Distributions of Taiwan Mandarin Synesthetic Transfer from Sensory Words to Emotion Words: A Corpus-Based Study

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Abstract

The present study aims to prove the correlation between emotional words and linguistic synesthesia and investigate the distributions of Taiwan Mandarin synesthetic transfer from 5 sensory words to emotion-trigger words. The gustatory word "sweet" in English and Mandarin has been discussed as an emotional word as well (Wu & Lai, 2011), but the emotion-trigger word has still rarely been studied in linguistic synesthesia. The purpose of the present study is the continuation of extending the study of emotion-linguistic synesthesia. In addition to examining the frequency of the sensory words of 5 sensory modalities in emotion-linguistic synesthesia, meanwhile, this study further will discuss the distribution of emotions that are mainly triggered by emotional synesthesia words in each sensory domain.

The study is corpus-based, and the usage of methodology is revised from the linguistic synesthesia identification procedure (LSIP) of Zhao (2018), which was previously employed in Mandarin studies by Zhao et al. (2019) to discuss the directionality of linguistic synesthesia. Besides the adoption of the LSIP, the sensory words list of the 5 sensory modalities from LSIP was used in this study. The text with the completed context where the emotional words located in this study were drawn from the sentiment texts of Chinese EmoBank (Lee et al., 2022). A contextual analysis was conducted to determine whether the sensory words in the compiled list triggered the specific emotion. Instances, where the sensory words trigger emotion successfully, were marked as instances of emotion-linguistic synesthesia and categorized into the 5 sensory domains to observe the distribution of this synesthesia. The findings will contribute to our understanding of the relationship between sensory modality and emotion-trigger in linguistic synesthesia of Taiwan Mandarin.

Keywords: linguistic synesthesia, emotional trigger, sensory modality, metaphor, synaesthetic transfer, corpus

I. Introduction

With the vigorous development of social media and technology, some popular usages of linguistic synesthesia can be seen in internet slang or neologism in the internet. For instance, in the Taiwanese college students' social platform, D-card, the comment "這堂課很涼" is common on the course board. The lexicon "涼" /liang4/ belongs to the tactile word from the 5 sensory modalities of human feeling. However, in the notion of linguistic synesthesia, the tactile word "涼" /liang4/ doesn't map to the other sensory word, but the emotion word means "work is easy".

Winter (2016) showed that linguistic data might also witness the integrations of scent with emotion and taste with emotion seen in the brain and behavior. For "emotionally valenced nouns," such as "fragrant kiss," gustatory and olfactory words are discovered to be more prevalent than visual terms. Additionally, terms with associations to taste and smell make up a significant portion of the English emotional language. Terms associated with taste and smell have also been found to be more emotionally adaptable than words associated with other senses, having the ability to be coupled with both positive and negative nouns. For instance, "sweet" can be used in "sweet joy" or "sweet disaster". However, compared to taste words, scent words are more negative and are used in more negative settings because the act of taste that can be easier controlled will be preferred by humans (Winter, 2016). In the relative emotion-linguistic synesthesia of Mandarin, Wu, and Lai (2021) examined the cognitive directionality of emotion synesthesia transfer from the gustatory word "甜" /tian2/. Additionally, Wu and Lai (2021) indicated that emotion tends to be triggered by "甜" /tian2/ is the feeling of joy.

The gustatory word "sweet" in English and Mandarin has been discussed but the emotion-trigger word has still rarely been studied in linguistic synesthesia. The purpose of the present study is the continuation of extending the study of emotion-linguistic synesthesia. In addition to examining the frequency of the sensory words of 5 sensory modalities in emotion-linguistic synesthesia, meanwhile, this study further will discuss the distribution of emotions that are mainly triggered by emotional synesthesia words in each sensory domain.

