CROSSMODAL CORRESPONDENCES BETWEEN THE SHAPES AND BRIGHTNESS OF CHINESE CHARACTERS AND TASTE PERCEPTION

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ABSTRACT

Past researchers have designed experiments to explore crossmodal correspondences between different tastes and sensory modalities including visual modalities (e.g., abstract shapes and colour) and non-visual modalities (e.g., speech sounds). Besides, previous research has documented that typefaces can convey meaning beyond their actual semantic on packaging. Hence, the aim of this study is to explore the corresponding relationships between the visual features of Chinese character typeface and the tastes perception. As a significant writing system, Chinese characters are logograms used in the writing of Chinese and some other Asian languages. It is not only the carrier of visual information but also of visual symbol. This study examines the influence of Chinese character design on taste impressions. In this study, Chinese typeface (Chinese Character) as visual symbol is primary research object. followed by its aesthetics, psychology and marketing and other related components. Here, the study designed to test how different typeface shapes (angular, rounded) and different typeface brightness (high brightness, low brightness) can convey different tastes information such as level of intensity and mildness. In other words, the research utilizes basic visual elements shape and brightness (colour) combination typeface to test the crossmodal correspondences between the shapes and brightness of Chinese character and taste perception. The hypotheses of this study are about Chinese character with angular shape and low brightness and Chinese character with rounded shape and high brightness. The findings supported the hypotheses in proving that will improve the quality of food packaging design in terms of guiding consumer perception about food product value.

ABSTRAK

Banyak penyelidik telah membuat eksperimen untuk meneroka crossmodal antara rasa yang berbeza dan modaliti deria termasuk modaliti visual (cth, bentuk abstrak, warna) dan modaliti bukan visual (contohnya, bunyi pertuturan). Selain itu, kajian sebelumnya telah didokumenkan bahawa tulisan-tulisan boleh menyampaikan makna yang melebihi semantik sebenar pada bungkusan. Oleh itu, tujuan kajian ini adalah untuk meneroka hubungan sama antara ciri-ciri visual tulisan-tulisan dan persepsi rasa itu. Sebagai sistem tulisan yang ketara, tulisan Cina logograms digunakan dalam penulisan Cina dan beberapa bahasa Asia yang lain. Ia bukan sahaja pembawa maklumat visual, tetapi juga memiliki simbol visual. Kajian ini mengkaji pengaruh reka bentuk watak Cina pada rasa gambaran. Dalam kajian ini, tulisan-tulisan Cina (tulisan Cina) sebagai simbol visual adalah objek penyelidikan utama. Pada masa yang sama, kajian ini juga melibatkan estetika, psikologi dan pemasaran dan lain-lain kajian pengetahuan yang berkaitan. Di sini, kajian ini direka untuk menguji bagaimana berbeza bentuk muka taip (sudut, bulat) dan kecerahan muka taip yang berbeza (tinggi kecerahan, kecerahan rendah) boleh menyampaikan maklumat cita rasa yang berbeza, seperti tahap intensiti dan kelembutan. Dalam erti kata lain, kajian ini menggunakan asas unsur-unsur visual bentuk dan kombinasi kecerahan (warna) muka taip untuk menguji menyurat crossmodal antara bentuk dan warna tulisan Cina dan rasa persepsi. Hipotesis kajian ini adalah tentang tulisan Cina dengan bentuk sudut dan kecerahan rendah dan tulisan Cina dengan bentuk bulat dan kecerahan yang tinggi. Penemuan ini akan meningkatkan kualiti makanan pembungkusan reka bentuk, dari segi membimbing persepsi pengguna mengenai nilai produk makanan.

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TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

CHAPTER 1: INTRODUCTION

1.1 Background

With the development of social economy, commodity market has become more and more prosperous as evident by varieties of products constantly introduced in the market. Today, such endless varieties of products have consequently exerted a strong influence on both the market and consumer lifestyle in varying manners. However, the ever-accelerated updating of commodity economy also inevitably has many problems. Owing to constantly emerging new products and even its new packaging, it caused a certain impact and interference on consumer choice. In particular, packaging is an extremely important factor. Admittedly, a challenging problem facing us is that what is good packaging and suitable for consumers' products. Under such a situation, careful research and exploration are strongly recommended for the problems of product and its packaging. For any consumer, it is not an exaggeration to say that food products occupy an indispensable position in all product types. With all these factors taken into consideration, food packaging is worth further exploring and researching.

1.1.1 Packaging and Packaging Design

Packaging or packaging design is a complex issue. On one hand, packaging plays an important role and studies on packaging have even referred to it as the "silent salesman" or "salesman on the shelf" (e.g. Wang & Chou, 2011, p. 1; Harith, Ting, & Zakaria, 2014, p. 849). Silayoi and Speece (2007) in an exploratory study found that as an important marketing communication tools, packaging elements such as visual elements and information elements can affect consumers and their purchase decision. Especially to deserve to be mentioned, some researchers have looked at how extrinsic cues could modulate taste or flavor experiences. According to related psychological and

neuroimaging studies, the perception of taste and flavor could be influenced via many extrinsic cues or the outside information of food itself such as price, brand, packaging design (Okamoto & Dan, 2013). Moreover, in certain previous research, packaging has several important functions in the supply chain (Rundh, 2005). Hence, it is a self-marketing tool. As a key role in product success, Simms and Trott (2010) in their packaging research also mentioned that "packaging is both pervasive and indispensable in modern society" (p. 398). There is no doubt that the function of packaging is very significant in a product. Packaging definitely paly a positive role, it keeps the consumer well-informed about the product needed in daily life.

On the other hand, there are numerous criticisms and development obstacles for the packaging and packaging design. In spite of its very important, "it is often viewed negatively and regarded as a necessary evil or an unnecessary cost" (Simms & Trott, 2010, p. 398). In addition, Rundh (2009) have demonstrated that packaging design was affected by a complex set of business environment factor including consumer influence, environmental influence, international influence, marketing influence (aspects), technology influence, logistic and distribution influence.

1.1.2 Consumer buying behavior and perceptions

In general, there is a mutual influence between packaging and consumer buying behavior. From previously marketing literatures, Baumgartner and Steenkamp (1996) have presented that consumers' exploratory buying behavior was influenced by sensory and cognitive stimulation. Furthermore, the visual stimuli of packaging affect "in-store buying decisions" (Clement, 2007, p. 917). According to a series of studies (e.g. Wang, 2013; Becker, van Rompay, Schifferstein, & Galetzka, 2011), the product packaging

through visual design could directly affect consumers' attitudes and perception for food product such as value, quality, brand preference, product price and taste evaluation. Hence, product packaging and consumer buying behavior are interactive and closely related. A study also claimed that consumers' buying decisions and choice will be influenced by the visual elements of packaging design such as pattern, shape, color, typography and so on (see Wang & Chou, 2011). Similarly, Spence and Ngo (2012) have suggested that the appropriate use of shape symbolism on food and beverage product packaging can be utilized to help establishment the correct sensory expectations in consumers' mind. Strictly speaking, packaging is indeed one of the important factors in consumer perception and purchase decisions, especially the visual impact of packaging; on the contrary, it can also be considered consumer perception and purchase decisions have an impact on the product (such as value, quality) and packaging (such as visual design).

1.1.3 Packaging attributes and visual elements

In view of the above analysis, no matter what food product or other kinds of product it is, there is no doubt that packaging is very significant and indispensable. In particular, the visual features of packaging play an influential role for consumer. As packaging appearance attributes or extrinsic cues, many research (e.g. Imram, 1999; Ampuero & Vila, 2006; Kauppinen-Räisänen, Owusu, & Abeeku Bamfo, 2012) stressed on the critical importance of "visual cues" in the product. From the study details, related visual studies of packaging are always around several major visual elements such as shape, colour, graphic, typeface and so on (e.g., Gofman, Moskowitz, & Mets, 2010; Wang, 2013). Moreover, a review of extant marketing literatures clearly indicated that single visual element and packaging appearance have close relation and influence,

4

namely color (see Kauppinen-Räisänen, & Luomala, 2010). Besides, graphic design is also an important part of packaging visual design as it uses a series of visual elements such as shape, color, typeface to convey product information to consumers. Graphic design has substantial impact on consumer response to packaged goods (Hamlin, 2016). Wang (2013) also suggested that food Company should pay attention to the visual factors of packaging design including colour, typeface, logo, graphics, and size, thereby affecting consumers' brand preference and positive perceptions. This study will thus examine color and shape elements as essential parts in product packaging design. There is no doubt that to some extent colour and shape also are influence factors.

1.1.4 Crossmodal Correspondences

In recent years, a growing research has demonstrated that sensory modalities such as visual sense, auditory sense and others have crossmodal correspondences (see Spence, 2011), while various studies have documented that particular tastes match with specific visual attributes such as shapes (e.g. Velasco, Woods, Deroy, & Spence, 2015; also see Velasco, Salgado-Montejo, Marmolejo-Ramos, & Spence, 2014), colours (e.g. Koch & Koch, 2003; Piqueras-Fiszman & Spence, 2011; Piqueras-Fiszman, Velasco, & Spence, 2012) and even typefaces (e.g., Velasco, Woods, Hyndman, & Spence, 2015; Velasco, Salgado-Montejo, Marmolejo-Ramos, & Spence, 2014). To a certain extent, these research that are about crossmodal correspondence can be seen as related to packaging research.

1.1.5 Background summary

In summary, the present research combined three visual attributes of packaging, which are shape, brightness and typeface, to explore the crossmodal correspondence relationships between the shapes and brightness of Chinese character and taste perception. This will help designers to use more appropriate Chinese typefaces in the food packaging (corresponding tastes), thereby conveying relatively accurate message and perception to consumers. As a result, food products would obtain positive results from evaluations and sales, among others.

1.2 Statement of Problem

While most previous research were limited to the fields of sensory modality crossmodal correspondences and packaging design, the present study intends to put forward the relevance and value of its practical application.

To start with, many studies indicated that the study of crossmodal correspondences between shape and brightness of typeface and taste perception is not comprehensive and profound, especially those involving Chinese characters. On the part of crossmodal correspondences, there is also no crossmodal correspondences study between the visual features of Chinese character and tastes. A few related literatures, researchers have indicated the crossmodal correspondences relationship between typeface and taste (see Velasco et al., 2014; Velasco, Woods, Hyndman & Spence, 2015). However, these typefaces are based on an English alphabetic system. It is clear that Chinese character and English alphabet belong to different writing system and cultures. Chinese Characters are based on a system of ideographs (Yang & McConkie, 1999). Thus,

researchers need to understand potential differences between ideographic and alphabetic writing.

In addition, packaging via extrinsic cues such as labels and packaging design, affect consumers' sensory and hedonic expectations on food product (Ares et al., 2011; Okamoto & Dan, 2013). According to above background analysis, typeface design (shape design) and taste have crossmodal correspondences relationship. Moreover, people consistently match variety of tastes with specific visual shapes and colours (Spence & Ngo, 2012). Actually, typeface played an important role in packaging. It is a major factor in defining the visual aspect of promotional materials (Celhay, Boysselle, & Cohen, 2015). However, cross-cultural difference factor as a huge issue still exists in this field and research has revealed its influence on the crossmodal correspondence between visual features and basic taste (see Wan et al., 2014). Wan et al., (2014) also presented that language has a certain influence in the matching task. In other words, different cultures bring different views about crossmodal correspondences between taste/flavors and visual features due to cross-cultural differences.

Based on the above related studies and analysis, research of typeface visual design is imperative, especially Chinese characters. Typeface shape-taste associations and typeface brightness-taste associations have important practical significance in food packaging. Due to the cultural differences in the writing system, the Chinese character different design should be distinguished from the English alphabetic typefaces. To put it simply, it belongs to a unique and new research in the field of crossmodal correspondences between visual features of typeface and tastes perception.

1.3 Research Objectives

1. To study the relationships between the shapes and brightness of Chinese characters and taste perception.

2. To investigate the crossmodal correspondences between Chinese characters shape-brightness congruency and taste perception

1.4 Research Question

The research in this study posits a central question and three sub-questions related to the title

Central Question. What types of Chinese characters shapes and brightness correspond to specific food taste and can better express appropriate food product to affect consumers buying behavior.

RQ1. What are the relationships between the shapes (angular, rounded) of Chinese characters and taste perception (intense, mild and sour, bitter, salty, sweet)?

RQ2. What are the relationships between the brightness (low brightness, middle brightness, high brightness) of Chinese characters and taste perception (intense, mild)?

RQ3. What are the crossmodal correspondences between Chinese characters shapes (strong/thin angular, strong/thin rounded)-brightness (low brightness, high brightness) congruency and taste perception (intense, mild)?

1.5 Significance of Research

This research will contribute to the research of visual elements in packaging design. There are various studies on the functions of packaging in products as well as typeface functions in packaging design. However, the relationship studies between shapes and brightness of typeface and the taste perception are still lacking. In most academic journals, the scope of research focuses mostly based on western alphabet writing system as the research object. Chinese characters were not included. Thus, the present study is a further exploration on the crossmodal correspondences relationship between visual features of typeface and taste perception, In view of writing system differences and cross-culture differences, this study may be used to compare differences and similarity between Chinese characters and alphabetic typefaces in the tastes correspondence and perception. Furthermore, this research involves two significant exploration points. First, the pretest exploration will find relationships between Chinese character shapes and the tastes perception. Second, the study will further explore Chinese character brightness and taste perception. Based on the first two explorations, last step will explore corresponding relationships between the Chinese characters shape-brightness and tastes perception. Consequently, the study will find the impact of the visual shapes and brightness of Chinese characters in food packaging. To summarize, the findings of research are beneficial to improve the quality of food packaging, and will guide consumers to buy more suitable food products. As a result, it can achieve the ultimate goal of sale.

1.6 Scope of Research

The aim of this study project is only to indicate the relationships between visual features of Chinese characters and taste, especially shapes and brightness of Chinese typefaces. Thus, the field of research will be delimited in next step. In present study, a series of surveys have an intimate association with consumers, especially consumers' behavior. Therefore, participants will be divided into different groups. The number of participants also has a specific limit. Moreover, the survey regions will have specific delimitation, because research is about Chinese characters.

1. In order to clarify the field of this study, Chinese characters (Chinese typefaces) as packaging visual elements were selected the only research object. All participants were involved a relationship test between the visual feature of Chinese characters and taste perception.

2. Owing to the Chinese characters as the main subject matter, the scope of the investigation was selected in China and Malaysia region. All participants have undergone mandarin education.

3. To ensure the validity of the study, an estimated 300 participants were invited to fill in questionnaires. Both Surveys 1 and 2 invited around 150 participants each. The final results will be reported in Chapter 4.

4. To further explore type of population was divided into age groups and gender groups. There are four age groups i.e. 18 - 29, 30-40, 41-50, 50 above. Gender groups include male and female.

1.7 Limitation of Research

The limitation reasons involve two main aspects including funding and population selection. Due to limited funding, experiments do not involve real food tasting process. Experiments just depend on visual elements test to do taste assumption. Visual test and taste test does not have virtual connection. Moreover, experiment test is only in China and Malaysia.

In this study, the way of experiment and test is questionnaire. In terms of survey, the distribution of questionnaire is affected by region and respondents. In the first place, the most important reason is that all questionnaire respondents must understand Mandarin and Chinese characters. There is no doubt that China as major research market is absolutely necessary. In Kuala Lumpur, some locals are mandarin educated, those who are not will still be excluded from the field of research. Obviously, questionnaires cannot distribute to this kind of people who do not read Chinese characters, otherwise it will affect the test results. In other word, Chinese people and some Malaysian-Chinese people as main survey group. The scope of the investigation is limited by language. Apart from respondents' language factor, another important reason is that respondents' age factor. Those people who are below 18 years old do not have independent economic and purchasing power. For the product packaging and purchase, their attention, perception and influence are less than other age groups. Therefore, survey respondents does not involve all ages.

It is not hard to see that the final goal of visual questionnaires survey is to collect data. Comparatively speaking, the part of data collection is harder part which is compared other parts. Data collection not only involves funding and population two major limitations, but also includes design (survey), district, culture and age limitations.

1.8 Theoretical Framework

From what has been mentioned above, the specific research direction was defined to explore crossmodal correspondences relationship between shapes and brightness of Chinese characters and taste perception. Theoretically, the core of the research was guided by crossmodal correspondences between visual elements and taste perception in this thesis. As matter of fact, present study also overlaps with many other fields of research and related concepts such as psychology, visual perception, packaging design, marketing, consumer perception and so on. Thus, this study involves a combination of theories and related knowledge from different domains. Packaging design, psychology, marketing are some of the fields directing related to this research and other theories are defined as an auxiliary research theory content, because the results of this research may be applied in these field.

Broadly speaking, crossmodal correspondences theory in this study analyzed how the consumers through the visual elements design of packaging are guided in taste perception and food product perception and buying behavior. It is worthwhile to note that visual theory occupied main aspect. The theoretical framework is divided into three main sections.

Visual perception

In terms of visual perception, Gibson (1950) in his book entitled "The perception of the visual world" have explained what is vision, that is "perceiving things depends on first having sensations" (p. 12). In other words, visual perception can also be understood as a sensation response. This psychological sensation depends on vision.

From what has been discussed above, visual effect could influence consumer buying behavior and subsequently marketing strategies. For example, Becker, van Rompay, Schifferstein, & Galetzka (2011) through experiments demonstrated the influence of packaging shape and color design on taste impressions and product evaluations. Wang (2013) also indicated that consumer can perceive food product quality, value, and brand preference by the influence of visual packaging design. It is obvious that impressions, evaluation and brand preference are influenced by a perception or sensation rather than actual content. More specifically, this type of visual perception is consumer perception and sensation.

To reiterate, the significance of the visual design of packaging is related to visual perception theory, and visual perception theory is associated with consumer perception (such as visual perception) and buying behavior (marketing research). Therefore, this relationship can be visualised in the figure below (see Figure 1.1).
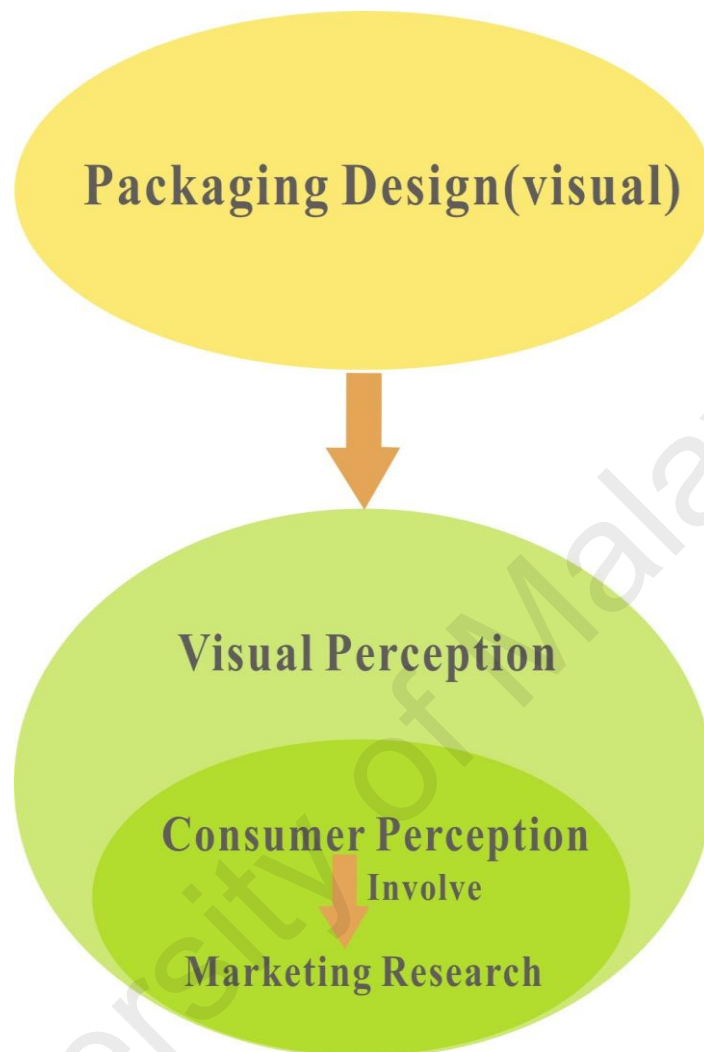
Figure 1. 1, Relationship between packaging design and visual perception

Crossmodal correspondences

In this study, Crossmodal correspondence is a core research theory. This is discussed within the context of sensory perception (e.g., Spence, 2011). Hence, crossmodal correspondences were classified as a branch in cognitive psychology research. However, this did not mean that it existed independently in the branch of general psychology. From a number of researches on crossmodal correspondence, the researchers focused on visual and auditory sensory testing.

At the same times, many studies have shown that crossmodal correspondences theory were applied on packaging design. For example, Velasco, Woods, Petit, Cheok, and Spence (2016) according to the results of finding in recent years showed that people consistently match specific abstract shape to particular taste on packaging. Additionally, Piqueras-Fiszman and Spence (2011) exploration found that consumers match specific flavors to specific packaging colors in a product (potato chips) category. Piqueras-Fiszman, Velasco, and Spence (2012) conducted a similar study in product packaging, i.e. crossmodal correspondences/matching between color and flavor. No one can deny the fact that these crossmodal explorations forms an important aspect of visual perception. As is known to all, the core of research in this thesis is the exploration crossmodal correspondences relationship between shapes and brightness of Chinese characters and taste perception. These above researches precisely supported crossmodal correspondences theory between visual elements and tastes, especially on packaging. In a nutshell, crossmodal correspondence theory not only belongs to a branch of cognitive psychology, but can also be used productively in visual research field (see Figure 1.2).
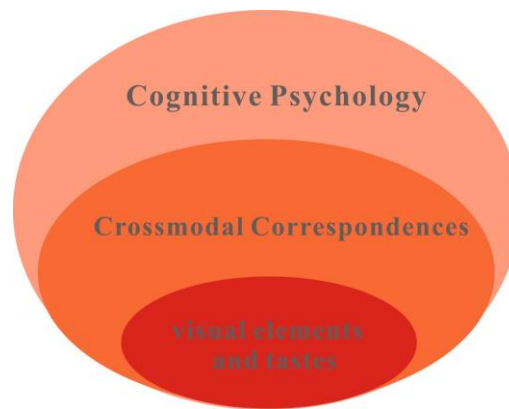
Figure 1. 2, Theoretical framework of crossmodal correspondences relationship

Theoretical summary

In this study, packaging design is a starting point for all studies. It is an indispensable part of a product. Packaging and packaging design plays an important role in a product and it has a close relationship with consumers buying behavior and marketing strategies. In this relationship, visual perception is a connection point and a medium. Product packaging through visual design could cause a visual effect, and this kind of visual effect was clearly defined as a consumer visual perception, thereby affecting consumer buying behavior and marketing.

Apart from packaging design, crossmodal correspondence is important too. Although, crossmodal correspondences were a branch of cognitive psychology, it also involved visual perception, for instance many studies have found crossmodal matching relationships between visual elements and tastes. As mentioned, this study only explore crossmodal correspondences relationship between shape and colour of Chinese characters and taste perception, namely, typeface, shape and color three aspects. Overall, the significance of crossmodal correspondences theory can be applied to theory of visual perception.

