FACTORS AFFECTING FEMALE CONSUMERS' ACCEPTABILITY ON NAIL POLISH

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Abstract

The market of nail polish has been booming in recent years. Research on nail polish is scarce. A sensory lexicon for nail polish has been developed at Kansas State University, but how sensory factors affect female consumers' acceptability of nail polish has not been examined. Also, other factors, such as price and usage characteristics that could affect consumers' acceptability, are yet to be determined. A nail polish consumer study was conducted at Kansas State University to explore several sensory and non-sensory factors that could affect female consumers' acceptability of nail polish. Eight nail polish samples, belonging to four categories, namely, regular (REG), gel (GEL), flake (FLK) and water-based (WAT), were evaluated by each of the 98 female consumers. The questionnaire consisted of three sections – application, observation and general usage questions. Results showed that consumers rated the samples similarly in both the application and observation sections. In general, consumers preferred the REG and the GEL samples more than the FLK and the WAT samples. Among all the sensory attributes, appearance attributes were the major attributes that affected consumers' overall acceptability, while aroma had negligible impact on acceptability. Some sensory attributes like runny, shininess, opacity, spreadability, smoothness, coverage and wet-appearance were found to drive the consumer's overall acceptability positively, while others such as pinhole, fatty-edges, blister, brushlines, pearl-like, flake-protrusion, glittery and initial-drag impacted their liking negatively. Four clusters of consumers were identified based on the consumers' overall liking scores for both the application and observation sections. Considering all the factors that could affect consumers' acceptability, sensory appeal, price, and conveniences of usage were the top factors picked by consumers. Age was also a factor that affected consumers' acceptability for some of the samples. Consumers' overall acceptability for these studied samples could guide a

beauty store or a nail salon on building their selection on nail polishes. Consumers' acceptability on different sensory attributes could help a nail polish company modify or improve their nail polish formula. The consumer cluster information could benefit a nail polish company on marketing a specific category of product and advertising to a specific group of consumers.

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Chapter 1 - Literature Review

Nail Polish Market

Nail polish Growth Worldwide

Globally, nail polish has been one of the most popular cosmetic categories in the past few years. It was one of the fastest-growing categories in 2009. The current value growth achieved at more than 8% globally [1]. Also, the average spending by global consumers on color cosmetics was $4.6 billion per month in 2012 [2].

Lipstick used to be an indicator of the overall economy, but the recent trend showed that nail polish has replaced lipstick as a more accurate indicator of the overall economy [3-4]. In 2011, the global retail growth for nail polish came to a record-high - 11%. The growth rate for lipstick was only half of that of nail polish. Also, between 2008 and 2011, which is a period considered as a global financial meltdown, the sales of nail polish increased by 43%, compared to 7%, 11% and 17% for lip products, facial makeup and eye makeup, respectively [3]. In 2012, the value of the U.K. nail color cosmetics market caught up that the lip color market for the first time [5]. It was also reported that, "while all core sectors (face, eyes, lips and nails) managed growth, nail makeup stole the limelight, posting double-digit growth (£221m in 2011 from £179m in 2010)" in UK [6].

Nail Polish Growth in developed markets

Research in the U.K. showed that, in 2007, 52% of women were nail polish consumers, whereas by 2011, the percentage has increased to 61% [6]. The nail color cosmetics category was expected to grow by 1.7% in 2013, reaching an estimated £233 million. This will be higher than £232 million for the lip color cosmetics market [5].

Not only in U.K., but across Europe, this trend has been observed. In 2008, among all the new color cosmetic launches, nail color cosmetics accounted for 10% of them. By 2012, the percentage has reached 26%. The top three European countries that contributed to the new product launches in the color cosmetics market in 2012 were U.K. (29%), Germany (22%) and France (20%) [6].

The dynamic performance of developed markets helped increase the global retail value of nail polish from less than $3 billion in 2007 to more than $45 billion in 2012. The reason for this increase could be that female consumers in Western markets have "rediscovered nail polish as a must-have fashion accessory with a reasonable price" [2]. It was also reported that, in 2012, the nail care market benefited from the market growth in the developed markets, such as the U.S., the U.K. and Germany [7].

The U.S. market has been one of the most important nail polish markets in the world. The U.S. replaced Brazil in 2011 as the largest nail polish market in the world, with a growth of 31% on retail sales, to reach $778 million [3]. In 2012, the nail category retail sales reached $1 billion. Some other market researchers have even assessed that "nail care sales for the 52-week period ending August 11, 2013, reached $1.7 billion in all U.S. multi-outlets, including supermarkets, drugstores, mass market retailers, military commissaries, and select club and dollar retail chains" [4]. The mass nail care market in the US has grown rapidly since 2009, whereas other cosmetics categories have increased slowly [8].

The compound annual growth in premium nail polish market achieved an increase of 46% in the U.S. since 2008. The Growth in nail color and care market in the US is expected to continue through 2017, with sales are estimated to reach more than $4 billion [9].

Nail Polish Growth in Emerging Markets

China, India, Brazil and Russia have been emerging markets in recent years, but they are also considered as "key projected growth markets" in cosmetics consumption. They were important to nail polish market, since their performance was crucial to nail polish industry's profit [3].

In 2012, many markets had a double-digit growth in the nail care markets, but Latin America took the spotlight with an increase of more than 30%. The increasing number of women who went out from home to work and the launches of new products were reported to account for this increase [7]. Brazil was the biggest beauty care emerging markets in 2011 [3]. More than $1 billion was spent by Brazilian consumers nail products in 2012 [2].

Reasons for nail polish's market growth

The financial crisis and affordability of nail polish

The financial crisis has been considered as one of the key factors that led to the market growth in the nail polish category. The "perception of nail polish as an affordable fashion accessory and a quick-fix morale booster for the tougher economic times" has grown [3]. "Even for the consumers on a tight budget, nail products offer a relatively guilt free treat, with the power to change their options" [10].

The cosmetic industry usually performs well when consumers have more "disposable income". However, nail color and care market in the U.S. stayed solid, since female consumers moved from nail salon to at-home care option. Nail polish not only offers women consumers an affordable way (often for less than $10 a bottle) to try new colors, but helps them stay current with fashion trends [9]. The transition from "lipstick index" to "nail polish index" as an indicator

of the overall economy also suggests that nail care products are an affordable way to change one's appearance [4].

The availability of premium brands at home

Premium brands used to be only available in a nail salon. The availability of premium brands at home helps lift up the premium nail polish market. The sales of premium nail polish markets more than doubled in 2011 to reach $191 million. This accounted for 25% of the total nail polish market, compared to less than 10% five years ago [3]. The premium brands offer consumers "a feel of luxury and sophistication" [4, 11].

The expanding consumer base

An expanding consumer base could be the additional support to the market growth in the nail polish category [6]. "A nail-centric fashion culture has transformed women's nails into stylish accessories; therefore, a growing population of women makes frequent use of do-it-yourself (DIY) nail care products" [12].

The invention of nail polish

The innovation of nail polish has kept consumers coming back and experiment new products. Consumers have more options to be connected with nail polish. With different new trends, nail polishes sales grew nearly 30% in 2011 [13]. The number of new nail color products entering the market in 2012 came to a record high, which was 400% higher than that in 2008 [5].

The new technology that have been reported to drive the growth of nail polish market includes bold colors and special effects, soak-off gels, long-lasting traditional manicure, new finishes (such as matte top coats, glitter polishes, nail pens, nail stickers and magnetic nail polish [4, 13].

In addition to the innovation in technology, the innovation in nail art also drives the nail polish market growth [4, 5]. According to Polla, "there are upwards of 2.5 million Google searches for the term "nail art" every month, and this is in addition to the launch of a plethora of nail blogs, Pinterest boards, Instagram photos and even magazines dedicated to nails" [4].

Other factors that drive the market

The properties of more options and convenience (no need to apply daily) could also contribute to the market growth of nail polish market [5].

The changes in consumers' habit was also said to benefit the nail polish markets, since more and more consumers started to use cellphones in front of other people. Nails could to be an important part of anatomy as displays. Thus, nail polish could be a decoration to nails [4].

History of Nail Polish

Ancient time

There has been a long history since humans started to use colors to decorate their nails. The fashion started from the upper class, since the people in the upper class did not have to do any labor with their hands [14].

In ancient China, people decorated their nails using herbal extracts and a "lacquer". The herbal extracts were made from mashed rose, orchid and impatiens petals combined with alum, and the "lacquer" was made from gum Arabic, egg whites, gelatin and beeswax. The mixture can provide a color ranging from pink to red. The dark colors, such as red and black could only be used by royalty. Gold and silver colors were also recorded in some of the manuscripts [14-16].

Ancient Babylonians and Egyptians people painted their nails using ingredients from natural resources, such as henna powder, reddish powder and dried leaves. The color of the nails was used to indicate the rank of the wearer in the society. Dark red and crimson colors were

reserved for women in the highest social order [14-16]. Women with lower rank can paint their nails only using pale colors [16]. Men in Egypt and ancient Rome colored their nails and lips with red before battling [14].

In 17th and 18th centuries, European royal courts recorded the appearance of shiny, varnished nails [17]. In 19th century, in some English and U.S. cookbooks, directions for making nail paints were documented [16].

Modern time

The lacquer industry was born because of the nitrocellulose leftover from World War I. When people were trying to make use of it, they discovered that, nitrocellulose, after boiled in water can be made soluble in organic solvents. When the solvents evaporated, the dry film of nitrocellulose left turned to be hard and glossy. At the same time, the automobile business had a problem with the old-fashioned paints, which required several days for each coat to dry. So, a quick-dry glossy coating was introduced to the automobile business [18].

Modern nail polish was inspired from car paint industry. Michelle Menard is generally recognized as the first person who developed nail polish based on automobile paint [15].

Red had been the most common color until the 1930s, when Charles Revson founded Revlon. He used pigments, rather than dyes, in the new nail polish, so that there could be more nail polish colors. By the 1940s, nail polish became a necessity of women's color cosmetics [15]. The next breakthrough came in 1964. A new nail lacquer product launched by Clairol that was easier to use and offered more consistent results. In the 1970s, the French manicure was invented. In 1995, deep and dark colors were launched [4].

Nail Polish Components

The technology used in nail polish has remained fundamentally unchanged for more than 70 years [17-18]. The basic components in nail polish includes film forming agents, plasticizers and resins, solvents, pigments and pigment suspension.

Film forming agents

Nitrocellulose is the most common primary film-former in nail polish. Although it had some shortcomings, it is cost-efficient, shine, easy-to-get, and low toxicity. An amount of 30% ethanol or isopropanol is usually mixed with nitrocellulose to prevent nitrocellulose from exploding when it is dry [15]. The drawbacks of nitrocellulose could be its "hardness, strength, flexibility, adhesion, gloss, resistance performance and viscosity of the film" [15, 19].

Plasticizer and resins

Plasticizers and resins are usually added to a nail polish system to modify its adhesion, toughness and flexibility [16, 18]. Toluene-sulfon-amide-formaldehyde (TSFR) is one of the most commonly used resins. It could be described as colorless, transparent and compatible with nitrocellulose. When added to the nitrocellulose lacquer, the film will be tougher and softened slightly. The adhesion could also be improved [18]. Camphor, adipate, benzoate, and citrate derivatives are some other common plasticizers [18-19].

Solvents

Solvents act as carriers. It provided liquid compositions with desired brush qualities, viscosity and drying time [16]. The product application, flow, leveling, hardness, gloss and stability could also be regulated [15, 18]. Ethyl acetate, n-propyl acetate and n-butyl acetate were the most frequently used solvents. Different solvents have different boiling point and drying time. A blend of solvents could balance dry time with film formation. The volatility profile of the

solvents chose usually balance with the amount of plasticizers and types of resins. Diluents are often added to the solvents in order to reduce the cost [15].

Pigments

Pigments add desired color and reflecting effects to the nail polish [16].The nail polish shades could range from simple off-white to complex shades using pigments [15].

Nail polish pigments could be either inorganic or organic. Inorganic pigments are “metal oxides, and usually include titanium dioxide and iron oxides (red, black and yellow)”. The problem with inorganic pigments is that their opacity, but they can be dull and “not-clean”. Organic pigments used in nail polish are the materials that are often bright and highly colored [15].

According to Pagano, “Effect and metallic pigments fall under a broader category of pearlescent pigments due to their design to manipulate light in specific ways”. For example, metallic pigments significantly increased the number of nail polish shades that are available to the consumer [15].

Pigment suspension

One problem with pigments initially was that the pigments tended to precipitate out [18].The pigment suspension is added to prevent pigments and other colorants from precipitating out. The pigment suspensions that are commonly used include “organically modified montmorillonite clays, such as quaternized hectorites and bentonites” [15].

Nail Polish Category

One of the reasons for nail polish’s booming is the innovation in nail polish. There have been varieties of nail polishes available in the market, which may include nail polish strips, gel

nails, color-changing nail polish, textured nails, water-based nail polish and etc. [20]. The following content introduced most nail polish categories that are available in the market.

Water-based nail polish

The water-based nail polish is based on "an acrylic polymer emulsion (e.g. styrene-acrylate copolymer) and pigments similar to those in water color paints". Most harmful chemicals such as formaldehyde, toluene, and dibutyl phthalate have been removed from the formula in this product. It has been marketed as a non-toxic and environmentally-friendly product. Furthermore, the solvent-water does not evaporate completely as traditional nail polish. Fingernails will absorb part of the water [16-17]. A 100% water-based nail polish would not work since it would peel off without durability [21].

Gel Nail Polish

Gel nail polish is a "long-lasting variety of nail polish made up of a type of methacrylate polymer". It does not dry until cured under an ultraviolet or an LED lamp. Regular nail polish formulas usually could stay 2-7 days before cracking, whereas gel polish can last up to two weeks [22-23]. The research and improvement in gels has resulted in fast drying, as well as preventing color from fading or yellowing [11]. The introduction of more than 30 important new gel nail polishes in recent years has been said to raise the recognition of gel nail polishes and to promote the market's strong performance [7, 11]. Some consumers may question about the safety of the UV lamp used for gel nail polish, but recent research showed that it is safe to use the UV nail lamp [24].

Glitter/Flake Polishes

"Glitter polishes that features larger particle sizes in colored bases are not only easier to remove but offer better coverage in fewer coats" [25].

Nail Nourish polish

Some nail nourishing polish may help nourish and grow nails. They can protect nails from worse weather conditions. They are good for thin, soft and split nails that are easy to chip and crack. Some other nail nourish polishes can "smooth ridges and imperfections, giving the nail plate with a water proof glossy shine" [26].

Single effect Nail Polish

The finish of nail polish does bring varieties of nail polish to the market. Single effect, here, is defined as the nail polish that has only one color and one element (base, glitter, particles, etc.). Some examples of single effect nail polish are Crème, matte, chrome, metallic shades, holographic, shimmer, foil, frosted, pearl, jelly, neon(Fluorescent colors) and sheer effect nail polishes [4, 6, 10, 15, 18, 25, 27, 28].

Duo/Multiple effect nail polish

Compared to the single effect nail polish, the duo/multiple nail polish is defined as the nail polish, whose finish has two or more colors or elements. Some examples of duo/multiple effect nail polish are duo-chrome, glitter, flakes, holographic glitter, polka-dot effect, crackle effect, iridescent, two-tone manicures and ombre effect nail polishes [4, 6, 10, 20, 25, 27, 29].

Some nail polishes that are even more complicated due/multiple may include color-change effect (depends on UV light, temperature or acidic condition), Magnetic, and sequin effect nail polishes [13, 20, 30].

Textured nail polish

Not only innovations of nail polishes were from color/particles part, but from the texture part. Some examples of nail polish that have a different texture are satin finish, matte finish,

three-dimensional woven fiber effect, velvet-textured effect, “fuzzy” texture sparkles, caviar nail finishes effect, liquid sand effect and 3D textures effect nail polishes [4, 11, 20].

Different add-ons

Nail polish/nail add-ons are also popular in the nail polish market. The add-ons include, nail polish strips, nail polish stickers, nail pens, nail tattoos, nail decals, acrylic nails, gel nails, nail wraps, press-on nails [4, 13, 20, 23].

Other effects/technology

Besides the innovations in the appearance and texture of nail polish, some other technologies related to nail polish have been developed. “Longer lasting” and “quicker to dry” could be two major characteristics that nail polish companies are interested in [4]. Breathable technology is developed to help reinforce the health of nails [4, 20, 28].Some other technologies include water transfer, striping tapes, and foil adhesives [23], self-adhering color coat nail polish [4, 11]. A product between regular nail polish and gel nail polish was also reported being developed [11].

The combination of nail products and electronics is also being developed. Electronics, like RFID (Radio-frequency identification) tags, small magnets and conductive polish could be hidden under plastic or gel nails. The wearer of the electronics can interact with objects in the environment. The new technology may even change peoples’ life. For example, we can open a door without a key, buy a ticket without physically paying, and borrow a book without using a physical card [31].

Nail Polish Accessories

Base Coat

A base coat is a "clear or milky-colored polish formula that is used specifically before applying nail polish to the nail" [22]. High levels of resin and low viscosity plasticizers are usually contained in a base coat [19]. A base coat can help reinforce nails, restore moisture and create an adhesive, flexible, uniform film on the nail surface [19, 22]. The components of a base coat are similar to that of a nail polish. The difference between a base coat and a nail polish is that there is no color pigments added in a base coat.

Top Coat

A top coat is a "clear colored polish formula that is used specifically after applying nail polish to the nail" [22]. High solids content resins and lower boiling point solvents were contained in the top coat [19]. A hardened barrier helps keep nail polish from chipping, scratching and peeling [22].