II. Literature Review

Synesthesia and metaphor are similar in that both involve the mapping from the source domain to the target domain, but the difference between synesthesia and metaphor is that the human senses are mapped by both the source domain and the target domain of synesthesia (Williams, 1976). In conceptual metaphors, the source and target domains present clear differences between concreteness and abstractness; in contrast, in synesthetic metaphors, it is not clear between concreteness and abstractness (Zhao et al, 2019).

Pragglejaz Group (2007) suggested the metaphor identification procedure (MIP) to determine whether there are more fundamental meanings of sensory words at the synchronic tier. The more fundamental meanings mean that to be more specific, such as the perception through the 5 human sensory modalities (i.e., vision, hearing, touch, smell, and taste), and to be more ancient in time. Williams (1976) determined the meaning based on the English dictionary appeared earliest to express the feeling as the basic sense meaning of a word, and thus determined "the sensory domain of the basic sense meaning " as "the source domain of the synesthesia". If there is a more basic meaning in a word than the current usage in the text at the synchronic tier, the similarities between the usage meaning and the basic meaning will

be judged further. If there are similarities between them, the textual sense of the word is marked as a metaphor (Group, 2007).

Compared to general metaphors, the source domain and target domain of synesthesia are both human sensations. Therefore, there are high physical experience and accessibility in the source domain and the target domain. Lehrer (1978) suggested that synesthesia results from the similarity in the experience of different senses (i.e., embodiment). Shen (1997) indicated that touch is the highest embodiment, followed by taste, smell, hearing, and vision. Through the behavior experiment, the preference for the lower-to-higher structure of 5 sensory modalities in synesthetic metaphor was observed among the subjects (Shen and Cohen, 1998; Shen and Aiseman, 2008). Furthermore, the directionality of synesthesia mapping can be explained and predicted by the difference in the degree of embodiment (Shen, 1997).

Studies by Zhou (2018) indicated that the synesthetic distributions of Mandarin adjectives have correlated to the degree of embodiment. The taste synesthesia words in Mandarin account for the highest ratio among the 5 senses, following the trend from embodied to less embodied. Relatively, the proportions of other less embodied sensory words (i.e., smelling, hearing, and vision) are less than the more embodiment sensory (i.e., taste and tactile) words. However, according to the embodiment from Shen (1997), compared to taste, touch should be more accessible to the sensory receptors of the body. Thus, the study of Zhao (2018) also anticipated the hitherto undetected direction from touch to flavor (Lehrer 1978; Shen 1997).

Based on the corpus study, Wu and Lai (2021) analyzed the types of linguistic synesthesia transfer and emotional triggers of the taste word “甜" /tian2/ and explored it in the cognitive directionality of synesthesia transfer and trigger. In addition to the other 4 sensory domains, the taste word “甜” /tian2/ was observed that can also transfer to the mental tier and trigger the happiness emotion mostly. For instance, “給分甜" in Taiwan Mandarin means that the teacher gives high grades, and the students feel happy because of the high grades from the teacher, which directly triggers the feeling of satisfaction of the speaker from the source of taste to the target of emotion.

The transfer to emotion-trigger words is rarely discussed, and most current research is discussed based on the 5 sensory modalities. The purpose of the present study was to examine the distributions of Taiwan Mandarin synesthetic transfer from 5 sensory words to emotion-trigger words.

III. Methodology

The study was to investigate how Taiwan Mandarin synesthetic words transform from sensory words to emotion-describing words and the distribution of the emotion-synesthetic words in the sensory domain. The sensory words list was referred to from the Mandarin sensory adjectives of Zhao (2018), and a total of 2643 emotion texts from Chinese EmoBank (Lee et al, 2022). The collection of synesthetic data from sensory words to emotional words in Taiwan Mandarin was based on the linguistic synesthesia identification procedure (LSIP) of Zhao (2018).

