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# Synaesthetic metaphors are neither synaesthetic nor metaphorical

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Speakers often use metaphor when talking about the contents of perception. For example, a word such as *sweet* can be used to talk metaphorically about sensory impressions that are not directly related to taste, as in so-called “synaesthetic metaphors” such as *sweet fragrance* and *sweet melody*. In this chapter, I present arguments against the synaesthetic and metaphorical nature of such expressions. First, a look at the neuropsychological literature reveals that the phenomenon commonly called “synaesthesia” bears little resemblance to the metaphors investigated by linguists. Moreover, in contrast to synaesthesia as a neuropsychological phenomenon, most “synaesthetic” metaphors involve mappings between highly similar and perceptually integrated sensory modalities, such as taste and smell. Finally, combinations of words that involve dissimilar sensory modalities, such as *sweet melody*, appear to perform largely evaluative functions. Thus, evaluation might be driving the use of these terms, more so than “synaesthetic” perception. I will then compare my analyses to the idea that many metaphors are grounded in primary metaphors and/or metonymies. All in all, this paper suggests that many and perhaps most “synaesthetic metaphors” are neither synaesthetic nor metaphorical. From a broader perspective, the case study of synaesthetic metaphors presented here fleshes out the way language and perception are related and how sensory content is encoded in the lexicon of human languages.

**Keywords:** synaesthesia, the senses, perceptual metaphors, primary metaphor

## 1. Introduction

One of the primary functions of language is to communicate perceptual content. Speakers constantly talk to each other about what they see, hear, feel, taste or smell, such as when warning a friend that the leftover chicken in the fridge smells rotten. Not all sensory experience is created equal, and some senses are easier to talk about

than others (Levinson & Majid, 2014). For example, it has been said that odours are particularly difficult to describe (Buck, 1949; Levinson & Majid, 2014). The case of smell is illustrative because the English language has relatively few smell terms, such as *fragrant*, *aromatic*, *pungent*, *rancid* and *stinky*. These terms furthermore appear to be ill-suited for describing the detailed perceptual impressions of actual smells, instead they describe general pleasantness or unpleasantness in the olfactory modality. To make up for this lack of descriptive vocabulary, English speakers often describe smells using taste terms, such as when describing a smell as *sour*, *coconutty*, *caramelised*, *juicy* or *sweet*. Expressions such as *sweet fragrance* are verbal expressions that appear to combine the sense of taste (*sweet*) with the sense of smell (*fragrance*).

When an English speaker says *sweet fragrance*, is the sensory adjective *sweet* used in a metaphorical fashion? Our intuition tells us that the word *sweet* is about taste and the word *fragrance* about smell. If this is true, then *sweet fragrance* marks a mapping between two distinct sensory modalities, namely, from taste to smell (Ullmann, 1959; Shen, 1997; Shen & Gil, 2007; Strik Lievers, 2015). If analysed as involving a “mapping”, the *sweet fragrance* would be characterised as metaphorical. Under another analysis, the adjective-noun pair *sweet fragrance* is not a metaphorical expression because olfaction falls under the referential domain of the word *sweet* and is part of its literal meaning (cf. Rakova, 2003; Paradis & Eeg-Olofsson, 2013). This analysis sees the word *sweet* as having both gustatory and olfactory meaning, which would render the expression *sweet fragrance* non-metaphorical. If we see *sweet* as inherently having meanings related to both senses, then no metaphorical meaning extension takes place. This paper deals with these two competing analyses, a metaphor-based one and a literal one. That is, I ask the question: How narrow or broad is the literal meaning of sensory words? Answering this raises deep theoretical questions relating to perception, synaesthesia, lexical semantics and metaphor.

