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Linguistic synesthesia in Korean: A compound word-based study of cross-modal directionality*

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Jo, Charmhun, Chu-Ren Huang, and Sun-A Kim. 2022. Linguistic synesthesia in Korean: A compound word-based study of cross-modal directionality. *Linguistic Research* 39(2): 275-296. In linguistics, synesthesia refers to lexical expressions for perceptual experience of one sense associated with another, such as 'warm color', which is often treated as metaphor. Previous studies of synesthetic metaphor are mostly based on Indo-European languages. This paper investigates linguistic synesthesia in Korean, focusing on compound words that have not been explored in the field. Synesthetic compounds were collected from Korean WordNet and a comprehensive Korean dictionary. The results show that synesthesia in Korean compounds supports the directionality of sensory transfer in the synesthetic hierarchy established for Indo-European languages. Simultaneously, Korean compound synesthesia exhibits particularities. *Vision* is maximized as a source, and neither *olfaction* nor *audition* serves as a source. The findings of the study are comparable to those of previous studies, providing further support for modality exclusivity-based results. In addition, this study shows differences between phrase-level and lexical-level tendencies of linguistic synesthesia in the same register in Korean. **(Southwest University · The Hong Kong Polytechnic University)**

Keywords linguistic synesthesia, metaphor, compound word, Korean, directionality

1. Introduction

Regarding the probable universal nature of synesthetic mappings, Ullmann (1963), the pioneering researcher of linguistic synesthesia, analyzed synesthetic examples from nineteenth-century poetic writings in English, French, and Hungarian. He then proposed a theoretical framework of hierarchical distribution identifying three general tendencies of synesthetic transfers. The first directional tendency showed transference from the "lower"

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to the "higher" sensory domains, as represented in Figure 1[1]. The second tendency, called the source domain tendency, has touch, the lowest level of sensation in the hierarchy, as the most frequent source domain of transfers. The target domain tendency is the third category, in which sound is the most frequent target domain for synesthetic transfers.

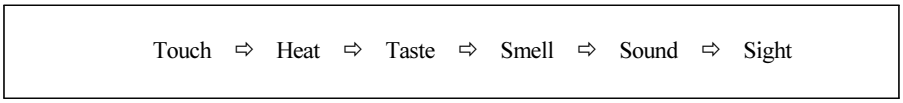

Figure 1. Synesthetic transfer directionality proposed by Ullmann (1963)

Ullmann (1963) admitted that his proposed principles of synesthesia required investigations of broader linguistic samples to establish its universality. Synesthetic phenomena were then examined first in English and then in several other languages such as Hebrew and Chinese (e.g., Shen 1997; Yu 2003). However, it remains unexplored in many languages including Korean. Therefore, the current study aimed to test Ullmann's (1963) theoretical framework of hierarchical distribution in Korean using synesthetic data retrieved from compound words. Particularly, this study intended to focus on the directionality of linguistic synesthesia, judge the reliability and generality of previous results gained from canonical studies of linguistic synesthesia, and then to explore the characteristics of synesthetic phenomena in compounds that have been scarcely addressed. Furthermore, we have investigated phrasal synesthetic metaphors in Korean for additional data, comparing the results with those obtained from the research on Korean synesthetic compounds.

For a detailed examination of linguistic synesthesia, examining Korean is an appropriate choice, given that the majority of evidence comes from the Indo-European language family (see Ullmann 1963; Williams 1976; Day 1996; Ronga et al. 2012; Winter 2016, 2019, among others). Also, the Korean language is quite unique in its origin and development. It is classified as a language isolate by most scholars (Sohn 2001), although there are still many hypotheses about the origin of Korean which are under vigorous debate (e.g., a linkage to Altaic languages, an association with Dravidian or

1 The notation "A ⇨ B" signifies that A (the source) is mapped onto B (the target) between sensory domains, A modifying B. In Ullmann's (1963) study, the term "transfer" was used instead of "mapping," and "destination" or "recipient" was used instead of "target." For the sensory domains, Ullmann (1963) selected six senses, including *heat* as distinct from *touch*, but some scholars simplified his hierarchy to *touch* ⇨ *taste* ⇨ *smell* ⇨ *sound* ⇨ *sight* without *heat*.

Austronesian languages). A long history of contact with Chinese and Japanese makes determining the linguistic affiliation of Korean even more complicated. The Chinese language, despite being in a completely different language family, has had a great influence on Korean through an enormous number of Sino-Korean words. This paper investigated synesthetic metaphors in Korean compounds, adding more linguistic data for grammatical constructions that are not often considered in this area, especially for a language that is not commonly featured in such studies.

Recent studies of synesthesia proposed accounts of how humans develop language as well as provide evidence of a cognitive basis for linguistic categories. They have noted asymmetric generalization in the sensory lexicon as a major issue. Strik-Lievers and Winter (2018) pioneered such studies by examining the distribution of words in the English sensory lexicon in a corpus and comparing them in the context of modality exclusivity norms developed for research on the relationship between perception and conception (Lynott and Connell 2009). Chen et al. (2017, 2019) constructed modality exclusivity norms for Mandarin Chinese and introduced a new methodology for investigating the context of coordinate compounds and synesthesia. Zhong et al. (2018) provided additional data and elaborated the concept of eventuality-based cognitive motivation, which usually assumes that a human being's behaviors are directed from an active understanding and processing of information or events. This study of synesthesia in Korean compounds can provide additional data from a typologically different language to evaluate the evidence for the cognitive motivation of lexical categories.