The sensory words of 5 sensory modalities in this study were collected from Zhao (2018). In the steps of following LSIP, initially, Zhao extracted the sensory words from two Chinese lexical thesauri. Secondly, the etymologies of these sensory words would be checked

from Chinese etymology dictionaries including 說文解字 Shuōwén Jiězì "Explaining Graphs and Analyzing Characters", 說文解字注 Shuōwén Jiězì Zhù "Annotation on Shuowen Jiezi", and 漢語大字典 Hànyǔ Dà Zìdiǎn "Great Compendium of Chinese Characters". According to the etymology of sensory word's morphemes, the sensory words were further categorized into 5 sensory modalities including touch, taste, vision, hearing, and smell. A total of 2643 emotion texts were gathered from Chinese EmoBank (Lee et al, 2022). The Chinese valence-arousal texts (CVAT) of Chinese EmoBank (Lee et al, 2022) had been analyzed in dimensional sentiment. The Chinese EmoBank constitutes a dimensional sentiment corpus, meticulously annotated to encompass continuous scalar values corresponding to two fundamental affective dimensions: valence and arousal. Valence denotes the extent of positive or negative emotional disposition, while arousal signifies the spectrum spanning serenity to exhilaration. Both dimensions are quantified on a numerical scale that spans from 1, representing a state of heightened negativity or tranquility, to 9, emblematic of an elevated positivity or fervor. Thus, the objectivity of the data was ensured.

The LSIP was adopted in the previous study to discuss the directionality of linguistic synesthesia in Mandarin (Zhao et al, 2019) and to synesthetic participation rates of Mandarin sensory adjectives for the 5 senses (Zhao, 2018). This criterion was employed to ensure a basic understanding of the methodology in this study.

According to the LSIP (Zhao, 2018; Zhao et al, 2019), in this study, the sensory words from 5 sensory modalities will be adopted directly instead of the step to compile a sensory list. The usages of the sensory words in the compiled list will be extracted from the sentiment texts of Chinese EmoBank. The emotion-describing and trigger words from Chinese EmoBank will be manually checked whether the morphemes of these emotional words are related to the sensory words in the compiled list. If the morphemes of the emotion words correspond to the sensory words in the compiled list, the usages will be marked as instances of emotion-linguistic synesthesia and categorized into 5 sensory domains to further observe the distribution of this emotion-linguistic synesthesia in the 5 sensory domains.

To discuss the distribution of emotional synesthesia words from 5 sensory modalities, the data will be evaluated as target data and non-target data through the criteria from Wu and Lai (2021). Non-target data includes dialect words, proper nouns, idioms, and other data that do not involve synaesthesia transfer; those that involve synaesthesia transfer and emotion triggers are target data. The emotion-trigger participation rates will be used to test what is the ratio of emotion-linguistic synesthesia (lexical types) to emotion words (lexical types) in each sensory field; the denominator is emotion words, and the numerator is emotion-linguistic synesthesia. The usage of emotion-trigger participation rates can make the accuracy of frequency to be insured.

IV. Findings and Discussion

In the 2954 data of CVAT, compared with the sensory words list of 5 sensory modalities collected by Zhao (2018), the frequency distribution of text with the emotional trigger was found: in the tactile domain, of the 106 target data which are already synaesthesia transfer, 88.68% were emotional transfer; in the taste domain, of the 23 target data, 86.96% were emotional transfer; in the vision domain, of the 72 target data, 90.28% were emotional transfer; in the auditory and olfactory domain, although there are fewer available data, the phenomena of emotional transfer still can be observed. Table 1 shows the distribution of

emotional synesthesia words from 5 sensory modalities in the CVAT of ChineseEmoBank. It can be explained that the source domain of emotional transfer does not only occur in the taste domain but also in tactile, vision, auditory, and olfactory.

Source Domain	Tactile	Taste	Vision	Auditory	Olfactory
Emotion Trigger	94	20	65	4	2
Target Data	106	23	72	4	2
Emotion Trigger-Percentage	88.68%	86.96%	90.28%	100%	100%

Table 1: The distribution of emotional synesthesia words from 5 sensory modalities.