Expressions such as *sweet fragrance* have variously been called “poetic synaesthesia” (Shen, 1997), “linguistic synaesthesia” (Holz, 2007), or “verbal synaesthesia” (Strik Lievers, 2015). These expressions are generally analysed as metaphors, that is, as conceptual mappings between two domains (Lakoff & Johnson, 1980), because they combine two seemingly distinct sensory modalities. For example, the adjective-noun pairs *sharp sound* and *smooth taste* appear to be mappings from touch to audition and from touch to gustation, respectively. In both cases, a touch-related word is used to talk about sensations perceived primarily through another modality. Linguists and non-linguists working on these metaphors have repeatedly made comparisons between these linguistic expressions and synaesthesia as a perceptual and neurological phenomenon (Ramachandran & Hubbard, 2001; Martino & Marks, 2001; Holz, 2007; Strik Lievers, 2017). For example, Martino and Marks (2001) describe the case of a synaesthete who experienced vivid colour

sensations when she was in pain; Cytowic (1993) described a synaesthete who experienced vivid shape sensations when tasting food.

In this paper, I will argue that such expressions are neither synaesthetic nor metaphorical. In line with the analyses of sensory words presented in Rakova (2003) and Paradis and Eeg-Olofsson (2013), I will argue that many and perhaps all sensory adjectives have highly multisensory or supramodal meanings that encompass a much broader referential scope than is commonly admitted. And I will argue that in many cases where sensory words are used to describe perceptual sensations, they are used in an evaluative fashion rather than a perceptual one. This is in line with the general view that language is intimately tied to concerns of emotional, affective and evaluative expressions (Wilce, 2009; Hunston, 2011; Majid, 2012; Eeg-Olofsson, 2013). As stated by Wilce (2009, p. 3), “nearly every dimension of every language at least potentially encodes emotion” – and sensory words are no exception. As will be shown below, understanding the emotional dimension of perceptual vocabulary turns out to be key to understanding their involvement in metaphor.

My argument proceeds as follows. After reviewing the literature on synaesthetic metaphors (§ 2), I criticise the use of the label “synaesthesia” to refer to these metaphors based on a short review of the relevant neuropsychological literature (§ 3), and based on empirical evidence which suggests that expressions such as *sweet melody* involve the mapping of evaluative attributes rather than mappings of perceptual content. Then I argue that most cases of synaesthetic metaphors involve highly supramodal sensory adjectives (§ 4). Contra to Shen and Gil (2007), Strik Lievers (2015) and others, cases such as *sweet fragrance* should not be considered synaesthetic metaphors because taste and smell are highly integrated in perception, and a word such as *sweet* is best analysed as literally referring to both gustation and olfaction. I then compare and contrast my analysis with similar analyses that are based on primary metaphors and metonymies (§ 5), arguing that while these approaches capture some aspects of the current proposal rather nicely, they do not fully recognise the underlying continuity of the senses.

## 2. Background on synaesthetic metaphors

Synaesthetic metaphors are said to be expressions that “transfer one sense to another” (Ullmann, 1945, p. 813), as the following definitions exemplify:

(...) synaesthesia is the syntactic relation between elements semantically incompatible, denoting sensations from different sensorial spheres.

(Erzsébet, 1974, p. 25)

An instance of synaesthesia (Greek, ‘feeling together’) is usually defined as conveying the perception of, or describing, one sense modality in terms of another (...) (Shen, 1997, p. 47)

(...) a perceptual experience related to one sense is described through lexical means typically associated with a different sense (...) (Strik Lievers, 2015, pp. 69–70)

All of these definitions emphasise that in order to count as an instance of a synaesthetic metaphor, *different* sensory modalities need to be involved. Strik Lievers (2016, p. 45) makes this explicit by saying that “in synaesthetic expressions, syntactic links between sensory lexemes create connections that generate conflict at the conceptual level” (see also Strik Lievers, 2017, and Prandi 2012’s notion of conflict). She discusses the example of *yellow voice*, which is seen as creating a conceptual conflict because sounds “do not have a visual manifestation” (Strik Lievers, 2016, p. 45). An adjective-noun pair such as *abrasive touch* would not be treated as a synaesthetic metaphor precisely because the touch-related adjective *abrasive* is used in a highly tactile context, i.e., there is no conceptual conflict between the adjective and the noun.

