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# Linguistic synesthesia is metaphorical: a lexical-conceptual account

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**Abstract:** This study seeks to clarify the nature of linguistic synesthesia using a lexical-conceptual account. Based on a lexical analysis of Mandarin synesthetic usages, we find that (1) linguistic synesthesia maps the metaphorical meaning between two domains; and (2) linguistic synesthetic mappings and conceptual metaphoric mappings have similar behaviors when sense modalities are treated as conceptual domains that contain a set of mappings constrained by Mapping Principles. This lexical-conceptual account is designed to capture the fact that linguistic synesthesia involves mapping between lexicalized concepts of sensory properties, instead of the real-time sensory input that is processed in neurological synesthesia. The incorporation of a lexical semantic view with the framework of Conceptual Metaphor Theory not only offers a coherent and comprehensive account for the nature of linguistic synesthesia, but also handles aspects of linguistic synesthesia previously only accounted for by non-metaphorical accounts. These design features make this proposal the most comprehensive account to fit the current data. Furthermore, by showing linguistic synesthesia as a type of metaphor, our study strengthens the role of conceptual metaphors as the link between the perceived world and our conceptualization of that world.

**Keywords:** lexical-conceptual account; linguistic synesthesia; mapping principle; metaphor

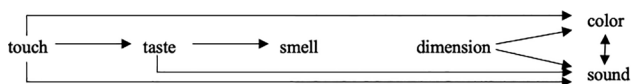
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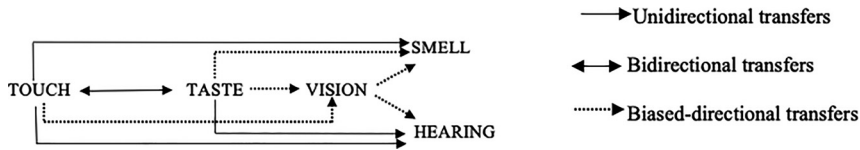
# 1 Introduction

Linguistic synesthesia is a type of language usage whereby lexical items commonly considered to be in one sensory modality are employed to describe perceptions in another (Shen 1997; Ullmann 1957; Williams 1976). For instance, the English expression *sweet voice* uses a gustatory concept to describe an auditory perception (Strik Lievers 2015: 70), and the Mandarin phrase 柔綠 *róu lǜ* ‘soft green’ illustrates an instance of visual perception modified by a tactile adjective (Zhao et al. 2019a: 7). Relevant literature shows that linguistic synesthesia is a productive linguistic phenomenon found in a wide variety of languages (Kumcu 2021; Strik Lievers 2015; Ullmann 1966 [1963]; Williams 1976; among others). Three questions are commonly explored in the research on linguistic synesthesia in the literature (Strik Livers et al. 2021). They include: (1) whether linguistic synesthesia shows certain patterns of transfer directions; (2) if yes, what mechanisms can explain the transfer tendencies of linguistic synesthesia; and (3) whether linguistic synesthesia can be analyzed as a type of metaphor.

Extensive studies have focused on the first research question, namely the directionality of linguistic synesthesia. They include synchronic studies on linguistic synesthesia in various languages, such as Ullmann (1957)’s work based on poetic English, French, and Hungarian, and Strik Lievers’ (2015) analysis of non-poetic English and Italian. In addition, diachronic studies on the transfer tendencies of linguistic synesthesia have also been conducted, such as Williams (1976) on English, and Strik Lievers and De Felice (2019) on Italian. In terms of the general transfer pattern of linguistic synesthesia, Williams (1976) proposed a hierarchical model, as shown in Figure 1. He assumed that the model would be applicable to any language in the world. However, based on an analysis of a large sample of corpus data from Mandarin, Zhao et al. (2019a) found a different pattern of generalization for the directionalities of linguistic synesthesia, as shown in Figure 2. In spite of reported differences on a few specific directions of linguistic synesthesia based on different models (e.g., the different directional relations between touch and taste in Figures 1 and 2), previous studies on linguistic synesthesia have reached a general consensus that linguistic synesthesia conforms to certain patterns of transfer directionalities (e.g., generally mapping from touch and taste to vision and hearing), rather than random mappings.



**Figure 1:** A hierarchical model for linguistic synesthesia (Williams 1976: 463).



**Figure 2:** Transfer directionalities of linguistic synesthesia based on Mandarin corpus data (Zhao et al. 2019a: 9).

The mechanism underlying the transfer directionality constraints has also been a central issue in the study of linguistic synesthesia. For instance, Shen and colleagues (Shen 1997; Shen and Cohen 1998; Shen and Eisenman 2008) have proposed that the mapping directionality of linguistic synesthesia is determined by the degree of embodiment. That is, synesthetic mappings are transferred from more embodied sensory modalities to less embodied ones. This account is conceptually compatible with the theory of metaphor, given that metaphors map from more embodied source domains to less embodied target domains (e.g., Gibbs 2005; Johnson 1987; Lakoff and Johnson 1980). In addition, the account has a shared premise with the theory of metaphor that embodied cognition (e.g., Meteyard et al. 2012; Wilson 2002; Wilson and Golonka 2013) underpins both linguistic synesthesia and metaphor. Specifically, scholars in cognitive linguistics have proposed to define the degree of embodiment based on bodily contact and interaction of the body with its surrounding environment (e.g., Gibbs 2005; Johnson 1987; Lakoff and Johnson 1980; among others). In this context, Shen (1997), Shen and Cohen (1998), and Shen and Eisenman (2008) argue that sensory modalities can also be differentiated in terms of the different degrees of embodiment, based on, for example, whether there is a physical contact between sensory organs and perceived objects, and whether there is a specialized sensory organ. Shen and colleagues' account, however, is not explicit in terms of the empirical criteria adopted, as pointed out by Winter (2019a). Relying crucially on the sensory modality norms of English (Lynott and Connell 2009, 2013), Winter (2019a) differentiated six explanatory accounts for the transfer hierarchy of linguistic synesthesia, including perceptual, lexical ineffability-based, evaluation-based, gradability-based, iconicity-based, and idiosyncratic accounts.

It is important to note that Winter's (2019a) proposal is also consistent with embodied cognition, which can be partially mapped to Wilson's (2002) six views of embodied cognition. Wilson (2002) has identified six different views on embodied cognition, including that it is situated, that it is bound by time, that the

environment plays a role in it (either contributing to processing or being part of the cognitive system), that it is an eventive activity, and that off-line cognitive processes are bodily based. However, Wilson's (2002) theory also suggests that there may be more than one way to measure the degree of embodiment. In addition, Zhong et al.'s (2022) study on sensorimotor norms of Mandarin Chinese has showed that correlations can also be established between orthographic conventions and the concept of embodiment. Thus, although the degree of embodiment calls for more examinations, there is a general consensus that linguistic synesthesia as a type of linguistic conceptualization is situated and defined by our bodily interactions with the world, whose directionality constraints are grounded in embodied cognition.