Beginning from each of the 5 sensory modalities as the source domain, its cognitive pathways can be divided into three types: 1. To transfer from one of the 5 sensory modalities to other sensory modalities. 2. To transfer from one of the 5 sensory modalities to other sensory modalities and then evoke emotions. 3. To directly evoke emotions from one of the 5 sensory modalities. Tables 2 to 6 are the cognitive pathways distribution of the 5 sensory modalities.

Zhao (2018) indicates a distinct directional bias between vision and touch in Mandarin synesthesia. The data analysis conducted on the Sinica corpus reveals a notably higher frequency of synesthetic mappings from the tactile modality to the visual modality, as opposed to the reverse direction from vision to touch. Moreover, the proportion of touch-to-vision adjectives significantly outweighs that of vision-to-touch adjectives within the Mandarin context. In addition, a comparable directional pattern emerges in the relationship between taste and vision. The observed trend mirrors that of touch and vision, where synesthetic transfers from the gustatory domain to vision exhibit significantly higher prevalence than transfers originating from vision to taste within the Sinica corpus.

The above research in the past can be explained in this study, why in the process of visual modality as the source domain and then emotion trigger (0% in table 2), the ratio of going through the other sensory modalities is much lower than that of tactile (16.04% in table 3) and taste (39.13% in table 4) as the source domain.

Path of Cognition	Tactile → Vision/ Auditory/Olfactory	Tactile → Taste/ Vision/Auditory → Heart	Tactile → Heart
Percentage	11.32% (12)	16.04% (17)	72.64% (77)

Table 2: The cognitive pathways distribution of the tactile modality.

Path of Cognition	Taste → Vision/ Olfactory	Taste → Vision/ Auditory → Heart	Taste → Heart
Percentage	8.7% (2)	39.13% (9)	52.17% (12)

Table 3: The cognitive pathways distribution of the taste modality.

Path of Cognition	Vision → Tactile/ Auditory	Vision → Tactile/ Taste/Auditory/ Olfactory → Heart	Vision → Heart
Percentage	9.72% (7)	0% (0)	90.28% (65)

Table 4: The cognitive pathways distribution of the vision modality.

Path of Cognition	Auditory → Taste/ Vision/Tactile/ Olfactory	Auditory → Vision → Heart	Auditory → Heart
Percentage	0% (0)	25% (1)	75% (3)

Table 5: The cognitive pathways distribution of the auditory modality.

Path of Cognition	Olfactory → Taste/ Vision/Auditory/ Tactile	Olfactory → Taste/ Vision/Auditory/ Olfactory → Heart	Olfactory → Heart
Percentage	0% (0)	0% (0)	100% (1)

Table 6: The cognitive pathways distribution of the olfactory modality.

No matter which sensory modality is used as the source domain, the rate of directly triggering emotions and the heart as the target domain is the highest. The ratio of tactile as a source domain and directly eliciting emotion is 72.64%, taste is 52.17%, and vision is 90.28%. For instance, in (1), “強烈的心聲和懇求” contains the intensity of emotions and needs, implying that children's emotions and thoughts are very urgent and real, and may not be directly expressed for some reason. From the perspective of cognitive metaphor, “強烈” can be interpreted as mapping the intensity of emotion to physical sensation and touch. In (2), “損傷巨大” means serious injury. The word "巨大" visualizes the health damage caused by excessive drinking, that is, maps from the physical perception of vision to the psychological state of being threatened and stressed, so as to induce the reader's emotion of fear. In (3), "甜蜜" means feeling happy, mapping from the bodily perception of sugar by the taste buds to the psychological state of happiness.

