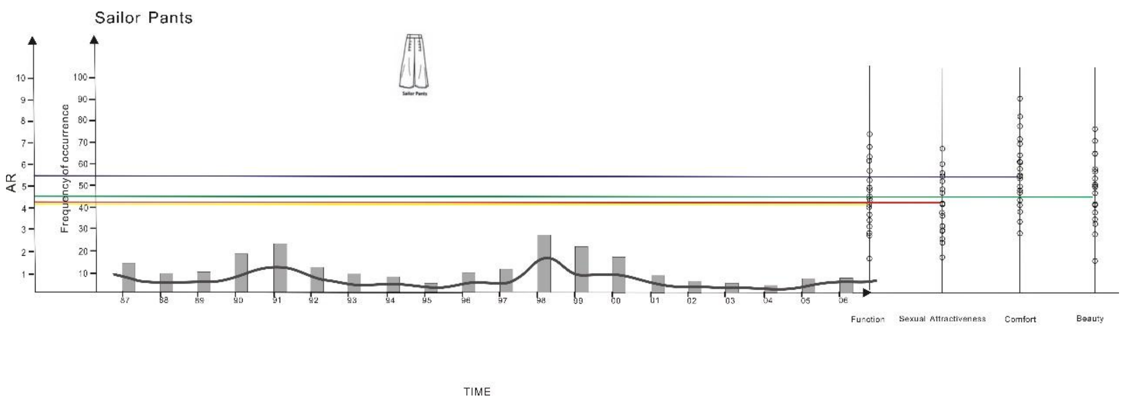

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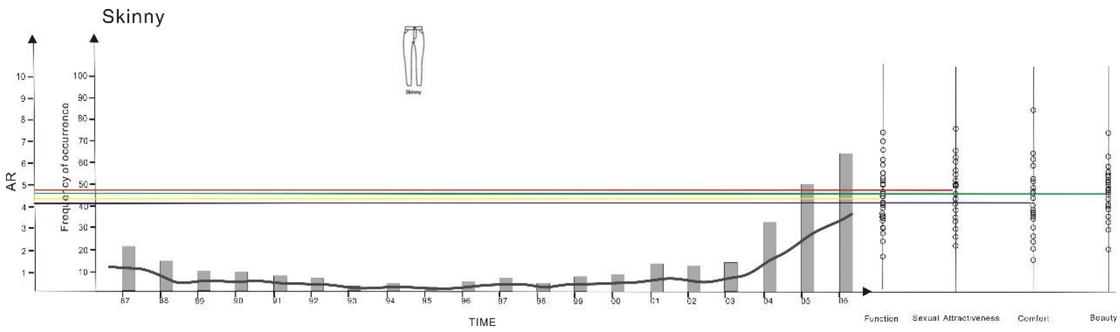

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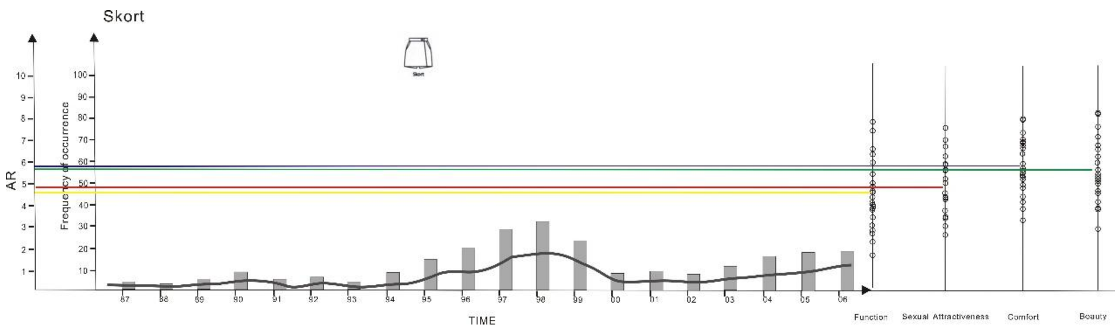

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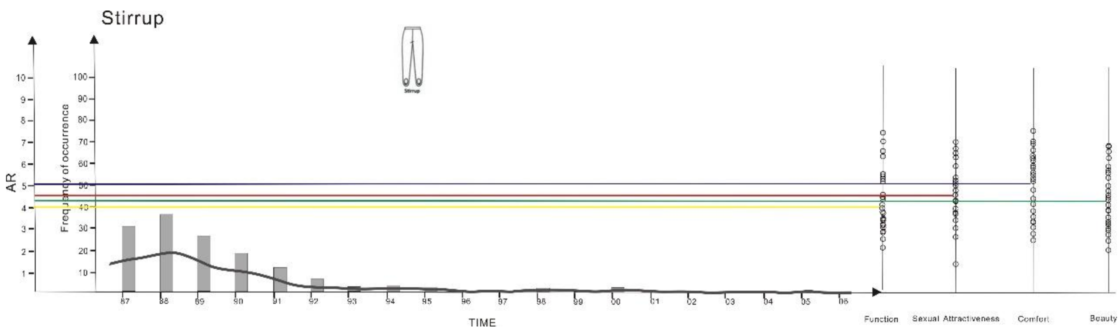

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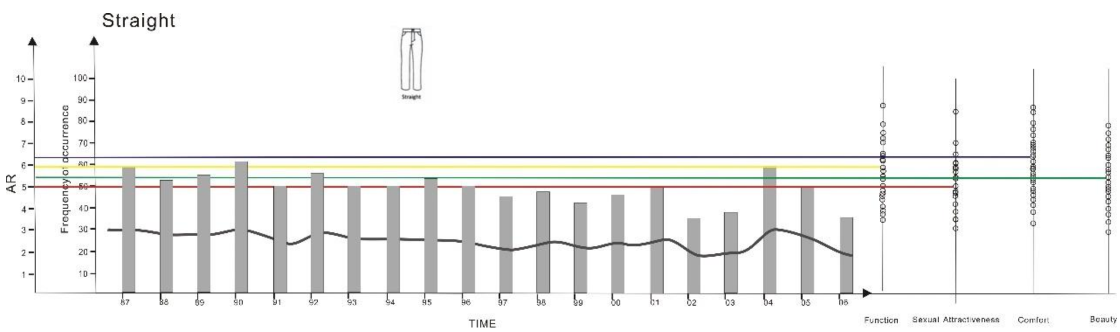

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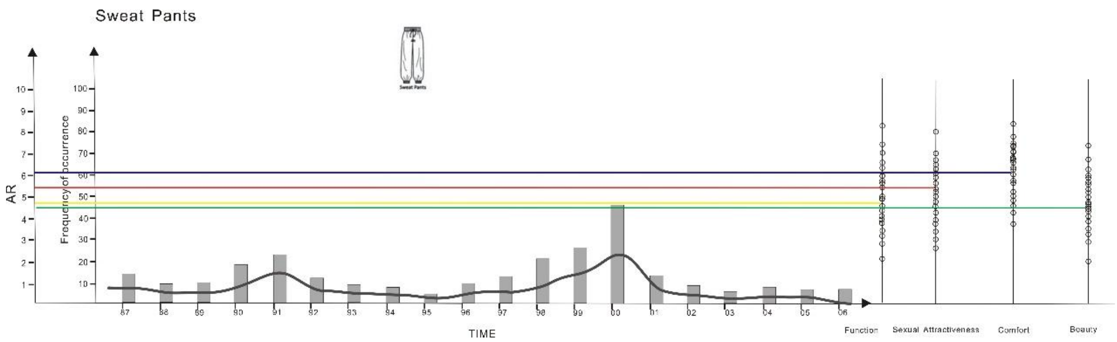

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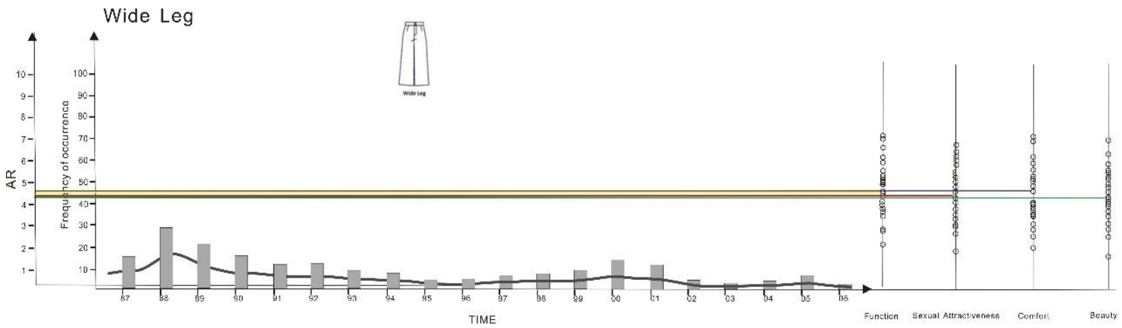

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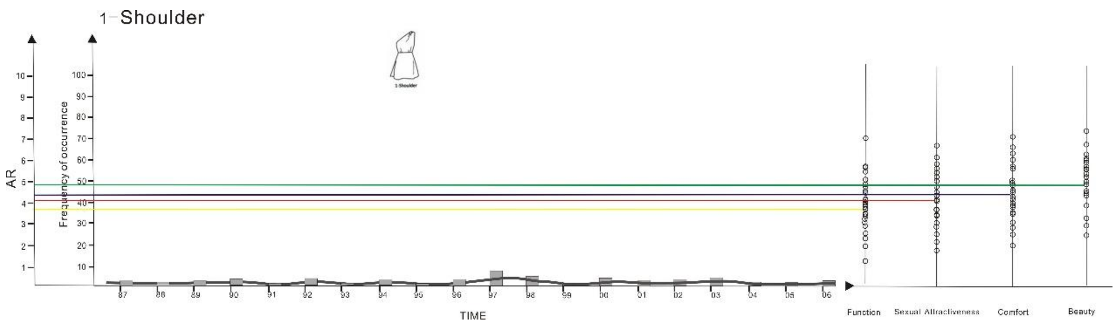

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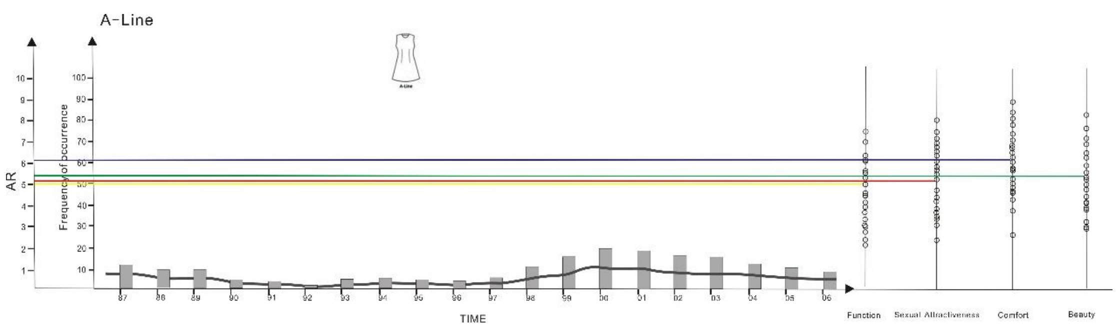

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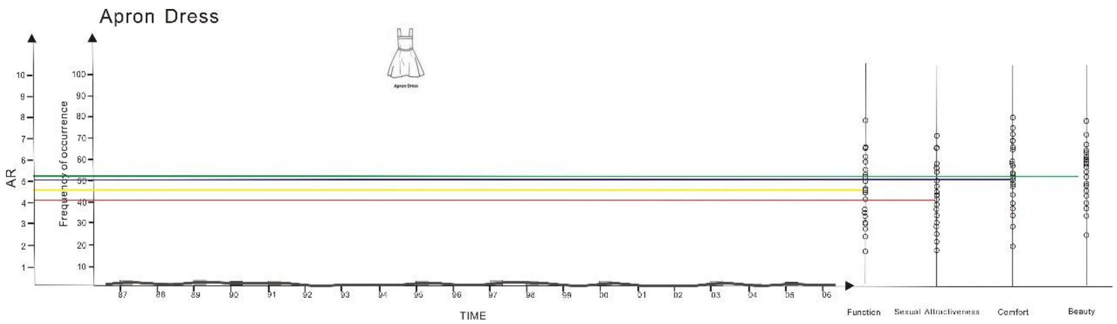

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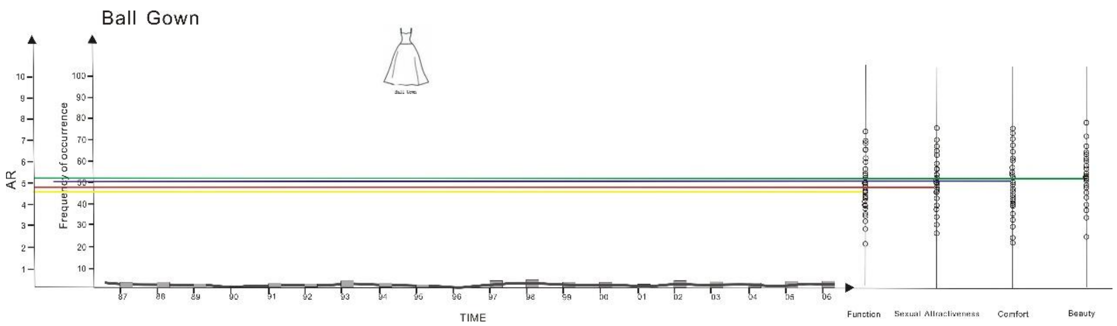

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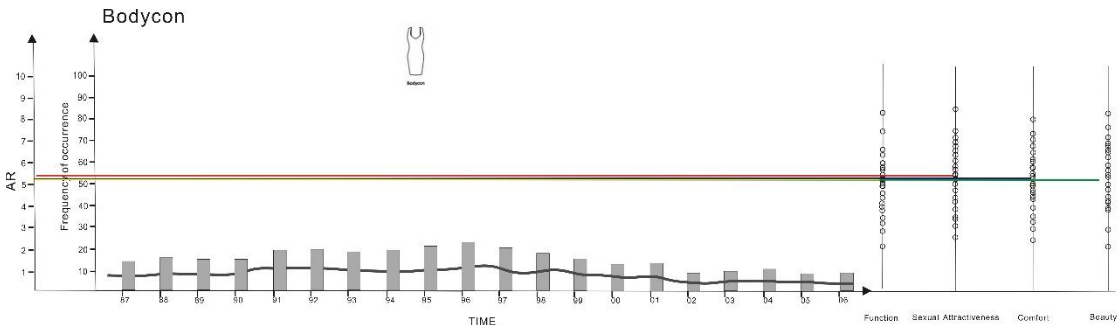

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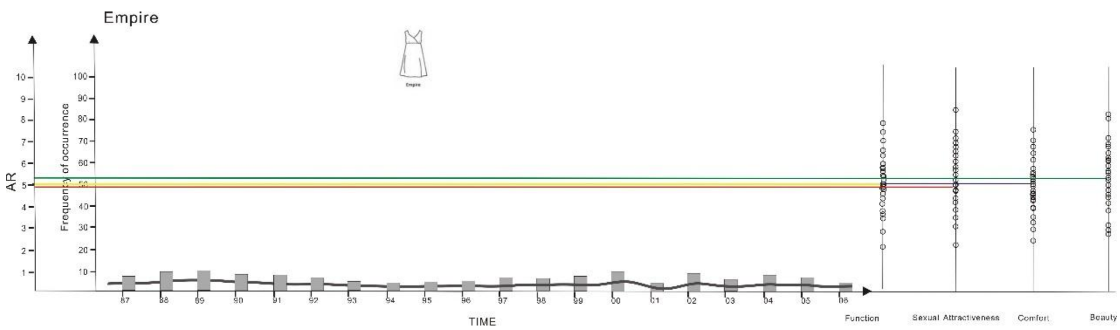

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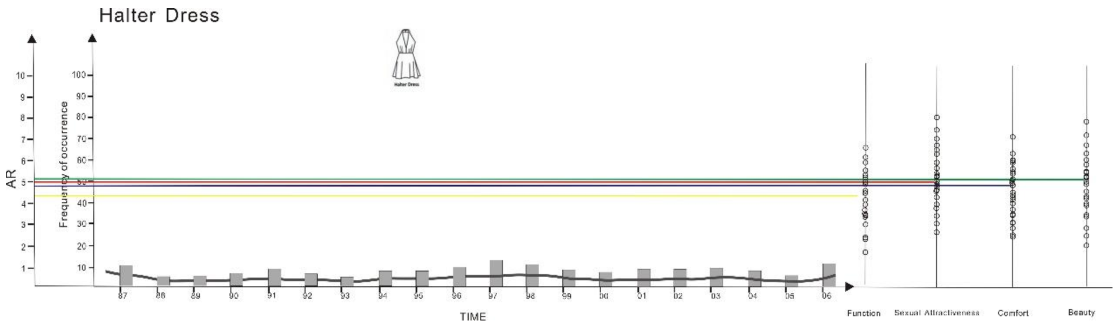

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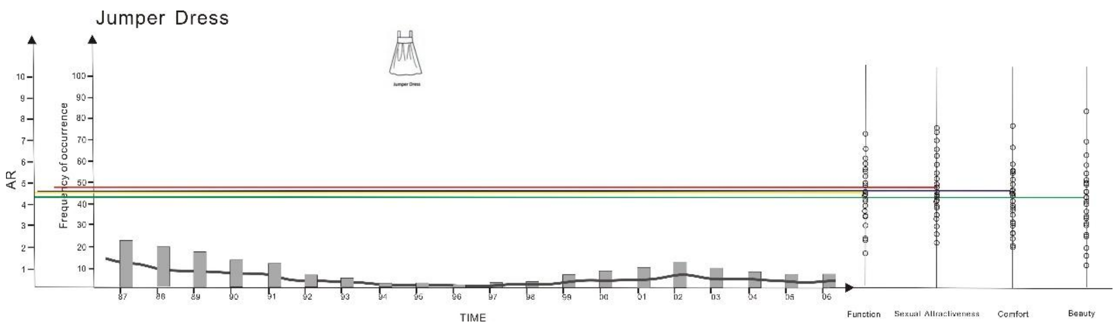

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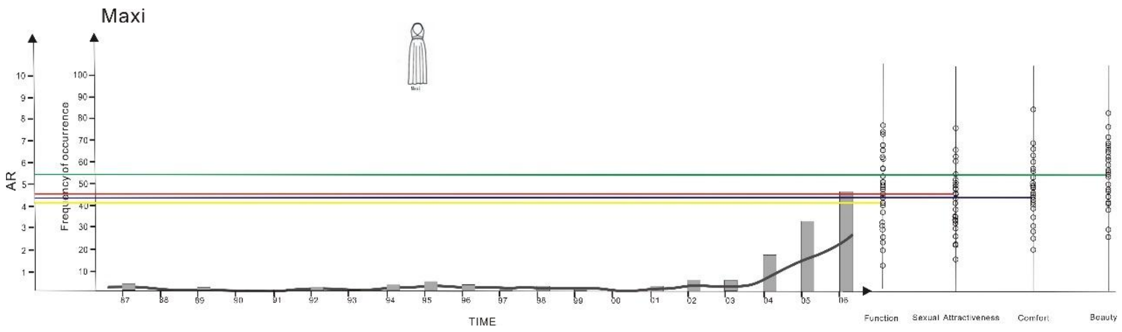

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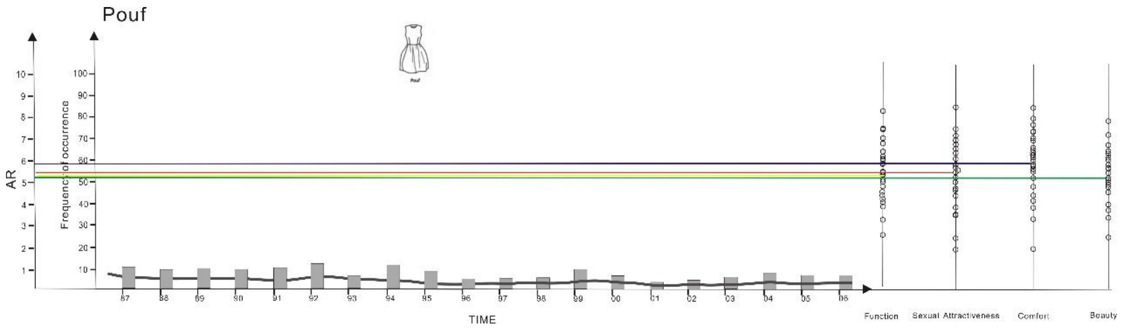

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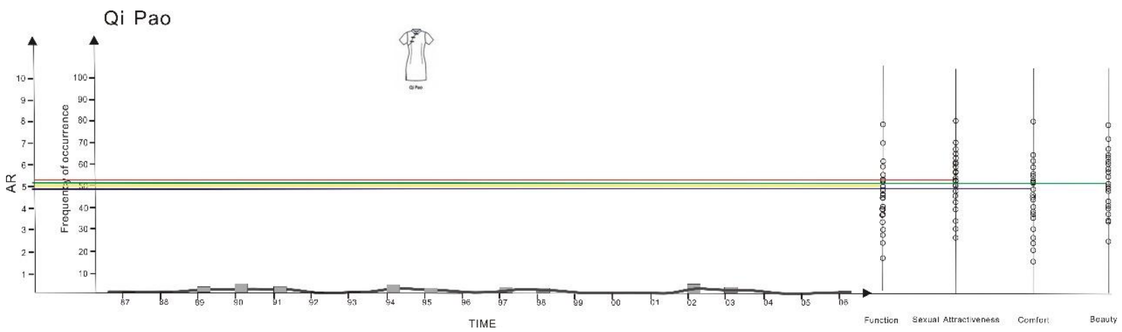

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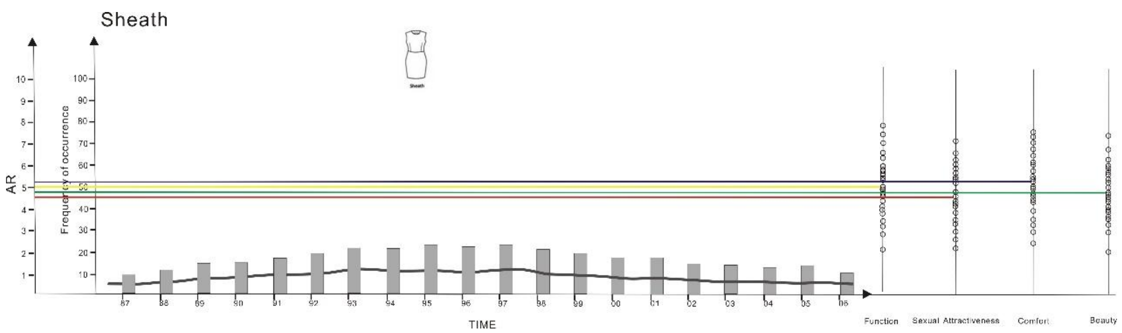

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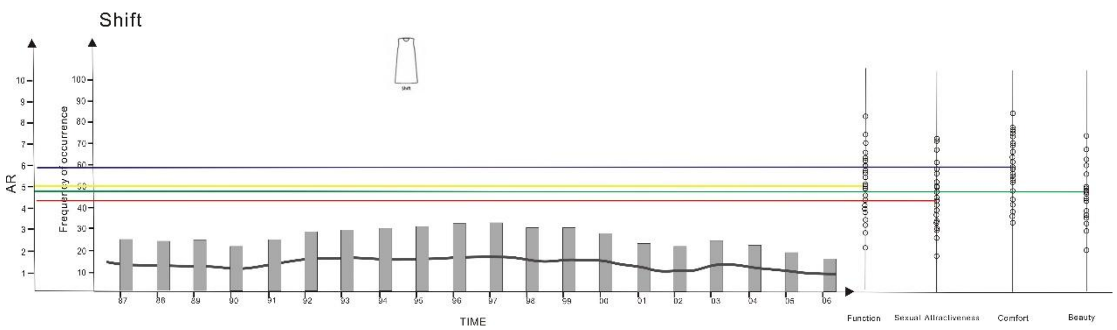

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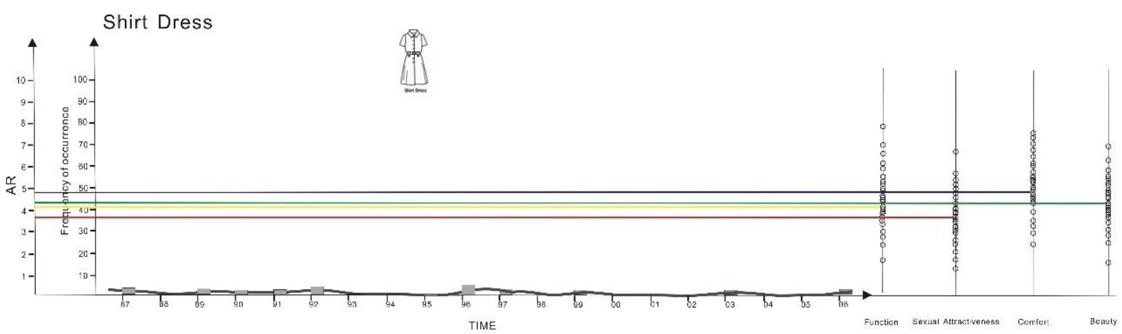