16

Figure 1.3 summarizes the relationships between visual packaging design, crossmodal correspondences theory and visual perception theory.
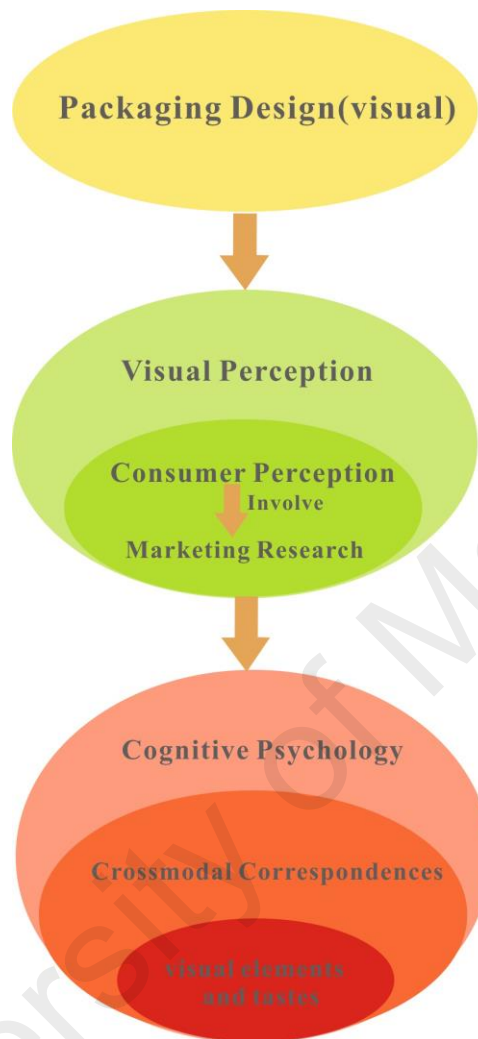
Figure 1. 3, Theoretical framework mind map

1.9 Definition of Terms Used in the Study

This study includes three major terms, namely Chinese character, packaging design and crossmodal correspondences. All major terms that are mentioned in this research are further accurately defined in this section.

1.9.1 Chinese characters

Chinese characters refer to the written form of Chinese language in this thesis. Unlike English writing, Chinese characters evolved from a pictograph and may thus be regarded as a graphic symbol or character. In other words, as an important writing system, Chinese characters have distinct graphic features. So Chinese Character is further defined as a visual symbol in this study.

1.9.2 Packaging design

In this thesis, the concept of packaging design refers to the visual concept of the package, i.e. the size, meterial, shape of the package, as well as, the surface design which included the layout, colour and typeface. This research is limited to the typeface and colour of the surface design of the package.

1.9.3 Crossmodal correspondences

The term crossmodal correspondences often appear in the field of psychology research. It also called crossmodal perception. More specifically, crossmodal correspondences are borrowed from the field of cognitive psychology. This type of perception involves interactions between two or more different particular sensory modalities. For example, synesthesia, sensory substitution etc. In terms of this study, crossmodal correspondences just involve interactions between vision sense and taste sense.

1.10 Summary

Chapter one is a general outline of the whole research. As for the introduction section, chapter one shows that why I chose this field of research. This reason was clearly indicated through three parts that include background introduction, problem statement and research significance. There are some reviews of literature related to the three parts. This chapter also provides an introduction to the main subject of study. Two research objectives and three research questions are critical points of this study. The research direction was clearly defined by the two parts. Moreover, the scope of research further confirmed population (age, gender) and region (China, Malaysia) of investigation. In this section, the three main conceptual points (Chinese characters, packaging design and crossmodal correspondences) constitute the whole theoretical framework. Lastly, the part of research limitation mentioned some unavoidable limitation factors of the study.

Anyway, the most important is that the purpose of this research is to achieve its two objectives by seeking reliable answers to the three questions.

CHAPTER 2: LITERATURE REVIEW

2.1 Introduction

The whole research is centered around the crossmodal correspondence relationships between the shapes and colours of Chinese character and taste perception. It is not hard to see that crossmodal correspondence is core knowledge point and critical factor and is also directly related to the research process. In this chapter, there is no doubt that the review of literature lays more emphasis on the introduction and explanation of crossmodal correspondence, especially, in terms of the visual senses. Moreover, Chinese characters as a carrier of visual information are another main research subject matter in this study. Because of this, the chapter will not only include the research direction and the result of visual crossmodal correspondences, but also describe relevant knowledge and research on visual crossmodal correspondences such as Chinese characters and typeface.

2.2 Crossmodal Correspondences

As the core knowledge of this study, there is no doubt that crossmodal correspondences are very important concept point.

2.2.1 The background and development of crossmodal correspondences

What are the crossmodal correspondences? From what has been mentioned above, crossmodal correspondence is one of the terms that refer to people tendency to match associations of features or stimuli across the senses. Current, research has increasingly demonstrated that people exhibit consistent crossmodal correspondences in many different sensory stimulus features including visual sense, auditory sense, and

taste sense and so on (e.g. Spence, 2011; Spence, & Deroy, 2014; Velasco, Woods, Petit, Cheok, & Spence, 2016). All things considered, crossmodal correspondences is neither an unknown concept nor a current research field in recent year. So the research about crossmodal correspondences is the same as other any theoretical studies that is to say, the crossmodal correspondences have its own development history as well.

In terms of crossmodal correspondences, Spence (2011) reviewed existing knowledge of crossmodal correspondences, and analyse them from the perspective of sensory cognition. According to early research on crossmodal matching, evidence clearly indicated that many early psychologists began exploring related crossmodal association of sounds or shapes since the 1920's by Spence's research. More specifically, Sapir (1929) found that the crossmodal associative exist between phonetic symbolism size (large and small) and expressive or phonic (vowel a and vowel i). Additionally, there are crossmodal correspondences between sounds and visual words and visual figure (Fox, 1935). Admittedly, these early study results have shown the existence of crossmodal association between visual and auditory. At the same time these precedents also laid the foundation for the other sensory modalities research such as odor and taste. As a result, crossmodal correspondences seems to belong to a several interdisciplinary research. Although it is based on psychology, it is also applied in visual, auditory and other sensory modality research.

2.2.2 Visual crossmodal correspondences between shape and taste perception

Based on previous studies, an increasing number of researchers continue to study crossmodal exploration about shape and sound aspect until now. As for the present study, this primary study's focus is to explore crossmodal

correspondences/matching between typeface shapes and tastes or typeface brightness and tastes. Moreover, this exploration is closely related to packaging and packaging visual design. According to a series of previous studies, it can be seen that crossmodal correspondences have a long development history. The most significant being the existence of association between visual and auditory. Thus, visual and other sensory forms may also have crossmodal relationships. This conjecture was confirmed in later studies. Such as by Spence and Deroy (2014), who comprehensively reviewed and described the association studies between shape and taste or flavor. This review is further to firm up the possibility of the crossmodal correspondence theory between shape and taste.

Actually, for the specific shape such as angular and rounded, some studies have already examined crossmodal correspondence between angular/rounded shape and tastes in a few years ago. Researchers have made a hypothesis that is "an angular packaging shape (as opposed to a rounded) will lead consumers to experience the product taste as more intense" (Becker, van Rompay, Schifferstein, & Galetzka, 2011, p. 18). At the same time, these researchers use three pairs of product variants (see Figure 2.1) to conduct their experiments, findings found that angular shape packaging variants are perceived as more potent than the rounded shape packaging variants. Hence, angular shape may inspire more potent consumers' perception. In other words, it can also be understood to inspire intense taste perception.

Figure 2. 1, Three pairs of product variants in Becker et al. (2011) research

In contrast, Zhang, Feick and Price (2006) previously concluded that rounded shapes logos are perceived more harmonious than angular shapes logos. Moreover, Velasco, Salgado-Montejo, Marmolejo-Ramos and Spence (2014) also further confirmed that the various sensory attributes of a product's packaging such as typeface, shape and name can convey taste of a product. Based on the range and depth of crossmodal correspondences studies, only a few studies have explored the crossmodal associations between tastes/flavors and shape features, especially in food packaging. Therefore, it is undeniable that these studies have supported the idea of crossmodal correspondences on product packaging.

During the later years, the scope of crossmodal research also more focuses on the product packaging. A lot of research findings and even related review literatures constantly and clearly confirmed that there are crossmodal correspondences between the visual shape features of product packaging and different tastes (e.g. Velasco et al. 2014; Velasco, Woods, Deroy, & Spence, 2015; Velasco, Woods, Petit, Cheok, & Spence, 2016).

Velasco, Woods, Petit, Cheok and Spence in their paper "Cross modal correspondences between taste and shape, and their implications for product packaging" detailed and comprehensively reviewed crossmodal associations about packaging shape and taste (2006). Their most important finding was some similar across a series of basis of important research. They established that:

> "First, people match tastes and shape features in a manner that is significantly non-random; Second, both packages and their respective shape-related features can convey information about the likely taste of a product; Third, under certain circumstances, such characteristics may influence taste, and presumably also flavour, perception" (Velasco et al., 2016 p. 24).

In summary, these inferences claimed that crossmodal correspondences between shape feature and taste was not only significantly non-random in people's crossmodal

matching cognitive, but also showed its importance and relevance with package and taste of a product. Moreover, these inferences were similarity as general summary.

As has been mentioned above, Velasco, Woods, Petit, Cheok and Spence (2016) have reviewed a series of literature and related research details for the packaging shapes and certain tastes. Some related studies about the relationships between shapes and tastes in packaging in this review paper were obtained. In terms of details, the relationship of matching is worth further in-depth examination, because the matching results between taste or flavor and shape is evident in these related literatures. For examples, Velasco, Salgado-Montejo, Marmolejo-Ramos and Spence's (2014) results of the rating task and categorization task have shown that rounded shapes, rounded typefaces (e.g., Swis721 B1kRnd BT—Black, 44 pt), and names (soft, rounded) with a fictional package were more rapidly categorized as sweet tastes, while angular shapes, angular typefaces (e.g., Hollywood Hills—Regular, 53 pt), and names (sharp, angular) with a fictional package were more rapidly categorized as sour tastes (see Figure 2.2).
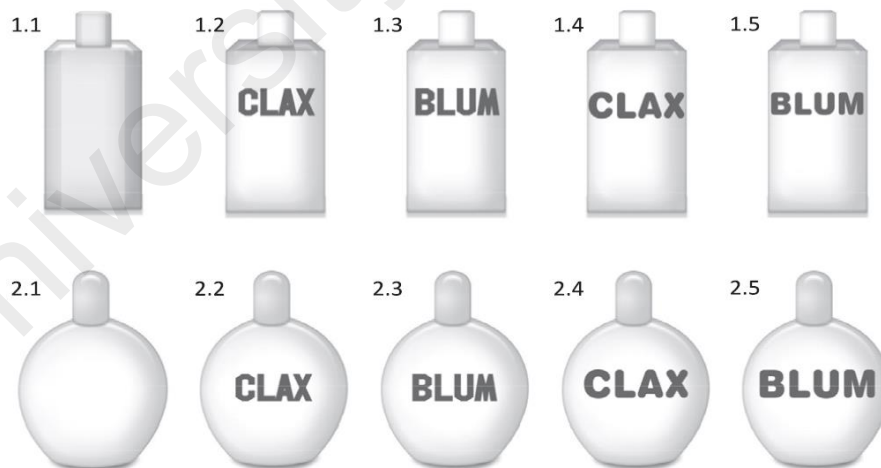
Figure 2. 2, Visual stimulus test materials in Velasco et al. (2014) research

Moreover, Velasco, Woods, Deroy and Spence (2015) designed four different experiments to robust support that people consistently matched four basic tastes or

flavors to particular visual shapes. In four experiments, they selected four names ("bitter", "salty", "sour", and "sweet") as taste words and two types of shape ('angular', 'rounded') as visual materials. Lastly, all finding results also clearly demonstrated a series of similar phenomenon that shapes of roundness were matched with sweetness, while shapes of angularity were matched with other tastes (e.g., sour, bitter, and salty), and even the crossmodal correspondence relationship between sweetness and roundness is more particular than other crossmodal correspondences.
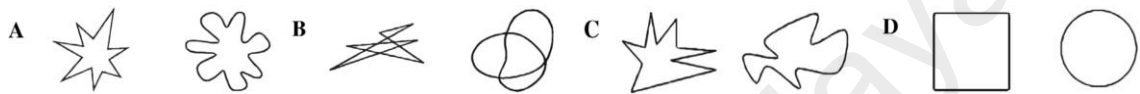
Figure 2. 3, Visual stimulus test materials in Velasco et al. (2015) research

In a nutshell, a lot of earlier studies have robust confirmed that there are crossmodal correspondence or matching relationships between visual shapes and tastes. This phenomenon is significant and non-random. From the above literature analysis, most of the experiments and tests seem trend certain same results. Comparatively speaking, rounded shape is more better matching specific sweet taste or flavor, while angular shape is more better matching specific sour, salty and bitter tastes or flavors. In addition to the above results, early test results presented angular packaging shape as being more potent than rounded packaging shape for the sensitivity of design (Becker, van Rompay, Schifferstein, & Galetzka, 2011), whereas rounded shapes logo are perceived more harmonious than angular shapes logo (Zhang, Feick, & Price, 2006). To some extent, these early findings have become basic evidences and argument supports for later studies and findings.

2.2.3 Visual crossmodal correspondences between color and taste perception

What is more, another crossmodal study worth mentioning is about color and taste. Just as shape and taste, there are correspondence relationships as well. So another important discussion is that prior researches and numerous tests have proven about the impact of color on taste/flavor perception in humans.

Concretely speaking, if only talking about crossmodal matching between color and taste, Evidences have shown that certain colors and specific flavors have a positive or a negative association. Koch and Koch (2003) in journal name 'perception of taste is based on color' have indicated that "a limited number of colors are positively associated with certain tastes" (p. 239-240). For instance, Koch and Koch test found that "red and orange colors were positively related to sweetness" (p. 236), whereas "green, brown, black, and gray were negatively related to sweetness" (p. 237). To put it simply, color can affect people's taste perception by a visual way. At the same time, the fact proved that the correspondence relationships between color and taste often closely associated with the food, consumers and products. In the case of crossmodal correspondences, many test results demonstrated that food colors can influence taste and flavor perception (Spence, Levitan, Shankar, & Zampini, 2010) and even consumer whether to correctly identify food beverage flavors (Garber, Hyatt & Starr Jr, 2000). Another significant finding by Koch and Koch (2003) was that some specific colours may produce certain preconceptions about taste, and therefore colours change people's perception of taste and related consumer behavior such as expected benefits or desirability for food product. In addition to the above, Piqueras-Fiszman, Alcaide, Roura and Spence (2012) utilized case study to prove when mousse sample was served from a white plate, it was perceived as significantly more intense and sweeter flavor than from a black plate and even more popular. Due to these robust evidences, the crossmodal matching

relationships between color and taste is similar to the crossmodal between shape and taste, i.e. people consistently insist certain matching relationships between specific colours and particular tastes.

Based on the above study results, some other studies and experiments also have further clearly indicated that there are certain crossmodal correspondence relationships between food packaging colour and product taste (e.g., Becker, van Rompay, Schifferstein, & Galetzka, 2011; Piqueras-Fiszman & Spence, 2011; Piqueras-Fiszman, Velasco, & Spence, 2012; Velasco, Wan, Knoeferle, Zhou, Salgado-Montejo & Spence, 2015). It is not an overstatement to say that packaging color can be considered as an indispensable part of sensory hedonic expectations of product. Therefore, crossmodal research between color and taste has important application value in food product. These ever-expanding crossmodal studies confirmed again the impact of crossmodal correspondences on consumers' perceptions (such as taste and product) and buying behavior.

Becker, van Rompay, Schifferstein and Galetzka (2011) selected two saturation variants of two lemon-greenish color pairs (see Figure 2.4) to do test, and the results found that highly (100%) saturated colour is more potent than lowly (50%) saturated color. Thus, different levels of colour may inspire the potency and intensity of consumer perception.

Figure 2. 4, Visual stimulus test materials in Becker et al. (2011) research

In the same way, Piqueras-Fiszman and Spence (2011) and Piqueras-Fiszman, Velasco and Spence (2012) have done a similar design to investigate whether consumers associated specific flavors to particular packaging colors. In terms of selection of the visual stimuli material, Piqueras-Fiszman and Spence in their study designed two colored images of crisp packets (one blue, one green) (see Figure 2.5) and chose two different flavors words (cheese & onion, salt & vinegar). Their study results demonstrated that as time goes on, brand acquaintance could affect and develop consumers' associations between the attributes (in this study, the color) of a package and the contents (in this study, flavor) of the packaging; for example, participants found it easier and more correct to match combination1 (salt & vinegar with green colour crisp packet and cheese & onion with blue colour crisp packet) than it opposite matching combination2 (salt & vinegar with blue colour crisp packet and cheese & onion with green color crisp packet) when some consumers are only familiar Walkers as potato chips (crisps) brand (Piqueras-Fiszman & Spence, 2011). At the same time, Piqueras-Fiszman and Spence (2011) via investigation also found that when consumers for any not especially well-acquainted specific brand will lead them having no a clear association between colors and specific flavors, therefore consumers pairing reaction is differently.

Figure 2. 5, Images of crisp packets in Piqueras-Fiszman and Spence (2011)

In brief, a product brand and the colour–flavor matching of food packaging (crisp packet) were related. Sometimes consumers in crossmodal correspondences between the packaging colour and taste of a product may be influenced by the product category and brand. On the other hand, the most important is that crossmodal correspondences between specific packaging colour and specific taste could be used to identify product brand and varieties. It is evident that the choice of packaging colour is beneficial to the establishment of product brand. As a critical factor, packaging colour determined consumer's expectations on a product such as flavor/taste, varietal, brand etc.

Based on Piqueras-Fiszman and Spence (2011) research and the design of experiment, Piqueras-Fiszman, Velasco and Spence (2012) chose some participants from Colombian and British two different countries to do further investigation that it is about the color-flavor of crisp (or potato chips) packet (see Figure 2.6). Piqueras-Fiszman and Spence in the both of countries found some of the new significant associations and results on the colour–flavor matching. For instance, when natural flavor with blue packaging and limón flavor with green packaging is a positive congruent combination in Colombian participants' mind, it is easier to link and responding significantly more rapidly than "queso ycebolla" [cheese and onion] (p. 149) with blue packaging and "saly vinagre"[salt and vinegar] (p. 149) with green packaging. Surprisingly, when the British participants had to pair lemon flavor with green packaging and plain flavor with blue packaging (this was hypothesized as incongruent combination in this study), they responded significantly more rapidly than their regular brand of crisps (Walkers) combination such as salt & vinegar with green packaging and cheese & onion with blue packaging, and in the other, British participants found the two types of combinations relatively easy to match. In addition to the above findings, as matter of fact, some of the participants also reported that "lemons are sometimes greenish, and blue is like water, tastes plain" (p. 154). These results suggested that when

the colour of the flavour's food was represented by the colours of packages, these associations would be easier in the consumers' minds, and therefore they aid in product recognition (Piqueras-Fiszman, Velasco & Spence, 2012).

Visual materials showed to Colombian participants. (a) a congruent block (b) an incongruent block

Visual materials showed to UK participants. (a) a congruent block (b) an incongruent block

Figure 2. 6, Visual stimuli material pictures in Piqueras-Fiszman et al. (2012)

In terms of above investigation, the finding results of this study further prove that the packaging colours in food sector still may have specific associations with flavors in consumer's mind, and the brand of food product still has a certain influence on color–flavor matching in each country.

According to two experiments report, Velasco, Wan, Knoeferle, Zhou, Salgado-Montejo and Spence in 2015 provided evidence that when color and taste are congruent, it could affect people's visual search for product packaging. Specifically speaking, people searched for flavor labels more rapidly when the colour was presented congruent with the cued flavor than incongruent in a packaging (Velasco et al., 2015).

There is no doubt that these studies have provided many robust evidences for the existence of a series of associations between food tastes and colours. Besides, the

crossmodal correspondences phenomenon not only existed on food packaging, but also it was used in food packaging. To put it from another perspective, the colours of packaging have specific crossmodal associations with the flavors of product. Moreover, the "congruence" between color and taste is essential in food product packaging design. As consequence, the research found that this type of crossmodal correspondences has an important influence and significance for consumers and food products. Colour, therefore, is a critical factor and plays a guiding role in food product packaging design, to which designers must pay particular attention.

2.3 Typeface

It is well known that typeface is an important visual design element. Further, it is absolutely true that typeface has been widely used in many different fields such as typography, books, packaging and so on. No one can deny the fact that typefaces are always represented by a visual way. In the meantime, it utilizes a unique visual characteristic to play a prominent role and function in design. For instance, packaging can convey covert messages via the choice of typeface they adopt, and styles of fonts in their appropriateness can describe certain different types of brands and products (Doyle & Bottomley, 2006). In addition to the above findings, Van Rompay and Pruyn (2011) through their two research experiments indicated that shape-typeface congruence (the shape variants and typeface variants of a fictitious brand of bottled water) has positive effects on the perceptions of brand credibility and price expectations, and consumer expect to pay more for these congruent designs due to more attractive. With all these points of view taken into consideration, typeface design therefore is essential and indispensable in packaging. It is clear that an appropriate typeface design such as about

typeface congruence aspect indeed has become an important criterion for the success of product and brand.

From the research focus of this paper, research question in chapter one has clearly mentioned that this study focused on crossmodal relationship researches. More specifically, the main task of present study is to explore to found the crossmodal correspondences between the visual features of Chinese characters and tastes. Although a lot of researchers have done a number of studies on the crossmodal correspondences researches, in fact that the crossmodal correspondence between shape and taste can be extended to typefaces as well.

As for the typeface, some research precedents (e.g. Van Rompay & Pruyn, 2011) have revealed that the theory of crossmodal correspondence is relevant to the research for the visual features of typeface. Moreover, like the above typeface analysis, Velasco, Woods, Hyndman and Spence (2015) in their research further demonstrated the importance of typeface design congruency, and different forms of the typeface can convey meaning over and above actual semantic contents and messages. From a series of specific experiments, total two hundred participants were instructed using 12 variants typefaces (the first six are rounded, the remaining six are angular) (see Figure 2.7) to match four basic taste words ('bitter', 'salty', 'sour', and 'sweet') from not all to very (see Figure 2.8). Experiment 1 the participants matched rounder typefaces with the word ''sweet,'' while matching more angular typefaces with the other three basic taste words ''bitter,'' ''salty,'' and ''sour.'' Experiment 2 demonstrates that not only rounder typefaces are liked more but also are judged easier to read than their more angular counterparts. There are some similarities between above findings and related packaging crossmodal studies, i.e., rounded typefaces with a fictional package were more rapidly categorized as sweet tastes, while angular typefaces with a fictional package were more

rapidly categorized as sour tastes (Velasco, Salgado-Montejo, Marmolejo-Ramos & Spence, 2014).

Figure 2. 7, Typeface visual materials in Velasco, Woods, Hyndman and Spence (2015)
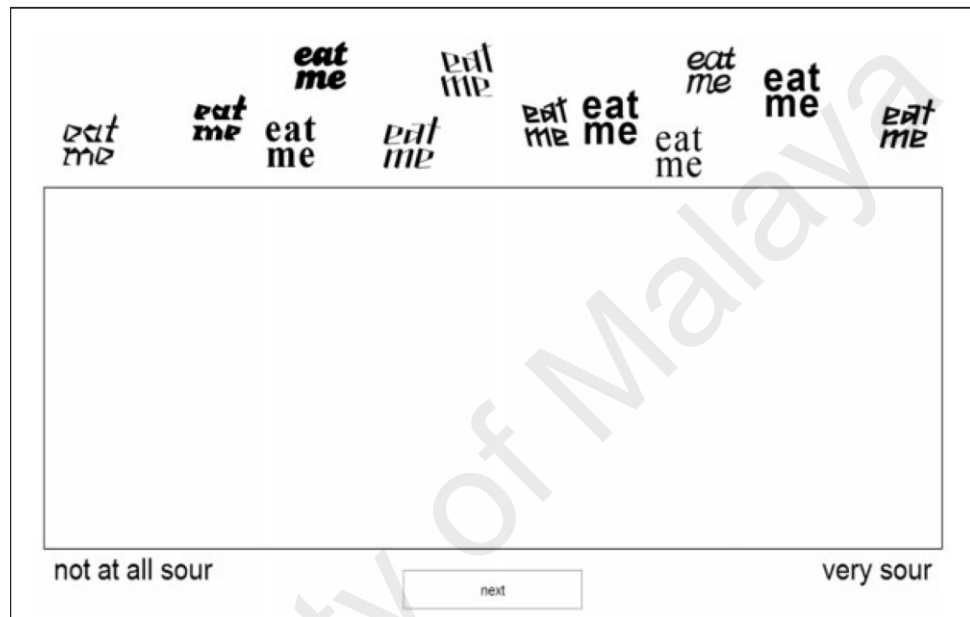
Figure 2. 8, Typeface experiment in Velasco, Woods, Hyndman and Spence (2015)

To the final analysis, as an indispensable packaging visual element, packaging typeface definitely is one of the significant factors in consumer perception, according to studies about packaging visual elements and packaging typeface congruence as well as the crossmodal relationships exploring between packaging typeface and taste.