(1) 實際上如果你能夠好好傾聽，孩子們微弱或者強烈的心聲和懇求裡，包含了許多意思，他們想說的有很多，只是，你聽不懂。

(2) 過度飲酒對健康的損傷巨大，包括成癮、精神病、失智、肝硬化、胰臟炎、心臟病及口腔癌，食道癌，大腸直腸癌及乳癌等各類疾病。
(3) 故事情節的發展，我也心中甜蜜，酸楚，失落，幸福。

The metric of sentiment analysis in Chinese EmoBank refers to two-dimensional valence-arousal space from Russell (1980) as shown in Figure 1. Valence corresponds to the level of agreeable and disagreeable (i.e., positive and negative) emotions, whereas arousal indicates the level of excitement and calm. Utilizing this portrayal, all forms of emotional expressions can be depicted as coordinates on the valence-arousal plane, determined by their respective valence and arousal ratings. In the two-dimensional valence-arousal space, the sentiment in the first quadrant represents high-arousal and positive-valence (i.e., excitement and positive); the second quadrant represents high-arousal and negative-valence (i.e., excitement and negative); the third quadrant represents low-arousal and negative-valence (i.e., calm and negative); the fifth quadrant represents low-arousal and positive-valence (i.e., calm and positive). Consequently, any emotional state can be graphically presented as a point within the valence-arousal coordinate system.

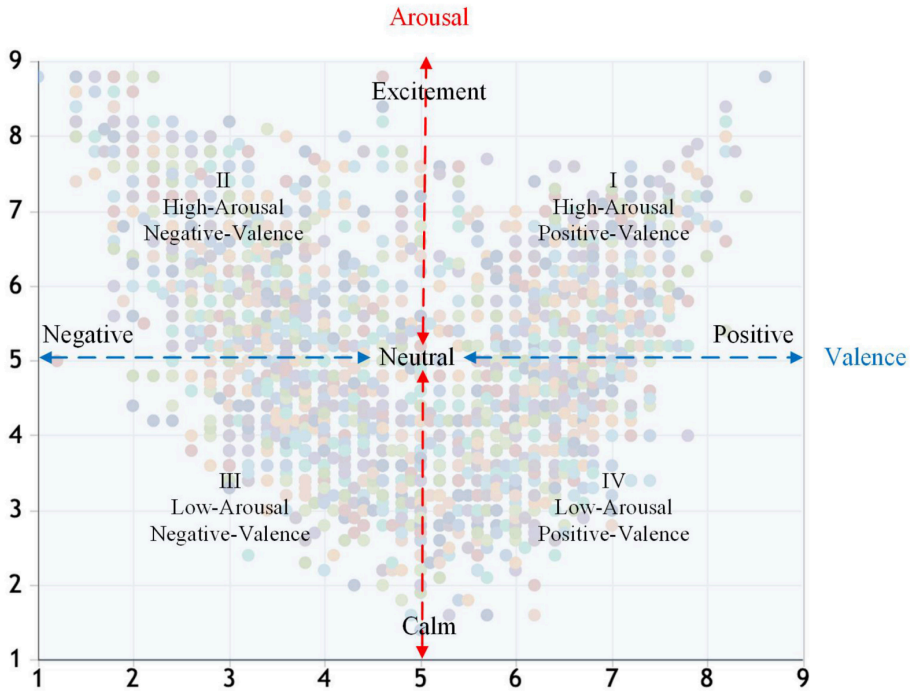

Figure 1. Two-dimensional valence-arousal space.
(Referred to ChineseEmoBank (Lee et al, 2022) Figure 1)

The results of emotional state show that the highest proportion of emotions induced by the "tactile domain" is located in the second quadrant (32.56%), indicating that its emotional valence is negative and emotional arousal is high; the "taste domain" induced The highest proportion of emotions is located in the second quadrant (41.18%), indicating that its emotional valence is negative and its emotional arousal is high; the highest proportion of

emotions induced by "vision domain" is located in the second quadrant (28.33%), indicating that its emotional valence is negative, and its emotional arousal is high; the highest proportion of emotions induced by "auditory domain" is located in the first quadrant (100%), indicating that its emotional valence is positive, and its emotional arousal is high; The highest proportion of emotions induced by "olfactory domain" is located in the third quadrant (100%), indicating that its emotional valence is negative and its emotional arousal is low. Table 7 shows the distribution of emotion quadrants for each of the 5 sensory modalities' source domains.