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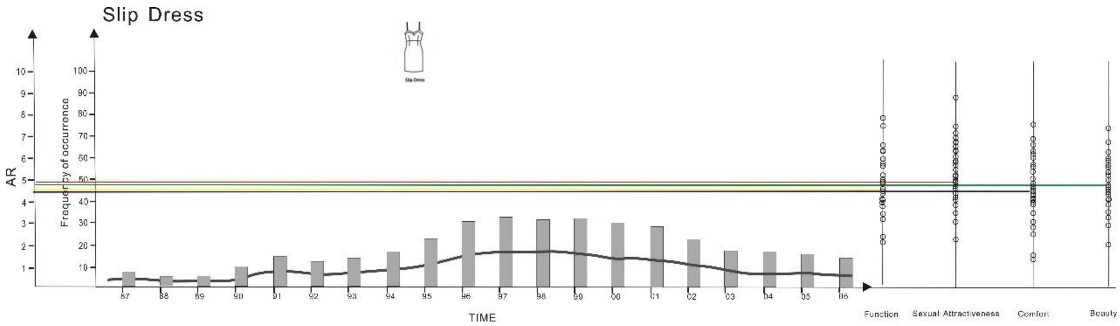

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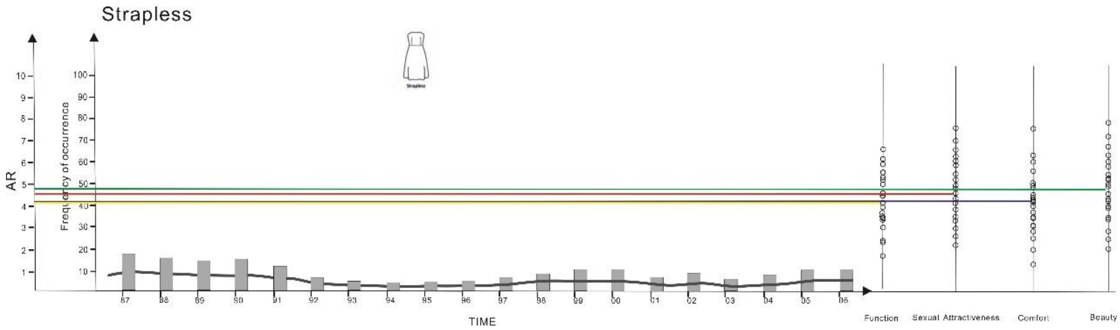

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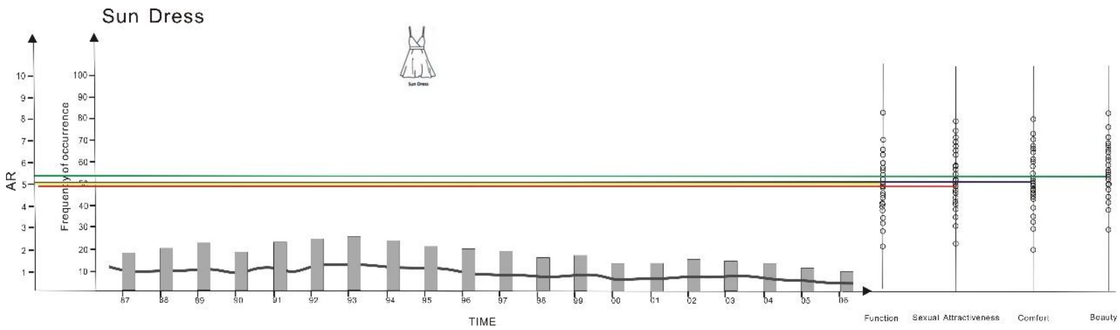

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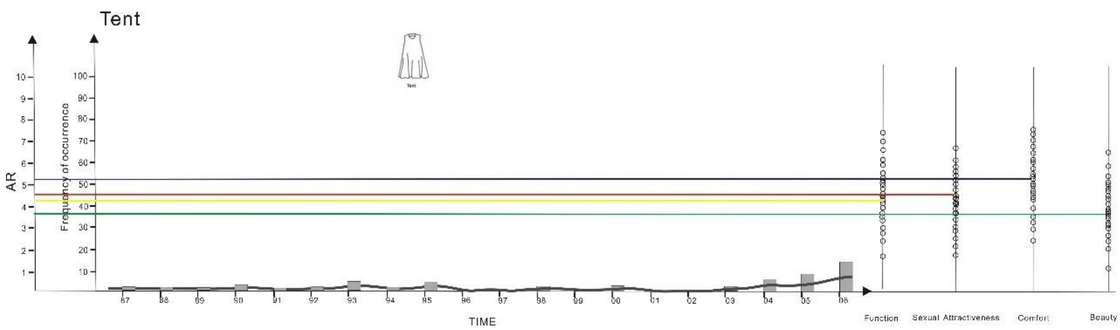

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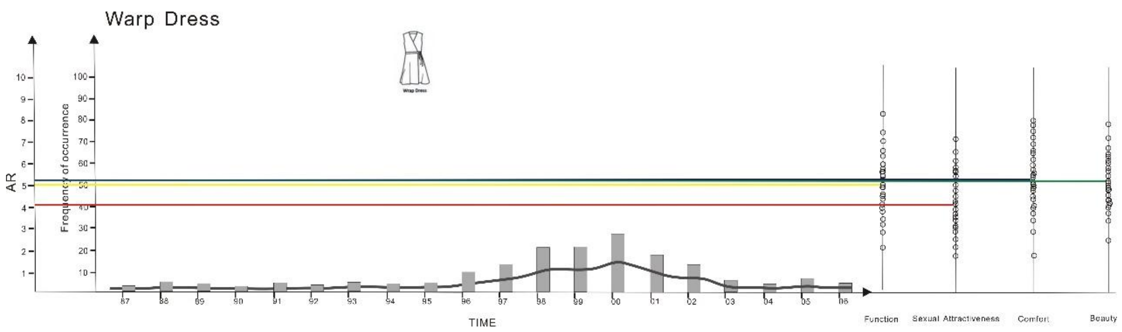

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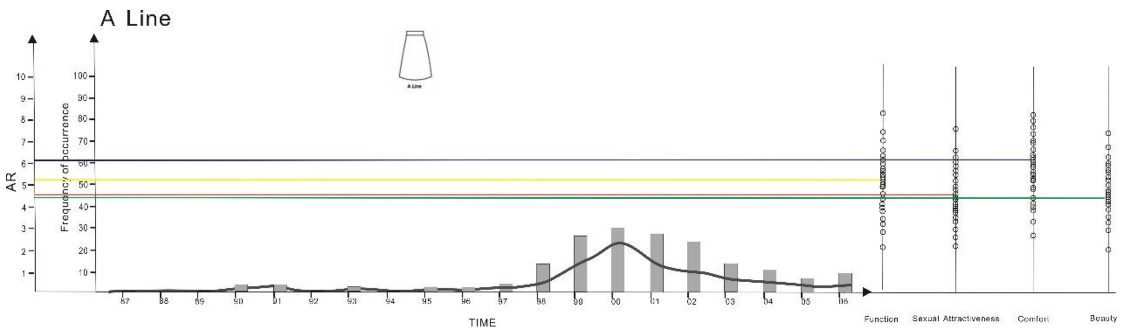

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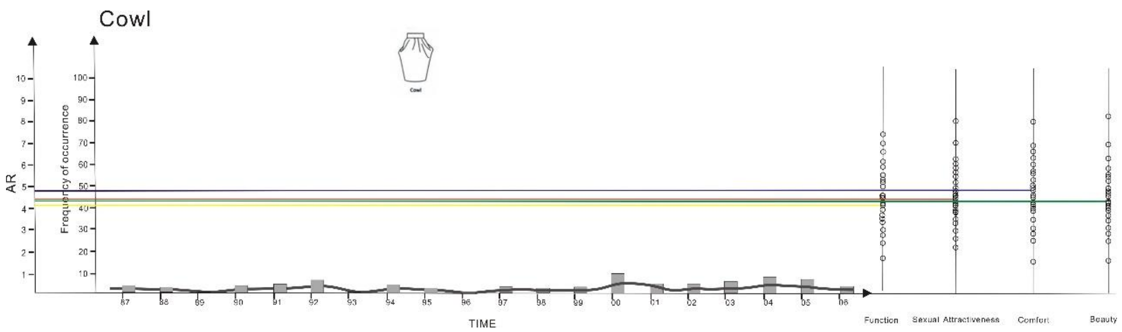

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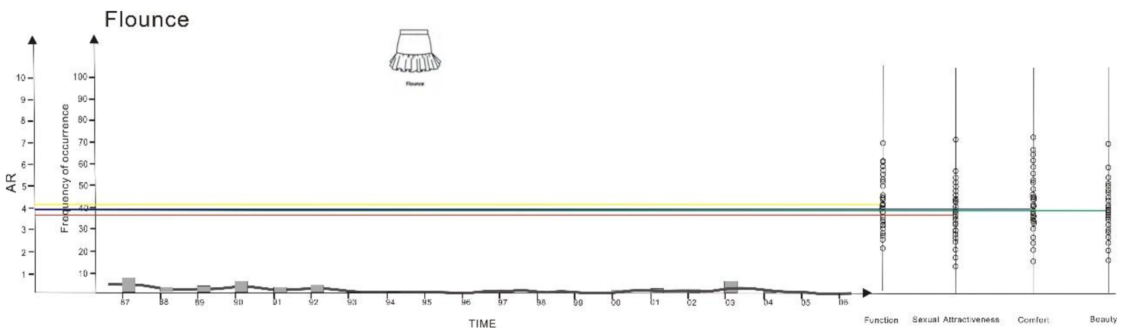

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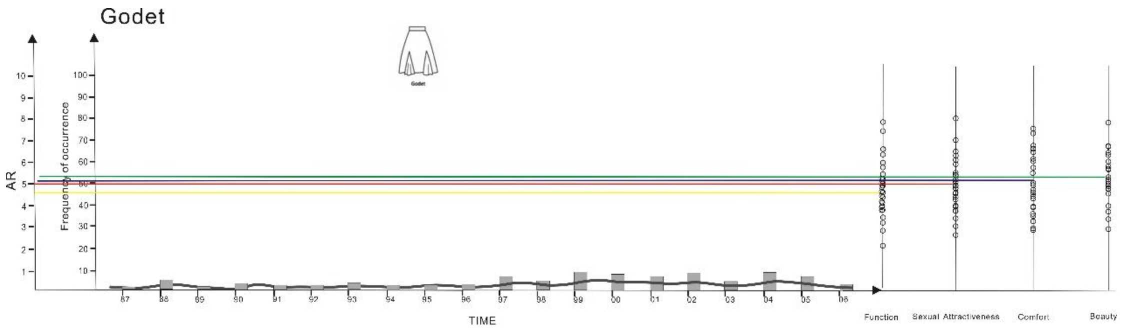

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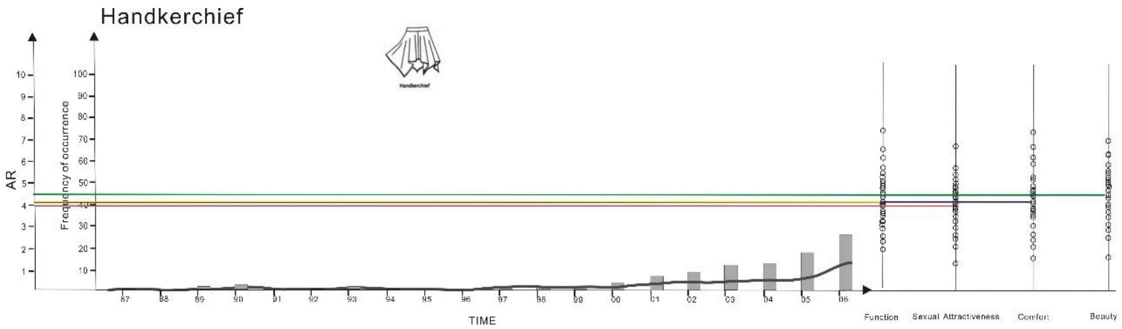

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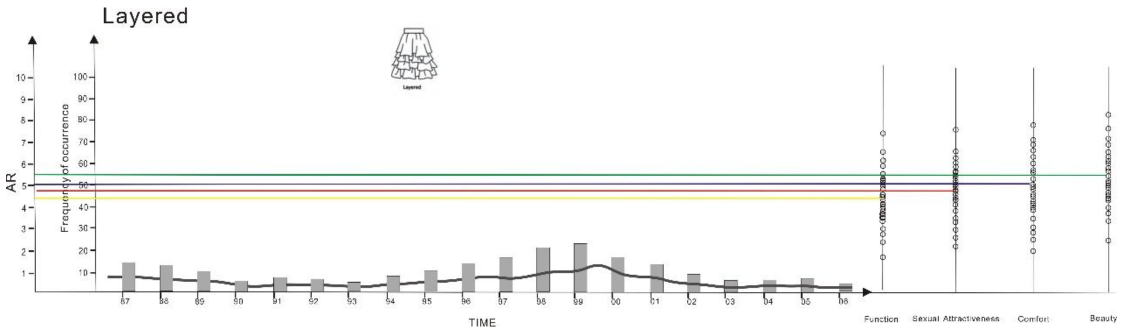

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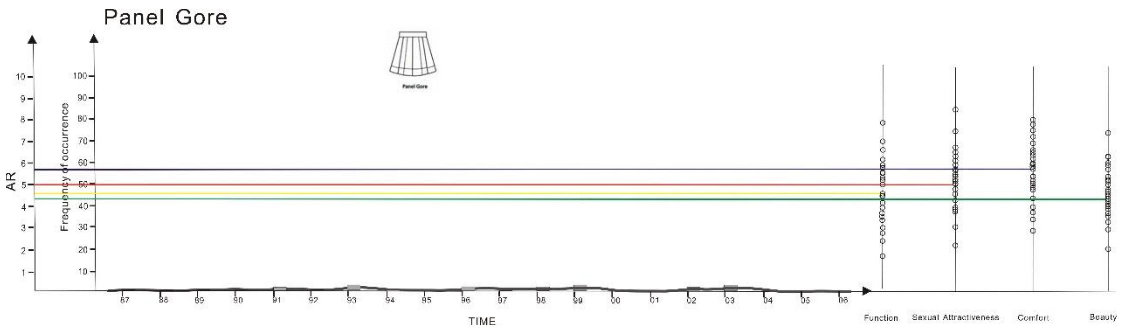

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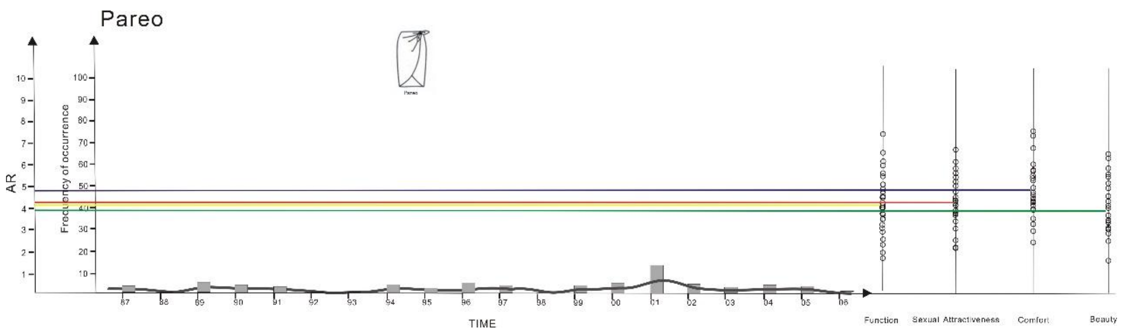

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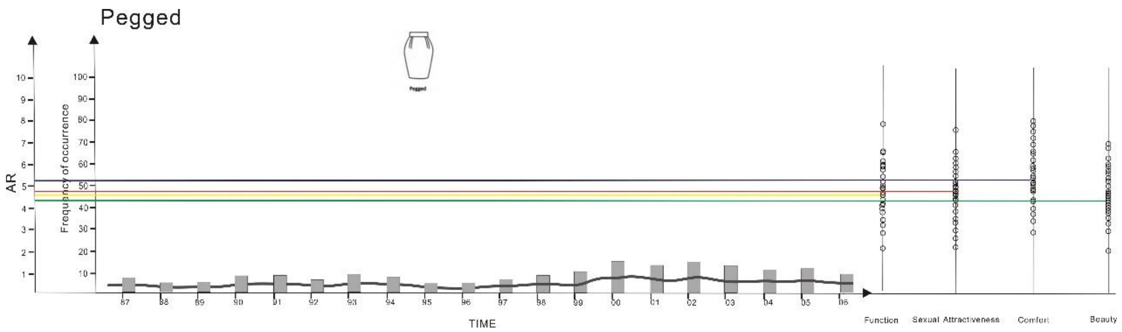

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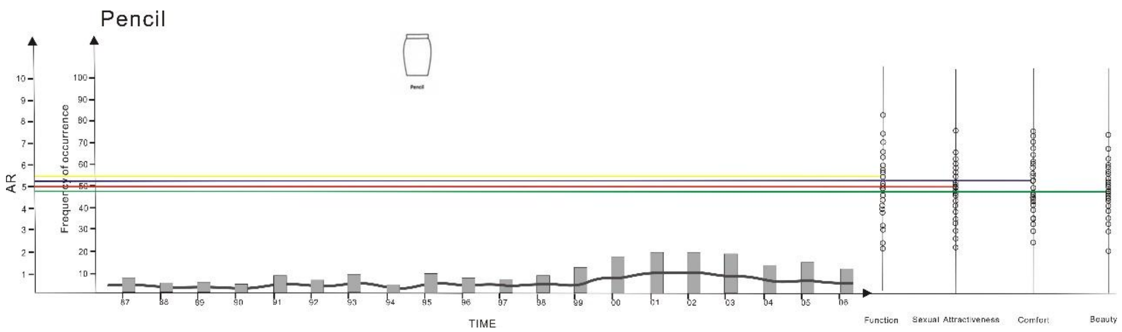

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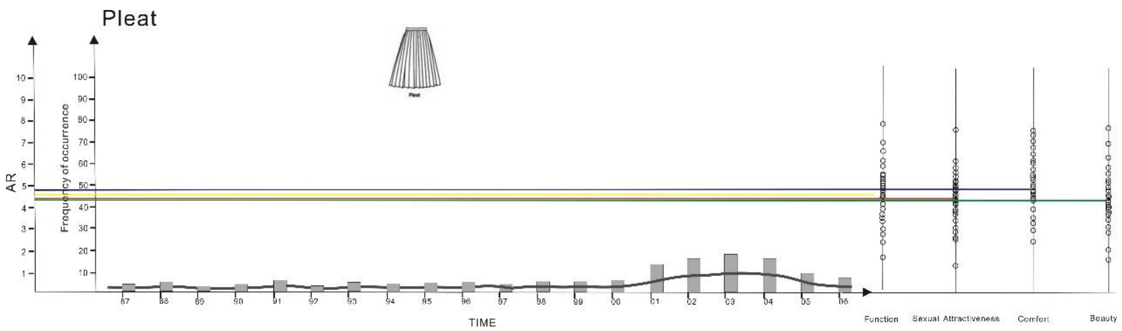

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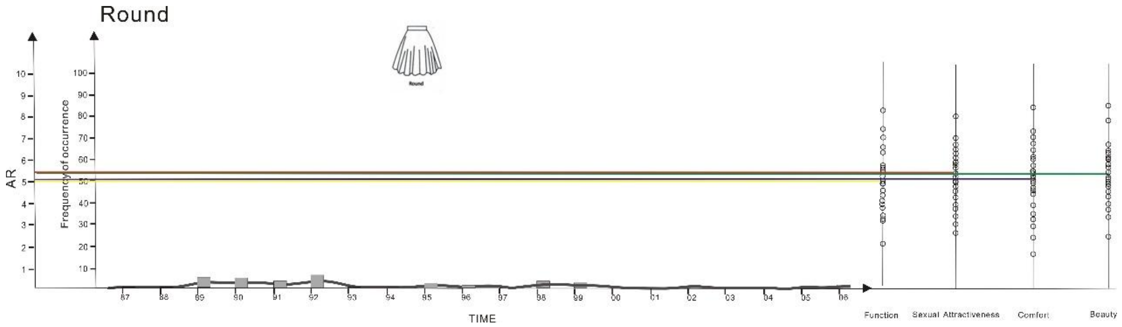

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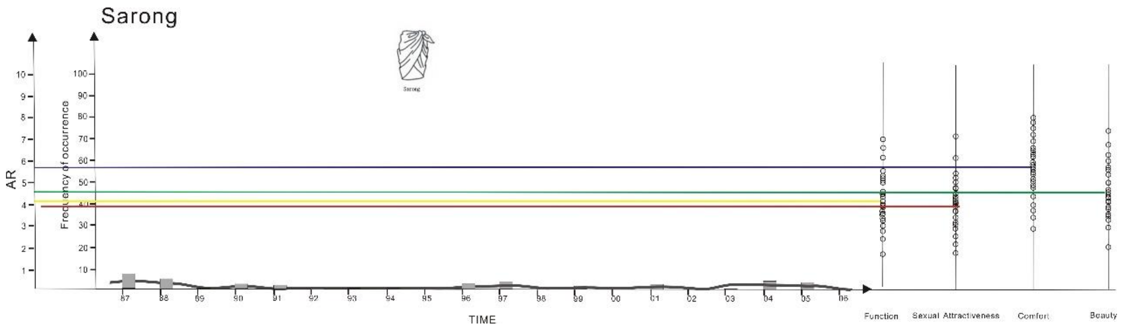

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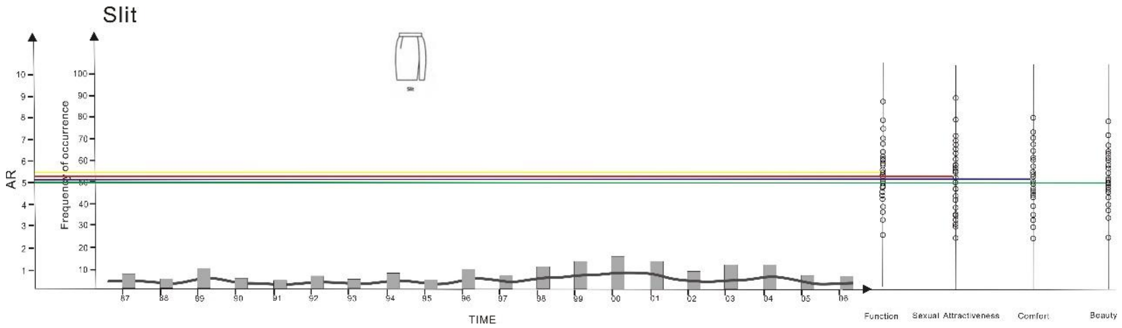

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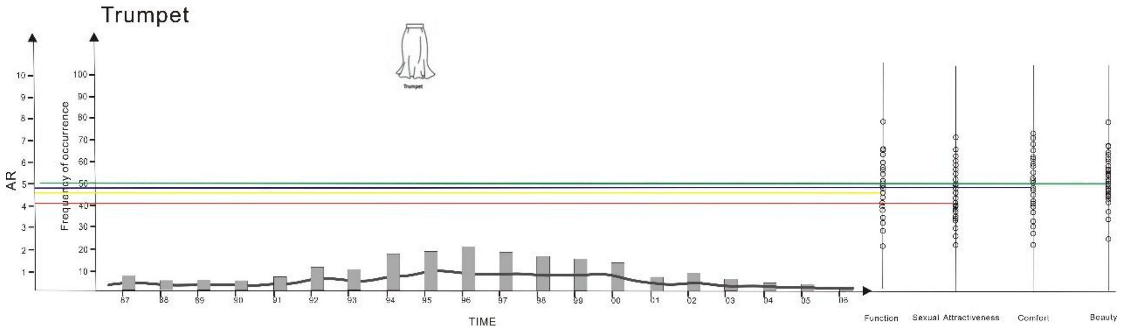

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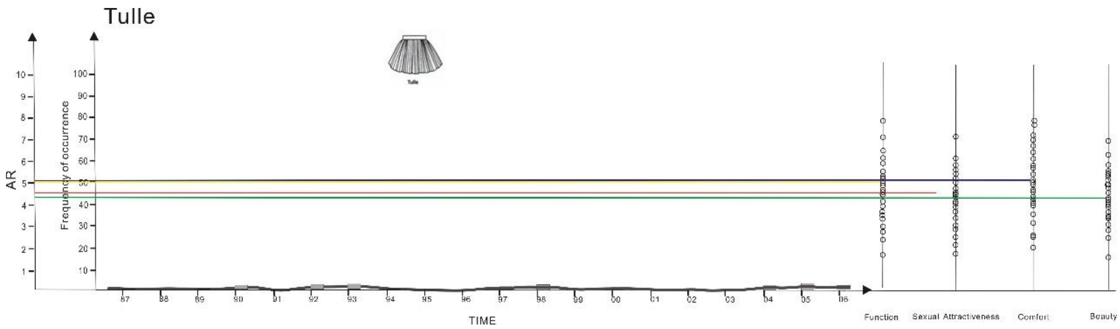

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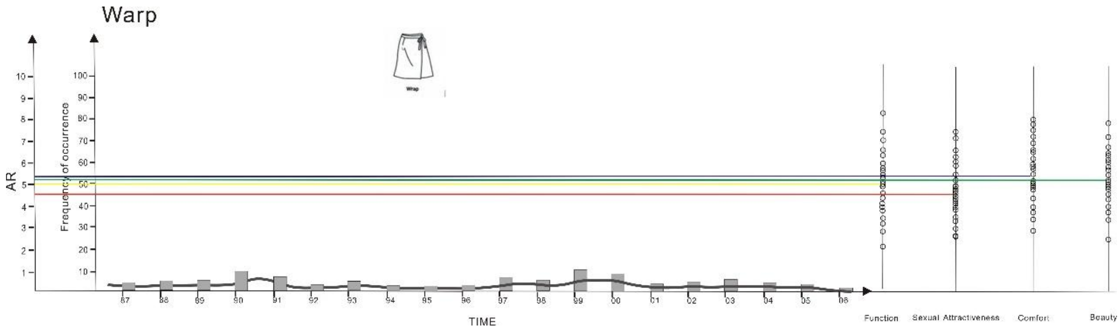