2.4 Cross-cultural Difference

Although there are distinct crossmodal correspondences between sensory modalities, this section is on correspondences with cross-cultural differences.

2.4.1 The impact of cross-culture difference for different sensory

Under the sufficient evidences (e.g. Ayabe-Kanamura et al., 1998; Aslam, 2006; Wan et al., 2014), people's sensory responses, preferences and perception are affected by cross-cultural differences. In particular, cross-cultural differences are apparent between Eastern and Western cultures. Owing to cross-cultural differences, early study founded that the population of labors from the Indian Karnataka is more strongly preferences for sour tastes than population from the West, because of differences in dietary history culture. (Moskowitz, Kumaraiah, Sharma, Jacobs, & Sharma, 1975). In odors researches, Japanese and German have obviously differences in perception of everyday odors (Ayabe-Kanamura et al., 1998). In terms of visual features aspect, Aslam (2006) have shown that sometimes cross-cultural differences affect different perceptions and preferences of the consumers in different countries for colors and even marketing cue such as product and packaging colors. In addition to visual color exploration research, Zhang, Feick and Price in 2006 explored about the influence of Self-Construal for different shapes. In a word, culture differences can affect aesthetic preference for shapes. They showed that

> "logos design from countries high on individualism (United States, United Kingdom, Canada, and Germany) were perceived as more angular than countries high on collectivism, while logos design from countries high on collectivism (Japan, Hong Kong, and Korea) were perceived more rounded than countries high on individualism" (Zhang et al.,2006 p. 797).

To most cross-culture difference studies, recent researches also have suggested that the crossmodal correspondences between sensory modalities such as basic tastes and visual feature (e.g. Wan et al., 2014) or colors and odors (e.g. Levitan et al., 2014) were influenced by cross-culture differences. Besides, it should be noticed that language is significant factor in the matching task, when research experiment asks participants to make a forced choice (Wan et al., 2014).

2.4.2 Chinese characters

The present study is based on Chinese culture. The emphasis of this study is Chinese characters. As is acceptable acknowledge, Chinese character as an important writing system has more than thousand years of history from the development of writing styles (e.g., Chan, 1959 p. xiv). Furthermore, research has clearly revealed that there are closely related relationships between Chinese characters and graphic shapes. In 1959, Chan in book "Elementary Chinese" has provided information on Chinese characters classification, for instance, "the first category pictographic" (p. xv) and "the second category diagrammatic or indicative" (p. xv) is related with visual and graphic shapes. Evidence showed that the earliest Chinese writing is called 'oracle bone inscriptions' and shows inerrant evidence of evolvement from basic pictographic stage (Boltz, 1986). From background of Chinese character, Juang et al. (2005) also support that as originally pictographic, Chinese writing system is pictures represent words that is close similar the meaning of the word. Hence with the development history of Chinese Characters, ancient Chinese characters as pictographs were easily recognized as picture.

2.4.3 Chinese characters and English

As mentioned trailer, in essence, Chinese character and English has distinct differences. "English and other western languages are based on an alphabet, whereas Chinese is based on ideographs" (Schmitt, Pan, & Tavassoli, 1994, p. 420). "Written Chinese is a logographic language, with a graphic symbol or character" (Yang & McConkie, 1999, p. 208). Chinese writing system was developed from pictographic writing into more complex ideographic writing (Juang et al., 2005). To analyze from related Chinese research, Leck, Weekes and Chen (1995) in study have clear indicated

that Chinese Characters on visual or phonological information are more diverse, complex and more visualization which is compared to English words. Because of different writing system and language, Chinese brand names are more easily memory as the visual brand identifiers, whereas English brand names are more easily memory as the auditory brand identifiers (Tavassoli & Han, 2002). To sum up, the visual shape feature and symbolic feature of Chinese characters is more obvious. To put it from another perspective, the difference between Chinese characters and the Western alphabets are basically reflective of differences in cultural perception. Due to above analysis, one cannot assume that the English alphabet test results can be applied directly to Chinese characters.

2.5 Summary

In summary, numerous literatures revealed that there are crossmodal correspondence relationships between different sensory modalities. As for the vision sense, people consistently matched certain visual features to particular tastes. As a significant visual factor, typeface plays an important role in product packaging. One of the important roles is that consumers perception and expectation such as product price and taste, are relatively influenced by typeface design.

In this study, the research object is Chinese characters. converse, to the majority of previous studies based on Western cultures and the English alphabetic writing system. Sufficient evidences showed that it is crystal clear that due to cross-culture differences, we need to assess Chinese characters differently from the English alphabet. Cross-culture differences may have very significant impact on the crossmodal correspondences Therefore, the research of crossmodal correspondences between the shape and color of Chinese character and taste/flavor has a realistic significance

CHAPTER 3: RESEARCH METHODOLOGY

3.1 Research Instrument

Instruments use scale questionnaires in quantitative type of the research. Passing scale questionnaires to the randomly selected respondents which were considered as samples in quantitative type collected data for this research. The researcher evaluated the impact and effectiveness of each Chinese character shape by analyzing a certain amount of respondents each sample. The research included pilot study and main study two parts of survey. The pilot study and main study instrument will be divided into two different surveys and questionnaires. The pilot study questionnaire (Survey 1) was divided into three main branch parts. Two parts mainly test corresponding relationship between Chinese character shapes and the different tastes level. The main study questionnaire (Survey 2) was divided into four parts. Part one and part two is related to the crossmodal corresponding test between Chinese character shape-colour and intense taste. Part three and part four is related to the crossmodal corresponding test between Chinese character shape-color and mild taste.

3.2 Sampling Design

A total of 300 questionnaires were distributed to respondents. However, the final number of questionnaires utilized was below 300. Survey 1 sampling size is 150 people, and plan to distribute 150 questionnaires. Survey 2 is same process. In terms of sampling, there is no doubt that food packaging needs to face different kind of people, such as different gender and age. Therefore, this study utilized probability sampling to conduct the research. Simple random sampling is specific sampling method. In order to ensure data collection, the ranges of participants' age were designed into three strata: young people (18 – 29), middle-aged people (30-40, 41-50) and old people (50 above).

Some children who are under the age of 18 will not be included this scope of research, because they do not have independent economic power. Both genders were accepted in the study. The final recovery results will be described in Chapter 4.

3.3 Research Site

The study is confined to the residents in China and Kuala Lumpur, Malaysia. There are two main reasons. First of all, the field of research is related to the visual perception of Chinese Characters. As the mainstay market of Chinese packaging, there is no doubt that China has the largest of consumer market. Furthermore, Kuala Lumpur is the political, economic, cultural and industrial center in Malaysia. It is most development region in Malaysia. Lots of Chinese Characters packaging existed in some supermarkets of Kuala Lumpur. Second of all, all of the participants must be able to identify Chinese characters and they are potential consumers of these products. The most important is that Malaysia has a certain Chinese cultural background and influence. Overall, the concentration of people who are of Chinese heritage, have undergone Chinese Mandarin education and comprehend Chinese characters as well as consume related food products is stronger in these two locations.

3.4 Research Process

In this research's process, it was divided into the pilot study and main study, namely Survey 1 and Survey 2. Each study included four detailed research processes.

3.4.1 Pilot study (Survey 1)

Regarding Chinese character shapes and taste: the first part of hypotheses states

H0: There is no significant difference between angular Chinese character and rounded Chinese character when people make an assumption on the intensity of taste.

H1: There is a significant difference between angular Chinese character and rounded Chinese character when people make an assumption on the intensity of taste.

H0: There is no significant difference between angular Chinese character and rounded Chinese character when people make an assumption on the mildness of taste.

H1: There is a significant difference between angular Chinese character and rounded Chinese character when people make an assumption on the mildness of taste.

Despite many researchers have studied the relationship between shape and taste. None have tested the relationship between the visual strength of typeface and intensity of taste. Although some studies have investigated the crossmodal correspondence between basic taste and shape (e.g., Velasco, Salgado-Montejo, Marmolejo-Ramos, & Spence, 2014; Velasco, Woods, Deroy, & Spence, 2015), related tests are still rare about the corresponding relationship between typeface shapes and basic tastes.

H0: There is no significant difference between angular Chinese character and rounded Chinese character when people make an assumption on the sour taste (basic taste).

H1: There is a significant difference between angular Chinese character and rounded Chinese character when people make an assumption on the sour taste (basic taste).

H0: There is no significant difference between angular Chinese character and rounded Chinese character when people make an assumption on the bitter taste (basic taste).

H1: There is a significant difference between angular Chinese character and rounded Chinese character when people make an assumption on the bitter taste (basic taste).

H0: There is no significant difference between angular Chinese character and rounded Chinese character when people make an assumption on the salty taste (basic taste).

H1: There is a significant difference between angular Chinese character and rounded Chinese character when people make an assumption on the salty taste (basic taste).

H0: There is no significant difference between angular Chinese character and rounded Chinese character when people make an assumption on the sweet taste (basic taste).

H1: There is a significant difference between angular Chinese character and rounded Chinese character when people make an assumption on the sweet taste (basic taste).

H0: There is no significant difference between thin Chinese character and strong/bold Chinese Character when people make an assumption on the intensity level of taste.

H1: There is a significant difference between strong/bold Chinese character and thin Chinese Character when people make an assumption on the intensity level of taste.

3.4.1.1 Participants

A total of one hundred fifty participants (Gender: males, females, Age range around 18-50 above years) took part in the study. All of the participants were instructed to complete a questionnaire.

3.4.1.2 Visual stimulus materials

The images of ten variants of the same text "好味道"（"good taste"）were written in different typefaces (see Figure 3.1). The pilot study was designed to select two specific Chinese character shape typefaces, which are angular and rounded. All Chinese characters were chosen from those bundled with Microsoft packages and Chinese Fang zheng font library, supplemented by a few relevant free software and share software obtained via the internet (See Figure 3.1). The first five group typefaces are the angular Chinese characters. According to shape feature from thin to strong, angular Chinese characters were sorted from 1 to 5. These typefaces are FangSong, SimHei, FZMeiHei-M07S, FZDaHei-B02S, FZJianZhi-M23S (500×500 pixels). The remaining five group typefaces are the rounded typeface. According to shape feature from thin to strong, rounded Chinese characters were sorted from 6 to 10. These typefaces are FZXiYuan-M01S, 7156FZKaTong-M19S, FZLiShu-S01S, FZShaoEr-M11S, FZPangWa-M18S (500×500 pixels). In order to eliminate color effect, all typefaces were represented using black wire frame.

(1)

Angular Chinese Characters

(2)

1. FangSong   2. SimHei   3.FZMeiHei-M07S

好味道 好味道 好味道

4.FZDaHei-B02S   5. FZJianZhi-M23S

好味道 好味道

Angular Chinese Characters

(3)

1. FZXiYuan-M01S   2.7156 FZKaTong-M19S   3.FZLiShu-S01S

好味道 好味道 好味道

4. FZShaoEr-M11S   5.FZCaiYun-M09S

好味道 好味道

Rounded Chinese Characters

(4)

1. FZXiYuan-M01S   2.7156 FZKaTong-M19S   3.FZLiShu-S01S

好味道 好味道 好味道

4. FZShaoEr-M11S   5.FZPangWa-M18S

好味道 好味道

Rounded Chinese Characters

Figure 3. 1 Visual stimulus materials of Chinese character in pilot study (survey 1)

3.4.1.3 Procedure

Both paper questionnaire and online questionnaire were used for data collection. Pilot study questionnaire (Survey 1) was divided into three parts. In part one and part two, the images of 10 variants (five angular/ five rounded) of the same text" 好味道 " matched intense and mild taste. In part three, ten variants of typefaces (five angular/ five rounded) matched bitter, salty, sour (part three), and sweet (part four) four basic tastes. Thus, there are total 60 trials. For each trial, all respondents were instructed rating a score using a ratio measurement scales range from 0 to 10, which allowed decimal fraction (See Appendix: questionnaire 1).

3.4.2 Main study (Survey 2)

The corresponding relationship between shape and colour of Chinese characters and taste perception

From what has been analyzed previously, Velasco, Woods, Hyndman and Spence (2015) showed that roundness match to sweetness and angularity match to sour, bitter, and salty. What is more, the taste tests are not just applicable to the shape element. Some studies have shown that people consistently match certain colors with particular food tastes (e.g., Koch & Koch, 2003). People's perception for food flavor is influenced by the food colour (e.g. Spence, Levitan, Shankar, & Zampini, 2010; Garber, Hyatt, & Starr, 2000) and even the packaging colour (e.g., Becker, van Rompay, Schifferstein, & Galetzka, 2011; Piqueras-Fiszman, & Spence, 2011; Piqueras-Fiszman, Velasco, & Spence, 2012; Velasco Wan, Knoeferle, Zhou, Salgado-Montejo, & Spence, 2015).

Additionally, in some previous marketing literatures, it can be revealed that there is an influence relationship between product packaging and consumer perception (e.g., Ampuero & Vila, 2006; Rundh, 2009). Previous Research also has provided significant evidence of correlation between packaging design elements (colour, typography, shape, image) and product-positioning, and this correlation can affect consumer perception (Ampuero & Vila, 2006). Anderson (1973) has found that actual product performance and high consumer expectations existence too great a gap may lead to a not very favorable evaluation of a product than a somewhat lower level of disparity. Becker, van Rompay, Schifferstein and Galetzka (2011) mentioned that shape–color congruency will lead to a more positive overall product attitude than shape–color incongruency, for instance, a rounded shape should match a lowly saturated colour or an angular shape should match a highly saturated colour. According to the above analysis, an appropriate packaging design is indispensable to consumers and product itself. It is a marketing tool that guides consumers to build up a right expectation and exception of products. Sometimes food packaging appearance may be considered a driver of taste evaluations. As a result, it not only played a positive effect but also made the product sale.

This study's core research objective is Chinese character. The formation of early Chinese character was based on shape symbol. So it is closely related with shape symbols. Based on the above analysis, the specific shapes of Chinese character will combine with the specific colours, thereby exploring comprehensive and in-depth crossmodal relationships between visual features of Chinese character and tastes. Due to taste preference, maybe appropriate typeface shapes and colours design will help consumers to set up the right sensory expectations about taste or flavor of food products. In order to ensure accurate test results, this study solely focused on the colour and shape-colour of Chinese typeface without any relation to certain particular tastes such as

acid, sweet and salty etc. Koch and Koch (2003) claimed that limited colours are associated with specific food taste. Thus, the second part of hypotheses states:

H0: There is no significant difference among the three different brightness typefaces (low brightness, middle brightness and high brightness) when people make an assumption on the intensity of taste.

H1: There is a significant difference among the three different brightness typefaces (low brightness, middle brightness and high brightness) when people make an assumption on the intensity of taste.

H0: There is no significant difference among the three different level of brightness typefaces (low brightness, middle brightness and high brightness) when people make an assumption on the mildness of taste.

H1: There is a significant difference among the three different level of brightness typefaces (low brightness, middle brightness and high brightness) when people make an assumption on the mildness of taste.

H0: There is no significant difference between Chinese character shape-brightness congruency (low brightness combination with angular shape) and Chinese character shape-brightness incongruency (high brightness combination with angular shape) when people make an assumption on the intensity of taste.

H1: There is a significant difference between Chinese character shape-brightness congruency (low brightness combination with angular shape) and Chinese character shape-brightness incongruency (high brightness combination with angular shape) when people make an assumption on the intensity of taste.

47

H0: There is no significant difference between Chinese character shape-brightness congruency (low brightness combination with angular shape) and Chinese character shape-brightness incongruency (low brightness combination with rounded shape) when people make an assumption on the intensity of taste.

H1: There is a significant difference between low Chinese character shape-brightness congruency (low brightness combination with angular shape) and Chinese character shape-brightness incongruency (low brightness combination with rounded shape) when people make an assumption on the intensity of taste.

H0: There is no significant difference between Chinese character shape-brightness congruency (low brightness combination with rounded shape) and Chinese character shape-brightness incongruency (high brightness combination with rounded shape) when people make an assumption on the mildness of taste.

H1: There is a significant difference between Chinese character shape-brightness congruency (low brightness combination with rounded shape) and Chinese character shape-brightness incongruency (high brightness combination with rounded shape) when people make an assumption on the mildness of taste.

H0: There is no significant difference between Chinese character shape-brightness congruency (high brightness combination with angular shape) and Chinese character shape-brightness incongruency (high brightness combination with rounded shape) when people make an assumption on the mildness of taste.

H1: There is a significant difference between Chinese character shape-brightness congruency (high brightness combination with angular shape) and Chinese character shape-brightness incongruency (high brightness combination with rounded shape) when people make an assumption on the mildness of taste.

3.4.2.1 Participants

A total of one hundred and fifty participants (Gender: male, female, Age range from 18-50 above years) took part in the study. All of the participants volunteered to participate in the study. Based on the criteria, participants were instructed to complete the research questionnaire.

3.4.2.2 Method and visual stimulus material

Adobe Photoshop CS5 and CorelDRAWx4 are used to create visual stimulus material color. Survey 2 was built on the visual material of survey 1. The Chinese characters were angular and rounded shape and their typeface choose from pilot study's visual material. The angular Chinese typefaces select FangSong, SimHei as thin angular shape and FZDaHei-B02S and FZJianZhi-M23S as strong angular shape material. The rounded Chinese typefaces select FZXiYuan-M01S, 7156FZKaTong-M19S as thin rounded shape and FZShaoEr-M11S and FZPangWa-M18S as strong rounded shape material. The colours that were used were selected from CMYK color codes in Adobe Photoshop CS5 as follows: Yellow, red and black. Yellow (C:0 M:0 Y:100 K:0) was of high brightness level. Red (C:0 M:100 Y:100 K:0) was of middle brightness level and black (C:0 M:0 Y:0 K:100) was of low brightness level. In angular Chinese typefaces, two strong angular typefaces were classified as a group. Two thin angular Chinese typefaces were classified as another group. The rounded Chinese typeface is same design process. Four groups matched yellow, red and black three colors to test intense or mild flavor. So there are total twelve groups (see Figure 3.2).

(1)

Strong angular Chinese Characters

(2)

Thin angular Chinese Characters

(3)

Strong rounded Chinese Characters

(4)

Thin rounded Chinese Characters

Figure 3. 2, visual stimulus materials of Chinese character in main study (survey 2)

3.4.2.3 Procedure

Survey 2 was divided into four parts including 12 groups and 24 trials. In fact that participants needed to complete 26 questions, because it also included two single-choice questions on gender and age. Participants were then instructed rating a score for each trial via a ratio measurement scales ranging from 0 to 10, and it allowed decimal

fraction. The first and second part is rating a score for different shapes and colors of the Chinese typeface in the intense taste. The third and fourth part is rating a score on the mild taste. (See Appendix: questionnaire 2)

3.5 Method of Data Analysis

This study attempts to analyse the data, which is according to the research questions obtaining. In the phase of quantitative research of data, the first step in the process of data analysis is to organize and prepare the data by gathering questionnaires.

The second step used software SPSS (Solutions Statistical Package for the Social Sciences) to analyse the questionnaires scores for each sample response. In this study, a large number of research tests are about mean scores comparison between the two groups or more than two groups, especially, Survey 2. Besides, this study has many hypotheses that were used to analyse and research questions. Usually significance testing is used in hypothesis research, using mostly the t-test as a guide. Therefore, t-test (Independent–sample t-test) was widely used in the survey. Further, not only t-test (Independent–sample t-test) but also ANOVA tests (One-Way ANOVA Test) also will be used in Survey 1 and 2. However, all of test data must be normally distributed when researchers do t-test and ANOVA tests. On balance, the research will be proposed to adopted independent–sample t-test and one-way ANOVA tests as two main parametric test methods. One the other hand, if data is normally distributed, test method will use nonparametric test such as Kruskai-Wallis test (independent- sample kruskai-wallis).

3.6 Summary

This chapter elaborated on the research methodology of this study which is based on a quantitative method design used for data obtainment and analysis. The exploratory sequential quantitative method was considered as the most suitable method design for this study to understand the research problem. Two surveys, namely, pilot study (Survey 1) and main study (Survey 2) were used in present study. In quantitative phase of the study, the visual effect of Chinese characters on taste perception are analysed by passing scale questionnaires to the respondents. Moreover, all the hypotheses and collected data in this study were used to analyse to answer the research questions. Four main shapes (Angular, Rounded and Strong, Thin) and three different levels of brightness including high brightness, middle brightness and low brightness (Yellow, Red and Black) are the variables of quantitative phase of this study.

3.7 Research Design

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                    │  Research Methodology   │
                    └─────────────────────────┘
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                    ┌─────────────────────────┐
                    │  Quantitative Research  │
                    └─────────────────────────┘
                                │
                    ┌─────────────────────────┐
                    │  Review of Literature   │
                    └─────────────────────────┘
                                │
                    ┌─────────────────────────┐
                    │  Survey 1: pilot study  │
                    └─────────────────────────┘
                                │
        ┌─────────────────────────────────────────────┐
        │ 1. The crossmodal correspondences test between│
        │ Chinese character shapes and tastes perception.│
        └─────────────────────────────────────────────┘
                                │
  ┌──────────┐   ┌─────────────────────────────┐
  │Question 1│───│  Seven research hypotheses  │
  └──────────┘   └─────────────────────────────┘
                                │
              ┌─────────────────────────────────┐
              │ Survey 1 (questionnaire survey) │
              └─────────────────────────────────┘
                                │
                  ┌─────────────────────────┐
                  │  Collect Data (primary) │
                  └─────────────────────────┘
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                        ┌──────────┐
                        │   SPSS   │
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                      ┌──────────────┐
  ┌───────────┐       │ Test Results │
  │ Objective │       └──────────────┘
  └───────────┘               │
                  ┌─────────────────────────┐
                  │  Survey 2: main study   │
                  └─────────────────────────┘
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        │ 2. The crossmodal correspondences test between the│
        │ brightness of Chinese character and tastes perception.│
        └─────────────────────────────────────────────┘
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        │ 3. The crossmodal correspondences test between │
        │ Chinese character shape-brightness congruency and│
        │ tastes perception.                             │
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 │Question 1││Hypotheses││Question 2││Hypotheses│
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                                │
              ┌─────────────────────────────────┐
              │ Survey 2 (questionnaire survey) │
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                        │   SPSS   │
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                      ┌──────────────┐
                      │ Test Results │
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                   ┌──────────────────────┐
                   │ Analyze & Discuss Data│
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                        │ Summary  │
                        └──────────┘
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CHAPTER 4: DATA ANALYSIS AND DISCUSSION

4.1 Introduction

Previous studies demonstrated that the crossmodal correspondences between different shapes/colours and different tastes had significant differences. In this study, the data of the two survey studies will be specifically analysed in Chapter four.