Researchers in this literature have proposed a hierarchy of the senses to characterise which sensory modalities are likely sources and which sensory modalities are likely targets in synaesthetic metaphor (see, e.g., Ullmann, 1945 versus Williams, 1976; see Strik Lievers & De Felice, this volume). All such proposals agree on having TOUCH, TASTE AND SMELL at the lower end, and VISION AND HEARING at the top, such as in (1):

- (1) TOUCH > TASTE > SMELL > VISION / HEARING

The hierarchy entails a directionality of metaphorical mappings, from the “lower” senses to the “higher” ones, i.e., TOUCH TO HEARING mappings should be more frequent than the reverse, a prediction that is confirmed in a substantial number of languages, including English, German, Italian, Hebrew, Hungarian and Chinese (Ullmann, 1945; Erzsébet, 1974; Day, 1996; Shen, 1997; Yu, 2003; Strik Lievers, 2015; see also Anderson, this volume; Strik Lievers & De Felice, this volume). Participants furthermore rate combinations of sensory words in accord with the hierarchy as more adequate and sensible than combinations going against the hierarchy (Shen & Gil, 2007; Shen & Aisenmann, 2008; Shen & Gadir, 2009). There are many methodological concerns regarding research on synaesthetic metaphors (for detailed discussion, see Winter, 2016b, Chapter 2, 7–8), the most relevant for the present discussion being that the hierarchy rests on the idea that the senses are distinct to begin with, i.e., the notion that senses such as taste and smell should occupy separate rather than overlapping positions on the hierarchy. We will return to this issue below.

### 3. Beware of synaesthesia

Should we call expressions such as *smooth taste* and *sweet fragrance* “synaesthetic” metaphors? This is more than just a purely terminological question. Using the term “synaesthesia” suggests a shared mechanism, or some underlying principles that govern both perceptual synaesthesia and linguistic synaesthesia (cf. Deroy & Spence, 2013).

In neuroscience and psychology, “synaesthesia” means something more specific than merely “crossing the senses”. People who are characterised as synaesthetes perceive vivid perceptual sensations in one sensory modality reliably triggered by particular stimuli in another modality. For example, a synaesthete might have colour sensations when looking at graphemes (Ramachandran & Hubbard, 2001), or she might have vivid spatial representations of numerals (Galton, 1880a, 1880b). For a long time, research on synaesthesia was met with scepticism because most of the evidence for the phenomenon stemmed from self-report. However, more recent experimental and neuroimaging studies empirically demonstrated the genuine perceptual nature of synaesthesia (Ramachandran & Hubbard, 2001).

Although several definitions for synaesthesia exist (see Simner, 2012 for a discussion), researchers commonly understand synaesthesia to be characterised by automaticity and involuntariness – synaesthetes cannot help but to experience a synaesthetic perception when a trigger is presented. Moreover, synaesthetic experiences are highly persistent within an individual, with the same stimulus-trigger pairings being observed across repeated experimental sessions. It is not entirely clear how many people are adequately classified as synaesthetes, with estimates varying widely and depending on the particular type of synaesthesia, as well as on the assessment criteria used. Using a strict battery of tests, Simner et al. (2006) find that the most common form of synaesthesia (associations between colours and names of the days) has a prevalence of about ~3% among university students.

Synaesthesia needs to be differentiated from the notion of “crossmodal associations” or “crossmodal correspondences” (Marks, 1978; for a recent review see Spence, 2011; see also Deroy & Spence, 2013). For example, five-year old children reliably match the brightness of perceived stimuli to the loudness of a sound (Bond & Stevens, 1969). Moreover, magnitude-related domains that can be expressed in terms of “more” or “less” are often perceptually associated with each other (Marks, 1978; Winter, Marghetis & Matlock, 2015). There are also many studies on the related topic of perceptual integration, such as Shams, Kamitani and Shimojo (2000), who demonstrated that a single light flash can be perceived as two light flashes when presented with two auditory beeps. The literature on perceptual integration and cross-modal correspondences is vast and many different connections between the senses have been reported for both adults and children (Spence, 2011). It is safe to say, then, that

while not everybody is a synaesthete, everybody has, to some extent, some form of perceptual integration and some forms of cross-modal correspondence.