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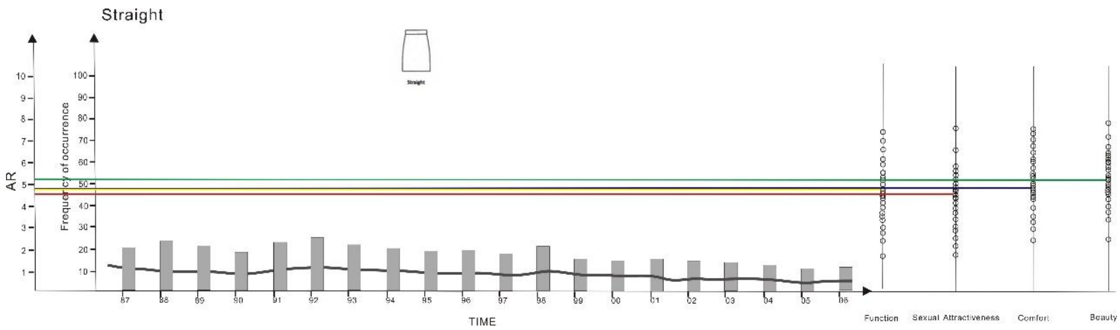

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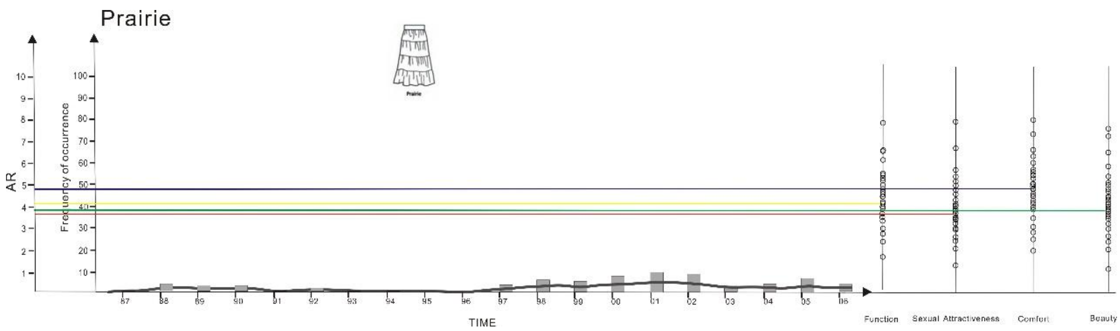

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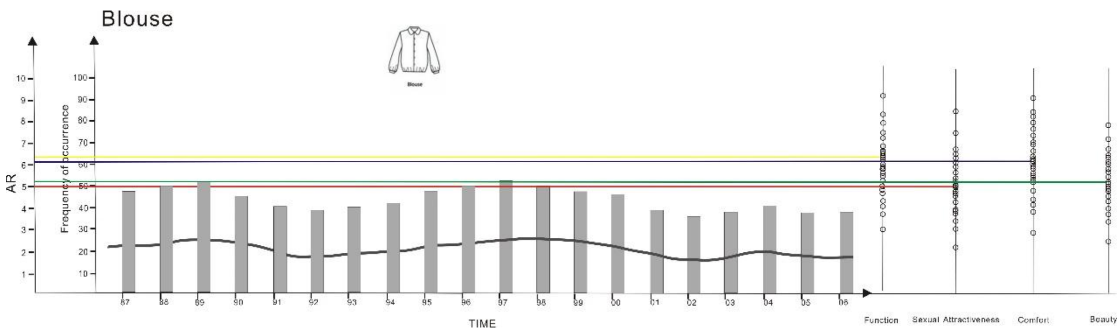

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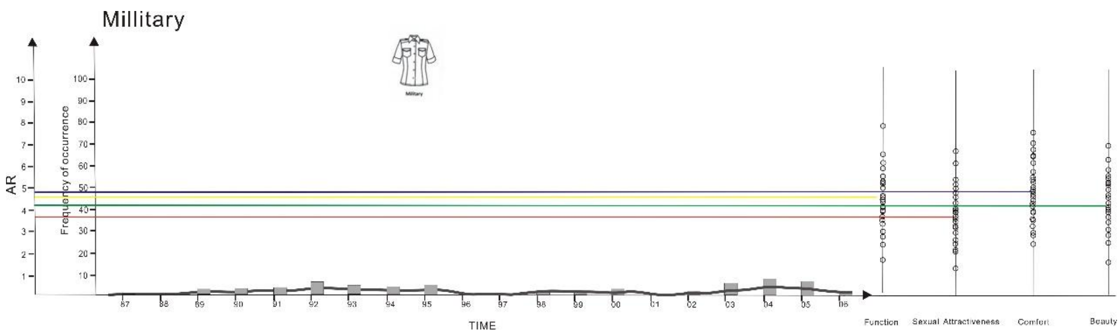

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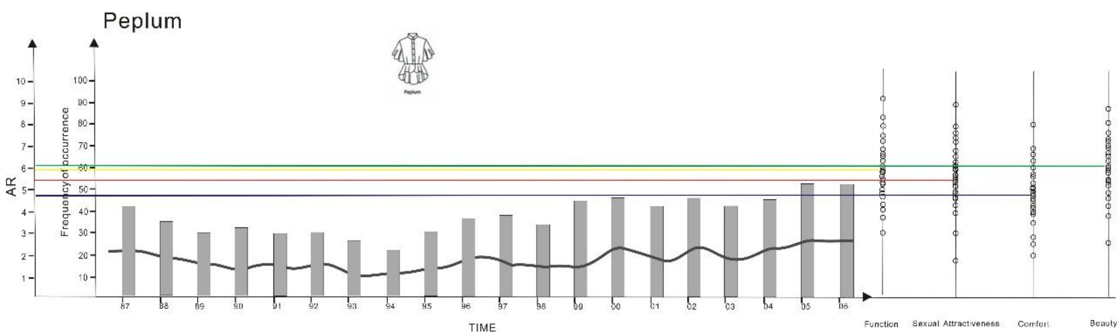

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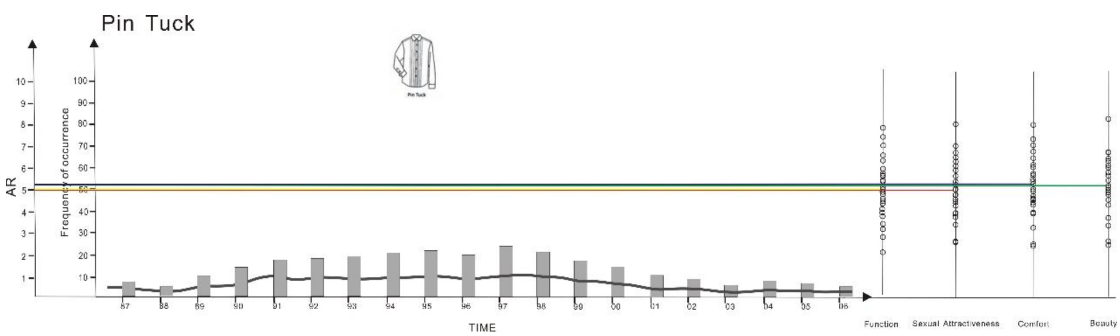

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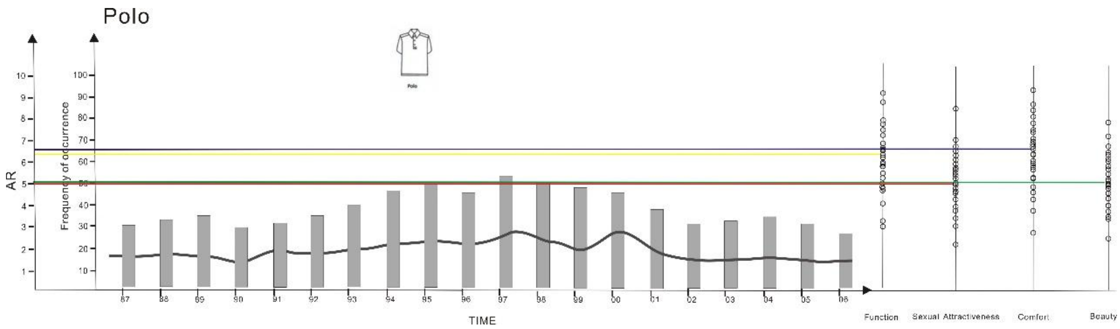

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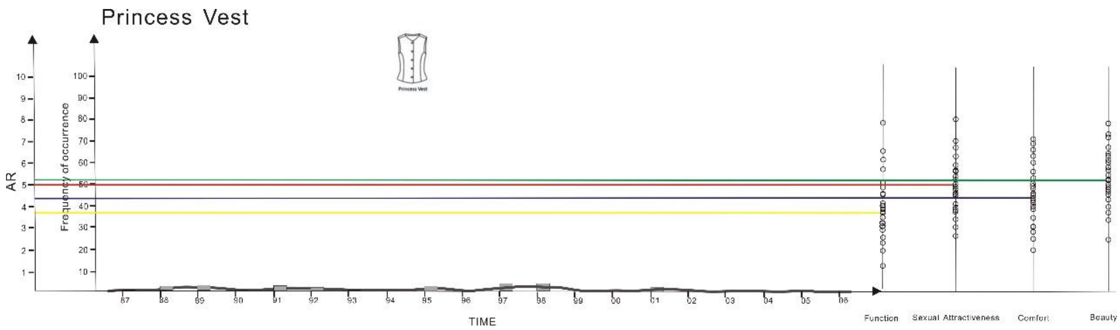

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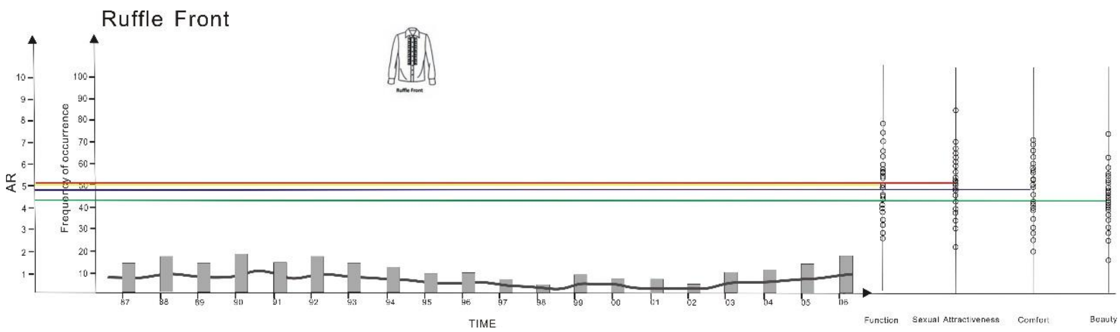

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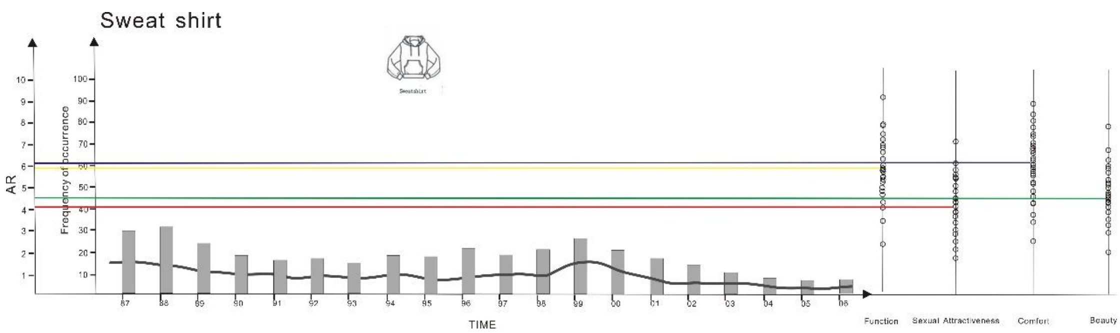

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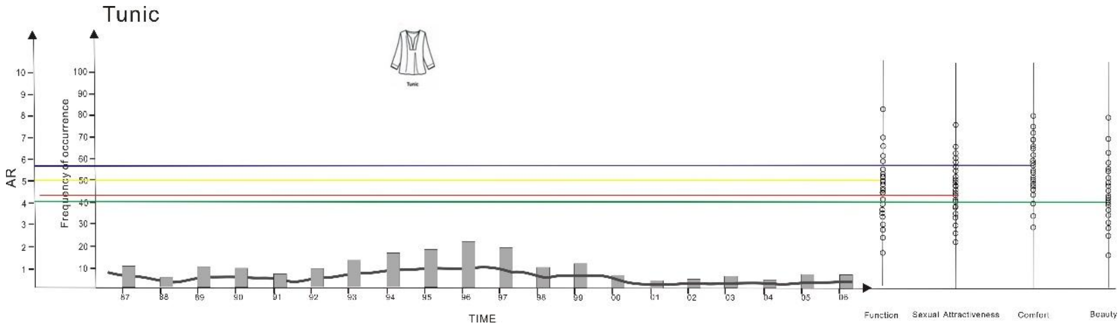

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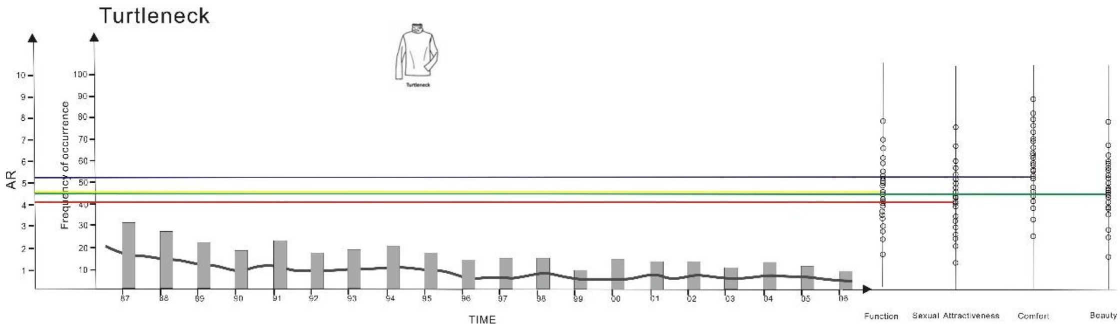

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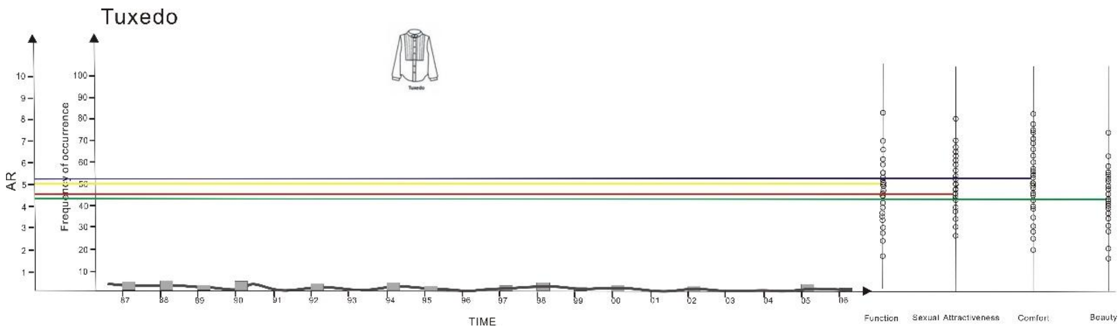

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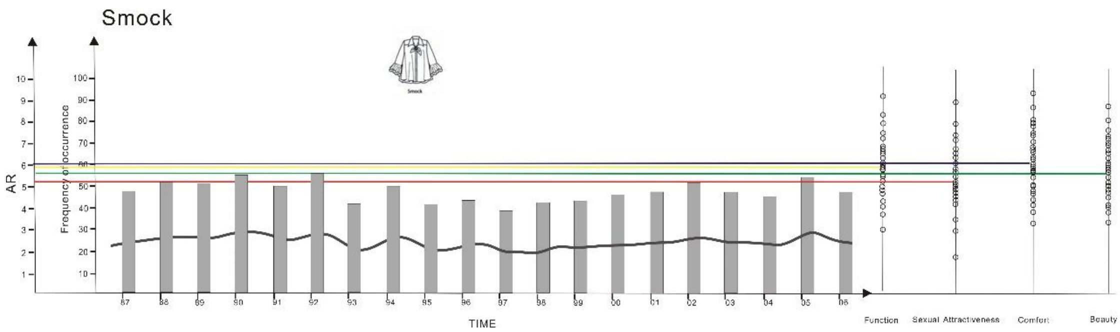

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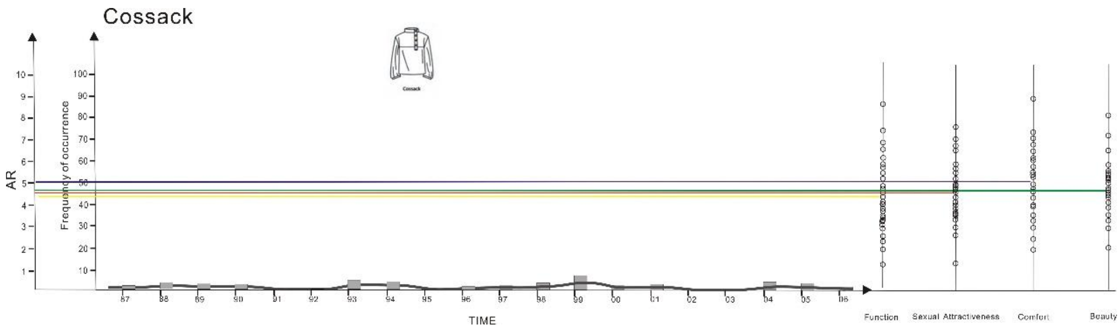

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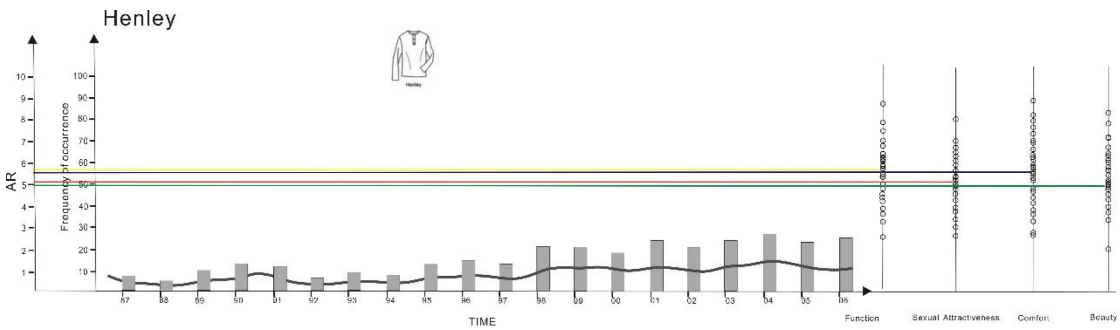

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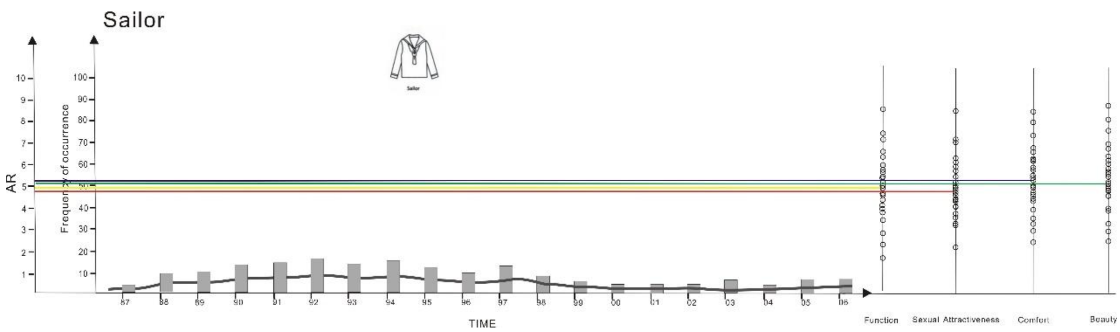


3.3 Statistical Data for Analyzing the Internal and External Principle of Fashion Evolution

In the studying of fashion clothes historical evolution, we found out each fashion item differs in details in the evolution. In this research, the different details changes in the same fashion style were neglected as more details consideration will cost too many variables. The quantities of variables need to be reduced in order to guarantee the usability and accuracy of the data.

Quantity and statistical Data for each clothes style evolution must be guaranteed in order to make sure of the data accuracy when exploring internal and external principle of fashion evolution. If the fashion clothes average proportion of data less than 0.5% of the total image collected, it will not be counted. In the end, there were 38 out of 70 fashion data reached the standard for research analysis. This is the reason why Table 3.1(VOGUE fashion clothes category including 73 items) differs from the clothes used for the subjective rating in terms of four components (Table 3.2 including 38 items).

3.4 Develop 3D Female Body Model and Clothing Model

Based on the body figure index BMI, WHR, VHI demonstrated in the literature review, an ‘Original body’ was created by 3D Max software. Twelve approaches were developed base on the ‘Original body’. The research selected six basic figure parameters which are height, length of leg, size of chest, size of the breast, size of the waist, size of the hip as figure variation (See below figures 3.1) parameters to create different 3D figure model.

3.5 Twelve approaches

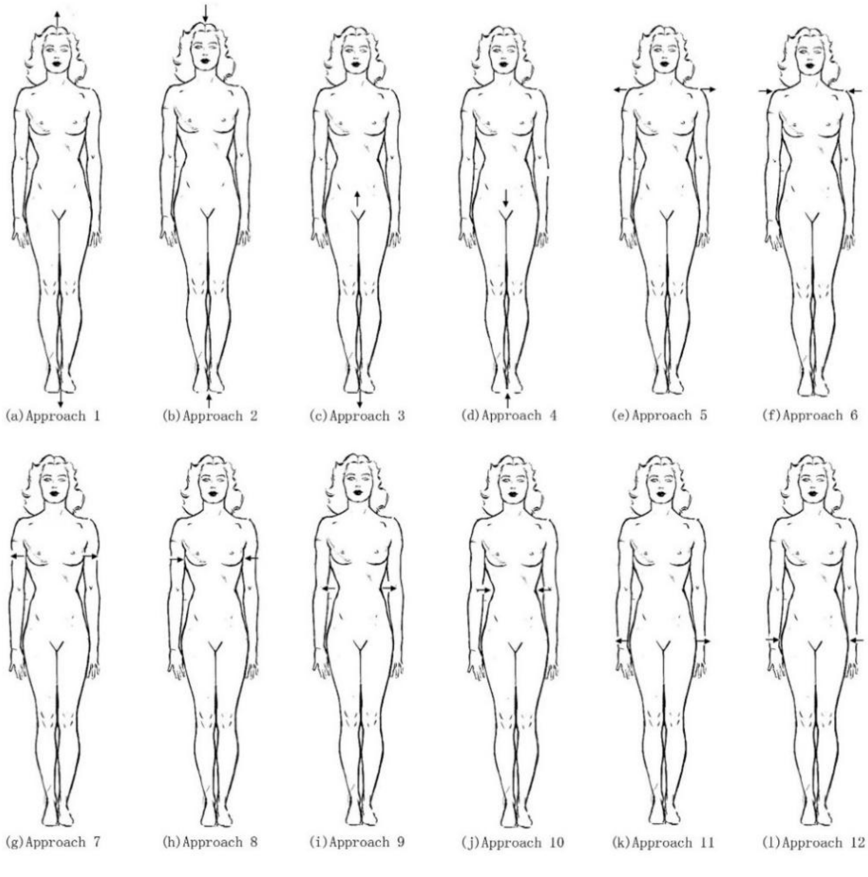


Figure 3.1 Twelve approaches

Approach 1: Mark 2 apex points at the top and bottom in figure. Increase the body height (i.e. the distance between the top and bottom apex points) by 2% of the original body to create a new body image. Repeat the above procedures 13 times to create a total of 14 body images. During the alteration, all other body dimensions were not changed.

Approach 2: Mark 2 apex points at the top and bottom in figure. Increase the body height (i.e. the distance between the top and bottom apex points) by 2% of the original body to create a new body image. Repeat the above procedures 13 times to create a total of 14 body images. During this alteration, all other body dimensions were not changed.

Approach 3: Mark 2 apex points as shown in figure (c). Increase the length of the leg by 2% of the original leg length to create a new body image. Repeat the above procedures 13 times to create a total of 14 body images. During this alteration, all other body dimensions were not changed.

Approach 4: Mark 2 apex points as shown in figure (d). Shorten the length of the leg by 2% of the original leg length to create a new body image. Repeat the above procedures 13 times to create a total of 14 body images. During this alteration, all other body dimensions were not changed.

Approach 5: Mark 2 apex points as shown in figure (e). Increase the size of the chest by 2% of the original chest sizes to create a new body image. Repeat the above procedures 13 times to create a total of 14 body images. During this alteration, all other body dimensions were not changed.

Approach 6: Mark 2 apex points as shown in figure (f). Shorten the size of the chest by 2% of the original chest sizes to create a new body image. Repeat the above procedures 13 times to create a total of 14 body images. During this alteration, all other body dimensions were not changed.

Approach 7: Mark 2 apex points as shown in figure (g). Increase the size of the breast by 3% of the original breast sizes to create a new body image. Repeat the above procedures 13 times to create a total of 14 body images. During this alteration, all other body dimensions were not changed.