In Survey 1, data analysis is divided into four major branch parts. The first part of data analysis consists of mean score comparison in the intense taste between the two groups of Chinese characters (five angular typefaces as one group, five rounded typefaces as another group). The second part of data analysis presents the mean scores comparison in the mild taste between the two groups (angular and rounded Chinese character). The third part compare mean scores between the two groups (angular and rounded Chinese character), which involved four basic tastes (sour, bitter, salty, sweet), unlike above only one taste. The last part is a comparison among the different Chinese characters (from thin to strong) in the intensity level of taste. However, it is different from the other parts, because the strong or bold shape and the thin shape typefaces are research objectives and independent variable is more than two groups or two mean scores.

In Survey 2, data analysis is similar to comparing the data of Survey 1. It is still the data comparison in different tastes. However, here has six major branch parts. Part 1 is a comparison of the intense taste scores among three different brightness typefaces (low brightness, middle brightness, high brightness). Part 2 is the comparison of the mild taste scores among three different brightness typefaces (low brightness, middle brightness, high brightness). Part 3 is about comparison of the intense taste scores between low brightness angular Chinese character and high brightness angular Chinese character. Part 4 is about comparison of the intense taste scores between low brightness angular typeface and low brightness rounded typeface. Part 5 is about comparison of the

mild taste scores between low brightness rounded typeface and high brightness rounded typeface. In part 6, it is about comparison of the mild taste scores between high brightness angular typeface and high brightness rounded typeface.

4.2 The Data Analysis of The Shape of Chinese Character in Different Tastes

In this section, due to questionnaire recovery, only 132 samples have been selected for the data analysis. 132 samples include 90 females and 42 males. The first three parts are the analysis of the different tastes scores between the two independent variables (angular Chinese character and rounded Chinese character). Independent–sample t-test was used to compare between the two independent variables. Due to involving two or more independent variables, one-way ANOVA test was used in last part. It is noteworthy that the data of each group must be normally distributed. Thus, each group must do a normally distributed analysis first. Normality of data can be identified using Kolmogorov-Smirnov test, Normal probability plot test (Q-Q plot) and other tests. However, if data is not normality distributed, nonparametric test will be conducted.

4.2.1 Intense taste analysis of Chinese character shapes (angular and rounded)

Part 1 is related to mean scores comparison in the intense taste between the two groups (angular Chinese character and rounded Chinese character). The initial requirement is to do a normal distribution analysis for angular Chinese character and rounded Chinese character, respectively. The results of normal distribution test are presented in Table 4.1.

Table 4.1: Results of normality test in the intense taste (angular data and rounded data)

Taste	Shape	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
		Statistic	df	Sig.	Statistic	df	Sig.
Intense score	Angular	.071	132	.097 *	.981	132	.061 *
	Rounded	.064	132	.200 *	.993	132	.732 *

Note. * $p > .05$

In terms of the Kolmogorow-Smirnow[a] and Shapiro-Wilk test, Chua (2013 p. 126) also support a fact that data is normally distributed if the tests are statistically insignificant (the tests will be statistically insignificant if $p > .05$). According to statistical software (SPSS) calculation, the results of normality test showed that angular Chinese character (K-S sig=.097, df =132, S-W sig=.061) and rounded Chinese character (K-S sig=.200, df =132, S-W sig=.732) are statistically insignificant ($p > .05$) in the intense taste test. Therefore, two sets of data are normally distributed. Therefore, parametric test can be used for compariing angular typeface and rounded typeface.

Unlike K-S test and S-W test, Q-Q plot is a graphical test method. Normal probability plot (Q-Q plot) is another important normality test method, in which each data obtained is paired with a value from the normal distribution represented by the straight line.

In order to ensure accuracy, Q-Q plot was used to check normality distribution again. Two Q-Q plots include the data of angular Chinese character (see Figure 4.1) and the data of rounded Chinese character (see Figure 4.2). As a result, this test further confirmed that two sets of data are normally distributed, as score points approximately lie on a line.

Figure 4.1, Q-Q plot of angular Chinese characters (intense taste)
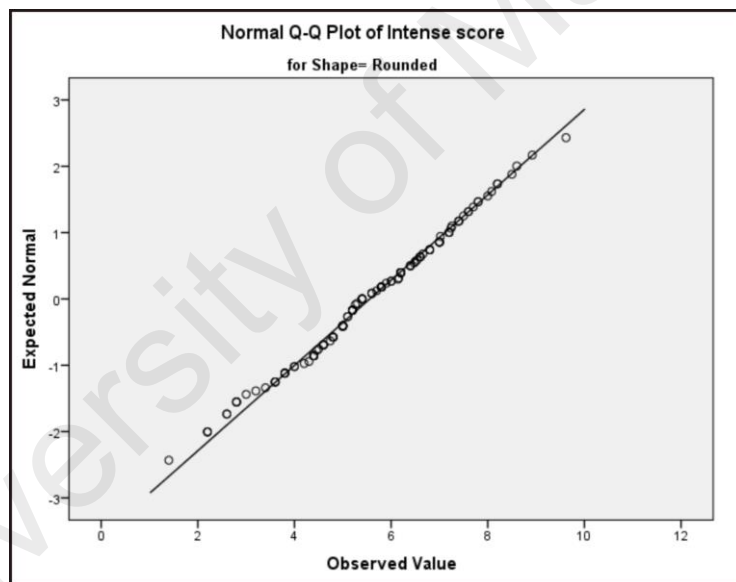
Figure 4.2, Q-Q plot of rounded Chinese characters (intense taste)

Based on the test results of normal distribution, the independent sample t-test is used as a specific parametric test method to compare between two mean scores. Statistical results via the SPSS program revealed that there is a significant difference between angular shape (Chinese character) and rounded shape (Chinese character) in the intense taste (see Table 4.2. for a summary of these statistical results).

Table 4.2: Results of t-test in the intense taste between angular Chinese character and rounded Chinese character

Taste	shape	N	Mean	Std. Deviation	Std. Error Mean
Intense score	Angular	132	5.99	1.70	0.15
	Rounded	132	5.56	1.55	0.14

	Levene's Test for Equality of Variances		t-test for Equality of Mean				
	F	Sig.	t	df	Sig. (2-taild)	Mean Difference	Mean Error Difference
Equal variances assumed	.46	.496	2.17	262	.031 *	.43	.20

Note. * $p < .05$

Some books have clearly defined that the value is significant difference if $p < .05$ (e.g., Chua, 2013). In Part 1, the independent–sample t-test results are statistically significant (t =2.17, df =262, $p < .05$). Here, the *p-value* .031 is smaller than .05. There is a significant difference between angular Chinese character and rounded Chinese character in the intense taste. Besides, the mean difference value of .43 shows that the mean score of angular Chinese character (mean score =5.99, SD =1.70) has a greater visual effect on the intense taste assumption which is compared to the mean score of rounded Chinese character (mean score = 5.56, SD =1.55).

4.2.2 Mild taste analysis of Chinese character shapes (angular and rounded)

In mild taste test, the process of data analysis is similar Normal distribution analysis is a prerequisite for t-test. The data of angular Chinese character and the data of rounded Chinese character are analysed separately. The results obtained from the SPSS program and the details are shown in Table 4.3.

Table 4.3: Results of normality test in the mild taste (angular data and rounded data)

Taste	Shape	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
		Statistic	df	Sig.	Statistic	df	Sig.
Mild score	Angular	.047	132	.200 *	.987	132	.230 *
	Rounded	.055	132	.200 *	.988	132	.098 *

Note. * $p > .05$

From the data of angular Chinese character, the test of normality showed that the results are statistically insignificant (K-S sig=.200, S-W sig=.230, df =132). It means that the data (angular scores) in the mild taste is normally distributed at $p < .05$. From the data of rounded Chinese character, the test result of normality is also statistically insignificant (K-S sig=.200, S-W sig=.098, df =132). Due to $p < .05$, the data of rounded Chinese character is normally distributed in the mild taste.

From the data analyse, no matter angular Chinese characters (see Figure 4.3) or rounded Chinese characters (see Figure 4.4), the data (score points) is represented by the straight line. Although it does not mean all of data (score points) or each data (score point), most of score points approximately lie on a straight line. In this case, two sets of data are normally distributed. Thus, two Q-Q plots (angular typeface and rounded typeface) belong to normally distributed Q-Q plot.
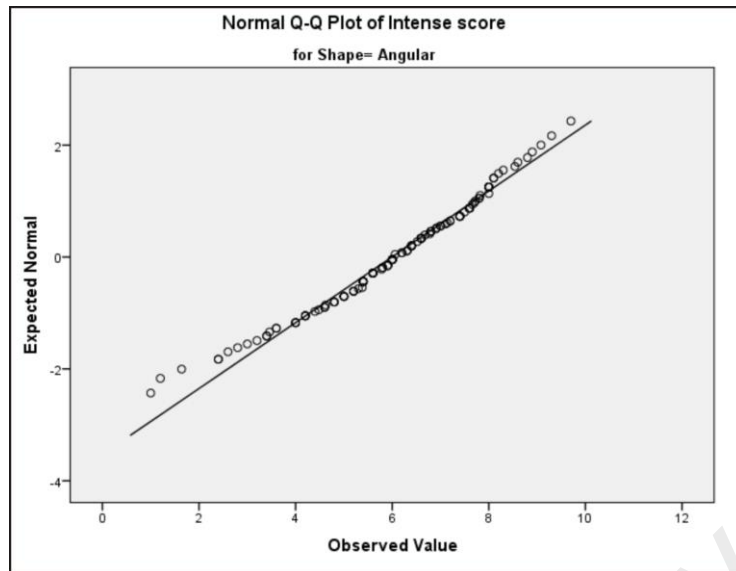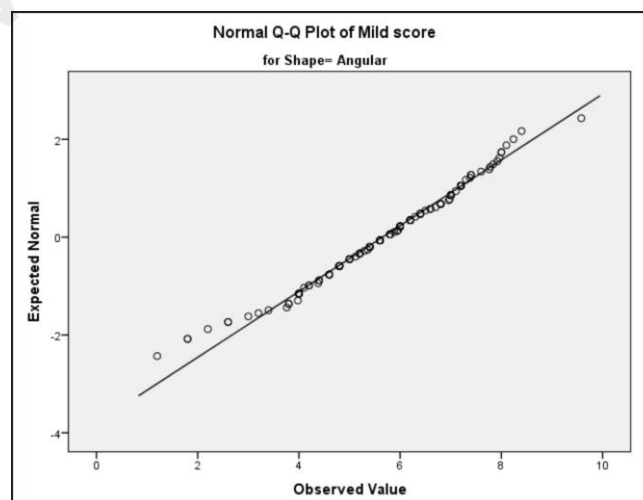

Figure4.3, Q-Q Plot of angular Chinese characters (mild taste)
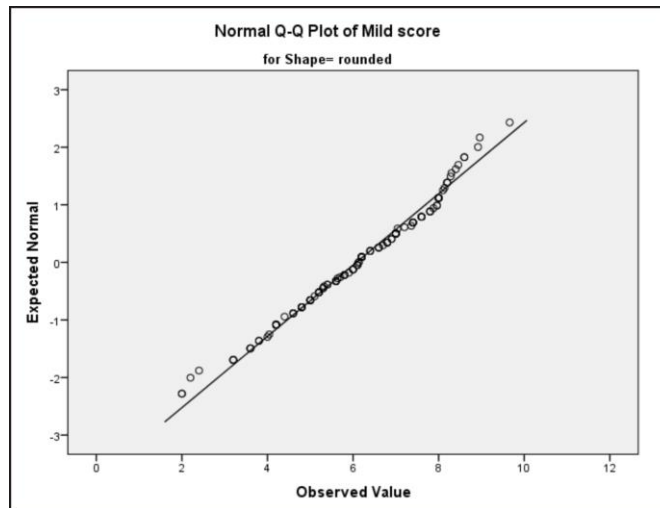
Figure4.4, Q-Q Plot of rounded Chinese characters (mild taste)

According to above test and analysis, t-test conditions are fulfilled. In part 2, independent sample t-test is again employed as a specific method to analyse data, because this part is still related to the data comparison between angular Chinese characters and rounded Chinese characters. The results of t-test in the mild taste data are presented in Table 4.4.

Table 4.4: Results of t-test in the mild taste data between angular Chinese character and rounded Chinese character

Taste	shape	N	Mean	Std. Deviation	Std. Error Mean
Mild score	Angular	132	5.65	1.49	1.29
	Rounded	132	6.07	1.62	1.41

	Levene's Test for Equality of Variances		t-test for Equality of Mean				
	F	Sig.	t	df	Sig. (2-taild)	Mean Difference	Mean Error Difference
Equal variances assumed	1.42	.234	-2.22	262	.027 *	-.42	-.19

Note. * *p* <.05

The results of Table 4.4 show that there is a significant difference between angular Chinese characters and rounded Chinese characters in the mild taste. It is clear that the *p-value* .027 is smaller than .05. The results are statistically significant (t =-2.22,

df =262, *p* <.05). Owing to the t =-2.22, the mean difference value of -.42 shows that the mean score of angular Chinese character (mean score =5.65, SD =1.49) is smaller than rounded Chinese character (mean score =6.07, SD =1.62). View from another perspective, the visual effect of different typeface shapes indicated that the rounded Chinese character has a greater visual effect on the mild taste assumption which is compared to angular Chinese character. The mild level (mean score =6.07) of rounded Chinese typeface is higher than angular typeface.

4.2.3 Four basic tastes analysis of Chinese character shapes (angular and rounded)

In terms of the four basic tastes test and analysis, there is no doubt that analysis process in this part is more complicated than the previous two parts. The order of test and analysis will follow sour, bitter, salty, and sweet. It means that four basic tastes are analysed separately. The scope of the analysis is still the comparison between angular Chinese character and rounded Chinese character. Hence, t-test is still the only test method. Moreover, normality test is necessary.

Sour taste

In view of the above analysis, it is still the comparison between angular Chinese typeface and rounded Chinese typeface. Only two independent variables will use t-test to test significance level like before. Thus, as a prerequisite, normality test is indispensable. The results of K-S test and S-W test are shown in Table 4.5.

Table 4.5: Results of normality test in the sour taste (angular data and rounded data)

Taste	Shape	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
		Statistic	df	Sig.	Statistic	df	Sig.
Sour score	Angular	.069	132	.200 *	0.987	132	.262 *
	Rounded	.067	132	.200 *	0.988	132	.304 *

Note. * $p > .05$

The sour taste test through SPSS program analysis indicated that the data of angular Chinese character is statistically insignificant (K-S sig=.200, S-W sig=.262, df =132) and the data of rounded Chinese character is also statistically insignificant (K-S sig=.200, S-W sig=.304, df =132). Thus, all data are normally distributed.

In angular typeface (Q-Q Plot), the data (score point) is represented by the straight line (see Figure 4.5). In rounded typeface (Q-Q Plot), the data (score point) is represented by the straight line as well (see Figure 4.6). Overall, both Q-Q Plots indicate normality in sour test. Meanwhile, two Q-Q plots have shown that most of data (score points) approximately lie on a straight line.

Figure 4.5, Q-Q Plot of angular Chinese characters (sour taste)

Normal Q-Q Plot of Sour score
for Shape= Rounded
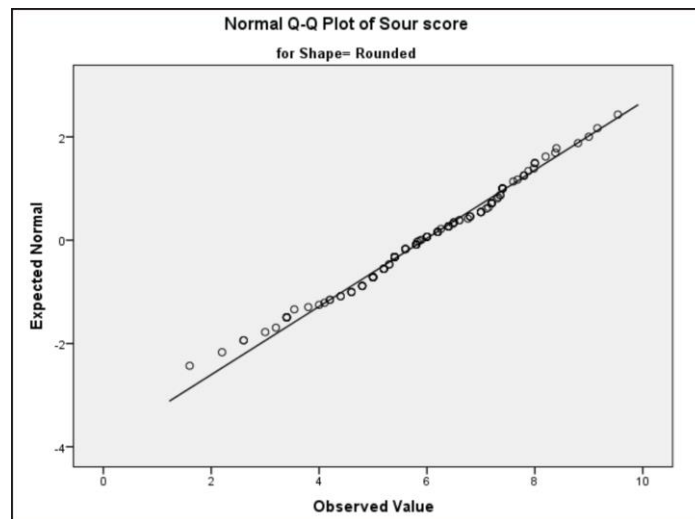
Figure 4.6, Q-Q Plot of rounded Chinese characters (sour taste)

In short, both angular Chinese character or rounded Chinese character, statistical test (K-S test, S-W test) and graphic (Q-Q plot) have revealed all of the data (scores) in sour taste are normally distributed.

Based on the normal distribution, parametric test was applied to data analysis, namely, t-test. The results of t-test on the sour taste are summarized in Table 4.6.

Table 4.6: Results of t-test in the sour taste between angular Chinese character and rounded Chinese character

Taste	shape	N	Mean	Std. Deviation	Std. Error Mean
Sour score	Angular	132	5.58	1.45	1.26
	Rounded	132	5.94	1.51	1.32

	Levene's Test for Equality of Variances		t-test for Equality of Mean				
	F	Sig.	t	df	Sig. (2-taild)	Mean Difference	Mean Error Difference
Equal variances assumed	.57	.452	-1.99	262	.047 *	-.36	.18

Note. * *p* <.05

In part three, the t-test results are statistically significant (t =-1.99, df =262, *p* <.05). The *p-value* .047 is smaller than .05. There is no doubt a significant difference between angular Chinese character and rounded Chinese character in the sour taste test. Furthermore, the t value (t =-1.99) is negative. Meanwhile, the mean difference of -.36

64

shows that the mean score of angular Chinese character (means score=5.58, SD =1.45) is smaller than angular Chinese character (means score=5.94, SD =1.51), that is to say, the rounded Chinese typeface (means score =5.94) has a greater visual effect on the sour assumption when compare with angular Chinese typeface (means score=5.58).

Bitter taste

The result of bitterness test are quite different from the previous taste tests. The details will be analyzed in normal distribution test and t-test. The results of K-S test and S-W test are shown in Table 4.7.

Table 4.7: Results of normality test in the bitter taste (angular data and rounded data)

Taste	Shape	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
		Statistic	df	Sig.	Statistic	df	Sig.
Bitter score	Angular	.075	132	.065 *	.984	132	.133 *
	Rounded	.063	132	.200 *	.986	132	.205 *

Note. * *p* >.05

In Table 4.7, the data of angular Chinese character showed that the data is statistically insignificant (K-S sig=.065, S-W sig=.133, df =132). The data of rounded Chinese character showed that the result is statistically insignificant (K-S sig=.200, S-W sig=.205, df =132). Thus, two sets of data are normally distrusted at *p* >.05.

In addition, a graphic device, namely Q-Q plot, further represented that two sets of data are normally distributed. The data of angular Chinese (see Figure 4.7) or the data of rounded Chinese character (see Figure 4.8) is represented by the straight line. Most of score points are lie on a line.
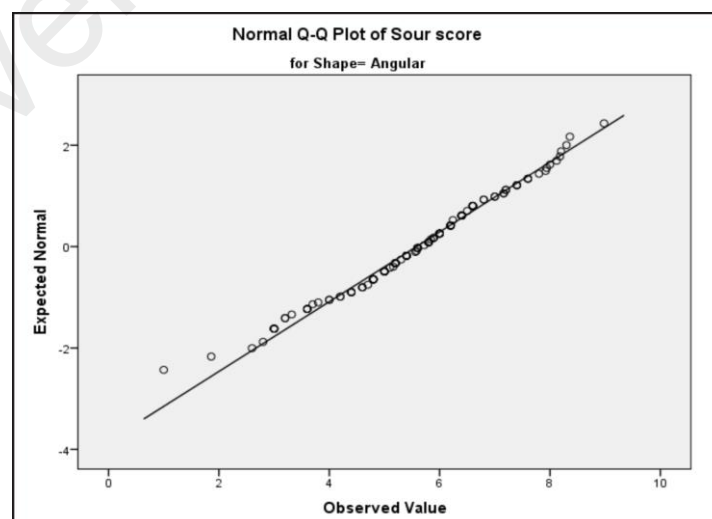
Figure 4.7, Q-Q Plot of angular Chinese characters (bitter taste)
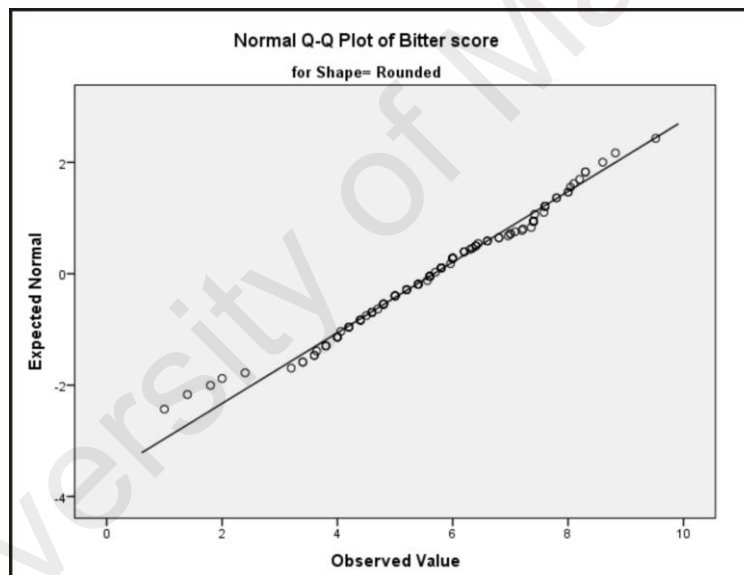
Figure 4.8, Q-Q Plot of rounded Chinese characters (bitter taste)

Although all of the data (score points) are normally distributed, the results of t-test are different from other tastes t-test results. The results of t-test on the bitter taste are presented in Table 4.8.

Table 4.8: Results of t-test in the bitter taste between angular Chinese character and rounded Chinese character

Taste	shape	N	Mean	Std. Deviation	Std. Error Mean
Bitter score	Angular	132	5.59	1.70	1.48
	Rounded	132	5.67	1.58	1.37

| | Levene's Test for Equality of Variances | | t-test for Equality of Mean | | | | |
	F	Sig.	t	df	Sig. (2-taild)	Mean Difference	Mean Error Difference
Equal variances assumed	.20	.655	-.38	262	.702	-.08	.20

Note. * $p <.05$

The results of t-test on the bitter taste are statistically insignificant (t =-.38, df=262, $p >.05$), and the *p-value* .702 is more than *p-value* .05. There is no significant difference between angular Chinese character and rounded Chinese character in the bitter taste. This means that the different typeface shapes (angular and rounded) are without any different visual effect on the bitter taste assumption. Thus, there is no crossmodal relationship between typeface shapes and bitter taste perception. Besides, the mean difference value of -.08 have revealed that the mean score between angular Chinese character (means score =5.59, SD =1.70) and rounded Chinese character (means score =5.67, SD =1.58) is not significant.

Salty taste

In salty taste test, the first step is normality test and the second step is t-test. Here, normality test for data distribution are shown in Table 4.9.

Table 4.9: Results of normality test in the salty taste (angular data and rounded data)

Taste	Shape	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
		Statistic	df	Sig.	Statistic	df	Sig.
Salty score	Angular	.059	132	.200 *	.992	132	.653 *
	Rounded	.065	132	.200 *	.984	132	.138 *

Note. * $p > .05$

First, according to SPSS program analysis, the results of normality test showed that two sets of data are normally distributed in the salty taste test. In Table 9, the data of angular Chinese character is statistically insignificant (K-S sig=.200, S-W sig=.653, df =132), and the data of rounded Chinese character is also statistically insignificant (K-S sig=.200, S-W sig=.138, df =132) at $p > .05$.