2. Previous studies

Ullman (1963) claimed that there is a unidirectional hierarchy of inter-sensory mappings in synesthetic metaphors (see Figure 1), which is considered as a universal principle for linguistic synesthesia. Following Ullmann's (1963) study of synesthetic directionality, Williams (1976) investigated synesthetic transfer patterns in everyday language. While Ullmann's (1963) research was based on synchronic data from nineteenth-century poetry, Williams' (1976) approach focused on diachronic data from vocabulary—historical meaning changes in synesthetic adjectives in everyday English (along with some evidence from other Indo-European languages and Japanese). Based on an analysis of 65 English adjectives, Williams (1976) posited that the semantic changes

display highly regular movement, a pattern repeated in other examined languages. Thus, the findings of Williams (1976) on synesthetic metaphors in ordinary language support Ullmann's (1963) framework of hierarchical distribution.

Shen (1997), against the backdrop of cognitive poetics, explored the directional tendency of mapping for synesthesia in Hebrew using a literary analysis of modern poetry and data from two psycholinguistic experiments. His results strongly confirmed Ullmann's (1963) observation of a synesthetic hierarchy. The synesthetic expressions in Hebrew tended to map lower perceptions onto higher ones in Ullmann's hierarchy. Shen (1997: 51) suggested that the "low to high" transfer comes from general cognitive constraints, where "a mapping from more 'accessible' or 'basic' concepts onto 'less accessible' or 'less basic' ones seems natural, and is preferred over the opposite mapping." He considered *sight* and *sound* less accessible due to their lack of direct contact with the entity perceived.

Meanwhile, to verify the universality of the synesthetic hypothesis claimed by Ullmann (1963) and Williams (1976), Yu (2003) analyzed synesthetic data drawn from literary works of the contemporary Chinese writer Mo Yan from a cognitive perspective. His research results demonstrate that Chinese synesthesia essentially accords with Ullmann and Williams' general schemas for metaphoric mappings. On the other hand, some recent synesthesia studies in Mandarin have displayed diverse findings (see Zhao et al. 2018; Zhao and Huang 2018; Zhao et al. 2019, among others). For instance, Zhao et al. (2019) reported three different directionalities in their Mandarin Chinese synesthesia data: "unidirectional" mapping (e.g., touch to hearing), "biased-directional" mapping (e.g., vision to touch), and "bi-directional" mapping (e.g., touch and taste), suggesting variations in linguistic synesthesia directionality within a specific language, unlike a linear hierarchy as proposed in Ullmann (1963).

Several studies, including Yoon (1970) and Chung (1997), have addressed Korean synesthetic phenomena based on Ullmann (1963) or Williams (1976), but they failed to show a clear and comprehensive directional route of synesthetic transfers, or obvious findings about the hierarchical order and manner. Recently, Jo and Jhang (2019) examined the synesthetic data from the self-built corpus of Korean modern poetry (consisting of 1,000 poems) to verify the generalizability of Ullmann's (1963) universal hypothesis, but concluded that Korean poetic synesthesia shows inconsistent and unstable directionality tendencies in mappings and source/target distributions, not aligning with the "universal" tendencies based on Indo-European languages. Although Jo and Jhang (2019)

contributed to enhancing the understanding of synesthetic directionalities in Korean poetry, it had methodological limitations. First of all, it was based on a comparatively small corpus—90 tokens of poetic synesthesia. Also, it did not conduct systematic comparisons of synesthetic directionality between Korean and Indo-European languages.

Jo (2017, 2019) attempted to clarify the regularities and features of Korean synesthesia with a larger corpus. Jo (2019) investigated synesthetic data extracted from the parsed Sejong corpus and compared his findings with those of Ullmann (1963). Unlike previous studies on Korean synesthesia which could not discover any consistent pattern, Jo (2019) found that the order of *sight* and *hearing* is switched in Korean compared to Ullmann's (1963) synesthetic hierarchy, but Ullmann's direction of synesthetic transfer in the lower sensory domains of *touch*, *taste*, and *smell* is confirmed in Korean. Furthermore, these results echoed Ullmann's (1963) findings identifying *touch* and *hearing* (*sound*) as the most frequent source and target domains of synesthetic transfers in Korean. Thus, Jo (2019) concluded that the directional order of Korean synesthesia generally corresponded to the orientations reported in Ullmann (1963) and Williams (1976). However, Jo's (2019) model for synesthetic metaphors simplified source-target synesthetic mappings with different values into a linear-hierarchical sequence as well as failed to systematically compare synesthetic directionalities in Korean with the results of previous studies.

In another study, Jo (2018) focused on the compound word level of Korean synesthetic metaphors from Korean WordNet and the *Standard Korean Grand Dictionary* and addressed the sources and targets of the synesthetic mappings in Korean compounds. Although it contributed to extending the research range of linguistic synesthesia to the compound word level, it was based on a relatively small dataset (45 tokens) and hardly dealt with important issues, such as the characteristics and constructions of Korean synesthetic compounds registered in the dictionary, the methodical comparisons of the results with those from previous studies, etc.

