

Sweetness or Mouthfeel: A corpus-based study of the conceptualization of taste*

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Zhong, Yin and Chu-Ren Huang. 2020. Sweetness or Mouthfeel: A corpus-based study of the conceptualization of taste. *Linguistic Research* 37(3): 359-387. The sensory lexicon plays a pivotal role in bridging our cognitive system to the physical world. In this role, it has been the focus of recent interdisciplinary investigations on cognition, language, culture, and their interactions. Recent studies on linguistic synesthesia and sensory modality exclusivity showed unequivocally that cross-modality usages of sensory words are the norm rather than the exception. Given the dominance of cross-modality uses, the null hypothesis that the five senses are separate but equal modules merits a closer examination. In this paper, we focus on the gustatory quality of sweetness because of its universal appeal as well as the well-attested cultural influence on the gustatory lexicon. Based on an analysis of online food reviews containing descriptions of desserts, we show that mouthfeel, a multisensory concept, is strongly preferred over sweetness. Mouthfeel is associated with words from all the sensory domains, including both sensory and abstract (e.g., mental state) concepts. The highly non-exclusive characteristic of gustatory sensation suggests that it might be the most connected sensory modality, and the cross-modality expressions indicating personal preferences further imply the subjective propensity of the gustatory sense. Our study adds to the existing literature the interrelationship among sensory modalities through language use, and further sheds light on the interactions between language, cognition, and culture. (The Hong Kong Polytechnic University)

Keywords sensory lexicon, taste, mouthfeel, linguistic synesthesia, online food review

* This research work is supported by Chiang Ching-Kuo Foundation Research Grant sponsored by the National Taiwan Normal University and the Hong Kong Polytechnic University (Project No.: RG012-D-16). An earlier version of this paper, entitled 'Pleasing to the mouth or pleasant personality: A corpus-based study of conceptualization of desserts in online Chinese food reviews,' was presented at the *32nd Pacific Asia Conference on Language, Information and Computation* (PACLIC-32) and appeared in the proceedings. We thank the two anonymous reviewers for their constructive comments and suggestions. All remaining errors are ours.

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1. Introduction

Food provides sustenance, pleasure, self-expression, identity, and more, for human beings. The Western food culture attaches importance to nutrients for the human body, as revealed in the measurement of nutrition facts, such as calories, carbohydrates, and proteins (Civitello 2011). The Chinese food culture, on the other hand, is deeply rooted in harmony between the micro- and the macro-environment (i.e., the body and the world). The harmony is maintained through the balance of the traditional cosmological concepts of ‘yin’ and ‘yang’ from Taoism and its later interpretation of ‘five elements’ (五行 *wuxing*: *wood, fire, earth, metal, and water*) (Kohn 2010). The ‘five elements’ further associate the human body and bodily experiences, for example, the basic human senses (*vision, touch, taste, smell, and hearing*), internal organs (e.g., *liver, heart, spleen, lungs, and kidney*), colors (*green, red, yellow, white, and black*), and tastes (*sour, bitter, sweet, spicy, salty*). This ancient Chinese philosophy of ‘yin-yang’ has also influenced the gastronomic culture of other Asian countries, for example, South Korea. Korean food culture values respect, balance, and health. Korean foods also manifest the aesthetics of harmonization and convergence, waiting and patience, beauty in various colors, and purification (Serdar and Erhun Kemal 2019). A balance of the five basic tastes in food is thus believed to be the most crucial factor that affects people’s health and dietary habits in Chinese and Korean food culture.

The Chinese have been influenced by the ‘five elements’ and thus believe in the traditional categorization of the five taste qualities, i.e., *sweet, sour, bitter, spicy, and salty*. The contemporary scientific view of TASTE,¹ however, narrows its discussion in sensations that can be detected by the tongue, which merely account for the genuine gustatory sense including *sour, sweet, salty* and *bitter*, and later *umami*—the fifth taste quality found by Japanese scientist Kikunae Ikeda (Mouritsen and Styrbæk 2014). *Umami* is typically described as a mild and lasting aftertaste and is conducive to salivation. It generally starts at the back of the tongue but can spread through the back of the oral cavity to the throat. This

1 Note that small capital letters in this paper are used to indicate conceptual domains following the convention in the Conceptual Metaphor Theory (Lakoff and Johnson 1980, 1999). Here, we consider TASTE a conceptual domain that represents a group of taste-related concepts.

description matches the Chinese sensation of 回甘 *huí-gān* ‘sweet-return’,² most frequently used with tea. In fact, Lee et al.’s (2008) study, among others, shows that oolong tea shares the same chemical process that contributes to *umami*, just like the better-known Matcha (Japanese green tea). It is also interesting to note that the Japanese kanji/characters 旨味 are coined by combining *umai* ‘delicious’ 旨 and *-mi* ‘taste’ 味; and 旨 *umai* ‘delicious’ is in fact derived from the Chinese 甘 *gān* ‘sweet; delicious’. On the other hand, even though *spicy* has been long considered one of the basic tastes in Chinese, it is in fact a type of chemesthesis, which is activated by the receptor mechanisms for other senses that usually mediate pain, touch, and thermal perception (Green 1996, 2016). Dong et al. (2018) and Zhong et al. (to appear) argued for the missing place of *spicy* in the perception of TASTE in Mandarin Chinese and attested that the Chinese treat *spicy* differently from other basic tastes.

The disparity between the basic taste qualities in people’s mind and those genuine taste qualities from the neurophysiological perspective leads us to question the linguistic manifestations of TASTE in Chinese. It seems that TASTE is a relatively fuzzy domain and is not limited to gustatory sensory qualities defined neurophysiologically. Another intriguing fact is that there is a term in English, *flavor*, often loosely interchangeable with *taste*, is usually used to depict multisensory perception and is engaged as a combination of other senses (Mouritsen et al. 2017; Piqueras-Fiszman and Spence 2016): “it turns out that what most people have in mind when they talk about *taste* is really *flavor*” (Piqueras-Fiszman and Spence 2016: 1). In other words, tasting, as a complicated process, elicits not only the gustation defined neurophysiologically but also activates the perception of FLAVOR, which is a ‘complex combination of the olfactory, gustatory and trigeminal sensations perceived during tasting’ and is influenced by ‘tactile, thermal, painful and/or kinesthetic effects’ as noted by the International Organization for Standardization (ISO) (Klosse 2014: 22). Figure 1 illustrates FLAVOR as an umbrella term that encompasses gustatory, olfactory, and

2 甘 *gān* is an ideogram symbolizing the shape of the tongue with the back marked. It stands for ‘good, pleasing taste’ which is assumed to cover sweetness in Archaic Chinese (its later form 甜 *tián* ‘sweet’ is used predominantly to refer to sweetness). It is noted that 甘 *gān* is two of the mostly likely candidates for *umami* in Mandarin Chinese; the other is 鮮 *xiān*—the pleasant taste of fresh seafood or meat, especially in soup.

tactile senses.

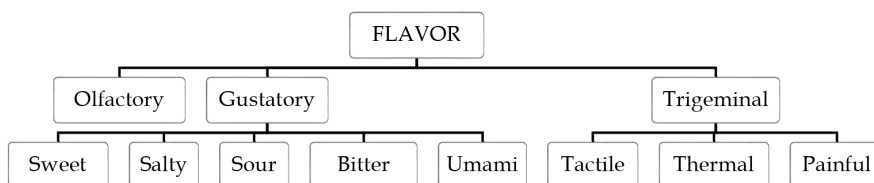


Figure 1. The concept of *FLAVOR* from a neurophysiological perspective

However, Chinese uses only one word, 味 *wèi* or 味道 *wèidào* to cover both the taste and flavor of food; and vocabulary from visual, olfactory, and tactile senses all contribute to the comprehension and conceptualization of 味 *wèi* and 味道 *wèidào* in Chinese (Zhong et al. to appear). It is the same case in Korean, where 맛 *mas* ‘taste’ is the most frequently used item to describe food (Kang et al. 2016); gustatory vocabulary, however, recruits extensive tactile- and auditory-related terms (i.e., onomatopoeia) to denote the taste and flavor of food (Rhee and Koo 2017). It hence triggered our interest in exploring how people would discuss their tasting experiences in real life? More importantly, can gustatory vocabulary alone manifest the versatility of TASTE in real-life language use?