Second, normal Q-Q plot was used to do graphical checking. From the Q-Q plots, both angular typeface data (see Figure 4.9) and rounded typeface data (see Figure 4.10) are separately represented by the straight line. Both Q-Q plots are normally distributed in here. Furthermore, above normality test has indicated that the *p-value* of angular is greater than the *p*-value of rounded. In Q-Q plot, angular data (score points) line is more visibly straight than rounded (score points) data line.
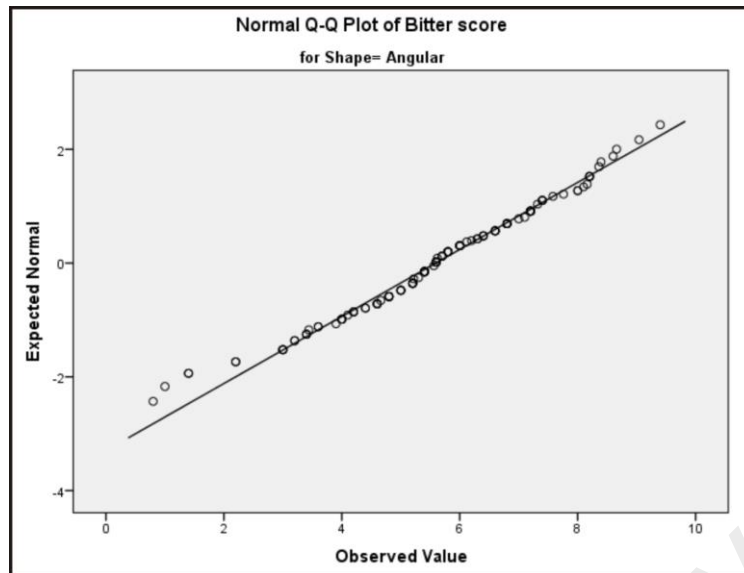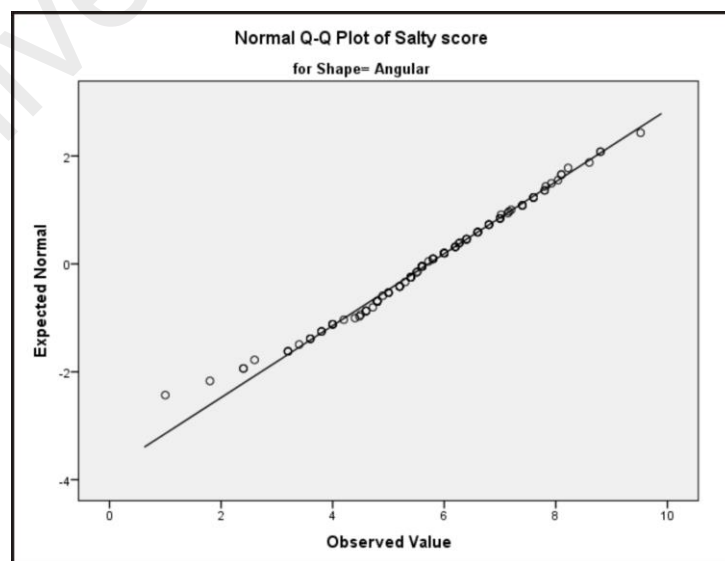

Figure 4.9, Q-Q Plot of angular Chinese characters (salty taste)
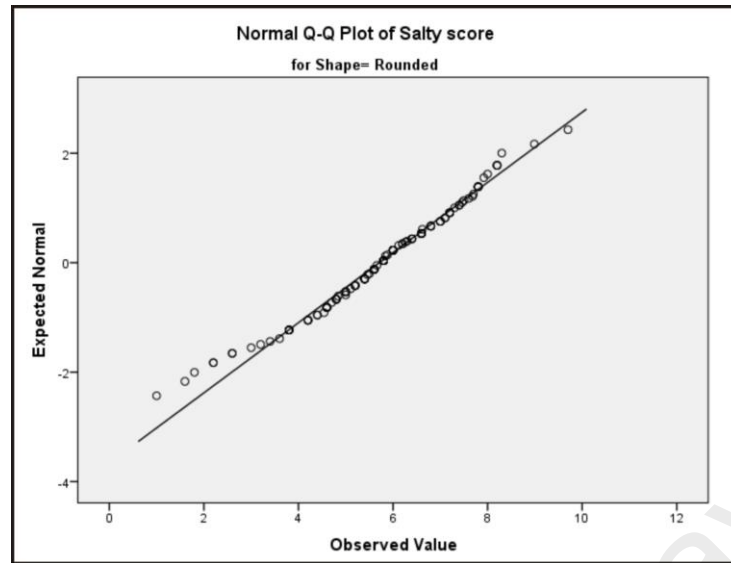
Figure 4.10, Q-Q Plot of rounded Chinese characters (salty taste)

Finally, it is undeniable that last step is t-test. Surprisingly, t-test on the salty taste shows a similar result. More specifically, it is similar the results of the bitter taste. Table 4.10 is the results of t-test on the bitter taste

Table 4.10: Results of t-test in the salty taste between angular Chinese character and rounded Chinese character

Taste	shape	N	Mean	Std. Deviation	Std. Error Mean
Salty score	Angular	132	5.72	1.50	1.30
	Rounded	132	5.71	1.56	1.36

	Levene's Test for Equality of Variances		t-test for Equality of Mean				
	F	Sig.	t	df	Sig. (2-taild)	Mean Difference	Mean Error Difference
Equal variances assumed	.09	.765	.03	262	.979	.00	.19

Note. * *p* <.05

In Table 4.10, the *p-value* .979 is greater than *p -value* .05. The results of t-test is statistically insignificant (t =.03, df =262, *p* >.05). There is no significant difference between angular Chinese character and rounded Chinese character in the salty taste.

69

Further, the mean difference value is .00. Basically, angular Chinese character (mean score =5.72, SD =1.50) and rounded Chinese character (mean score =5.71, SD =1.56) is indicated same result. Therefore, the shapes of Chinese characters (angular and rounded) in the salty taste do not have statistical significance and tendentious.

Sweet taste

In the sweet taste test, normal distribution as t-test prerequisite is first step. Relevant data are presented in Table 4.11

Table 4.11: Results of normality test in the sweet taste (angular data and rounded data)

Taste	Shape	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
		Statistic	df	Sig.	Statistic	df	Sig.
Sweet score	Angular	.051	132	.200 *	.990	132	.423 *
	Rounded	.061	132	.200 *	.993	132	.741 *

Note. * $p >.05$

No matter the data of angular Chinese Character (K-S sig=.200, S-W sig=.423, df =132) or the data of rounded Chinese character (K-S sig=.200, S-W sig=.741, df =132), two sets of data in the sweet taste test are normally distributed ($p >.05$). Their results are insignificant. Meanwhile, Table 4.11 also shows that the *p-value* (S-W test) of the two groups is larger than above most taste test results.

Additionally, normal Q-Q plot as a graphical device presented the results more clearly and directly. To start with, both Q-Q plots are normally distributed. Besides, the angular data (see Figure 4.9) and the rounded data (see Figure 4.9) in Q-Q plot have shown that the date is represented by the straight line. The most important is that most of data (score points) lie on a line and the data line appears straighter.
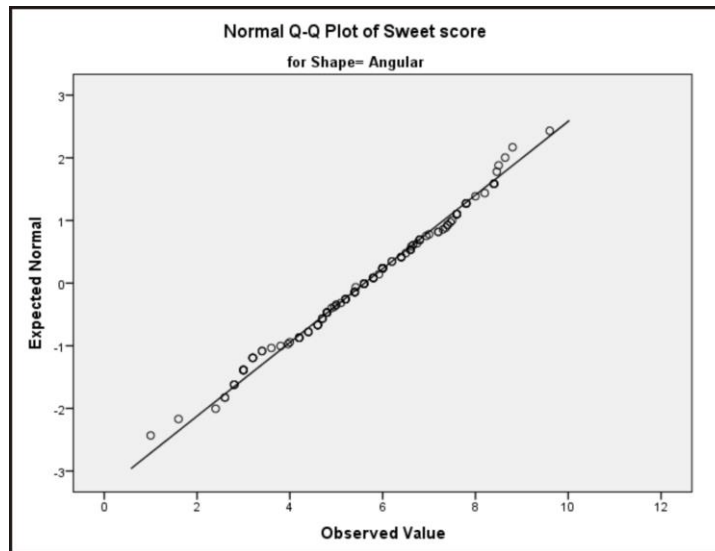
Figure 4.11, Q-Q Plot of angular Chinese characters (sweet taste)
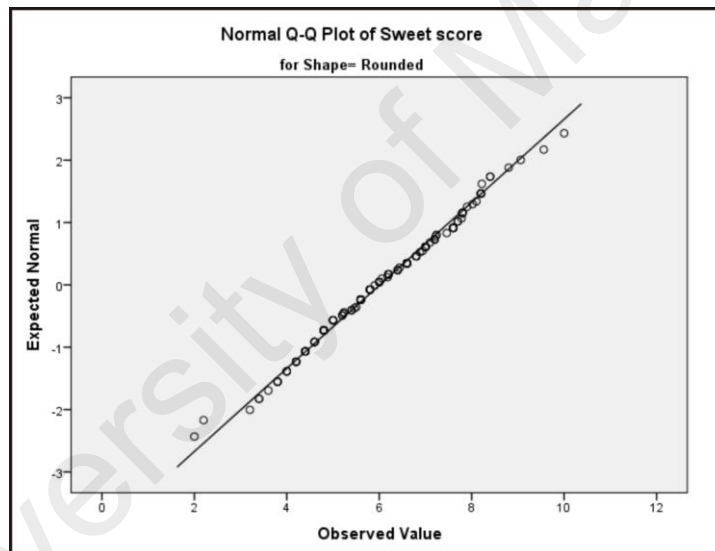
Figure 4.12, Q-Q Plot of rounded Chinese characters (sweet taste)

From the previous analysis, in the bitter taste test, there is no significant difference between angular Chinese character and rounded Chinese character. However, the effects of typeface shapes in the sweet taste test indicated difference once again. (see Table 4.12). Sweet taste has tendentious in different typeface shapes.

Table 4.12: Results of t-test in the sweet taste between angular Chinese character and rounded Chinese character

Taste	shape	N	Mean	Std. Deviation	Std. Error Mean
Sweet score	Angular	132	5.61	1.70	1.48
	Rounded	132	6.01	1.50	1.31

	Levene's Test for Equality of Variances		t-test for Equality of Mean				
	F	Sig.	t	df	Sig. (2-taild)	Mean Difference	Mean Error Difference
Equal variances assumed	1.56	.212	-2.04	262	.043 *	-.40	.20

Note. * *p* <.05

Obviously, the *p-value* .043 is smaller than .05. In fact that the significance level is not very high at *p* =.047. However, the t-test results are significant (t =-2.04, *df* =262, *p* >.05). Because of this, there is a significant difference between angular Chinese character and rounded Chinese character in the sweet taste. Because of t =-2.04, the mean difference value of -.40 reveal that the angular Chinese character (mean score = 5.61, SD = 1.70) is smaller than rounded Chinese character (mean score =6.01, SD = 1.50). Oppositely, the mean score of rounded Chinese character, as matter of fact, is greater than angular Chinese character. Thus, rounded Chinese typeface has a greater visual effect on the sweet taste perception.

4.2.4 Taste intensity level analysis of Chinese character shapes (from thin to strong)

It is not exaggeration to say that this part of the analysis process is the most complex in all data analysis. The previous branch parts are mainly analysis angular Chinese character and round Chinese character in different tastes. In this part, it is about intensity level test and analysis in the taste. Unlike before, research objectives will focus on strong or bold Chinese typeface and thin Chinese typeface. As has been presented above, five different angular typefaces are one group, and five different rounded Chinese characters are another group. Moreover, most importantly is that shape feature

in each group is from thin to strong. In each group, the first two Chinese typefaces were categorized thin typeface, whereas after the two Chinese typefaces were categorized strong/bold typeface (see Figure 3.1). So all typefaces data are selected from angular group and rounded group. In the next test, five angular Chinese typefaces including "angular 1", "angular 2", "angular 3", "angular 4", and "angular 5" (from thin to strong) will be compared and analyzed in different tastes. Five rounded Chinese typefaces including "rounded 1", "rounded 2", "rounded 3", "rounded 4", and "rounded 5" (from thin to strong) are same.

In addition to above changes, test methods have been changed in this part. Independent–sample t-test as only method was used in the previous analysis because of only two mean scores. Here, if all data are normality distributed, the method of one-way ANOVA test will be used to comparison more than two mean scores. If all data are not normality distributed, the method of independent-sample Kruskai-Wallis will be as comparison of two or more independent samples.

As for the tastes, just intense taste is selected for the test and analysis. There are two reasons. First, intense taste can directly observe the intensity level, and second, previous part has been confirmed that there is a correspondence relationship between the shapes (angular and rounded) of Chinese character and intense taste

Intensity level (score) of five angular Chinese characters in the intense taste

In the beginning, five angular Chinese Characters inevitably did a normal distribution test. Hence, normality test results of five angular Chinese typefaces (from thin to strong) are shown in Table 4.13

Table 4.13: Results of normality test in the intense taste (five angular Chinese typefaces)

Taste	Shape	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
		Statistic	df	Sig.	Statistic	df	Sig.
Intense score	Angular 1	.099	132	.003	.972	132	.007
	Angular 2	.150	132	.000	.971	132	.006
	Angular 3	.148	132	.000	.969	132	.004
	Angular 4	.133	132	.000	.963	132	.001
	Angular 5	.104	132	.000	.957	132	.000

Note. * $p > .05$

As is widely accepted, data is normally distributed if the test results are statistically insignificant, namely $p > .05$. In five angular Chinese typefaces, angular1 (K-S sig= .000, S-W sig= .000, df = 132), angular 2 (K-S sig=.001, S-W sig= .027, df = 132), angular 3 (K-S sig= .000, S-W sig=.035, df =132), angular 4 (K-S sig=.000, S-W sig=.005, df =132), and angular 5 (K-S sig=.008, S-W sig=.002, df =132) are significant. All of the angular data are not normally distributed in the intense taste

As a prerequisite of one-way ANOVA test, all of the data must be normally distributed. In view of above analysis, one-way ANOVA test is not allowed, because the p-value is smaller than .05. Therefore, Kruskai-Wallis, a nonparametric test which is used to analyze the data. The results of Kruskai-Wallis (k independent samples) test in the intense taste indicate statistical difference (see Table 4.14)

Table 4.14: Results of Kruskai-Wallis test in the intense taste among five angular Chinese typefaces

	N	Chi-Square	df	Asymp. Sig.
Intense score	660	10.57	4	.032
Smaple1-Sample2	Std. Statistic	Std. Error	Sig.	Adj. Sig.
Angular4-Angular1	9.36	23.29	.688	1.000
Angular1-Angular5	-13	23.29	.577	1.000
Angular2-Angular4	-36.56	23.29	.116	1.000
Angular2-Angular5	-58.90	23.29	.011	.114

Note. * $p < .05$

In the intense taste, the result of five angular typefaces is significant (Chi-Square = 10.57, df = 4, $P < .05$). The *p-value* (Asymp. Sig.) .032 is small than .05 on the whole. There is a difference among five different angular Chinese characters.

If the overall result is significant, data can be compared between the two groups. As previously mentioned, Chinese typeface 1 and 2 belong to thin typeface, whereas Chinese typeface 4 and 5 belong to strong or bold typeface. Therefore, here only selected four different samples for the comparison (see Table 4.14). The results showed that the Adj. *p*-value for Angular4-Angular1, Angular1-Angular5, and Angular2-Angular4 are the same and insignificant (Adj. $p = 1.000$). Although the Adj. *p*-value for Angular2-Angular5 (Adj. $p = 0.114$) is small than other results, it is still insignificant.

In brief, the result is statistically significant *(p-value =.032)* on the whole (five angular Chinese Characters), but there is no significant differences between thin and strong/bold angular Chinese typeface due to Adj. *p-value* more than .05 (Adj. $p > .05$)

Intensity level (score) of five rounded Chinese typefaces in the intense taste

Apart from the five angular Chinese characters, normality test results of five rounded Chinese typefaces (from thin to strong) also are shown in Table 4.15.

Table 4.15: Results of normality test in the intense taste (five rounded Chinese typefaces)

	Shape	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
		Statistic	df	Sig.	Statistic	df	Sig.
Intense score	Rounded1	.112	132	.000	.966	132	.002
	Rounded2	.136	132	.000	.948	132	.000
	Rounded3	.117	132	.000	.945	132	.000
	Rounded4	.107	132	.001	.954	132	.000
	Rounded5	.122	132	.000	.953	132	.000

Note. * $p > .05$

In five rounded Chinese typefaces, it is clearly that most of the *p*-value including rounded 2, rounded 3 and rounded 5 are equal to 0 or less than .05, i.e., K-S sig= .000, S-W sig=.000, df = 132. Moreover, the *p*-value of rounded 1 (K-S sig=.000, S-W sig=.002, df =132) and rounded 4 (K-S sig=.001, S-W sig=.000, df =132) are small than .05 (*p* <.05) as well. Therefore, the data of five rounded Chinese typefaces are not normally distributed in the sour taste.

As a result of the non-normal distribution (*p* <.05), Kruskai-Wallis (k independent samples) is used as a nonparametric test method to analyze the data among the five rounded Chinese typefaces in the intense taste (see Table 4.16).

Table 4.16: Results of Kruskai-Wallis test in the intense taste among the five rounded Chinese typefaces

	N	Chi-Square	df	Asymp. Sig.
Intense score	660	16.21	4	.003
Smaple1-Sample2	Std. Statistic	Std. Error	Sig.	Adj. Sig.
Rounded1-Rounded4	-21.24	23.31	.362	1.000
Rounded1-Rounded5	-60.45	23.31	0.10	.095
Rounded4-Rounded2	55.91	23.31	.016	.165
Rounded5-Rounded2	16.70	23.31	.474	1.000

Note. * *p* <.05

From Table 4.16, the result of five rounded typefaces is statistically significant (Chi-Square =16.21, df =4, *P* <.05). The *p-value* (Asymp. Sig.) .003 is smaller than .05 on the whole. There is a significant difference among the five different rounded Chinese characters (typefaces).

Data can be compared between the thin typeface and strong/bold typeface (thin typeface1, 2 and strong typeface 4, 5) (see Table 4.16). However, the results are the same thin and strong angular Chinese character. All of the data including Rounded1-Rounded4 (Adj. *p* =1.000), Rounded1-Rounded5 (Adj. *p* =.095), Rounded1-Rounded4

(Adj. p =.165), and Rounded2-Rounded5 (Adj. p =1.000) are insignificant. There is no doubt that these data are more than .05 (Adj. p >.05), and there is no significant difference between thin and strong/bold rounded Chinese typeface.

4.3 The Data Analysis of The Shapes and Colors of Chinese Character in Different Tastes

In the shape and color analysis, 152 samples have been selected to do data analysis. 152 samples include 93 females and 59 males. The first two branch parts are the analysis and comparison of different taste scores among the three independent variables (black, yellow and red Chinese typeface). One-way ANOVA test was used to compare more than two independent variables. The next few parts (from three to six) will use independent samples t-test as test method, because the remaining four parts are related to comparison between only the two groups. As a prerequisite for the above parametric test methods, all of data must be normally distributed as usual. On the contrary, test method will use nonparametric test. This section still selected K-S/S-W test and Normal Q-Q plot as normality test methods.

4.3.1 Intense taste analysis of three different level brightness typefaces

This part is related to the comparison of the intense taste among three different color typefaces. In order to exclude the shape factor, all black typefaces are grouped together and all red typefaces and all yellow typefaces as grouped in other group. As mentioned above, it should be noted that the three colours typefaces, black, red and yellow, represent low brightness, middle brightness and high brightness respectively. In other words, this part presents the comparison among three different brightness

typefaces. Normality test is first requirement for one-way ANOVA test. The K-S and

results are presented in Table 4.17.

Table 4.17: Results of normality test in the intense taste among the three different brightness typefaces

Taste	Brightness	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
		Statistic	df	Sig.	Statistic	df	Sig.
Intense score	Black typeface	.52	152	.200 *	.993	152	.673 *
	Red typeface	.65	152	.200 *	.991	152	.438 *
	Yellow typeface	.61	152	.200 *	.993	152	.687 *

Note. * $p > .05$

In the intense taste, the data of three different brightness typefaces are insignificant. Three sets of data, low brightness typeface (K-S sig=.200, S-W sig=.673, df =152), middle brightness typeface (K-S sig=.200, S-W sig=.438, df =152) and high brightness typeface (K-S sig=.200, S-W sig=.687, df =152), are greater than *p*-value .05 respectively. Thus, all of the data are normally distributed ($p > .05$).

According to the above statistical analysis, the *p-value* is far more than .05. Q-Q plot as a visual device presents a more intuitive result. No matter low brightness typeface (see Figure 4.13) or high brightness typeface (see Figure 4.15) even red typeface (see Figure 4.14), data (score points) were all approximately lie on the line.
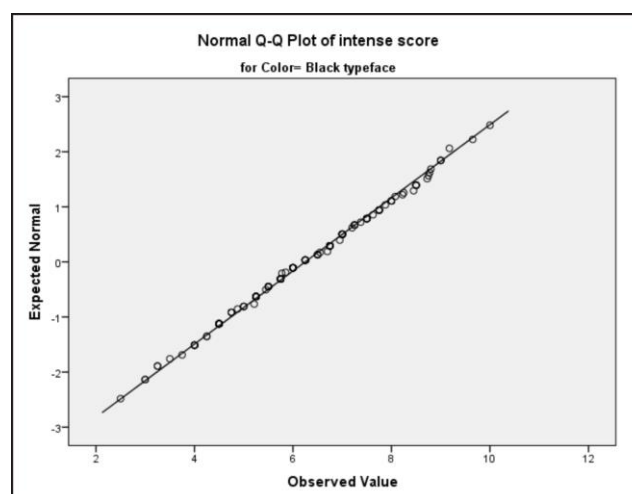
Figure 4.13, Q-Q Plot of low brightness Chinese typeface (intense taste)

Figure 4.14, Q-Q Plot of middle brightness Chinese typeface (intense taste)

Figure 4.15, Q-Q Plot of high brightness Chinese typeface (intense taste)

Based on the above normality test results, the ANOVA test was used to compare

the three mean scores. The ANOVA test results are shown in Table 4.18

Table 4.18: Results of ANOVA test in the intense taste among the three different brightness typefaces

	N	Mean	Std. Deviation	Std. Error
Black typeface	152	6.25	1.51	.12
Red typeface	152	5.92	1.53	.12
Yellow typeface	152	5.04	1.77	.14
Total	456	5.74	1.68	.08
Intense score	Levene Statistic	df1	df2	sig.
	2.33	2	453	.099
	Sum of squares	df	F	Sig.
Between groups	117.88	2	22.77	.000 *
Within groups	1172.39	453		
Total	1290.27	455		

Note. * $p < .05$ (F sig)

In this case, the one-way ANOVA test results show that the *p-value*.000 is smaller than .05. The value of F (df = 2, 453 $p < .05$) = 22.77 is significant. Thus, there is a very significant difference in the intense taste among the three different brightness typefaces. The mean scores for the three different colours typefaces, it is observed that, the mean score of low brightness typeface (Mean =6.25, SD =1.51) is far higher than other two groups. Besides, middle brightness typeface has middle mean score (Mean =5.92, SD =1.53), whereas high brightness typeface has the lowest mean score (Mean =5.04, SD =1.77).