Source Domain	Tactile	Taste	Vision	Auditory	Olfactory
First Quadrant	19.77% (17)	17.65% (3)	23.33% (14)	100% (3)	0%
Second Quadrant	32.56% (28)	41.18% (7)	28.33% (17)	0%	0%
Third Quadrant	20.93% (18)	23.53% (4)	23.33% (14)	0%	100% (1)
Forth Quadrant	26.74% (23)	17.65% (3)	25% (15)	0%	0%

Table 7: The emotion quadrant distribution of emotional synesthesia words from 5 sensory modalities.

This study further explored the highest word frequency in 5 sensory modalities word and its triggered emotion. In the modality domain, “強烈” with the highest word frequency mainly induces emotions in the second quadrant, with negative emotional valence and high emotional arousal. In (4), the target of “強烈” is in order to intensify the context word “不滿”, so the emotion is anger that is triggered by “強烈” can be inferred. In (5), the intent of "強烈" is also to amplify the impact of the following term “BS” (i.e., the Internet homonym of “鄙視" in Chinese). As a result, it can be deduced that the emotion evoked by "強烈" is loathing.

(4) 但卻有一些無知的網民，在公眾都在為逝去的生命默哀、救援隊伍仍在日夜不停搜救的時候，在網路釋出一些侮辱性言論、虛假的資訊，造成了惡劣影響，使廣大網民強烈不滿。

(5) 首先酒店任何員工對客人都沒有應有的尊重，客人可以被他們呼來呵去，其次CHECK-IN和CHECK-OUT都要半小時以上，強烈**BS**張XX和左XX，效率低下，態度傲慢。

Within the taste modality, the term "苦" with the highest frequency predominantly elicits emotions in the second quadrant, characterized by a negative emotional valence and elevated emotional arousal. For instance (6), through the inference of the context “莫名的悲哀” and the argument “不想竟也碰到胡蘭成這樣，惡俗的混世魔王。”, the emotion is upset and anger triggered by the term “苦”. (7) shows that the term “苦” triggers the emotion

of stress, which is caused by the context "每年還編列各種獎金名目Ａ人民錢、變相加薪。"

(6) 莫名的悲哀，想像中愛玲應該是金枝玉葉，雖飽受風塵之苦，卻也是冰清玉潔，不想竟也碰到胡蘭成這樣，惡俗的混世魔王。
(7) 前言：人民生活苦，政府官員不願減薪，也不願少領年終，每年還編列各種獎金名目Ａ人民錢、變相加薪。

In addition, in the vision modality, the term "大" with the highest frequency primarily evokes emotions within the second quadrant as well, characterized by a negative emotional valence and heightened emotional arousal. In (8), through the observation of the context and the word "心理壓力", the term "大" arouses emotion of stress. In (9), from a few tag questions with a questioning tone in the context, it can be inferred that the emotion aroused by "big" is disappointment and high valence.

(8) 目前有越來越多的證據表明，許多年輕的遊戲玩家在玩電子遊戲時出現了上癮行為，並因此面臨著極大的心理壓力。
(9) 有的文章純粹我覺得可能還是編的，比如說表姨媽的時候，說成了watchaunt，這可能嗎？？？除非開玩笑的時候故意的吧，任何一個學過英語的初中以上的人都難以犯這種錯誤吧？翻了幾個故事看了之後，積極性大受打擊。

Although there is less data on the auditory and the olfactory modalities, some tendency can be observed. In the auditory modality, "和諧" of 2 texts happened with emotional linguistics synaesthesia trigger emotions all from the first quadrant, characterized by a positive emotional valence and high emotional arousal. Through the context of (10) and (11), "和諧" triggers the emotion of happiness. On the other hand, in the olfactory modality, the only data is from the third quadrant, and the olfactory adjective "臭" triggers the emotion of low arousal and negative valence.