Approach 8: Mark 2 apex points as shown in figure (h). Shorten the size of the breast by 3% of the original breast sizes to create a new body image. Repeat the above procedures 13 times to create a total of 14 body images. During this alteration, all other body dimensions were not changed.

Approach 9: Mark 2 apex points as shown in figure (I). Increase the size of the waist by 2% of the original waist sizes to create a new body image. Repeat the above procedures 13 times to create a total of 14 body images. During this alteration, all other body dimensions were not changed.

Approach 10: Mark 2 apex points as shown in figure (j). Shorten the size of the waist by 2% of the original waist sizes to create a new body image. Repeat the above procedures 13 times to create a total of 14 body images. During this alteration, all other body dimensions were not changed.

Approach 11: Mark 2 apex points as shown in figure (k). Increase the size of the hip by 3% of the original hip sizes to create a new body image. Repeat the above procedures 13 times to create a total of 14 body images. During this alteration, all other body dimensions were not changed.

Approach 12: Mark 2 apex points as shown in figure (l). Shorten the size of the hip by 3% of the original hip sizes to create a new body image. Repeat the above procedures 13 times to create a total of 14 body images. During this alteration, all other body dimensions were not changed.

The ‘Original Body’ and the 168 (12x14) images created above have wide variations in body height, the length of body leg, the sizes of chest, the size of breast, the size of waist and the size of hip. Other body features (viz. knees position, arm length) remain unchanged. In order to take as much variations into consideration as possible and minimize the sample size, we applied the orthogonal experiment design to create additional 625 (25x24) body images from the ‘Original body’ and 24 body images were selected from the above 168 images. It is impossible to conduct this kind of study when using real human body.

3.6 Three Dimensional Clothes Image Creation

The method of three dimensional clothes image creation is to use the ‘polygon’ 3D creation tool to create CG clothes images based on the previous research.

There were 38 different clothes created based on the previous research rule.

Figure 3.2 Examples of nude body image

Figure 3.3 Example of image with variable body and clothes

3.7 Software Development

Develop a software with two sub-directories and an evolution system embedded in the background. Sub-directory 1 contains all the 3D body figures, Sub-directory 2 contains different clothes styles. The system will distribute one figure from Sub-directory 1 randomly and match all the clothes styles in Sub-directory 2. The viewers will be asked to rate every clothes styles with 0 is the minimum, 10 is the maximum, with accuracy of 2 decimal digit.

3.8 Data Preparation and Catalogues Set

There were 634 people involved in this research. They rated based on four indexes: function, sexual attractiveness, comfort and beauty. Score set from 0-10 with 0 is minimum, 10 is maximum. (See Table 3.2 for Average score of each component)

Table 3.2 Summary the medial scores of Four Component

Clothes	Function	Sexual Attractiveness	Comfort	Beauty
Pocket Jeans	**6.3**	5.0	5.2	5.1
Hot pants	**4.7**	6.3	6.1	5.7
Palazzo	5.5	4.6	5.7	44
Sailor Pants	4.1	4.2	5.4	4.5
Shinny	4.3	4.8	4.1	4.6
Skort	4.6	4.8	5.8	5.7
Straight	5.9	6.0	6.3	5.4
Sweat Pants	4.7	5.4	6.1	4.5
A Line（Dress）	4.9	5.1	6.1	5.4
Empire	4.8	4.9	5.0	5.4
Halter Dress	4.6	5.0	4.8	5.1
Jumper Dress	4.7	4.8	4.5	4.3

Maxi	4.0	4.5	4.4	5.4
Pouf	5.3	5.5	5.8	5.1
Shift	5.0	4.3	5.9	4.8
Slip Dress	4.5	4.9	4.4	4.8
Strapless	4.1	4.6	4.2	4.8
Sun Dress	4.9	4.8	5.0	5.4
Warp Dress	5.0	4.1	5.3	5.2
A Line（Skirt）	5.2	4.6	6.1	4.5
Layered	4.4	4.8	5.0	5.5
Pegged	4.5	4.7	5.2	4.3
Pencil	5.4	5.0	5.2	4.8
Slit	5.5	5.3	5.1	5.0
Trumpet	4.5	4.0	4.8	5.0
Pleat	4.6	4.5	4.8	4.4
Blouse	6.3	5.0	6.1	5.2
Peplum	5.9	5.4	4.7	6.1
Pin Tuck	5.0	5.1	5.1	5.1
Polo	6.4	5.0	6.6	5.0
Ruffle Front	4.9	5.0	4.8	4.3
Sweat shirt	5.9	4.1	6.1	4.5
Tunic	5.0	4.3	5.7	4.0
Turtleneck	4.5	4.1	5.2	4.5
Smock	5.9	5.2	6.0	5.7
Henley	5.7	5.1	5.6	4.9
Sailor	4.9	4.7	5.2	5.1
Sheath	5.0	4.5	5.2	4.7

3.9 Statistical Methods for Analyzing the Internal and External Principle of Fashion Evolution

From the collected evolution data, the chart shows different fashion styles have their own rates to become popular or die off. This research proposed that fashion adoption velocity quickly increased in popularity will die faster. Fashion adoption velocity generally increased in popularity maintain their evolution cycle longer. Survival analysis was applied to detect the relationship between adoption velocity and fashion evolution.

To analyse the correlation with different fashion styles, factor analysis was applied, this analysis can catalogued different fashion styles by common factors, which will help finding why some certain types of clothes appeared alternatively or at the same time in fashion evolution.

External factors: function, sexual attractiveness, beauty and comfort are contributing to the fashion evolution. These factors demonstrate consumer psychology and emotional behavior. Correlation analysis was applied to help find out how these factors influence on different fashion evolution models.

CHAPTER 4

HOW VELOCITY OF ADOPTION IN FASHION AFFECTS FASHION EVOLUTION

4.1 Introduction

Fashion styles often catch on and become popular, but very rarely know about why and how styles of fashion clothes dying off or disappearing. Some fashion styles may come back in the future and some of them may die out. What leads fashion evolution/cycle to be long-term or short-term? When and how fashion items become popular or unfashionable?

Researchers have long been interested in understanding why and how such fashion items succeed or die off, This research demonstrate that the velocity of adoption may affect fashion evolution. Analysis of twenty years of data taken from VOGUE magazines on clothes frequency of appearance illustrates that clothes appearance adopted quickly will become unfashionable faster. We believe that these results are driven by concerns about symbolic value: fads are perceived negatively, so potential consumers avoid choosing those clothes with sharply increasing popularity because they will be unfashionable quickly.

This may explain why certain clothes adopted quickly tend to be less successful. This research aims to find inner principle of fashion evolution. It also shed the lights on one factor that may help understanding fashion consumption.

4.2 Data Preparation for Survival Analysis

A product is anything that can be offered to a market that might satisfies a consumer's want or need. (Kotler, 2006) It can be a tangible product (clothes, cars, houses) or an intangible service (hotel service, airline service, banking). Irrespective of the kind of product, all products introduced into the market will undergo a product life cycle. A product life cycle refers to the time period between the launch of a product into the market till it is finally withdraw from it. This term was firstly used by Theodore Levitt in a Harvard Business Review article in 1965. (Theodore, 1965)

Appearance and function are two basic important elements in most durable products consumption. It is true for clothing design, furniture design, vehicle design, and electronic equipment design, etc. The aim of this part of the research is to find the way to predict the fashion items' life cycle, whether it is long term or short- term from aspects of appearance and function.

Survival analysis is a collection of statistical procedures for data analysis for which the outcome variable of interest is time until an event occurs. (Kleinbaum & Klein, 2011).

We used survival analysis to research the relationship between velocity adoption and fashion evolution. It tries to understand when and how style of clothes evolved. The rates of fashion adoption strongly influence fashion cycle. The result shows the fashion evolution through the rate of adoption analysis, as well as provides the taste's popularity influence its symbolic meaning.

Potential consumers may avoid buying clothes that catch on quickly because they concern about their symbolic value. If people think that sharply increasing clothes style will be short lived, they may avoid to have it that may later be seen as a flash in the pan.

Such social dynamics could get based on data evaluation and analysis. We focus our analyses on the pictures taken from VOGUE magazines (French edition) in order to obtain accurate data. Fashion researchers used statistical fashion pictures to study fashion cycle and fashion evolution, and statistical fashion pictures from VOGUE also shows the fashion trend.

Our main objective in this research is to investigate the adoption speed of different fashion clothes. The first step is to classify the different styles. Loschek (2009) pointed out in a similar way to art, in fashion means the attention of the viewer is captured. Clothing is a 'second skin' and fashion is the dressing of clothing. Fletcher (2008) demonstrated fashion clothes are used to signal who and what we are, to attract or repel others. There are plenty of varied fashion clothes in the industry. Sumathi (2010) listed in the fashion terminology that modern clothing can be categorized as jeans, pullover, sweater, lingerie, sailor, pants, top, wrap coat… etc. In the 2001 CEX Purchase Events and Category Share for Adult Clothing Category Expenditures, Clothing is classified as coat, jacket, sports coat, suit, vest, sweater, pants, jeans, short, dress, skirt, shirt, blouse, top…etc. (Cho 2007) Stalder (2008) explores different clothing items in categories of Tops, Pants, Skirts, Dresses and Coats. Combined the clothing category published by the International Textile and Apparel Association, in this research, clothes is classified into four main categories: top, bottom, skirt and dress. (See Table 4.1)

Table 4.1 Summary of fashion styles

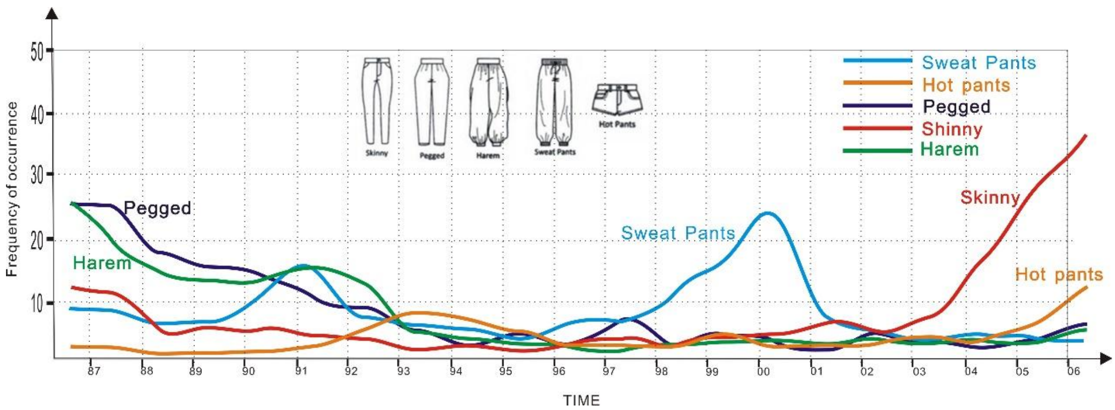
Tops	Pants	Skirts	Dresses
Princess Vest	Straight	Straight	shift
Blouse	Skinny	Pencil	A Line

Jumper	Boot-cut	A Line	Sheath
Sweatshirt	Flare	Pegged	Bodycon
Military	Wide Leg	Slit	Tent
Peplum	Pegged	Cowl	Empire
Gypsy	Stirrup	Panel Gore	Strapless
Pin Tuck	Pocket Jeans	Godet	Halter Dress
Tuxedo	Bush Pants	Flounce	1- Shoulder
Ruffle Front	Cargo Pants	Trumpet	Apron Dress
Cossack	Sailor Pants	Pleat	Jumper Dress
Smock	Jodhpurs	Prairie	Sun Dress
Sailor	Hot Pants	Layered	Wrap Dress
Tunic	Short	Tulle	Pouf
Polo	Sweat Pants	Round	Slip Dress
Henley	Harem	Handkerchief	Qi Pao
Turtleneck	Palazzo	Wrap	Shirt Dress
	Jumpsuit	Pareo	Maxi
		Sarong	Ball Gown

In order to analyse the relation between adoption velocity and fashion evolution, the research used statistical method by counting the yearly frequency of appearance of different fashion clothes in 20 years' Vogue magazines from 1987-2006. Pictures of fashion clothes were taken from every single page of the magazine for counting and draw a chart for each single style.

After demonstrating the clothes frequency of appearance, the research found that fashion clothes have distinct patterns of evolution in popularity. At their peak, sweat pants, hot pants, pegged, skinny and harem counted for ≈0.4% of all frequency of appearance in Vogue fashion styles. From the data collection, we found that sweat pants and skinny were adopted and abandoned much more quickly (See Chart 4.1).

Chart 4.1 Example of Clothes frequency of appearance



It seems that fashion cycle for sweat pants and skinny are shorter than the others. In order to demonstrate the findings and research different rates of fashion cycle and evolution, the above chart of 5 types of pants were made out.

It is found that different styles of clothes have their own rates become fashionable or unpopular. The quantity of valid data must be guaranteed as the fashion evolution is the focus. If the average proportion of data less than 0.5% of the total image collected under the rules being set, the fashion clothes were not counted. Finally, 38 fashion clothes out of 70 were suitable for survival analysis.

Table 4.2 Summary of fashion style under the basic research rule

Pants	Pocket Jeans	Hot pants	Palazzo	Sailor Pants	Shinny	Skort	Straight	Sweat Pants				
Dress	Empire	Halter Dress	Jumper Dress	Maxi	Pouf	Shift	Slip Dress	Strapless	Sun Dress	Warp Dress	sheath	A-line
Skirts	A Line	Layered	Pleat	Pegged	Pencil	Slit	Trumpet					
Top	Blouse	Peplum	Pin Tuck	Polo	Ruffle Front	Sweat shirt	Tunic	Turtleneck	Sailor	Smock	Henley	

This study researched the popularity of fashion style evolution. It demonstrates the relationship between adoption velocity and fashion style evolution, fashion style that has become popular faster tends to be abandoned faster. Survival analysis is a collection of statistical procedures for data analysis for which the outcome variable of interest is time until an event occurs. (Kleinbaum & Klein, 2011). Precisely, it is an analysis of data that correspond to the time from a well-defined time origin until the occurrence of some particular event or end-point. (Collett, 1994) In short, survival analysis typically focuses on time to event data. The research used statistical method by counting the yearly frequency of appearance of different fashion clothes in 20 years’ Vogue magazine from 1987-2006. Pictures of fashion clothes were taken from every single page of the magazine for counting. Kaplan–Meier estimator was used to estimate the survival function from lifetime data in survival analysis. It is widely used in various industry researches. In economics, it is used to measure the time until failure of machine parts. In medical research, it is used to measure the fraction of patient living for a certain amount of time after treatment. (Kaplan & Meier, 1958). In fashion evolution research, it was used to measure the different style of clothes hazard rate to show the relationship between fashion evolution and velocity adoption.

4.3 Rules Setting for Research Estimator

Kaplan-Meier estimator has been used to examine the relation between adoption velocity and subsequent abandonment of 70 different fashion clothes by counting the frequency of appearance from Vogue magazines (1987 -2006).

The survival rules should be set before using Kaplan-Meier estimator to study fashion clothes adoption velocity from the data collected. First of all, we treat a fashion clothes style as abandoned or disappeared in one fashion cycle when the proportion of data with that clothes first drops below 20% of it past maximum. Secondly, we consider fashion clothes become popular again if the proportion of data with that clothes achieves 80% of it past maximum after being abandoned. Thirdly, we are not counting the fashion clothes if their average proportion of data less than 0.5% of the total image collected in that year. Set a peak point, and set a bottom point ahead of it to calculate the average slope in any five years between. The interval of the two points less than five years was not considered.

4.3.1 Adoption velocity calculation formula:

$$m=\frac{\Delta y}{\Delta x}=\frac{y_2-y_1}{x_2-x_1}$$

4.3.2 Adoption Velocity Classification

According to the formula, the adoption velocity of 40 clothes styles were figured out and the average slope is 2.98. Clothes with slope less than the average slope are classified to the Group 0, while those more than the average slopes are classified to the Group 1.

4.3.3 Death classification

We treat a fashion clothes style as abandoned or disappeared in one fashion cycle when the proportion of data with that clothes first drops below 20% of it past maximum. A death classification was made according to the above mentioned rule, death is 1, survival is 0.

Table 4.3 Summary of Data for research estimator under the rules

Clothes	Group	Adoption velocity	Death
Pocket Jeans	**0**	M pocket Jeans= 79-69 /5=2	**0**
Hot pants	**1**	M Hot pants= 30-4 /4=6.5	**1**
Palazzo	1	M Palazzo= 26-6 /4=5	1
Sailor Pants	1	M Sailor Pants=29-5/5=6	1
Shinny	1	M Skinny= 64-15 /5=9.4	1
Skort	1	M Skort= 31-4 /5=5.4	1
Straight(Pants)	0	M Straight= 62-59 /5=0.6	0
Sweat Pants	1	M Sweat Pants= 46-13 /5=6.6	1
A Line（Dress）	1	M A Line(Dress)= 30-2/5=5.6	1
Sheath	0	M Sheath= 22-15 /5=1.4	0
Empire	0	M Empire= 12-2/5=2	0
Halter Dress	0	M Halter Dress= 12-3/5=1.8	0
Jumper Dress	0	M Jumper Dress= 12-3/5=1.8	1

Maxi	1	M Maxi= 45-6/5=7.8	0
Pouf	0	M Pouf= 12-10/5=0.2	0
Shift	0	M Shift= 31-26/5=1	0
Slip Dress	1	M Slip Dress= 31-12/5=3.8	0
Strapless	0	M Strapless= 10-3/5=1.4	1
Sun Dress	0	M Sun Dress= 24-18/5=1.2	0
Warp Dress	1	M Warp Dress= 28-12/5=3.2	1
A Line（Skirt）	1	M A Line(skirt)= 32-4/5=5.6	0
Layered	0	M Layered= 25-12/5=2.6	0
Pegged	0	M Pegged= 12-5/5=1.6	0
Pencil	0	M Pencil= 18-8/5=2	0
Slit	0	M Slit= 16-6/5=2	0
Trumpet	0	M Trumpet= 21-9/5=2.4	1
Pleat	1	M Pleat= 20-5/5=3	0
Blouse	0	M Blouse= 52-41/5=1.8	0
Peplum	0	M Peplum= 53-41/5=2.4	0
Pin Tuck	0	M Pin Tuck= 25-22/5=0.6	0
Polo	0	M Polo= 52-41/5=2.4	0
Ruffle Front	1	M Ruffle Front= 20-5/5=5	1
Sweat shirt	1	M Sweat shirt= 25-20/5=1	0
Tunic	0	M Tunic= 22-9/5=2.6	1
Turtleneck	0	M Turtleneck= 25-22/5=0.6	0
Smock	0	M Smock= 55-51/5=0.8	0
Henley	0	M Henley= 25-18/5=1.4	0
Sailor	0	M Sailor= 18-4/5=2.8	1
Straight(Skirt)	0	M Straight(Skirt)= 22-18/5=0.8	0
Bodycon	0	M Bodycon = 23-18/5=1	0

4.4 Survival Events for Survival Analysis

Kaplan-Meier estimator has been used to examine the relation between adoption velocity and subsequent abandonment of different fashion clothes. The adoption velocity of clothes was figured out and the average slope is 2.98. Group 0 means clothes with slope less than the average slope. Group 1 means clothes with slope more than the average slope. The results are listed in Group 0 and Group 1 (Table 4.4).

Table 4.4 Number of event for Kaplan-Meier estimator

Group	Total N	N of Events	Censored	
			N	Percent
1	26	26	0	0.0%
2	14	14	0	0.0%
Overall	40	40	0	0.0%

4.5 Survival Table and Survival Rates

Table 4.5 Survival Table and Survival rates for Group 1 and Group 2

Survival Table

Items	Time	Status	Cumulative Proportion Surviving at the Time		N of Cumulative Events	N of Remaining Cases
			Estimate	Std. Error		
1	.360	1.00	.962	.038	1	25

2	.380	.00	.	.	2	24
3	.380	1.00	.885	.063	3	23
4	.420	1.00	.	.	4	22
5	.420	.00	.	.	5	21
6	.420	.00	.769	.083	6	20
7	.500	.00	.	.	7	19
8	.500	.00	.	.	8	18
9	.500	.00	.	.	9	17
10	.500	.00	.615	.095	10	16
11	.560	.00	.	.	11	15
12	.560	1.00	.	.	12	14
13	.560	.00	.500	.098	13	13
14	.630	.00	.462	.098	14	12
15	.710	.00	.	.	15	11
16	.710	1.00	.	.	16	10
17	.710	.00	.346	.093	17	9
18	.830	.00	.308	.091	18	8
19	1.000	.00	.	.	19	7
20	1.000	.00	.231	.083	20	6
21	1.250	.00	.	.	21	5
22	1.250	.00	.154	.071	22	4
23	1.670	.00	.	.	23	3
24	1.670	.00	.	.	24	2
25	1.670	.00	.038	.038	25	1
26	5.000	.00	.000	.000	26	0
1	.110	1.00	.929	.069	1	13
2	.130	.00	.857	.094	2	12

3	.150	1.00	.786	.110	3	11
4	.154	1.00	.714	.121	4	10
5	.170	1.00	.643	.128	5	9
6	.180	1.00	.	.	6	8
7	.180	.00	.500	.134	7	7
8	.190	1.00	.429	.132	8	6
9	.200	1.00	.357	.128	9	5
10	.260	.00	.286	.121	10	4
11	.310	1.00	.214	.110	11	3
12	.330	.00	.143	.094	12	2
13	1.000	.00	.071	.069	13	1
14	5.000	1.00	.000	.000	14	0

Table 4.6 Means and Medians for Survival Time For Group 1 and Group 2 on 95% Confidence Interval

Means and Medians for Survival Time

Group	Mean				Median			
	Estimate	Std. Error	95% Confidence Interval		Estimate	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound			Lower Bound	Upper Bound
.00	.929	.182	.573	1.286	.560	.076	.410	.710
1.00	.597	.344	.000	1.271	.180	.012	.156	.204
Overall	.813	.168	.484	1.142	.500	.063	.377	.623

a. Estimation is limited to the largest survival time if it is censored.

Considering fashion items with many styles, each of them is either a high slope (type α) or a low slope (type β). Estimated $q \in [0,9.4]$ denote a generic fashion style slope. If $q \leq S\ (2.98)$ (average slope) then q is a high slope type, and if $q > S\ (2.98)$ then q is a low slope type. Depending on the interpretation, the slope shows how fast the fashion items become popular or die off.