In order to make the analysis more specific, the next step is post hoc multiple comparisons. Meanwhile, "Tukey HSD" as a specific method will be used in post hoc multiple comparisons, because the sample size of each group is the same (N =152). In intense taste, the results are shown in Table 4.19.

Table 4.19: Results of post hoc multiple comparisons (Tukey HSD) in the intense taste among the three different brightness typefaces

Taste	(I) brightness	(J) brightness	Mean Difference (I-J)	Std. Error	Sig.
Intense score Tukey HSD	Black typeface	Red typeface	.32	.18	.189
		Yellow typeface	1.20	.18	.000 *
	Red typeface	Black typeface	-.32	.18	.189
		Yellow typeface	.88	.18	.000 *
	Yellow typeface	Black typeface	-1.20	.18	.000 *
		Red typeface	-.88	.18	.000 *

* The mean difference is significant at the 0.05 level

The Tukey post hoc multiple comparisons test results show that a significant difference between the intense taste mean score of high brightness typeface and the intense taste mean score of low brightness typeface and middle brightness typeface (the significance value is smaller than .05). Additionally, there is no significant difference between low typeface and red/middle typeface.

4.3.2 Mild taste analysis of three different color typefaces

In terms of the current part of the test, it is about the mild taste perception. Test process is similar to three different brightness typefaces on intense taste test. The results of normality test are indicated in Table 4.20.

Table 4.20: Results of normality test in the mild taste among the three different brightness typefaces

	Brightness	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
		Statistic	df	Sig.	Statistic	df	Sig.
Intense score	Black typeface	.57	152	.200 *	.990	152	.376 *
	Red typeface	.48	152	.200 *	.991	152	.488 *
	Yellow typeface	.46	152	.200 *	.990	152	.375 *

Note. * *p* >.05

In the mild taste, low brightness typeface (K-S sig=.200, S-W sig=.376, df =152), middle brightness typeface (K-S sig=.200 S-W sig=.488, df =152) and high brightness typeface (K-S sig=.200, S-W sig=.370, df =152) are greater than *p-value* .05. Clearly in this case, each set of data is statistically insignificant and therefore normally distributed.

In terms of the normal distribution of the data, it is clearer that the data distribution of middle brightness typeface is better than other two sets of data distribution, according to their Q-Q plots. Their Q-Q plots, low brightness typeface, middle brightness typeface and high brightness typeface, were presented in Figure 4.16, Figure 4.17 and Figure 4.18 respectively.
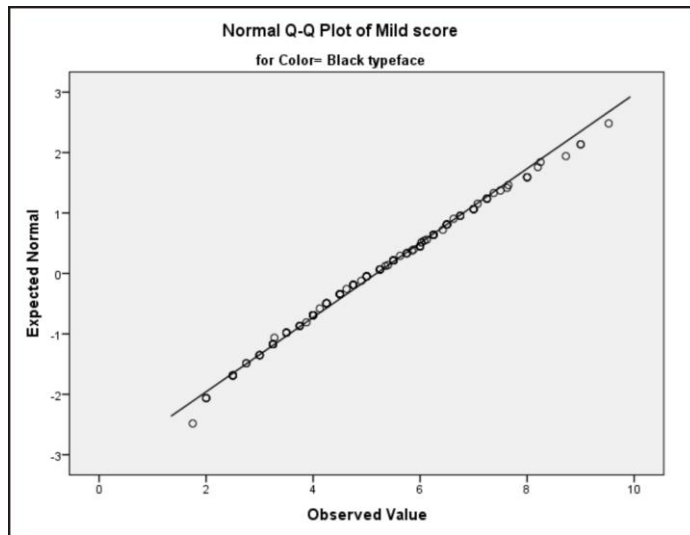
Figure 4.16, Q-Q Plot of low brightness Chinese typeface (mild taste)
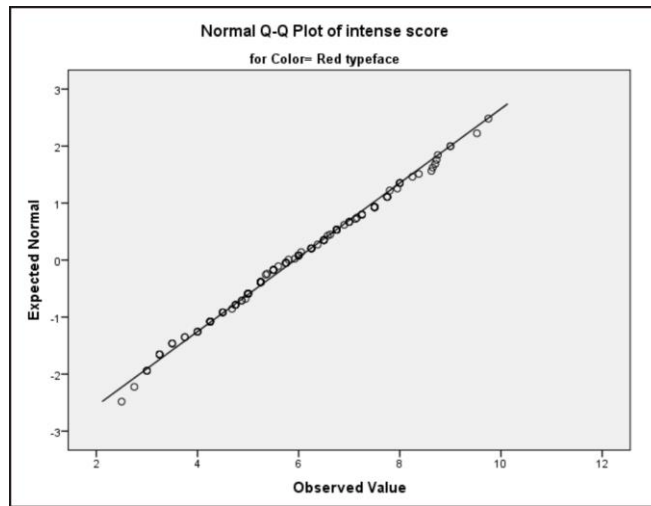

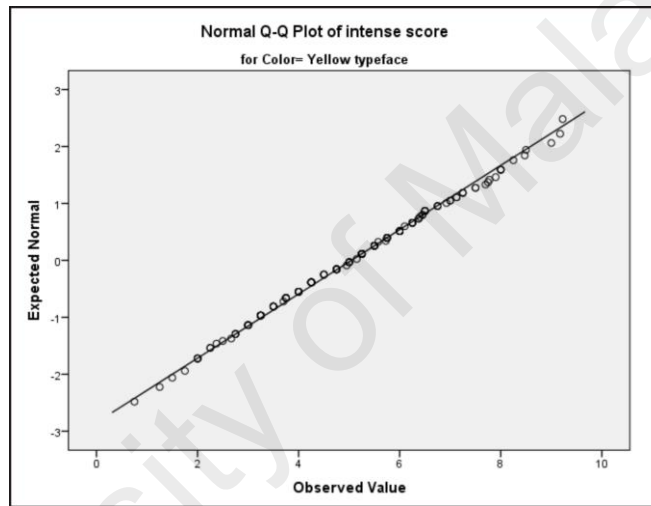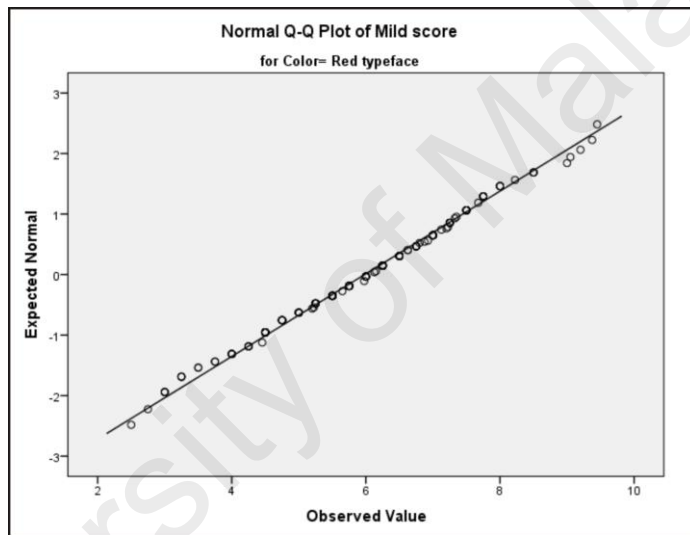Figure 4.17, Q-Q Plot of middle brightness Chinese typeface (mild taste)
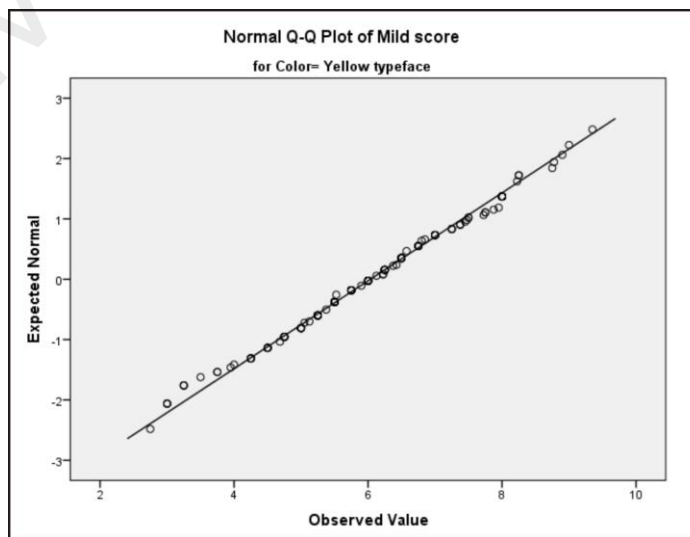
Figure 4.18, Q-Q Plot of high brightness Chinese typeface (mild taste)

In view of the above analysis, the ANOVA test as parametric test is used in the comparison of the three different brightness typefaces in the mild taste. The ANOVA test calculation results are summarized in Table 4.21.

Table 4.21: Results of ANOVA test in the mild taste among the three different brightness typefaces

	N	Mean	Std. Deviation	Std. Error
Black typeface	152	5.18	1.62	.13
Red typeface	152	5.98	1.46	.12
Yellow typeface	152	6.03	1.37	.11
Total	456	5.73	1.54	.07
Mild score	Levene Statistic	df1	df2	sig.
	2.71	2	453	.068
	Sum of squares	df	F	Sig.
Between groups	69.38	2	15.61	.000 *
Within groups	1006.98	453		
Total	1076,36	455		

Note. * $p < .05$ (F sig)

In Table 4.21, the *p-value* .000 is smaller than .05. Clearly, the value of F (df = 2, 453 $p < .05$) =15.61 is significant. This indicates that there is a significant difference among three different brightness typefaces in the mild taste. High brightness typeface has highest mean score (Mean =6.03, SD =1.37), whereas low brightness typeface has lowest mean score (Mean =5.18, SD =1.62). Red typeface remains the middle mean score (Mean =5.98, SD =1.46) in the three different brightness typefaces.

Based on the result of significant difference, "Tukey HSD" as a specific method is used in post hoc multiple comparisons like Part one. Table 4.22 is calculating the results of post hoc multiple comparisons in Part two.

Table 4.22: Results of post hoc multiple comparisons (Tukey HSD) in the mild taste among the three different color typefaces

	(I) brightness	(J) brightness	Mean Difference (I-J)	Std. Error	Sig.
Mild score Tukey HSD	Black typeface	Red typeface	-.80	.17	.000 *
		Yellow typeface	-.85	.17	.000 *
	Red typeface	Black typeface	.80	.17	.000 *
		Yellow typeface	-.05	.17	.946
	Yellow typeface	Black typeface	.85	.17	.000 *
		Red typeface	.05	.17	.946

* The mean difference is significant at the 0.05 level

The Tukey post hoc multiple comparisons test results shows that there is a significant difference between the mild taste mean score of low brightness typeface and the mild taste mean score of middle brightness typeface and high brightness typeface (the significance value are smaller than .05). However, there is no significant difference between middle typeface and high typeface.

4.3.3 Congruency analysis of Chinese character shape–brightness (low brightness angular shape and high brightness angular shape) in the intense taste

Survey 1 has indicated that angular Chinese character has a greater visual effect when people make an assumption on intense taste. Furthermore, survey 2 in part one and part two demonstrated that there is a significant difference between low brightness typeface and high brightness typeface. Hence, current part is a comparison between low brightness angular Chinese character and high brightness angular Chinese character. Normality test results are summarized in Table 4.23.

Table 4.23: Results of normality test in the intense taste between low brightness angular Chinese character and high brightness angular Chinese character

Taste	Shape-brightness	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
		Statistic	df	Sig.	Statistic	df	Sig.
Intense score	Black angular	.071	152	.061 *	.984	152	.078 *
	Yellow angular	.058	152	.200 *	.983	152	.052 *

Note. * $p > .05$

As for the low brightness angular typeface (K-S sig=.061, S-W sig=.078, df =152) and the high brightness angular typeface (K-S sig=.200, S-W sig=.052, df =152), all of the data are statistically insignificant at $p > .05$. Hence, two sets of data are normally distributed.

According to Q-Q plot, two sets of data are normally distributed, and points lie on a straight line in general. However, the distribution of data is not very well. Their Q-Q plots are presented in Figures 4.19 and Figures 4.20 respectively.
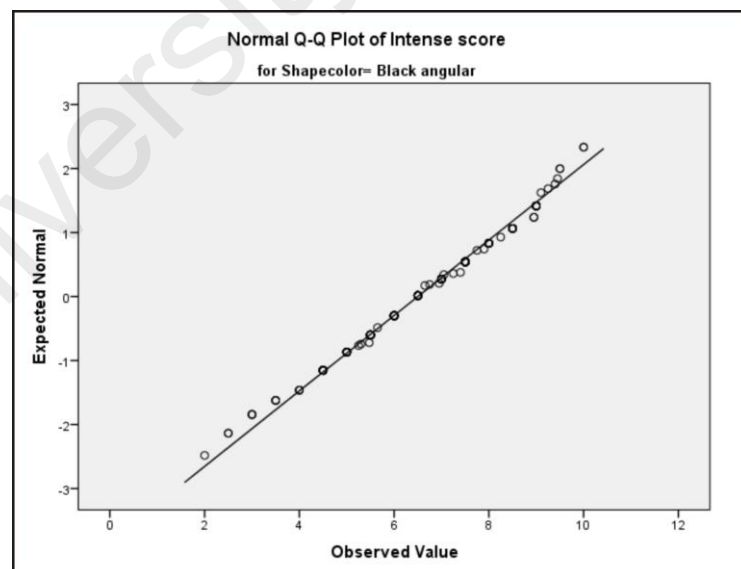
Figure 4.19, Q-Q Plot of low brightness angular Chinese character (intense taste)
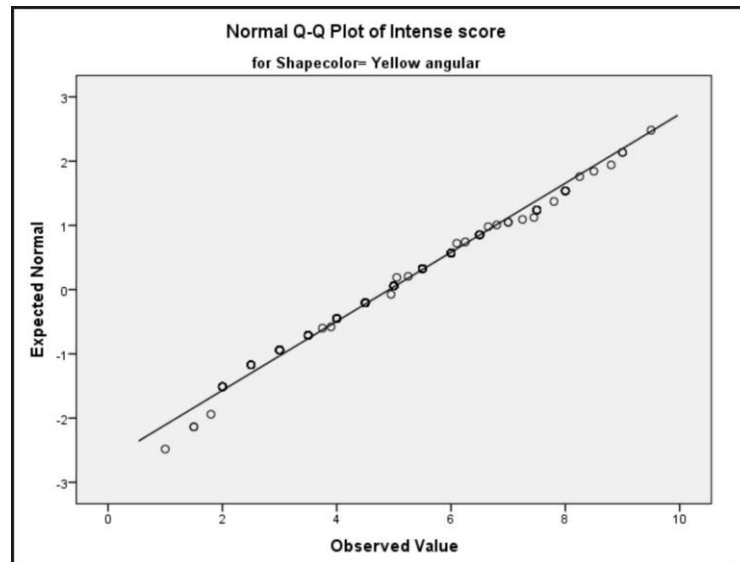
Figure 4.20, Q-Q Plot of high brightness angular Chinese character (intense taste)

As a parametric test method, independent sample t-test is allowed to do data analysis in this part, because two sets of data are normally distributed. T-test results are shown in Table 4.24

Table 4.24: Results of t-test in the intense taste between low brightness angular Chinese character and high angular brightness Chinese character

Taste	shape-brightness	N	Mean	Std. Deviation	Std. Error Mean
Intense score	Black angular	152	6.50	1.70	0.14
	Yellow angular	152	4.92	1.86	0.15

	Levene's Test for Equality of Variances		t-test for Equality of Mean				
	F	Sig.	t	df	Sig. (2-taild)	Mean Difference	Mean Error Difference
Equal variances assumed	1.51	.220	7.76	302	.000 *	1.58	.20

Note. * $p < .05$

In Table 4.24, the *p-value* .000 is smaller than .05. The t-test results are significant (t =5.31, df =302. $p < .05$). There is a significant difference between low brightness angular Chinese character and high brightness angular Chinese character in the intense taste. Moreover, the mean difference value of 1.58 has shown that low brightness angular Chinese character (Mean score =6.50, SD =1.70) has more visual

effect on the intense taste assumption which is compared to high brightness angular Chinese character (Mean score =4.92, SD=1.86).

4.3.4 Congruency analysis of Chinese character shape–brightness (low brightness angular shape and low brightness rounded shape) in the mild taste

According to above test, the results had indicated that low brightness typeface has a greater visual effect than high brightness typeface in the intense taste when the shape of Chinese typeface is angular. Therefore, this part will compare the different shapes of Chinese typeface when the brightness of Chinese typeface is low brightness, i.e. it is a comparison between low brightness angular Chinese character and low brightness rounded Chinese character in the mild taste. In Part 4, the normality test results are summarized in Table 4.25.

Table 4.25: Results of normality test in the intense taste between low brightness angular Chinese character and low brightness rounded Chinese character

Taste	Shape-brightness	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
		Statistic	df	Sig.	Statistic	df	Sig.
Intense score	Black angular	.071	152	.061 *	.984	152	.078 *
	Black rounded	.058	152	.062 *	.983	152	.105 *

Note. * *p* >.05

In the intense taste, low brightness angular Chinese character (K-S sig=.061, S-W sig=.078, df =152) and low brightness rounded Chinese character (K-S sig=.062, S-W sig=.105, df =152), data are statistically insignificant (*p* >.05) and normally distributed.

In the intense taste, the Q-Q plot of low brightness angular Chinese typeface has been shown in Figure 4.19. Thus, this part just presents the Q-Q plot of black low

brightness rounded Chinese typeface in the intense taste (see Figure 4.21) According to above analysis results, all of the data are normally distributed. In fact, it is not hard to see that the distribution of the data is not very well.
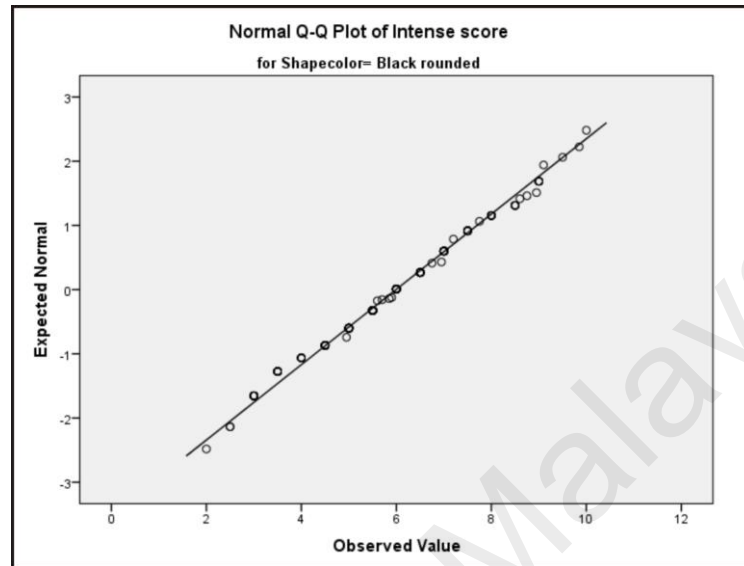
Figure4.21, Q-Q Plot of low brightness rounded Chinese character (intense taste)

As has been analyzed above, all of the data are normally distributed. In part 4, there is no doubt that independent sample t-test are used comparison between two mean scores. The t-test calculation results are summarized in Table 4.26

Table 4.26: Results of t-test in the intense taste between low brightness angular Chinese character and low brightness rounded Chinese character

Taste	shape-brightness	N	Mean	Std. Deviation	Std. Error Mean
Intense score	Black angular	152	6.50	1.70	0.14
	Black rounded	152	5.99	1.70	0.14

	Levene's Test for Equality of Variances		t-test for Equality of Mean			
	F	Sig.	t	df	Sig. (2-taild)	Mean Difference	Mean Error Difference
Equal variances assumed	.000	.996	2.61	302	.010 *	.51	.20

Note. * $p < .05$

It is obviously that the *p-value* .010 is smaller than .05, and the t-test results are significant (t = 2.61, df = 302. $p < .05$). As a consequence, there is significant difference

in the intense taste between the mean score of low brightness angular Chinese character and the mean score of low brightness rounded Chinese character. In addition, the mean difference value of .51 shows that low brightness angular Chinese character (mean score =6.50, SD =1.70) on the intense taste assumption has more visual effect which is compared to low brightness rounded Chinese character (mean score =5.99, SD =1.70)

4.3.5 Congruency analysis of Chinese character shape–brightness (low brightness rounded shape and high brightness rounded shape) in the mild taste

Apart from angular Chinese character, rounded Chinese Character in experiment 1 also confirmed that it has a greater visual impact when people assumption a mild taste. Meanwhile, there is a significant difference between low brightness typeface and high brightness typeface in the mild taste. Therefore, Part 4 is a comparison between low brightness rounded Chinese character and high brightness rounded Chinese character in the mild taste. Therefore, t-test will be used if data is normally distributed. Table 4.27 is normality test results.

Table 4.27: Results of normality test in the mild taste between low brightness rounded Chinese character and high brightness rounded Chinese character

Taste	Shape-brightness	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
		Statistic	df	Sig.	Statistic	df	Sig.
Mild score	Black rounded	.070	152	.069 *	.989	152	.266 *
	Yellow rounded	.069	152	.070 *	.984	152	.068 *

Note. * $p > .05$

For the k-S test results and the S-W test results, the data of low brightness rounded Chinese character (K-S sig=.069, S-W sig=.266, df =152) is statistically insignificant and normally distributed. Besides, the data of high brightness rounded

Chinese character (K-S sig=.070, S-W sig=.068, df =152) is statistically insignificant and normally distributed as well. All of results are more than .05.

From the graphical representation, the Q-Q plots of the two sets of data also demonstrate that data are normally distributed. Data (score point) is represented by a straight line. Meanwhile, the distribution of low brightness rounded data (see Figure 4.22) is better than high brightness rounded data (see Figure 4.23) in the mild taste.
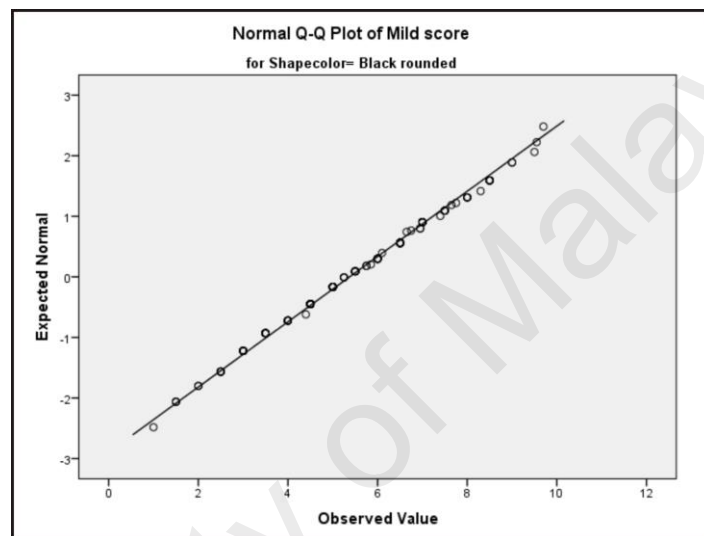
Figure 4.22, Q-Q Plot of low brightness rounded Chinese character (mild taste)
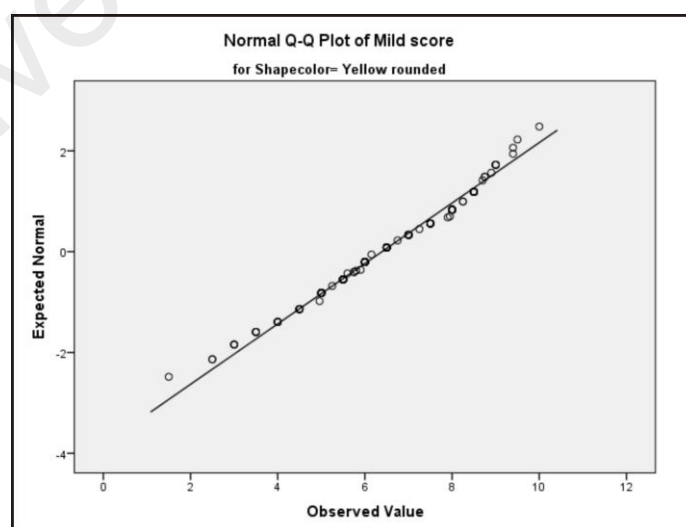
Figure 4.23, Q-Q Plot of high brightness rounded Chinese character (mild taste)

Based on the result of normal distribution, t-test results on the mild taste are summarized in Table 4.28.