Whether linguistic synesthesia should be considered a type of metaphor or not has been at the center of an on-going debate. For example, Ramachandran and Hubbard (2001) highlighted the neurological nature of linguistic synesthesia. They have hypothesized that the directionality tendency (e.g., from hearing to vision) observed in both linguistic synesthesia and neurological synesthesia is "a result of strong anatomical constraints that permit certain types of cross-activation, but not others" (Ramachandran and Hubbard 2001: 18).<sup>1</sup> However, the dichotomy of the "off-line" and "on-line" cognitive processes within embodied cognition proposed by Wilson (2002: 633) can be applied to resolve the puzzle of the differences between linguistic synesthesia and neurological synesthesia. That is, linguistic synesthesia, by the nature of its mapping, does not involve real-time perceptual input from the external environment; rather the process of linguistic synesthesia accesses the "stored" or "lexically encoded" sensory information therein (i.e., are "off-line"). Neurological synesthesia, on the other hand, necessarily involves processing of perceptual input obtained in real time (i.e., are "on-line"). With respect to the nature of linguistic synesthesia, Rakova (2003: 67) suggested a "no-polysemy view" for linguistic synesthesia and Winter (2019a, 2019b) analyzed linguistic synesthesia not as metaphors but as literal usages of sensory items. Details of their accounts do differ. Rakova (2003: 68), for instance, proposed that there was the same "psychologically primitive concept BRIGHT" for the adjective *bright* when used in both *bright music* and *bright light*. In Winter's account, on the other hand, the uses of the adjective *sweet* in *sweet fragrance* and *sweet cake* are considered to be literal by virtue of involving the same integrated perceptual system (Winter 2019b). Rakova's cross-modal primitive concepts and Winter's integrated perceptual system have different predictions in psychological reality

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<sup>1</sup> Neurological synesthesia refers to when people experience sensations in one sense as a different sense is stimulated or have a percept in one sub-modality elicited by the stimulus from another sub-modality (see Cytowic 2002 [1989]; Simner and Hubbard 2013).

that may be tested, but as of yet, lack empirical evidence. These non-metaphorical accounts contrast with the view of many linguists (cf. discussion in Strik Lievers [2017: 87], who notes that accounting for linguistic synesthesia as a metaphor has been the “default” view for most linguists). For instance, Shen (1997), Yu (2003), and Popova (2005) who all take the metaphorical view typically assume that what differentiates linguistic synesthesia from other types of metaphor is that it involves sensory modalities as both source and target domains.

This paper aims to clarify the nature of linguistic synesthesia by proposing to account for it with a lexical-conceptual model. We will show that different positions held by metaphorical and non-metaphorical accounts make different assumptions about the different levels of linguistic synesthesia. Based on the shared premise of embodied cognition, this paper argues that linguistic synesthesia, like metaphors, involves cognitive process of bodily based concepts that are already stored in the lexicon. The off-line cognitive process is the mapping relation between two lexical meanings and differs from neurological synesthesia of processing real-time perceptual input. Given the nature of processing stored lexical information, it is advantageous to incorporate the standard lexical semantic view of lexicalized conceptualization (e.g., Huang et al. 2010; Levin and Pinker 1991; Pustejovsky 1995) with Conceptual Metaphor Theory (CMT). This approach allows us to easily account for the data related to linguistic synesthesia that has been viewed previously as only able to be handled by non-metaphorical models.

In what follows, Section 2 introduces an overview of the metaphorical and non-metaphorical accounts for linguistic synesthesia. Section 3 demonstrates that linguistic synesthesia shows metaphorical meanings of sensory items, based on a lexical analysis of Mandarin synesthetic usages. Section 4 presents systematic similarities between linguistic synesthesia and conceptual metaphors, when a lexical-conceptual account that incorporates a lexical semantic view of lexical conceptualization with CMT is adopted. Following that, Section 5 evaluates the non-metaphorical accounts for linguistic synesthesia. We conclude with a summary of our results and suggest the future work in the last section.

## 2 Metaphorical and non-metaphorical accounts

### 2.1 The metaphorical account

Many previous studies have posited that linguistic synesthesia, also referred to as “synesthetic metaphor,” is a particular type of metaphor (Strik Lievers 2017). For instance, Shen (1997), Yu (2003), and Popova (2005) regard linguistic synesthesia as a type of metaphor within a CMT-based approach. They postulate that concepts

in linguistic synesthesia are mapped from more embodied to less embodied domains. Popova (2005: 416), for example, suggested that embodiment was realized “at its strongest, in touch,” when considering the scalarity and subjective evaluations involved in perceptions. Thus, the conceptualization of perceptual experiences in vision and hearing through concepts from touch illustrated the mapping from the more embodied to the less embodied. Strik Lievers (2017) argues that linguistic synesthesia is a kind of metaphor that features the conceptual conflict between separate sensory concepts involved, where our consistent conceptual structures are challenged and a consistent link between the different conceptual areas cannot be identified.

However, there are characteristics of linguistic synesthesia attested by previous research, which might pose a challenge to the metaphorical account of linguistic synesthesia. For instance, Ullmann (1957), Strik Lievers (2015), and Zhao et al. (2019a) found that linguistic synesthesia showed biased directional tendencies based on frequency (i.e., asymmetries in one transfer direction than the reverse direction), rather than an absolute unidirectionality (i.e., without the reverse direction). These biased directional tendencies of linguistic synesthesia are not predicted by theories based on conventional conceptual metaphors mapping from the more embodied to the less embodied, as understood in CMT.<sup>2</sup> Zhao (2020) took a more expansive corpus-based approach and suggested that there was a relationship between linguistic synesthesia and metaphor; however, except for proposing the ideas of degree of embodiment and embodied types, the study did not provide further details on how a theory of metaphor could account for linguistic synesthesia.

## 2.2 The non-metaphorical account

The non-metaphorical accounts are derived from two very different positions. The first is that linguistic synesthesia patterns with neurological synesthesia and follows the same neuro-biological constraints. Ramachandran and Hubbard (2001) and Cacciari (2008) propose that both linguistic synesthesia and neurological synesthesia follow directionality tendencies that are the result of biological constraints (e.g., the direction from hearing to vision observed in both types of synesthesia). In addition, Asano and Yokosawa (2012) and Hung et al. (2014) found that neurological synesthesia exhibited similar patterns among people speaking

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<sup>2</sup> Conceptual metaphors are when non-bodily and more abstract experiences are conceptualized using bodily and concrete experiences, as in *LOVE IS A JOURNEY* (see Gibbs 2005, 2011; Johnson 1987; Lakoff and Johnson 1980).

different languages. In terms of linguistic synesthesia, Williams (1976) suggested the proposal of a cross-linguistic universality of the transfer tendencies of linguistic synesthesia. Thus, the lack of variations in different languages and cultures for neurological synesthesia and linguistic synesthesia seems to provide another parallel between the two phenomena at first glance, although the pattern does not contradict the metaphorical account. However, as pointed out by Winter (2019a), the position of the commonalities of linguistic synesthesia with neurological synesthesia is mainly based on the exploration of specific sensory associations or selective observations, rather than on systematic comparisons.

The second non-metaphorical account argues that synesthetic usages of adjectives are simply part of their literal meanings. Rakova (2003) argues for a no-polysemy view for linguistic synesthesia. For example, she proposed that all instances of the adjective *hot* involved a single “psychologically primitive concept” *HOT*, as the mechanisms of transduction for temperature and spicy taste overlapped in the brain (Rakova 2003: 149). In line with Rakova (2003), Paradis and Eeg-Olofsson (2013: 38) described expressions such as *sharp flavor* as “synesthetic metonymization,” and postulated that the adjective *sharp* used for *VISION*, *SMELL*, *TASTE*, and *TOUCH* was monosemous. However, a polysemous test can be applied into most synesthetic adjectives.<sup>3</sup> For instance, Mandarin adjective 鮮 *xiān* ‘tasty’ can be used in the pattern of “This is X, but not X,” such as 這肉是鮮的，但是不鮮 *zhè ròu shì xiān de, dànshì bù xiān* ‘The meat is fresh, but not tasty.’ In addition, there is no evidence suggesting overlapping mechanisms, for instance, to represent the concepts of fresh and tasty in the brain, to the best of our knowledge. Winter (2019b: 107) argues that linguistic synesthesia involves either highly integrated sensory modalities or performs evaluative functions, both of which indicate the “highly multisensory or supramodal meanings” of sensory items. Thus, Winter (2019a, 2019b) argues that the cross-modal usages of lexical items should be considered as literal rather than metaphorical. For instance, Winter (2019b) considered the expression *sweet fragrance* to be the literal usage of *sweet*, as taste and smell were regarded to be integrated parts of the same sensory modality in his model. In terms of the expressions involving associations between “dissimilar modalities” (e.g., the association between taste and hearing in *sweet melody*), Winter (2019b: 122) has argued that these usages “simply follow from word-inherent evaluative meaning.”