2. Literature review

2.1 TASTE in a narrow sense

Previous literature examining TASTE in Chinese typically focuses on the five traditional tastes, i.e., 酸 *suān* ‘sour’, 甜 *tián* ‘sweet’, 苦 *kǔ* ‘bitter’, 辣 *là* ‘spicy’, and 鹹 *xián* ‘salty’, along with their mental representations (e.g., Jiang 2008; Pan and Zhang 2017) and their meanings transferring to other sensory modalities (e.g., Zhao et al. 2018). The meaning transfers using concepts from one sensory modality to describe another are defined as ‘linguistic synesthesia’.³ For example,

³ It is to distinguish from ‘neurological synesthesia’, in which sensory stimuli cause additional experiences in another sense neurologically, such as seeing colors while listening to music, seeing

in the phrase *sweet voice*, *sweet* modifies *voice* with the mapping direction from TASTE to HEARING. Linguistic synesthesia, therefore, to some extent resembles a conceptual metaphor that associates perceptual experiences through lexical expressions that originate in two distinct sensory domains (e.g., Jo 2019; Strik Lievers 2017; Zhao et al. 2019a). In previous linguistic synesthesia studies, the classification of synesthetic metaphors usually resorts to the etymology of the word, i.e., the sensory domain that the lexical item is first pertinent to. For example, although 美 *měi* in contemporary Chinese is understood as ‘beautiful’ and primarily perceived by the sense of vision, it was interpreted as 甘 *gān* ‘sweet; delicious’ in *Shuowenjiezi* (Xu 1963) for its composition of 羊 ‘sheep’ and 大 ‘big’—a big sheep is tasty; it is hence coded as a synesthetic adjective transferring its meaning from taste to vision (cf. Zhao et al. 2019a; Zhao et al. 2018; Zhao et al. 2019b). In this respect, TASTE only incorporates items that signify gustatory perception in Archaic Chinese.⁴ Apart from the five basic taste terms 酸 *suān* ‘sour’, 甜 *tián* ‘sweet’, 苦 *kǔ* ‘bitter’, 辣 *là* ‘spicy’, and 鹹 *xián* ‘salty’, Zhao et al. (2019b: 244) extended the list of monosyllabic gustatory synesthetic adjectives to include 甘 *gān* ‘sweet; delicious’, 辛 *xīn* ‘spicy’,⁵ 鮮 *xiān* ‘savory’, 淡 *dàn* ‘of mild taste’, 濃 *nóng* ‘of intense taste’, 膩 *nì* ‘greasy; excessive’, and 美 *měi* ‘tasty; beautiful’, because all these words implied a gustatory feeling in Archaic Chinese.

Sharing origins with the Chinese food culture, TASTE in Korean is likewise composed of 시다 *si-ta* ‘sour’, 달다 *tal-ta* ‘sweet’, 쓰다 *ssu-ta* ‘bitter’, 맵다 *map-ta* ‘spicy’, and 짜다 *cca-ta* ‘salty’ (Park 2013), but also involves 고소하다 *kosoha-ta* ‘umami’, 비리다 *pili-ta* ‘fishy’, and 싱겁다 *singkep-ta* ‘bland’ (Rhee and Koo 2017: 44-45). These items are considered the ‘primary taste category’,⁶ and consist of 146 related terms that have origins in native Korean (compared to Sino-Korean). Some frequently used taste terms in ‘primary taste category’ later gave rise to an

alphabets and numbers in colors, so on and so forth (cf. Hubbard and Ramchandran 2005).

4 Also known as Old Chinese, which can be traced back from the Shang Dynasty to the Han Dynasty (16th century B.C.-220 A.D.) (Huang and Shi 2016).

5 An earlier use of 辣 *là* ‘spicy’ in Archaic Chinese.

6 The ‘primary taste category’ is based on the intuition of native Korean speakers. Therefore, these taste terms might not originally denote gustatory feelings as those in Chinese. Rhee and Koo (2017) claimed that words related to other sensory domains (e.g., TOUCH and SMELL), and those composed of a combination of tastes (e.g., SWEET+SOUR) were not included in this category.

'extended taste category', which mostly contains multiple flavors such as SWEET+SOUR, SPICY+BITTER, SPICY+SALTY (cf. Rhee and Koo 2017). Turning to linguistic synesthesia, Jo (2019) suggested that Korean, like Chinese, perceives TASTE as a primary source domain that contributes to meaning transfers to SMELL, VISION, and HEARING. However, note that although TASTE produces a number of synesthetic adjectives in Chinese, the synesthetic transfers between TASTE and TOUCH, VISION, and SMELL exhibit a 'biased-directional' tendency. This means a bidirectional mapping (i.e., a transfer back and forth between two sensory domains instead of a unidirectional transfer from one sensory domain to another) is suggested between TASTE and other senses, albeit that transferability from other senses to TASTE is much weaker when it is compared to when TASTE acts as the source domain (Zhao et al. 2019a). On the contrary, in English, TASTE is used less frequently as the source domain such as in Mandarin and Korean, but the meaning transfer between TASTE and other sensory domains is in a more unidirectional course (e.g., Strik Lievers 2015; Ullmann 1957; Williams 1976). Such language and cultural peculiarities further confirmed that as a relative 'more embodied' sense, TASTE is language-specific and cultural-bound in nature.

2.2 TASTE in a broad sense

The multisensory nature of TASTE discussed in the Introduction has rendered gustatory vocabulary not limited to the five genuine tastes that can be perceived by the receptors on the tongue. It involves all possible descriptors that could be felt in the oral cavity when we are ingesting—this might be one of the reasons why 辣 *là* 'spicy' and 맵다 *map-ta* 'spicy' have long been deemed as one of the basic tastes in Chinese and Korean. Zhong et al. (to appear) examined modifiers centered on the concept of 味道 *wèidào* 'taste; smell' in the corpus and found that words originated in other sensory modalities were all largely adopted to describe 味道 *wèidào* 'taste; smell'. They further suggested that the feelings in the mouth are concrete bodily sensations which are open to embracing more embodied concepts (e.g., temperature and texture related words). In the meantime, the concept of 味道 *wèidào* 'taste; smell' might become less embodied to the extent that people will focus on the desirability and pleasantness when

they are tasting. Thus, it is reasonable to use less embodied terms (e.g., visual-related words) to depict amalgamated feelings in the mouth.

TASTE as a multisensory perception is not only evidenced in Chinese, Korean taste terms similarly do not follow a strict definition of gustatory sensation from the neurological perspective. As observed in Rhee and Koo (2017), tactile-based terms, including those denoting ASTRINGENT, BURNING, REFRESHING, SLIPPERY, SHARP, LACK-STIMULATION (lacking flavor, e.g., *bland*), and LACKING-PURITY (causing a thick, dull, and muddy taste), as well as onomatopoeic words, all partake in the mechanism of lexicalization of the gustatory vocabulary in Korean. Yet, Korean taste terms were found placing more emphasis on tactile items than onomatopoeia (Strauss 2005). On the contrary, Japanese, a language that is rich in ideophones, is inclined to adopt the sound to describe the texture of the food items in flavor expressions. One of the possible reasons is that onomatopoeic expressions can utilize multiple sensory stimulations (e.g., via acoustic sounds) instead of extensive descriptions to deliver much more concrete expressions (Noda 2014). Even though the cross-modal association between sound and taste has been established in a number of experimental studies (e.g., Simner et al. 2010; Winter et al. 2019; Zampini and Spence 2004, 2010), no particular onomatopoeic words were found modifying 味道 *wèidào* 'TASTE; smell' in the Chinese data (Zhong et al. to appear). It thus makes one wonder if there is any other word than 味道 *wèidào* 'taste; smell' that covers all the possible correlations among senses. In general, TASTE can possibly go beyond the gustatory domain as defined in a narrow sense and take advantage of its multimodal nature to invite lexical items from other sensory modalities.

2.3 What DESSERT can tell us

In this study, we would like to compile a specific corpus for DESSERT to explore the descriptions of food in real life. The reasons for choosing DESSERT as the target food domain are twofold.

First, DESSERT primarily contains sweetness, which is possibly the most appealing taste quality across all ages, races, and cultures (Drewnowski et al. 2012). Even though food culture varies across cultures, people assumedly share a

strong inclination for tempting and unhealthy food that is exceptionally high in calories and containing fat and sugar (Pinel et al. 2000). In Papiés' (2013) examination of food-related words using a feature-listing experiment, words for foods that are more tempting (attractive but unhealthy food, like ice cream, cookies, and chips) led to more taste, texture, and temperature features. In contrast, neutral but healthy foods (such as cucumber, apple, and rice) were primarily given features related to visual adjectives (e.g., *red*). This is considered a pioneering study suggesting that the more enjoyable food is, the more sensory experience will be triggered (Speed and Majid 2019). Adopting Lynott et al.'s (2019) Sensorimotor Norms,⁷ Speed et al. (2020) likewise found that words used to depict unhealthy foods, like desserts, were rated more strongly in the gustatory, olfactory, and interoceptive modalities than healthy food words, and were rated as more attractive than healthy foods. That is to say, the relationship between healthiness and attractiveness could be mediated by perceptual strength in the gustatory, olfactory, and interoceptive modalities. Moreover, unhealthy foods are more desirable because they are more strongly associated with sensory experiences in general. Such the hedonistic feature of food is in line with Jurafsky's (2014) discussion of the association between dessert and sex. In a million online food reviews, Jurafsky (2014) identified that the most commonly used words to describe dessert were those based on tactile sensation for describing textures and temperatures, such as *rich*, *moist*, *sticky*, *gooey*, *smooth*, *spongy*, and *melting*. These expressions were claimed to imply veiled sexual connotations and focus intensely on the feelings in the mouth, rather than the 'appearance, smell, taste, or sound' (Jurafsky 2014: 103). However, the sensual hedonism and pleasure in Western food culture hinted in the vocabulary that captures the notion of 'softness, creaminess or sweetness' was claimed to be lacking in Eastern culture where a focus on 'lightness and airiness' was implied, especially in Japanese as a representative of East Asian languages (Strauss 2005).