In this study, employing a larger and more refined data sample and more improved methods, we aimed to test whether the directionality of linguistic synesthesia that Ullmann (1963) found is confirmed with Korean compound nouns or verbs and to discuss how the three tendencies in Ullmann's (1963) study are manifested in phrase-level and lexical level synesthesia in Korean in daily language. Methodologically, the current study is distinctive from previous studies including Jo (2018) in the following three ways. First, it is grounded on a bigger, polished data (i.e., 110 tokens) by including more compound

words and excluding several grammaticalized compounds which were covered by Jo (2018). Second, the synesthetic data were analyzed by type rather than by token to show a more precise transfer directionality. Third, the scope of analysis is more comprehensive, including transfer directionalities, cognitive properties of sensory modalities, and unique characteristics of compound word synesthesia, which is extensively compared with the results of previous studies. In addition, supportive data of Korean phrasal synesthesia are gathered from Sejong Corpus and compared with the data of Korean compound synesthesia to identify the similarities and differences between phrase-level and lexical-level tendencies of linguistic synesthesia. This study is timely, considering the recent growing interest in the sensory lexicon distribution research (e.g., Strik-Lievers and Winter 2018; Zhong et al. 2018; Chen et al. 2019) and the conventionality of linguistic synesthesia. Essentially, the results would be comparable to those of Williams' (1976) lexical synesthesia research as well as Ullmann's (1963) work.

3. Data

3.1 Categorization of sensory domains

There is no consensus among scholars over how many sensory modalities exist, and classification of sensory domains varies depending upon the researchers' perspectives and criteria (Strik-Lievers et al. 2013; Strik-Lievers 2015). This methodology has been elaborated and refined to be aligned with the commonly accepted Metaphor Identification Principles (MIP; Steen et. al. 2010) by Zhao et al. (2019). Most synesthetic studies currently follow the Aristotelian five-sense system of touch, taste, smell, sight, and hearing (e.g., Cytowic 1989; Shen 1997; Strik-Lievers 2015). Some studies slightly alter the system. For instance, Ullmann (1963) separated heat from touch[2], and Williams (1976) divided sight into the two categories of dimension and color. Day (1996) draws upon Ullmann's (1963) taxonomy, but Yu (2003) follows Williams' (1976). Lin and Hsien (2011) add emotion to the six senses of touch, temperature, taste, smell, hearing, and vision, and Zhao and Huang (2015) consider emotion along with the five traditional senses. This study selects the five Aristotelian sensory modalities to ensure a harmonious

2 However, as Ullmann (1963: 278) noted, there is also "no harm in combining the two sets of data; actually this would only throw an even more glaring light on the general pattern."

comparison with the results of most previous studies, including Jo (2019). The details of each sense, including sensory domains and organs, are displayed in Table 1:

Table 1. Five sensory domains and related information

Sensory domain	Sub-categorical sensory modality	Sensory organ	Sensory object
Touch	temperature/heat, pain, hardness, tightness, humidity, texture, pressure, etc.	hands and skin	physical and non-physical entities (e.g., *toys*, *water*, *wind*)
Taste	sweetness, saltiness, spiciness, sourness, bitterness, "umami-ness" etc.	tongue	physical entities (e.g., *food*, *drinks*)
Smell	quantity, intensity, etc.	nose	smell and fragrance
Sight	dimension (size, length, height, width, depth, thickness, etc.), color, form/shape, appearance, etc.	eyes	visible entities (e.g., *buildings*, *clouds*, *sky*, *smoke*, *rainbows*)
Hearing	quality, quantity, intensity, etc.	ears	sound and voice

3.2 Data collection

For Korean compound word synesthesia, data were gathered through manual inspection of the Korean WordNet and the Standard Korean Grand Dictionary, along with compounds from the first author's intuition. WordNet, as a database that defines a hierarchy of word semantics, has become an important resource for natural language processing (NLP), playing a vital role in treating multiple complex linguistic tasks (e.g., information extraction and word-sense disambiguation). We selected Korean WordNet (http://WordNet.kaist.ac.kr/), not Sejong Corpus which was used in Jo (2019), as our focus was on lexical (i.e., compound) synesthesia, not phrasal or sentential synesthesia. We used the Korean WordNet from KAIST, which includes lemmas, definitions, examples for synsets, and case frames for predicates; providing 9,714 concepts [synsets], 8,270 words, 20,415 senses [synset-word pairs], 5,752 definitions, 7,126 examples, and 4,157 case frames (for further information on Korean WordNet, refer to Choi et al. 2004; Chagnaa et al. 2007, among others). The Standard Korean Grand Dictionary (http://stdweb2.korean.go.kr/main.jsp) lists 423,182 headwords. To identify Korean

compound word synesthesia, the lead author of this study searched for synonyms or related/expanded words in the Korean WordNet and the dictionary using existing examples, such as *ta-n-nay* 단내 'sweet smell' and *ssu-n-soli* 쓴소리 'bitter sound'. A total of 110 tokens and 48 types of synesthetic Korean compounds (see the Appendix for a complete list of the synesthetic expressions in the Korean compound word data) were found and analyzed, which is comparable to Williams' (1976) diachronic study of lexical-level synesthesia based on 65 adjectives from the Oxford English Dictionary and the Middle English Dictionary.