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<sup>3</sup> We thank Bodo Winter for offering this idea. For more information about the tests for ambiguity, polysemy, and vagueness in lexical semantics, please refer to Tuggy (1993).

## 2.3 Research questions

Careful review of the different positions on the nature of linguistic synesthesia reveals that linguistic synesthesia is being viewed from different perspectives by different researchers. The neurological account presupposes the biological reality of the five senses and the neuro-cognitive processes of the sense modalities. Given this presupposition, the neurological account generally focuses on the actual neuro-cognitive relations between sensory modalities. However, the metaphorical account and the literal account take a different perspective, focusing on specific lexical items involved in linguistic synesthesia. Take *sweet voice* for example. The metaphorical account suggests that the concept of *sweet* is mapped from the gustatory domain to the auditory domain. However, the literal account hypothesizes that there is no basic meaning of *sweet* in five sensory modalities, and the auditory usage of *sweet* conveys a positive evaluation and thus is the literal meaning.<sup>4</sup>

It is interesting that the starkly different premises between the account focusing on the relations of sensory modalities and the account focusing on the relations of lexical meanings for linguistic synesthesia were not explicitly recognized or reconciled in previous studies. We maintain that the lack of consensus and clear stipulation of the levels involved in linguistic synesthesia has partly contributed to the lack of agreement about the nature of linguistic synesthesia. For example, Strik Lievers (2017) argues for linguistic synesthesia as a type of metaphor that involves the conceptual conflict between sensory concepts denoted by lexical items. In contrast with Strik Lievers (2017) focusing on lexical items and their associated concepts, Ronga et al. (2012) viewed linguistic synesthesia from the perspective of the relations between sensory modalities and found parallels between linguistic synesthesia and neurophysiological interactions among different sensory stimuli. Thus, viewing linguistic synesthesia at different levels has resulted in competing accounts, as argued by Strik Lievers et al. (2021).

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<sup>4</sup> There is another possible use-based definition of “the literal meaning” that we need to point out, as it is an interpretation that would allow neurological and literal accounts to make identical predictions. Take the famous protagonist of Cytowic (1998) for example. When he used synesthetic expressions, he literally tasted shapes. By this definition, the claims of neurological synaesthesia are reduced to a narrow version of claiming that linguistic synesthesia must be literal and reflect biological reality. There might be conceptual differences between the literal sense of actual perceptions for those with a particular neurological condition versus the literal sense of being aware of the biological potential for those who do not have a similar particular condition. As past literature did not consider this possibility explicitly from either the neurological or the literal position, we lay it out here to exclude this option from further discussion.



Given the different perspectives adopted by the different accounts for linguistic synesthesia, this study examines the relations between lexical meanings of words used in linguistic synesthesia to test the metaphorical account and the literal account, while focusing on the relations between sensory modalities involved in linguistic synesthesia to test the neurological account. Thus, the first research question of this study is whether there is a basic meaning for lexical items used in linguistic synesthesia.<sup>5</sup> That is, a metaphorical account would be supported if the basic meanings can be identified for lexical items used in linguistic synesthesia; otherwise, a literal account would be corroborated.

A semantic analysis of words and their associated concepts involved is typically employed to examine linguistic realizations of conceptual metaphors (e.g., Bagli 2016, 2017; Lakoff and Johnson 1980). By adopting such a lexical-conceptual perspective, Ahrens (2002, 2010) proposed a model that is compatible with the CMT framework to account for the underlying reasons for the source-target pairings of a conceptual metaphor. Specifically, the underlying reason why a particular target domain has selected a particular source domain (i.e., the Mapping Principle termed by Ahrens 2002, 2010) may be postulated through analyzing the lexical items that are frequently mapped or not mapped from the source domain to the target domain. In addition, for a target domain, it selects lexical items and their associated concepts from different source domains based on different Mapping Principles (MPs) (Ahrens 2002, 2010). For example, when *INFANT* is mapped to *IDEA*, the notion of creation is at the forefront of the lexical items mapped (e.g., 一個偉大的想法終於誕生了 *yīgè wěidà de xiǎngfǎ zhōngyú dànshēng le* ‘A great idea is finally being born.’), while when *BUILDING* is mapped to *IDEA*, the lexical items related to structure are paramount (e.g., 建構一套理論 *jiàngòu yītào lǐlùn* ‘to construct a theory’) in Mandarin Chinese (Ahrens 2002).

In terms of linguistic synesthesia, a number of studies have found that sensory modalities involved are embodied conceptual domains whereby different experiences (e.g., flavor, scent, sight, sound, temperature, etc.) are processed directly from our sensory organs to our brain (Bagli 2021; Kövecses 2019; Popova 2005; Sweetser 1990). For instance, Kövecses (2019) showed elaborate conceptual dimensions for smell, such as existence, intensity, and lack of control. Similarly, Bagli (2021) suggested complex conceptual structures involved in taste, on which versatile conceptual mappings can be based, such as *HARMONY IS SWEET* and

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<sup>5</sup> We follow Pragglejaz Group (2007: 3) and Steen et al. (2010) to adopt the term “basic meaning,” which is generally utilized in identification of metaphorical expressions for lexical items and refers to lexical meanings that are more concrete, related to bodily action, more precise, and historically older. In addition, the term “basic meaning” is also adapted as “basicness” of lexical meanings in this paper.

DISCORDANCE IS SOUR. Thus, the second research question that this current study aims to explore is whether linguistic synesthesia shows similarities with conceptual metaphors based on a lexical-conceptual perspective compatible with the CMT framework. Therefore, for instance, in comparison with conceptual metaphors, instances of linguistic synesthesia are compared to individual linguistic metaphors (such as *The path of life is never easy* in the conceptual metaphor LIFE IS A JOURNEY), and the sensory modalities to conceptual domains (such as the conceptual domains of LIFE and JOURNEY).

The lexical-conceptual approach taken by the current study also allows for the examination of the relations between sensory modalities. That is, the aggregation of all lexical items in one sensory domain can be employed to examine the relation among the five sensory modalities in linguistic synesthesia (such as the general transfer patterns of linguistic synesthesia between sensory modalities in Figures 1 and 2). Thus, a neurological account for linguistic synesthesia can also be tested at the same time.

To summarize, the research questions of this study are: (1) whether the lexical items with linguistic synesthetic usages show basic meanings, in line with the assumption of the metaphorical account; (2) if yes, whether linguistic synesthesia has patterns of mapping between sensory domains on par with those found in source-target pairings in conceptual metaphors, based on a lexical-conceptual perspective compatible with the CMT framework; and (3) whether a lexical-conceptual account captures aspects of linguistic synesthesia that are previously only accounted for by non-metaphorical accounts.

### 3 A lexical-conceptual analysis of linguistic synesthesia in Mandarin

The metaphorical account and the literal account both focus on the lexical items used in linguistic synesthesia; however, they differ drastically in assuming whether or not there is a basic meaning for the lexical items, as elaborated above. This section aims to test the different assumptions by examining the lexical meanings and the associated concepts of sensory items in linguistic synesthesia of Mandarin.

In order to identify metaphorical uses, Pragglejaz Group (2007: 3) stipulated that the basic meanings of lexical items would be “more concrete,” “related to bodily action,” “more precise,” and “historically older.” Though the first three criteria suggested by Pragglejaz Group (2007) cannot be easily applied into linguistic synesthesia, Zhao (2020) suggested that the basic meanings of sensory

items could still be determined through historical information. For instance, the basic meaning of 甜 *tián* ‘sweet’ is regarded to be related to gustation, as its gustatory meaning was earliest used in the history of Chinese (Zhao 2020: 21–22). As Zhao (2020) pointed out, this account might be challenged as the basic meaning for lexical items is determined by relying on the etymological clues exclusively in linguistic synesthesia. Nevertheless, the following analysis will demonstrate that the etymologically original meanings (i.e., the meanings earliest used based on the etymology) do show basicness among different sensory meanings for Mandarin sensory adjectives; hence the adjectives used in their non-original sensory meanings (i.e., linguistic synesthetic usages) are metaphorical. More specifically, the basicness of the etymologically original meanings for Mandarin sensory adjectives can be demonstrated via sensory distribution, perceptual strength, and collocational patterns.