Each fashion item has its own rate to become fashionable or disappeared. The purpose of this research is to find out survival functions P $(x > t)$

Suppose that $q \leq S\ (2.98)$, then fashion style is a high slope type. To capture the life cycle of fashion style, the following transformed survival functions P $(x > t)$ was applied to fit the data plotted,

$$P(x > t) = \pi\hat{P} = \pi(\frac{n-d}{n})$$

where P is the fashion item of each Survival function Estimated. By applying survival analysis, the values for high slope type are determined as following:

$$P(x > 0.36) = \hat{P}_1 = (\frac{26-1}{26}) = 0.962$$

$$P(x > 0.38) = \hat{P}_1 \times \hat{P}_2 = (\frac{26-1}{26}) \times (\frac{25-2}{25}) = 0.885$$

$$P(x > 0.42) = \hat{P}_1 \times \hat{P}_2 \times \hat{P}_3 = (\frac{26-1}{26}) \times (\frac{25-1}{25}) \times (\frac{24-1}{23})=0.769$$

… …

Suppose $q > S\ (2.98)$, then fashion style is a low slope type, the values for low slope type are determined as following:

$$P(x > 0.11) = \hat{P}_1 = (\frac{14-1}{14}) = 0.929$$

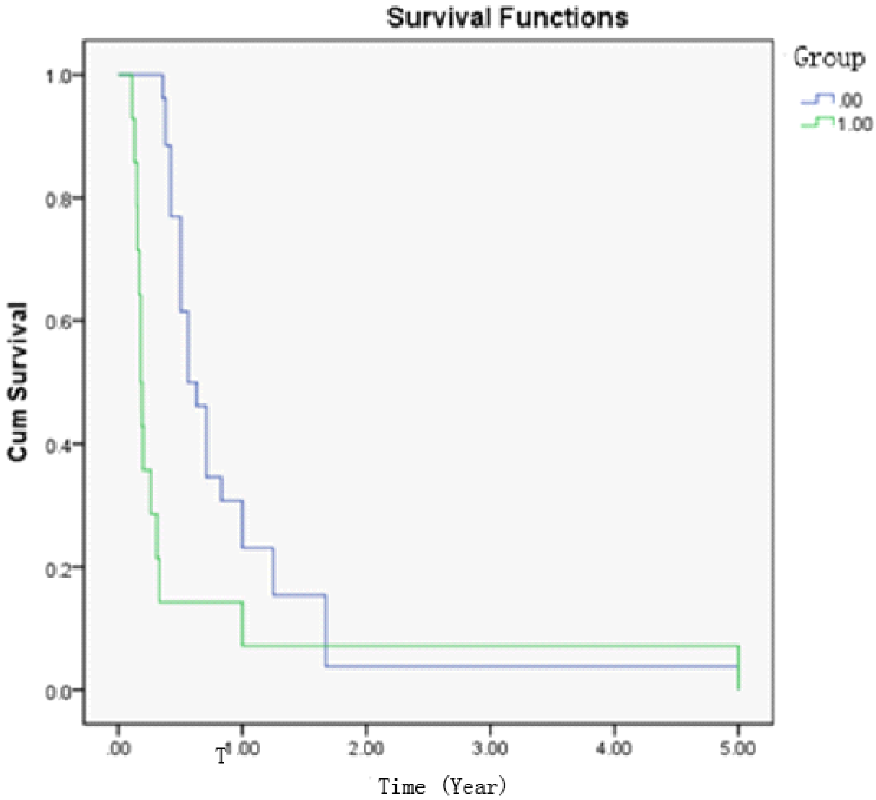
$$P(x > 0.13) = \hat{P}_1 \times \hat{P}_2 = (\frac{14-1}{14}) \times (\frac{13-1}{13}) = 0.857$$

$$P(x > 0.15) = \hat{P}_1 \times \hat{P}_2 \times \hat{P}_3 = (\frac{14-1}{14}) \times (\frac{13-1}{13}) \times (\frac{12-1}{12})=0.786$$

… …

See Table 4.5 for details

Chart 4.2 Survival Function for Group 1 and Group 2



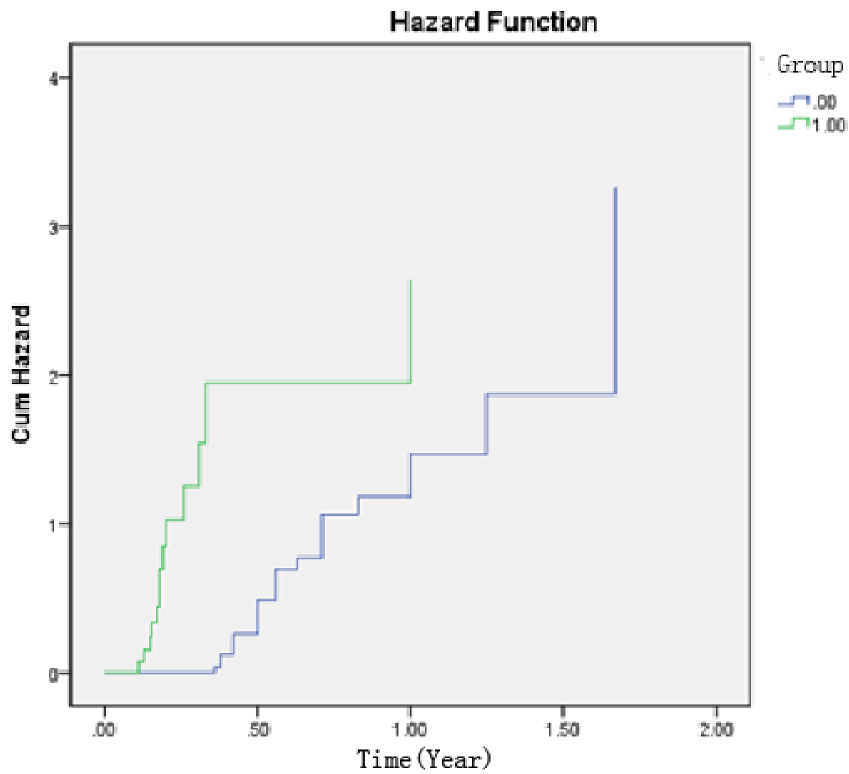
Survival functions plot the accumulated survival rating of different fashion styles in two groups (high slope and low slope) against time-varying changes. We found that low slope fashion group survives longer than high slope group. Use Linear interpolation method, survival function P (x> t) =0.5, Median survival time for two groups is determined as following:

t_1=0.56×360=201.6 days

t_2=0.18×360=64.8 days

See Chart 4.2 for details of survival function for Group 1 and Group 2

Chart 4.3 Hazard Function for Group 1 and Group 2



For the hazard function, an alternative characterization of the distribution of T is given by the hazard function of fashion style appearance, or instantaneous rate of occurrence of this event, defined as:

$$h(t) = \lim_{\Delta t \to 0} \frac{P(t < T < t + \Delta t T \geq t)}{\Delta t}$$

The numerator of this expression is the conditional probability that fashion clothes style as abandoned or disappeared occur in the interval, (t,$t + \Delta t T$) given that it has not occurred before. And the denominator is the width of the interval,

$$h(t) = \lim_{\Delta t \to 0} \frac{n(t) - n(t + \Delta t)}{n(t) \cdot \Delta t}$$

where $n(t)$ is survival function in time t, $n(t + \Delta t)$ is survival function in time

4.6 Relationship between Survival Function and Hazard Function

If integrate from 0 to t and introduce the boundary condition S (0) = 1 (since every fashion style is sure not to be finished in one fashion cycle by duration 0), we can solve the above expression to obtain a formula for the probability of surviving to duration t as a function of the hazard at all durations up to t, The formula is:

$$S(t) = \exp\left[-\int_0^t h(t)\,dt\right]$$

4.7 Results

Chart 4.2 presents the median survival time for low slope group is 201.6 days in this model, and the median survival time for high slope group is 64.8 days in this model. It shows that it is obvious the group with low slope adoption survive much longer than the high slop group. Chart 4.2 shows that the instantaneous failure rate for the two groups. The findings suggest that adoption velocity, or speed of adoption, may contribute to the fashion evolution, in addition to examining the popularity itself and cumulative hazard, It is deducted that clothes style sharper increase in adoption velocity tend to die out faster.

Chart 4.3 illustrates the relationship of lifecycle dynamics and fashion evolution. Clothes experienced sharper increases in popularity tend to die faster. The estimated hazard function implies that the hazard of group with higher slope is four times than the lower slope group. For instance, in the research, the loss probability of straight pants is 0.03846, while sailor pants is 0.96154. It is obvious that the disappearance hazard of sailor is higher than the straight.

4.8 Discussions

Fashion evolution is a complex social element decided by many aspects. It seems intuitive that changes in adverting, technology, celebrity or institution lead old fashion style to be replaced with new ones (Rogers, 1995; Pesendorfer, 1995). These factors make it temping to infer that the decline of the old style is replaced by the new one. Fashion cycle and evolution similar to vacancy chains (White, 1970), where new or popular items fill the vacuum left when old or unpopular items go off.

But different fashion styles have their own rules in fashion trend. Each single style has its own rates to become popular and die off. Some of them may become popular once again in the future; the other may not appear again.

In addition, focusing on external factors neglects the possible internal dynamics, psychology and emotional behavior of consumers and designers may lead the fashion trend. Because people prefer some differentiation, fashion styles that become too popular may be abandoned or disappearing due to lack of uniqueness. (Lieberson & Lynn, 2003; Leibenstein, 1950; Snyder, 1980) Psychology of consumer emotional behavior may influence fashion aesthetics and fashion evolution. People may not choose clothes they think the style would shortly become unpopular. This consumer behavior is really important for fashion evolution and consumption. However, it is difficult for consumers to identify whether a style of clothing is classic or short-lived.

The result shows that clothes appearance frequency adoption quickly tend to become unfashionable faster. More importantly, the effect of adoption velocity on fashion evolution is strongly positive and significant. Clothes appearance frequency sharper increase in popularity tends to unpopular faster.

4.9 Conclusion

Consumers care about symbolic value, and the total popularity and fast changing adoption velocity will decrease the attractiveness of clothes. The clothes popular values may sharply decreased when a fashion cycle finished. People may reconsider to buy those new clothes which has strong adoption velocity, as those clothes may quickly unpopular. The results also suggest that individual consumer perceive differ in adoption velocity, in other words, it can influence buying behavior.

The factors like technological characteristics, social movements and fashion marketing, etc. definitely play important roles in fashion evolution. (Jonah B.,2009) For example, clothes advertising may lead to fast adoption, but when advertising stops, popularity may quickly decline. It is difficult to know the impact of the above mentioned factors on fashion evolution or the correlation between new clothes style and the old ones. Besides the above mentioned external factors, the correlation between fashion styles can be considered as internal factors. Both lead to the evolution in fashion market.

Adoption velocity provides a context to reduce such unobserved heterogeneity. The quantified data demonstrate how external factors and internal dynamics impact on fashion evolution which helps limit potential confounds.

It is important to note that negative effects of adoption velocity in fashion evolution more likely in symbolic domains. The domains are often used to communicate personal identity. (Shavitt S (1990) (Berger J, Heath C (2007)

Negative effects of adoption velocity should occur in situations where choice is seen as a signal, or marker, of identity and where rapidly adopted fashion items may be stigmatized. (Jonah B, 2009) In other domains, fast adoption may be seen as a positive and may increase further adoption. De Vany A (2004) Negative effects of adoption velocity may also be more likely when there are high costs of abandonment. Although it is much more difficult to stop people buying a new clothes whether this clothes to be long-term or short-term trend. By examining the fashion cycle and adoption velocity, these findings also contribute to the fashion consumption. Major fashion house demand for design long-term commodities in fashion market will benefit to all consumers. Short-term commodities will be less valuable to all consumers as the value will be lose very quick when the fashion cycle finished.

If the designer tries to expand his clients by catering the short –term level, the average quality of his clients may collapse, since long-term level switch to competing designs and leave him with a design that nobody wants. (Wolfgang Pesendorfer, 1995)

In this paper, we derived new analytical expressions for the fashion evolution and velocity adoption based on the data collected from VOGUE magazine. The research on past fashion evolution proved that the new style will gain the old one's market share. Based on the survival analysis theory, the analytical expressions of $P(x>t)$, and $h(t)$ with collected specify fashion quantitative data will intensify the relationship between adoption velocity and fashion cycle.

The present data clearly indicate that clothes experienced sharper increases in popularity tend to die faster. The estimated hazard function implies that the hazard of group with higher slope is four times than the lower slope group.

CHAPTER 5

CORRELATION AND FACTOR ANALYSIS FOR FASHION EVOLUTION

5.1 Introduction

Fashion styles appearance frequency is an important component in fashion evolution research. These resources from VOGUE magazine are not only shows individual fashion style evolution, but also help evaluating the correlation and internal principles of the fashion items.

This chapter reports the investigation on the internal principles of the fashion style by researching effective fashion data and appropriate fashion items. The results show that internal principles were strongly related.

5.2 Data Preparation and Catalogues Set

The data collected from VOGUE magazine by counting clothes frequency of appearance were described in Chapter 3. Effective variables were used for factor analysis to research the correlation between the data. It means that fashion evolution data need to be valid to reveal their involvement in one fashion cycle in that time. According to the rules been set, 38 clothes in four catalogues are suitable analysis were summarized in table 5.1

Table 5.1 Summary of fashion style under the basic research rule

Pants	Pocket Jeans	Hot pants	Palazzo	Sailor Pants	Shinny	Skort	Straight	Sweat Pants				
Dress	Empire	Halter Dress	Jumper Dress	Maxi	Pouf	Shift	Slip Dress	Strapless	Sun Dress	Warp Dress	sheath	A-line
Skirts	A Line	Layered	Pleat	Pegged	Pencil	Slit	Trumpet					
Top	Blouse	Peplum	Pin Tuck	Polo	Ruffle Front	Sweat shirt	Tunic	Turtleneck	Sailor	Smock	Henley	

An extensive statistical analysis was made with a principle component analysis in chapter 5, fashion clothes appearance frequency data (1987-2006) were used to research their correlations by using principle component analysis. Table 5.2, Table 5.3, Table 5.4, Table 5.5 were added to show the fashion clothes evolution appearance frequency for 38 items from 1987 to 2006. Below are the new tables provided in the thesis to show the variables involved in principle component analysis.

Table 5.2 Summary the Appearance frequency of Top

Item / App / Yea	Blouse	Peplum	PinTuck	Polo	Ruffle Front	Sweatshirt	Tunic	Turtle-neck	Sailor	Smock	Henley
1987	48.00	42.00	8.00	31.00	15.00	30.00	12.00	32.00	3.00	48.00	8.00
1988	50.00	36.00	6.00	32.00	18.00	32.00	5.00	38.00	10.00	51.00	5.00
1989	53.00	31.00	10.00	35.00	16.00	25.00	10.00	23.00	11.00	50.00	11.00
1990	45.00	33.00	14.00	30.00	20.00	19.00	9.00	18.00	14.00	54.00	14.00
1991	41.00	31.00	19.00	32.00	17.00	17.00	7.00	24.00	15.00	49.00	13.00

1992	39.00	32.00	20.00	34.00	18.00	18.00	9.00	17.00	17.00	55.00	7.00
1993	40.00	28.00	21.00	40.00	16.00	16.00	14.00	18.00	14.00	42.00	10.00
1994	42.00	23.00	22.00	48.00	14.00	19.00	17.00	20.00	16.00	49.00	9.00
1995	48.00	32.00	23.00	50.00	10.00	18.00	19.00	18.00	12.00	42.00	13.00
1996	50.00	38.00	22.00	47.00	11.00	22.00	22.00	15.00	10.00	43.00	15.00
1997	52.00	39.00	25.00	53.00	7.00	20.00	19.00	16.00	14.00	38.00	14.00
1998	50.00	36.00	23.00	50.00	5.00	21.00	10.00	16.00	9.00	42.00	20.00
1999	48.00	45.00	19.00	49.00	11.00	26.00	13.00	11.00	7.00	43.00	20.00
2000	47.00	42.00	16.00	48.00	9.00	21.00	7.00	16.00	5.00	45.00	18.00
2001	39.00	43.00	12.00	35.00	10.00	18.00	3.00	15.00	5.00	49.00	24.00
2002	36.00	47.00	10.00	29.00	6.00	13.00	5.00	15.00	5.00	51.00	19.00
2003	38.00	43.00	7.00	32.00	11.00	10.00	7.00	13.00	8.00	49.00	23.00
2004	40.00	45.00	9.00	34.00	13.00	8.00	4.00	15.00	4.00	47.00	27.00
2005	38.00	52.00	8.00	32.00	15.00	7.00	9.00	14.00	8.00	54.00	24.00
2006	38.00	51.00	6.00	27.00	18.00	8.00	8.00	11.00	7.00	49.00	25.00

Table 5.3 Summary the Appearance frequency of Dress

Item App Yea	*Empire*	*Halter Dress*	*Jumper Dress*	*Maxi*	*Pouf*	*Shift*	*Slip Dress*	*Strap -less*	*Sun Dress*	*Warp Dress*	*sheath*	*Aline (Dress)*
1987	*9.00*	*10.00*	*23.00*	*3.00*	*11.00*	*26.00*	*8.00*	*18.00*	*18.00*	*2.00*	*10.00*	*17.00*
1988	*10.00*	*4.00*	*20.00*	*.00*	*10.00*	*25.00*	*4.00*	*17.00*	*21.00*	*4.00*	*13.00*	*19.00*
1989	*11.00*	*5.00*	*18.00*	*1.00*	*11.00*	*26.00*	*5.00*	*16.00*	*23.00*	*3.00*	*17.00*	*22.00*
1990	*9.00*	*6.00*	*15.00*	*.00*	*10.00*	*23.00*	*11.00*	*17.00*	*18.00*	*2.00*	*17.00*	*18.00*
1991	*8.00*	*10.00*	*14.00*	*.00*	*11.00*	*26.00*	*16.00*	*14.00*	*23.00*	*4.00*	*19.00*	*13.00*
1992	*6.00*	*8.00*	*7.00*	*1.00*	*14.00*	*28.00*	*14.00*	*7.00*	*25.00*	*2.00*	*21.00*	*14.00*
1993	*5.00*	*5.00*	*5.00*	*.00*	*7.00*	*30.00*	*15.00*	*5.00*	*26.00*	*5.00*	*25.00*	*10.00*
1994	*4.00*	*9.00*	*2.00*	*2.00*	*13.00*	*31.00*	*17.00*	*4.00*	*25.00*	*4.00*	*24.00*	*9.00*
1995	*5.00*	*9.00*	*2.00*	*5.00*	*11.00*	*32.00*	*23.00*	*5.00*	*23.00*	*5.00*	*26.00*	*5.00*
1996	*5.00*	*11.00*	*1.00*	*2.00*	*5.00*	*34.00*	*32.00*	*6.00*	*21.00*	*10.00*	*25.00*	*6.00*
1997	*6.00*	*16.00*	*2.00*	*1.00*	*5.00*	*34.00*	*34.00*	*9.00*	*19.00*	*15.00*	*26.00*	*7.00*
1998	*6.00*	*14.00*	*3.00*	*1.00*	*6.00*	*32.00*	*32.00*	*10.00*	*17.00*	*20.00*	*25.00*	*9.00*
1999	*7.00*	*10.00*	*8.00*	*1.00*	*11.00*	*32.00*	*33.00*	*12.00*	*18.00*	*20.00*	*21.00*	*11.00*
2000	*10.00*	*9.00*	*10.00*	*6.00*	*9.00*	*29.00*	*32.00*	*12.00*	*15.00*	*28.00*	*20.00*	*16.00*
2001	*4.00*	*10.00*	*12.00*	*1.00*	*4.00*	*25.00*	*30.00*	*9.00*	*15.00*	*18.00*	*20.00*	*15.00*
2002	*10.00*	*11.00*	*14.00*	*6.00*	*5.00*	*24.00*	*25.00*	*11.00*	*17.00*	*14.00*	*17.00*	*6.00*
2003	*6.00*	*12.00*	*12.00*	*5.00*	*6.00*	*26.00*	*20.00*	*6.00*	*16.00*	*6.00*	*17.00*	*3.00*
2004	*9.00*	*9.00*	*10.00*	*20.00*	*10.00*	*25.00*	*20.00*	*10.00*	*15.00*	*5.00*	*16.00*	*5.00*
2005	*8.00*	*6.00*	*8.00*	*34.00*	*9.00*	*23.00*	*19.00*	*12.00*	*15.00*	*7.00*	*17.00*	*9.00*
2006	*4.00*	*15.00*	*8.00*	*50.00*	*9.00*	*20.00*	*18.00*	*12.00*	*12.00*	*4.00*	*11.00*	*2.00*

Table 5.4 Summary the Appearance frequency of Pants

Items / Appea / Year	Pocket Jeans	Hot Pants	Palazzo	Sailor Pants	Skinny	Short	Straight Pants	Sweat Pants
1987	38.00	8.00	8.00	15.00	22.00	4.00	59.00	15.00
1988	40.00	4.00	7.00	10.00	15.00	3.00	53.00	10.00
1989	47.00	5.00	11.00	11.00	11.00	5.00	55.00	11.00
1990	45.00	4.00	20.00	20.00	10.00	10.00	63.00	19.00
1991	53.00	13.00	24.00	25.00	8.00	6.00	50.00	25.00
1992	45.00	21.00	15.00	14.00	6.00	7.00	56.00	13.00
1993	59.00	30.00	11.00	11.00	2.00	4.00	50.00	10.00
1994	49.00	28.00	10.00	10.00	4.00	10.00	50.00	9.00
1995	67.00	20.00	6.00	5.00	2.00	16.00	55.00	5.00
1996	49.00	15.00	12.00	10.00	6.00	22.00	50.00	11.00
1997	50.00	11.00	8.00	14.00	7.00	30.00	47.00	14.00
1998	81.00	10.00	7.00	30.00	6.00	34.00	49.00	22.00
1999	62.00	20.00	9.00	25.00	8.00	25.00	45.00	27.00
2000	85.00	12.00	12.00	20.00	10.00	10.00	48.00	47.00
2001	75.00	13.00	3.00	12.00	19.00	11.00	50.00	15.00
2002	54.00	12.00	11.00	8.00	17.00	10.00	38.00	10.00
2003	63.00	18.00	7.00	6.00	19.00	14.00	40.00	7.00
2004	74.00	16.00	8.00	5.00	32.00	18.00	62.00	9.00
2005	49.00	28.00	17.00	10.00	52.00	20.00	50.00	8.00
2006	53.00	45.00	19.00	10.00	68.00	21.00	38.00	9.00

Table 5.5 Summary the Appearance frequency of Skirts

Items / Appear / Year	Aline Skirts	Layered	Pleat	Pegged	Pencil	Slit	Trumpet
1987	.00	15.00	3.00	8.00	8.00	8.00	8.00
1988	.00	15.00	4.00	4.00	4.00	5.00	6.00
1989	.00	11.00	2.00	5.00	5.00	12.00	7.00
1990	3.00	7.00	3.00	9.00	4.00	5.00	6.00
1991	3.00	8.00	6.00	9.00	10.00	4.00	8.00
1992	.00	9.00	2.00	7.00	7.00	7.00	15.00
1993	2.00	6.00	5.00	10.00	11.00	5.00	14.00
1994	.00	10.00	4.00	8.00	4.00	9.00	21.00
1995	2.00	13.00	5.00	4.00	12.00	5.00	22.00
1996	2.00	18.00	6.00	5.00	9.00	15.00	24.00
1997	4.00	21.00	4.00	7.00	8.00	10.00	22.00

1998	16.00	24.00	7.00	10.00	10.00	15.00	20.00
1999	28.00	28.00	7.00	12.00	12.00	17.00	19.00
2000	30.00	20.00	8.00	16.00	20.00	19.00	17.00
2001	29.00	18.00	17.00	15.00	23.00	17.00	9.00
2002	27.00	11.00	22.00	16.00	23.00	14.00	12.00
2003	16.00	7.00	24.00	15.00	22.00	16.00	9.00
2004	14.00	8.00	22.00	13.00	20.00	16.00	6.00
2005	10.00	9.00	15.00	14.00	21.00	11.00	4.00
2006	14.00	6.00	10.00	12.00	20.00	10.00	2.00

Refer to the literature review, Fashion style were concluded to four different catalogues of clothes, which are top, pants, skirt and dress. Based on the rules of factor analysis and fashion collocation, the research data of top and pants should be highly related; while skirt and dress should be highly related. Therefore, the above four catalogues of clothes were divided into two groups; group 1 contains the evolution data for top and pants, while group 2 contains the evolution data for skirt and dress. The evolution data in the Tables are the reflection of fashion cycles. We put the data to principle component analysis in SPSS to compare their correlation.

5.3 Sampling Accuracy for Factorial Analysis

To verify the adequacy of the sample for factor analysis, the Kaiser-Meyer-Olkin Measure of Sampling Adequacy was calculated and KMO and Bartlett test were carried out. The results of group 1 and group 2 are listed in Table 5.6 and Table 5.7

Table 5.6 KMO and Barlett's Test for Group 1

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.690
Bartlett's Test of Sphericity	Approx. Chi-Square	437.692
	df	171
	Sig.	.000

Table 5.7 KMO and Barlett's Test for Group 2

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.687
Bartlett's Test of Sphericity	Approx. Chi-Square	488.088
	df	171
	Sig.	.000

The possibility that the data not adequate was less than 0.01. The KMO measured the sampling adequacy which should be greater than 0.5, the data gave a satisfactory factor analysis. The Bartlett's test measured the strength of the relationship among of variables. The observed significance level for two groups both are 0.000, which concluded that the strength of the relationship among the variables is strong and fit for the factor analysis.

5.4 Principal Component Analysis (PCA)

In Chapter 3, 38 different clothes evolution data were defined. Both group 1 and group 2 contained data of 19 different types of clothes respectively. These data may be interrelated. By using principal component analysis (PCA), independent principal components can be extracted and underlying structure among the variables in the analysis can be defined. (Hair, 2010)

The data were first normalized and then analyzed by PCA using PASS. As shown in the scree plot, under the minimum fraction variance of 0.005(or 5%,) Five principle components with the eigenvalue greater than 1(see figure 5.1) was identified in group 1, which accounts for cumulative variance of about 90%. Four principle components with the eigenvalue greater than 1(see figure 5.2) was identified in group 2, which accounts for cumulative variance of about 90%.

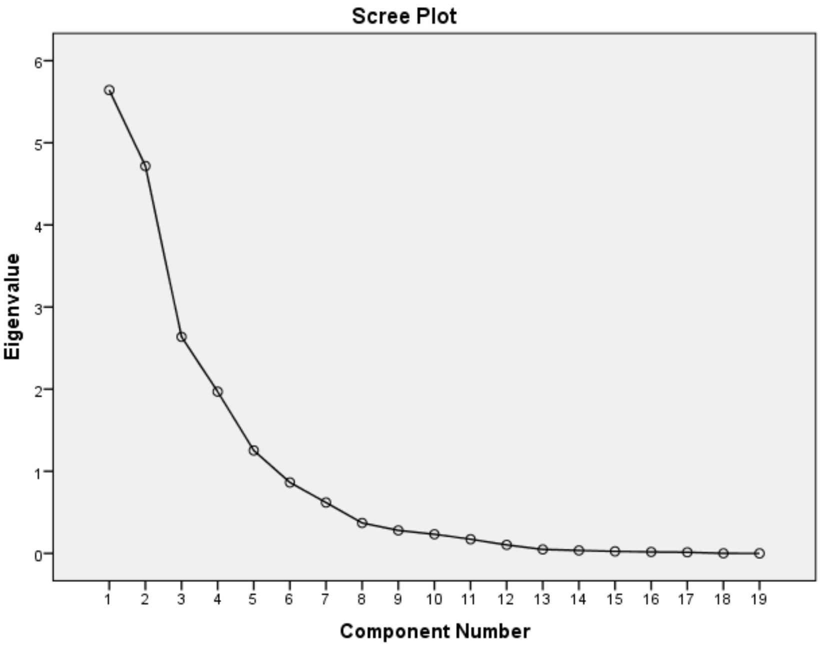


Figure 5.1 Scree plot for Group 1

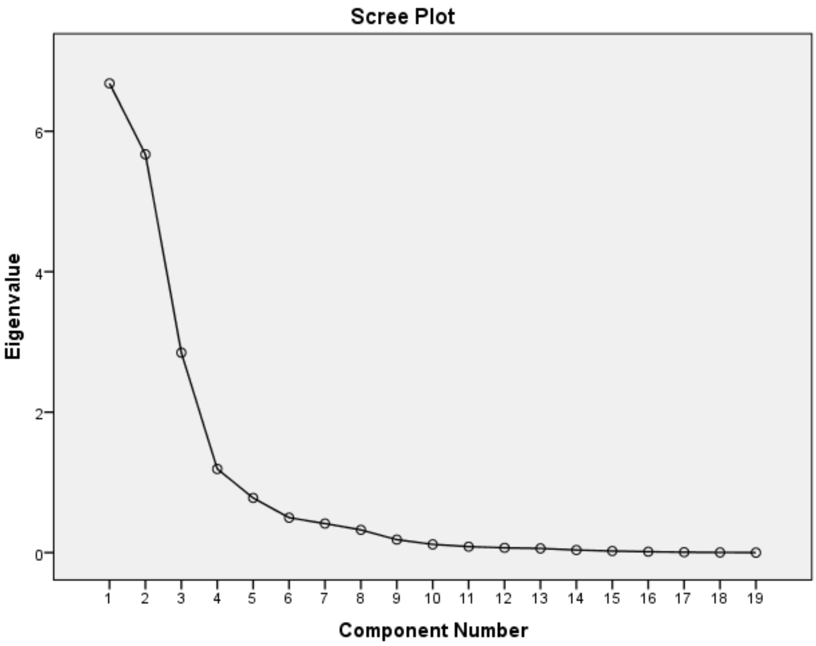


Figure 5.2 Scree plot for Group 2

Table 5.8 lists the variance explained by each of these five components as well as the accumulative variance in group 1.