7 This line of studies is also known as 'Modality Exclusivity Norms'. It typically collects perceptual ratings by asking people how strongly they experience a particular concept via *seeing*, *hearing*, *tasting*, *smelling* or *touching/feeling*. Recently a new norm 'Sensorimotor Norms' was collected, including perceptual ratings from the five basic human senses and an additional vector *interoception*—sensations inside the body—which more relate to the awareness of internal bodily states, emotions, and cognitive processes, together with ratings collected from some action effectors (e.g., *foot*, *hand*, *head*, *mouth*, *torso*).

Second, even though the craving for sweetness seems to be a universal phenomenon, DESSERT is absent from ‘the grammar of cuisine’ on a Chinese dining table (Jurafsky 2014: 177) —it did not exist in traditional Chinese meal course. *Dessert*, originally a French word, referred to ‘to de-serve, to remove what has been served’ and was later used by the British and then the Americans in the eighteenth century to stand for sweet things only (Jurafsky 2014). Note that Chinese cuisine also consists of a variety of sweet items, like 糕點 (*gāodiǎn* ‘cakes and pastries’) and Cantonese Tong Sui (literally translated as ‘sugar water’), but DESSERT in the current context refers to western desserts only, which are served as the last course in a Western meal, for example, pudding, cake, and even ice cream. Although DESSERT is neither an integral part of a traditional Chinese meal nor an element of Chinese food culture, statistics collected from big data indicated that the younger generation in China had acquired a growing interest in desserts—out of all types of restaurants in China, cake and bakery shops ranked at the top 25% among the generation born after 1990 (‘The generation after the 90s is not fond of Chinese cuisine any more’ 2018).⁸ Given the craving for western desserts in contemporary China, one may wonder how the Chinese describe dishes like desserts, which are not originally part of their culture.

This study takes the initiative to investigate how gustatory vocabulary can narrate sweetness in Chinese by building a DESSERT corpus and examining current expressions of TASTE in Chinese. It mainly addresses two questions:

- 1) How will people discuss the TASTE of one specific type of food, i.e., DESSERT, in real life?
- 2) Will people only use gustatory vocabulary in a narrow sense to describe TASTE? For example, the authentic taste qualities that can be perceived by the tongue, like 甜 *tián* ‘sweet’; or, will they note the multisensory nature of TASTE and employ all possible sensory lexical items to conceptualize it?

8 Accessed at http://k.sina.com.cn/article_6440155365_17fddf8e500100321r.html

3. Methodology

3.1 Data

The power of corpora data in empirical linguistic research has been noted in Park and Nam (2017) and Davies and Kim (2019), among others. This study adopts a corpus-based method to investigate lexical patterns and authentic linguistic usages in the context, specifically in food reviews.

Online food reviews from the largest restaurant review website *Dazhong Dianping* (also known as *Dianping* or *Meituan-Dianping*)⁹ in Mainland China were collected among 30 bakeries and cafés in Beijing, Shanghai, and Guangzhou. The restaurants were evenly chosen in the three cities, i.e., ten shops each in Beijing, Shanghai, and Guangzhou. The three cities were picked because they are among the top first-tier cities in China, and the numbers of restaurants and netizens that use *Dazhong Dianping* constitute a considerable proportion of the population. In addition, Beijing, Shanghai, and Guangzhou are respectively located in the northern, central, and southern parts of China, which helped reduce the influence of dialects spoken in any specific region in China.

In the first step of data collection, the 30 shops were arranged in descending order according to the total number of reviews. Hence, the food reviews collected were from the restaurants that received the most comments in the three cities. Only one branch of a franchisor was chosen to avoid repetition—for example, only one *Starbucks* branch was picked. Those restaurants were further checked to ensure that most of the foods sold at the shop were western desserts. The second step was to select comments. In *Dazhong Dianping*, three categories, positive, neutral, and negative comments, were available to choose from. We opted for the comments under the positive and negative categories because positive comments had already accounted for around 80% of the total comments, while negative comments were collected to compare the descriptors for good taste and bad taste if there were any.

After the restaurants and comments were chosen, a third-party web crawler *Octoparse* (*Bazhuayu* in Chinese)¹⁰ was utilized to scrape the data from the

9 Accessed at <http://www.dianping.com/>

10 Accessed at <https://www.octoparse.com/>

website automatically. Excluding repeated comments, 85,318 positive comments versus 4,007 negative comments were collected by 8 June 2018, 89,325 comments in total. A DESSERT corpus was then compiled in the *Sketch Engine* (Kilgarriff et al. 2014),¹¹ with words segmented and parts-of-speech tagged. This yielded a total of 4,785,363 tokens as our data.

3.2 Analysis

Four main functions in the *Sketch Engine* assisted in the data analysis. First, *Wordlist* was used to generate word frequency lists encompassing the main parts of speech in the corpus data, for example, nouns, verbs, and adjectives. We then used *Word Sketch Difference* to differentiate synonyms found in the word lists. *Word Sketch Difference* is a function that generates word sketches for two words and compares their differences in use; the two words are most closely related, such as near-synonyms, antonyms, and words from the same semantic field. *Word Sketch*—sketching a word's grammatical and collocational behavior ranked by the logDice score (or MI log Frequency)—was further adopted to examine the co-occurred words of the keyword in different grammatical relations. The logDice score indicates how strong a collocation is—the higher the score, the stronger the collocation, and vice versa (for the algorithm of logDice score, please see Rychlý 2008). *Concordance* was additionally implemented to scrutinize the context of the keyword.

4. Results

4.1 Taste or mouthfeel

A word list using the *Wordlist* function was generated to examine the overall frequency of the vocabulary. Appendix 1 presents the top ten frequently used words related to the tasting experience across the three main lexical categories: nouns, adjectives, and verbs. As indicated by the word frequency, verbs

11 Accessed at <https://app.sketchengine.eu/>

appeared much less frequently than nouns and adjectives when describing the tasting experience. 甜 *tián* ‘sweet’, 膩 *nì* ‘greasy, excessively (flavored)’, 新鮮 *xīnxiān* ‘fresh’, 濃郁 *nóngyù* ‘rich; thick’, and 香 *xiāng* ‘fragrant; delicious’, were the most relevant adjectives related to the feeling of tasting; yet, if they were used to describe DESSERT only is a question. Turning to nouns, apart from the specific foods or drinks, we spotted the three most frequently used terms as well as near-synonymous pairs that imply tastes and flavors of food: 味道 *wèidào* ‘taste; smell’, 口味 *kǒuwèi* ‘taste; flavor’, and 口感 *kǒugǎn* ‘mouthfeel’.

To compare the similarities and differences of the three words, *Word Sketch Difference* facilitated in unraveling the only patterns for the three words—see Appendices 2-4. 味道 *wèidào* ‘taste; smell’ was found to be mostly collocated to TASTE in a narrow sense, e.g., 膩 *nì* ‘greasy; excessively (flavored)’, 濃郁 *nóngyù* ‘rich; thick’, 濃 *nóng* ‘of intense taste’ and 淡 *dàn* ‘of mild taste’. As for 口味 *kǒuwèi* ‘taste; flavor’, we can 選擇 *xuǎnzé* ‘to choose’ or 嘗試 *chángshì* ‘to try’ different flavors, and we have 個人口味 *gèrén kǒuwèi* ‘personal flavor’; other than that, this word was found scarce in taste-related expressions. Concerning 口感 *kǒugǎn* ‘mouthfeel’, we identified several tactile terms that indicate texture, such as 脆 *cùi* ‘crisp’, 乾 *gān* ‘dry’, 滑 *huá* ‘smooth’, 酥 *sū* ‘flaky’, and 軟 *ruǎn* ‘soft; tender’, as listed in Appendix 4. To begin with, the differences among the three near synonyms attested our assumption that descriptions for DESSERT might be more concerned with TASTE in a broad sense, i.e., all the feelings in the mouth rather than the five genuine taste qualities, considering that most of the features depicting DESSERT were found to be associated to the concept of MOUTHFEEL.