(10)社會上處處可見"和諧"，人在"和諧"的環境中生活，哪麼每一個人不都過上了幸福的生活嗎？想自己過幸福生活的人，就去看《小知道答案》吧！
(11)總統說，願臺灣產業升級，經濟振興，人人有工作，家家都歡喜；願社會和諧安定，大家相互關懷，互助合作；願全民充滿朝氣，相互激勵，迎向新挑戰，開創新世紀。
(12)但有分析稱，他們誤認為握有包括稀土等三張王牌，其實是禍國殃民的三張臭牌，...在Google新聞上檢視完整報道

Conceptual Metaphor Theory (CMT) posits that human cognition draws upon bodily experiences to construct metaphoric expressions. These experiences, characterized by heightened bodily engagement and interactions with the immediate environment, are considered more embodied. (Lakoff and Johnson, 1980; Johnson, 1987). However, Zhao (2018) doesn't agree with the traditional dichotomy of CMT which is the metaphorical mapping from the bodily (source domain) to the non-bodily event (target domain). Instead,

the degree of the embodiment should be considered the pivotal cause of the source-target domain in linguistics synaesthesia. In other words, experiences ought to be delineated based on a gradient extending from highly embodied to markedly de-embodied occurrences. Embodiment theory can also explain why abstract emotion needs to be embodied through linguistics synesthesia.

V. Conclusion

This study delved into the phenomenon of emotional transfer through linguistic synesthesia across various sensory modalities, namely tactile, taste, vision, auditory, and olfactory. The analysis of data from the CVAT ChineseEmoBank revealed intriguing patterns of emotional triggers across these sensory domains. Notably, emotional transfer was observed to occur predominantly from the source domain to the target domain, with the tactile, taste, and vision modalities exhibiting significant percentages of emotional transfer. The auditory and olfactory domains, although having fewer available data, still exhibited indications of emotional transfer.

The investigation also revealed the cognitive pathways through which emotional transfer occurs. Depending on the source sensory modality, three primary types of pathways were identified: transferring across sensory modalities, transferring across sensory modalities and then evoking emotions, and directly evoking emotions from a single sensory modality. The directional bias observed in Mandarin synesthesia, particularly between vision and touch, aligns with the findings of Zhao (2018) and provides further support for the intricate interplay between sensory domains in linguistic synesthetic expressions.

This study illuminated the prevalence of direct emotional triggering from various sensory source domains. The highest ratios were observed for tactile, taste, and vision, highlighting how these sensory modalities directly evoke emotions in the target domain. Moreover, the sentiment analysis revealed a nuanced distribution of emotions within the valence-arousal space, indicating the emotional nuances embedded in linguistic synesthetic expressions.

Furthermore, the study unveiled how certain high-frequency words within each sensory modality induce specific emotions. These findings emphasized the intricate relationship between sensory experiences, linguistic expression, and emotional states. Conceptual Metaphor Theory was also applied to provide a comprehensive framework for understanding the embodiment of emotions through linguistic synesthesia. The study endorsed the notion that bodily experiences play a pivotal role in constructing metaphoric expressions and influencing emotional transfer.

In conclusion, this research contributes to a deeper comprehension of linguistic synesthesia and sheds light on the complex interplay between sensory modalities, emotional triggers, and linguistic expression. The findings underscore the rich tapestry of human cognition and language, where sensory experiences and emotions intertwine to create a multifaceted communication system. As the study of linguistic synesthesia continues to evolve, it holds the potential to unveil new layers of human perception, cognition, and expression.

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