For additional data, phrasal (or sentential) synesthesia examples (e.g. sweet sound, his voice is so warm, and so on) were retrieved from Korean Sejong Corpus (https://ithub.korean.go.kr/user/main.do). As a collection of various Korean texts, the Sejong Corpus is a large-scale national corpus supported by the Korean government, known for its importance and authoritative status in research on the Korean language (Kang and Kim 2004). We used the national corpus in order to gather more objective and large-scale samples of Korean synesthesia. The study essentially followed Strik Lievers et al.'s (2013) methods for extracting synesthetic data from the corpus. These methods can be summarized as follows: First, lexical items are compiled for sense-related word lists, classified according to the five sensory domains and a part-of-speech (POS) categorization, including verb (V), adjective (A), and noun (N); the compilation starts from native-speaker's intuitions and relevant literature, and is expanded via such available electronic resources as the Korean WordNet or web dictionaries. Second, for synesthetic extraction from the corpus, a simple method that lists all sentences containing at least two perception-related words is applied to the parsed corpus. Lastly, to sort out "true" occurrences of synesthesia, a manual inspection of the extracted output is conducted. Based on this methodology, we have collected the total number of tokens of synesthetic metaphors from Sejong Corpus to 315, and 130 types of Korean phrasal synesthesia were identified in 315 synesthetic tokens.

4. Results

The data of compound synesthesia consisted of 110 tokens within 48 types, and token and type were counted in the following manner. For example, the following three words, *noph-un-um* 높은음(音) 'high sound', *noph-un-um-cali* 높은음(音)자리 'high sound

place', and *noph-un-um-cali-phyo* 높은음(音)자리표(標) 'the treble clef', are all from *noph-un-um* 높은음(音) 'high sound', so we counted them as three tokens and one type which is *noph-un-um* 높은음(音) 'high sound'. Instead of token, thus, type can exhibit a more accurate pattern of synesthetic transfer directionality, because counting by type can eliminate the influence of a very small number of highly frequent or productive items. The overall distribution of synesthetic mappings among sensory modalities in Korean compound data by type is shown in Table 2. For sensory transfer in Korean synesthetic compounds, the predominant sensory source modality is visual and the predominant target is auditory. The visual domain is as a source in 20 of the 48 collected types of synesthesia, followed by the tactile domain with 16. The auditory domain is the largest target at 33 out of 48 types, followed by the olfactory modality with 7.

Table 2. Synesthetic mappings of sensory domains in Korean compounds by type

Source \ Target	Touch	Taste	Smell	Sight	Hearing	Total
Touch	0	3	0	3	10	16
Taste	0	0	5	2	5	12
Smell	0	0	0	0	0	0
Sight	0	0	2	0	18	20
Hearing	0	0	0	0	0	0
Total	0	3	7	5	33	48

For phrasal synesthesia data, a total of 130 Korean synesthesia types were found in 315 synesthetic tokens retrieved from the Sejong Corpus. Table 3 illustrates the distribution of the whole Korean synesthetic mappings in Sejong Corpus among sensory modes, which is based on type frequencies. Jo's (2019) study used tokens to analyze Korean synesthetic transfers, which probably resulted from the small gap between the total numbers of types (83) and tokens (100). The following is representative instances of Korean phrasal synesthesia based on types.

(1) *pwutulewun mas* 부드러운 맛 'smooth taste' [Touch ⇨ Taste]
(2) *kosohan naymsay* 고소한 냄새 'delicately-flavored smell' [Taste ⇨ Smell]

(3) *tancolowun wullim* 단조로운 울림 'monotonous ringing' [Sight ⇨ Hearing]
(4) *yolanhan momcis* 요란한 몸짓 'loud gestures' [Hearing ⇨ Sight]
(5) *hyangkilowun umseng* 향기로운 음성 'fragrant voice' [Smell ⇨ Hearing]
(6) *ssutissun nukkim* 쓰디쓴 느낌 'bitter feeling' [Taste ⇨ Touch]
(7) *tachaylowun mas* 다채로운 맛 'colorful flavor' [Sight ⇨ Taste]

Table 3. Synesthetic mappings of sensory domains in Korean Sejong Corpus by type

Source \ Target	Touch	Taste	Smell	Sight	Hearing	Total
Touch	0	5	5	15	24	49
Taste	3	0	10	13	20	46
Smell	0	0	0	1	2	3
Sight	2	1	5	0	15	23
Hearing	0	1	1	7	0	9
Total	5	7	21	36	61	130

5. General discussion

Based on the synesthetic Korean compound data in Table 2, we found a frequency-based transfer direction of the five senses. The linear model for synesthetic associations in Korean compounds can be formulated as in Figure 2. Figure 2 displays a bird's-eye view of synesthetic mappings in Korean compounds. In the synesthetic metaphors from Korean compounds, there is no instance of transfer from smell and sound to other domains (see also Table 2). In the frequency-based model shown in Figure 2, the mappings in the direction of the arrow make up approximately 96% of the total mappings, whereas those which do not follow the unidirectional constraints make up approximately 4% of the total (see Table 2).

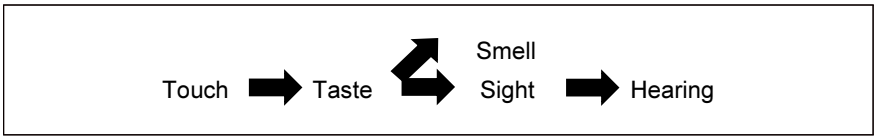

Figure 2. Linear synesthetic transfer route in Korean compound words

The directional tendency and pattern found in this study aligns with the results of Ullmann (1963) and Williams (1976). This is more similar, specifically, to Williams' findings (1976), given that dimension and color in his adapted sensory domains are combined into vision. Figure 3 shows the synesthetic hierarchy that Williams (1976) proposed. In sum, the directionality of Korean conventional synesthesia inferred from larger and more refined compound word synesthetic data conforms to Ullmann's (1963) theoretical framework of a hierarchical distribution.