Nail Polish Remover

Nail polish is usually removed with cotton pads and nail polish remover. Nail polish remover is an organic solvent that usually contains acetone and helps remove nail polish. It may also contain oils, scents and coloring. The drawback of an acetone-containing nail polish remover is that it may be harmful to skin and nails [16].

The function of Nail Polish

Nail polish, as one of the category in cosmetics, played an important role as the decorative coating for the nails [15]. The big selection of nail polish does provide consumers more options to decorate their nails and to show their personality.

Nail polish could also be a good resource of self-confidence. Makeup could be a promotion to self-esteem of the women who wear it [5]. In a survey, "eight out of ten women say that wearing makeup could make themselves more confident, and self-confidence is the main reason for them to wear color cosmetics" [6]. The trustiness could be different based on the perception of different colors [32].

Nail polish might differ from other cosmetics, since it is not only a decorative cosmetic, but a coating to resist a variety of challenges to nails' integrity [15, 19]. Some nail polishes are advised to cause "nail growth, make nails stronger, prevent nails from breaking or splitting, and to stop nail biting" [15].

Factors that may affect consumers' choice on Cosmetics

Sensory Factors

Sensory Factors may affect consumers' choice on nail polish. Brightening and illuminating were among the most popular new product claims in 2013 in UK [5]. Gloss is one of the criteria that consumers use to judge a nail polish's performance. Smooth and even are among the popular nail polish market trends [19].

Convenience of usage

Besides sensory factors, convenience of usage could also be an important factor that affects consumers' choice. Quicker and easier to use products could attract more fast-paced consumers [5]. Consumers have to take care of both their work and family, and they have limited time to work on their nails. Long-lasting could be one of the favorite claims by consumers. It could help improve the time nail polish without chipping and flaking from 2-3 days to 7-10 days. Drying time could also be a popular market claim for nail polish. It is also one of the criteria that consumers use to judge the performance of a nail polish. Ease of maintenance is another popular

market claim, for example, to prevent polish smudges and smears. Similar to ease of maintenance, wearability is one of the factors that consumers used to judge its performance [19].

Health

In the beginning years of nail polish, a lot of the clinical results were reported regarding to allergies and sensitivity to nail polish, including damaged nails, asthmatic attacks and hair loss [18]. Later, petroleum-based solvent, such as toluene and xylene, have been reported linked to cancer [16, 33]. Dibutyl phthalate (DBP) is usually added as plasticizer in nail polish. It may cause a number of birth defect in lab animals, primarily to male offspring [34]. Gel Polish manicure may result in a thinner finger plate. Both application and removal process in the manicure system could contribute to this thinning effect [35]. However, nail polish did not pose a microbial risk under the test conditions [36].

Nail Polish Companies have been applying new formula to make nail polishes more health- and eco-friendly. Companies have been trying to reduce and eliminate some of the potential harmful ingredients [16-17, 37]. To create more health- and eco-friendly products and to keep the useful properties of current nail polish have become an extremely important goal for nail polish companies [18].

Season

Season could be an important factor since weather condition may affect nails' condition, as well as a nail polish's quality. Some premium nail care products have been reported to withstand the change of season. Another product is said to strengthen the nail protection from weather conditions [26].

Color

Color could be one of the most important factors that affect consumers' choice. Most consumers may focus more on color than brand [10].

Age

Younger women are reported to be more willing to experience nailing art, artificial nails and gel nail polish. They are more likely to follow the trend and try different new products [10].

Descriptive analysis

Some studies about Nail polish have been done, but few of them had described the sensory properties of nail polish. To provide a sensory lexicon for nail polish, Sun and et al developed a sensory lexicon that covers both the application and the removal process. For the application part, 21 attributes, including texture, aroma and appearance were developed. For the removal part, 5 attributes in 5 states were developed. To validate the lexicon, seventeen samples, which included regular, gel, flakes and water-based samples, were evaluated. The lexicon was able to separate all the samples according to their categories. Also, a base coat was found to affect more in the removal process than in the application process [38].

Sensory and consumer studies on cosmetics

Sensory tests have been applied to cosmetics, including lotions, soaps, antiperspirants, shampoos, and hair mousses. Sensory tests could be used for "screening prototypes, competitive evaluations, product development and claims substantiation" [39].

A sensory study worked on the tribology of personal care. The relationship between seven types of feature quantities and five sensory attributes were investigated using multiple regression analysis. The attributes used in this study were smoothness, silkiness feeling, velvety feeling, softness and skin-adhesion ability. The authors found "the smooth rubbing of fingers

does not always create a comfortable tactile sensation", since the static friction had a positive effect on smoothness. That is, lower friction does not necessarily mean more comfort; similarly, higher friction does not necessarily mean lower comfort [40].

Almeida *et al.* did both a consumer study and a descriptive study on the skinfeel of two "oleogel" gel systems and four other topical semisolid formulations. From the descriptive analysis, they found that the two oleogels chose in this study had similarities in overall sensory profile. Also, the two oleogels were closer to the W/O (water in oil) cream than to the other semisolid products. For the consumer study, they noticed that "the oleogels were well appreciated by the consumers, which could lead to a positive impact on patient compliance". Sensory data provided by a trained descriptive panel can connect clinical and consumer data. It can also be used to predict the consumer data [41].

Cortez-pereira *et al.* proposed a method to evaluate the intensity of the odor. In this method, a substantively test would be used to measure the intensity odor using labeled magnitude scale (LMS). Panelists would evaluate fragrance intensity immediately after the perfume every 1.5 h for 6 h. The fragrance lasting time could be estimated, and this information could be helpful to product developer [42].

Objectives

The objectives of this study were to:

1. explore what category of nail polishes consumers liked more
2. explore what sensory factors impact consumers' acceptability and how they impact consumers' acceptability.
3. investigate if there are any consumer segments, and what the characteristics of each segment are
4. scrutinize the determinants of consumers' decision to buy a nail polish
5. explore how age would affect consumers' acceptability of nail polish.

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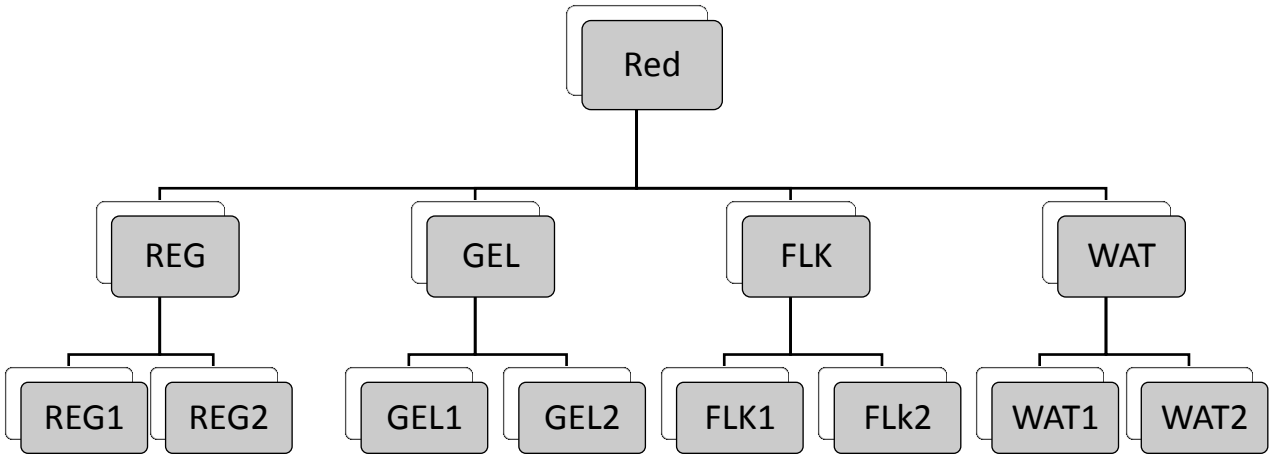
Chapter 2 - Methods and Materials

Samples

Samples Chosen

Eight samples were selected for this consumer study (Figure 2-1). All the eight samples were selected according to a descriptive study on nail polish [1]. Four categories of nail polish were selected for this study. They were regular nail polishes-REG 1 and REG2, gel nail polishes-GEL1 and GEL2, nail polishes with flakes-FLK 1 and FLK 2, and water-based nail polishes-WAT1 and WAT2.

Figure 2-1 Nail Polish Samples Description



Samples for Application

This study consisted of three sections- application, observation and general usage sections. The application and observation sections required the evaluation of nail polish samples.

In the application section, consumers were allowed to apply the nail polish. To blind the brand and bottle shape information, each of the nail polish bottles was wrapped using masking

tape and stored in a plastic cup. Plaster was then used to fix bottles onto the bottom of the container. The combination of plaster and cardboard can adjust the height of the nail polish bottle, so that the bottle shoulder was able to line up with the lid of the container. After plaster hardened, foam peanut was used to fill in the space in the plastic cup, to further mask the bottle shape information. Detailed procedures for masking the nail polish bottles were shown in Appendix A. After the masking step, all the nail polish samples were stored in a ventilation hood with moderate temperature and humidity.

Artificial nail wheels that would be used as a nail polish carrier in the test were painted over ahead. There were a total of eighteen artificial nails initially on the nail wheel. Every other nail was removed to provide consumer a better view of each sample. A set of numbers (1 to 8) were marked on the 8 artificial nails left on the nail wheel. During the test, consumers were then asked to use the nails from 1 to 8, so that they can easily keep track of the nail polishes they just used.

Samples for Observation

In the observation section, the nail polish samples were prepared for consumers in their finished look. All the samples were prepared using a standard preparation method to ensure a full coverage of the nail polish on the artificial nails. The method is described in Appendix B. Depending on the type of nail polish, the preparation method for each nail polish may vary. For example, some nail polishes need both a base coat and a top coat, whereas some nail polishes need neither of the coats. For the two gel nail polish samples, each coat (base, top and color coat) need to be cured under a UV lamp. The necessity of a base/top coat and the necessity of a UV could be verified according to manufacturer instructions.

Artificial nail wheels were used as the nail polish carrier. Every other artificial nail was removed to provide consumers a better view. The order of the nail polishes was set according to the test design. Different from the application section, the nail wheel used in this section was put on a hard paper, preventing consumers from accidentally touching the nail polish samples.

Samples Rotation

For the nail polish application section, to keep the best quality of the nail polish, 6 sets of each sample were used in 3 continuous days' study (2 sets for each day). During the test, all the nail polish samples were handled by trained researchers to prevent nail polish from being exposed to air for a long time.

For nail polish observation section, the 7th set of samples were used to provide the best quality. The 8th set of samples were kept as backup.

Consumer Recruitment

Consumer recruitment included three parts: screening, scheduling and reminding.

Screening

All the consumers needed to pass a screening before being able to participate in the consumer study. The criteria to screen the consumers included gender, age, frequency of usage and fingernails/toenails questions. Only female consumers were the targets in this study. Male consumers disqualified. Consumers younger than 18 were not the recruited for this study. The consumers who used nail polish less often than once every three months did not qualify for this study. Consumers who only applied nail polish to their toe nails were not recruited in this study. Once a consumer qualified for this study, she was asked to input her contact information and to choose all the time slot(s) that she would be available. The questionnaire used in the screening process is shown in Appendix C.

The screening questionnaire was sent out to all the consumers that are in the K-State Sensory Analysis Center consumer database, and located in Manhattan, KS area. It was set up online using Compusense (Compusence, Inc.,West Guelph, Ontario, Canada).The link to the test was sent through emails. All the consumers who received the questionnaire were welcomed to distribute it to their friends and family members. A $25 incentive was advised in the email to recruit consumers.

Scheduling

A total of 14 thirty minutes sessions were designed. However, only 8 spots were available in each session considering the potential chemical aroma from nail polishes during the test. Each consumer was allowed to attend only one of the sessions they chose. More than 300 consumers participated in the screening process. One hundred and ninety-nine of them qualified for this study, and these consumers were the ones that were actually contacted. One hundred and six consumers were finally scheduled at the end of the scheduling section.

The availability and contact information collected during screening were all entered to a master sheet. The consumers were then sorted by their age, and then by their availability in the master sheet. Two principles were applied when contacting with the consumers. One was that the number of consumers in each age group should be kept relatively the same. The other principle was that consumers who had less availability in each group were contacted first. Each consumer was contacted up to three times. After the third time, if a consumer still could not be connected, she was temporarily removed to from the calling list.

A phone call recruiting process was used to guarantee a higher scheduling success rate. The calling process included two major parts-scheduling and instruction. In the scheduling part, each consumer needed to confirm one session from the one(s) she chose. At the beginning of the

whole calling process, consumers had more flexibility to choose a session. As more consumers were scheduled, the recruiter may ask a consumer for a specific session according to her availability, because some sessions might be filled up sooner than the other sessions. After choosing a specific session, the consumer was reconfirmed with the time and the location of her test session.

In the instructions part, the consumer was informed with some principles for attending this consumer study. Consumers needed to arrive 10 minutes earlier to check in. A photo ID and SSN number should be prepared in order receive the compensation. No chewing gum, drinking coffee and smoking were allowed within 30 minutes before the study. Perfume was also not allowed to wear in the testing session. If a consumer was running late, she was advised to contact us to cancel her session.

All the recruiters are the graduate students in Sensory Analysis Center, Kansas State University, and they were trained before scheduling. A calling moderator guide that contained the information for both scheduling and instruction was also available to the recruiter. (Appendix D)

Reminding

After all the scheduling was done, all the consumer and test session information were organized into groups according to their session. Consumers would receive a reminder email 24 hours before their session. The email contained test session, test date and location information, as well as the instruction which had been shown in the calling process.

Test Room Environment

Two class rooms were chosen for this consumer study according to the availability. The temperature and humidity conditions were controlled by the central air-conditioning, and kept at

moderate temperature and humidity. Two or three fans were kept running during test to improve the ventilation in the room. Direction signs were also provided on the test day to lead consumers to the test room

Test Room Setup

Ten spots were set up in each room, although no more than 8 consumers were scheduled for each session. The other two spots were for back up. Five rows of tables were set up in the room. There was plenty of space between the consumers in the same row, so that they were not able to see each other's samples or questionnaire. There was also plenty space between each two row, allowing student servers to walk quickly without any obstacles. All the tables were covered with plastic covers to keep them from staining.

On each of the ten spots, a set of iPad with stands, water, placemat, and an artificial nail wheel were provided. A warm wet white cloth was provided to each consumer just before the application section. The warm cloth was used to "refresh" consumers' nose after aroma evaluation.

Napkins, water, water cups, scissors, cleaning utensils, pencils, trash cans and other materials were prepared in the testing room.

Consumers checking In/out process

All consumers were advised to come 10 minutes earlier than scheduled time to check in. Four things needed to be done in a check in process. At first, a consumer needed to show her ID to prove her identity. Secondly, she needed to fill out the sign-in sheet including name, address and signature. Thirdly, the consumer was asked to fill out a SSN number collecting slip. This was used for the paying process. Finally, the serving order slip was given to the consumer, and consumer was advised to log into the system.

A total of 98 consumers out of the 106 consumers scheduled showed up on the testing days. After testing, each consumer received an amount of $25 compensation. When they received the compensation, it was marked on the sign-in sheet that they have received the compensation.

Test Instruction

After the check in-process, a consumer needed to log in to the testing system. Each consumer was assigned a username and password before the testing. After login, they needed to verify their names, and input their panelist code, which was indicated in the serving order slip.

When all the consumers in the same session arrived, they were then advised to read and e-sign a consent form (Appendix E) to proceed to the next step. Before starting the test session, some instructions were given by a student moderator to the consumers to help them understand the rules and methods for the test.

The moderator guide included three major sections. They are general instruction, instructions for application section and instructions for observation section. In the general instruction section, some basic rules were introduced to consumers. For example, after finishing a sample, a consumer needed to raise her hand to indicate that she is ready for the next sample. Also, consumers were advised that no right or wrong answer existed, and the results of this study were confidential. A detailed moderator guide is shown in Appendix F.

Samples serving

Before testing, all the student helpers had signed up for different test sessions to help for the test. To help serve each session, four students were needed. One student was helping in the kitchen to organize samples and prepare the warm cloths. The other three students were in the test room to help consumers check in/out, log into the test system, serve the samples and clean

the evaluation station between sessions. All the students had been trained before serving samples to consumers.

Before each session, all the samples were rotated ten times to make sure the nail polish sample was mixed well. There were two major aspects for serving the samples during the test. One was cutting off the artificial nail that a consumer just used, and the other was serving the correct sample to a consumer. The reason to cut off the artificial nail was not allowing consumers to compare different samples. For each consumer, there was a specific sample serving plan, which matched the test design. To make sure a correct sample was being served, a serving order slip was prepared for all the consumers. The serving order slip was a paper slip which contained both the sample code and sample serving order information. There was also a space in the slip for student helper to make a mark. Every time after a student served a sample, she/he would make a mark.

Between each two sessions, a new place mat was replaced onto the table. All the iPads were cleaned using an iPad screen cleaner.

Samples Evaluation

After agreeing with the informed consent form, consumers entered into the questionnaire page. There were three major sections-application, observation and general question section.

Application section

In this section, consumers were instructed to try and apply the nail polish by themselves, and then evaluated the samples. Consumers were applying nail polish samples on to the artificial nail wheel. They were able to use their own way to apply and evaluate the nail polish samples. The only one advice given was to use a “waft” technique to smell. This was done to prevent

consumers wouldn't accidently inhale in too much chemicals from the nail polishes. There were numbers 1-8 marked on the nail wheel to indicate the serving order of the samples.