Martino and Marks (2001) distinguish between strong and weak forms of synaesthesia, where the existence of weak synaesthesia is understood to characterise the general population. They suggest that a continuum between strong and weak forms of perceptual synaesthesias exist, but even they stress that the two phenomena are not to be equated:

Over the two centuries since strong synesthesia was first identified in the scientific literature, several heterogeneous phenomena have been labeled as synesthetic. These phenomena range from strong experiences (...), on the one hand, to weaker crossmodal literary expressions, on the other. We believe it is a mistake to label all of these phenomena simply as synesthesia because the underlying mechanisms cannot be identical (...)  
(Martino & Marks, 2001, p. 62)

Considering what we know of (strong) synaesthesia as a neurological phenomenon, it is perhaps a misnomer to label expressions such as *smooth taste* “synaesthetic”. The same argument has been made for using the term synaesthesia as a cover term for all kinds of cross-modal correspondences (Deroy & Spence, 2013). It is not always clear whether the term “synaesthesia” is used “metaphorically” in linguistics, i.e., the researcher may want to merely make a comparison to perceptual synaesthesia, as a loose analogy. It is clear that *equating* linguistic and perceptual synaesthesia is not appropriate (Martino & Marks, 2001). If the two phenomena were actually rooted in the same underlying system, we would expect much closer connections. Within linguistics, nobody, so far, has empirically demonstrated a link between the usage of these metaphors and the neurological phenomenon of synaesthesia, both in terms of overall frequency of usage (do synaesthetes use synaesthetic metaphors more frequently?) and in terms of the types of mappings involved (are common synaesthesias common synaesthetic metaphors?). There is no empirical evidence showing that synaesthetes actually use synaesthetic metaphors more frequently or in a different way than the general population. And there is no empirical evidence showing links between the specific mappings involved in synaesthesia proper and synaesthetic metaphors. In fact, linguistic and non-linguistic synaesthesia appear to involve quite different mappings. For example, whereas most synaesthetic metaphors discussed in the literature involve touch as a source domain (e.g., *sharp sound*, *smooth taste*, *rough smell*), the most common form of synaesthesia according to Simner et al. (2006) is an association between colour and days of the week, something that is not observed in metaphor. Thus, common forms of synaesthesia involve very different mappings from those reported for cross-modal metaphors. The lack of any empirical connection between synaesthesia and “synaesthetic” metaphors (both

in terms of usage within individuals and in terms of attested types of mappings) suggests that the two ideas cannot be equated.

Linguists working on perception metaphors are aware that synaesthesia in language and synaesthesia in perception are not exactly the same. It is perhaps no coincidence that many of the researchers who use the term “synaesthesia” in the context of metaphor are keen to stress that their use of the term deviates from perceptual synaesthesia (for discussion, see Strik Lievers, 2017). For example, Ullmann (1945, p. 812) states that “the present paper investigates synaesthesia first and foremost as a linguistic-semantic problem”. Strik Lievers (2016, p. 44) clearly states: “In literary and linguistic studies, (...) synaesthesia is a figure associating *linguistic expressions* that refer to different sensory modalities (...)” (italics in original). Holz (2007, p. 193) states that “If we use the term *synesthesia*, we have (...) to distinguish between a neuropsychological and a linguistic phenomenon.”