Table 4.28: Results of t-test in the mild taste between low brightness rounded Chinese character and high brightness rounded Chinese character

Taste	shape-brightness	N	Mean	Std. Deviation	Std. Error Mean
Mild score	Black rounded	152	5.38	1.86	0.15
	Yellow rounded	152	6.39	1.67	0.14

	Levene's Test for Equality of Variances		t-test for Equality of Mean			
	F	Sig.	t	df	Sig. (2-taild)	Mean Difference	Mean Erro Difference
Equal variances assumed	1.81	.180	-5.00	302	.000 *	1.01	.20

Note. * $p < .05$

The results obtained from the SPSS show that the *p-value* .000 is smaller than .05. The t-test results are significant (t =-5.00, df =302. $p < .05$). There is a significant difference between low brightness rounded Chinese character and high brightness rounded Chinese character in the mild taste. In mild taste, the mean difference value of 1.01 indicates that the mean score of low brightness angular Chinese character (Mean=5.38, SD=1.86) is smaller than the mean score of high brightness rounded Chinese character (Mean=6.39, SD=1.67). Conversely, these results at t =-4.99 also indicates that high brightness rounded Chinese Character on the mild taste assumption has greater visual effect which is compared to low brightness angular Chinese character.

4.3.6 Congruency analysis of Chinese character shape–brightness (high brightness rounded shape and high brightness angular shape) in the mild taste.

According to Part five test, the results indicated that there is significant difference in the mild taste between low brightness typeface and high brightness when Chinese typeface is rounded shape. In Part six, it will compare the different shapes of

Chinese typeface in the mild taste when the color of Chinese typeface is low brightness.

So it is still a comparison between only two mean scores. The normality test calculation

results are summarized in Table 4.29

Table 4.29: Results of normality test in the mild taste between high brightness rounded Chinese character and high brightness angular Chinese character

	Shape-brightness	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
		Statistic	df	Sig.	Statistic	df	Sig.
Mild score	Yellow rounded	.069	152	.070 *	.984	152	.068 *
	Yellow angular	.070	152	.068 *	.985	152	.104 *

Note. * $p > .05$

For the k-S test and the S-W test, the results of high brightness rounded Chinese

character (K-S sig=.070. S-W sig=.068, df =152) and the results of high brightness

angular Chinese character (K-S sig=.068. S-W sig=.104, df =152) are insignificant.

Therefore, two sets of data are more than .05 and normally distributed in the mild taste.

As has been mentioned above, the Q-Q plot of high brightness rounded typeface

has been shown in Figure 4.23. Hence, part six just present the Q-Q plot of high

brightness angular Chinese typeface in the mild taste (see Figure 4.24). It is obvious

that points approximately lie on a straight line by Q-Q plot observation.
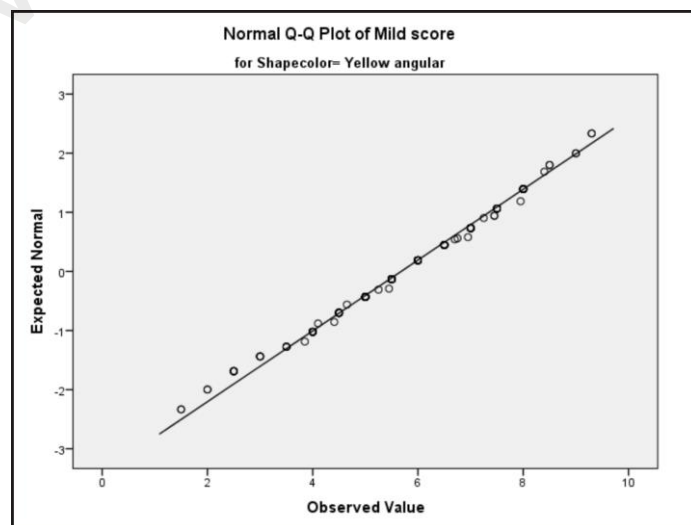
Figure4.24, Q-Q Plot of high brightness angular Chinese character (mild taste)

Based on above analysis, further data analysis is conducted by parametric test. In this situation, t-test results between two groups are shown in Table 4.30.

Table 4.30: Results of t-test in the mild taste between high brightness rounded Chinese character and high brightness angular Chinese character

Taste	shape-brightness	N	Mean	Std. Deviation	Std. Error Mean
Mild score	Yellow rounded	152	6.39	1.67	0.14
	Yellow angular	152	5.67	1.67	0.14

	Levene's Test for Equality of Variances		t-test for Equality of Mean				
	F	Sig.	t	df	Sig. (2-taild)	Mean Difference	Mean Error Difference
Equal variances assumed	.02	.880	3.72	302	.000 *	.71	.19

Note. * $p < .05$

In part 6, the statistical results indicate that the *p-value* .000 is smaller than .05. Consequently, the t-test results are statistically significant (t =3.72, df =302. $p < .05$). There is a significant difference between high brightness rounded Chinese character and high brightness angular Chinese character in the mild taste. The mean difference value of .71 shows that high brightness rounded Chinese character (mean score =6.39, SD =1.67) on the mild taste assumption has more visual effect which is compared to high brightness angular Chinese character (mean score =5.67, SD =1.67).

4.4 General Data Discussions

The details of the data will be further discussed on the whole.

4.4.1 The test results of the shapes of Chinese character in different tastes

In survey 1, the relationships tests between different Chinese typeface shapes and different tastes were divided into four parts. According to the normality test and data analysis, the first three parts of the data are normally distributed, and it involves a

comparison between only two mean scores (two groups). Consequently, independent sample t-test as a parametric test method was used data comparison in the first three parts. Therefore, the t-test results for the first three parts are summarized in Table 4.31. Specific details will be analyzed and discussed in the next step.

Table 4.31: T-test results of the shapes of Chinese character in different tastes

	Taste	Shape	N	Mean	t	df	sig. (2-taild)	Mean Difference
Part 1	Intense score	Angular	132	5.99	2.17	262	.031 *	.43
		Rounded	132	5.56				
Part 2	Mild score	Angular	132	5.65	-2.22	262	.027 *	-.42
		Rounded	132	6.07				
Part 3	Sour score	Angular	132	5.58	-1.99	262	.047 *	-.36
		Rounded	132	5.94				
	Bitter score	Angular	132	5.59	-.38	262	.702	-.08
		Rounded	132	5.67				
	Salty score	Angular	132	5.72	.03	262	.979	.00
		Rounded	132	5.71				
	Sweet score	Angular	132	5.61	-2.04	262	.043 *	-.40
		Rounded	132	6.01				

Note. * $p < .05$

In Part 1 and Part 2, it is clearly indicated that results have a significant difference between the two groups on the intense and mild taste. The *p-value*, Part 1 and Part 2, is .031 and .027 respectively. In Part 3, it involves four different basic tastes analyses. The *p-value* of sour taste test ($p = .047$) and the *p-value* of sweet taste test ($p = .043$) indicated that there is a significant difference between the two groups, whereas the *p-value* of bitter taste test ($p = .702$) and the *p-value* of salty taste test ($p = .979$) indicated there is no significant difference between the two groups.

Additionally, there are some more details in each part. In Part 1, the t-test result can reject the null hypothesis, i.e. H0:$\mu1 \neq \mu2$. So there is a significant difference between angular Chinese character and rounded Chinese character in which people make assumption on the intensity of taste. The mean difference value of .43 shows that

the visual effect of angular typeface (Mean =5.99) on the intense taste assumption is greater than rounded typeface (Mean =5.56).

In Part 2, the null hypothesis again rejected by the t-test results, i.e. H0:μ1≠ μ2. There is a significant difference between angular Chinese character and rounded Chinese character when people make an assumption on the mildness of taste. Due to t =-2.22, the mean difference value of -42 shows that rounded typeface (Mean =6.07) on the mild taste assumption is greater than angular typeface (Mean =5.65).

In Part 3, no matter in the sour taste or in the sweet taste, the null hypothesis is rejected by the t-test result, i.e. H0:μ1≠ μ2. Specifically, there is a significant difference between angular Chinese character and rounded Chinese character in which people make an assumption on the sour taste or sweet taste. The t value (-1.99 and -2.44) and the mean difference (-.36 and -.40) also show that the visual effect of rounded typeface (Mean =5.94 and Mean =6.01) on the sour or sweet taste assumption is greater than angular typeface (Mean =5.58 and Mean =5.61). In terms of bitter or salty taste, the null hypothesis is retained by the t-test result, i.e. H0:μ1= μ2. There is no significant difference between angular Chinese character and rounded Chinese character when people make an assumption on the bitter or salty taste.

In brief, there is significant difference between angular Chinese typeface and rounded Chinese typeface in the intense taste, mild taste, sour taste and sweet taste, that is to say, the *p-value* is smaller than .05 (*p* <.05). Moreover, the significance of the intense taste (*p* =.031) and the mild taste (*p* =.027) is significant than the sour taste (*p* =.047) and the sweet taste (*p* =.043). In the mild, sour and sweet taste, the visual effect of rounded typeface is greater than angular typeface. In the intense taste, the visual effect of angular Chinese typeface is greater than rounded Chinese typeface. Oppositely, there is no significant difference between angular Chinese typeface and rounded

Chinese typeface in bitter taste and salty taste, that is to say, the *p-value* is more than .05 ($p > .05$)

In addition to above the first three parts, last part is a relatively complex part. To start with, this part involves a comparison more than two mean scores. Besides, data is not normally distributed, according to the normality test and analysis. Therefore, the Kruskai-Wallis test as a nonparametric test method is used in last part. The Kruskai-Wallis test results for the last parts are summarized in Table 4.32.

Table 4.32: Kruskai-Wallis test results of the shapes of Chinese character in the tastes

Intense score (five angular Chinese Characters)	N	df	Asymp. Sig.
	660	4	.032
	Samp1- Sample 2	Sig.	Adj. Sig.
	Angular4-Angular1	.688	1.000
	Angular1-Angular5	.577	1.000
	Angular2-Angular4	.116	1.000
	Angular2-Angular5	.011	.114
Intense score (five rounded Chinese Characters)	N	df	Asymp. Sig.
	660	4	.003
	Samp1- Sample 2	Sig.	Adj. Sig.
	Rounded1-Rounded4	.362	1.000
	Rounded1-Rounded5	.100	.095
	Rounded4-Rounded2	.016	.165
	Rounded5-Rounded2	.474	1.000

Note. * $p < .05$

In last Part, not only five different angular Chinese characters but also five different rounded Chinese characters has shown that there is a significant difference among five different Chinese typefaces in the intensity level of taste. In intensity level of taste, the *p-value* (Asymp. Sig.) of five different angular Chinese characters ($p = .032$) and the *p-value* (Asymp. Sig.) of five different rounded Chinese characters ($p = .003$) is smaller than .05.

Based on the significance analysis among five different angular typefaces and five different rounded typefaces, the comparison between two groups again shows that there is no significant difference between a typeface which is categorized as strong/bold shape (angular 1, angular 2/ rounded 1, rounded 2) and a typeface which is categorized

as thin shape (angular 4, angular 5/ rounded 4, rounded 5) in the intensity level of taste. In five different angular typefaces (from thin shape to strong shape), the *p-value* (Adj. Sig.) 1.000 between angular 4 and angular 1/ angular 1 and angular 5/ angular 2 and angular 4 is greater than .05 ($p < .05$). The *p-value* (Adj. Sig.) .114 between angular 2 and angular 4 is still greater than .05 ($p < .05$). So the all results are insignificant. In five different rounded typefaces (from thin shape to strong shape), all of the *p-value* (Adj. Sig.) between thin shape typeface and strong shape/blod typeface also is greater than .05 and insignificant ($p > .05$).

In the final analysis, no matter in five different angular Chinese characters (from thin shape to strong shape) or in five rounded Chinese characters (from thin shape to strong shape), the results of Kruskai-Wallis test have clearly demonstrated that there is a significant difference among the five different typefaces (from thin shape to strong shape). However, there is no significant difference between thin shape Chinese typeface and strong/bold shape Chinese typeface. Therefore, the null hypothesis is retained by the Kruskai-Wallis result, i.e. H0:µ1= µ2. More specifically, there is no significant between thin Chinese Character and strong/bold Chinese character when people make an assumption on the intensity level of taste.

4.4.2 The test results of the shapes and color of Chinese character in different tastes

In Survey 2, the relationships tests were divided into six parts. The first two parts are about the relationship test between different Chinese typeface brightness and different tastes. According to normality test and data analysis, the first two parts of the data are normally distributed, and the both of parts involve a comparison more than two

mean scores. Due to this, one-way ANOVA test as a parametric test method was used data comparison in the first two parts. Thus, the ANOVA test results of the first two parts are summarized in Table 4.33.

Table 4.33: ANOVA test results of the three brightness Chinese typefaces in the different tastes

Part 1	Taste	Brightness	N	Mean	Sig.
	Intense score	Black typeface	152	6.25	
		Red typeface	152	5.92	.000 *
		Yellow typeface	152	5.04	
		(I) brightness	(J) brightness	Mean Difference (I-J)	Sig.
	Intense score Tukey HSD	Yellow typeface	Black typeface	1.20	.000 *
			Red typeface	-.88	.000 *
Part 2	Taste	Brightness	N	Mean	Sig.
	Mild score	Black typeface	152	5.18	
		Red typeface	152	5.98	.000 *
		Yellow typeface	152	6.03	
		(I) color	(J) color	Mean Difference (I-J)	Sig.
	Mild score Tukey HSD	Black typeface	Red typeface	-.80	.000 *
			Yellow typeface	-.85	.000 *

Note. * *p* <.05

In Table 4.33, it is clear that there is significant difference among the three different brightness typefaces (black/low brightness, red/middle brightness and yellow/high brightness). Furthermore, no matter in the intense taste or in the mild taste, the *p-value* is same (*p* =.000) and smaller than .05 (*p* <.05).

In fact, there are other more specific differences in Part 1 and Part 2. In part 1, the ANOVA test has indicated that the null hypothesis is rejected, i.e. H0:μ1≠ μ2. There is a significant difference among the three different brightness typefaces (black/low brightness, red/middle brightness and yellow/high brightness) when people make an assumption on the intensity of taste. Based on the significant difference among the three brightness typefaces, data were compared between the two groups. The Tukey HSD post hoc test has shown a significant different between high brightness typeface and low brightness typeface or middle brightness typeface, and the *p-value*.000 is smaller

than .05 ($p <$.05). There is no significant difference between low brightness typeface and middle brightness typeface. Moreover, the mean difference value of 1.20 has shown that low brightness typeface has the higher mean score (Mean =6.25), whereas high brightness typeface has lower mean score (Mean =5.04).

In Part 2, the null hypothesis is rejected by the ANOVA test, i.e. H0:µ1≠ µ2. There is a significant difference among the three different brightness typefaces (low brightness, middle brightness and high brightness) when people make an assumption on the mildness of taste. Like Part 1, data were compared between the two groups. The Tukey HSD post hoc test has shown a significant between different low brightness typeface and middle brightness typeface or high brightness typeface, and the *p-value*.000 is smaller than .05 ($p <$.05). Nevertheless, there is no significant difference between middle brightness typeface and high brightness typeface. Further, the visual effect of high brightness typeface (Mean =6.03) is higher than the visual effect of low brightness typeface (Mean =5.18) due to the mean difference value of -.85.

To sum up, there is very significant difference among the three different brightness typefaces in the intense taste and mild taste. The most important is that there is a very significant difference between low brightness typeface and high brightness typeface. In the intense taste, the visual effect of low brightness typeface is higher than the visual effect of high brightness typeface. In the mild taste, the visual effect of high brightness typeface is higher than the visual effect of low brightness typeface.

In terms of the last four parts, it is about the relationship test between Chinese typeface shape- brightness congruency and different tastes. According to the normality test and analysis, the last four parts of the data are normally distributed. From what has been presented above, the last four parts involve a comparison between only two mean scores (two groups). Because of this, independent sample t-test as a parametric test

method was used data comparison in the last four parts. The t-test results for the last

four parts are summarized in Table 4.34

Table 4.34: T-test results of Chinese character shape-brightness congruency in the different tastes

	Taste	Shape-brightness	N	Mean	t	df	sig. (2-taild)	Mean Difference
Part 3	Intense score	Black angular	152	6.50	7.76	302	.000 *	1.58
		Yellow angular	152	4.92				
Part 4	Intense score	Black angular	152	6.50	2.61	302	.010 *	.51
		Black rounded	152	5.99				
Part 5	Mild score	Black rounded	152	5.38	-5.00	302	.000 *	-1.01
		Yellow rounded	152	6.39				
Part 6	Mild score	Yellow rounded	152	6.39	3.72	302	.000 *	.71
		Yellow angular	152	5.67				

Note. * $p < .05$

It is obviously a significant difference between the two groups in last four parts.

The *p-value* .000 is smaller than .05 ($p < .05$) in Part 3, Part 5 and Part 6. In Part 4, the *p-value* .010 is smaller than .05 ($p < .05$) as well.

In Part 3, the null hypothesis is rejected, i.e. H0:μ1≠ μ2. Hence, there is a

significant difference between Chinese character shape-brightness congruency (low

brightness combination with angular shape) and Chinese character shape-brightness

incongruency (high brightness combination with angular shape) when people make an

assumption on the intensity of taste. The mean difference value of 1.58 has shown that

the visual effect of low brightness angular Chinese character (Mean =6.50) on the

intense taste is greater than high brightness angular Chinese character (Mean =4.92).

In Part 4, the null hypothesis is rejected, i.e. H0:μ1≠ μ2. There is a significant

difference between Chinese character shape-brightness congruency (low brightness

combination with angular shape) and Chinese character shape-brightness incongruency

(low brightness combination with rounded shape) when people make an assumption on

the intensity of taste. The mean difference value of 1.58 has shown that the visual effect

of low brightness angular Chinese character (Mean =6.50) on the intense taste is greater than low brightness rounded Chinese character (Mean =5.99).

In Part 5, the null hypothesis is rejected, i.e. H0:µ1≠ µ2. There is a significant difference between Chinese character shape-brightness congruency (low brightness combination with rounded shape) and Chinese character shape-brightness incongruency (high brightness combination with rounded shape) when people make an assumption on the mildness of taste. The mean difference -1.01 and t value -5.00 has shown that the visual effect of high brightness rounded Chinese character (Mean =6.39) on the intense taste is greater than low brightness rounded Chinese character (Mean =5.38).

In Part 6, the null hypothesis is rejected, i.e. H0:µ1≠ µ2. There is a significant difference between Chinese character shape-brightness congruency (high brightness combination with rounded shape) and Chinese character shape-brightness incongruency (high brightness angular shape) when people make an assumption on the mildness of taste. The mean difference value of .71 has shown that the visual effect of high brightness rounded Chinese character (Mean =6.39) on the intense taste is greater than high brightness angular Chinese character (Mean =5.67).

In view of the last four Parts analysis, the results of Part three and Part four indicated a significant difference between Chinese character shape-brightness congruency (low brightness combination with angular shape) and Chinese character shape-brightness incongruency (high brightness combination with angular shape and low brightness combination with angular shape) in the intense taste. Besides, the mean score of low brightness angular typeface is higher than other two Chinese typefaces. The results of Part five and Part six indicated a significant difference between Chinese character shape-brightness congruency (high brightness combination with rounded shape) and Chinese character shape-brightness incongruency (low brightness

combination with rounded shape and high brightness combination with angular shape)

in the mild taste. The mean score of high brightness rounded typeface is the highest.

CHAPTER 5: CONCLUSION AND FURTHER RESEARCH

5.1 Introduction

It is an indispensable fact that visual element and the concept of psychological cognition play an important role in food packaging design aesthetic. As mentioned a series of previous studies (e.g. Becker, Rompay, Schifferstein & Galetzka 2011; Wang, 2013), consumer buying behavior and cognition is affected by the visual features of the packaging such as shape, colour and pattern, among others. More specifically, experimental investigations have shown that there are the crossmodal correspondences between shapes and tastes or colors and tastes. To sum up, food packaging design that utilizes visuals elements to influence consumer perception in tastes should obtain a positive evaluation for the food product and increase its sales.

5.2 Research Findings

The present study designed two experiments to evaluate how the shapes and colours of Chinese Character in a product's packaging can affect consumer perception on different tastes. These two experiments are considered as an association and matching test between typeface (in a product's packaging) and taste. As visual elements, the shape and colour of typeface is related to various packages. In addition, these visual materials were manipulated to investigate whether there would be any effect for the tastes perception when people via the shapes and colours of Chinese typeface (Chinese character) make an assumption. On the whole, the results showed that all of the brightness (Chinese typeface) tests and even the shape-brightness (Chinese typeface) tests are more influential than only the shape (Chinese typeface) tests when people make an assumption on the tastes. From the two experimental details, there are a number of findings between the shapes and colours of Chinese character and tastes.

5.2.1 Research findings of the shapes of Chinese character in different tastes assumption

In Survey 1, the results supported a series of crossmodal correspondences between the shapes of Chinese character and tastes. Furthermore, there is a significant difference between angular Chinese character and rounded Chinese character in the different tastes assumption. From the statistical data analysis results, angular Chinese character can better express intensity of taste than rounded Chinese character, whereas rounded Chinese character can better express mildness of taste than angular Chinese character. Moreover, rounded Chinese character can better express sourness and sweetness of taste than angular Chinese character. However, it is worth noting that there are no correspondence relationships between the shapes of Chinese character (angular and rounded) with bitter and salty taste. Apart from above results, there was no significant difference and correspondence between the strong and thin Chinese typeface on the intensity level of taste test.
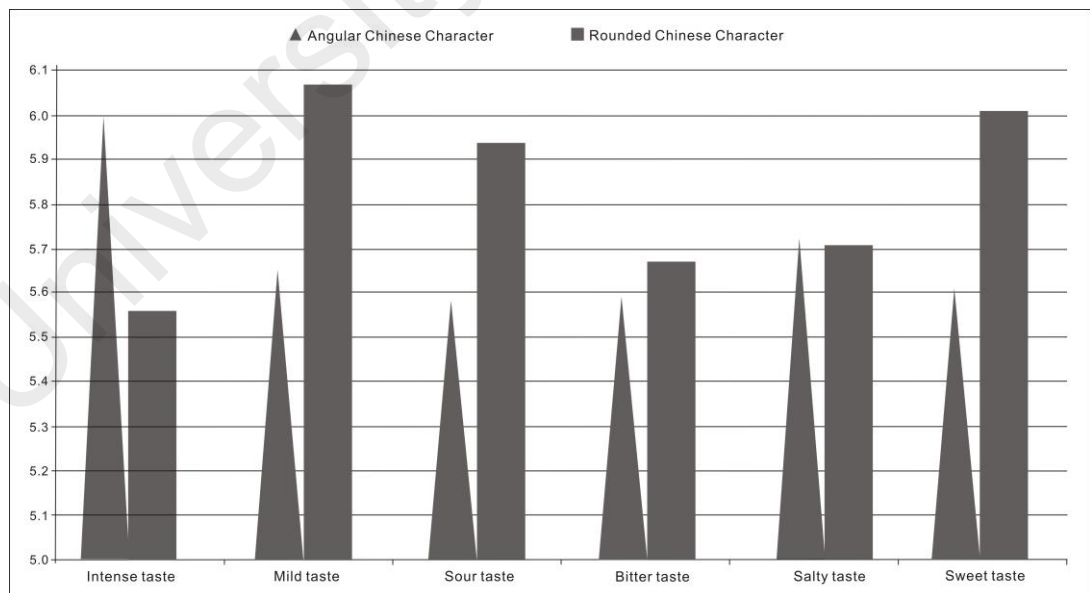

Figure 5. 1 The mean score of Chinese character shapes in different tastes assumption.