Table 5.8 Total variance explained from PCA in group 1

Total Variance Explained

Component	Initial Eigenvalues		
	Total	% of Variance	Cumulative %
1	5.642	29.695	29.695
2	4.717	24.827	54.522
3	2.637	13.877	68.399
4	1.970	10.367	78.765
5	1.253	6.595	85.360
6	.863	4.544	89.904
7	.619	3.259	93.163
8	.370	1.947	95.110
9	.280	1.472	96.583
10	.233	1.227	97.809
11	.173	.908	98.717
12	.103	.542	99.260
13	.048	.251	99.511
14	.036	.189	99.700
15	.024	.129	99.828
16	.018	.095	99.923
17	.014	.071	99.994
18	.001	.004	99.999
19	.000	.001	100.000

Extraction Method: Principal Component Analysis.

Table 5.9 lists the variance explained by each of these five components as well as the accumulative variance in group 2.

Table 5.9 Total variance explained from PCA in group 2

Total Variance Explained

Component	Initial Eigenvalues		
	Total	% of Variance	Cumulative %
1	6.681	35.164	35.164
2	5.671	29.845	65.009
3	2.847	14.986	79.995
4	1.192	6.273	86.268
5	.778	4.095	90.363
6	.497	2.618	92.981
7	.414	2.180	95.161
8	.324	1.704	96.864
9	.185	.973	97.838
10	.118	.619	98.456
11	.085	.447	98.903
12	.069	.362	99.265
13	.059	.313	99.578
14	.037	.194	99.773
15	.023	.121	99.893
16	.013	.066	99.960
17	.005	.029	99.988
18	.002	.011	99.999
19	.000	.001	100.000

Extraction Method: Principal Component Analysis.

Table 5.10 lists the transformation matrix between the five components and 19 different types of clothes in group 1. The matrix was used for the regression analysis.

Table 5.10 Transformation matrix for Group 1

Component Transformation Matrix

Component	1	2	3	4	5
1	.561	.517	.606	-.112	.194
2	-.485	.586	-.226	-.565	.225
3	-.590	.264	.516	.432	-.359
4	-.261	-.214	.193	.275	.879
5	.181	.523	-.527	.637	.097

Extraction Method: Principal Component Analysis.

Rotation Method: Varimax with Kaiser Normalization.

Table 5.11 lists the transformation matrix between the four components and 19 different types of clothes in group 2. The matrix was also used for the regression analysis.

Table 5.11 Transformation matrix for Group2

Component Transformation Matrix

Component	1	2	3	4	5
1	.561	.517	.606	-.112	.194
2	-.485	.586	-.226	-.565	.225
3	-.590	.264	.516	.432	-.359
4	-.261	-.214	.193	.275	.879
5	.181	.523	-.527	.637	.097

Extraction Method: Principal Component Analysis.

Rotation Method: Varimax with Kaiser Normalization.

5.5 Estimate the Factor Matrix

In table 5.12 and table 5.13, the unrotated component analysis was calculated by SPSS. It showed the factor loadings between the variable and the principal components. The range of the factor loading from -1 to +1. Take "Tunic" as an example, the factor loading were 0.609, 0.111, 0.660, -0.215 and 0.142 for components 1,2,3,4 and 5, respectively. The factor loading for component 1 and 3 were 0.609 and 0.660, which were almost equal, but in different signs. This makes unclear that "Tunic" mainly determines Component 1 or Component 3.

Table 5.12 Unrotated component analysis factor matrix for Group 1

Component Matrix[a]

	Component				
	1	2	3	4	5
Pocket Jeans	-.058	.741	-.273	.185	-.471
Hot Pants	-.459	.214	.692	.017	.097
Palazzo	-.247	-.361	.367	.705	.280
Sailor Pants	.381	.176	-.280	.764	.214
Skinny	-.864	.007	.024	-.050	.412
Short	.022	.809	.136	.007	.392
Straight Pants	.339	-.477	-.161	-.010	-.107
Sweat Pants	.260	.262	-.472	.710	.009
Blouse	.768	.063	-.311	-.148	.427
Peplum	-.730	.383	-.329	-.080	.364
Pin Tuck	.753	.373	.438	.209	-.123
Polo	.718	.627	.141	-.052	.014
Ruffle Front	-.177	-.825	.235	.211	.168
Sweatshirt	.733	-.284	-.465	-.089	.248
Tunic	.628	.218	.540	-.267	.325
Turtleneck	.357	-.719	-.381	-.211	.104
Sailor	.500	-.337	.681	.239	-.114
Smock	-.526	-.686	-.052	.201	-.111
Henley	-.686	.647	-.108	.081	-.018

Extraction Method: Principal Component Analysis.

a. 5 components extracted.

Table 5.13 Unrotated component analysis factor matrix for Group 2

Component Matrix[a]

	Component			
	1	2	3	4
Empire	-.413	.436	.583	.136
Halter Dress	.663	-.043	-.159	-.563
Jumper Dress	-.571	.626	.411	.050
Maxi	.142	.569	-.542	-.407
Pouf	-.649	-.121	-.052	-.069
Shift	.345	-.882	.204	.003
Slip Dress	.935	-.225	.154	-.094
Strapless	-.519	.519	.546	-.350
Sun Dress	-.503	-.748	-.084	.343
Warp Dress	.772	-.021	.577	.000
sheath	.421	-.830	-.035	.241
Aline (Dress)	-.621	.023	.688	.124
Aline Skirts	.745	.471	.325	.140
Layered	.483	-.326	.706	-.297
Pleat	.538	.640	-.243	.353
Pegged	.592	.664	.013	.277
Pencil	.651	.651	-.202	.209
Slit	.758	.286	.335	.091
Trumpet	.448	-.846	.144	.011

Extraction Method: Principal Component Analysis.

a. 4 components extracted.

5.6 Factor Rotation

In order to minimize the cross-loading of the variables on the principal components so as to clarify the relationship between the principal components and the variables (i.e. Evolution Data), the factor matrix was rotated by Varimax with Kaiser Normalization Method. Table 5.14 lists factor matrix after rotation. After rotation, each variable is predominantly related to one principal component and more specific.

Table 5.14 Rotated component analysis factor matrix for Group 1-Full set of variable

Rotated Component Matrix[a]

	Component				
	1	2	3	4	5
PocketJeans	-.364	.046	-.059	-.779	.371
HotPants	-.757	.118	-.017	.296	-.265
Palazzo	-.313	-.247	.110	.763	.386
SailorPants	.134	.174	.082	.084	.907
Skinny	-.415	-.209	-.740	.352	-.178
Short	-.391	.725	-.304	-.149	.182
StraightPants	.501	-.201	.285	.091	-.002
SweatPants	.114	.015	-.013	-.179	.904
Blouse	.700	.606	.037	-.024	.186
Peplum	-.315	-.032	-.906	-.066	.027
PinTuck	-.094	.615	.703	-.127	.245
Polo	.032	.794	.349	-.379	.185
RuffleFront	.138	-.470	.153	.753	-.103
Sweatshirt	.892	.238	.121	.011	.191
Tunic	.056	.823	.387	.173	-.226
Turtleneck	.848	-.238	.087	.210	-.131
Sailor	-.041	.130	.837	.422	-.024
Smock	-.004	-.789	-.093	.408	-.072
Henley	-.660	-.031	-.593	-.324	.121

Extraction Method: Principal Component Analysis.

Rotation Method: Varimax with Kaiser Normalization.

a. Rotation converged in 8 iterations.

Table 5.15 Rotated component analysis factor matrix for Group 2

Rotated Component Matrix[a]

	Component			
	1	2	3	4
Empire	.055	.794	.021	.291
Halter Dress	.179	-.362	.422	-.666
Jumper Dress	.027	.909	-.218	.126
Maxi	.266	.043	-.376	-.768
Pouf	-.538	.226	-.302	.110
Shift	-.307	-.616	.617	.292
Slip Dress	.450	-.504	.691	-.158
Strapless	-.170	.953	.075	-.131
Sun Dress	-.652	-.326	-.177	.612
Warp Dress	.511	-.066	.814	.055
sheath	-.126	-.793	.386	.363
Aline (Dress)	-.342	.697	.135	.504
Aline Skirts	.850	.095	.406	-.082
Layered	.006	.003	.961	.024
Pleat	.897	-.053	-.237	-.134
Pegged	.920	.094	-.007	-.118
Pencil	.920	-.057	-.106	-.267
Slit	.724	-.016	.498	-.061
Trumpet	-.212	-.679	.612	.241

Extraction Method: Principal Component Analysis.

Rotation Method: Varimax with Kaiser Normalization.

a. Rotation converged in 8 iterations.

Table 5.16 Reduced set of variable for group 1: rotated component analysis factor matrix sorted by component and factor loading in group 1,

Rotated Component Matrix[a]

	Component				
	1	2	3	4	5
Hot Pants	-.757				
Straight Pants	.501				
Sweatshirt	.892				
Turtleneck	.848				
Henley	-.660				
Blouse	.700	.606			
Short		.725			
Smock		-.789			
Polo		.794			
Tunic		.823			
Pin Tuck		.615	.703		
Skinny			-.740		
Peplum			-.906		
Sailor			.837		
Pocket Jeans				-.779	
Palazzo				.763	
Ruffle Front				.753	
Sailor Pants					.907
Sweat Pants					.904

Extraction Method: Principal Component Analysis.

Rotation Method: Varimax with Kaiser Normalization.

a. Rotation converged in 7 iterations.

Component 1 is determined by 5 variables, viz, Short, Pin Tuck, Polo, Tunic and Smock.

Component 2 is determined by 5 variables, viz, Hot Pants, Straight Pants, Blouse, Sweatshirt and Turtleneck.

Component 3 is determined by 4 variables, viz, Pocket Jeans, Palazzo, Ruffle Front and Sailor.

Component 4 is determined by 2 variables, viz, Sailor Pants and Sweat Pants.

Component 5 is determined by 3 variables, viz, Skinny, Short and Peplum.

Table 5.17 Reduced set of variable for group 2: rotated component analysis factor matrix sorted by component and factor loading In group 2,

Rotated Component Matrix[a]

	Component			
	1	2	3	4
Sun Dress	-.652			.612
Pouf	-.538			
Aline Skirts	.850			
Pleat	.897			
Pegged	.920			
Pencil	.920			
Slit	.724			
Empire		.794		
Jumper Dress		.909		

Strapless		.953		
Aline (Dress)		.697		
Sheath		-.793		
Trumpet		-.679	.612	
Shift		-.616	.617	
Slip Dress			.691	
Warp Dress			.814	
Layered			.961	
Halter Dress				-.666
Maxi				-.768

Extraction Method: Principal Component Analysis.

Rotation Method: Varimax with Kaiser Normalization.

a. Rotation converged in 8 iterations.

Component 1 is determined by 7 variables, viz, Pouf, Sun Dress, Aline Skirts, Pleat, Pegged, Pencil and Slit.

Component 2 is determined by 6 variables, viz, Empire, Jumper Dress, Shift, Strapless, Aline (Dress) and Trumpet.

Component 3 is determined by 5 variables, viz, Shift, Slip Dress, Warp Dress and Aline (Dress) .

Component 4 is determined by 3 variables, viz, Halter Dress, Maxi and Sun Dress.

5.7 RESULTS AND DISCUSSIONS

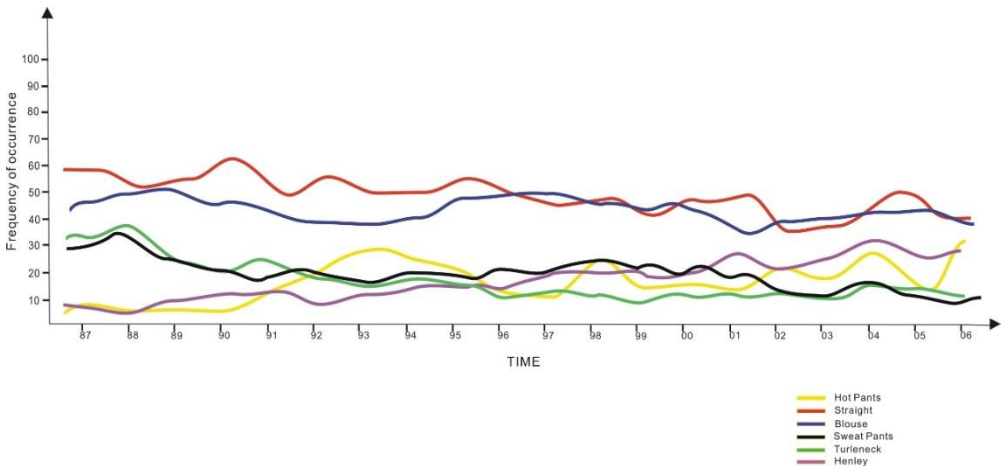
5.71 Physical Meaning of Components in Group 1

Component 1

This component was mainly determined by 6 variables, Hot Pants, Straight Pants, Blouse, Sweat shirt, Turtleneck and Henley.

The variables were put in one chart for comparison, Chart 5.1 shows that the variables adoption velocity slightly increased or slightly decreased. The slope of Straight Pants, Sweat shirt, Turtleneck and Blouse were decreased, while the slope Hot Pants and Henley were increased. The absolute value of the adoption velocity are quite similar. The analysis result shows that Hot Pants and Henley took the place of Straight Pants, Sweat shirt, Turtleneck and Blouse.

Chart 5.1 Fashion style evolution in Component 1 Group1



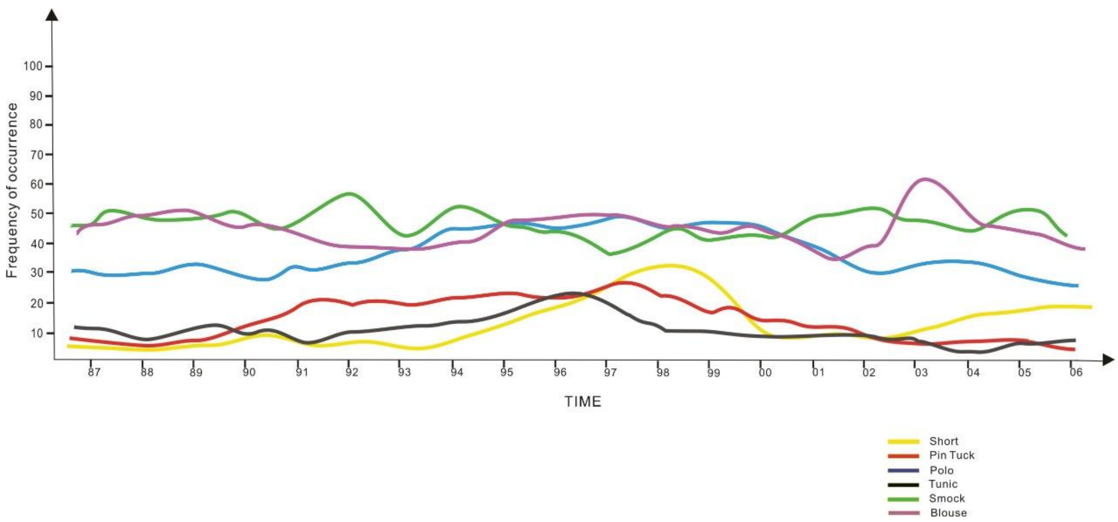
Component 2

This component was mainly determined by 6 variables, Short, Pin Tuck, Polo, Tunic, Smock and Blouse.

The variables were put in one chart for comparison, Chart 5.2 shows that the absolute value of those variables are quite similar, but it generally has two distinct evolution ways. The frequency of appearance of Short, Pin Tuck, Polo and Tunic increased at the beginning but decreased at the second half which shows that they finished one fashion cycle in 20 years. The appearance of Smock and Blouse decreased at the beginning but increased at the second half which shows they are in between two fashion cycles.

Thus, the adoption velocity of fashion styles in Component 2 in group 1 are gradually increased or decreased. It also presents that those fashion styles in a complete fashion cycle or in between two fashion cycles.

Chart 5.2 Fashion style evolution in Component 2 Group1



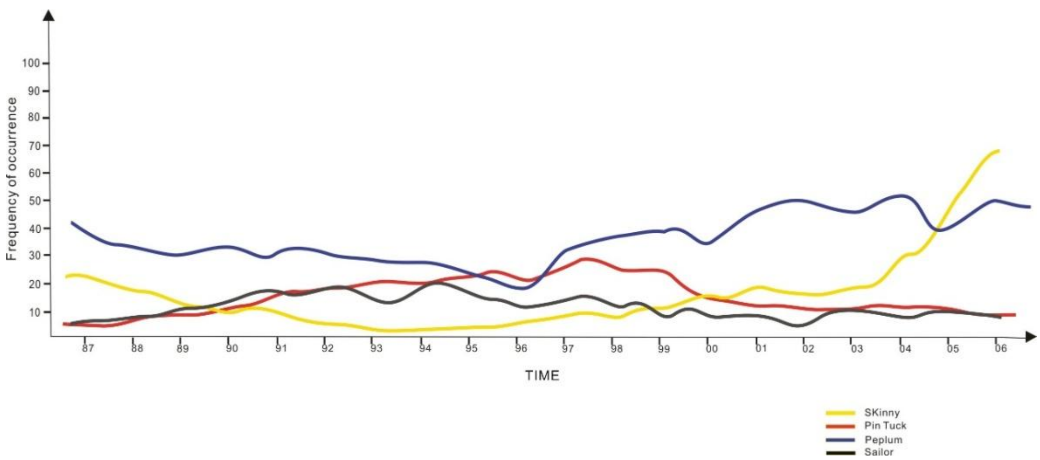
Component 3

This component was mainly determined by 4 variables, Skinny, Pin tuck, Peplum and sailor.

The variables were put in one chart for comparison, Chart 5.3 shows that the absolute value of those variables are quite similar, but it generally has two distinct evolution ways. The appearance of Pin tuck and sailor increased at the beginning but decreased at the second half which shows that they finished one fashion cycle in 20 years. The appearance of Skinny and Peplum decreased at the beginning but increased at the second half which shows they are in between two fashion cycle.

Thus, the adoption velocity of fashion styles in Component 3 in group are sharply increased or decreased. It also presents that those fashion styles in a complete fashion cycle or in between two fashion cycles.

Chart 5.3 Fashion style evolution in Component 3 Group1



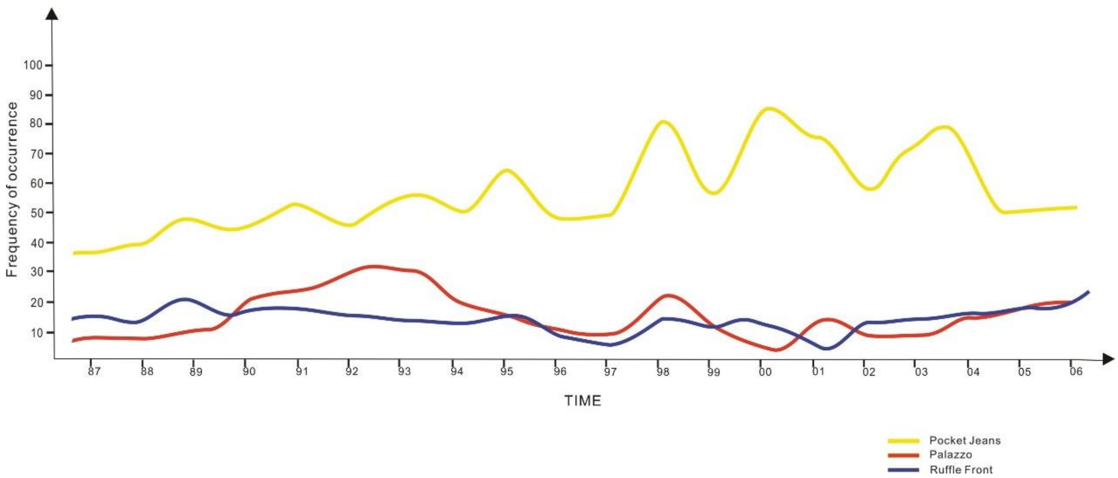
Component 4

This component was mainly determined by 4 variables, Pocket Jeans, Palazzo, Ruffle Front and Sailor.

The variables were put in one chart for comparison; Chart 5.4 shows that the numbers of appearance for those variables are maintained. The numbers of appearance are quite different in short time. The evolution curve shows large short-term volatility.

Thus, the fashion styles in Component 4 in group 1 has involved in a long term fashion cycle. The curve in long term trend is stable. It shows that those fashion items may continue for long term, but maintained short-term volatility.

Chart 5.4 Fashion style evolution in Component 4 Group1



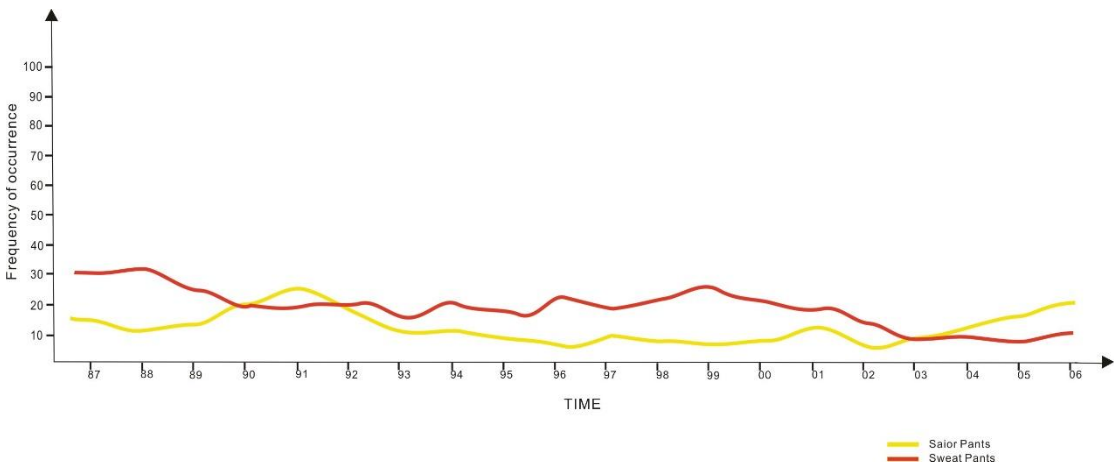
Component 5

This component was mainly determined by 2 variables, Sailor Pants and Sweat Pants.

Those variables were put in one chart for comparison, Chart 5.5 shows that the numbers of appearance for those variables are maintained their value. The numbers of appearance are also quite similar in short time. The evolution curve shows large short-term volatility.

Therefore, the fashion styles in Component 5 in group 1 has involved in a long term fashion cycle. The curve shows the evolution data are not fluctuated much. It also shows that the evolution of these fashion items may continue for long- term as a part of one fashion cycle.

Chart 5.5 Fashion style evolution in Component 5 Group1



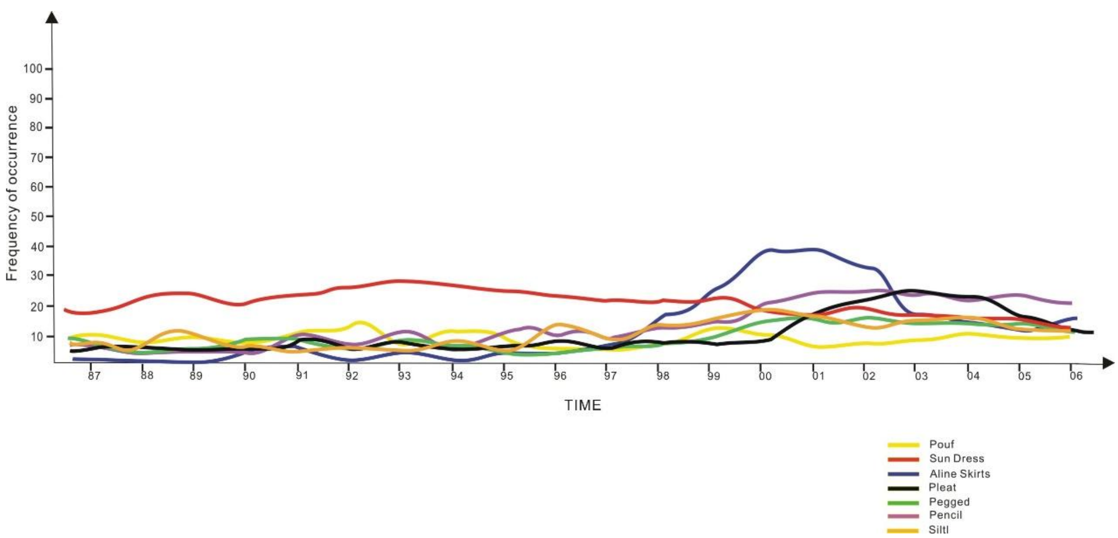
5.72 Physical Meaning of Components in Group 2

Component 1

This component was mainly determined by 7 variables, Pouf, Sun Dress, Aline Skirts, Pleat, Pegged，Pencil and Slit.