There were 8 samples for each consumer to evaluate. The order of the samples for each consumer was shown in the test design part. There were 5 questions for each sample. The first three questions asked about consumers' liking on aroma, ease of application and appearance, which covers three major categories of sensory attributes-aroma, texture and appearance. The fourth question asked about consumers' overall liking of the nail polish sample. This question would then be correlated to descriptive analysis data. The fifth question was asking about a consumer's immediate reaction in terms of attraction. After each sample, there would be at least 45 seconds mandatory stop before evaluating the next samples. The warm cloth provided to consumers could help consumers to refresh their nose after each sample.

Observation section

Before moving to the observation section, the student moderator would give some more instructions on evaluating the samples in this section. The consumers were informed that these samples were prepared using instruction from manufacturer, and all the samples would be served at the same time. Consumers were advised not to touch any of the nails since they would be shared with other consumers.

Similar to the application section, 8 samples were evaluated by each consumer. The main reason to separate the application section and the observation section is to see if there would be difference on consumers' acceptability when the nail polish is newly applied and when the nail polish is dry. There were two questions asked for each sample. The first question was about the overall liking of a nail polish sample, and the second question was about how interest a consumer is in using this sample.

General Question Section

After applying the nail polish, some general questions regarding how consumers usually used a nail polish were asked. The first question asked about the frequency of applying nail polish. The second question asked about who will apply the nail polish-a consumer herself, a professional at salon, or both. Question 2b and 2c were subsequent questions for question 2, to ask if ask how often a consumer would go to a nail salon and if she would go to a nail salon for purposes other than applying nail polish. The third question focused on where consumers usually purchase a nail polish. The options included department store, discount store, etc. The fourth and the fifth questions were asking if a consumer would use a base coat and a top coat when they apply a nail polish. The sixth question investigated what categories of nail polish consumers usually use. All the categories in this question were from the categories used in this study. The seventh question asked about all the factors that may affect consumers' decision on buying.

In the seventh question, 24 descriptors were selected from an initial research based on Amazon reviews. Around 1000 consumer reviews were collected from the four categories of nail polished used in current research. The frequency of each word mentioned in the reviews was calculated using NVivo (QSR International, Melbourne, Australia). Only the words that were related to consumers' acceptability were kept in the list. Twenty-four descriptors that were mentioned the most were selected as the descriptors in the seventh question in current research. The 24 descriptors can be put into seven categories, including sensory appeal, convenience of usage, information or brand related descriptors, price, time or occasion, health and recommendations.

Questionnaire was set up using Compusense (Compusence, Inc.,West Guelph, Ontario, Canada). Between each two samples. A stop sign was shown to give a consumer at least 45 seconds break before proceeding to the next sample. Paper version of the questionnaire was also

printed as a backup for the consumer test. A copy of the questionnaire is available in Appendix G.

Test Design

Application Section

A Latin square test design (Appendix H) was used in this section. The Latin square used in this test design could help save samples and save time. The Latin square in this section guaranteed that only one sample is being used at one time, if all the consumers follow the same pace. In reality, even though different consumers may have a different pace, a second set of samples were prepared. In the worst case, if a third consumer needed a sample that was being used by another two consumers, the third consumer wouldn't wait more than two minutes on average. There were up to 10 consumers (there might be two consumers who were switched from other sessions) in each session, and the chance that a consumer needed to wait was low.

Observation Section

The same as Latin square, a set of William square design (Appendix I) was used in this section. A total of 8 different orders were available in this section. Every 8 consumers will repeat the 8 orders.

Statistical Analysis

A t-test and a correlation analysis were done using XLSTAT (Version 2014.2.05Addinsoft, Paris, France) to explore the relationship between the overall liking scores from the application section and the observation section. An ANOVA (Analysis of variance) analysis, along with Fisher's LSD test, was done for each of the two sections to investigate if there was significant difference among the samples, using XLSTAT (Version

2014.2.05Addinsoft, Paris, France). To determine the potential groups of consumers based on their overall liking score, a cluster analysis and a PCA (Principal component analysis) test were carried using XLSTAT (Version 2014.2.05Addinsoft, Paris, France) using a combination of data from the application section and the observation section. Internal preference mapping was conducted using XLSTAT (Version 2014.2.05Addinsoft, Paris, France) for each of the cluster to explore the correlation between consumers; overall liking and sensory attributes. External preference mapping analysis was conducted using XLSTAT (Version 2014.2.05Addinsoft, Paris, France) to explore what attributes would affect consumer's overall liking, as well as aroma liking, etc. Correlation analysis between overall liking and aroma liking, appearance of liking and ease of application were also conducted using XLSTAT (Version 2014.2.05Addinsoft, Paris, France). Correlation analysis between overall liking and immediate reaction, interest in buying were conducted. The frequency of the answer for each general question was collected. ANOVA was conducted using XLSTAT (Version 2014.2.05Addinsoft, Paris, France) to explore the age effect on the overall likings.

Reference

1. Sun C, Koppel K, Chambers E. An Initial lexicon of sensory properties for nail polish. Int J Cosmetic Sci 2014; 36(3):262-272.

Chapter 3 - Sensory Factors Affecting Female Consumers' Acceptability of Nail Polishes

Abstract

OBJECTIVE: The objective of this study was to determine what category of nail polishes female consumers accepted more, and also to explore what sensory factors might drive and affect their acceptability.

METHODS: Ninety-eight female consumers participated in a nail polish consumer study at Kansas State University. Eight commercial products belonging to four categories - regular (REG), gel (GEL), flake (FLK) and water-based (WAT) were evaluated. Consumers evaluated the same nail polish samples twice in two different sections, that is, an application section and an observation section. Mainly hedonic data, along with some analytical data were collected. Pearson's Correlation, ANOVA, external preference mapping, cluster analysis and internal preference mapping were applied for data analysis.

RESUTLS: Consumers' overall liking scores were similar in the application section and in the observation. In general, consumers preferred REG and GEL samples more than the FLK and WAT samples. Among all the sensory attributes, appearance attributes were the major ones that affected consumers' overall liking. Aroma seemed to be a minor factor that affected consumers' overall liking. Some sensory attributes like runny, shininess, opacity, spreadability, smoothness, coverage and wet-appearance were found to drive consumers' overall acceptability positively, while others such as pinhole, fatty-edges, blister, brushlines, pearl-like, flake-protrusion, glittery and initial-drag impacted their liking negatively. Four clusters of consumers were identified according to consumers' overall liking scores based on the acceptability scores from the observation and application sections.

CONCLUSIONS: Considering all the factors that could affect consumers' acceptability, sensory appeal, price, conveniences of usage were the top factors picked by consumers. Consumers' acceptability on these studied samples could guide a beauty store or a nail salon on building their selection on nail polishes. Consumers' acceptability on different sensory attributes could help a nail polish company modify or improve their nail polish formula. The consumer cluster information could benefit a nail polish company on marketing a specific category of product and advertising to a specific group of consumers.

Introduction

Nail polish has globally become one of the most popular cosmetic categories in the past few years, globally. In 2009, it was the fastest growing cosmetic category, gaining more than 8% on its current value growth [1]. Nails polish as replaced lipstick as a more accurate indicator of the overall economy [2-3].

The U.S. market has become one of the leading nail polish markets in the world. In 2011, it became the largest nail polish market in the world, with retail sales of $778 million [2]. The growth rate in the U.S. nail polish market has been dynamic since 2009, compared to the relative slow growth rates in other cosmetics categories [2]. The mass nail care market in the US has grown rapidly since 2009, whereas other cosmetics categories have increased slowly [4]. The nail polish sails in the U.S. are expected to reach $4 billion by 2017 [5].

There are seven factors that may have contributed to nail polish's market growth: 1. Financial crisis and affordability of nail polish [2, 5-6]. 2. The availability of premium salon brand at home [2-3, 7]. 3. The expanding consumer base [8]. 4. The innovation in nail polish category and nail art [3, 9-10]. 5. The convenience (no need to apply everyday) of nail polish [9]. 6. Changes in consumers' behavior, such as heavy use of cell phone in front of other people [3].

There has been a long history since humans started applying colors on their nails. The trend of putting on colors on nails began among the people in upper class, who they do not need do any domestic work [11]. People in ancient China, Babylon, Egypt and Rome used color mixtures from natural substances [11-13]. Records from 17th and 18th centuries showed that people used nail paints to make their nails shiny [14]. Modern nail polish originated from car paint in 1920. Michelle Menard is generally considered as the first person who developed nail polish [12-14]. By the 1940s, nail polish became a necessity of women's color cosmetics [12].

The technology used in nail polish has been fundamentally unchanged for more than 70 years [14-15]. The basic components in nail polish are film forming agent, plasticizers and resins, solvents, pigments and pigment suspension. The most common film-former in nail polish is nitrocellulose [12]. Plasticizers and resins are added to modify adhesion, toughness and flexibility [13, 15]. Solvents act as carriers and they provide liquid compositions with desired brush qualities, viscosity and drying time. Pigments can provide consumers with desired color of a nail polish [13]. Pigment suspension can prevent pigments and other colorants from precipitating out [12].

A variety of nail polishes are available in the market. Gel nail polish is a "long-lasting variety of nail polish made up of a type of methacrylate polymer." One characteristics of this nail polish is that it would not dry until cured under an ultraviolet or an LED lamp. It usually has a longer lasting time-up to two weeks, compared to 2-7 days for a regular nail polish. Glitter/Flake nail polishes that contain small or big particles/flakes could give more shiny and sparkly finish [16]. Water-based nail polishes have been developed without the most harmful chemicals. These are usually marketed as a non-toxic and environmentally-friendly product. Water-based nail polish is based on an acrylic polymer emulsion [3, 14]. Beside these, other categories of nail

polishes are also available in the market, such as nail nourish polish, nail polishes with single or multiple appearance effect, textural nail polish, and color change effect nail polish [6-8, 10, 15-21].

Some studies about nail polish have been done, but few of them have described the sensory properties of nail polish. To provide a sensory lexicon for nail polish, Sun *et al* developed a sensory lexicon that covers both the application and the removal process. For the application part, 21 attributes, including texture, aroma and appearance were developed. For the removal part, 5 attributes in 5 phases were developed. To validate the lexicon, seventeen samples, which included regular, water-based, gel and flakes samples, were evaluated. The lexicon was able to differentiate all the samples according to their categories. In addition, base coat was found to affect the sensory qualities more in the removal process than in the application process [22].

The objective of this study was to determine what category of nail polishes female consumers liked, to explore what sensory factors that may drive and impact their overall acceptability, and to investigate if there could be any consumer segments based on their overall acceptability to different nail polishes.

Materials and Method

Samples

Eight commercial samples were used in this study. The samples belonged to four categories, namely, regular nail polish (REG), gel nail polish (GEL), flake nail polish (FLK) and water-based nail polish (WAT). Each of the categories had two samples - REG1, REG2, GEL1, GEL2, FLK1, FLK2, WAT1 and WAT2. All eight samples were selected according to a descriptive analysis study on nail polish [22]. Samples used in the application section (see

"Consumer Evaluation") were all masked with plastic cups and masking tapes to mask the brand information. Detailed samples preparation information could be found in Appendix A.

Consumers

The study was approved by Kansas State University's Institutional Review Board (IRB). Ninety-eight female consumers in Manhattan, KS area were recruited for this study. All the consumers passed a screening questionnaire before being able to participate in this study. The criteria to screen the consumers included gender, age, frequency of usage and fingernails/toenails questions. Consumers younger than 18-year old were also not the target of this study. The female consumers who use nail polish less than once every three months did not quality for this study. Only consumers who regularly applied nail polish to their finger nails, and both finger nails and toe nails were recruited to this study. The questionnaire used in the screening process is shown in Appendix C.

All the screening questionnaires were completed online using the data collection software Compusense at-hand (Compusence, Inc.,West Guelph, Ontario, Canada). Qualified consumers were then scheduled to a half-an-hour session according to their availability information collected in the screening questionnaire. All the scheduling process was done through a phone interview to achieve a relatively higher scheduling success rate. A general instruction about the study was given to consumers if they qualified for the study and an email reminder was sent one day before the test.

Consumer Evaluation

Test Room Environment and Setup

Two class rooms were chosen for this consumer study. The rooms were maintained at moderate humidity approximately, through the central air conditioning system. Two to three pedestal fans were kept running during test to aid with the ventilation in the room.

Ten spots were set up in the evaluation room. On each spot, an iPad with its stand, water, placemat, artificial nail wheels were provided. A warm moist white dish cloth was provided before the application section to help consumers refresh their noise after aroma evaluation.

Test Design

In the application section, a set of 8×8 Latin square design (Appendix H) was used to balance the number of samples being used at the same time. Similarly, a set of 8×8 William square design (Appendix I) was used in the observation. Ten different William square designs were available in this section.

Sample Evaluation

The study consisted of two sections-application and observation. In the application section, consumers applied the nail polish, and then evaluated the samples. In the observation section, consumers observed the pre-applied nail polish, and then evaluated the samples. The samples used in these two sections were the same but had different 3-digit random codes.

Application Section

In this section, consumers were instructed to apply the nail polish by themselves on artificial nails for evaluating the samples. Consumers applied nail polish to artificial nails on an artificial nail wheel that had 3-digit random codes for each of the eight samples. Five questions were asked for each sample. The first three questions were about liking of aroma, ease of application, and appearance, which covers three major categories of sensory attributes-aroma, texture and appearance. The fourth question asked about consumers' overall liking of the nail

polish sample. This question would then be correlated to descriptive analysis data. The fifth question was about the consumer's immediate reaction in terms of attraction. In-between two consecutive samples, there was a mandatory break of 45 seconds.

Observation section

Before moving to the observation section, the session moderator gave some additional instructions on evaluating the samples in this section. The same 8 samples with different 3-digit random codes were evaluated by each consumer. The main reason to separate the application section and the observation section was to see if there would be a difference in consumers' acceptability when the nail polish is fresh and when the nail polish is dry. There were only two questions asked for each sample. The first question was about the overall liking of the nail polish sample, and the second question was about how much they would be interested in using this sample.

Data Resources

Data used in this paper were from two resources. Consumers' related data was collected from the current study. Descriptive data used in external preference mapping and internal preference mapping (see "Statistical Analysis") was from a descriptive analysis study done by *Sun et al.* [22].

Statistical Analysis

A Student's t-test and Pearson's correlation analysis were done to explore the relationship between the overall liking scores from the application section and the observation section. Analysis of Variance (ANOVA) analysis, along with Fisher's LSD test for post-hoc mean separation, was done for each of the two sections to investigate if there is a significant difference among the samples (α=0.05). External preference mapping analysis carried out to explore what

sensory attributes affected consumers' overall liking, as well as aroma liking. To determine the potential groups of consumers based on their overall liking score, a cluster analysis was conducted using a combination of data from the application section and the observation section. Internal preference mapping then carried out for each of the cluster to investigate the correlation between consumers, overall liking and sensory attributes. Pearson's Correlation Analysis was done between overall liking and aroma liking, appearance liking, ease of application, immediate reaction and interest in buying. The frequency of the answer for each general question was collected. Age effect was explored according to the overall liking means for each sample. All analyses in this study were done using XLSTAT (Addinsoft, Paris, France) Version 2014.2.05.

Results and Discussion

Analysis of Variance (ANOVA)

According to the results in Table 3-1, consumers showed similar trend in both of the two sections on their acceptability of the samples. Generally, they liked the two GEL and the two REG samples more than the two FLK and the two WAT samples.

Table 3-1 Means Separation for overall Liking in the application and observation sections

Sample	Application		Observation	
FLK1	3.80	e	3.21	f
FLK2	6.09	c	6.24	c
GEL1	6.95	b	7.14	ab
GEL2	6.87	b	6.65	bc
REG1	7.15	ab	7.46	a
REG2	7.57	a	7.12	ab
WAT1	4.56	d	5.42	d
WAT2	3.04	f	3.94	e
Pr > F	< 0.0001		< 0.0001	
LSD Value	0.473		0.497	

*LS-means with the same letter (a, b, c, d) are not significantly different within each section (column) at 95% confidence level.

Pearson's Correlation Analysis and Student's T test on Overall Liking between the Application and the Observation Section

The correlation coefficient between the two sections on overall liking scores was 0.948, suggesting a high correlation between the two sections on overall liking score. This indicated that the application section and the observation section had the same trend for the most part.

The p-values for a two samples t-test (α=0.05) between the application section and the observation section for overall liking was 0.131, 0.041, 0.035, 0.599, 0.318, 0.362, 0.004 and 0.000 for REG1, REG2, FLK1, FLK2, GEL1, GEL2, WAT1 and WAT2, respectively. So, Sample REG1, FLK2, GEL1, GEL2 were not significantly different ($P>0.05$) between the two sections, while samples REG2, FLK1, WAT1 and WAT2 were significantly different, ($P<0.05$). Based on Table 3-1, WAT1 and WAT2 were given higher scores in the observation section, whereas REG2 and FLK1 were given lower scores in the observation section.

In the application section, nail polishes were applied by consumers using their own technique, while in the observation section, nail polishes were applied by trained students using a standardized method. This standardized method required a full coverage of the nail. According to *Sun et al* [22], WAT1 and WAT2 were low in the coverage attribute. So, the change in coverage of these two samples could lead to a higher acceptability in the observation section. REG2 had a lower acceptability. It was high on coverage, but the coverage may not change much in the two sections. However, REG2 was the highest among all the 8 samples on opacity. When opacity is too high, the overall liking may drop. According to a nail polish buying guide by eBay, "Nail polish opacity also affects the manicure's finished look" [23]. FLK1 sample was high in initial-drag. However, unlike WAT1 and WAT2, its acceptability was lower in the observation section. The initial drag of this sample was the highest, which suggested that the initial drag contributed to the acceptability for this FLK sample. According to a cosmetic foundation study by Horiuchi

et al, high friction may not necessarily mean low comfort. Friction within a domain could contribute to consumers' comfort [24].