### 3.1 Sensory distributions of Mandarin synesthetic adjectives

Zhao (2020) previously identified 199 Mandarin adjectives with synesthetic usages in a balanced corpus (i.e., the Sinica corpus, Chen et al. 1996).<sup>6</sup> The study also summarized specific distributions for each adjective in its non-original sensory modalities. For instance, the gustatory adjective 甜 *tián* ‘sweet’ is used for vision with 15 tokens, for smell with 13 tokens, for hearing with eight tokens, but with no instance for the tactile modality (Zhao 2020: 135).

This current study took the 199 Mandarin adjectives identified by Zhao (2020) and collected the sensory usages of these adjectives in their original sensory modalities in the same corpus as utilized by Zhao (2020) (i.e., the Sinica corpus). We followed Praggeljaz Group (2007) and Zhao et al. (2019a) to ask no fewer than two annotators to check each of the expressions of the 199 adjectives. In addition, controversial instances were discussed to reach a consensus; if none was reached, they were not included in this study. Through this method, we identified 27,584 token examples for the 199 Mandarin sensory adjectives. For instance, there are 519 tactile token examples found for the adjective 冷 *lěng* ‘cold,’ whose original meaning conceptualized the tactile perception in ancient Chinese (see Zhao 2020). Sensory distributions of all the 199 Mandarin sensory adjectives in five modalities can be found at <https://osf.io/rgv3y/>.

Based on the sensory distribution of the 199 adjectives, we find that different sensory meanings of Mandarin synesthetic adjectives show varying frequencies of usages. However, for most of the adjectives, their original sensory meanings are

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<sup>6</sup> Accessed at: <http://lingcorpus.iis.sinica.edu.tw/modern/>.

**Table 1:** Mandarin adjectives whose original meanings are consistent or inconsistent with their most frequent sensory meanings.

Adjective	Lexical type	Lexical token
Original-most frequent consistent	149 <b>(74.9%)</b>	26,434 <b>(95.8%)</b>
Original-most frequent inconsistent	50 (25.1%)	1,150 (4.2%)
Total	199 (100%)	27,584 (100%)

The largest percentage is in bold.

still the most frequently used. As shown in Table 1, these adjectives take up 74.9% (149/199) of all the Mandarin synesthetic adjectives, with 26,434 token examples found in the Sinica corpus (e.g., the etymologically tactile adjective 滑 *huá* ‘smooth’ with 77 usages for touch, two usages for vision, one usage for smell, but no usage for taste and hearing). In terms of the adjectives whose original sensory meanings are not the most frequently used in Mandarin, they occupy 25.1% (50/199) of all the Mandarin synesthetic adjectives with 1,150 token examples (e.g., the etymologically tactile adjective 粗 *cū* ‘rough’ with 133 instances for vision, 40 instances for touch, seven instances for hearing, but no instance for taste and smell). Praggeljaz Group (2007) and Hanks (2013) argue that frequent meanings are not necessarily equal to basic meanings for lexical items. However, the significant consistency between the original sensory meaning and the most frequently used sensory meaning, especially when considered as being complementary to additional analyses given in the following sub-sections, appears to support the argument for the basicness of the original meanings for Mandarin sensory adjectives.

### 3.2 Perceptual strength of Mandarin sensory adjectives

Empirical studies have been conducted on the modality exclusivity norms of sensory words in different languages, such as English (Lynott and Connell 2009, 2013; Lynott et al. 2020), Dutch (Speed and Brysbaert 2021; Speed and Majid 2017), and Mandarin Chinese (Chen et al. 2019; Zhong et al. 2022). In these studies, participants were asked to rate the perceptual strength of a word without context. For instance, using a rating range from 0 to 5, Chen et al. (2019) showed that the Mandarin adjective 甜 *tián* ‘sweet’ received around 0.12 in touch, 5.0 in taste, 2.35 in smell, 1.03 in vision, and 0.57 in hearing.

Following Zhao et al. (2019a) and Zhao (2020), this study identified the original sensory meanings of the 171 Mandarin adjectives included in Chen et al. (2019)’s modality exclusivity norm. Specifically, we relied on the etymological paraphrasing in dictionaries, radicals of Chinese characters, and specific uses in classic

**Table 2:** Mandarin adjectives whose original sensory modalities are consistent or inconsistent with the modalities receiving the highest perceptual scores.

Adjective	Number	Example
Original-highest score consistent	138 (80.7%)	脆 <i>cùi</i> ‘crisp’, 膩 <i>nì</i> ‘greasy’, 腥 <i>xīng</i> ‘of fishy smell’, 凹 <i>āo</i> ‘concave’, 吵 <i>chǎo</i> ‘loud’
Original-highest score inconsistent	33 (19.3%)	酥 <i>sū</i> ‘crisp’, 雜 <i>zá</i> ‘varicolored’, 羶 <i>shān</i> ‘of mutton’s smell’
Total	171 (100%)	–

Chinese to determine the original meanings of lexical items. For instance, the adjective 吵 *chǎo* ‘loud’ was paraphrased as ‘loud and disturbing’ in 說文解字 *Shuōwén Jiězì* ‘Explaining graphs and analyzing characters’ (Xu 1963 [121]), with the radical 口 (originally 言) meaning words produced by the mouth. One of its usages in classic Chinese is 鬧吵吵, 甜言美語枉徒勞 *nào chǎochǎo, tiányán měiyǔ wǎng túláo* ‘If the sound is too noisy, the sweet words conveyed by the sound is useless.’ in 海浮山堂詞稿 *Hǎifúshāntángcígǎo* ‘Manuscripts written in Haifushantang.’ Thus, we consider the auditory meaning as the original sensory meaning for the adjective 吵 *chǎo* ‘loud.’

Table 2 shows that 80.7% of the 171 Mandarin adjectives received the highest perceptual rating scores in the sensory modalities to which their original meanings belong. For instance, the adjective 吵 *chǎo* ‘loud’ whose original meaning is related to hearing, received the highest rating score of 4.97 in the auditory modality in Chen et al.’s (2019) task. In addition, adjectives whose original meanings are related to gustation and hearing were all given the highest perceptual strength in taste and hearing respectively by native Mandarin participants.<sup>7</sup> We argue that this significant consistency pattern also implies the basicness of original sensory meanings for Mandarin sensory adjectives, similar to the frequency of usages elaborated above.<sup>8</sup>

<sup>7</sup> Chen et al. (2019) have found that the semantic radicals of Chinese characters are significantly correlated with the perceptual ratings. Thus, we presume that the radicals of Chinese characters generally indicating the original meanings (see Duan 2007 [1815]; Xu 1963 [121]) result in the sensory modalities to which the original meanings belong gaining the highest rating scores. This is more evident in the adjectives whose original meanings are related to taste and hearing, of which radicals usually conceptualize gustatory organs or edible objects (e.g., 甘 *gān* ‘sweet’ and 鮮 *xiān* ‘tasty’) and sensory organs making sounds (e.g., 啞 *yǎ* ‘dumb’) respectively.