Those variables were put in one chart for comparison, Chart 5.6 shows that those variables adoption velocity slightly increased or slightly decreased. The slope of Pouf, Aline Skirts, Pleat, Pegged, Pencil and Slit increased, while the slope of Sun Dress decreased. The absolute value of the adoption velocity are quite similar. The analysis result means that Pouf, Aline Skirts, Pleat, Pegged，Pencil and Slit took the place of Sun Dress.

Chart 5.6 Fashion style evolution in Component 1 Group2



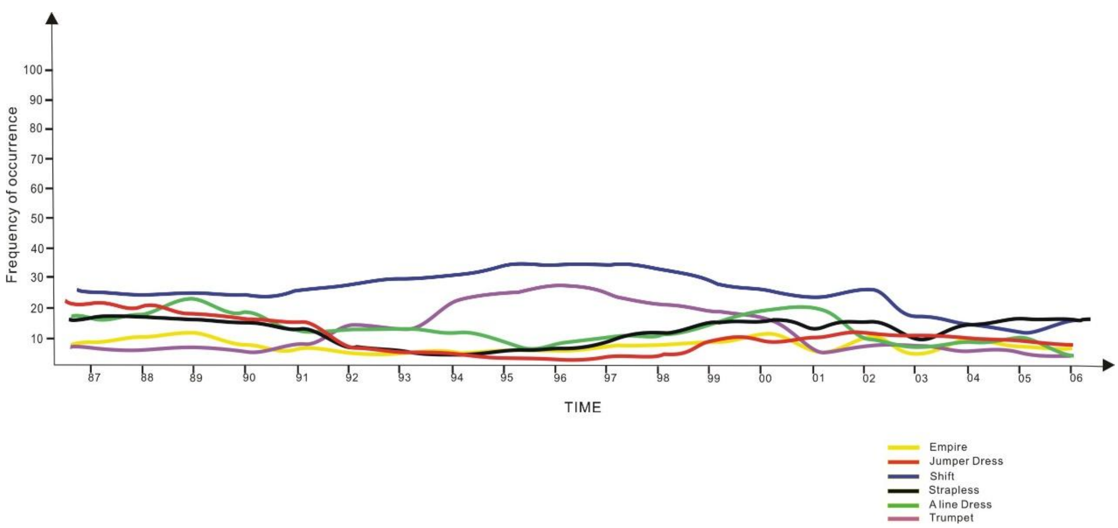
Component 2

This component was mainly determined by 6 variables, Empire, Jumper Dress, Shift, Strapless , Aline (Dress) and Trumpet.

Those variables were put in one chart for comparison, Chart 5.7 shows that the absolute value of those variables are quite similar, but it generally has two distinct evolution ways. The appearance of Shift and Trumpet increased at the beginning but decreased at the second half. Those fashion styles show that they finished one fashion cycle in 20 years. The appearance of Empire, Jumper Dress, Strapless and Aline (Dress) decreased at the beginning but increased at the second half. Those fashion styles show they are in between two fashion cycles.

Therefore, the adoption velocity of the fashion styles in Component 2 in group are generally increased or decreased. It also presents that those fashion styles in a complete fashion cycle or in between two fashion cycles.

Chart 5.7 Fashion style evolution in Component 2 Group2



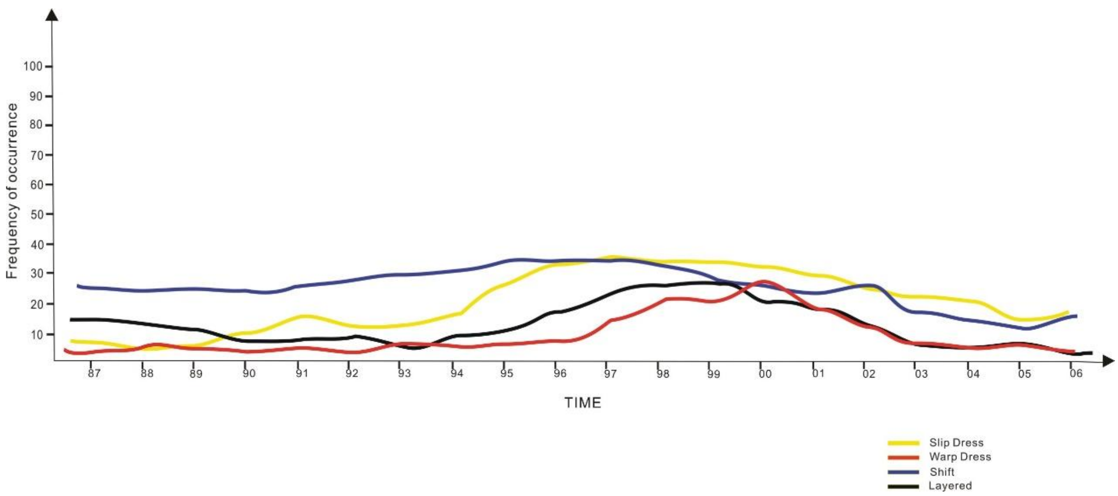
Component 3

This component was mainly determined by 5 variables, Shift, Slip Dress, Warp Dress and Layered.

Those variables were put in one chart for comparison; Chart 5.8 shows that the absolute value those variables are quite similar. The appearance of those variables increased at the beginning but decreased at the second half. Those fashion styles show that they finished one fashion cycle in 20 years.

Therefore, the adoption velocity of the fashion styles in Component 3 in group 2 are sharply increased or decreased.

Chart 5.8 Fashion style evolution in Component 3 Group2



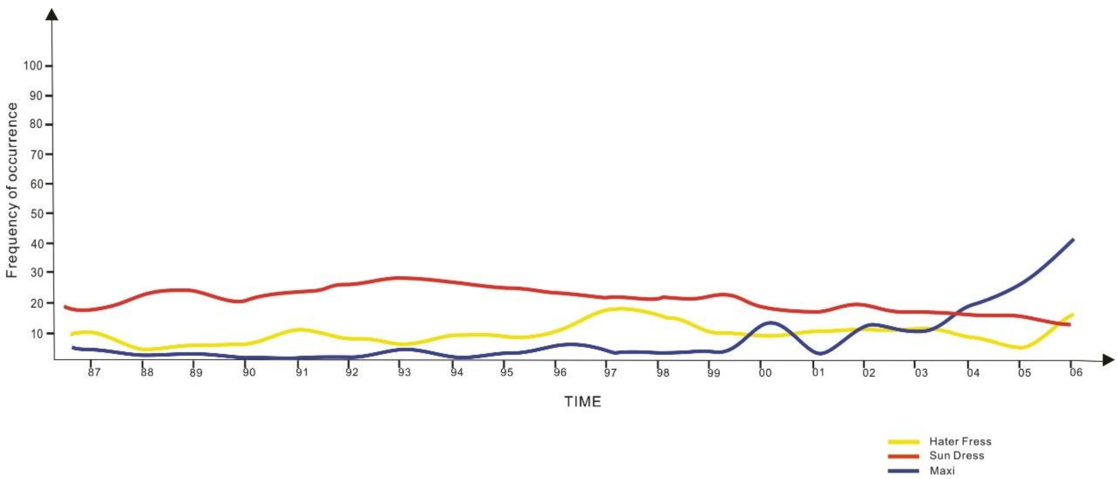
Component 4

This component was mainly determined by 3 variables, Halter Dress, Maxi and Sun Dress.

Those variables were put in one chart for comparison; Chart 5.9 shows that the number of appearance for those variables maintained their value. The numbers of appearance are also quite similar in short time. The evolution curve shows large short-term volatility.

Therefore, the fashion styles in Component 5 in group 2 has involved in a long term fashion cycle. The curve shows the evolution data are not fluctuated much. It also shows the evolution of these fashion items may continue for long term as a part of one fashion cycle.

Chart 5.9 Fashion style evolution in Component 4 Group2



5.8 Discussion

We learned from previous research on fashion evolution and fashion cycle that each fashion item has its own path to evaluate. Some of the fashion items become popular for long term, while the others more likely to be perceived as "flash in the pan". Some of the fashion styles may come back to the market in the future, while the others may not. As for the adoption velocity or cumulative adoption, it showed in chapter 4 that popularity of fashion items sharply increased in adoption tend to die faster. The popularity of fashion items generally increases might maintain in fashion market longer than others. It helps understanding how fashion style evaluated and also created a fashion evolution prediction method based on the previous evolution data collected.

CHAPTER 6

THE EFFECT OF CONSUMER EMOTIONAL BEHAVIOR PSYCHOLOGY ON FASHION EVOLUTION

6.1 Introduction

Function, comfort, sexual attractiveness and beauty are the key elements highly related to consumer emotional behavior. It is also important aspects affect fashion consumption and fashion evolution.

This chapter is devoted to investigate the relationship between psychology of consumer emotional behavior and fashion evolution by correlation analysis. In this investigation, function, sexual attractiveness, comfort and beauty were chosen as variable parameters to investigate the psychology influence on fashion evolution.

Refer to the literature review and chapter 5, Top and Pants were highly related, while Skirts and Dress were highly related in factor analysis. Those fashion items were divided into two groups in factor analysis during the research, group 1 contains the data of top and pants, while group 2 contains the data of skirt and dress. The factor data were selected from the evolution platform.

6.2 Data preparation and Catalogue Set

The research selected function, sexual attractiveness, comfort and beauty as variable parameters, and try to investigate the influence towards the consumer emotional behavior psychology.

The system picked the nude model and match up with different clothes styles randomly. We select pictures from fashion clothes style randomly, and ask 634 people to rate based on four indexes: function, sexual attractiveness, comfort and beauty. Score set from 0-100 with 0 is minimum, 100 is maximum. (See below Table 6.1 and Fig 1-38 for details). Those figures were used for Principal Component analysis (PCA).

Table 6.1 Avenge score of 4 components of different fashion clothes

Fashion items	Function	Sexual Attractiveness	Comfort	Beauty
Pocket Jeans	63.00	50.00	52.00	51.00
Hot Pants	47.00	63.00	61.00	57.00
Palazzo	55.00	46.00	57.00	44.00
Sailor Pants	41.00	42.00	54.00	45.00
Skinny	43.00	48.00	41.00	46.00
Short	46.00	48.00	58.00	57.00
Straight Pants	59.00	60.00	63.00	54.00
Sweat Pants	47.00	54.00	61.00	45.00
Blouse	63.00	50.00	61.00	52.00

Peplum	59.00	54.00	47.00	61.00
Pin Tuck	50.00	51.00	51.00	51.00
Polo	64.00	50.00	66.00	50.00
Ruffle Front	49.00	50.00	48.00	43.00
Sweatshirt	59.00	41.00	61.00	45.00
Tunic	50.00	43.00	57.00	40.00
Turtleneck	45.00	41.00	52.00	45.00
Sailor	49.00	47.00	52.00	51.00
Smock	59.00	52.00	60.00	57.00
Henley	57.00	51.00	56.00	49.00
Empire	48.00	49.00	50.00	54.00
Halter Dress	46.00	50.00	48.00	51.00
Jumper Dress	47.00	48.00	45.00	43.00
Maxi	40.00	45.00	44.00	54.00
Pouf	53.00	55.00	58.00	51.00
Shift	50.00	43.00	59.00	48.00
Slip Dress	45.00	49.00	44.00	48.00
Strapless	41.00	46.00	42.00	48.00
Sun Dress	49.00	48.00	50.00	54.00
Warp Dress	50.00	41.00	53.00	52.00
sheath	50.00	45.00	52.00	47.00
A-line (Dress)	49.00	51.00	61.00	54.00
A-line Skirts	52.00	46.00	61.00	45.00
Layered	44.00	48.00	50.00	55.00
Pleat	46.00	45.00	48.00	44.00
Pegged	45.00	47.00	52.00	43.00
Pencil	54.00	50.00	52.00	48.00
Slit	55.00	53.00	51.00	50.00
Trumpet	45.00	40.00	48.00	50.00

6.3 Sampling Accuracy in Factors Analysis for Group 1

As mentioned in chapter 5, to verify the adequacy of the sample for factor analysis, the Kaiser-Meyer-Olkin Measure of Sampling Adequacy and KMO and Bartlett test were applied. The result for group 1 and group 2 are listed in table 6.2 and table 6.3

Table 6.2 KMO and Barlett's Test for Group 1

KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.632
Bartlett's Test of Sphericity	Approx. Chi-Square	13.840
	df	6
	Sig.	.031

Table 6.3 KMO and Barlett's Test for Group 2

KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.649
Bartlett's Test of Sphericity	Approx. Chi-Square	13.862
	df	6
	Sig.	.031

The result shows that the KMO measures the sampling adequacy for both groups are greater than 0.5, which are satisfactory. The Bartlett's test measures the strength of the relationship among the variables. The observed significance level for group 1 and group 2 are both 0.031, they both show the strength of the relationship among the variables are appropriate and strong for the factor analysis.

6.4 Principal Component Analysis (PCA)

As the similar analysis did in chapter 5, each group contains 19 different type of clothes. Each type of clothes contains 4 components which are function, beauty, sexual attractiveness and comfort. By using principal component analysis (PCA), independent principal components can be extracted and underlying structure among the variables in the analysis can be defined. (Hair, 2010).

Table 6.4 Total variance explained from PCA in group 1

Total Variance Explained

Component	Initial Eigenvalues		
	Total	% of Variance	Cumulative %
1	1.996	49.892	49.892
2	1.077	26.917	76.809
3	.609	15.214	92.023
4	.319	7.977	100.000

Extraction Method: Principal Component Analysis

Table 6.5 Total variance explained from PCA in group 2

Total Variance Explained

Component	Initial Eigenvalues		
	Total	% of Variance	Cumulative %
1	1.857	46.415	46.415
2	1.087	27.186	73.601
3	.797	19.925	93.527
4	.259	6.473	100.000

Extraction Method: Principal Component Analysis

The data were first normalized and then analyzed by PCA using PASS. As shown in the scree plot, under the minimum fraction variance of 0.005(or 5%,) Two principle components with the eigenvalue greater than 1(see figure 6.4) were identified in group 1, which account for cumulative variance of about 90%. Two principle components with the eigenvalue greater than 1(see figure 6.5) were identified in group 2, which account for cumulative variance of about 90%.

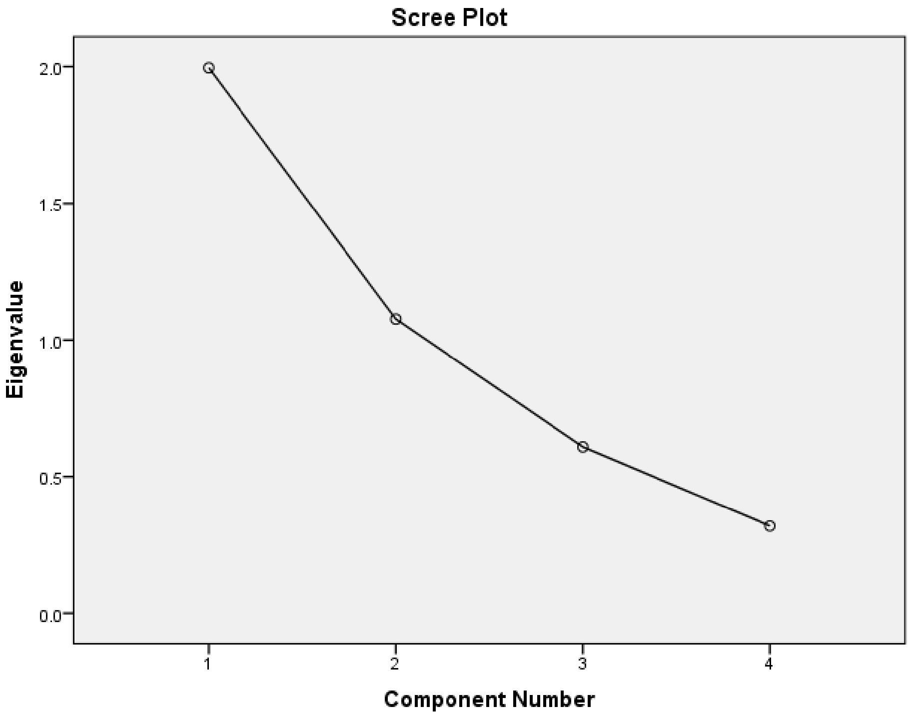


Figure 6.1 Scree plot for Group 1

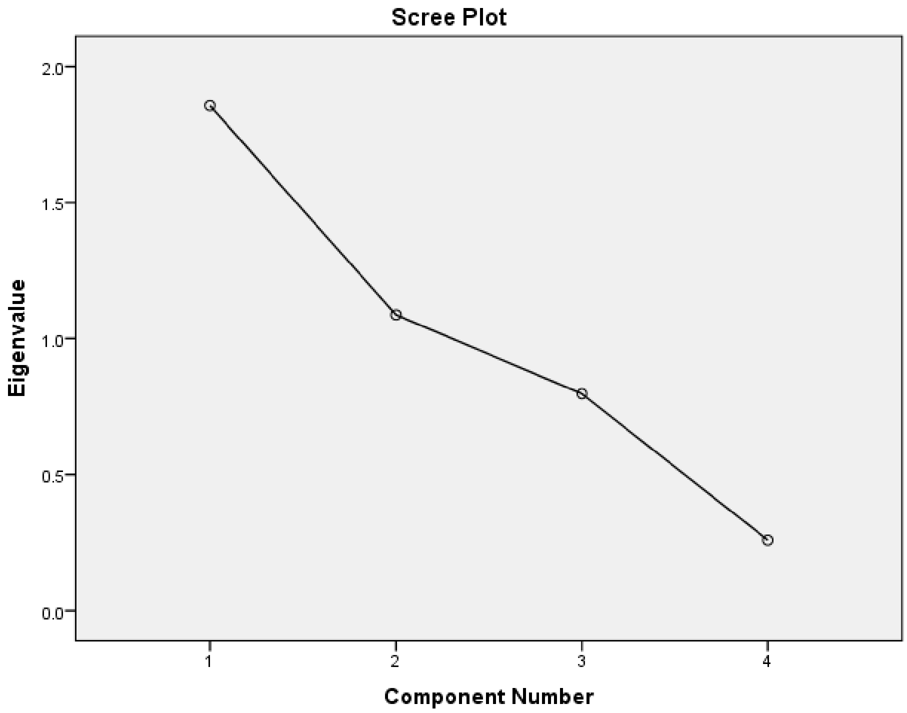


Figure 6.2 Scree plot for Group 2

6.5 Factor Matrix Estimation

In table 6.6 and table 6.7, the unrotated component analysis was calculated by SPSS. It showed the factor loadings between the variable and the principal components. The range of the factor loading is from -1 to +1. Take “Sexual Attractiveness” as an example, the factor loading were 0.581 and 0.452 for components 1 and 2, which were almost equal, but with different signs. This makes unclear that “Sexual Attractiveness” mainly determines Component 1 or Component 2.

Table 6.6 Unrotated component analysis factor matrix for Group 1

Component Matrix[a]

	Component	
	1	2
Function	.671	.488
Sexual Attractiveness	.779	-.436
Comfort	.567	.660
Beauty	.786	-.461

Extraction Method: Principal Component Analysis

a. 2 components extracted

Table 6.7 Unrotated component analysis factor matrix for Group 2

Component Matrix[a]

	Component	
	1	2
Function	.909	-.200
Sexual Attractiveness	.581	.452
Comfort	.828	-.190
Beauty	.085	.898

Extraction Method: Principal Component Analysis

a. 2 components extracted

6.6 Factor Rotation

In order to minimize the cross-loading of the variables on the principal components so as to clarify the relationship between the principal components and the variables (i.e. Evolution Data), the factor matrix was rotated by Varimax with Kaiser Normalization Method. Table 6.8 and table 6.9 list factor matrix after rotation. After rotation, each variable is now predominantly related to one principal component and more clearly.

Table 6.8 Rotated component analysis factor matrix for Group 1

Rotated Component Matrixa

	Component	
	1	2
Function	.225	.798
Sexual Attractiveness	.881	.139
Comfort	.038	.870
Beauty	.903	.123

Extraction Method: Principal Component Analysis.

Rotation Method: Varimax with Kaiser Normalization.

a. Rotation converged in 3 iterations.

Table 6.9 Rotated component analysis factor matrix for Group 2

Rotated Component Matrix[a]

	Component	
	1	2
Function	.930	.029
Sexual Attractiveness	.453	.580
Comfort	.849	.018
Beauty	-.137	.892

Extraction Method: Principal Component Analysis.

Rotation Method: Varimax with Kaiser

Normalization.

a. Rotation converged in 3 iterations.

Table 6.10 Reduced set of variable for group 1: rotated component analysis factor matrix sorted by component and factor loading in group 1

Rotated Component Matrix[a]

	Component	
	1	2
Sexual Attractiveness	.881	
Beauty	.903	
Comfort		.870
Function		.798

Extraction Method: Principal Component Analysis

Rotation Method: Varimax with Kaiser Normalization

Table 6.11 Reduced set of variable for group 2: rotated component analysis factor matrix sorted by component and factor loading in group 2

Rotated Component Matrixa

	Component	
	1	2
Sexual Attractiveness Function	.580	
Beauty	.892	
Comfort		.849
Function		.892

Extraction Method: Principal Component Analysis

Rotation Method: Varimax with Kaiser Normalization

a. Rotation converged in 3 iterations

6.7 Discussion

As learned from the factor analysis, component 1 was highly related to sexual attractiveness and beauty, while component 2 was highly related to comfort and function both in group1 and group 2. The factor sexual attractiveness and beauty belong to fashion appearance, while comfort and function belong to consumer wearing experience for fashion items. From the above analysis, we found that fashion appearance and body experience are the key components highly affect fashion evolution. As discussed in chapter 5, 38 different types of clothes involved in the research and nine different components showed the different evolution models in group1 and group 2.

6.8 Correlation Analysis and Result

The common factor data were generated after factor analysis for correlation analysis.

Correlation analysis and physical meaning in group 1

Component 1

As discussed in chapter 5, component 1 was mainly determined by 6 variables, Hot Pants, Straight Pants, Blouse, Sweat shirt, Turtleneck and Henley.

Table 6.12 shows the correlation factor between fashion appearance and body experience in component 1. The factor loading was 0.01, which was almost irrelevant.

Table 6.12 correlation factor in component 1 group 1

Correlations

		REGR factor score 1 for analysis 1	REGR factor score 2 for analysis 1
REGR factor score 1 for analysis 1	Pearson Correlation	1	-.010
	Sig. (2-tailed)		.985
	N	6	6

REGR factor score 2 for analysis 1	Pearson Correlation	-.010	1
	Sig. (2-tailed)	.985	
	N	6	6

Comparing with the findings in chapter 5, component 1 in group 1 mainly related to the fashion items adoption velocity slightly increased or slightly decreased. The absolute value of those adoption velocity are quite similar, but in different directions. The slope of appearance frequency of Straight Pants, Sweat shirt, Turtleneck and Blouse were decreased, while the slope of appearance frequency of Hot Pants and Henley were increased. The correlation factor shows those type of clothes mainly effected either fashion appearance or wearing experience. Take Straight Pants and Hot Pants as examples. Straight Pants mainly determined by wearing experience as function and comfort are the primary factors being considered in purchasing. Hot Pants mainly determined by appearance, Sexual attractiveness and Beauty are the primary factors have been considered in fashion market. The popularity of hot pants increased, while the popularity of straight pants decreased. It shows that those type of clothes have exactly the reverse effect. The fashion trend of clothes with wearing experience factor will decline when clothes with appearance factor come into fashion, vice versa. There is no correlation between appearance and wearing experience. Meanwhile, this group of clothes has a long fashion cycle.

Component 2

As we discussed in chapter 5, component 2 was mainly determined by 6 variables, Short, Pin Tuck, Polo, Tunic, Smock and Blouse.

Table 6.13 shows the correlation factor between fashion appearance and wearing experience in component 2. The factor loading was 0.186, which shows the two factors have little correlation.

Table 6.13 correlation factor in component 2 group 1

Correlations

		REGR factor score 1 for analysis 1	REGR factor score 2 for analysis 1
REGR factor score 1 for analysis 1	Pearson Correlation	1	-.186
	Sig. (2-tailed)		.871
	N	6	6
REGR factor score 2 for analysis 1	Pearson Correlation	-.186	1
	Sig. (2-tailed)	.871	
	N	6	6

Comparing with the finding in chapter 5, component 2 in group 1 shows absolute adoption velocity value of the fashion items are quite similar, but it generally has two distinct evolution ways. The appearance frequency of some clothes increased at the beginning but decreased at the second half, while the others just reversed. Some of them showed almost one fashion cycle in 20 years, while the others showed they are in between two fashion cycles. The curves (see chart 5.2) show the adoption velocity are both generally increased or decreased. The adoption velocity data also indicated the popularly of these clothes are generally increased or decreased in chapter 4. It shows these clothes styles are involved in middle term fashion cycle.

If there is little correlation between appearance and wearing experience, a completed fashion cycle means the appearance factor has the biggest influence, while if the fashion trend is in between two fashion cycles means the wearing experience factor has the biggest influence. Vice versa. Meanwhile, this group of clothes has a short fashion cycle, and the slope of appearance frequency variation is lower.