External Preference Mapping

Three external preference mapping analysis were done to explore the relationship between consumers' overall liking scores and descriptive sensory attributes. The overall liking data were correlated with all descriptive sensory attributes. The aroma liking and appearance liking data were correlated with aroma and appearance attributes, respectively.

The descriptive sensory attributes used in current study could be divided into three groups. Three labels (Brightness, Dimness and Flakeness) were chosen arbitrarily by the author to indicate each of the group. Attributes acetone, runny, shininess, opacity, spreadability, smoothness, coverage and wet-appearance were labeled as "Brightness" group attributes. Attributes pinhole, fatty-edges, blister, brushlines, pearl-like, woody, nutty, fruity-floral, petroleum-like were assigned to the a group with the label "Dimness". Attributes flake-protrusion, glittery and initial-drag were put into one group, with the label "Flakeness". In the following discussion, samples were described using different group labels.

According to Figure 3-1, REG1, REG2 and GEL1 were liked the most among all the samples. They could be described as belonging to the "Brightness" group attributes. Compared to the above three samples, GEL2 was slightly lower on the liking scale. It could be described with the "Brightness" group attributes, but it also had the characteristics of the "Dimness" group attributes. FLK1 and FLK2, which were the next two samples liked by consumers, were described with the "Flakeness" group attributes, and low on the "Brightness" group attributes (except acetone). WAT1 and WAT2 were liked the least by consumers. They were low on

"Brightness" group attributes and low on "Flakeness" group attributes, but they were relatively high on the "Dimness" group attributes.

According to the results in Figure 3-1, the Brightness group attributes seemed to be the positive driving factors for consumers' acceptability. The "Dimness" and "Flakeness" group attributes seemed to be the negative driving factors for consumers' overall acceptability.

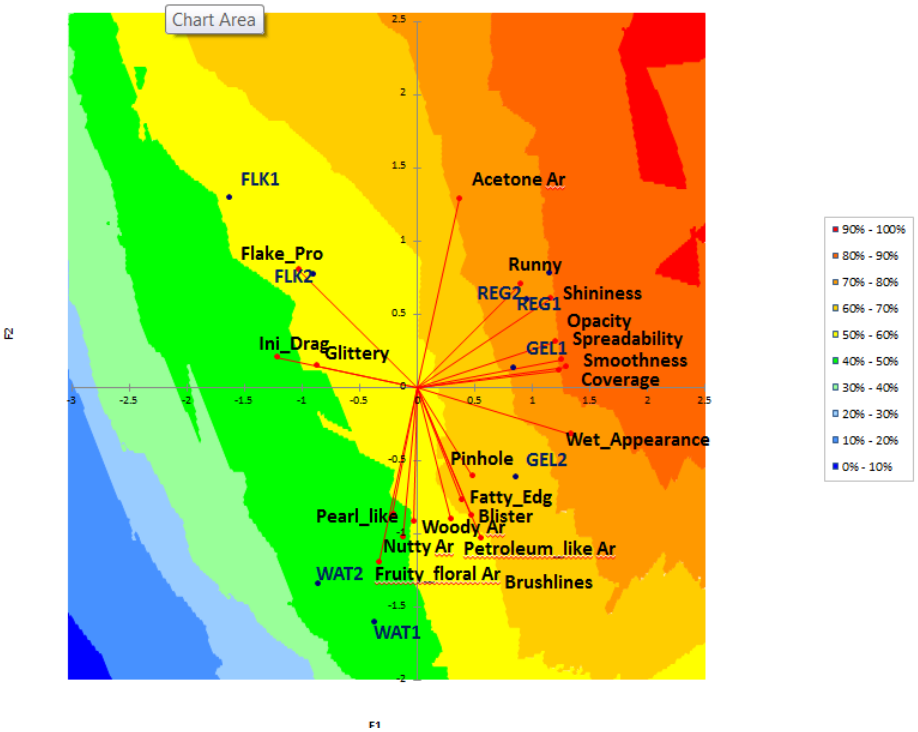


Figure 3-1 External preference mapping with All Descriptive Attributes

*The percentage in the legend in the three maps is the percentage of consumers that "liked the samples." If a consumer gave a score higher than 6 (out of 9) for a sample, she was considered "liked the sample".

Consumers' acceptability on the samples was different when only aroma attributes were evaluated (Figure 3-2). Consumers liked the samples with a fruity-floral aroma, and disliked the samples with an acetone aroma. This result was on the opposite of that in the external preference mapping with all descriptive sensory attributes. This contradiction suggested that aroma may not be a major factor to affect consumers' overall acceptability. Furthermore, the correlation coefficient between aroma liking and overall liking (r=0.017), confirmed this interpretation.

According to Wysocki *et al*, "acetone is a weak sensory irritant", and "sensory adaptation is an important factor affecting its overall irritancy [25]." Consumers may have already adapted to the acetone aroma, and the acetone aroma didn't affect their overall experience of using a nail polish. The reason that consumers seemed to like the samples with higher acetone and lower fruity-floral (Figure 3-1) might be that all the samples that consumers liked in overall happened to have the acetone aroma.

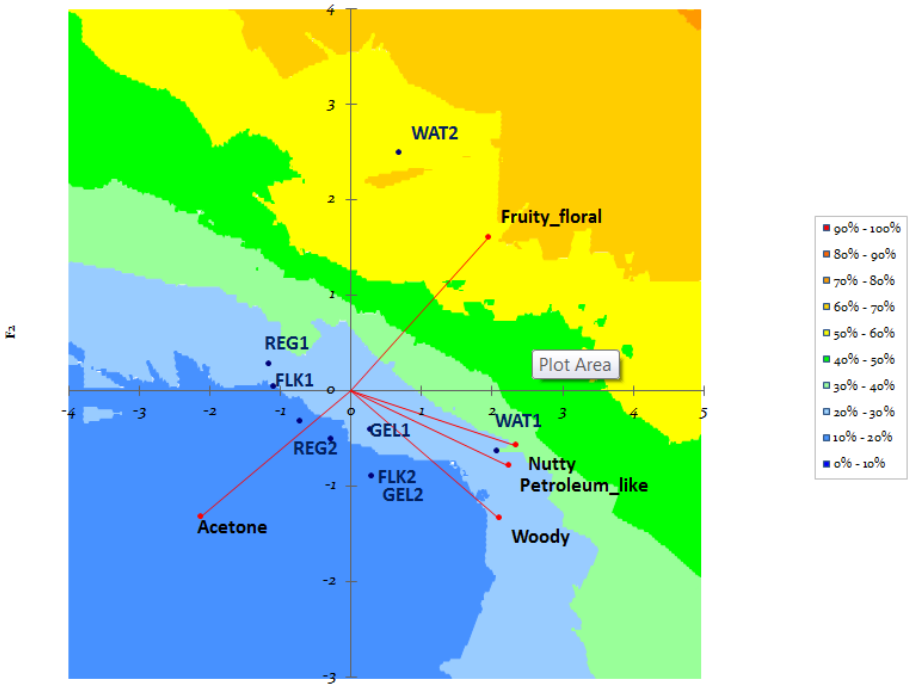


Figure 3-2 External Preference Mapping with Descriptive Aroma Attributes

In Figure 3-3, the distribution of the samples and the attributes was similar to that in Figure 3-1, which suggested the appearance of nail polish could be the major factor that affected consumers' overall acceptability. REG2, GEL1 and REG1, could be described with the Brightness group attributes (without aroma and texture). This group of attributes seemed to be the driving factors for the relatively high percentage liking. GEL2, besides the Brightness group attribute, could also be described with Dimness group attributes (expect for pearl like, aroma and texture attributes). WAT1 and WAT2 could be described with Dimness group attributes (without

aroma and texture). FLK1 and FLK2 would be described with Flakiness group attributes (without aroma and texture). Furthermore, the correlation coefficient between appearance liking and overall liking (r=0.938) confirmed that the overall liking was highly correlated with the appearance liking.

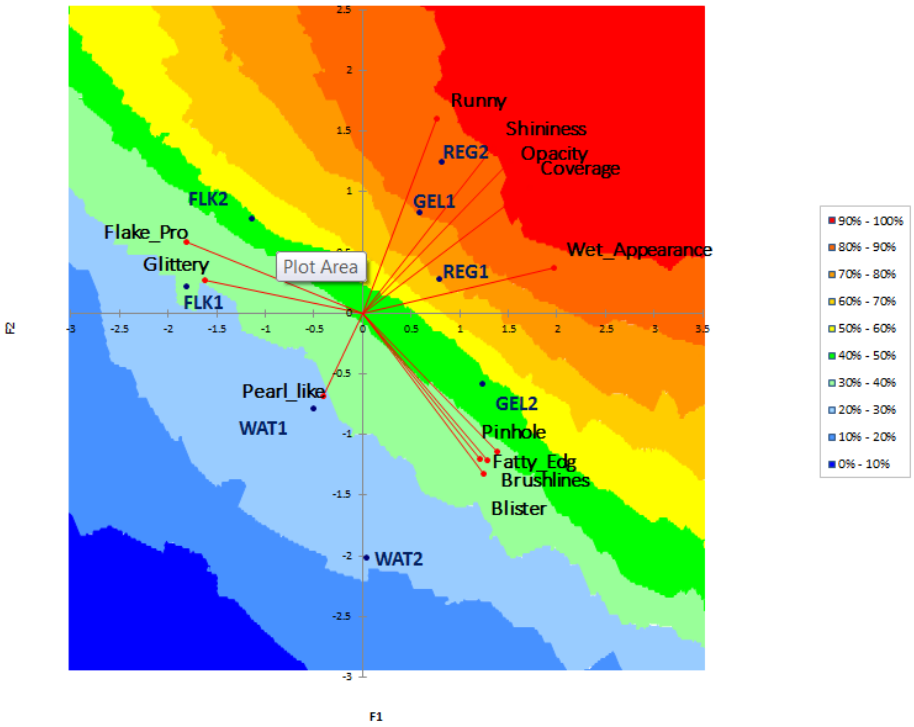


Figure 3-3 External Preference Mapping with Descriptive Appearance Attributes

Ease of application was one of the questions asked during consumers' evaluation. The correlation coefficient between overall liking and ease of application evaluated by consumers is 0.771, which suggested that as the ease of the application increased, the overall liking score increased. Compared to appearance and aroma, texture contributes much more than aroma, but less than appearance to overall liking.

Cluster Analysis

According to the hierarchical tree diagram (Figure 3-4), four clusters were selected. The sample size for cluster A, B, C and D are 26, 24, 26 and 22, respectively. For all four clusters,

consumers seemed to like the two REG samples, the two GEL samples and FLK2 more than the other samples (the two WAT samples and FLK1). These results are consistent with that from the ANOVA analysis earlier.

In Figure 3-5, cluster A seemed to be higher on the two WAT samples, compared to the other clusters. They could be potential consumers for water-based nail polishes. Cluster B was among one of the highest on all REG and GEL samples, but was among one of the lowest on the two WAT and FLK1. Cluster C was relatively lower on all REG, GEL and WAT samples, but is was among the highest on the two FLK samples. They could be potential consumers for flake samples, and they may not be the potential consumers for GEL samples. Cluster D seemed to dislike the two FLK samples. They may be not the target consumers for flake samples.

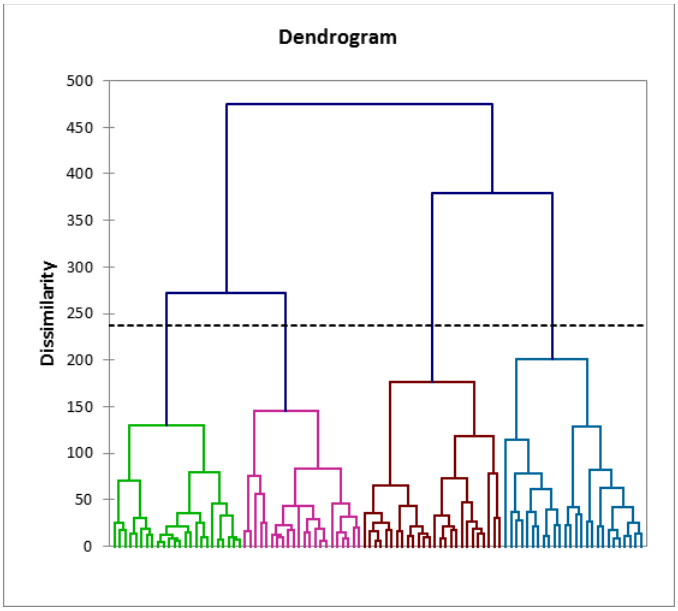


Figure 3-4 Cluster Analysis Using the Results from the Application and Observation Sections

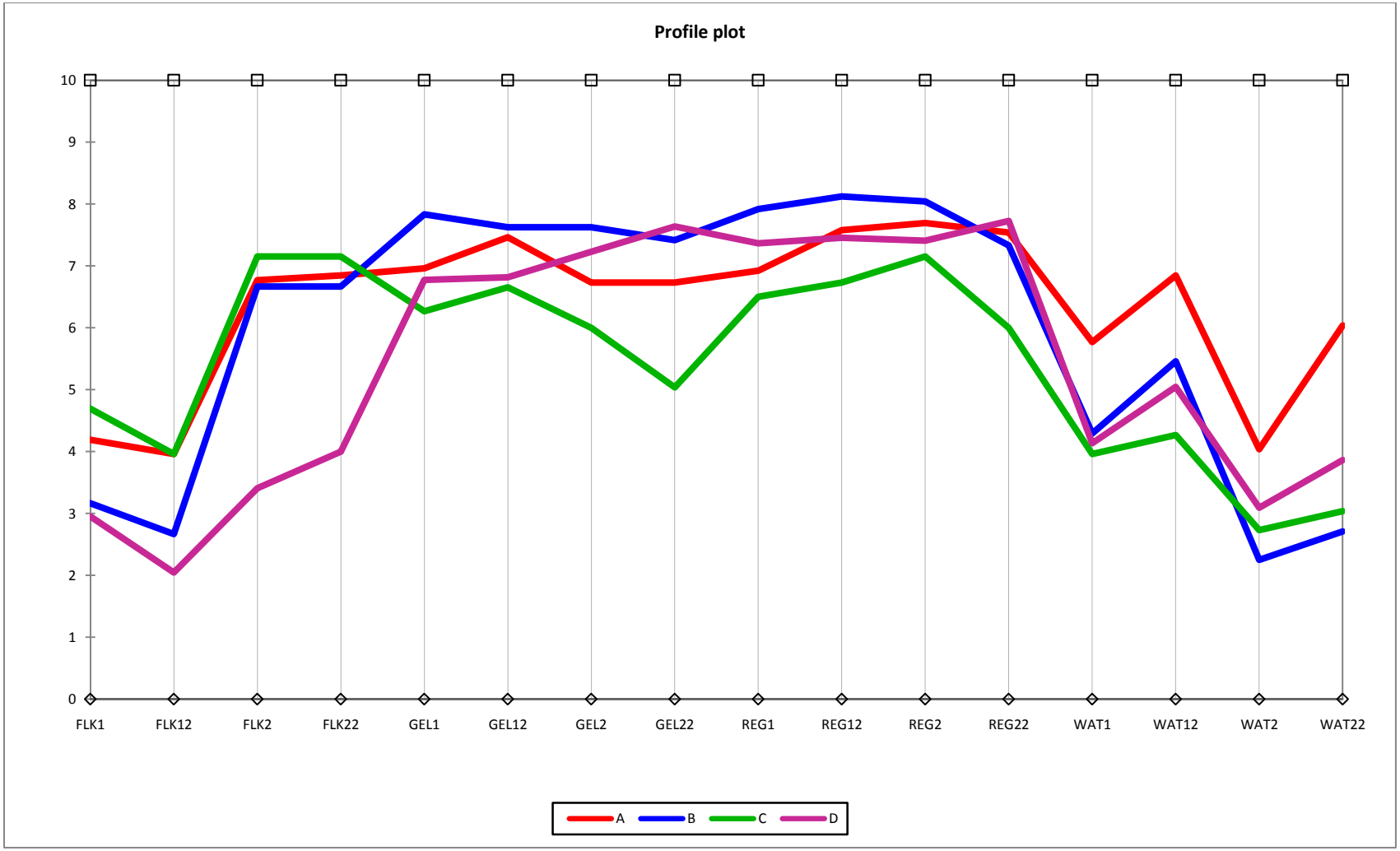


Figure 3-5 Clusters Profile

*Samples with 1 digit number were from the application section; samples with 2 digit number were from the observation section.

Internal Preference Mapping

Internal preference mapping was done for each cluster to investigate what sensory factors that each cluster may like.

Compared to other clusters, cluster A was relatively close to sample WAT1 and FLK2 (Figure 3-6). According to the descriptive data from the nail polish lexicon study [22], WAT1 and FLK2 contained the glittery and pearl-like effects. The definition for glittery is "Sample composed of individual reflective particles that have a sparkling effect", and the definition for pearly-like is "A soft, reflective luster reminiscent of a pearl of mother-of-pearl [22]." This suggested that consumers in cluster A may like the reflective or sparkling effect in the nail polish samples. So, glittery and pearl-like could be potential claims used on a nail polish label to draw the attention for consumers who may like the reflective/sparkling effect.