<sup>8</sup> There are a small number of Mandarin adjectives whose original meanings are not used most frequently or did not receive the highest perceptual rating scores, such as 美 *měi* ‘tasty’ and 澀 *sè* ‘not smooth.’ Gibbs et al. (1993) have showed that each speaker judges figurative language literally to a different extent, depending on how one defines the literal meaning. Thus, it is necessary to

### 3.3 Collocational patterns of Mandarin synesthetic adjectives

In addition to the sensory distribution and the perceptual strength, the collocational pattern in the context can also suggest the basicness of original meanings for Mandarin synesthetic adjectives. Patterson (2017) has shown that an investigation into the context in which a lexical item is situated or the language with which the item is associated can decide the metaphoricity for uncertain cases. For instance, the expression *grew noisy* is more metaphoric than the expression *grew big*, as the former meaning of *grew* refers less to the organic growth in the context (Patterson 2017: 113–114). A careful examination of Mandarin synesthetic uses in context reveals that adjectives used in their etymologically original meanings show different collocational patterns than those in their non-original sensory meanings. That is, adjectives in their original meanings can generally collocate with diverse sensory objects, while adjectives in their non-original sensory meanings (i.e., synesthetic meanings) collocate with a limited number of sensory objects.<sup>9</sup>

- (1) 暖 *nuǎn* ‘warm’:
  - a. in the **tactile** meaning modifies 氣溫 *qìwēn* ‘temperature,’ 陽光 *yángguāng* ‘sunshine,’ 身體 *shēntǐ* ‘body,’ 被窩 *bèiwō* ‘bed,’ 冬天 *dōngtiān* ‘winter’ etc.
  - b. in the **visual** meaning only modifies 色 *sè* ‘color,’ 色調 *sèdiào* ‘color,’ 顏色 *yánsè* ‘color,’ 黃 *huáng* ‘yellow,’ and 白 *bái* ‘white.’
- (2) 鮮 *xiān* ‘tasty’:
  - a. in the **gustatory** meaning modifies 海鮮 *hǎixiān* ‘seafood,’ 雞湯 *jītāng* ‘chicken soup,’ 滋味 *zīwèi* ‘taste,’ 蘆筍 *lúsǔn* ‘sparrowgrass,’ 肉 *ròu* ‘meat’ etc.
  - b. in the **visual meaning** only modifies 顏色 *yánsè* ‘color,’ 色 *sè* ‘color,’ 紅 *hóng* ‘red,’ 黃 *huáng* ‘yellow,’ 綠 *lǜ* ‘green,’ and 藍 *lán* ‘blue.’
- (3) 臭 *chòu* ‘smelly’:
  - a. in the **olfactory** meaning modifies 腳 *jiǎo* ‘foot,’ 汗 *hàn* ‘sweat,’ 尿 *niào* ‘urine,’ 垃圾 *lājī* ‘rubbish,’ 空氣 *kōngqì* ‘air’ etc.
  - b. in the **visual** meaning only modifies 臉 *liǎn* ‘face.’

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examine whether native Mandarin speakers would still judge the original meanings of 美 *měi* ‘tasty’ and 澀 *sè* ‘not smooth’ as being basic or literal. We leave this issue for further study.

<sup>9</sup> This difference might be related to the fact that adjectives in their original meanings are usually used more frequently than those in their non-original sensory meanings (i.e., synesthetic meanings) in Mandarin as elaborated above.

- (4) 隱隱 *yǐnyǐn* ‘faint’:
- in the **visual** meaning modifies 亮光 *liàngguāng* ‘light,’ 小山 *xiǎoshān* ‘hill,’ 目光 *mùguāng* ‘eye,’ 潮水 *cháoshuǐ* ‘tidewater,’ 輪廓 *lúnkuò* ‘profile’ etc.
  - in the **tactile** meaning only modifies 痛 *tòng* ‘pain’ and 疼 *téng* ‘pain.’
- (5) 喧鬧 *xuānnào* ‘noisy’:
- in the **auditory** meaning modifies 童歌 *tónggē* ‘the song of children,’ 村莊 *cūnzhuāng* ‘village,’ 聲浪 *shēnglàng* ‘the wave of sound,’ 鳥類 *niǎolèi* ‘birds,’ 孩童 *háitóng* ‘children’ etc.
  - in the **visual** meaning only modifies 色彩 *sècǎi* ‘color.’

As shown in examples (1) to (5), Mandarin adjectives are restricted to modify special kinds of sensory objects when they are used in their non-original sensory meanings (i.e., synesthetic meanings). Specifically, 暖 *nuǎn* ‘warm,’ 鮮 *xiān* ‘tasty,’ and 喧鬧 *xuānnào* ‘noisy’ only modify the color in the visual sensation, while 臭 *chòu* ‘smelly’ only characterizes the facial expression of vision and 隱隱 *yǐnyǐn* ‘faint’ is only used to describe the pain of touch. However, it should be noted that tactile and visual modalities are multi-dimensional, where the tactile modality includes haptic sensation, somatic sensation, pain, and so forth, and the visual modality includes light, color, size, and so on (see Miller and Johnson-Laird 1976; Purves et al. 2001 [2000]; Williams 1976). Thus, it can be concluded that Mandarin adjectives show more versatile collocational patterns when used in their original sensory meanings than in their non-original sensory meanings (i.e., synesthetic meanings).

Apart from the collocational patterns, Mandarin adjectives used in their synesthetic meanings are much closer to metaphorical usages of these adjectives. For example, 暖 *nuǎn* ‘warm’ used for color in example (1) describes a distinct perceptual property compared to when it is used for temperature, as colors do not make people feel warm physically. However, 暖 *nuǎn* ‘warm’ used for color is similar to it used in the metaphorical expression characterizing personality (e.g., 暖男 *nuǎnnán* ‘warm person’), both of which focus on the pleasantness the modified objects bring. Similarly, we cannot identify a real physical relationship between 隱隱 *yǐnyǐn* ‘faint’ used for pain and when it is used for light as in example (4), as pain is normally invisible. Nevertheless, 隱隱 *yǐnyǐn* ‘faint’ used for pain is analogous to the adjective used in the metaphorical expression 隱隱知道 *yǐnyǐn zhīdào* ‘faintly know (know a little),’ which conceptualizes the undefined feeling the modified objects bring.

### 3.4 Summary

A lexical-conceptual analysis of linguistic synesthesia focusing on the lexical items and their associated concepts in Mandarin reveals that the etymologically original meanings of Mandarin adjectives are generally the most frequently used, have received the highest perceptual scores, and show more versatile collocational patterns. These tendencies could indeed suggest the basicness of original sensory meanings for most of the Mandarin adjectives, and hence the usages of these adjectives in their non-original sensory meanings (i.e., synesthetic usages) are metaphorical.

It should be noted that we do not claim that the basic meaning of lexical items can be decided by relying on the etymology of the items exclusively. A lexical semantic analysis of different sensory meanings in this current study for Mandarin synesthetic adjectives does reveal that the etymological meanings of the adjectives show more basicness than other lexical sensory meanings of the adjectives in Mandarin. Thus, a literal account assuming no basic meanings for sensory items in linguistic synesthesia is not supported. Instead, our data is consistent with a metaphorical account for linguistic synesthesia.<sup>10</sup>

## 4 Comparisons between linguistic synesthesia and conceptual metaphor

A lexical-conceptual analysis of Mandarin sensory items suggests that linguistic synesthesia is compatible with a metaphorical account. We now turn our focus on whether linguistic synesthesia patterns similarly to conceptual metaphors viewed from a Conceptual Mapping Model approach (i.e., one that incorporates a lexical-conceptual view with the CMT framework) (Ahrens 2002, 2010), as discussed above in Section 2.3.<sup>11</sup>

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**10** It is unclear whether the etymologically original meanings of sensory items show basicness in linguistic synesthesia of other languages. We leave this question for future research.

**11** Not all scholars view metaphors as being conceptual in nature. For instance, Lakoff and Turner (1989) suggested image metaphors as a departure from conceptual metaphors, as they involve basic visual characteristics rather than conceptual knowledge (but see El Refaie [2015] for an opposing argument). Furthermore, psychologists have argued for a competing account of metaphors where they are viewed as class inclusion statements (i.e., Glucksberg and Keysar's [1993] Attributive Categorization Model and Gentner and Bowdle's [2008] Structure Mapping Model).