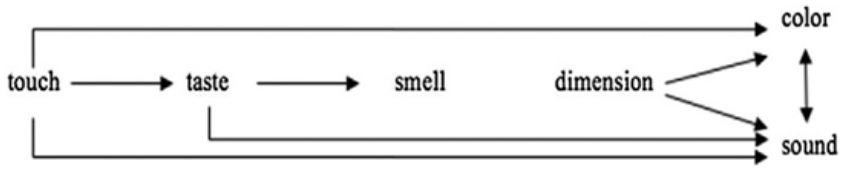

Figure 3. Synesthetic transfer route by Williams (1976: 463)

Meantime, based on synesthetic mappings found in the Korean Sejong Corpus (see Table 3), we can illustrate a general transfer directionality for linguistic synesthesia in Korean phrases. Figure 4 shows that there is a particular directional pattern in Korean phrasal synesthesia, which follows the 'universal' schemes of synesthetic mappings from Ullmann (1963) and Williams (1976). This result is in line with the conclusion coming from the research on Korean synesthetic compounds, having some variations (see Figure 2). It suggests that the transfer directionality of synesthetic metaphors in Korean has a similarity between phrases/sentences and compounds, which confirms linguistic universality claimed by Ullmann's research based on poetic samples from Indo-European languages.

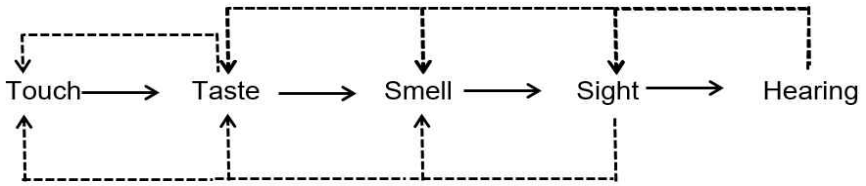

Figure 4. The overall transfer route in Sejong Corpus synesthesia

The frequency of the synesthetic mapping of compounds in Korean, however, is somewhat different from Ullmann's (1963) hypothesis as the most basic source modality of the senses, namely, *touch* has no interaction with *smell*, thus not showing a linear hierarchy in the relations of *touch*, *taste*, and *smell*. Moreover, the greatest source is not *touch* (which accounts for about 33%) but *sight* (accounting for 42%), which does not match Ullmann's (1963) model, though the largest target is *sound* (about 69%), as mentioned in his theory. The distributions of the source and target sensory domains in the synesthetic mappings from Korean compounds are summarized in Tables 4 and 5.

Table 4. Source sensory domains in decreasing order of frequency in synesthetic mappings of Korean compound words

Sight	**Touch**	**Taste**	**Hearing**	**Smell**
42%	33%	25%	0%	0%

Table 5. Target sensory domains in decreasing order of frequency in synesthetic mappings of Korean compound words

Hearing	**Smell**	**Sight**	**Taste**	**Touch**
69%	15%	10%	6%	0%

The results of this study (in Tables 4 and 5) are comparable to the findings of additional Korean synesthetic data from the Sejong Corpus, which completely followed Ullmann's source and target domain tendencies, as shown in Tables 5 and 6. The comparison with the results of phrasal synesthetic metaphors in Korean (Tables 5 and 6) shows that the visual modality in Korean compound synesthetic metaphors of this study (Tables 4 and 5) stands out. The role of sight is maximized as a source in the compound

data but unstable as a target, while touch and taste play significant roles as a source in the Sejong Corpus data, as seen in Table 7. This result is consistent with previous modality exclusivity-based studies, where vision is the most dominant modality in the sensory lexicon in English and Mandarin Chinese (Strik-Lievers and Winter 2018; Zhong et al. 2018), as well as the most dominant source domain for synesthesia in Mandarin Chinese (Chen et al. 2017; Zhao et al. 2018; Zhao and Huang 2018; Chen et al. 2019). Chen et al.'s (2019) study confirmed the dominance of vision as a source of synesthesia in their research on Mandarin, and Zhao and Huang (2018) also found that the most frequent synesthesia mapping to be from vision to hearing in Mandarin Chinese. Moreover, although Zhao et al.'s (2018) and Zhao and Huang's (2018) corpus-based analysis of Mandarin Chinese admits the universality of a hierarchical distribution, they also pointed out some language-specific characteristics. Zhao and Huang (2018) proposed that the hierarchical order in Chinese should be 'Touch/Taste --> Sight/Hearing --> Smell', placing the olfactory modality at the end of the hierarchy, which is quite different from the current study's model and Ullmann's (1963) framework. This suggests that the order of senses in the transfer route can be language-dependent, despite the universal directionality tendency found in various languages.