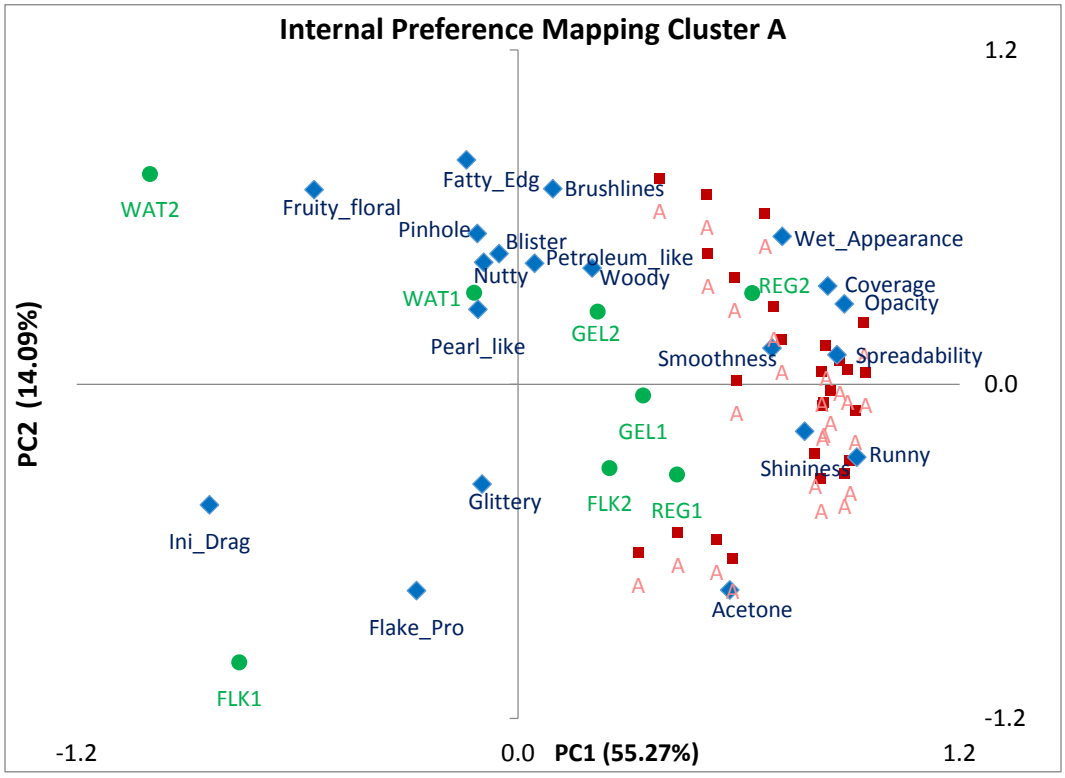


Figure 3-6 Internal Preference Mapping Cluster A

Consumers in cluster B were located much closer to each other (Figure 3-7). Also, the PC1 in this map accounted for 81.78% of the variation, which confirmed the consumers' clear acceptability on the REG and GEL samples over the WAT and FLK samples. These indicated that consumers may like the attributes smoothness, spreadability, wet appearance, shininess, coverage, opacity, runny and dislike attributes, such as pearl-like, initial drag, fatty-edges, etc. So, if a nail polish company is to market a regular or gel nail polish samples to the consumers in cluster B, it may emphasize on the attributes they like, and avoid the they dislike.

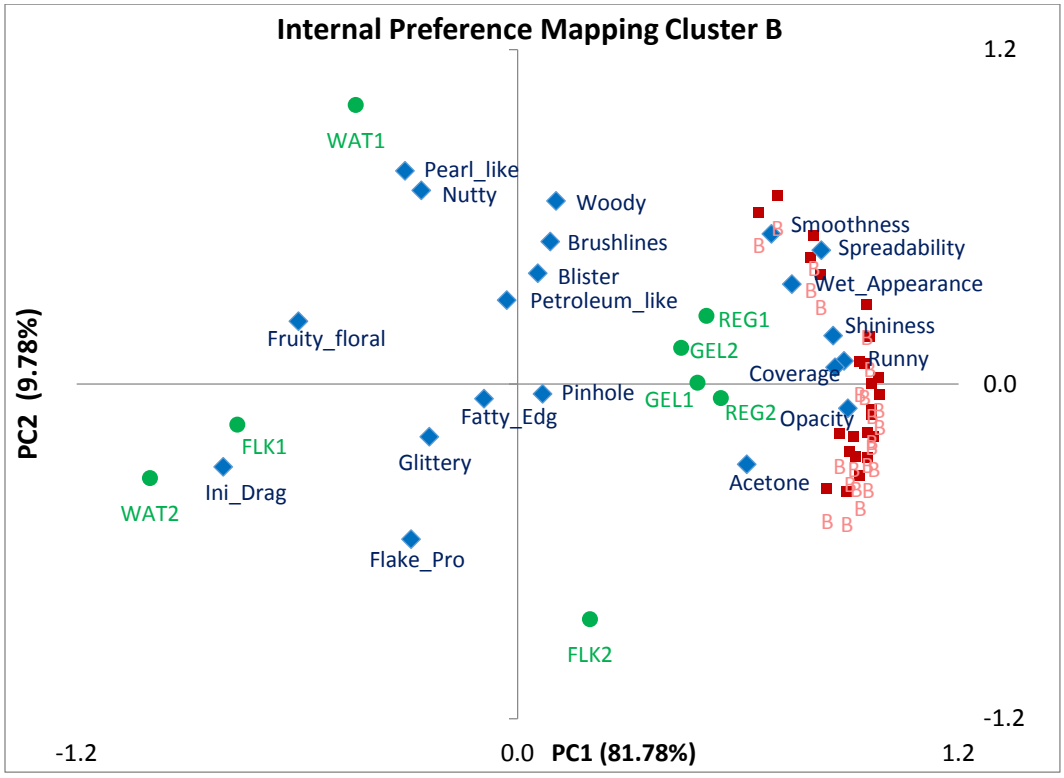


Figure 3-7 Internal Preference Mapping Cluster B

Cluster C was relatively far from GEL2 (Figure 3-8), compared to other clusters. According to the nail polish lexicon study, GEL2 has blister, pinhole and brushlines effect. Consumers in cluster C may not like these effects, and they seemed to be more critical than other clusters on these effects. Thus, if a nail polish company broadens their consumer base, they need

to fix the small defects to attract those who are more careful and picky about the quality of the products.

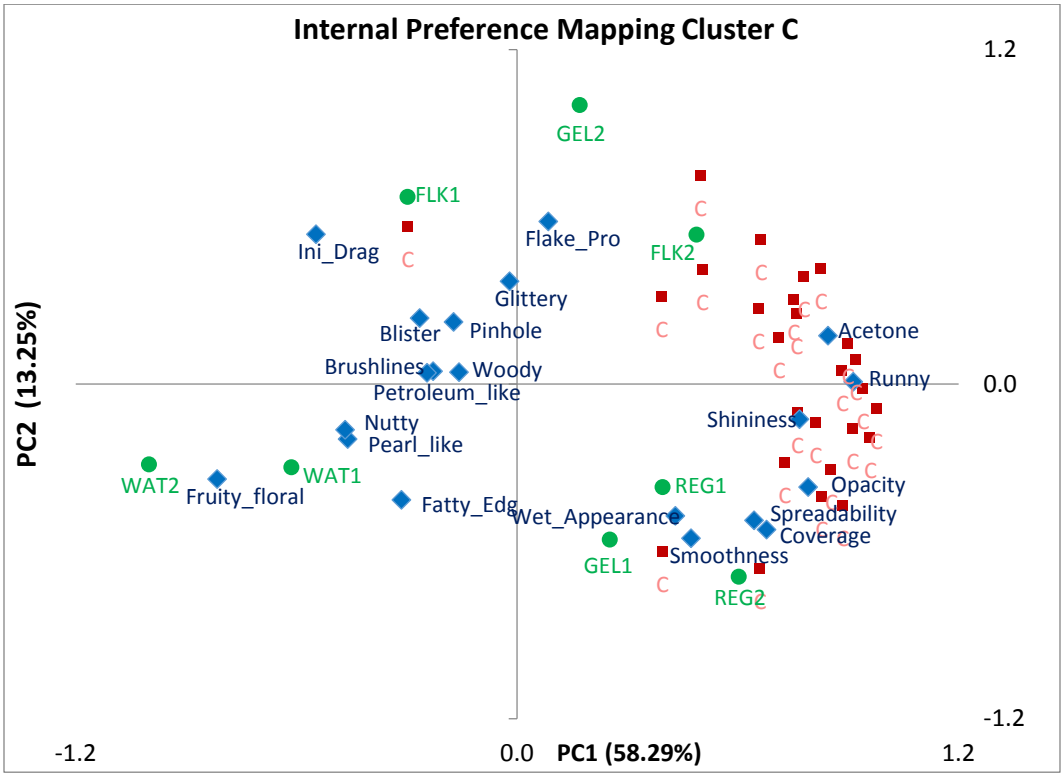


Figure 3-8 Internal Preference Mapping Cluster C

Similar to cluster B, consumers in cluster D (Figure 3-9) showed clear interest towards the REG and GEL samples, and dislike for the WAT and FLK1 samples. Different from cluster B, cluster D did not show any interest in FLK2, and it was the lowest on FLK2 among all the clusters. This suggested that consumers in cluster D were not the target consumers for flake samples, and they may not like samples with high flake-protrusion, initial-drag, glittery and pearl-like. Unlike cluster C, they can tolerate the small defects, such as fatty-edges, brushlines, blister and pinhole.

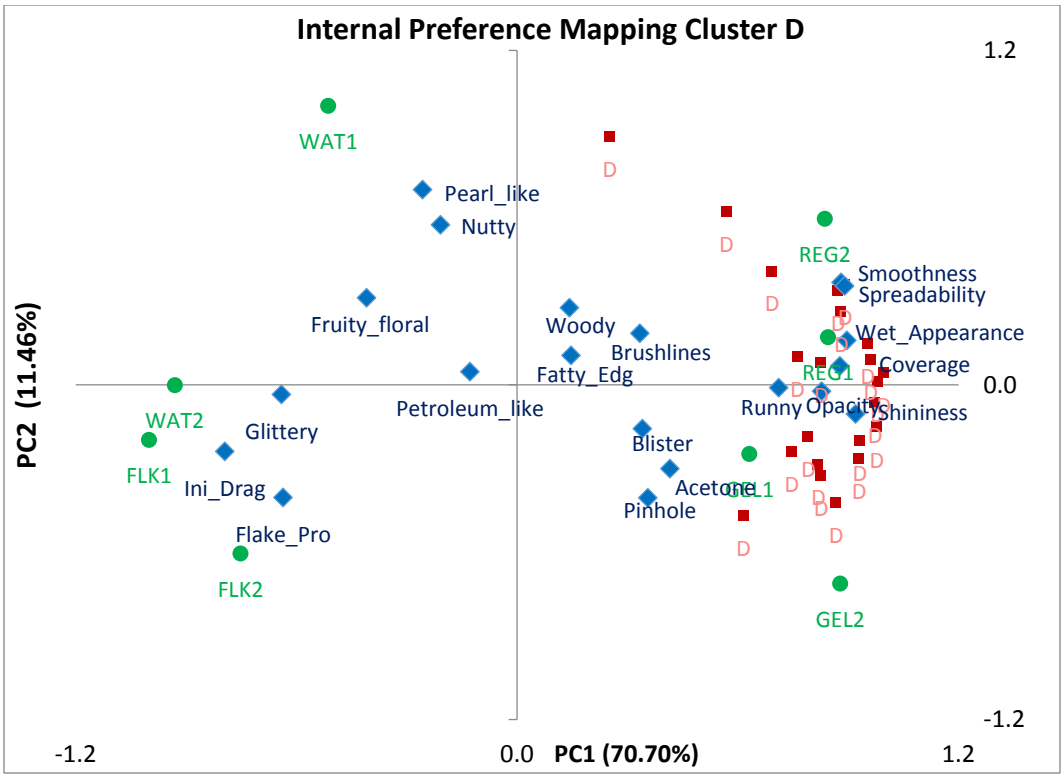


Figure 3-9 Internal Preference Mapping Cluster D

Overall Liking and Immediate reaction

The correlation between overall liking and immediate reaction was 0.907. This suggested that consumers' acceptability on the same sample remained relatively the same when a question was asked differently. So, if another nail polish study would be done, researchers may choose to ask either the overall liking or the immediate reaction question.

Caveats and future studies

Future sensory or consumer study on nail polish could be done. Four categories of nail polish were examined in this study; caution need to be taken if researchers want to apply the information on consumers' acceptability to be bigger domain. In the application section, all the samples were wrapped using plastic cups and tapes, so the feeling of manipulating a nail polish could be different from that in real life. The study was done in a central location. Consumers

were told to use their own way to apply their nail polish, but there could still be a difference when they apply at home. When applying the nail polish, consumers put the nail polish on an artificial nail wheel. However, a difference might be found about applying nail polish on an artificial nail and real nail. The study was done only on Kansas consumers. The purchasing behavior could vary in different regions. Caution needs to be taken if the results of this study would to be applied to a bigger population.

Conclusions

Appearance and texture could be the major factors that drive consumers' overall liking on nail polishes. Aroma seemed not to be a major factor that affects consumers' overall liking. This suggested that, to achieve a relatively higher consumers' overall acceptability, a nail polish company may focus on the innovation and research on the appearance of nail polish, rather than the aroma of a nail polish.

"Brightness" group attributes drive consumers' overall acceptability positively, whereas "dimness" and "flakeness" group attributes drive consumers' overall acceptability negatively. This suggested that a nail polish company can focus on improving or minimizing the effects of these sensory attributes in a certain domain with the help of descriptive sensory data, to achieve a higher consumers' overall acceptability.

Cluster analysis showed potential consumers' segments according to their acceptability of nail polish. A nail polish company can advertise a product using different strategies according to the acceptability of that specific consumer segment.

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Chapter 4 - An exploratory study on factors that may affect Consumers' Decision on Buying a Nail Polish

Abstract

OBJECTIVE: The objective of this study was to determine what factors consumers valued more when they decide to buy a nail polish, and also to whether age has any impact on acceptability of nail polishes.

METHODS: Ninety-eight female consumers participated in a nail polish consumer study at Kansas State University. A questionnaire containing a check-all-that-apply (CATA) question, behavior questions and demographic questions was presented to each of the consumers. In the CATA question, the factors that may affect consumers' decision to buy a nail polish, which included both sensory and non-sensory factors, were explored. The frequency in percentage of each factor chosen was calculated. Analysis of Variance (ANOVA) was used to explore the age effect on consumers' overall liking.

RESULTS: Sensory appeal, price and convenience of usage were the top picked factors that affected consumers' buying decisions. Season is a factor that may get young consumers' attention. Age could be a factor that affected consumers' overall liking on some of the samples.

CONCLUSION: Consumers valued sensory appeal and convenience of usage; this suggested that a nail polish company's product development and advertising may want to focus on these two areas. The age effect information could help a nail polish company understand more about consumer segmentation and advertising strategy.

Introduction

The history of human's using nail polish could date back hundreds of years ago. The trend of applying nail polish first started with people living in an upper class, who did not need

to do any manual work and led a luxurious life [1]. In ancient China, people decorated their nails using herbal extracts and a special "lacquer." In ancient Babylon and Egypt, people colored their nails with a mixture from natural resources. Only women in the highest social order can use the dark red and crimson colors [1-3]. Records from 17th and 18th centuries showed that European people were with appearance of shiny, varnished nails [4].

The lacquer was discovered after World War I, when people were trying to make use of the nitrocellulose left from the war. Someone later discovered that, after boiled in water nitrocellulose is soluble in organic solvents. After all the solvents evaporated, the nitrocellulose became hard and glossy. Nitrocellulose was soon used as a fast-drying glossy coating in car-painting industry [5]. Michelle Menard is generally recognized as the first person who introduced automobile paint to nail polish industry in 1920. Nail polish became one of the necessities in women's color cosmetics by the 1940s [2].

Nail polish today has received more and more attention among consumers. In 2009, it was the fastest growing cosmetic category [6]. Nail polish has taken the place of lipstick as a barometer for the overall economy [7-8]. In 2011, nail polish had a global retail growth of 11% [7].

Part of the reason for nail polish's boom is about emerging markets. China, India, Brazil and Russia have been emerging markets in recent years, but they are also considered as "key projected growth markets" in cosmetics consumption. They were important to nail polish market, since their performance was crucial to nail polish industry's profit [7]. However, not only emerging markets, but developed markets, such as the U.S., the U.K. and Germany are also driving the market growth in nail polish [9]. The strong performance of developed markets

helped raise the global retail value of nail polish from no more than $3 billion in 2007 to more than $45 billion in 2012 [10].

In the U.S., the nail category retail sales reached around $1 billion in 2012, gaining a 26% growth compared to the previous year [8]. The mass nail care market in the US has grown rapidly since 2009, whereas other cosmetics categories have increased slowly [11].

A variety of factors may affect consumers' choices of cosmetics. The factors may include sensory appeal, convenience of usage, health, season, color, age, etc. Sensory appeal could be a major factor that contributes to consumers' choice of nail polish. Brightening and illuminating were among the most popular terms used as product claims in 2013 in UK [12]. Gloss is one of the criteria that consumers use to judge nail polish's performance [13]. Smoothness and evenness are reported being two of the popular terms used in nail polish market [13]. Convenience of usage could also be an important factor that affects consumers' choice. Quicker and easier to use products could attract the modern consumers who have a fast-paced life [12]. Long-lasting nail polishes could be one of the favorite claims by consumers. It could help improve the time nail polish can last without suffering chipping and flaking from 2-3 days to 7-10 days [13]. Drying time, ease of maintenance and wearability could also be some other popular market claims for nail polish, and have been used as criteria to judge the performance of a nail polish by consumers [13]. Regarding the safety of nail polish, it did not lead to a microbial risk under the test conditions [14]. However, it brought health concerns since the born of nail polish [15-17]. Nail polish companies have been working on new formulae to make more health- and eco-friendly nail polishes [3-5, 18]. Season could be an important factor since weather condition may affect nails' condition, as well as a nail polish's quality. Some premium nail care products have been reported to tolerate the change of season, and another product is said to strengthen the nail

protection from severe weather conditions [19]. Color could be one of the important factors that affect consumers' choice. Most consumers may focus more on color than brand [20]. Age could be another important factor. Younger women are reported to be more willing to experience nailing art, artificial nails and gel nail polish. They are more likely to follow the trend and try different new products [20].