It is clear that this study's results share some similarities and differences with related previous researches. For example, on the sensitivity of design, Becker et al. (2011) have clearly stated that angular packaging shape is more potent than rounded packaging shape and may lead to intense taste sensations. In present study, angular packaging typeface obtained a similar test result on the intensity of taste perception. Angular Chinese Character may inspire an intense taste assumption. Based on above research conception, an extended test showed that rounded packaging typeface, as opposed to angular packaging typeface, that lead consumer to the assumption a more mild taste. Here, this test result can be compared with the relevant studies of Chapter two. For example, rounded shapes logo are perceived more harmonious than angular shapes logo (Zhang, et al., 2006). Hence, the test result of this study on rounded Chinese character is similar to those of previous studies.

From the four basic tastes discussion (sweetness, sourness, bitterness and salty), many related researches and summary for sourness and sweetness have indicated angular shape matching sour taste and rounded shape matching sweet taste (see Velasco et al., 2014; Velasco, Velasco, Woods, Deroy, & Spence, 2015; Velasco et al., 2016). Obviously, this study produced a similar test result due to the finding of rounded shape correspondence or matching sweetness of basic taste. Velasco, Woods, Hyndman and Spence (2015) in final test results also suggested that round typeface is associated with sweet taste assumption. In this study, the most important finding is that this result also applies to the Chinese character. That is to say, rounded packaging typeface (Chinese character) will lead people to the assumption that taste is sweet by an intuitive visual influence. Regardless of the packaging shape or Chinese typeface shape, this study's analysis further demonstrates a significant association between rounded shape and sweetness. Therefore, it can be concluded that rounded Chinese character can be used in sweet food packaging, especially in China. However, sourness test result is different

with the previous sweetness test result. The result showed that rounded Chinese character is better to convey the assumption of sourness. In other words, rounded Chinese character was matched with sourness as well. In addition to sourness and sweetness, Velasco, Velasco, Woods, Deroy and Spence (2015) in their research also indicated that shapes of angularity were matched with bitter and salty taste assumption. However, this study's result differs from the above result on the bitter and salty assumption.

From what has been discussed above, the evaluation results of intense taste, mild taste and sweet taste are consistent with previous studies. In contrast, the taste results of the other three basic tastes (sourness, bitterness and salty) are not consistent with previous studies. The causes for this bias phenomenon are comprehensive but the major reasons contributing to this problem can be identified from three perspectives. Firstly, culture differences affect sensory responses and preferences including tastes (e.g. Moskowitz et al., 1975) odor (e.g. Ayabe-Kanamura et al., 1998) and aesthetic preference for shapes (e.g. Zhang, et al., 2006). Further, cross-cultural differences were observed in crossmodal correspondences between sensory modalities including visual features and basic tastes (Wan, et al., 2014) or colours and odors (e.g. Levitan et al., 2014). As a matter of fact, numerous previous crossmodal correspondence researches and investigations are only limited to Western consumer market. On the contrary, present research is based on Chinese culture and the Chinese market. As we all know, Chinese characters is an indispensable part of the Asian culture, and, therefore, China and even Asian consumers and Westerner consumer may be differences in concept, cognition and response due to cross-cultural differences. This means that these impacts vary probably depending on people's regional culture background including semantic knowledge. Secondly, Chinese characters and Western alphabet are two different writing systems. Analysis and research have shown that Chinese character is a writing

107

form that is similar to graphic symbols (see Yang & McConkie, 1999; Juang et al., 2005). Therefore, it can be understood that the visual graphic features of Chinese characters are more distinct than the Western alphabet. Because of this reason, it is possible that visual differentiation will cause different test results on the taste perception. Lastly, different experimental methods may be a reason for this systematic bias, because this study is limited selection questionnaire as test method and tool.

5.2.2 Research findings of the shapes and colors of Chinese character in different tastes assumption.

In Survey 2, the test results of brightness showed that there are crossmodal correspondence relationships between the brightness of Chinese typeface and different tastes assumption. Besides, there is a very significant difference among the three different level of brightness for Chinese typefaces (low brightness, middle brightness and high brightness). The significance testing has shown that the results of brightness are far higher than the shape. In a nutshell, not only there are correspondences relationships, but also there is a higher statistical significance. From the specific statistical data analysis results, low brightness Chinese typeface is better to express the intensity of taste than high brightness typeface. On the contrary, high brightness Chinese typeface is better to express the mildness of taste than low brightness Chinese typeface. Based on the test results of the shapes and brightness, Survey 2 also indicated the test results of Chinese character shape-brightness congruency. On one hand, the ow brightness angular Chinese character is better to express the intensity of taste than high brightness angular Chinese character and low brightness rounded Chinese character. On the other hand, the high brightness rounded Chinese character is better to express the mildness of taste than low brightness rounded Chinese character and high brightness

108

angular Chinese character. In short, angular shape combination with low brightness is most congruent Chinese typeface design for the intense taste matching and rounded shape combination with high brightness is most congruent Chinese typeface design for mild taste matching.
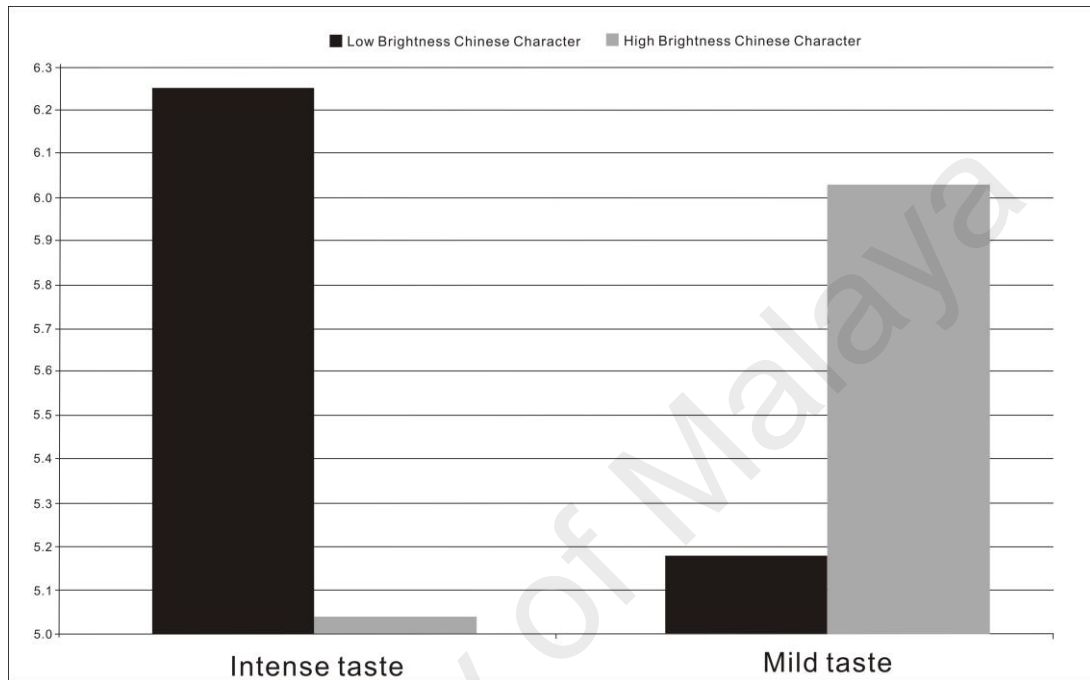

Figure 5. 2 The mean score of Chinese character brightness in different tastes assumption.
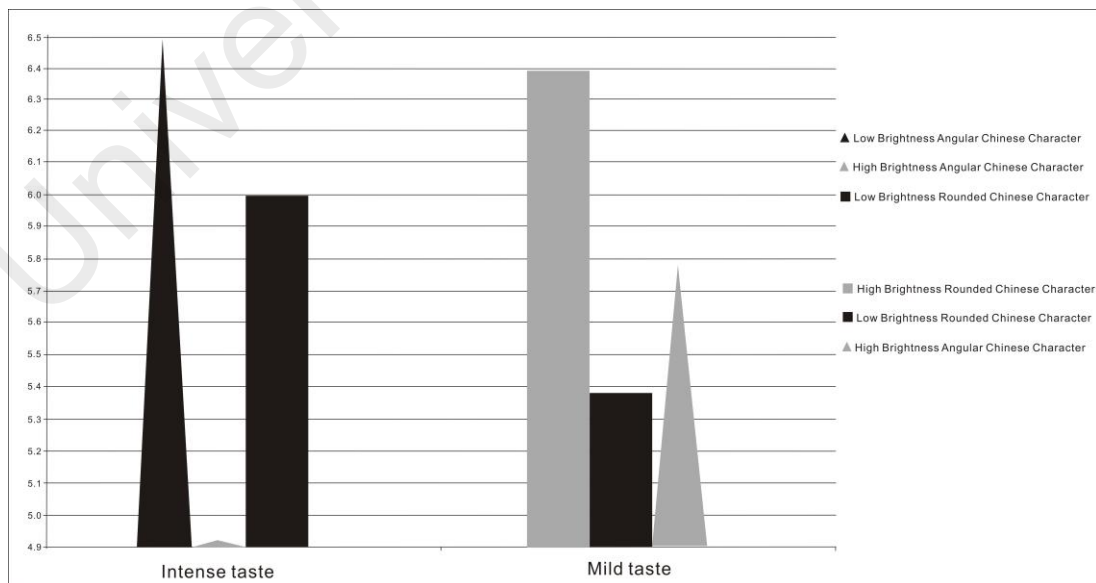

Figure 5. 3 The mean score of Chinese character shapes-brightness in different tastes assumption.

In terms of taste impressions, numerous studies (e.g. Koch and Koch, 2003) have demonstrated that people are able to associate the tastes by the colors. In this study, experiment has shown that the color brightness level of Chinese character is associated with intensity of taste. In other words, the concept of the crossmodal correspondences between colors and tastes also applies to typeface, especially Chinese Character. In addition, past research indicated that shape-typeface congruence (the shape variants and typeface variants of a fictitious brand of bottled water) has positive effects on perceptions of brand credibility and price expectations (see Van Rompay & Pruyn, 2011). According to the test results of Survey 1 and 2, angular shape and low brightness were better design for the expression of intense taste, while rounded shape and high brightness are more correctly design in the expression of mild taste. In the present study, the congruency tests also showed that low brightness angular Chinese character is better to convey the assumption of intense taste, while high brightness rounded Chinese character is better to convey the assumption of mild taste. Thus, the shapes and brightness of Chinese character indeed have congruency in the taste matching. Meanwhile, the test results of Survey 2 once again proved the crossmodal correspondence relationships between the visual features of Chinese characters and the tastes, when shapes (angular, rounded) and brightness (low, high) and are combined. Based on the results, the congruent design between the shapes and brightness of Chinese typeface and the taste may receive positive effects in perceptions of brand credibility and price expectations.

5.2.3 The summary of research findings

The research findings reveal that visual elements such as shape (angular, rounded) and brightness (low, high) of Chinese character in food packaging may inspire consumer perception for taste. In particular, specific Chinese character shape and colour

may inspire particular taste assumption, thereby supporting the concept of crossmodal correspondences. This means that the visual features of packaging typefaces such as shape and brightness can convey appropriate messages about the likely taste of a product, thus which in turn may influence food product evaluations and sale. It is noteworthy that these crossmodal correspondences between the visual features of typefaces and the tastes are also affected by cross-cultural differences. Due to cross-cultural differences, the results of crossmodal correspondences may have some biases to some extent. In practical application, food and beverage companies and packaging designers need to investigate the local actual situation. In summary, this study also indicated that packing typeface may be specially designed to portray particular symbolic meanings in a product. This study demonstrated that Chinese characters, as particular visual symbols, may impact the expression of a product's related meanings, thereby affecting subsequent taste perception and evaluation and overall food product evaluation.

5.3 Suggestions for the Future Research

This exploratory quantitative research study measured the reaction of people's attitudes and taste perceptions towards the typeface variables (Chinese character) in a single trial only. In reality, relevant experiments and studies which are about crossmodal correspondence between typeface and taste are neither mature nor extensive. Although the scope of such studies has been extended to explore the relationships between typeface and taste, current studies still cannot guarantee its implementation due to a lack of substantial practical experiments and research. In order to determine whether the visual features of typefaces actually match certain tastes and to further explore crossmodal correspondence relationships between packaging typefaces and tastes, research would be desirable to express the typeface variables in more comprehensive ways and to gather people responses for taste via appropriate visual

experimental design methodologies. Given the reasons of outlined above, some other specific problems need to be addressed in the future research.

To begin with, the selection of packaging typeface and test region should be more diversified. Packaging typeface should not be confined to Chinese characters or English alphabets. New research should try to test other writing system typeface such as Arabic, Tamil, Thai and so on. Here, Arabic is more widely used in the world, especially Middle East. What is more, it is absolutely necessary that new research need further find the commonness and differences of the correspondence relationships between the different packaging typeface (belonging different writing systems) and the tastes. In order to further prove cross-cultural differences, future research can also compare the responses between native speakers and other different regions people for the same typeface (native speakers' language).

Another equally vital goal to be considered is that packaging typeface can attempt to establish a relationship with the contents of the packaging picture. In the present study, there is absolutely no doubt that objective and focus was only on packaging typefaces. Usually, consumers pay attention to a product packaging not only keeping on one visual feature point. The colors, typefaces and pictures of the packaging will be of interest at the same time. Becker et al (2011) founded that angular packaging is perceived as more intense taste than rounded packaging on a lemon picture yogurt packaging (see Figure 2.4). Here the lemon picture may also be a secondary influence factor on taste perception. Thus, if there is no association between typeface and graphic, it may be one of the difficult problems besetting consumers. To probe into this phenomenon, the next step is to ensure that future research should expand and explore the visual-taste crossmodal relationship between packaging typefaces and packaging pictures.

To make one final point, future typeface research should enhance and improve the method of experiment and test because of the demerit of this study. There is no denying that the present study is based on an assumption test. Specifically speaking, experimental participants simply relied on the visual features of Chinese typefaces to make an assumption on virtual taste. It is obvious that there is no real tasting process in this study, namely taste stimulus. If real visual stimulation was combined with the real taste stimulus, participants will get a more real experience in the test, thereby getting a more real and accurate test response and results.

On the part of prospect, a series of future studies and present study have a long-lasting effect for the development of product packaging. One of the most important aspect is that these test results will not only help packaging designer to create the appropriate packaging typeface to express the corresponding taste, but also guide consumers to obtain meaningful information such as right taste expectations and perception. For most products, this also will help the establishment of the brand and even high quality price.

Appendix: Survey Questionnaires

This Survey is designed to collect information about the relationships tests between the shapes and colors of Chinese character (on the food packaging) and the tastes perception, as a part of study and fulfilling University Malaya Master of Visual Arts. It may take 10-15 minutes to complete the questionnaire. Please answer all questions in all sections. Please be advised that all information will be treated with the strictest confidentially and only the aggregated data will be analyzed.

Questionnaire1 (Survey 1)

**The relationships test between the shapes of Chinese character
on the food packaging and the tastes perception**

1.Gender

Female ☐   Male ☐

2.Age

16-29 ☐   30-40 ☐   41-50 ☐   above 50 ☐

Part One: The shapes of Chinese character test in the intense taste (score range from 0-10 and allowing decimal fraction)

1. Please rating score for five different angular Chinese typefaces on the intense taste level (score range from 0-10 and allowing decimal fraction)

1. Angular Chinese character(1)   2. Angular Chinese character(2)

好味道   好味道

3. Angular Chinese character(3)   4. Angular Chinese character(4)

好 味 道   好味道

5. Angular Chinese character(5)

好味道

2. Please rating score for five different rounded Chinese typefaces on the intense taste level (score range from 0-10 and allowing decimal fraction)

1. Rounded Chinese character(1)   2. Rounded Chinese character(2)

好味道   好 味 道

3. Rounded Chinese character(3)   4. Rounded Chinese character(4)

好味道   好味道

5. Rounded Chinese character(5)

好味道

Part Two: The shapes of Chinese character test in the mild taste (score range from 0-10 and allowing decimal fraction)

1. Please rating score for five different angular Chinese typefaces on the intense taste level (score range from 0-10 and allowing decimal fraction)

1. Angular Chinese character(1)

好味道

2. Angular Chinese character(2)

好味道

3. Angular Chinese character(3)

好味道

4. Angular Chinese character(4)

好味道

5. Angular Chinese character(5)

好味道

2. Please rating score for five different rounded Chinese typefaces on the mild taste level (score range from 0-10 and allowing decimal fraction)

1. Rounded Chinese character(1)

好味道

2. Rounded Chinese character(2)

好味道

3. Rounded Chinese character(3)

好味道

4. Rounded Chinese character(4)

好味道

5. Rounded Chinese character(5)

好味道

Part Three: The shapes of Chinese characters test in the sour, bitter, salty and sweet taste (score range from 0-10 and allowing decimal fraction)

Sour taste

1. Please rating score for five different angular Chinese typefaces on the sour taste level (score range from 0-10 and allowing decimal fraction)

1. Angular Chinese character(1)

好 味 道

2. Angular Chinese character(2)

好 味 道

3. Angular Chinese character(3)

好 味 道

4. Angular Chinese character(4)

好味道

5. Angular Chinese character(5)

好味道

2. Please rating score for five different rounded Chinese typefaces on the sour taste level (score range from 0-10 and allowing decimal fraction)

1. Rounded Chinese character(1)

好味道

2. Rounded Chinese character(2)

好 味 道

3. Rounded Chinese character(3)

好味道

4. Rounded Chinese character(4)

好味道

5. Rounded Chinese character(5)

好味道

Bitter taste

1. Please rating score for five different angular Chinese typefaces on the bitter taste level (score range from 0-10 and allowing decimal fraction)

1. Angular Chinese character(1)

好 味 道

2. Angular Chinese character(2)

好 味 道

3. Angular Chinese character(3)

好 味 道

4. Angular Chinese character(4)

好味道

5. Angular Chinese character(5)

好味道

2. Please rating score for five different rounded Chinese typefaces on the bitter taste level (score range from 0-10 and allowing decimal fraction)

1. Rounded Chinese character(1)

好味道

2. Rounded Chinese character(2)

好 味 道

3. Rounded Chinese character(3)

好味道

4. Rounded Chinese character(4)

好味道

5. Rounded Chinese character(5)

好味道

Salty taste

1. Please rating score for five different angular Chinese typefaces on the salty taste level (score range from 0-10 and allowing decimal fraction)

1. Angular Chinese character(1)

好 味 道

2. Angular Chinese character(2)

好 味 道

3. Angular Chinese character(3)

好 味 道

4. Angular Chinese character(4)

好 味 道

5. Angular Chinese character(5)

好味道

2. Please rating score for five different rounded Chinese typefaces on the salty taste level (score range from 0-10 and allowing decimal fraction)

1. Rounded Chinese character(1)

好味道

2. Rounded Chinese character(2)

好 味 道

3. Rounded Chinese character(3)

好 味 道

4. Rounded Chinese character(4)

好味道

5. Rounded Chinese character(5)

好味道

Sweet taste

1. Please rating score for five different angular Chinese typefaces on the sweet taste level (score range from 0-10 and allowing decimal fraction)

1. Angular Chinese character(1)

好 味 道

2. Angular Chinese character(2)

好 味 道

3. Angular Chinese character(3)

好 味 道

4. Angular Chinese character(4)

好 味 道

5. Angular Chinese character(5)

好味道

2. Please rating score for five different rounded Chinese typefaces on the sweet taste level (score range from 0-10 and allowing decimal fraction)

1. Rounded Chinese character(1)

好味道

2. Rounded Chinese character(2)

好 味 道

3. Rounded Chinese character(3)

好 味 道

4. Rounded Chinese character(4)

好味道

5. Rounded Chinese character(5)

好味道

Questionnaire2 (Survey 2)

The relationships test between the shapes and colors of Chinese character on the food packaging and the tastes preception

1.Gender

Female ☐   Male ☐

2.Age

16-29 ☐   30-40 ☐   41-50 ☐   above 50 ☐

Part One: The shapes and colors of Chinese characters test in the intense taste (score range from 0-10 and allowing decimal fraction)

1. Please rating score for three sets of strong angular Chinese typefaces on the intense taste level (score range from 0-10 and allowing decimal fraction)

1. Black strong angular Chinese character

好味道
好味道

2. Red strong angular Chinese character

好味道
好味道

3. Yellow strong angular Chinese character

好味道
好味道

2. Please rating score for three sets of thin angular Chinese typefaces on the intense taste level (score range from 0-10 and allowing decimal fraction)

1. Black thin angular Chinese character

好味道
好味道

2. Red thin angular Chinese character

好味道
好味道

3. Yellow thin angular Chinese character

好味道
好味道

Part Two: The shapes and colors of Chinese characters test in the intense taste (score range from 0-10 and allowing decimal fraction)

1. Please rating score for three sets of strong rounded Chinese typefaces on the intense taste level(score range from 0-10 and allowing decimal fraction)

1. Black strong rounded Chinese character

好味道

好味道

2. Red strong angular Chinese character

好味道

好味道

3. Yellow strong angular Chinese character

好味道

好味道

2. Please rating score for three sets of thin rounded Chinese typefaces on the intense taste level(score range from 0-10 and allowing decimal fraction)

1. Black thin rounded Chinese character

好味道

好味道

2. Red thin rounded Chinese character

好味道

好味道

3. Yellow thin rounded Chinese character

好味道

好味道

Part Three: The shapes and colors of Chinese characters test in the mild taste (score range from 0-10 and allowing decimal fraction)

1. Please rating score for three sets of strong angular Chinese typefaces on the mild taste level (score range from 0-10 and allowing decimal fraction)

1. Black strong angular Chinese character

好味道
好味道

2. Red strong angular Chinese character

好味道
好味道

3. Yellow strong angular Chinese character

好味道
好味道

2. Please rating score for three sets of thin angular Chinese typefaces on the mild taste level (score range from 0-10 and allowing decimal fraction)

1. Black thin angular Chinese character

好味道
好味道

2. Red thin angular Chinese character

好味道
好味道

3. Yellow thin angular Chinese character

好味道
好味道

Part Four: The shapes and colors of Chinese characters test in the mild taste (score range from 0-10 and allowing decimal fraction)

1. Please rating score for three sets of strong rounded Chinese typefaces on the mild taste level (score range from 0-10 and allowing decimal fraction)

1. Black strong rounded Chinese character

好味道

好味道

2. Red strong angular Chinese character

好味道

好味道

3. Yellow strong angular Chinese character

好味道

好味道

2. Please rating score for three sets of thin rounded Chinese typefaces on the mild taste level (score range from 0-10 and allowing decimal fraction)

1. Black thin rounded Chinese character

好味道

好味道

2. Red thin rounded Chinese character

好味道

好味道

3. Yellow thin rounded Chinese character

好味道

好味道

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