Table 6. Source sensory domains in decreasing order of frequency in Sejong Corpus synesthesia

Touch	Taste	Sight	Hearing	Smell
37.69%	35.38%	17.69%	6.92%	1.30%

Table 7. Target sensory domains in decreasing order of frequency in Sejong Corpus synesthesia

Hearing	Sight	Smell	Taste	Touch
46.92%	27.69%	16.15%	5.38%	3.84%

In this study of Korean compound synesthesia, no source domain exists in smell and hearing as presented in Table 2 and Figure 2. The rare frequency of olfaction and audition as sources in compound synesthesia is significant due to their unequal lexical distribution within the sensory lexicon (Strik-Lievers and Winter 2018). Additionally, the

use of compounds to explore interactions in the sensory lexicon is significant in research on linguistic synesthesia as we can find competition between two sensory modalities within the same lexicon item. Chen et al. (2019) also concurred with this study by reporting that smell and hearing showed the highest number of gaps among Mandarin coordinate synesthetic compounds, suggesting that olfactory and auditory senses are the least versatile in compound formation in both Korean and Mandarin Chinese. Whether the lack in these two sensory domains is a mere language-dependent variation or is caused by the grammatical and combinational structure emerging from synesthesia at the lexical level or the morpho-lexical characteristics of compounding in Chinese/Korean could be a topic for further study. Chen et al. (2019) suggest that this phenomenon may be due to the universal scarcity of olfactory words (see also Strik-Lievers and Winter 2018) and the position of auditory modality at the end of mapping hierarchy, typically constituting rare uses as sources of synesthesia. This study's Korean compound data and findings support this account. The results of the current study also have parallels with the findings of Strik-Lievers and Winter (2018) in terms of the correlation between sensory modality and linguistic features. They found that visual words are the most dominant, and olfactory words are the least dominant, containing the least number of words. They argued that cognitive properties of each sense affect how human languages express them. The issue of the relation between cognitive properties of senses and their lexical and grammatical representations in Korean and other languages offers a scope for further research.

Phrase-level and lexical-level tendencies of linguistic synesthesia differ in the same genre (daily language) of the same language (Korean). Though the current analyses of both compounding synesthesia and Sejong Corpus synesthesia in Korean largely support Ullmann's 'universal' hierarchy of synesthetic metaphors, they show some variations in the three tendencies. In particular, while the phrase-level results (i.e., linguistic synesthesia from Sejong Corpus) are similar with those of Ullmann (1963) in source and target frequencies, the lexical-level tendencies (i.e., linguistic synesthesia from compound words) are different (see Tables 4, 5, 6, and 7). In the compound synesthesia dataset, furthermore, there are no mappings between tactile and olfactory modalities and neither olfaction nor audition constitutes a source (see Figure 2). This may be compared with the findings of Williams' (1976) linear model of English lexical synesthesia, which varies from the general scheme of Ullmann's (1963) poetic phrasal synesthesia in English (see Figure 3). The differences between phrase-level and lexical-level synesthetic metaphors

represent a similar pattern in both Korean and English, eliciting potential research questions for future studies, such as which languages are (dis)similar in such variations and what motivates this (dis)similarity.

Different results of compound synaesthesia of the present study should be also emphasized based on its phrase-level research in Korean synesthesia. When we compared the number of types and tokens of Korean compounds of synesthesia (i.e., 48 types and 110 tokens) with the numbers of Korean synesthetic phrases in the Sejong Corpus (i.e., 130 types and 315 tokens), there were fewer types and tokens at the lexical level than at phrasal level in Korean. It may suggest that linguistic synesthesia in Korean is not relatively various at the lexical level in synesthetic types and use. Another notable tendency is related to the number of reverse cases in mapping directionality between Korean lexical and phrasal synesthesia. The proportion of tokens following the rightward arrow direction in compound synesthesia (approximately 96%) is higher than the synesthetic data from the corpus, which was 84.62% (see Tables 2 and 3). This may mean that synesthesia more faithfully conforms to Ullmann's hierarchy at the lexical level than at the phrasal or sentential level in Korean, exhibiting a remarkably smaller number of leftward/backward cases.

To understand the characteristics of synesthetic phenomena in Korean compounds further, an analysis of word structural information from the entire dataset is required. Table 8 presents the parts of speech (POS) of synesthetic compounding words in this study's data, which helps to understand morpho-syntactic constructions in the instances of Korean compound synesthesia. According to Table 8, only two POS types, i.e., noun and verb, exist in synesthetic metaphors in Korean compounds. Compound nouns absolutely take up 96% of Korean compounds, and 92% of those are structures with a noun modified by an adjective. Compound verbs are of two types: one with the verb taking the noun as an object (2%) and the other with the verb taking another verb as an adverbial (2%). They are all based on the Korean sentence structure reflecting SOV language typology.

Table 8. Part of Speech (POS) patterns in Korean synesthetic compounds

POS	Sub-structure (mapping)	Proportion (%)
Noun	AP + N (AP ⇨ N)	92
	N + N (N ⇨ N)	4
Verb	N + V (V ⇨ N)	2
	V + V (V ⇨ V)	2

(N = Noun, V = Verb, AP = Adjective Phrase)

The above POS patterns in Korean synesthetic compounds are compared with grammatical structures in synesthetic mappings from Sejong Corpus in this study, as shown in Table 9. They show that the synesthetic examples of both nouns modified by adjectives and noun-adjective sentences include an overwhelming majority (94%), followed by the verb-noun and adjective-verb combinations (4%). When comparing them to the morphological constructions exhibited in Table 8, it can be assumed that adjective-noun compounding nouns in Korean synesthesia were lexicalized over time from adjective-noun phrases or noun-adjective sentences, which enjoy an absolute majority in Korean phrasal/sentential synesthesia. In addition, it is observed that the process of lexicalization for compounding compressed various grammatical patterns (Table 9) into nouns or verbs (Table 8) in the synesthetic phenomena of Korean.