The objective of this study was to explore what factors that consumers valued more when they purchase a nail polish, and also to examine how age affects consumers' overall liking of nail polish.

Materials and Methods

Consumers

The study was approved by Kansas State University's Institutional Review Board (IRB). Ninety-eight female consumers were recruited from Manhattan, KS area. All the consumers passed a screening questionnaire in order to qualify for this consumer study. The criteria to screen the consumers included gender, age, frequency of usage and fingernails/toenails questions. Consumers younger than 18 were not in the scope of this study. Consumers who used nail polish less often than once every three months disqualified for this study. Consumers who only applied nail polish on their toenails were also not recruited in this study. The questionnaire is shown in Appendix C.

All the questionnaires were completed online through using the data collection software Compusense at-hand (Compusence, Inc.,West Guelph, Ontario, Canada). Consumers that qualified for this study were scheduled to a half-an-hour session based on their availability. The availability information was collected during the screening questionnaire. A phone call interview was used in the screening process to achieve a relative higher scheduling success. A general

instruction about the test was also given to consumers if they qualified for this study. When scheduling, the number of consumers in each age group (18-30, 31-43, 44-56, 57 and over) was balanced.

Consumer Evaluation

Test Room Environment

The rooms were maintained moderate temperature and humidity through the central air conditioning system. Three fans were kept running during the test to improve ventilation condition in the room.

There were ten places for each session in the test room. An iPad with its stand, water, placemat, and an artificial nail wheel were provided on each place.

Evaluation

The first question asked consumers about how often they applied nail polish. The second question and its subsequent questions asked about consumers' experience regarding to visiting a nail salon. The third question asked where consumers usually purchased a nail polish. The options included department store, discount store, online, drug store, nail salon and beauty supply store. The fourth and the fifth questions asked if a consumer would use a base coat and a top coat when they apply a nail polish. The sixth question investigated what nail polish categories consumers usually use. All the categories in this question were from the categories used in this study. The seventh question explored all the factors that may affect consumers' decision on buying.

In the seventh question, each consumer was asked to select the 5 most important descriptors they usually consider when deciding to buy a nail polish. Twenty-four descriptors were selected. All these twenty-four descriptors were selected based on a word frequency test on

around 1000 Amazon reviews using NVivo (QSR International, Melbourne, Australia). The descriptors selected were thickness of nail polish, reviews from online resources, aroma (scent), ease of application, color, long-lasting, drying speed, ease of removal, health concern (components in a nail polish), special occasion to wear a nail polish, health concern (components in a nail polish), brand, price, shininess, effort required to maintain, package, season (spring, summer, etc.), bottle shape, applicator, additional supplies, flakes, recommendations, smoothness of appearance and time (morning, afternoon, etc.).

The questionnaire was set up using Compusense at-hand (Compusence, Inc.,West Guelph, Ontario, Canada). Consumers answered all the questions on an iPad. They were given instructions about how to use the iPad to answer the questions. A copy of the questionnaire is available in Appendix G.

Data Resources and Statistical Analysis

Data used in this paper were from two resources. General questions data were from this current study. Consumers' overall liking data were from a related consumer study [21].

The frequency of the answer for each CATA question was collected. Group means were also calculated for each age group.

Results and Discussion

CATA Data

Factors affecting consumers' decision to purchase a nail polish

According to Table 4-1, sensory factors, except for removal, flakes and aroma, were all among the first half by ranking. Color, as expected, was the most selected sensory factor when looking at the top five most important factors impacting consumers' buying decision. Almost 90%

of the consumers' chose color as their single most important factor while buying nail polish. Coverage and ease of application had a percentage close to 50%, underscoring their importance. Around 33% of the participants selected smoothness (7 out of 24), suggesting that the smoothness of appearance was considered important by consumers. Smoothness was with 32.7% and ranked 7th out of 24 factors, suggesting that the smoothness of appearance was considered important by consumers. Shininess and thickness were close to 20%-25%. Removal was relatively low, with a percentage of 13.3%, suggesting that consumers may focus on application and maintenance of the nail polish, rather than removal. Flakes and aroma were not considered important with a percentage of less than 10%.

All three convenience of usage descriptors (drying, long-lasting and maintenance) ranked among the top 8 most important factors, which suggested that physical properties were considered important for consumers.

All the brand related factors, including brand, applicator, supplies, bottle and package were not with high percentage. This suggested that information and supplies related information may not be considered as important as the sensory, price and physical property factors to consumers.

All three time-related factors (season, occasion and time) were with a relatively low percentage, compared to sensory, price and physical property factors. However, season had a percentage of 20.4% and was relatively higher than brand, which suggested that consumers may consider purchasing products for different seasons. According to the demographic data, 31% consumers from the 18-30 age group, selected season as one of the top five factors. So, younger female consumers may be more willing to use different nail polishes in different seasons.

Price was selected as the top five important descriptors by around 50% of the participants, which turned out to be the 2nd most important factor for making buying decisions. It was not as high as color, and there was a big gap between color and price. Nail polish was probably not considered very expensive, and it could be used for a long time. Health was not chosen as many as expected. Only 5.1% of the consumers put health as an important factor. This might be caused by that the aroma only exists during the initial application stage, and usually does not last long enough physically and in the users' memory long. Also, consumers may not use nail polish that often. Reviews were not chosen by any consumer, which indicated that not many people actually using online reviews to help them to make a decision to buy a product. Consumers do not use reviews as their resources, probably because nail polish is a common cosmetics, and there is no need for consumers to search advises from online reviews.

Table 4-1Frequency Table for Factors that may Affect Consumers' Decision on Purchasing

Rank	Factors	Freq.	Category	Total	Percentage (%)
1	Color	87	Sensory	98	88.8
2	Price	50	Others	98	51.0
3	Application	50	Sensory	98	51.0
4	Coverage	44	Sensory	98	44.9
5	Drying	34	Con. of usage*	98	34.7
6	Long-lasting	33	Con. of usage	98	33.7
7	Smoothness	32	Sensory	98	32.7
8	Maintenance	27	Con. of usage	98	27.6
9	Shininess	23	Sensory	98	23.5
10	Thickness	20	Sensory	98	20.4
11	Season	20	Time/Occasion	98	20.4
12	Brand	17	Brand Related	98	17.3
13	Removal	13	Sensory	98	13.3
14	Applicator	9	Brand Related	98	9.2
15	Occasion	8	Time/Occasion	98	8.2
16	Health	5	Others	98	5.1
17	Flakes	5	Sensory	98	5.1
18	Supplies	4	Brand Related	98	4.1
19	Aroma	2	Sensory	98	2.0
20	Recommendations	2	Others	98	2.0
21	Time	2	Time/Occasion	98	2.0
22	Bottle	2	Brand Related	98	2.0
23	Package	1	Brand Related	98	1.0
24	Reviews	0	Others	98	0.0

*Con. Of usage represents for convenience of usage:

Consumers' Purchasing on Different Categories

According to the Table 4-2, from Nail Polish Category CATA data, fast-drying and long-lasting were the two most frequently used nail polish products. These indicated that convenience could be one of the reasons that consumers choose a nail polish. Around the same percentage of consumers chose the Gel/Shellac and Flakes/Glitter samples. Gel/shellac was usually liked more by consumers than the flakes/glitter samples were. Gel/shellac samples usually cost more, and are typically available in a nail salon. This might be the reason that consumers liked them, but rarely used them. Water-based nail polishes were least often used category in this table. The reason for this low percentage might be that consumers recruited in this study were 18 and older,

while water-based nail polishes are usually claimed for children. Three out of 5 the consumers who cared about health actually purchased the water-based nail polishes. This also suggested that water-based nail polishes could focus on consumers who think health is an important factor affecting their decisions on buying.

Table 4-2 Frequency Table for Nail Polish Category

Rank	Category	Frequency	Total	Percentage (%)
1	Fast-drying	75	98	76.5
2	Long-lasting	71	98	72.4
3	Gel/Shellac	24	98	24.5
4	Flakes/Glitter	23	98	23.5
5	Water-based	15	98	15.3
6	Other	4	98	4.1

General Questions

According to Table 4-3, two thirds of the consumers chose self-application only, but no more than 5% of consumers chose professional application only. For one thirds of the consumers who had experience of having nail polish applied by a professional, the major of them visited a nail salon once a month or less. So, all these facts indicated that home-use of nail polish is the major way for nail polish consumption.

Discount store, drug store and beauty supply store were the top three picked locations where consumers purchased their nail polish, whereas nail salon was the least picked location. Price, convenience and ease of access to more selections may explain the gap between these locations. Few people purchased nail polish online, and this suggested that online shopping may not have an advantage over store purchasing on nail polish.

Table 4-3 Frequency Table for Other General Questions

Q1 Frequency of Usage	Frequency	Total	Percentage
Once a week or more	37	98	37.8
Once every two weeks	32	98	32.7
Once a month	21	98	21.4
Once every three months	8	98	8.2
Q2 Who usually applies your nail polish	**Frequency**	**Total**	**Percentage**
Self application only	66	98	67.3
Professional application only	4	98	4.1
Both self and professional application	28	98	28.6
Q2a Frequency of visiting a nail salon	**Frequency**	**Total**	**Percentage**
At least once a week	1	32	3.1
Once every two weeks	3	32	9.4
Once every three weeks	5	32	15.6
Once a month	8	32	25.0
Less than once a month	15	32	46.9
Q2b Visiting a nail salon for service other than nail polish applying	**Frequency**	**Total**	**Percentage**
Yes	25	32	78.1
No	7	32	21.9
Q3 Where to purchase a nail polish?	**Frequency**	**Total**	**Percentage**
Department store (JCPenny, Sears, etc.)	14	98	14.3
Online	8	98	8.2
Nail salon-only use nail polish without buying an extra bottle	9	98	9.2
Nail salon-Either use nail polish or not and buy additional nail polish	6	98	6.1
Discount store (Target, Walmart, etc.)	89	98	90.8
Drug store (Walgreens, CVS Pharmacy, etc)	65	98	66.3
Beauty supply store (Sally Beauty Supply, etc)	41	98	41.8
Q4 Frequency of usage of a base coat	**Frequency**	**Total**	**Percentage**
Always or almost always	28	98	28.6
Often but not always	28	98	28.6
Occasionally but not often	24	98	24.5
Rarely or never	18	98	18.4
Q5 Frequency of usage of a top coat	**Frequency**	**Total**	**Percentage**
Always or almost always	41	98	41.8
Often but not always	26	98	26.5
Occasionally but not often	17	98	17.3
Rarely or never	14	98	14.3
Q8 Age	**Frequency**	**Total**	**Percentage**
18-30	29	98	29.6
31-43	23	98	23.5
44-56	25	98	25.5
57 and over	21	98	21.4

Age Effect

Four groups of consumers were selected in this study, the number of consumers for each age group 18-30, 31-43, 44-56, 57 and over are 29, 23, 25 and 21.

According to Table 4-3, only 1 consumer in the 44-56 groups used the gel/shellac nail polish, whereas 9, 7 and 7 consumers from the other groups used the gel/shellac nail polish. Also, for the water-based nail polishes, only 1 person from both 44-56 age group and 57 and over age group used it, whereas 8 consumers from the 18-30 group and 5 consumers from the 31-43 group used water-based nail polish. This suggested young people may be more willing to use Gel/Shellac and Water-Based nail polishes.

The percentage of consumers who chose price as an important factor were 82.8%, 47.8%, 40.0% and 23.8%, respectively, for group 18-30, 31-43, 44-56, 57 and over. The trend showed that younger consumers may care more about price than older people, probably because generally younger people make less money than older people.

The percentage of consumers who chose season as an important factor in each group were 31.0%, 26.1%, 16% and 4.8% respectively, for group 18-30, 31-43, 44-56, 57 and over. This suggested that younger consumers were more willing to change their nail polish colors according to the seasons than older consumers.

According to Figure 4-1, for one of the FLK1, younger consumers showed relatively higher overall liking scores. For WAT1, younger consumers showed consistent acceptability between the application section and the observation, whereas older consumers gave higher scores in the observation section. For the WAT2, consumers from most age groups-except for age group 31-43, gave higher scores in the observation section. The reasons might be that the WAT samples had a better coverage in the observation section, where all the samples were prepared

following a standard procedure. Older people seemed to be more careful about the coverage changes in the two sections.

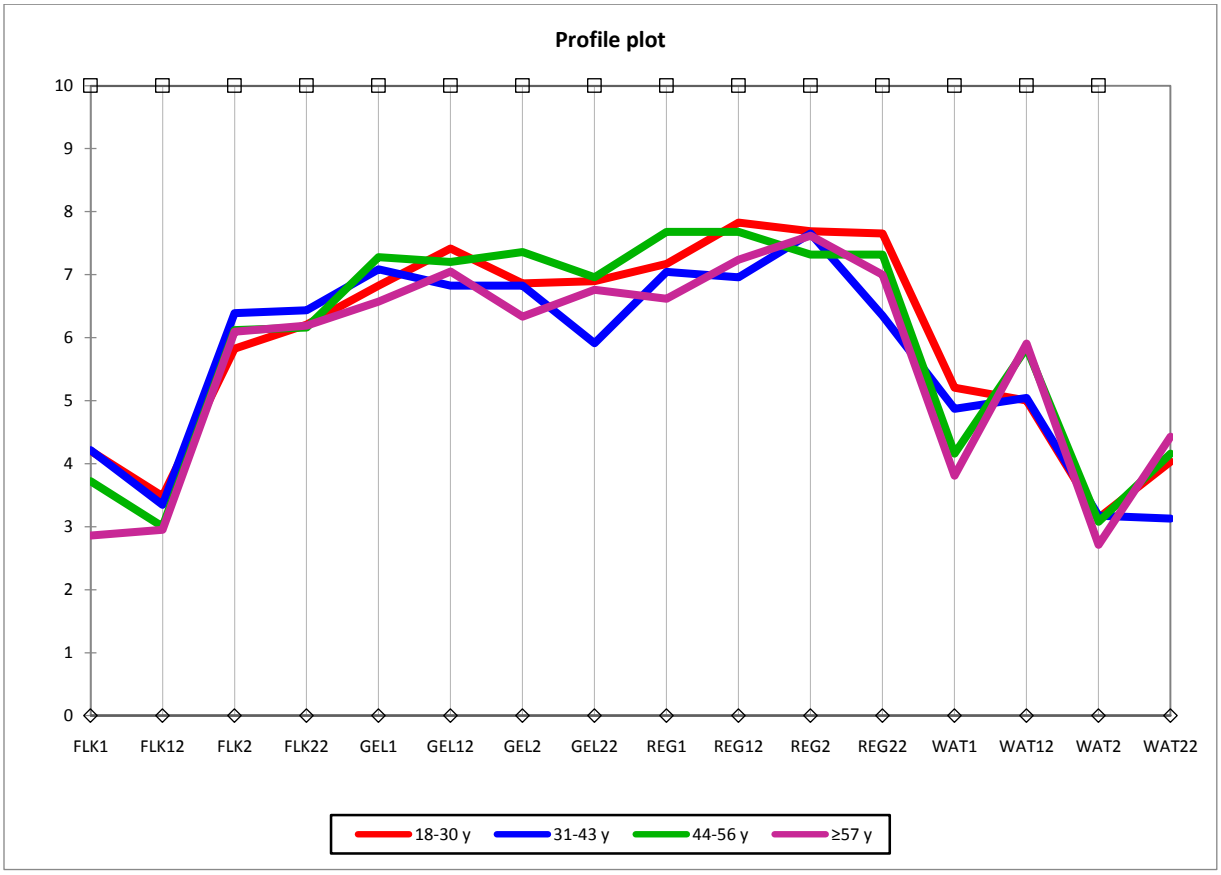

Figure 4-1 Age Groups Profile

Overall Liking and interest in buying

The correlation coefficient between consumers' overall liking and interest in buying was 0.939. This suggested that consumers' overall acceptability remained the same even if a question was asked differently. If later another nail polish study would be done, researcher may choose to ask either the overall liking or consumers' interest in buying question.

Caveats and future studies

Some cautions need to be taken when apply the results from this study. All the consumers chosen were from Manhattan, KS area. Studies in other categories need to be done if the results

needed to be applied to a broader population. Health is not major factor in purchasing a nail polish, but it may be something consumers will value more in the future.

Conclusions

Among all the factors that may affect consumers' decision to buy a nail polish, sensory appeal, price and convenience of usage are the factors valued most by consumers. Brand related factors, time or occasion, health and recommendations were not as important factors. When a nail polish company develops, advertises or markets a nail polish, the sensory qualities, price and convenience of usage should be major aspects they need to focus on.

Age could also affect consumers' decisions on buying. Younger consumers seemed to be willing to try different products. They would like to use different products according to different seasons. Price is valued more among younger consumers than elder consumers.

Home-use is a more common way for consumers to use nail polish. This suggested there could be a potential bigger market in the home-use nail polish market. For home-use nail polish consumers, convenience of nail polish contributes to their decisions to buy a nail polish. For example, a long-lasting product but without the need of curing might be welcomed by consumers. Nail polish accessories are also important in nail polish product industry.