In contrast to this, many linguists have tried to explain regularities of synaesthetic metaphors with respect to some underlying perceptual mechanism, treating linguistic synaesthesia as a linguistic phenomenon whose regularities are rooted in the senses. For example, researchers have long since tried to relate asymmetries in synaesthetic metaphors in language to language-external asymmetries in perception (e.g., Williams, 1976; Shen, 1997; for discussion, see Winter, 2016b). For example, Shen (1997) distinguishes the senses along a scale of “cognitive accessibility”, with the “lower” modalities of touch, taste, and to some extent smell, having more direct contact or proximity to a perceptual stimulus. These properties of the corresponding senses are then thought to impose constraints on the use of metaphors, with only mappings from “low” to “high” senses being favoured. Thus, Shen (1997)’s explanation of why certain metaphors are more frequent than others is rooted in language-external perceptual considerations, and it is thus considering “poetic synaesthesia” not just as a purely linguistic phenomenon. As another example of researchers making strong connections between language and perception in the context of these metaphors, consider Holz (2007), who defines what he calls “linguistic synaesthesia” as follows: “We may talk of a *verbal simulation of synesthetic perception* or of a *linguistic creation of cross-modality illusions*” (ibid. 193, italics in original). Just like the term “synaesthesia” is used in perception, this characterisation appears to invoke vivid perceptual representations.

Thus, we have researchers who characterise synaesthetic metaphors, or linguistic synaesthesia, as more of a linguistic phenomenon, as well as researchers who think of it as a linguistic phenomenon that directly relates to extra-linguistic perceptual processes. The term “synaesthesia” is not appropriate for linguistic description because no clear connection between synaesthesia and language has been established yet. And if the term “synaesthesia” were to be used as a mere analogy, it would not be appropriate either, because in perceptual synaesthesia, different

kinds of mappings are involved. If “synaesthesia” is used merely as a term to suggest some form of “crossing” between the senses, the term “crossmodality” is theoretically more innocuous and also more generally applicable. There are a myriad of connections between the senses, only some of which can be described as involving synaesthesia (Deroy & Spence, 2013). Using the label “synaesthesia” furthermore easily glosses over more important issues, such as what the precise (cognitive) connection between language and perception is that is evidenced by these expressions. Do these expressions involve actual perceptual imagery or perceptual simulation? Do they stem from underlying perceptual connections or are the sensory connections created through language?

Using “synaesthesia” to talk about expressions such as *smooth taste* conjures up the idea that these expressions actually involve some kind of vivid sensory imagery, the same way that grapheme-colour synaesthetes cannot help but to see colours when they see certain graphemes (Ramachandran & Hubbard, 2001). This understanding of linguistic synaesthesia is exemplified by Holz’s description of the phenomenon as “*verbal simulation of synesthetic perception*” (2007, p. 193). While it clearly has been shown in experimental studies (Pecher, Zeelenberg & Barsalou, 2003) and through neuroimaging research (e.g., González, Barros-Loscortales, Pulvermüller, Meseguer, Sanjuán, Belloch, & Ávila, 2006) that processing sensory words involves the activation of perceptual brain areas, it is not clear that expressions involve cross-modal perceptual simulation. In fact, researchers have proposed other plausible connections between source and target concepts in these metaphors. These alternative explanations do not directly have to do with the detailed perceptual qualities of the terms involved rather than with the dimension of evaluation, or emotional meaning more generally.

Rather than *sweet melody* involving mappings of perceptual content (TASTE > SOUND), they could involve mappings of evaluative content. Thus, these sensory terms may be used evaluatively, rather than in a sensory fashion. This proposal has received support from theoretical analyses by various linguists, as well as from several empirical studies (see below). Tsur (2012) discusses the example of *loud perfume* as an instance of a “synaesthetic” expression that – under one analysis – appears to involve the mapping of specific auditory content onto the target domain of smell. However, Tsur (2012) rightly points out that the use of *loud* in this context has a strong evaluative sense, clearly implying that the perfume was annoying, just as when talking about a *loud colour* (Barcelona, 2003). The notion of the perfume being loud in a strictly auditory sense is de-emphasised in this expression; the emphasis is on the negative connotation of *loud*. A similar example can be found in Lehrer (1978), who describes the expression *sour note* as follows: “When sour transfers to sound, it is not because the note sounds as if it would taste sour (...) but rather the transfer of the feature [Displeasing of the Senses]