## 4.1 Directionality constraint

One focal issue comparing linguistic synesthesia with conceptual metaphors has been the mapping directionality constraint. That is, conceptual metaphoric mapping is typically considered to be unidirectional, but linguistic synesthesia bi-directional (e.g., Zhao 2020; Zhao et al. 2018). However, this mismatch is the artificial result of erroneously comparing concept-to-concept with domain-to-domain mappings. Thus, this study compares linguistic synesthesia with conceptual metaphors concerning the directionality from both the lexical-conceptual and domain-based levels.

### 4.1.1 Lexical-conceptual mapping directionality

Conceptual metaphors involve specific mappings from a lexical concept in a source domain to another lexical concept in a target domain. When multiple metaphors (i.e., mapping pairs) are considered, each conceptual domain can serve as either, or both, source or target domains (Ahrens 2002, 2010; Ahrens and Jiang 2020; Grady et al. 1999). For example, AIRPLANE IS A BIRD, and ECONOMY IS AN AIRPLANE (Chung et al. 2003). This mapping versatility applies to even the most embodied domain, the human body. For instance, the body part 腰 *yāo* ‘waist’ in Mandarin can be used as the source domain, as expected, in examples (6) and (7). Somewhat unexpectedly, 腰 *yāo* ‘waist’ can also serve as the target domain, as illustrated in (8) and (9) where the willow and the bucket are employed to conceptualize the shape of the body part waist.

- (6) 腰斩 *yāozhǎn* ‘Lit. waist-cut; to terminate an in-progress event (such as story, show, project etc.) or to cut a number in half (price, participation etc.)’
- (7) 半山腰 *bànshānyāo* ‘Lit. half-mountain-waist; mid-level of a mountain’
- (8) 楊柳腰 *yángliǔyāo* ‘Lit. willow-waist; wasp waist’
- (9) 水桶腰 *shuǐtǒngyāo* ‘Lit. bucket-waist; beer belly’

Ahrens (2002, 2010) shows that the versatile mapping relations of lexical concepts in conceptual metaphors are consistent with experience and constrained by ontological knowledge. In addition, based on the idea of Mapping Principle (MP), mappings of conceptual metaphors can be explicated in terms of prioritized conceptual components of each conceptual domain (Ahrens 2002, 2010; Ahrens et al. 2007;

Huang et al. 2007).<sup>12</sup> That is, the underlying reason for mappings of conceptual metaphors can be found by examining the frequently used lexical items and their associated concepts in a particular source-target domain pairing. Hence the source domain usages of 腰 *yāo* ‘waist’ in (6) and (7) refer to the conceptual knowledge of waist as the middle part of the body. However, when referring to the shape of the middle part of a human body with 腰 *yāo* ‘waist’ in (8) and (9), the experience of higher degree of variability requires the language to use images of familiar and conventionally stable objects to conceptualize it (in a culturally dependent way, see ‘willow’ vs. ‘wasp’). Thus, a directionality contradiction does not arise from the lexical-conceptual perspective to conceptual metaphors, because when a domain is used as both source and target domains, it typically involves different sets of conceptual elements with different underlying MP constraints.

There is no linguistic or conceptual constraint to stipulate that a certain domain can serve only as the source or target domain. This has also been clearly demonstrated for linguistic synesthesia in various languages, where each of five sensory modalities can be both the source and target domains (see Strik Lievers 2015; Ullmann 1957; Zhao et al. 2019a). In addition, multiple mapping relations of linguistic synesthesia also follow different MPs and are constrained and predicted by ontological knowledge. For example, the expression in (10) shows TASTE as the source domain and illustrates the MP that “VISAGE IS SWEET because a (smiling) face is pleasant to see just like sweet things are pleasant to taste.” On the other hand, TASTE as the target domain, illustrated in (11), follows the MP that “TASTE IS THICK because the strength of the taste is like the strength of thick things with more layers and mass.” The subjective affection and the perceptual intensity both indicate an evaluative meaning in the two examples.

Similarly, the examples in (12) and (13) demonstrate TOUCH as both the source and target domains. The expression in (12) follows the MP that “DRINK IS FIERY because it tastes strong like fire has strong heat,” based on the evaluation of intensity in tactile and gustatory modalities. Example (13) follows the MP that “BODY\_PART IS SOUR because it feels as bad as sour things tastes bad.” This again is an example of borrowing evaluative measures from taste to touch (i.e., unpleasantness). The evaluative measures mapped from source to target

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<sup>12</sup> The concept of Mapping Principle shares the common idea with the theory of image schema that the recurring patterns of bodily and sensorimotor activities play an important role in structuring human language and cognition (Ahrens 2002, 2010; Gibbs and Colston 1995). This study employs the Mapping Principle, as it can provide a finer-grained description and explanation for metaphoric and linguistic synesthetic mappings. For the image schema utilized for linguistic synesthesia, please refer to Popova (2005).

domains indicate the image schema of *SCALE* functioning in linguistic synesthesia, as argued by Popova (2005).

(10) 甜美的笑容 *tiánměi de xiàoróng* ‘sweet smile’

(11) 厚味 *hòu wèi* ‘Lit. thick taste; strong taste’

(12) 烈酒 *liè jiǔ* ‘Lit. fiery wine; strong wine’

(13) 腰酸 *yāo suān* ‘Lit. waist sour; the waist feels sore’

Ahrens (2002, 2010) has also found that particular target domains select concepts from different source domains based on different MPs. This pattern can also be observed in linguistic synesthesia. For instance, example (11) illustrates *VISION* mapped to *TASTE* focusing on the strong perceptual intensity of gustation, while example (12) shows *TOUCH* mapped to *TASTE* highlighting both the strong perceptual intensity and the accompanying thermal perception when tasting the wine.

Thus, when different mappings of linguistic synesthesia between sensory modalities are analyzed as individual separate metaphors from the lexical-conceptual perspective, linguistic synesthesia follows Mapping Principles similar to those found for conceptual metaphors. In addition, there is no directionality contradiction for a domain acting as both source and target domains in conceptual metaphors and linguistic synesthesia, as different mappings follow different underlying MP constraints.

#### 4.1.2 Conceptual domain-based mapping directionality

Conceptual metaphors have been recognized to show directional preferences, generally mapping from concrete to abstract domains (see Gibbs 2005; Johnson 1987; Lakoff and Johnson 1980). However, Lee and Schwarz (2012) have shown that there is a variety of behavior studies suggesting bidirectional effects of conceptual metaphors, including both concrete to abstract and abstract to concrete effects. In addition, Porat and Shen (2017) have demonstrated that the bidirectional relations are more basic than the unidirectional relations in conceptual metaphors, as the latter require additional mechanisms (e.g., grammatical asymmetry) to be realized.

Though empirical evidence is still needed to show that one sensory modality is more embodied than another (Winter 2019a), various studies have found asymmetry in mapping directions among sensory modalities (Strik Lievers 2015; Ullmann 1957; Zhao et al. 2019a; among others). For instance, Zhao et al. (2019a) and Zhao (2020) found that over 75% of transfers of linguistic synesthesia in Mandarin showed the asymmetry in particular directions, when the aggregation of all

sensory items in the same sense modality was considered. For example, the transfer from TASTE to HEARING is unidirectional, with no occurrence of transfers from HEARING to TASTE found. Moreover, the transfer from TOUCH to VISION is biased-directional, in which both transfer directions between TOUCH and VISION were attested, but the transfer from TOUCH to VISION showed a much higher frequency than the transfer from VISION to TOUCH (see Figure 2). Thus, based on these unidirectional and biased-directional transfers, linguistic synesthesia behaves similarly to conventional conceptual metaphors. In addition, we presume that conceptual metaphors showing bidirectional psychological effects suggest that directionality of conceptual metaphors is not unidirectional, but rather asymmetrical, analogous to linguistic synesthesia.