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Chapter 5 - Conclusions and Future Research

Appearance and texture could be the major factors that may drive consumers' overall liking. Aroma seemed not to be a major factor that affects consumers' overall liking. This suggested that, to achieve a relatively higher consumers' overall acceptability, a nail polish company may focus on the innovation and research on the appearance of nail polish, rather than the aroma of a nail polish.

"Brightness" group attributes drive consumers' overall acceptability positively, whereas "dimness" and "flakeness" group attributes drive consumers' overall acceptability negatively. This suggested that a nail polish company can focus on improving or minimizing the effects of these sensory attributes in a certain domain with the help of descriptive panel, to achieve a higher consumers' overall acceptability.

Cluster analysis showed potential consumers' segments according to their acceptability of nail polish. A nail polish company can advertise a product using different strategies according to the acceptability in that specific consumer segment.

Among all the factors that may affect consumers' decision to buy a nail polish, sensory appeal, price and convenience of usage are the factors valued most by consumers. Brand related factors, time or occasion, health and recommendations were not as important as previous factors. When a nail polish company develops, advertises or markets a nail polish, the sensory qualities, price and convenience of usage should be major aspects they need to focus on.

Age could also affect consumers' decisions on buying. Younger consumers seemed to be willing to try different products. They would like to use different products according to different seasons. Price is valued more among younger consumers than elder consumers.

Home-use is a more common way for consumers to apply their nail polish. This suggested there could be a potential bigger market in the home-use nail polish market. For home-use nail polish consumers, convenience of nail polish contributes to their decisions to buy a nail polish. For example, a long-lasting product but without the need of curing might be welcomed by consumers. Nail polish necessaries are also important in nail polish product industry.

Appendix A - Materials, Equipment and Procedures for Masking Nail polish Samples

Materials

- White tape (wrapping the cap), white wide tape (wrapping the cup)
- Plaster, container for mixing (plastic cup), cold water, stirrer, cardboard
- measuring cup (1/2 cup, ¼ cup)
- Compass pencil, cutting board (wood or waterever), art knife, and cardboard knife, and ruler.
- 5.5oz plastic cup, lid for plastic cups,
- Peanut Styrofoam/ Shredded paper
- Superglue for gluing lid
- Cold water for reducing the temperature

Equipment

- Gloves
- Mask
- Goggles
- Work outside

Procedures

1. Wrap the cap of the bottle using either Styrofoam sheet or white tape.
2. Cut cardboard into pieces.
3. Cut the cap for nail polish
4. Put in the card box pieces

5. Make plaster and pour it in. Let it dry.

- Use measuring cup (1/2 cup plaster+1/4 cup water)
- Pour

5. Fill in with Styrofoam peanut

6. Use nail glue and adhere the cap

Appendix B - Procedures for Preparing Nail Polish for Observation Section

1. Check sampling plan if the nail needs a base coat, top coat and lamp dryer.
2. Take nail polish bottle, turn on side, turn 1 time per second for 20 seconds or 20 times.
3. If there is a base coat needed, select the base coat that has the same code as the sample – pay attention not to select a top coat. The base coat should be applied before the nail polish, and the top coat should be applied on the top of the nail polish after the nail polish dries.
    - Start from the middle, and then stroke the left and the right side of the nail.
    - You should decide the amount of the polish you use in each stroke. The amount should be enough to cover the whole nail in three strokes.
    - If there are some parts not covered by the polish, you can use some more to cover the uncovered parts.
4. For some nail polish, curing is needed – see sampling plan. Use UV or LED lamp as directed after applying base coat.
5. Apply first coat of nail polish on the nails in 3 strokes as described above. Before you do the second coat, wait 5 minutes (in the hood) till the polish dries.
6. Apply second coat of nail polish on the nails, the same way as described above. Wait 5 min before applying top coat (if necessary).
7. Apply top coat if needed.
8. Use sealer as needed

Appendix C - Screener

SCHEDULED SESSION TIME: _____

1. **Please indicate your gender:** Male Female

   Disqualify

2. **Which of the following best describes your age?**

   Younger than 18 18-30 31-43 44-57 over 57

   Disqualify

3. **How often do you apply nail polish ON AVERAGE?**

   Once a week or more

   Once every two weeks

   Once every three weeks

   Once a month

   Once every two months

   Once every three month

   Less than one every three months Disqualify

   Rarely Never Disqualify

4. **Which set of nails do you usually apply nail polish to?**

   Finger nails only

   Toe nails only Disqualify

   Both finger and toe nails

You have QUALIFIED for a nail polish study that we are conducting on **November 19th, 20th and 21st**. You only need to come on one of those three days.

You will evaluate several nail polish samples on artificial nails, NOT on your own nails. The study will last approximately 1 hour and will be held on K-State Manhattan Campus. $25compensation for your participation will be provided.

Would you be interested in participating in this study?

YES NO

Disqualify

We will contact you to confirm the time you are scheduled.

As a participant, you must comply with the following rules of the center:

- Bring a photo id.
- Do not chew gum, drink coffee or smoke within 30 minutes of the study
- Do not wear any fragrances on the day of testing (perfume, cologne, body spray, and etc.).
- Please arrive at the Center at least 10 minutes earlier than your scheduled session for check-in purposes.
- If you use glasses for reading, please bring them to the session as you will be reading a questionnaire.
- You will be asked for your Social Security Number in order to receive compensation, but you don't have to bring your Social Security Card as long as you can remember the number.
- Please note that there is no childcare available at the center.

Do you understand these guidelines? Do you have any questions?

Failure to comply could result in your being disqualified for the study. We are looking forward to seeing you at Justin Hall, Manhattan. The room number will be told when you are being scheduled. On the testing day, there will be signs to guide you in Justin Hall. If you have problems finding the facilities or are unable to attend, please call us at (785) 532-0166.

We will send you a reminder email 24 hours before your first session. The email will include your schedule time and location info.

If you have any other female family members or friends, please feel free to forward the email to them:)

Appendix D - Calling Instructions

-Hi. This is __(YOUR NAME)__ from K-State Sensory Analysis Center. You have qualified for our Nail Polish study next week. I'm calling to schedule you for a one-hour session.

-Based on the screener you filled out, we want to schedule you at (Chen: **See the spread sheet, the number of consumers should be relatively equal in each session**). Would that work for you? (Chen: the consumer only need to choose one session, and it's a 1 hour session)

-The room number is_____ (Chen: see table below)

-mark the time they prefer on the schedule spreadsheet. (Chen: remember to save when you are using excel)

DAY, DATE	MORNING	Room	AFTERNOON	
Tuesday, 11/19	8:30 am, 10:30am	115	3:30,5:00pm	146
Wednesday, 11/20	8:30 am, 10:30am	128	12:00, 1:30, 3:30,5:00pm	128
Thursday, 11/21	8:30 am, 10:30am	128	12:00, 1:30 pm	128

Have you ever done a study for us before? (Chen: The only difference below is the wording. Both answers should go through the rules below**)**

YES

Okay, then I'll quickly go over reminders

- We'll send you the **reminder email 24 hrs before** your session.

- The email will contain location and phone number information in case you need to contact us

NO, this is the first time.

Okay, I just need to go over a few things with you

- We'll send you the **reminder email 24 hrs before** your session.

- The email will contain location and phone number information in case you need to contact us

- The study will be on the Kansas State, Manhattan Campus in **Justin Hall**. Signs will guide you on the test day.
- Please arrive 10 MINUTES EARLY; Bring a PHOTO ID; and be prepared to tell us your SSN in order to receive compensation. Bring glasses if you need.

- Do not chew gum, drink coffee or smoke within 30 minutes of the study

- DON'T WEAR ANY PERFUME (woman) or any type of fragrance (Chen: If they ask if they should take off their own nail polish, and then you would say there is no need to do that)

-You won't apply nail polish on your own nails. Artificial nails will be provided.

- Be sure to watch for our email AND we'll see you at (___) next (Tuesday/WednesdayThursday)

- Please call and let us if you are running late or if you have to cancel on the day of the study. Phone to call: 785 532 0166 (also in the reminder email) **Thankyou!**

Appendix E - Consent Form

Sensory Analysis Center

Kansas State University, Justin Hall 139, Manhattan, KS 66506

1. I agree to participate as a panelist in research conducted by the Sensory Analysis Center at Kansas State University.

2.I understand that the purpose of this project is to participate in a consumer test evaluating nail polish samples.

3. I understand that if I have allergies to any product similar to those in a study I should not participate in the study.

4. For this test, I will receive $25 when I complete this 1 hour study.

5. I understand my performance as an individual will be treated as research data and will in no way be associated with me for other than identification purposes, thereby assuring confidentiality of performance and responses.

6. I understand that I do not have to participate in this research, and may choose not to participate without penalty.

7. I understand that I may withdraw from the research at any time.

8. If I have any questions concerning this study, I understand that I may contact Dr. Koushik Adhikari, Justin 143E, at 785-532-5160.

9. If I have any questions about my rights as a consumer or about the manner in which this research was conducted, I may contact Dr Rick Scheidt, Chair, Committee on Research Involving Human Subjects, or Dr. Gerald Jaax, Associate Vice-provost for Research, 1 Fairchild Hall (785-532-2334)

By signing my name in the space below, I am providing my signature and acknowledging that I understand the above statements.

_____

Appendix F - Moderator Guide

General Instruction

1. Hello. My name is_____. On behalf of the Sensory Analysis Center, I would like to thank you for your participation in this study.
2. Please read the informed consent form carefully and then stop.
3. The session will last approximately 1 hour.
4. Please raise your hand when you have finished your sample and we will bring you the next sample.
5. There are several things you need to remember as you participate today.

- Please silence your cell phones.
- There is no right or wrong answers to any of the questions. Be honest in answering the questions.
- Take your time considering each sample - your input is very important to us.
- If you have any questions during the session, please raise your hand.
- The results of this study are confidential. Please do not discuss what you have tested with anyone outside this room.

Instruction for this study I (mainly application)

1. There will be three sections of the test today: Application, observation and general questions.
2. We may wait a little bit after the first section, application section, for further instructions for next section.
3. There are 8 samples for each section, and there are 2 colors of nail polish in this study today (pink and red)
4. Please focus on the nail polish itself.
5. Please double check if the 3 digit code on the sample served matches the one in your ballot before you begin.
6. Do not apply nail polish on your own nails. Please be careful with samples you apply to artificial nails as they will be wet and we do not want you to damage any of your clothing, etc.
7. You will put nail polish on the artificial nail wheel. Clockwise beginning @ nail 1 to nail 8. (Demonstration)
8. Each sample should be applied on ONLY one artificial nail on the nail wheel provided to you.
9. We have limited sample sets. So, you may wait a little bit when you finish a sample.
10. There will be a short break after each sample, during which we would like you to use the wash towel to clean aroma.
11. When you smell, please use the wafting technique (demonstration)
12. Between each sample, we will cut off the used artificial nail because the nail polish is still wet.
13. Don't take off the lid of the cup. Please only open the cap of the nail polish. (Demonstration)
14. Please put on the cap after you use each nail polish sample.

Any question?

Instruction for this study II observation

In this section, you will be evaluating 8 samples that have already been prepared for you. There were prepared as instructed by manufacturer.

All the nails on one wheel will be given to you at one time.

Double check if the 3 digit code on the cup matches the one in your ballot.

Please only observe the nail polish sample without touching, because we will use that for other sessions. Please hold the paper part of the sample, and do not bend any nails.

Any question?

Appendix G - Questionnaire

Please write down in your panelist number (The number is on the paper that was given to you when you checked in) and your name.

Panelist number_____ (Important)

Name_____

Date_____

Please wait for instructions to start this ballot.

Section 1. Sample related questions I

Instructions

- Please double check if the 3-digit code on sample matches the one in this ballot.
- Each sample should be applied on ONLY ONE artificial nail on the nail wheel provided to you.
- The number (1-8) on your nail wheel indicates the serving order of samples.
- When you are finished with a sample, please raise your hand to ask your next sample.

Assume that you are considering buying a nail polish product, and you are trying it on.

Please write down the Sample code

#Sample Code_____(important)

Please take a sniff of the nail polish sample, but don't put your nose close to the bottle. Use the WAFTING TECHNIQUE shown in the picture below.

1. Please rate how much you LIKE or DISLIKE the **aroma (scent)** of the nail polish sample

☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐

Dislike Extremely	Neither Like nor Dislike	Like Extremely

Please apply the nail polish as you usually do on the nail wheel provided, and then answer the following questions.

2. Please rate the **ease of application** of this nail polish sample.

☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐

Extremely hard | Neither hard nor easy | Extremely easy

3. How much do you LIKE or DISLIKE the **appearance** of this nail polish sample?

☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐

Dislike Extremely | Neither Like nor Dislike | Like Extremely

4. **OVERALL**, how much do you LIKE or DISLIKE this nail polish sample?

☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐

Dislike Extremely | Neither Like nor Dislike | Like Extremely

5. Please rate your immediate reaction in terms of attraction (positive) or aversion (negative) to this nail polish sample.

☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐

Extremely negative | Neither negative nor positive | Extremely positive

<u>Stop! Please take a sniff of the warm cloth provided to help refresh your nose, and take a 45 seconds break before going ahead to the next sample.</u>

Please write down the Sample code

#Sample Code_____(important)

Please take a sniff of the nail polish sample, but don't put your nose close to the bottle. Use the WAFTING TECHNIQUE shown in the picture below.

1. Please rate how much you <u>LIKE or DISLIKE</u> the **aroma (scent)** of the nail polish sample

☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐

Dislike Extremely	Neither Like nor Dislike	Like Extremely

Please apply the nail polish as you usually do on the nail wheel provided, and then answer the following questions.

2. Please rate the **ease of application** of this nail polish sample.

☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐

Extremely hard	Neither hard nor easy	Extremely easy

3. How much do you LIKE or DISLIKE the **appearance** of this nail polish sample?

☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐

Dislike Extremely	Neither Like nor Dislike	Like Extremely

4. **OVERALL**, how much do you LIKE or DISLIKE this nail polish sample?

☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐

Dislike Extremely	Neither Like nor Dislike	Like Extremely

5. Please rate your immediate reaction in terms of attraction (positive) or aversion (negative) to this nail polish sample.

☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐

Extremely negative	Neither negative nor positive	Extremely positive

Stop! Please take a sniff of the warm cloth provided to help refresh your nose, and take a 45 sections break before going ahead to the next sample.

Please write down the Sample code

#Sample Code_____(important)

Please take a sniff of the nail polish sample, but don't put your nose close to the bottle. Use the WAFTING TECHNIQUE shown in the picture below.

1. Please rate how much you LIKE or DISLIKE the **aroma (scent)** of the nail polish sample

☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐

Dislike Extremely	Neither Like nor Dislike	Like Extremely

Please apply the nail polish as you usually do on the nail wheel provided, and then answer the following questions.

2. Please rate the **ease of application** of this nail polish sample.

☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐

Extremely hard	Neither hard nor easy	Extremely easy

3. How much do you LIKE or DISLIKE the **appearance** of this nail polish sample?

☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐

Dislike Extremely | Neither Like nor Dislike | Like Extremely

4. **OVERALL**, how much do you LIKE or DISLIKE this nail polish sample?

☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐

Dislike Extremely | Neither Like nor Dislike | Like Extremely

5. Please rate your immediate reaction in terms of attraction (positive) or aversion (negative) to this nail polish sample.

☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐

Extremely negative | Neither negative nor positive | Extremely positive

Stop! Please take a sniff of the warm cloth provided to help refresh your nose, and take a 45 sections break before going ahead to the next sample.

Please write down the Sample code

#Sample Code_____(important)

Please take a sniff of the nail polish sample, but don't put your nose close to the bottle. Use the WAFTING TECHNIQUE shown in the picture below.

1. Please rate how much you LIKE or DISLIKE the **aroma (scent)** of the nail polish sample

☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐

Dislike Extremely	Neither Like nor Dislike	Like Extremely

Please apply the nail polish as you usually do on the nail wheel provided, and then answer the following questions.

2. Please rate the **ease of application** of this nail polish sample.

☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐

Extremely hard	Neither hard nor easy	Extremely easy

3. How much do you LIKE or DISLIKE the **appearance** of this nail polish sample?

☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐

Dislike Extremely | Neither Like nor Dislike | Like Extremely

4. **OVERALL**, how much do you LIKE or DISLIKE this nail polish sample?

☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐

Dislike Extremely | Neither Like nor Dislike | Like Extremely

5. Please rate your immediate reaction in terms of attraction (positive) or aversion (negative) to this nail polish sample.

☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐

Extremely negative | Neither negative nor positive | Extremely positive

Stop! Please take a sniff of the warm cloth provided to help refresh your nose, and take a 45 sections break before going ahead to the next sample.

Please write down the Sample code

#Sample Code_____(important)

Please take a sniff of the nail polish sample, but don't put your nose close to the bottle. Use the WAFTING TECHNIQUE shown in the picture below.

1. Please rate how much you LIKE or DISLIKE the **aroma (scent)** of the nail polish sample

☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐

Dislike Extremely	Neither Like nor Dislike	Like Extremely

Please apply the nail polish as you usually do on the nail wheel provided, and then answer the following questions.

2. Please rate the **ease of application** of this nail polish sample.

☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐

Extremely hard	Neither hard nor easy	Extremely easy

3. How much do you LIKE or DISLIKE the **appearance** of this nail polish sample?

☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐

Dislike Extremely	Neither Like nor Dislike	Like Extremely

4. **OVERALL**, how much do you LIKE or DISLIKE this nail polish sample?

☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐

Dislike Extremely	Neither Like nor Dislike	Like Extremely

5. Please rate your immediate reaction in terms of attraction (positive) or aversion (negative) to this nail polish sample.

☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐

Extremely negative	Neither negative nor positive	Extremely positive

Stop! Please take a sniff of the warm cloth provided to help refresh your nose, and take a 45 sections break before going ahead to the next sample.