4.2 MOUTHFEEL descriptors

To examine what descriptors contribute to the conceptualization of MOUTHFEEL in the DESSERT corpus, 口感 *kǒugǎn* ‘mouthfeel’ was set as the KWIC (keyword in context) and scrutinized in the context. Since a large number of concordances existed in the data—5,928 instances in positive comments—only 口感 *kǒugǎn* ‘mouthfeel’ that acted as the subject and the object being modified in the instances was examined manually.

In 1,734 concordances containing the keyword 口感 *kǒugǎn* ‘mouthfeel’ in the

positive comments, 175 words (types) and 1,325 tokens were identified, including 138 monosyllabic and disyllabic adjectives (the top 20 are provided in Table 1 below), 5 ABB adjectives (e.g., 軟綿綿 *ruǎnniánnián* ‘soft and smooth’, 硬邦邦 *yìngbāngbāng* ‘hard’, 甜津津 *tiánjīnjīn* ‘sweet’), 6 four-word conventionalized phrases (e.g., 入口即化 *rù-kǒu-jí-huà* ‘melt in one’s mouth’, 甜而不膩 *tián-ér-bù-nì* ‘sweet, and just right’, 外脆內軟 *wài-cuì-nèi-ruǎn* ‘crunchy/crispy outside and tender inside’), 4 nouns (層次 *céngcì* ‘layer’, 嚼勁 *jiáoqìn* ‘chewiness’, 韌性 *rènxìng* ‘elastic’, 彈性 *tánxìng* ‘bouncy’), 5 verbs (回甘 *huí-gān* ‘sweet-return’, 帶甘 *dài-gān*, ‘with sweetness’, 爆漿 *bàojiāng* ‘molten’, 層疊 *céngdié*, ‘layered’, 刺激 *cìjī*, ‘stimulating’), 4 onomatopoeia (咯吱咯吱 *gēzhī-gēzhī*, ‘crunching sound’, 沙沙 *shāshā*, ‘rustling sound’, 啞啞 *zāzā*, ‘smacking sound’, 咣咣 *guāngguāng* ‘bounce sound’), 9 dialect words (e.g., Q ‘chewy’, Q彈 *Q-tán* ‘chewy’, 紮實 *zhāshí*, ‘solid’, 面 *miàn*, ‘mushy’, 粉 *fěn*, ‘powdery’), and 4 English words (*heavy, creamy, juicy, fresh*).

Table 1. The top 20 adjectives describing MOUTHFEEL in the positive comments

MOUTHFEEL Descriptors	
1 甜 <i>tián</i> ‘sweet’ (89)	2 膩 <i>nì</i> ‘greasy, excessively (flavored)’ (67)
3 濃郁 <i>nóngyù</i> ‘rich; thick’ (59)	4 脆 <i>cuì</i> ‘crisp’ (57)
5 清爽 <i>qīngshuǎng</i> ‘refreshing’ (43)	6 豐富 <i>fēngfù</i> ‘rich’ (43)
7 苦 <i>kǔ</i> ‘bitter’ (42)	8 鬆軟 <i>sōngruǎn</i> ‘fluffy’ (41)
9 酥脆 <i>sūcuì</i> ‘flaky; crunchy’ (39)	10 酸 <i>suān</i> ‘sour’ (28)
11 細膩 <i>xìnì</i> ‘fine and smooth’ (28)	12 硬 <i>yìng</i> ‘hard’ (27)
13 綿密 <i>miánmì</i> ‘silky’ (27)	14 甜膩 <i>tiánnì</i> ‘overly sweet’ (26)
15 淡 <i>dàn</i> ‘of mild taste’ (26)	16 清新 <i>qīngxīn</i> ‘refreshing’ (25)
17 乾 <i>gān</i> ‘dry’ (24)	18 香 <i>xiāng</i> ‘fragrant; delicious’ (21)
19 新鮮 <i>xīnxiān</i> ‘fresh’ (20)	20 軟 <i>ruǎn</i> ‘soft; tender’ (18)

Note: The numbers in the parentheses indicate the frequency of the lexical item in the corpus.

In contrast, negative comments only contained 175 concordances discussing MOUTHFEEL, in which 31 words (types) and 46 tokens were found (only the top 10 are presented in Table 2, as the frequency is relatively low after the first ten words). Positive and negative comments shared most of the common MOUTHFEEL vocabulary, and only a few terms in the negative comments could not be found in the positive comments, such as 糊 *hú* ‘mushy’, 空 *kōng* ‘empty’, 遲鈍 *chídùn* ‘dull’, 高冷 *gāolěng* ‘arrogant’ and 淡而無味 *dàn-ér-wú-wèi* ‘bland’.

Table 2. The top 10 adjectives describing MOUTHFEEL in negative comments

MOUTHFEEL Descriptors	
1 硬 <i>yìng</i> 'hard' (5)	2 粗糙 <i>cūcāo</i> 'coarse' (4)
3 乾巴巴 <i>gānbābā</i> 'dry and crusty' (3)	4 甜 <i>tián</i> 'sweet' (2)
5 軟綿綿 <i>ruǎnniánnián</i> 'soft and smooth' (2)	6 膩 <i>nì</i> 'greasy; excessively (flavored)' (2)
7 淡 <i>dàn</i> 'of mild taste' (2)	8 醇厚 <i>chún hòu</i> 'full-bodied' (2)
9 新鮮 <i>xīnxiān</i> 'fresh' (2)	10 酥軟 <i>sūruǎn</i> 'flaky and soft' (1)

Note The numbers in the parentheses indicate the frequency of the lexical item in the corpus.

Comparing the vocabulary used to describe the good and bad tastes of DESSERT in Chinese, it is observed that very few items are directly associated with the negative valence. Most of the time, people simply apply negative structures to positive words to express their dislikes, such as 不... *bù...* 'not...' and 太...了 *tài...le* 'too...', consider:

- (1) 鬆餅賣相不錯, 可惜不脆, 軟軟的。

sōngbǐng mǎixiàng bùcuò kěxī bù cuì ruǎn-ruǎn de
pancake sell-look not-bad pity not crispy soft-soft DE

'The pancakes are nice-looking. It is a pity that it is soft inside and not fluffy.'

- (2) 布朗尼口感還不錯, 但太甜了。

bùlǎngní kǒugǎn hái bùcuò dàn tài tián le
brownie mouthfeel relative not-bad but too sweet LE

'The brownie tastes good, but (a bit) too sweet.'

硬 *yìng* 'hard', 粗糙 *cūcāo* 'coarse', 乾 *gān* 'dry', and 膩 *nì* 'greasy, excessively (flavored)' are possibly the only four items that mainly arouse negative affection. Among them, 膩 *nì* 'greasy, excessively (flavored)' is an interesting word, and it is hard to locate its equivalence in English. In fact, most of the usages in the corpus do not denote fatty or greasy (the original meaning of 膩 *nì*); it is more related to the sick feeling that we experience when something is too sweet or when we get tired of eating too much of something sweet or greasy. For example:

- (3) 抹茶芝士蛋糕的奶酪味好厚重，但一塊下來就有點膩。

mǒchá zhīshì dāngāo de nǎilào wèi hǎo hòuzhòng dàn yī kuài

Matcha cheese cake DE cheese taste very thick but one piece

xiàlái jiù yǒu diǎn nì

down then have a-bit greasy

‘The Matcha cheesecake is rich and full (with cheesy flavor), but one might get a bit overwhelmed after finishing one full piece.’

To summarize, our corpus data establishes that gustatory words associated with 口感 *kǒugǎn* ‘mouthfeel’ outnumbered those with 味道 *wèidào* ‘taste; smell’ or 口味 *kǒuwèi* ‘taste; flavor’. Most of these gustatory words are adjectives, and the most frequent ones are also most likely to occur in compounds. For instance, 甜 *tián* ‘sweet’, 香 *xiāng* ‘fragrant; delicious’, and 滑 *huá* ‘smooth’ are part of the frequently compounds such as 香甜 *xiāngtián* ‘delicious and sweet’, 甜滑 *tiánhuá* ‘sweet and smooth’, and 香滑 *xiānghuá* ‘delicious and smooth’. These compounds tend to describe the preferable combinations of gustatory properties. In this regard, gustatory vocabulary in Chinese resembles those in the ‘extended taste category’ in Korean, in which multiple tastes and flavors can be coupled in the lexicalization of taste terms (Rhee and Koo 2017). Another interesting observation in our analysis of MOUTHFEEL descriptors is that negative polarity words are rarely used to describe dessert in Chinese. This finding mirrors the ‘Pollyanna effect’ proposed by Jurafsky (2014), which means that people tend to remember pleasant items more accurately than unpleasant ones when talking about food, especially in food reviews.