## 4.2 Mechanisms underlying mappings

Conceptual metaphors have been widely regarded as grounded in the embodied and sensorimotor experiences (e.g., Gibbs 2005, 2011; Lakoff 1993; Lakoff and Johnson 1980). Recent studies of metaphor put more emphasis on the neural basis for metaphorical mappings. For instance, Gallese and Lakoff (2005), Teng (2006), Cacciari (2008), and Lakoff (2008) assumed that metaphor is grounded in neural computation, though varying in how it is grounded. Winter (2016) and Reilly et al. (2020) have further attested that metaphorical usages of English sensory words mirror neural activations in the brain. Thus, although the “full simulation” theory of metaphor has been challenged as demonstrated by Meteyard et al. (2012: 793), it has reached the consensus that conceptual metaphors are rooted in both the recurring sensorimotor patterns and neural substrates.

In terms of linguistic synesthesia, Winter (2019a: 105) distinguished “global” and “local” accounts for underlying mechanisms of linguistic synesthesia, and argued against the viability of a global embodiment account proposed by Shen and colleagues as shown in Shen (1997), Shen and Cohen (1998), and Shen and Eisenman (2008). The lexical-conceptual model for linguistic synesthesia is consistent with Winter’s (2019a) “local” model. For instance, the analysis of examples (10) through (13) above focusing on specific lexical concepts, demonstrates that linguistic synesthesia is motivated by recurring sensorimotor patterns. That is, for example, the expression 甜美的笑容 *tiánměi de xiàoróng* ‘sweet smile’ mapping from TASTE to VISION is grounded in the recurring perceived similarity of pleasantness between a sweet thing and a smiling face; and the expression 厚味 *hòu wèi* ‘Lit. thick taste; strong taste’ mapping from VISION to TASTE is grounded in the recurring perceived similarity of strength between thick things with more layers or mass and strong tastes.

In addition, Zhao et al. (2019a) and Zhao (2020) have also demonstrated that there are some Mandarin adjectives indicating a neural mechanism underlying linguistic synesthesia. For example, the Mandarin adjective 麻 *má* ‘numbing’ is used most frequently for touch with 47 occurrences in the Sinica corpus (e.g., 腿麻了 *tuǐ má le* ‘The leg is numbing.’), and it also received the highest perceptual rating in touch with the score of 4.77 in Chen et al.’s (2019) study. Thus, the adjective 麻 *má* ‘numbing’ used for the gustatory perception as in 麻辣 *málà* ‘Lit. numbing-spicy; spicy’ illustrates linguistic synesthesia. In terms of the mechanism underlying the usage, it is in line with neuro-biological connectedness between the gustatory sensation induced by Szechuan pepper and a mechanical vibration discussed in Hagura et al. (2013). Similarly, Zhao et al.’s (2018) study has found that the gustatory adjective 辣 *là* ‘spicy’ used for a tactile sense describing a mixed feeling of pain and hotness is also consistent with a neural mechanism, i.e., the shared neural pathway for pain and spicy taste in the human brain. Thus, the lexical-conceptual model focusing on sensory concepts, suggests that linguistic synesthesia is motivated by both the recurring sensorimotor patterns and neural mechanisms.

It is intriguing to note that Spence (2011) summarized the consistent cross-modal correspondences between stimuli from different sensory modalities. This current study finds that all the cross-modal correspondences demonstrated by Spence (2011) can be found with linguistic counterparts in Mandarin synesthesia, as shown in Table 3.

As cross-modal correspondences result from both environmental couplings and neural mechanisms as argued by Spence (2011), it is reasonable to presume that the linguistic counterparts of the correspondences (i.e., linguistic synesthesia) are also rooted in both mechanisms. Therefore, we conclude that conceptual metaphors and linguistic synesthesia are also similar on the underlying

**Table 3:** Linguistic counterparts of crossmodal correspondences in Mandarin synesthesia.

Crossmodal correspondences in Spence (2011)	Linguistic counterparts in Mandarin synesthesia
Pitch-Elevation	高音 <i>gāoyīn</i> ‘high pitch’
Pitch-Brightness/Lightness	嗓音很亮 <i>sǎngyīn hěnliàng</i> ‘The voice is very bright.’
Pitch-Shape/angularity	聲音很尖 <i>shēngyīn hěnjiān</i> ‘The voice is very sharp.’
Pitch-Size	中音 <i>zhōngyīn</i> ‘ Lit. middle voice; alto voice”
Pitch-Spatial frequency	他說話很快 <i>tā shuōhuà hěn kuài</i> ‘His speech is very fast.’
Pitch-Direction of movement	聲音從遠處傳來 <i>shēngyīn cóng yuǎnchù chuánlái</i> ‘The sound is coming from far away.’
Loudness-Brightness	洪亮的聲音 <i>hóngliàng de shēngyīn</i> ‘ Lit. loud-clear voice; resonant voice”

mechanisms of mappings, as they are motivated by both the recurring sensori-motor patterns and neural mechanisms.

### 4.3 Other similarities between linguistic synesthesia and conceptual metaphor

In addition to directionality constraints and underlying mechanisms, this study finds that linguistic synesthesia shows alignment with properties of conceptual metaphors. Firstly, linguistic synesthesia and conceptual metaphors both show language-specific variations. For example, as discussed in Zhao et al. (2019a), linguistic synesthesia exhibits cross-linguistic differences in the transfer tendencies. Similarly, a variety of studies have also found that conceptual metaphors are coherent with culture by showing culturally-grounded variations across different languages (see Kövecses 2000, 2005; Lakoff and Johnson 1980; among others). For instance, Ahrens and Huang (2002) demonstrated that the orientation of the ego in the conceptual metaphor *TIME IS A MOVING ENTITY* is language-specific. For example, in the English temporal expression *coming years/months/days*, the orientation of ego is towards future, while in the Mandarin temporal expression 前 *qián* ‘front,’ such as in 前年 *qiánnián* ‘Lit. front-year; the year before last,’ the orientation of ego is towards the past (Ahrens and Huang 2002: 515).

Secondly, analogous to conceptual metaphors obeying “the invariance principle” (Lakoff 1993: 215), we find that linguistic synesthesia preserves the image schemas of *SCALE* from the source modalities to the target modalities. For example, the Mandarin adjective 強 *qiáng* ‘strong’ retains its high position, while 弱 *ruò* ‘weak’ its low position on the intensity scale in synesthetic mappings, and 美 *měi* ‘tasty’ preserves a positive polarity, while 膩 *nì* ‘cloying’ a negative polarity on the evaluation scale for synesthetic usages in Mandarin.

Linguistic synesthetic expressions can also fulfill a wide range of communicative and conceptual functions, similar to conceptual metaphorical expressions as argued by El Refaie (2015). For instance, the English expression in (14) can provoke people to understand the auditory experience of the voice through the experience of the tactile sharpness of knives. Therefore, the expression may imply that the voice has a strong stimulation to human’s auditory faculty and is unpleasant. Similarly, the Mandarin expression in (15) conceptualizes light in terms of the tactile sensation obtained from thorns. Hence, the expression has the implication that the light is strong and unfriendly to the eyes, akin to thorns to human skin.

- (14) *sharp voice*
- (15) 刺眼 *cìyǎn* ‘Lit. stabbing to eyes; dazzling’

## 4.4 Summary

When we incorporate a lexical-conceptual view with CMT and focus on the mappings in both the lexical-conceptual and domain-based levels for linguistic synesthesia, we find that linguistic synesthesia behaves similarly to conceptual metaphors concerning directionality constraints and underlying mechanisms. In addition, linguistic synesthesia and conventional conceptual metaphors share other crucial similar properties. Thus, linguistic synesthesia is not only metaphorical, but also shows similar patterns with conceptual metaphors.<sup>13</sup>

## 5 The non-metaphorical accounts revisited

Studies such as Martino and Marks (2001) and Winter (2019a) have illustrated the differences between linguistic synesthesia and neurological synesthesia. Based on the lexical-conceptual account for linguistic synesthesia, we argue that linguistic synesthesia is different than neurological synesthesia in terms of the frequency of occurrences, the directionality constraint, and the mechanism underlying sensory associations.