Please write down the Sample code

#Sample Code_____(important)

Please take a sniff of the nail polish sample, but don't put your nose close to the bottle. Use the WAFTING TECHNIQUE shown in the picture below.

1. Please rate how much you LIKE or DISLIKE the **aroma (scent)** of the nail polish sample

☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐

Dislike Extremely	Neither Like nor Dislike	Like Extremely

Please apply the nail polish as you usually do on the nail wheel provided, and then answer the following questions.

2. Please rate the **ease of application** of this nail polish sample.

☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐

Extremely hard	Neither hard nor easy	Extremely easy

3. How much do you LIKE or DISLIKE the **appearance** of this nail polish sample?

☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐

Dislike Extremely	Neither Like nor Dislike	Like Extremely

4. **OVERALL**, how much do you LIKE or DISLIKE this nail polish sample?

☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐

Dislike Extremely	Neither Like nor Dislike	Like Extremely

5. Please rate your immediate reaction in terms of attraction (positive) or aversion (negative) to this nail polish sample.

☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐

Extremely negative	Neither negative nor positive	Extremely positive

Stop! Please take a sniff of the warm cloth provided to help refresh your nose, and take a 45 sections break before going ahead to the next sample.

Please write down the Sample code

#Sample Code_____(important)

Please take a sniff of the nail polish sample, but don't put your nose close to the bottle. Use the WAFTING TECHNIQUE shown in the picture below.

1. Please rate how much you LIKE or DISLIKE the **aroma (scent)** of the nail polish sample

☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐

Dislike Extremely	Neither Like nor Dislike	Like Extremely

Please apply the nail polish as you usually do on the nail wheel provided, and then answer the following questions.

2. Please rate the **ease of application** of this nail polish sample.

☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐

Extremely hard	Neither hard nor easy	Extremely easy

3. How much do you LIKE or DISLIKE the **appearance** of this nail polish sample?

☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐

Dislike Extremely	Neither Like nor Dislike	Like Extremely

4. **OVERALL**, how much do you LIKE or DISLIKE this nail polish sample?

☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐

Dislike Extremely	Neither Like nor Dislike	Like Extremely

5. Please rate your immediate reaction in terms of attraction (positive) or aversion (negative) to this nail polish sample.

☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐

Extremely negative	Neither negative nor positive	Extremely positive

Stop! Please take a sniff of the warm cloth provided to help refresh your nose, and take a 45 sections break before going ahead to the next sample.

Please write down the Sample code

#Sample Code_____(important)

Please take a sniff of the nail polish sample, but don't put your nose close to the bottle. Use the WAFTING TECHNIQUE shown in the picture below.

1. Please rate how much you LIKE or DISLIKE the **aroma (scent)** of the nail polish sample

☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐

Dislike Extremely	Neither Like nor Dislike	Like Extremely

Please apply the nail polish as you usually do on the nail wheel provided, and then answer the following questions.

2. Please rate the **ease of application** of this nail polish sample.

☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐

Extremely hard	Neither hard nor easy	Extremely easy

3. How much do you LIKE or DISLIKE the **appearance** of this nail polish sample?

☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐

Dislike Extremely	Neither Like nor Dislike	Like Extremely

4. **OVERALL**, how much do you LIKE or DISLIKE this nail polish sample?

☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐

Dislike Extremely	Neither Like nor Dislike	Like Extremely

5. Please rate your immediate reaction in terms of attraction (positive) or aversion (negative) to this nail polish sample.

☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐

Extremely negative	Neither negative nor positive	Extremely positive

You have finished your first section.

Please stop and wait for instructions for next section

Section 2. Sample related questions II

Instruction:

- In this section, you will be evaluating 8 samples. All the 8 samples will be presented simultaneously on a nail wheel.
- Please make sure the 3-digit code on the wheel matches the one on this ballot.
- The following questions should be answered based ONLY on your experience of reviewing the products presented in this section.

Please write down the sample code.

#Sample Code_____(important)

1. OVERALL, how much do you LIKE or DISLIKE this nail polish sample?

☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐

Dislike extremely	Neither like nor dislike	Like extremely

2. Please rate how interested you are in using this nail polish sample.

☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐

Extremely Disinterested	Neither disinterested nor interested	Extremely interested

Please write down the sample code.

#Sample Code_____(important)

1. OVERALL, how much do you LIKE or DISLIKE this nail polish sample?

☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐

Dislike extremely	Neither like nor dislike	Like extremely

2. Please rate how interested you are in using this nail polish sample.

☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐

Extremely Disinterested	Neither disinterested nor interested	Extremely interested

Please write down the sample code.

#Sample Code_____(important)

1. OVERALL, how much do you LIKE or DISLIKE this nail polish sample?

☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐

Dislike extremely	Neither like nor dislike	Like extremely

2. Please rate how interested you are in using this nail polish sample.

☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐

Extremely Disinterested | Neither disinterested nor interested | Extremely interested

Please write down the sample code.
#Sample Code_____(important)

1. OVERALL, how much do you LIKE or DISLIKE this nail polish sample?

☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐

Dislike extremely | Neither like nor dislike | Like extremely

2. Please rate how interested you are in using this nail polish sample.

☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐

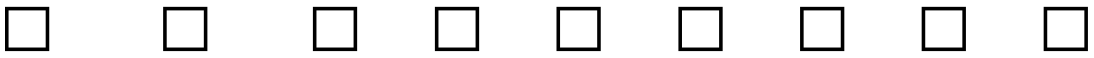
Extremely Disinterested | Neither disinterested nor interested | Extremely interested

Please write down the sample code.
#Sample Code_____(important)

1. OVERALL, how much do you LIKE or DISLIKE this nail polish sample?

Dislike extremely	Neither like nor dislike	Like extremely

2. Please rate how interested you are in using this nail polish sample.



Extremely Disinterested	Neither disinterested nor interested	Extremely interested

Please write down the sample code.
#Sample Code_____(important)

1. OVERALL, how much do you LIKE or DISLIKE this nail polish sample?

Dislike extremely	Neither like nor dislike	Like extremely

2. Please rate how interested you are in using this nail polish sample.

☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐

Extremely Disinterested | Neither disinterested nor interested | Extremely interested

Please write down the sample code.

#Sample Code_____(important)

1. OVERALL, how much do you LIKE or DISLIKE this nail polish sample?

☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐

Dislike extremely | Neither like nor dislike | Like extremely

2. Please rate how interested you are in using this nail polish sample.

☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐

Extremely Disinterested | Neither disinterested nor interested | Extremely interested

Please write down the sample code.

#Sample Code_____(important)

1. OVERALL, how much do you LIKE or DISLIKE this nail polish sample?

☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐

Dislike extremely	Neither like nor dislike	Like extremely

2. Please rate how interested you are in using this nail polish sample.

☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐

Extremely Disinterested	Neither disinterested nor interested	Extremely interested

Section 3. General Questions

Instruction:
All the questions in this section should be answered ONLY based on your experience of applying nail polish on your <u>FINGER NAILS</u> (not toe nails).

Please circle the option you choose.

1. Approximately how often do you apply nail polish?

- At least once a week
- Once every two weeks
- Once every three weeks
- Once a month
- Once every two months
- Once every three month

2.a. Who usually applies your nail polish: yourself, a professional at a nail salon, or both?

- Self-application only
- Professional application only
- Both self and professional application

2.b. If you chose "Professional application only" or "Both self and professional application" in 2a question, Approximately how often do you go to a nail salon? If you chose "by yourself" in 2a question, please skip this question and go directly to question 3.

- At least once a week
- Once every two weeks
- Once every three weeks
- Once a month
- Less than once a month

2.c. If you chose "Professional application only" or "Both self and professional application" in 2a question, do you go to a nail salon for purposes other than application of nail polish? If you chose "by yourself" in 2a question, please skip this question and go directly to question 3.

- Yes
- No

3. Where do you usually purchase a nail polish? Please circle all that apply.

- Department store (JCPenny, Sears, etc.)
- Online
- Nail salon-only use nail polish, without buying an extra bottle
- Nail salon-Either use nail polish or not, and buy additional nail polish
- Discount store (Target, Walmart, etc.)
- Drug store (Walgreens, CVS Pharmacy, etc.)
- Beauty supply store (Sally Beauty Supply, etc.)

4. How often do you use a base coat when you apply nail polish?

- Always or almost always
- Often, but not always
- Occasionally, but not often
- Rarely or never

5. How often do you use a top coat when you apply nail polish?

- Always or almost always
- Often, but not always
- Occasionally, but not often
- Rarely or never

6. Please choose categories of nail polish you USUALLY use. **Please circle all that apply.**

- Gel/Shellac nail polish
- Long lasting nail polish
- Fast day nail polish
- Water-based/natural/non-toxic nail polish
- Nail Polish with flakes/glitter
- Other. Please specify_____

7. Please check 5 most important features/factors you usually consider when deciding to buy a nail polish.

- ☐ Thickness of nail polish
- ☐ Aroma(scent)
- ☐ Color
- ☐ Drying Speed
- ☐ Health Concern (components in a nail polish)
- ☐ Price
- ☐ Effort required to maintain
- ☐ Season (Spring, Summer, etc)
- ☐ Whether the nail polish requires additional supplies for application
- ☐ Recommendations from friends or family members
- ☐ Time (morning, afternoon, etc.)
- ☐ Reviews from online resources
- ☐ Ease of application
- ☐ Evenness of coverage
- ☐ Long-lasting
- ☐ Ease of removal
- ☐ Special occasion to wear a nail polish
- ☐ Brand
- ☐ Shininess
- ☐ Package
- ☐ Bottle Shape
- ☐ Applicator
- ☐ Whether the nail polish contain flakes (glitter)
- ☐ Smoothness of nail polish appearance

8. Which of the following best describes your age?

- Under 18
- 18-30
- 31-43
- 44-56
- 57 and over

Thank you for completing this test!

Please submit your answers and return to the check-in table to sign out before you leave.

Appendix H - Test Design-Application

Row	Sample 1	Sample 2	Sample 3	Sample 4	Sample 5	Sample 6	Sample 7	Sample 8
Consumer 1	775	359	237	208	426	118	135	563
Consumer 2	118	775	208	135	237	563	426	359
Consumer 3	208	237	563	359	118	135	775	426
Consumer 4	563	118	135	426	208	359	237	775
Consumer 5	237	426	118	563	775	208	359	135
Consumer 6	135	208	359	775	563	426	118	237
Consumer 7	359	563	426	237	135	775	208	118
Consumer 8	426	135	775	118	359	237	563	208
Consumer 9	775	208	237	563	118	135	359	426
Consumer 10	426	118	563	237	208	359	135	775
Consumer 11	563	359	775	426	135	208	118	237
Consumer 12	208	237	135	359	563	426	775	118
Consumer 13	135	426	118	208	775	563	237	359
Consumer 14	237	135	426	775	359	118	208	563
Consumer 15	359	775	208	118	426	237	563	135
Consumer 16	118	563	359	135	237	775	426	208
Consumer 17	426	135	359	563	775	237	118	208
Consumer 18	118	359	237	426	563	208	775	135
Consumer 19	237	118	775	359	135	563	208	426
Consumer 20	563	208	135	775	118	359	426	237
Consumer 21	775	237	208	118	426	135	563	359
Consumer 22	208	775	563	237	359	426	135	118
Consumer 23	359	426	118	135	208	775	237	563
Consumer 24	135	563	426	208	237	118	359	775
Consumer 25	563	118	426	359	237	135	208	775
Consumer 26	426	775	359	135	563	118	237	208
Consumer 27	208	359	237	563	775	426	118	135
Consumer 28	775	426	208	237	118	563	135	359
Consumer 29	135	237	118	775	359	208	426	563
Consumer 30	118	563	775	208	135	237	359	426
Consumer 31	237	135	563	426	208	359	775	118
Consumer 32	359	208	135	118	426	775	563	237
Consumer 33	426	237	118	359	135	208	563	775
Consumer 34	208	135	563	118	359	775	426	237
Consumer 35	118	208	135	237	775	563	359	426
Consumer 36	237	118	208	426	563	135	775	359

Consumer 37	775	359	426	563	118	237	208	135
Consumer 38	563	775	359	135	237	426	118	208
Consumer 39	359	426	237	775	208	118	135	563
Consumer 40	135	563	775	208	426	359	237	118
Consumer 41	426	135	118	359	775	563	237	208
Consumer 42	237	426	135	775	563	208	359	118
Consumer 43	118	208	563	426	237	359	135	775
Consumer 44	563	775	359	118	135	426	208	237
Consumer 45	775	359	237	208	118	135	563	426
Consumer 46	359	237	426	563	208	118	775	135
Consumer 47	135	118	208	237	359	775	426	563
Consumer 48	208	563	775	135	426	237	118	359
Consumer 49	775	237	118	426	208	135	359	563
Consumer 50	237	359	563	135	775	208	118	426
Consumer 51	208	775	359	563	135	426	237	118
Consumer 52	426	135	775	359	563	118	208	237
Consumer 53	359	118	426	208	237	775	563	135
Consumer 54	563	426	208	237	118	359	135	775
Consumer 55	135	208	237	118	426	563	775	359
Consumer 56	118	563	135	775	359	237	426	208
Consumer 57	426	118	208	775	135	237	563	359
Consumer 58	359	563	775	208	237	135	118	426
Consumer 59	135	359	563	118	775	208	426	237
Consumer 60	118	208	135	237	359	426	775	563
Consumer 61	237	426	118	563	208	775	359	135
Consumer 62	563	775	237	135	426	359	208	118
Consumer 63	775	237	426	359	118	563	135	208
Consumer 64	208	135	359	426	563	118	237	775
Consumer 65	775	118	237	208	359	426	135	563
Consumer 66	563	359	426	135	237	775	118	208
Consumer 67	426	135	359	563	118	237	208	775
Consumer 68	208	237	775	118	426	563	359	135
Consumer 69	118	775	208	237	563	135	426	359
Consumer 70	359	563	135	426	208	118	775	237
Consumer 71	237	208	118	775	135	359	563	426
Consumer 72	135	426	563	359	775	208	237	118
Consumer 73	359	208	135	426	775	118	237	563
Consumer 74	135	426	237	563	208	359	118	775
Consumer 75	563	135	775	237	359	426	208	118
Consumer 76	237	563	118	775	426	135	359	208

Consumer 77	775	237	208	118	135	563	426	359
Consumer 78	426	359	563	135	118	208	775	237
Consumer 79	118	775	359	208	563	237	135	426
Consumer 80	208	118	426	359	237	775	563	135
Consumer 81	563	359	237	118	135	775	426	208
Consumer 82	135	208	426	563	359	118	775	237
Consumer 83	208	426	118	359	237	135	563	775
Consumer 84	775	563	359	426	118	237	208	135
Consumer 85	426	118	135	237	775	208	359	563
Consumer 86	359	237	775	135	208	563	118	426
Consumer 87	237	775	563	208	426	359	135	118
Consumer 88	118	135	208	775	563	426	237	359
Consumer 89	118	237	563	426	208	775	135	359
Consumer 90	563	426	359	208	118	237	775	135
Consumer 91	135	118	775	563	359	208	426	237
Consumer 92	775	563	237	359	135	118	208	426
Consumer 93	237	359	426	135	775	563	118	208
Consumer 94	208	775	118	237	426	135	359	563
Consumer 95	359	208	135	118	563	426	237	775
Consumer 96	426	135	208	775	237	359	563	118
Consumer 97	208	563	775	426	135	359	118	237
Consumer 98	237	118	208	563	775	426	359	135
Consumer 99	118	208	563	775	426	135	237	359
Consumer 100	775	426	135	359	237	118	563	208
Consumer 101	135	359	237	118	208	563	426	775
Consumer 102	563	775	426	135	359	237	208	118
Consumer 103	426	135	359	237	118	208	775	563
Consumer 104	359	237	118	208	563	775	135	426
Consumer 105	208	118	563	426	359	237	775	135
Consumer 106	135	237	118	208	426	775	563	359
Consumer 107	118	135	208	563	775	359	426	237
Consumer 108	563	208	426	775	237	135	359	118
Consumer 109	359	775	237	135	208	563	118	426
Consumer 110	426	563	775	359	135	118	237	208
Consumer 111	237	359	135	118	563	426	208	775
Consumer 112	775	426	359	237	118	208	135	563
Consumer 113	237	208	775	426	118	563	359	135
Consumer 114	118	135	237	563	359	208	775	426
Consumer 115	359	426	118	208	775	135	237	563
Consumer 116	563	237	426	359	208	775	135	118

Consumer 117	775	563	359	135	237	426	118	208
Consumer 118	426	775	135	118	563	359	208	237
Consumer 119	208	118	563	775	135	237	426	359
Consumer 120	135	359	208	237	426	118	563	775

Appendix I - Test Design-Observation

	Sample 1	Sample 2	Sample 3	Sample 4	Sample 5	Sample 6	Sample 7	Sample 8
Consumer 1	903	643	458	841	685	260	790	987
Consumer 2	643	841	903	260	458	987	685	790
Consumer 3	841	260	643	987	903	790	458	685
Consumer 4	260	987	841	790	643	685	903	458
Consumer 5	987	790	260	685	841	458	643	903
Consumer 6	790	685	987	458	260	903	841	643
Consumer 7	685	458	790	903	987	643	260	841
Consumer 8	458	903	685	643	790	841	987	260
Consumer 9	643	841	903	260	458	987	685	790
Consumer 10	841	260	643	987	903	790	458	685
Consumer 11	260	987	841	790	643	685	903	458
Consumer 12	987	790	260	685	841	458	643	903
Consumer 13	790	685	987	458	260	903	841	643
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