5. Discussion

5.1 Conceptualization of MOUTHFEEL through cross-modal concepts

The above section has corroborated our hypothesis that when people describe food in real life, what they really talk about are all possible perceptual feelings in the mouth, i.e., MOUTHFEEL, instead of TASTE in a narrow sense. MOUTHFEEL to this extent is similar to the concept of FLAVOR, which is related to taste and

aroma and is greatly influenced by ‘the structure, texture and responsible for the overall impression of the food’ (Mouritsen and Styrbæk 2014: 6). It is also supported by Klosse’s (2014: 38) claim that, ‘there is no flavor without some kind of mouthfeel’, and the mouthfeel is considered the ‘major determinant of consumer acceptance and preference for foods and beverages’ (Guinard and Mazzucchelli 1996: 213).

Despite the fact that the predominant position of MOUTHFEEL is confirmed in DESSERT, it is crucial to delve into the composition of MOUTHFEEL descriptors. The classification of the sensory vocabulary mainly follows the method of categorizing sensory words in Zhong et al. (to appear): 1) the sensory domain that the etymology of the word is pertinent to (cf. Zhao et al. 2019b); 2) the dominant sensory domain that the word belongs to (cf. Chen et al. 2019); and 3) other words not listed in Zhao et al. (2019b) or Chen et al. (2019) will be traced in *Shuowenjiezi* (Xu 1963) for their original connotations or their frequent usages in a general corpus data in the *Sketch Engine*, e.g., *Chinese Web 2017 (zhTenTen11)*.

First, we have determined that in all the 182 MOUTHFEEL descriptors identified in the previous section, more than 80 are possessed by tactile sensation, in which TEXTURE and TEMPERATURE are the two primary subcategories. Under the category of TEXTURE, tactile properties are mostly associated with hardness (e.g., 硬 *yìng* ‘hard’, 脆 *cuì* ‘crisp’ and 酥 *sū* ‘crunchy’), viscosity (e.g., 黏 *nián* ‘sticky’), smoothness (e.g., 滑 *huá* ‘smooth’ and 粗 *cū* ‘coarse’), dampness (e.g., 乾 *gān* ‘dry’ and 潤 *rùn* ‘moist’), and springiness (e.g., 彈 *tán* ‘bouncy’). With regard to TEMPERATURE, it is noted that instead of the two polarities, i.e., hot and cold, most of the temperature-related words indicate mild degrees, like 溫 *wēn* ‘warm’, 暖 *nuǎn* ‘warm’, 冰 *bīng* ‘icy’, and 涼 *liáng* ‘cool’. This reveals that foods and beverages in the DESSERT corpus are preferably served at a mild and moderate temperature rather than hot or cold.

Apart from the tactile vocabulary, MOUTHFEEL items undoubtedly comprise gustatory terms in a narrow sense as those discussed in Section 2.1, and they primarily denote intensity (e.g., 濃 *nóng* ‘of intense taste’ and 淡 *dàn* ‘of mild taste’) and the neurological taste qualities like 甜 *tián* ‘sweet’. However, only one olfactory word 香 *xiāng* ‘fragrant; delicious’ was found in MOUTHFEEL descriptions. Yet, limited smell connotation in the DESSERT corpus is indicated—香 *xiāng* ‘fragrant; delicious’ primarily refers to a delicious taste of food in our

data. As a matter of fact, taste and smell are closely intertwined in a way that odors apparently induce the perception of taste, and gustatory terms are also extensively used to describe odors (Auvray and Spence 2008). Another possibility for the absence of olfactory sensation in the DESSERT corpus is that desserts typically do not carry strong smell, as opposed to the pungent scent brought by other types of food.

Moreover, visual and auditory sensations both engage in the conceptualization of MOUTHFEEL. Visual items portraying thickness (e.g., 薄 *báo* 'thin'), cleanliness (e.g., 乾淨 *gānjìng* 'clean'), clearness (e.g., 清澈 *qīngchè* 'clear'), tightness (e.g., 蓬鬆 *péngsōng* 'fluffy'), density (e.g., 濃密 *nóngmì* 'dense'), and purity (e.g., 純 *chún* 'pure') were suggested as considerable components of MOUTHFEEL. Note that visual adjectives, to a large extent, are more abstract and metaphorical, which will be discussed in detail in the following section. A few auditory terms, i.e., onomatopoeia, were also identified, although not as many as those in Japanese and Korean.

The above categories of MOUTHFEEL in Chinese to some extent mirror the lexicalization mechanism of taste terms in Korean as discussed in Rhee and Koo (2017), especially those that denote TEXTURE (e.g., DRYNESS, RESILIENCE, CRUNCHINESS), although onomatopoeia in Chinese does not play an essential role in the class of crunchiness as those in Korean do. In fact, MOUTHFEEL examined in other languages suggested that Japanese has the wealthiest words describing TEXTURE and MOUTHFEEL—around 400 terms compared to 78 reported in American English (Mouritsen et al. 2017: 99). However, in English, *mouthfeel* is considered a neology that only became prevalent in recent years. Only one instance of *mouthfeel* was found in the *British National Corpus (BNC)*,¹² which was to describe the taste of wine:

- (4) Vosges oak...vividly yellow-gold, with spicy oak, good acidity, *mouthfeel* and pungency...

Note that BNC corpus was created in the 1980s – early 1990s. After ten to twenty years when *Corpus of Contemporary American English (COCA)*¹³ was built,

¹² Accessed at <https://app.sketchengine.eu/>

92 instances containing *mouthfeel* were gathered. However, in *English Web 2015 (enTenTen15)*,¹⁴ 1,330 tokens of *mouthfeel* were identified. Among these instances, the *mouthfeel* modifiers likewise contained a group of olfactory, tactile, and visual related adjectives as those in Chinese, including *aroma, velvety, silky, oily, smooth, lush, crisp, thick, thin, soft, and round*. One noticeable word is *round* – which is classified under the class of SHAPE in the visual domain; however, none of the MOUTHFEEL descriptors is categorized as SHAPE in Chinese.¹⁵

In brief, MOUTHFEEL is more versatile than TASTE, for its grounding on all sensory domains (see Figure 2 for an illustration of the concept of MOUTHFEEL of DESSERT). It further validates the multisensory nature of TASTE in a broad sense, which is capable of integrating all the five sensory modalities, although to varying degrees.

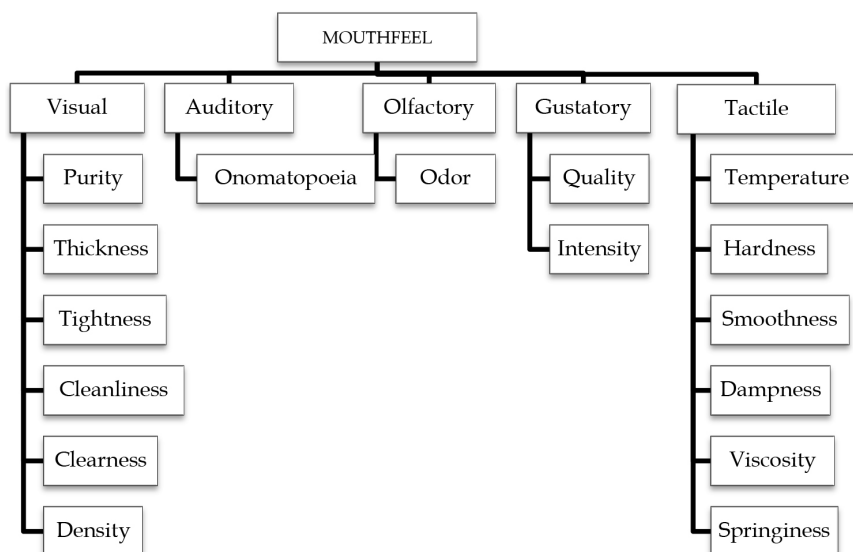


Figure 2. The concept of MOUTHFEEL (of DESSERT)

13 Accessed at <https://www.english-corpora.org/coca/>

14 Accessed at <https://app.sketchengine.eu/>

15 Note a mouthfeel term 圓潤 *yuánrùn* 'mellow and full' contains the shape word 圓 *yuán* 'round', however, the meaning of 圓 *yuán* 'round' is opaque in this compound.