Table 9. Phrasal and sentential structures in Sejong Corpus synesthesia

Structure	Mapping	Ratio (%)
A [MOD] + N	A ⇨ N	83
V [MOD] + N	V ⇨ N	2
A [MOD] + V	A ⇨ V	2
N [SBJ] + A	A ⇨ N	11
N [SBJ] + V	V ⇨ N	1
N [SBJ] + NP	NP ⇨ N	1

(A = Adjective, MOD = Modifier, SBJ = Subject, NP = Noun Phrase)

6. Conclusion

This research examined how three tendencies of linguistic synesthesia from Ullmann (1963) are found in Korean at the lexical level by considering the frequencies of each transfer direction in compound synesthetic samples. The synesthetic Korean compound data in this study confirmed and supported Ullmann's (1963) synesthetic hierarchy, and a similar directionality of sensory transfer was also found based on frequency-based tendencies. Compound word synesthesia in Korean, however, offers fresh findings regarding mapping sources and targets: *vision* is maximized as a source, but is deemed unstable as a target, and *olfaction* and *audition* do not serve as source domains.

The result of this study supports the findings of Strik-Lievers and Winter (2018) as well, in that visual lexicons are the most dominant and olfactory ones the least. As in Chen et al. (2019), the use of compounding words to investigate interactions in the sensory vocabulary is an important contribution to the study of linguistic synesthesia, as it provides a context for competition between two sensory modalities within the same lexical item. Although the compounding structures and rules must be considered (Zhao et al. 2019), our study and Chen et al. (2019) confirm the dominance of vision as a sensory modality, particularly as a source of synesthesia. Furthermore, both studies found that olfactory and auditory senses are the least versatile in compound formation in Korean and Mandarin. Finally, it is noted that there exist significant differences in certain variations of the directional scheme between phrase-level and lexical-level synesthesia in the Korean daily language, such as the number of each token and type, the ratio of reverse examples of mapping directionality, and grammatical/structural patterns of synesthetic transfer relations. The differences between phrase-level and lexical-level synesthetic metaphors require further studies with more various language samples in the future, including what motivates these dissimilarities.

References

Chagnaa, Altangerel, Ho-Seop Choe, Cheol-Young Ock, and Hwa-Mook Yoon. 2007. On the evaluation of Korean WordNet. *Proceedings of the 10th international conference on Text, speech and dialogue*, 123-130. Berlin: Springer Verlag.

Chen, I-Hsuan, Qingqing Zhao, Yunfei Long, Qin Lu, and Chu-Ren Huang. 2019. Mandarin Chinese

modality exclusivity norms. *PLoS ONE* 14(2): 1-18.

Chen, I-Hsuan, Qingqing Chao, Shichang Wang, Yunfei Long, and Chu-Ren Huang. 2017. Exclusivity and competition of sensory modalities: Evidence from Mandarin synaesthesia. Presented at *International Cognitive Linguistics Conference*. Tartu, Estonia. July 10-14.

Choi, Key-sun, Hee-sook Bae, Wonseok Kang, Juho Lee, Eunhe Kim, Hekyeong Kim, Donghee Kim, Youngbin Song, and Hyosik Shin. 2004. Korean-Chinese-Japanese multilingual WordNet with shared semantic hierarchy. *Proceedings of International Conference on Language Resource and Evaluation* (LREC) 2004, 1131-1134. Lisbon: European Language Research Association.

Chung, Insoo. 1997. Synaesthetic transfer of Korean adjectives. *Studies in Modern Grammatical Theories* 11: 163-180.

Cytowic, Richard E. 1989. *Synaesthesia: A union of the senses*. New York: Springer-Verlag.

Day, Scan. 1996. Synaesthesia and synaesthetic metaphors. *Psyche* 2(32): 1-16.

Geurts, Bart. 2000. Explaining grammaticalization. *Linguistics* 38(4): 781-788.

Hopper, Paul J. and Elizabeth Closs Traugott. 2003. *Grammaticalization*. Cambridge: Cambridge University Press.

Jo, Charmhun. 2017. A corpus-based study on synaesthesia in Korean ordinary language. *Proceedings of the 31st Pacific Asia Conference on Language, Information and Computation*, 249-254. Cebu, Philippines. November 16-18.

Jo, Charmhun. 2018. Synaesthetic metaphors in Korean compound words. In Barry Devereux, Ekaterina Shutova, and Chu-Ren Huang (eds.), *LREC 2018 Workshop LiNCR*, 38-44. Miyazaki, Japan. May 7-12.

Jo, Charmhun. 2019. A corpus-based analysis of synaesthetic metaphors in Korean. *Linguistic Research* 36(3): 459-483.

Jo, Charmhun and Se-Eun Jhang. 2019. Synesthetic metaphors in a self-built corpus of modern Korean poetry. *Journal of Language Sciences* 26(4): 241-260.

Kang, Beom-mo and Hunggyu Kim. 2004. Sejong Korean corpora in the making. *LREC* 2004: 1747-1750.

Lin, Yenhan and Shelley Ching-Yu Hsieh. 2011. Synaesthetic metaphors of television food commercial ads in Mandarin Chinese. *TMUE Journal of Language and Literature* 1(6): 1-16.