Component 3

As we discussed in chapter 5, component 3 was mainly determined by 4 variables, Skinny, Pin tuck, Peplum and sailor.

Table 6.14 shows the correlation factor between fashion appearance and wearing experience in component 3. The factor loading was 0.355, which shows the two factors have some correlation.

Table 6.14 correlation factor in component 3 group 1

Correlations

		REGR factor score 1 for analysis 1	REGR factor score 2 for analysis 1
REGR factor score 1 for analysis 1	Pearson Correlation	1	.355
	Sig. (2-tailed)		.745
	N	4	4
REGR factor score 2 for analysis 1	Pearson Correlation	.355	1
	Sig. (2-tailed)	.745	
	N	4	4

Comparing with the findings in chapter 5, component 3 in group 1 shows the fashion items absolute adoption velocity value are quite similar, but it generally has two distinct evolution ways. The appearance frequency of some fashion

items increased at the beginning but decreased at the second half, while the others items just reversed. Parts of them showed almost one fashion cycle in 20 years, while the others showed they are in between two fashion cycles. The curves (see chart 5.3) show the adoption velocity are both sharper increased or decreased. The adoption velocity data also indicated the appearance frequency of these clothes are sharply increased or decreased in chapter 4. It shows these clothes styles are involved in middle term fashion cycle.

If there is medium correlation between appearance and wearing experience, a complete fashion cycle means the appearance factor has the biggest influence, while if the fashion trend is in between two fashion cycles means the wearing experience factor has the biggest influence. Vice-versa. Meanwhile, this group of clothes has a short fashion cycle, and the slope of appearance frequency variation is greater.

Component 4

As discussed in chapter 5, component 4 was mainly determined by 4 variables, Pocket Jeans, Palazzo, Ruffle Front and Sailor.

Table 6.15 shows the correlation factor between fashion appearance and wearing experience in component 4. The factor loading was 0.800, which shows the two factors have highly correlation.

Table 6.15correlation factor in component 4 group 1

Correlations

		REGR factor score 1 for analysis 1	REGR factor score 2 for analysis 1
REGR factor score 1 for analysis 1	Pearson Correlation	1	.800
	Sig. (2-tailed)		.409
	N	3	3
REGR factor score 2 for analysis 1	Pearson Correlation	.800	1
	Sig. (2-tailed)	.409	
	N	3	3

Comparing with the finding in chapter 5, component 4 in group 1 shows the popularity of fashion items almost maintain the same level in long term evolution, but quite different in short time.

If there is close correlation between appearance and wearing experience, which means such clothes’ popularity with both factors included, but the influence of the two factors are not equal. And the difference in correlation explains that one of the factors dominates in the fashion and leads to the result of popularity steady in long term, fluctuate in short term.

Component 5

As discussed in chapter 5, component was mainly determined by 2 variables, Sailor Pants and Sweat Pants.

Table 6.16 shows the correlation factor between fashion appearance and wearing experience in component 5 The factor loading was 1.000, which shows the two factors have great correlation.

Table 6.16 correlation factor in component 5 group 1

Correlations

		REGR factor score 1 for analysis 1	REGR factor score 2 for analysis 1
REGR factor score 1 for analysis 1	Pearson Correlation	1	1.000**
	Sig. (2-tailed)		.
	N	2	2
REGR factor score 2 for analysis 1	Pearson Correlation	1.000**	1
	Sig. (2-tailed)	.	
	N	2	2

**. Correlation is significant at the 0.01 level (2-tailed).

Comparing with the findings in chapter 5, component 5 in group 1 shows the popularity of fashion items almost equal every year. It also shows the clothes items involved in long term fashion cycle.

There is necessary relation between appearance and body experience, which means such clothes' popularity with both factors included, and the influence of the two factors are equal. Clothes with both factors are likely to show a steady long term popularity.

Correlation analysis and physical meaning in group 2

Component 1

As discussed in chapter 5, component 1 in group 2 was mainly determined by 7 variables, Pouf, Sun Dress, A line Skirts, Pleat, Pegged，Pencil and Slit.

Table 6.17 shows the correlation factor between fashion appearance and body experience in component 1. The factor loading was 0.137, which was almost irrelevant.

Table 6.17 correlation factor in component 1 group 2

Correlations

		REGR factor score 1 for analysis 1	REGR factor score 2 for analysis 1
REGR factor score 1 for analysis 1	Pearson Correlation	1	.137
	Sig. (2-tailed)		.609
	N	7	7
REGR factor score 2 for analysis 1	Pearson Correlation	.137	1
	Sig. (2-tailed)	.609	
	N	7	7

Comparing with the findings in chapter 5, component 1 in group 2 mainly related to the fashion items adoption velocity which slightly increased or slightly decreased. The absolute value of those adoption velocity are quite similar, but in different directions. The slope of Pouf, Aline Skirts, Pleat, Pegged, Pencil and Slit were increased, while the slope of Sun Dress was decreased. The correlation factor shows those types of clothes mainly affected by either fashion appearance or wearing experience.

The fashion trend of clothes with wearing experience factor will decline when clothes with fashion appearance come into fashion, vice versa. There is no correlation between both factors. Clothes with both factors are likely to show a steady long term popularity.

Component 2

As discussed in chapter 5, component 2 was mainly determined by 6 variables, Empire, Jumper Dress, Shift, Strapless, Aline Dress and Trumpet.

Table 6.18 shows the correlation factor between fashion appearance and wearing experience in component 2. The factor loading was 0.344, which shows the two factors have little correlation.

Table 6.18 correlation factor in component 2 group 2

Correlations

		REGR factor score 1 for analysis 1	REGR factor score 2 for analysis 1
REGR factor score 1 for analysis 1	Pearson Correlation	1	.344
	Sig. (2-tailed)		.598
	N	7	7
REGR factor score 2 for analysis 1	Pearson Correlation	.344	1
	Sig. (2-tailed)	.598	
	N	7	7

Comparing with the findings in chapter 5, component 2 in group 2 shows the fashion items absolute adoption velocity value are quite similar, but it generally has two distinct evolution ways. The appearance frequency of some fashion

items increased at the beginning but decreased at the second half, while the others just reversed. Some of them showed almost one fashion cycle in 20 years, while the others showed they were in between two fashion cycles. Therefore, the adoption velocity of the fashion styles in Component 2 in group are generally increased or decreased.

The adoption velocity data also indicate the popularity of these clothes are generally increased or decreased in chapter 4. It shows these clothes styles were involved in middle term fashion cycle.

If there is little correlation between appearance and wearing experience, a complete fashion cycle means the appearance factor has the biggest influence, while if the fashion trend is in between two fashion cycles means the wearing experience factor has the biggest influence. Vice versa. Meanwhile, this group of clothes has a medium fashion cycle, and the slope of appearance frequency variation is lower.

Component 3

As discussed in chapter 5, component 3 was mainly determined by 5 variables, Shift, Slip Dress, Warp Dress and Layered

Table 6.19 shows the correlation factor between fashion appearance and wearing experience in component 3. The factor loading was 0.471, which shows the two factors have certain correlation.

Table 6.19 correlation factor in component 3 group 2

Correlations

		REGR factor score 1 for analysis 1	REGR factor score 2 for analysis 1
REGR factor score 1 for analysis 1	Pearson Correlation	1	.471
	Sig. (2-tailed)		.423
	N	5	5
REGR factor score 2 for analysis 1	Pearson Correlation	.471	1
	Sig. (2-tailed)	.423	
	N	5	5

Comparing with the findings in chapter 5, component 3 in group 2 shows the fashion items absolute adoption velocity value are quite similar, but it generally has two distinct evolution ways. The appearance frequency of some fashion

items increased at the beginning but decreased at the second half, while the others just reversed. Part of them shows almost one fashion cycle in 20 years, while the others shows they were in between two fashion cycles. The curves (see chart 5.8) show the adoption velocity are both sharper increased or decreased. The adoption velocity data also indicate the popularity of these clothes are sharply increased or decreased in chapter 4. It shows these clothes styles were involved in middle term fashion cycle.

If there is medium correlation between appearance and wearing experience, a complete fashion cycle means the appearance factor has the biggest influence, while if the fashion trend is in between two fashion cycles means the wearing experience factor has the biggest influence. Vice versa. Meanwhile, this group of clothes has a medium fashion cycle, and the slope of appearance frequency variation is greater.

Component 4

As discussed in chapter 5, component 4 in group 3 variables, Halter Dress, Maxi and Sun Dress

Table 6.20 shows the correlation factor between fashion appearance and wearing experience in component 4. The factor loading was 0.998, which shows the two factors have great correlation.

Table 6.20 correlation factor in component 4 group 2

Correlations

		REGR factor score 1 for analysis 1	REGR factor score 2 for analysis 1
REGR factor score 1 for analysis 1	Pearson Correlation	1	.998*
	Sig. (2-tailed)		.042
	N	3	3
REGR factor score 2 for analysis 1	Pearson Correlation	.998*	1
	Sig. (2-tailed)	.042	
	N	3	3

*. Correlation is significant at the 0.05 level (2-tailed).

Comparing with the findings in chapter 5, component 4 in group 1 shows the popularity of fashion items almost equal every year. It also shows the clothes items involved in long term fashion cycle.

There is necessary relation between appearance and body experience, which means such clothes' popularity with both factors included. Clothes with both factors are likely to show a steady long term popularity.

6.9 General Discussions

The findings suggest that external factors: function, sexual attractiveness, beauty and comfort are contributing to the fashion evolution.

One important question is to what extend these findings affect fashion evolution. It is for sure the external factors like function, sexual attractiveness, comfort and beauty play very important roles in fashion evolution. For example, in a down economy, the consumers' spending dropped, the popularity of functional or comfortable clothes might increase; when economy recovered, the consumption level ascended, the popularity of sexual attractiveness and beauty clothes might increase.

Through correlation analysis with the findings in chapter 5, we try to quantify the above mentioned four external factors influence in fashion evolution.

In previous research, the results show that there are 9 different evolution models in chapter 5. The models were classified into 5 types of fashion evolution. The previous results in chapter 5 provide the resources to research how external factors of sexual attractiveness, function, beauty and comfort affect the fashion evolution. According to the factor analysis, function and comfort are common in wearing factor; attractiveness and beauty are common in appearing factors. The correlation analysis between the two kinds of factors explains the fashion trend of 9 different evolution models in chapter 5.

If there is no correlation between wearing factor and appearance factor, the fashion trend of this type of clothes only affected by either wearing factor or appearance factor, the slope of appearance frequency variation is lower, and presents a long fashion cycle.

If there is little correlation between appearance and wearing experience factor, the fashion trend of this type of clothes mainly affected by either wearing factor or appearance factor, other factors have little influence. This type of clothes presents a complete fashion cycle or in between two fashion cycles, the slope of appearance frequency variation is lower with a long term fashion cycle. Consumers' purchase is decided by beauty, sexual attractiveness, function or comfort, which means people identify with its single attribute. When considering beauty and sexual attractiveness, consumers rarely think of its function and comfort. This type of clothes has a quite short fashion cycle with the slope of appearance frequency variation is lower.

If there is medium correlation between appearance and wearing experience factor, the fashion trend of this type of clothes mainly affected by wearing factor or appearance factor as well as other factors. This type of clothes presents a complete fashion cycle or in between two fashion cycles, the slope of appearance frequency variation is greater with a short term fashion cycle. When considering beauty and sexual attractiveness, consumers rarely think of its function and comfort. This type of clothes has a relative short fashion cycle with the slope of appearance frequency variation is greater.

If there is close correlation between appearance and wearing experience factor, the fashion trend of this type of clothes affected by both wearing factor and appearance factor. But the difference in correlation leads to the result of popularity steady in long term, fluctuate in short term. When considering beauty and sexual attractiveness, consumers think of its function and comfort as well. But the influence of the two kinds of factors is not equal on this type of clothes.

If there is necessary correlation between appearance and wearing experience factor, the fashion trend of this type of clothes was affected by both wearing factor and appearance factor. The fashion cycle presents a long, steady evolution. When considering beauty and sexual attractiveness, consumers think of its function and comfort as well. The two kinds of factors have same influence on this type of clothes.

CHAPTER 7

CONCLUSIONS AND SUGGESTIONS FOR FURTHER WORKS

7.1 Summary of Work

Searching for the principle of fashion evolution is an ever interesting topic. This research tries to find the internal and external relationship with fashion evolution of different fashion styles.

The present work of this research is to collect the evolution data by counting the appearance frequency of fashion clothes from VOGUE magazine (French Edition). There were 70 different styles of clothes been counted yearly from 1987 to 2006. Pictures of fashion clothes were taken from every single page of the magazine for counting.

The satisfied fashion data should have enough popularity each year, the quantity of valid data must be guaranteed. If the fashion clothes' average proportion of data less than 0.5% of the total image collected, it was not counted. There were 38 out of 70 fashion data meet the standard for research analysis. A platform was created to evaluate the function, sexual attractiveness, comfort and beauty data for the fashion styles involved in the research.

Based on the study, it's clear that adoption velocity, or speed of adoption, contribute to the increased or decreased of fashion evolution. It also reviews the different fashion evolution trend through factor analysis. By investigating the correlation of external factors: function, sexual attractiveness, beauty and comfort, we realized how psychology of consumer emotional behavior affected and determined different types of fashion evolution.

From factor analysis, 38 different clothes styles were divided into two groups to present 9 different fashion evolution types.

7.2 General Conclusions

7.2.1 Adoption velocity

38 out of 70 popularity data valid were found for analysis. The purpose of this research is to find what leads fashion evolution/cycle to be long-term or short-term. It also derived new analytical expressions for predicting fashion evolution.

The research on past fashion evolution proved that the new styles will gain the old one's market share. The fashion quantitative data intensified the relationship between adoption and fashion cycle. Based on the survival analysis, clothes adoption velocity or cumulative survival sharper increased in popularity tend to die faster, while clothes adoption velocity generally increased or decreased may maintain fashion evolution longer.

7.2.2 Factor Analysis

Base on the previous research on fashion evolution and fashion cycle, each fashion item has its own path to evolve. But some of the fashion items have common properties and analogous evolution path. This may explain why such fashion styles become popular at the same time.

From this study, it's clear that fashion style evolution can be catalogued to different evolution models. Based on the rules of factor analysis, the research found that top and pants are highly related, skirt and dress are highly related. Therefore, the four components were divided into two groups, group 1 contains the evolution data for top and pants, while group 2 contains the evolution data for skirt and dress.

The models are classified into 5 types of fashion evolution.

(1) A long fashion cycle with the slope of appearance frequency variation is

lower

(2) A quite short fashion cycle with the slope of appearance frequency variation is lower.

(3) A relative short fashion cycle with the slope of appearance frequency variation is greater.

(4) A steady long term fashion cycle with fluctuate in short term.

(5) The fashion cycle presents a long, steady evolution.

The above inductions of fashion clothes demonstrate the inner relationship of fashion cycle, and explain why some certain types of clothes appeared alternatively or at the same time in fashion evolution.

7.2.3 Correction Analysis

The findings suggest that the external factors: function, sexual attractiveness, beauty and comfort contribute to the fashion evolution.

The paper tries to analyse the rates of function, sexual attractiveness, beauty and comfort of fashion clothes, and quantify those factors influence on fashion evolution.

According to the factor analysis, function and comfort are common in wearing factor; attractiveness and beauty are common in appearance factor.

The result shows through correlation analysis, if there is no correlation between wearing factor and appearance factor, the slope of appearance frequency variation is lower, and presents a long fashion cycle. If there is little correlation between appearances and wearing experience factor, this type of clothes has a quite short fashion cycle with the slope of appearance frequency variation is lower. If there is medium correlation between appearances and wearing experience factor, this type of clothes has a relative short fashion cycle with the slope of appearance frequency variation is greater. If there is close correlation between appearance and wearing experience factor, the fashion trend presents a steady long term cycle with fluctuate in short term. If there is necessary correlation between appearance and wearing experience factor, the two kinds of factors have same influence on this type of clothes. The fashion cycle present a long, steady evolution. This demonstrates how psychology consumer emotional behavior, function, beauty, sexual attractiveness and comfort influence fashion evolution.

7.3 Limitation of Study

This study is limited to data accuracy. In the research, the ability to discern the fashion life cycle is limited by the 20 years' fashion clothes data. The data ends at a fixed time, make it impossible to assert whether a fashion style has been permanently abandoned. Some fashion styles may revive in the future. Therefore, “abandonment” in this research is defined with respect to its past evolution. A fashion style is considered abandoned only when its adoption drops to a low level in its history.

7.4 Suggestions for Future Works

7.4.1 Perception of Research Data by Different Resources

The research data were collected from VOGUE magazines. Although this magazine is a favorable platform to introduce the new fashion styles to the fashion market. The fashion style appearance frequency data may not perfectly match the real life. Future research can consider investigating the perception of fashion evolution data from other resources like taking photos from a certain period in different fixed locations to explore the real life fashion evolution data.

7.4.2 Male Clothes

This research concentrated on analyzing female clothes evolution. However, consumers pay attention to the fashion evolution male clothes as well as female's. Nowadays, how male fashion evolving are also important in fashion consumption. Market research show a great potential for male fashion clothing and it's worthy of studying.

REFERENCES

Acerbi, A., Ghirlanda, S. Enquist, M. (2012) *The Logic of Fashion Cycles*. PLoS ONE 7(3): e32541. doi:10.1371/journal.pone.0032541.

Apruedo, R. A. (2005) *Applied Consumer Psychology.* Rex Bookstore, Inc.

Bates, B., Cleese, J. (2001) *The human face*. Dorling Kindersley Pub.

Belk, R. W., et al. (1996) *Consumption and Marketing: Macro Dimensions*. Ohio: Southern Western College Publishing.

Berger, J., Le Mens, G. (2009) *How adoption spread affects the abandonment of cultural tastes*. PNAS 106: 8146–8150.

Berger, J., Heath, C. (2007) *Where consumers diverge from others: Identity-Signaling and product domains*. J Consumer Res 34:121–134.

Buss, D. M. (2003) *The Evolution of Desire: Strategies of Human Mating. (2nd edition)* New York: Basic Books.

Cantor, A. (1997) *SAS Survival Analysis Techniques for Medical Research*. SAS Institute.

Cash, T. Editor in Chief. (2012) *Encyclopedia of Body Image and Human Appearance*.1st Edition, Academic Press.

Chaiken, S., Wood, W., Eagly, A.H. (1996) *Principles of persuasion. In: Higgins ET, Kruglanski A, eds. Social psychology: Handbook of basic mechanisms and processes*. New York: Guilford Press.

Chaudhuri, A., (2006) *Emotion and Reason in Consumer Behavior.* Butterworth-Heinemann.

Cho, S. E. (2007) *Clothing Gift Expenditures: The Influence of Gender, Ethnicity, and Age*. ProQuestion Information and Learning Company.

Collett, D. (1994) *Modelling Survival Data in Medical Research*. Second Edition. Chapman & Hall.

Cox, D.R., Hinkley, D.V. (1974) *Theoretical Statistics*. Chapman & Hall.

De Vany A. (2004) *Hollywood Economics*. Routledge, New York.

Dhinakaran, M., Sundaresan, S., Dasaradan, B. S. (March, 2007) *Comfort properties of apparels*. The Indian Textile Journal.

Dunlap, R.A. (1997) *The Golden Ratio and Fibonacci Numbers*. World Scientific Publishing Company.

Eknoyan, Garabed. (2007) "*Adolphe Quetelet (1796–1874)—the average man and indices of obesity"*. Nephrology Dialysis Transplantation 23 (1): 47–51.

Fan, J., Yu, W., Hunter, L. (2004) *Clothing Appearance and Fit: Science and technology*. Woodhead Publishing Series in Textiles.

Ferrera, L.A. (2005) *Body Mass Index and Health*. Nova Publishers.

Fisher, M.L., Voracek M. (June 2006) *The shape of beauty: determinants of female physical attractiveness*. J Cosmet Dermatol 5 (2): 190–4.

Hansen, F., Christensen, S. R. (2007) *Emotions, Advertising and Consumer Choice*. Copenhagen Business School Press.

Haugtvedt, C.P., Herr, P., Kardes, F., eds. (2008) *The Handbook of Consumer Psychology*. New York and London: Lawrence Erlbaum Associates.

Herzog, H.A., Bentley, R.A, Hahn, M.W. (2004) *Random drift and large shifts in popularity of dog breeds*. Proceedings Royal Society London B 271: S353–S356.

Hill, D.D. (2004) *As Seen in Vogue: A Century of American Fashion in Advertising*. Texas Tech University Press.

Horn, M. J., Gurel, L. M. (1981) *The second skin: an interdisciplinary study of clothing*. Houghton Mifflin.

Jansson-Boyd, C. V. (2010) *Consumer Psychology.* Open University Press.

Jonah, B. (2009) *How adoption speed affects the abandonment of cultural tastes*. PNAS

Jones, S. J. (2002) *Fashion Design*. London: Laurence King Publishing.

Kaplan. E. L., Meier. P. (1958) *"Nonparametric estimation from incomplete observations"*. J. Amer. Statist. Assn. 3 (282): 457–481.

Kardes, F.R., Cronley, M.L., Cline, T. (2010) *Consumer Behavior.* Cengage Learning.

Karni, Edi and Schmeidler, David. (1990) *“Fixed Preferences and Changing Tastes”.* American Economic Review, May (Papers and Proceedings), 80(2) pp.262-67

Kindes, M. V. (2006) *Body Image: New Research*. Nova Science Pub Inc.

Kleinbaum, D. G., & Klein, M. (2011) *Survival Analysis: A Self-Learning Text Third Edition*. Springer Publishers New York, Inc.

Kotler, P., Armstrong, G., Brown, L., and Adam, S. (2006) *Marketing*, 7th Ed. Pearson Education Australia/Prentice Hall.

Lieberson, S., Lynn, F.B. (2003) *Popularity as a Taste: An application to the naming*. process. Onoma.;38:235–276.

Leibenstein, H. (1950) *Bandwagon, snob, and Veblen effects in the theory of consumers' demand*. Q J Econ.;64:183–207.

Loschek, I. (2009) *When Clothes Become Fashion: Design and Innovation Systems*. Bloomsbury Academic.

Marlowe, F., Wetsman, A. (2001) *Preferred waist-to-hip ratio and ecology*. Personality and Individual Differences 30 (3): 481–489.

Mesoudi, A., Lycett, S.J. (2009) *Random copying, frequency-dependent copying and culture change*. Evolution and Human Behavior 30: 41–48.

Mullen, B., Johnson, C. (1990) *The Psychology of Consumer Behavior.* Psychology Press.

Park, H. (2012) *Toward Finding an Optimal Balance between Function and Comfort in the Most Intimate Human Environment*. J Ergonomics 1:e114. doi:10.4172/2165-7556.1000e114.

Penz, E., Hogg, M. K. (2011) *"The role of mixed emotions in consumer behaviour: Investigating ambivalence in consumers' experiences of approach-avoidance conflicts in online and offline settings"*. European Journal of Marketing, Vol. 45 Iss: 1/2, pp.104 – 132.

Pesendorfer, W. (1995) *Design innovation and fashion cycles*. Am Econ Rev.; 85:771–792.

Roach, M. E., Eicher, J. B. (1973) *The visible self: perspective on dress* Prentice-Hall.

Rogers, E.M. (1995) *Diffusion of Innovations*. New York: The Free Press.

Selvin, S. (2008) *Survival Analysis for Epidemiologic and Medical Research (Practical Guides to Biostatistics and Epidemiology)* New York: Cambridge University Press.

Shavitt S (1990) *The role of attitude objects in attitude functions*. J Exp Psych 26:124–148.

Singh, D., Young, R. K. (1995) *Body Weight, Waist-to-Hip Ration, Breasts, and Hips: Role in Judgments of Female Attractiveness and Desirability for Relationships*. Ethology and Sociobiology Volume 16: 483–507.

Snyder, C.R. (1980) *Fromkin HL. Uniqueness*. New York: Plenum.

Stalder, E. (2008) *Fashion 101: A Crash Course in Clothing*. Zest Books.

Stecker, P. (1996) *The Fashion Design Manual*. Macmillan Education AU.

Sumathi, G. J. (2010) *Elements of Fashion and Apparel Design*. New Age International.

Swami, V., & Furnham, A. (2008) *The psychology of physical attraction.* Routledge.

Theodore Levitt. (1965) *Exploit the Product Life Cycle*. Harvard Business Review, 43, 81-94.

Walser, H. (2001) *The Golden Section*. MAA.

Welter, L., Lillethun, A. (2011) *The Fashion Reader. Second Edition*. Bloomsbury Academic.

White, H.C. (1970) *Chains of Opportunity*. Cambridge, MA: Harvard University Press.

Wolfgang Pesendorfer. (1995) *"Design Innovation and fashion Cycle"*. The American Economic Review, Vol.85, No.4 1995 771-792.

Yang, S. H. (2004) *Traditional Chinese Clothing: Costumes, Adornments & Culture*. Long River Press.

Global Database on Body Mass Index. World Health Organization. 2006. Retrieved July 27, 2012.

http://www.itaaonline.org/ Accessed on July. 27, 2012.

www.transpersonal-web.com Accessed on July. 27, 2012.

www.molium.blogspot.com Accessed on Dec. 26, 2014.

http://apps.who.int/bmi/index.jsp?introPage=intro_3.html Accessed on Nov. 10, 2015.

http://www.amstat.org/chapters/northeasternillinois/pastevents/presentations/summer05_Ibrahim_J.pdf Accessed on Nov. 10, 2015.