Specifically, linguistic synesthesia shows frequent usages in various languages (Jo 2019; Strik Lievers 2015; Ullmann 1957; Zhao 2020; among others). However, the “uncommon” nature of neurological synesthesia has been recognized by various researchers, though the estimates of the prevalence vary in different studies (Cytowic 2002 [1989]; Martino and Marks 2001: 62; Ramachandran and Hubbard 2001). For example, in terms of the grapheme-color synesthesia, one of the most common neurological synesthetic types, Carmichael et al. (2015)

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<sup>13</sup> As pointed out by a reviewer, the lexical meanings of sensory items should be distinguishable from larger conceptual structures involved in linguistic synesthesia. This study finds that Kövecses’ (2017) four-level model of conceptual metaphors is also applicable to linguistic synesthesia. Specifically, the image schema of SCALE functions on the level of image schema, and sensory modalities including TOUCH, TASTE, SMELL, VISION, and HEARING on the level of domain for linguistic synesthesia, based on Kövecses’ (2017) model. Additionally, the INTENSITY OF PERCEPTION and SUBJECTIVE AFFECTION are invoked at the level of frame. Lastly, the linguistic expressions where specific sensory meanings are used, such as 甜美的笑容 *tiánměi de xiàoróng* ‘sweet smile’ in Mandarin and *sweet voice* in English, illustrate the level of mental space.

employed an online Synesthesia Battery test to show that its prevalence is only 1.2% in the general population. In terms of the cross-linguistic characteristic of directionality constraints, Zhao et al. (2019a) contrasted linguistic synesthesia in Mandarin with those in Indo-European languages, and found that the proposal of a universal model for transfer directionalities of linguistic synesthesia could not be supported, as previously shown in Figures 1 and 2. On the contrary, neurological synesthesia, owing to shared biological bases, is not expected and has not been found to show significant language-specific variations (Asano and Yokosawa 2012; Hung et al. 2014; Simner 2007; Witthoft and Winawer 2006). Lastly, linguistic synesthesia is grounded in both the sensorimotor patterns and neural mechanisms, while neurological synesthesia is widely recognized as being grounded in hard-wired neural mechanisms (Cytowic 2002 [1989]; Ramachandran and Hubbard 2001; Seitz 2005).

Apart from the differences between linguistic synesthesia and neurological synesthesia, one should note that the lexical-conceptual account for linguistic synesthesia allows for the examination of the relations between sensory modalities on which the neurological account focuses, when the aggregation of all lexical items in one sensory modality is considered. Furthermore, the biological potential of linguistic synesthesia proposed by the neurological account (e.g., Cacciari 2008; Ramachandran and Hubbard 2001) can also be captured by the lexical-conceptual model. That is, the lexical-conceptual model predicts both the sensorimotor experiences and neural substrates underlying linguistic synesthetic mappings, as shown in Section 4.2.

In terms of the literal account for linguistic synesthesia, we have demonstrated in Section 3 that this proposal is not supported by a lexical analysis of Mandarin synesthetic usages, as these usages generally do show non-basic and hence metaphorical meanings. In addition, a lexical-conceptual account can also handle the important observation that sensory words show evaluative functions in linguistic synesthesia provided by Winter (2019a, 2019b). That is, by introducing the Mapping Principles (Ahrens 2002, 2010), the evaluative functions are explicated in linguistic synesthetic mappings. As demonstrated in example (10), the evaluative measure (i.e., pleasantness) is transferred from *TASTE* to *VISION*, based on the MP that “*VISAGE IS SWEET* because a (smiling) face is pleasant to see just like sweet things are pleasant to taste.” Similarly, the evaluation of intensity is borrowed from *TOUCH* to *TASTE* and is constrained by the MP that “*DRINK IS FIERY* because it tastes strong like fire has strong heat,” as illustrated in (12).

There is another aspect of linguistic synesthesia, i.e., the creativity of linguistic synesthesia, which has not received much attention in previous accounts. Yu (2003) and Zhao et al. (2019b) demonstrated that there are abundant instances of linguistic synesthesia that have not been conventionalized in Mandarin, such as



the expression 熱乎乎的腥氣 *rèdūdū de xīngqì* ‘the hot fishy smell’ used in one of the Mo Yan’s novels. The varying degrees of conventionalization of linguistic synesthetic usages can be predicted by a lexical-conceptual model that incorporates a lexical-conceptual view with CMT. That is, it is expected that linguistic synesthesia involves both conventional and novel usages, as conceptual metaphors do have the two kinds of metaphors (Lakoff and Johnson 1980; Lakoff and Turner 1989). For instance, Ahrens (2002, 2010) found that conventional metaphors following the Mapping Principle were processed on par with literal examples, and novel metaphors constrained by the Mapping Principle received lower acceptability ratings and higher processing time, while novel metaphors contradicting the Mapping Principle showed the lowest acceptability and highest processing time. Ahrens et al.’s (2007) fMRI study and Lai et al.’s (2009) ERP study also demonstrated that the processing of conventional metaphors is more similar to literal usages than to novel metaphors. Thus, the lexical-conceptual account for linguistic synesthesia not only allows for the possibility of some instances of linguistic synesthesia to become conventionalized, but also predicts novel usages of linguistic synesthesia that are not attested but can be understood.

To summarize, the lexical-conceptual account (i.e., one that incorporates a lexical semantic view of lexical conceptualization with CMT) can also offer a coherent and comprehensive account for the aspects of linguistic synesthesia previously only accounted for by non-metaphorical accounts. They include the neural bases between sensory modalities, evaluation functions in synesthetic mappings, and the creativity of linguistic synesthesia.

## 6 Conclusion

This study tests competing theoretical accounts concerning the nature of linguistic synesthesia within the scope of a lexical-conceptual model. The choice of the lexical-conceptual model for our analysis is crucial and motivated by the nature of linguistic synesthesia involving processing of stored concepts of sensory properties, instead of processing of real-time perceptual input by neurological synesthesia. We demonstrate that neither a literal account nor a neurological account can account for the linguistic synesthetic usages in Mandarin Chinese.

This paper also defends the position that linguistic synesthesia is a type of metaphor. Specifically, we demonstrate that linguistic synesthetic usages are metaphorical in Mandarin, based on a lexical-conceptual analysis of sensory items from different sensory domains. In addition, linguistic synesthesia is found to show systematic similarities with conceptual metaphors when utilizing a lexical-conceptual perspective, thus demonstrating that linguistic synesthesia may also

be analyzed as a conceptual metaphor. Furthermore, we also show that aspects of linguistic synesthesia that may be considered to pose challenges to the lexical-conceptual account (e.g., neural bases, evaluative function, and creativity) can instead be incorporated into this account.

This study underlines the importance of differentiating variations in perspective from empirical inconsistencies. By showing that linguistic synesthesia is indeed a type of metaphor, our study strengthens the role of conceptual metaphor as the link between the perceived world and our conceptualization of that world. For instance, following Huang et al.'s (2021) study showing the correspondence between metaphorical weather expressions and associated meteorological patterns, conceptual metaphors in general and linguistic synesthesia in particular have the potential to lead us to new knowledge about our current and past environments, and about how the perceived world shapes our language and cognition. Moreover, when provided with a literal-figurative dichotomy, speakers generally adopt a fluid definition of what is literal, but still maintain a degree of relative literalness among different figurative meanings (Michl 2019). Thus, linguistic synesthesia is fertile ground for future studies on the cognitive basis of what it means to “be literal.”

## Data availability statement

The dataset generated and analyzed during this current study is available in the OSF repository, with a permanent link as <https://osf.io/rgv3y/>.

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