5.2 Representation of MOUTHFEEL through personal preferences

The primary association of sweetness is the gustatory pleasure rather than nourishment for the body. Studies suggest that desserts are highly desirable due to the powerful impact sugar has on the reward system (Drewnowski 1995; Pinel et al. 2000), and consuming unhealthy but tempting food will activate reward-processing areas in the brain (Simmons et al. 2005; van der Laan et al. 2011). This is perhaps the underlying reason why, in English and other Indo-European languages, words that express sensuality and sexuality are dominant when used to describe the good taste of desserts (Jurafsky 2014). However, in Chinese, where explicit sensual expressions are not encouraged to represent hedonism, we propose that the embodied, yet abstract peculiarity of gustatory sensation has given rise to the conceptual metaphor of MOUTHFEEL IS PERSONALITY, as exemplified below:

- (5) ...醇厚的口感中帶些清新**調皮**...
 ...*chún hòu de kǒu gǎn zhōng dài xiē qīng xīn tiáo pí*...
 full-bodied DE mouthfeel in with some refreshing mischievous
 ‘...full-bodied taste with some refreshing mischief’
- (6) ...口感不雜，不**浮誇**。
 ...*kǒu gǎn bù zá bù fú kuā*
 mouthfeel not mixed not ornate
 ‘...the taste is pure and simple, and not superficial.’
- (7) ...口感很充實**硬朗**...
 ...*kǒu gǎn hěn chōng shí yìng lǎng*...
 mouthfeel very solid robust
 ‘...the taste is very full and robust...’

Words highlighted in bold imply that MOUTHFEEL can be conceptualized as an individual’s personality in Chinese, and often a pleasant one. On the contrary, 遲鈍 *chídùn* ‘dull’ and 高冷 *gāolěng* ‘arrogant’, deemed as unpleasant personalities, are found to describe the bad taste. These adjectives stem from impressions of personalities gained through social interactional contact. Thus,

personifying pleasant MOUTHFEEL as characters using such positive adjectives illustrates that, in the Chinese culture, language emanating from social interactional experience, rather than the feeling of physical bodily pleasure only, can also be used to describe MOUTHFEEL and TASTE.

Such an intimate relationship between taste experiences and psychological states were likewise suggested in some psychological studies. Meier et al. (2012) proposed an association between sweet taste experiences and personality characteristics by illustrating that taste metaphors could predict prosocial personality traits. Sagioglou and Greitemeyer (2014, 2016) on the other hand, suggested bitter taste preferences (as compared to sweet taste experiences) could provoke hostile thoughts and behavior, and would link to antisocial and malevolent personality traits. Moreover, preferences for spicy tastes could relate to risk-seeking tendency and behavior (Wang et al. 2016). Our study reinforced the above studies and calls for more attention to the overlooked mapping direction from the experience of personal relation to the gustatory experience: given that the whole theory of embodied cognition is built upon the well-attested fact that conceptual metaphors involve using more concrete and embodied concepts to express abstract concepts (Lakoff and Johnson 1980, 1999), what cognitive and linguistic mechanisms are involved in activating mental states derived from interpersonal contexts to represent those risen from the gastronomic experience?

5.3 Gustatory modality as the least exclusive sense

We observed earlier the unique position of the gustatory sense modality for its frequent involvement in linguistic synesthesia as either a source domain or a target domain with almost all other senses, as attested in previous literature. With our in-depth examination of sweetness substantiating the above observation with an even more versatile range of usage in this study, last but not least, it is important to explore the reason why the gustatory modality is fully connected to all other sense modalities.

First, it is well known that the adjacent faculty of olfactory sense will be activated simultaneously when the gustatory sense is in effect. This is attested by

a robust association of gustatory and olfactory senses in the Modality Exclusivity Norms collected across various languages (e.g., Chen et al. 2019; Lynott and Connell 2009, 2013; Miklashevsky 2018; Speed and Majid 2017). Second, the gustatory sense also necessarily involves tactile sense, as tasting entails that the tasted objects come into physical contact with the inside of the mouth. This contact brings a wide range of tactile sensations into play in any gustatory event. Third, tasting presupposes ingestion, which means that a food item was put into the mouth. The act of transporting food typically engages either hand (or utensils), thus requires sensorimotor coordination. This is also reflected by the close correlations between the gustatory sense and action effectors in the Sensorimotor Norms (Lynott et al. 2019). Fourth, in addition to the need of vision and touch in the act of transporting, ingestion of food also typically involves selecting a food item by seeing (and perhaps evaluating) the object to be ingested. This might be the reason for the subjective preference of visual and personality concepts in the conceptualization of MOUTHFEEL and TASTE. Lastly, although eating does not have to involve active listening or processing of sound, the human physiology (of the head) entails that some sound will travel to the ear and be picked up when an object is ingested.

This built-in connection between the gustatory modality and other modalities likely motivated the use of a taste word a self-hyponym standing for all sensory associations in the early Chinese Buddhist texts. It can be shown that 味 *wèi* ‘taste’ serves as a head noun for a whole range of sensory works covering sense organs and sensory stimuli from the five basic sensory modalities to connect the physical and mental constructs (Huang and Xiong 2019; Xiong and Huang 2016). This practice is also influential in other languages in East Asia, as attested by the choice of 味 *-mi* to in the coinage of *umami* in Japanese.

6. Conclusion

The uniqueness of the gustatory sense arose from its pivotal role in bridging cognition and other human activities. Tasting entails eating/ingestion, which is a pre-requisite for human survival. However, by requiring the self-initiated act of selecting and transporting food, it also involves volition and value selection from

the agent. Built around this volitional choice, fulfillment, culture, and identity can be constructed.

With online food reviews, we tackled the challenge of teasing a part of the true nature of the gustatory sense and its roles in a wide range of cross-modal interactions via exploration of how people perceive foods in real-life language use. Focusing on the descriptions of DESSERT in Chinese, this study revealed that the concept of MOUTHFEEL is used more often than TASTE to describe the desirable experience of tasting. Provided that MOUTHFEEL mostly consists of tactile properties and being concurrently influenced by gustatory, olfactory, visual, and auditory concepts, this study further provides manifestations for TASTE in a broad sense, which can be treated as a target domain and other sensory domains are all possible to have an impact on it. It is thus proposed that gustatory sense is highly non-exclusive and is the most connected sensory modality to other senses. Moreover, the representation of MOUTHFEEL through personality traits further sheds light on how embodiment and abstract notions interact.

Some future directions may include a further examination of physical and mental interrelations as reflected by our bodily experiences. One intriguing finding in Speed et al. (2020) is that ‘interoception’, deemed an internal bodily state or a visceral sense neurologically (Cameron 2002), is more salient in words that associate with more desirable food. Provided that an integration of gustatory and interoceptive perception is indicated in our brain (Avery et al. 2017), along with a possible correlation between the physical feeling (MOUTHFEEL) and the more abstract construct (PERSONALITY) suggested in the current study, future work in relation to the representation of concepts from the internal and external environment is a worthwhile direction. Moreover, Kang et al. (2016) and Jang et al. (2016) reported the importance of a unique gustatory concept 시원한맛 *siwenhan-mas* ‘delicious’ in Korean dishes. This expression indicates a refreshing and pleasurable experience which is not directly perceived by external bodily feelings like the taste (delicious) or the temperature (cool), but is more closely related to the internal sensation (e.g., 氣 *qi* ‘energy’) and the mental sentiment (Kang et al. 2016). Comparisons between Chinese and other languages also need to be undertaken to unveil cultural variances in this subject.