Lynott, Dermot and Louise Connell. 2009. Modality exclusivity norms for 423 object properties. *Behavior Research Methods* 41(2): 558-564.

Ronga, Irene, Carla Bazzanella, Ferdinando Rossi, and Giandomenico Iannetti. 2012. Linguistic synaesthesia, perceptual synaesthesia, and the interaction between multiple sensory modalities. *Pragmatics and Cognition* 20(1): 135-167.

Shen, Yeshayahu. 1997. Cognitive constraints on poetic figures. *Cognitive Linguistics* 8(1): 33-72.

Sohn, Ho-Min. 2001. *The Korean language*. Cambridge: Cambridge University Press.

Steen, Gerard J., Aletta G. Dorst, J. Berenike Herrmann, Anna Kaal, Tina Krennmayr, and Trijntje Pasma (eds.). 2010. *A method for linguistic metaphor identification: From MIP to MIPVU* (Vol. 14). Amsterdam: John Benjamins Publishing.

Strik-Lievers, Francesca. 2015. Synaesthesia: A corpus-based study of cross-modal directionality. *Functions of Language* 22(1): 69-95.

Strik-Lievers, Francesca and Bodo Winter. 2018. Sensory language across lexical categories. *Lingua* 204(1): 45-61.

Strik-Lievers, Francesca, Hongzhi Xu, and Ge Xu. 2013. A methodology for the extraction of lexicalized synaesthesia from corpora. Presented at *International Congress of Linguists* 19. Geneva, Switzerland. July 21-27.

Takada, Mari. 2008. *Synaesthetic metaphor: Perception, cognition, and language*. Saarbrueken: VDM Publishing.

Ullmann, Stephen. 1963. *The principles of semantics*. Oxford: Basil Blackwell.

Yoon, Hongno. 1970. Structurality of synaesthetic metaphors. *Korean Language and Literature* 47: 183-200.

Yu, Ning. 2003. Synaesthetic metaphor: A cognitive perspective. *Journal of Literary Semantics* 32(1): 19-34.

Williams, Joseph M. 1976. Synaesthetic adjectives: A possible law of semantic change. *Language* 52: 461-478.

Winter, Bodo. 2016. The sensory structure of the English lexicon. PhD Dissertation. Merced, CA: University of California, Merced.

Winter, Bodo. 2019. *Sensory Linguistics: Language, perception and metaphor.* Amsterdam: John Benjamins.

Zhao, Qingqing and Chu-Ren Huang. 2015. A corpus-based study on synaesthetic adjectives in modern Chinese. *Chinese Lexical Semantics* (LNAI) *16th Workshop*, 535-542. Beijing, China. May 9-11.

Zhao, Qingqing and Chu-Ren Huang. 2018. A study on the mapping model and underlying mechanisms of synaesthetic metaphors in Mandarin. *Language Teaching and Linguistic Studies* 189: 44-55.

Zhao, Qingqing, Chu-Ren Huang, and Kathleen Ahrens. 2019. Directionality of linguistic synaesthesia in Mandarin: A corpus-based study. *Lingua* 232: 1-15.

Zhao, Qingqing, Chu-Ren Huang, and Yunfei Long. 2018. Synaesthesia in Chinese: A corpus-based study of gustatory adjectives in Mandarin. *Linguistics* 56(5): 1167-1194.

Zhao, Qingqing, Jiajuan Xiong, and Chu-Ren Huang. 2019. Linguistic synaesthesia, metaphor and cognition: The systematicity and significance of linguistic synaesthesia in Chinese. *Chinese Language* 389(2): 240-256.

Zhong, Yin, Sicong Dong, and Chu-Ren Huang. 2018. Lexical differentiation in Mandarin Chinese sensory lexicon. Presented at *The 10th European Association of Milan.* Milan, Italy. September 28-29.

Appendix: Korean Synesthetic Compound Words (by type)

약감미 弱甘味 slightly sweet taste
약(弱)한단맛 slightly sweet taste
감칠맛 savory taste
냉소 冷笑 cold smile
찬웃음cold smile
습소 濕笑 bitter smile
소리치다 yell
격음 激音 aspirated consonant
경음 硬音 fortis
된소리 fortis
거센소리 aspirated consonant
거센말 a word having any aspirated consonant
센소리 a term referring to both fortis and aspirated consonants
센말 a word with fortis consonants
강음 强音 strong sound
약음 弱音 weak sound
쓴내 bitter smell
단내 sweet smell
짠내 salty smell
쉰내 sour smell
비린내 fishy smell
고소 苦笑 wry/bitter smile
쓴웃음 wry/bitter smile
고언 苦言 bitter remarks
쓴소리 bitter remarks
감언 甘言 flattery
쉰소리 hoarse sound
쉰목소리 hoarse voice
미향 微香 fine fragrance
농향 濃香 dark fragrance
새겨듣다 listen carefully
고성 高聲 loud/big voice
고함 高喊 loud/big voice
대성 大聲 big voice

고언 高言 vain boast
큰소리 vain boast or scolding
높임말 honorific form of language
낮춤말 informal form of language
낮은말 vulgar language
저성 低聲 low voice
고음 高音 high sound
높은음(音) high sound
저음 低音 low sound
낮은음(音) low sound
세설 細說 useless talk
잔사설(辭說) useless talk
잔말 useless talk
잔소리 useless talk

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