References

- Auvray, Malika and Charles Spence. 2008. The multisensory perception of flavor. *Consciousness and Cognition* 17(3): 1016-1031.
- Avery, Jason A., Stephen J. Gotts, Kara L. Kerr, Kaiping Burrows, John E. Ingeholm, Jerzy Bodurka, Alex Martin, and W. Kyle Simmons. 2017. Convergent gustatory and viscerosensory processing in the human dorsal mid-insula. *Human Brain Mapping* 38(4): 2150-2164.
- Cameron, Oliver G. 2002. *Visceral sensory neuroscience: Interoception*. New York: Oxford University Press.
- Chen, I-Hsuan, Qingqing Zhao, Yunfei Long, Qin Lu, and Chu-Ren Huang. 2019. Mandarin Chinese modality exclusivity norms. *PLoS One* 14(2): e0211336.
- Civitello, Linda. 2011. *Cuisine and culture: A history of food and people* (3rd ed.). Hoboken, New Jersey: John Wiley & Sons.
- Davies, Mark and Jong-Bok Kim. 2019. The advantages and challenges of “big data”: Insights from the 14 billion word iWeb corpus. *Linguistic Research* 36(1): 1-34.
- Dong, Sicong, Yin Zhong, and Chu-Ren Huang. 2018. How do non-tastes taste? A corpus-based study on Chinese people’s perception of spicy and numbing food. In Stephen Politzer-Ahles, Yu-Yin Hsu, Chu-Ren Huang, and Yao Yao (eds.), *Proceedings of the 32nd Pacific Asia Conference on Language, Information and Computation (PACLIC-32): 25th Joint Workshop on Linguistics and Language Processing (JWLLP-25)*, 858-866. Hong Kong: Association for Computational Linguistics.
- Drewnowski, Adam. 1995. Intense sweeteners and the control of appetite. *Nutrition Reviews* 53(1): 1-7.
- Drewnowski, Adam, Julie A. Mennella, Susan L. Johnson, and France Bellisle. 2012. Sweetness and food preference. *The Journal of Nutrition* 142(6): 1142-1148.
- Green, Barry G. 1996. Chemesthesis: Pungency as a component of flavor. *Trends in Food Science & Technology* 7(12): 415-420.
- Green, Barry G. 2016. Chemesthesis chemical touch in food and eating. In Shane T. McDonald, David A. Bolliet, and John E. Hayes (eds.), *Introduction: what is chemesthesis?*, 1-7. Chichester, West Sussex: Wiley Blackwell.
- Guinard, Jean-Xavier and Rossella Mazzucchelli. 1996. The sensory perception of texture and mouthfeel. *Trends in Food Science & Technology* 7(7): 213-219.
- Huang, Chu-Ren and Dingxu Shi. 2016. *A reference grammar of Chinese*. Cambridge: Cambridge University Press.
- Huang, Chu-Ren and Jiajuan Xiong. 2019. Linguistic synaesthesia in Chinese. In Chu-Ren Huang, Zhuo Jing-Schmidt, and Barbara Meisterernst (eds.), *The Routledge handbook of Chinese applied linguistics*, 294-312. Abingdon, UK: Routledge.

- Hubbard, Edward M. and V. S. Ramachandran. 2005. Neurocognitive mechanisms of synesthesia. *Neuron* 48(3): 509-520.
- Jang, Dai Ja, Ae Ja Lee, Soon Kang, A., Seung Min Lee, and Dae Young Kwon. 2016. Does siwonhan-mat represent delicious in Korean foods? *Journal of Ethnic Foods* 3(2): 159-162.
- Jiang, Shaoyu. 2008. The names of five tastes and their extended meanings. *Journal of Jiangsu University: Social Science Edition* 10(3): 55-61.
- Jo, Charmhun. 2019. A corpus-based analysis of synesthetic metaphors in Korean. *Linguistic Research* 36(3): 459-483.
- Jurafsky, Dan. 2014. *The language of food: A linguist reads the menu*. New York: W.W. Norton & Company.
- Kang, Soon Ah, Hyun Ji Oh, Dai Ja Jang, Min Jung Kim, and Dae Young Kwon. 2016. Siwonhan-mat: The third taste of Korean foods. *Journal of Ethnic Foods* 3(1): 61-68.
- Kilgarriff, Adam, Vít Baisa, Jan Bušta, Miloš Jakubíček, Vojtěch Kovář, Jan Michelfeit, Pavel Rychlý, and Vít Suchomel. 2014. The Sketch Engine: Ten years on. *Lexicography* 1(1): 7-36.
- Klosse, Peter. 2014. *The essence of gastronomy: Understanding the flavor of foods and beverages*. Boca Raton: CRC Press, Taylor & Francis Group.
- Kohn, Livia. 2010. *Daoist dietetics: Food for immortality* (1st ed.). Dunedin, FL: Three Pines Press.
- Lakoff, George and Mark Johnson. 1980. *Metaphors we live by*. Chicago: University of Chicago Press.
- Lakoff, George and Mark Johnson. 1999. *Philosophy in the flesh: The embodied mind and its challenge to Western thought*. New York: Basic Books.
- Lee, Viola S. Y., Jianpeng Dou, Ronald J. Y. Chen, Ruey-Song Lin, Maw-Rong Lee, and Jason T. C. Tzen. 2008. Massive accumulation of gallic acid and unique occurrence of mricetin, qercetin, and kaempferol in preparing old oolong tea. *Journal of Agricultural and Food Chemistry* 56(17): 7950-7956.
- Lynott, Dermot and Louise Connell. 2009. Modality exclusivity norms for 423 object properties. *Behavior Research Methods* 41(2): 558-564.
- Lynott, Dermot and Louise Connell. 2013. Modality exclusivity norms for 400 nouns: The relationship between perceptual experience and surface word form. *Behavior Research Methods* 45(2): 516-526.
- Lynott, Dermot, Louise Connell, Marc Brysbaert, James Brand, and James Carney. 2019. The Lancaster Sensorimotor Norms: Multidimensional measures of perceptual and action strength for 40,000 English words. *Behavior Research Methods* 52(3): 1271-1291.
- Meier, Brian P., Sara K. Moeller, Miles Riemer-Peltz, and Michael D. Robinson. 2012. Sweet taste preferences and experiences predict prosocial inferences, personalities, and behaviors. *Journal of Personality and Social Psychology* 102(1): 163-174.
- Miklashevsky, Alex. 2018. Perceptual experience norms for 506 Russian nouns: Modality

- rating, spatial localization, manipulability, imageability and other variables. *Journal of Psycholinguistic Research* 47(3): 641-661.
- Mouritsen, Ole G. and Klavs Styrbæk. 2014. *Umami: Unlocking the secrets of the fifth taste*. New York: Columbia University Press.
- Mouritsen, Ole G., Klavs Styrbæk, and Mariela Johansen. 2017. *Mouthfeel: How texture makes taste*. New York: Columbia University Press.
- Noda, Mari. 2014. It's delicious! How Japanese speakers describe food at a social event. In Polly E. Szatrowski (ed.), *Language and food: Verbal and nonverbal experiences*, 79-102. Amsterdam: John Benjamins Publishing Company.
- Pan, Qiuping and Jiamin Zhang. 2017. Semantic extension of words expressing the five cardinal tastes: A semantic map approach. *Essays on Linguistics*. 318-372.
- Papies, Esther K. 2013. Tempting food words activate eating simulations. *Frontiers in Psychology* 4: 838.
- Park, Hyejin and Daehyeon Nam. 2017. Corpus linguistics research trends from 1997 to 2016: A co-citation analysis. *Linguistic Research* 34(3): 427-457.
- Park, Min Jun. 2013. *An ontology-based research on the lexical field of taste in Chinese and Korean*. Master Thesis. Tsinghua University, Beijing.
- Pinel, John P. J., Sunaina Assanand, and Darrin R. Lehman. 2000. Hunger, eating, and ill health. *The American Psychologist* 55(10): 1105-1116.
- Piqueras-Fiszman, Betina and Charles Spence. 2016. *Multisensory flavor perception: From fundamental neuroscience through to the marketplace*. UK; USA: Woodhead Publishing.
- Rhee, Seongha and Hyun Jung Koo. 2017. Multifaceted gustation: Systematicity and productivity of taste terms in Korean. *Terminology. International Journal of Theoretical and Applied Issues in Specialized Communication* 23(1): 38-65.
- Rychlý, Pavel. 2008. A lexicographer-friendly association score. In Petr Sojka and Aleš Horák (eds.), *Proceedings of the 2nd Workshop on Recent Advances in Slavonic Natural Languages Processing (RASLAN-2)*, 6-9. Czech Republic: Masaryk University.
- Sagioglou, Christina and Tobias Greitemeyer. 2014. Bitter taste causes hostility. *Personality & Social Psychology Bulletin* 40(12): 1589-1597.
- Sagioglou, Christina and Tobias Greitemeyer. 2016. Individual differences in bitter taste preferences are associated with antisocial personality traits. *Appetite* 96: 299-308.
- Serdar, Oktay and Ekinci Erhun Kemal. 2019. Medicinal food understanding in Korean gastronomic culture. *Journal of Ethnic Foods* 6(1): 1-11.
- Simmons, W. Kyle, Alex Martin, and Lawrence W. Barsalou. 2005. Pictures of appetizing foods activate gustatory cortices for taste and reward. *Cereb Cortex* 15(10): 1602-1608.
- Simner, Julia, Christine Cuskey, and Simon Kirby. 2010. What sound does that taste? Cross-modal mappings across gustation and audition. *Perception* 39(4): 553-569.
- Speed, Laura J. and Asifa Majid. 2017. Dutch modality exclusivity norms: Simulating perceptual modality in space. *Behavior Research Methods* 49(6): 2204-2218.

- Speed, Laura J. and Asifa Majid. 2019. Grounding language in the neglected senses of touch, taste, and smell. *Cognitive Neuropsychology* 37(5-6): 363-392.
- Speed, Laura, J., Esther K. Papies, and Asifa Majid. 2020. *Perceptual associations explain attractiveness of healthy and unhealthy food words*. Paper presented at the UK Cognitive Linguistics Conference (UKCLC), Birmingham, UK: University of Birmingham.
- Strauss, Susan. 2005. The linguistic aestheticization of food: A cross-cultural look at food commercials in Japan, Korea, and the United States. *Journal of Pragmatics* 37(9): 1427-1455.
- Strik Lievers, Francesca. 2015. Synaesthesia: A corpus-based study of cross-modal directionality. *Functions of Language* 22(1): 69-95.
- Strik Lievers, Francesca. 2017. Figures and the senses: Towards a definition of synaesthesia. *Review of Cognitive Linguistics* 15(1): 83-101.
- Ullmann, Stephen. 1957. *The principles of semantics*. Oxford: Basil Blackwell.
- van der Laan, L. N., D. T. D. de Ridder, M. A. Viergever, and P. A. M. Smeets. 2011. The first taste is always with the eyes: A meta-analysis on the neural correlates of processing visual food cues. *Neuroimage* 55(1): 296-303.
- Wang, Xue, Liuna Geng, Jiawen Qin, and Sixie Yao. 2016. The potential relationship between spicy taste and risk seeking. *Judgment and Decision Making* 11(6): 547-553.
- Williams, Joseph M. 1976. Synaesthetic adjectives: A possible law of semantic change. *Language* 52(2): 461-478.
- Winter, Bodo, Paula Pérez-Sobrino, and Lucien Brown. 2019. The sound of soft alcohol: Crossmodal associations between interjections and liquor. *PLoS One* 14(8): e0220449.
- Xiong, Jiajuan and Chu-Ren Huang. 2016. The synaesthetic and metaphorical uses of wei 'taste' in Chinese Buddhist texts. In Jong C. Park and Jin-Woo Chung (eds.), *Proceedings of the 30th Pacific Asia Conference on Language, Information and Computation (PACLIC-30)*, 485-492. Seoul: Kyung Hee University.
- Xu, Shen. 1963. *Explaining graphs and analyzing characters*. Beijing: Zhonghua Book Company.
- Zampini, Massimiliano and Charles Spence. 2004. The role of auditory cues in modulating the perceived crispness and staleness of potato chips. *Journal of Sensory Studies* 19(5): 347-363.
- Zampini, Massimiliano and Charles Spence. 2010. Assessing the role of sound in the perception of food and drink. *Chemosensory Perception* 3(1): 57-67.
- Zhao, Qingqing, Chu-Ren Huang, and Kathleen Ahrens. 2019a. Directionality of linguistic synesthesia in Mandarin: A corpus-based study. *Lingua* 232: 102744.
- Zhao, Qingqing, Chu-Ren Huang, and Yunfei Long. 2018. Synaesthesia in Chinese: A corpus-based study on gustatory adjectives in Mandarin. *Linguistics: an interdisciplinary journal of the language sciences* 56(5): 1167-1194.
- Zhao, Qingqing, Jiajuan Xiong, and Chu-Ren Huang. 2019b. Synaesthesia, metaphor and

cognition: Systematic representations of synaesthesia in Chinese and its linguistic values. *Studies of the Chinese Language* 2: 240-253.

Zhong, Yin and Chu-Ren Huang. 2018. Pleasing to the mouth or pleasant personality: A corpus-based study of conceptualization of desserts in online Chinese food reviews. In Stephen Politzer-Ahles, Yu-Yin Hsu, Chu-Ren Huang, and Yao Yao (eds.), *Proceedings of the 32nd Pacific Asia Conference on Language, Information and Computation (PACLIC-32): 25th Joint Workshop on Linguistics and Language Processing (JWLLP-25)*, 893-903. Hong Kong: Association for Computational Linguistics.

Zhong, Yin, Chu-Ren Huang, and Sicong Dong. to appear. Bodily sensation and embodiment: A corpus-based study of gustatory vocabulary in Mandarin Chinese. *Journal of Chinese Linguistics*.

Appendix 1

Top ten frequent words related to tasting experience across three main lexical categories

Nouns	Adjectives	Verbs
咖啡 <i>kāfēi</i> 'coffee' (30,379)	好 <i>hǎo</i> 'good' (38,866)	吃 <i>chī</i> 'to eat' (27,752)
味道 <i>wèidào</i> 'taste; smell' (25,240)	不錯 <i>bùcuò</i> 'not bad' (36,280)	感覺 <i>gǎnjué</i> 'to feel' (15,336)
蛋糕 <i>dāngāo</i> 'cake' (17,672)	好吃 <i>hǎochī</i> 'tasty' (18,749)	喝 <i>hē</i> 'to drink' (14,775)
巧克力 <i>qiǎokèlì</i> 'chocolate' (11,593)	一般 <i>yībān</i> 'alright' (9,128)	烘焙 <i>hōngbèi</i> 'to bake' (2,621)
口味 <i>kǒuwèi</i> 'taste; flavor' (8,142)	甜 <i>tián</i> 'sweet' (8,301)	嘗試 <i>chángshì</i> 'to try' (2,183)
甜品 <i>tiánpǐn</i> 'dessert' (6,126)	好喝 <i>hǎohē</i> 'good to drink' (5,113)	體驗 <i>tǐyàn</i> 'to experience' (2,175)
抹茶 <i>mǒchá</i> 'matcha' (6,072)	膩 <i>nì</i> 'greasy, excessively (flavored)' (4,245)	配 <i>pèi</i> 'to go with' (2,030)
口感 <i>kǒugǎn</i> 'mouthfeel' (5,928)	新鮮 <i>xīnxiān</i> 'fresh' (2,715)	搭配 <i>dāpèi</i> 'to go with' (1,877)
麵包 <i>miànbāo</i> 'bread' (5,721)	濃郁 <i>nóngyù</i> 'rich; thick' (2,677)	煙熏 <i>yānxūn</i> 'smoked' (1,752)
拿鐵 <i>Nátiě</i> 'Latte' (5,392)	香 <i>xiāng</i> 'fragrant; delicious' (2,338)	品嚐 <i>pǐncháng</i> 'to try' (1,167)

Note: The numbers in the parentheses indicate the frequency of the lexical item in the corpus.

Appendix 2

味道 *wèidào* 'taste; smell' only patterns (first five words)

Subject	Modifiers (including adjective and noun modifiers)
很好 <i>hěnhǎo</i> 'very good' (8.2)	抹茶 <i>mǒchá</i> 'matcha' (10.1)
好 <i>hǎo</i> 'good' (7.7)	濃郁 <i>nóngyù</i> 'rich; thick' (9.4)
不過不失 <i>bù-guò-bù-shī</i> 'alright' (7.4)	淡淡 <i>dàn-dàn</i> 'of mild taste' (9.0)
膩/不膩 <i>nì/bù nì</i> 'greasy/not greasy' (6.8)	特別 <i>tèbié</i> 'special' (8.8)
不錯 <i>bùcuò</i> 'not bad' (6.7)	濃濃 <i>nóng-nóng</i> 'of intense taste' (8.7)

Note logDice scores are suggested in the parentheses.

Appendix 3

口味 *kǒuwèi* 'taste; flavor' only patterns (first five words)

Subject	Modifiers (including adjective and noun modifiers)
選擇 <i>xuǎnzé</i> 'choice' (9.1)	個人 <i>gèrén</i> 'personal' (10.9)
選 <i>xuǎn</i> 'to choose' (8.1)	我的 <i>wǒ-de</i> 'my' (10.6)
可選 <i>kě-xuǎn</i> 'can choose' (7.7)	新 <i>xīn</i> 'new' (8.5)
嘗試 <i>chángshì</i> 'to try' (7.7)	沒有 <i>méiyǒu</i> 'no' (8.5)
保持 <i>bǎochí</i> 'to keep' (7.4)	甜膩 <i>tiánnì</i> 'overly sweet' (8.4)

Note logDice scores are suggested in the parentheses.

Appendix 4

口感 *kǒugǎn* 'mouthfeel' only patterns (first five words)

Subject	Modifiers (including adjective and noun modifiers)
乾 <i>gān</i> 'dry' (8.3)	脆 <i>cuì</i> 'crisp' (9.3)
順滑 <i>shùnhuá</i> 'smooth' (7.7)	酥脆 <i>sūcuì</i> 'flaky; crunchy' (9.3)
細滑 <i>xìhuá</i> 'fine and smooth' (7.5)	鬆軟 <i>sōngruǎn</i> 'fluffy' (9.1)
綿綿 <i>mián-mián</i> 'spongy' (7.2)	脆脆 <i>cuì-cuì</i> 'crisp' (9.1)
酥軟 <i>sūruǎn</i> 'crunchy and soft' (7.2)	膩 <i>nì</i> 'greasy, excessively (flavored)' (8.6)

Note logDice scores are suggested in the parentheses.

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Received: 2020. 09. 27.

Revised: 2020. 11. 25.

Accepted: 2020. 12. 01.