(...)” (ibid. 121). Barcelona (2003) discusses that the use of *loud* in *loud colour* relates to deviancy; and the use of *sweet* in *sweet music* relates to the experience of pleasure (see also Barcelona, 2008). Shibuya, Nozawa, and Kanamaru (2007) discuss how the comprehension of expressions such as *fragrant music* is based on emotional experiences. Bagli (2016) analyses *sweet* as involving a conceptual metaphor PLEASURE IS SWEET in the works of Shakespeare. Several chapters in this volume outline the emotional qualities of taste (Steinbach-Eicke) or smell (Kövecses; Takashima). More generally, researchers have pointed out that sensory adjectives clearly have evaluative functions on top of their descriptive functions (Lehrer, 2009, p. Chapter 6). In expressions such as *loud perfume*, *sweet melody* and *sour note* the evaluative function may be highlighted, and modality-specific perceptual content may be de-emphasised at the expense of performing evaluation. From this perspective, the use of *sweet* in *sweet melody* is similar to the colloquial use of *sweet* as an affirmative expression or as a word to describe a spouse, family member or friend (*sweetie*). For example, in response to “*The movie has just come out*”, one could respond “*Sweet, let’s go to the cinema*”. Here too, the perceptual meaning does not appear to be primary.

Direct evidence for the evaluative functions of these expressions being dominant comes from Winter (2016b), who conducted a quantitative corpus analysis of over 140,000 adjective-noun pairs in the Corpus of Contemporary American English (Davies, 2008). This study showed that the more highly valenced a sensory word is, the more likely it is to be used in linguistic contexts outside of its most common sensory modality. For example, whereas *sweet* occurs frequently in expressions such as *sweet melody*, the relatively more neutral word *palatable* does not (*?palatable melody*). Words such as *sweet* are frequently used in appreciation of things, even in contexts that are not gustatory. Thus, Winter (2016b) suggests that precisely those adjective-noun pairs that combine *dissimilar* sensory modalities (i.e., those that would be most likely classified as “synaesthetic”) are those pairs that also involve more highly valenced adjectives. In other words, cases commonly classified as “synaesthetic metaphors” appear to have a statistical dispreference for neutral words, suggesting a strong role for an evaluative component in the cross-modal uses of sensory adjectives. The involvement of sensory adjectives in evaluative language makes “synaesthetic metaphors” somewhat less “synaesthetic”, since their primary role is not tied to the senses as such, but to the evaluative dimension of these senses.

The findings of Winter (2016b) may explain partly why taste in particular is a common source domain in most hierarchies of the senses: Taste and smell are more strongly emotionally valenced (see Winter, 2016a; Buck, 1949, pp. 1022–1032; Levinson & Majid, 2014), with taste words more likely to have positive meanings than smell words, which are often more negative (see also Kövecses, this volume; Takashima, this volume). The emotional involvement of taste and smell makes

them particularly suited for evaluative functions outside the context of their own modalities. This may also partly explain why touch is such a common source domain (see Anderson, this volume; Caballero, this volume). For example, Winter (2016b, Chapter 5) discusses the strong emotional meanings of many touch adjectives, such as *rough* and *smooth*. Many auditory adjectives, on the other hand, do not stand out as particularly emotional, such as *silent* or *whistling* (Winter, 2016a; Winter, 2016b: Chapter 4). Those auditory adjectives that do have strong positive or negative emotional qualities are more likely to be used outside of the context of the auditory modality, such as in the negatively connoted expressions *loud colour*, *noisy colour* or *shrill colour*.<sup>1</sup>

What has been implicit in the discussion so far is the idea that evaluative and perceptual uses somehow oppose each other. In line with the title of this chapter, “Synaesthetic metaphors are neither synaesthetic nor metaphorical”, the suggestion is that expressions which focus on evaluation do not constitute metaphors, at least in the context of cross-modal expressions such as *sweet fragrance*. In the background of this argument is a view of the lexicon where the emotional meaning of a word is part of its lexical representation. There is psycholinguistic evidence that emotional meaning is represented in the mental lexicon (e.g., De Houwer & Randell, 2004). The same way that denotative content determines use (a word is chosen based on whether it fits the referent), expressive content determines use (a word is chosen based on whether it fits the emotional meaning of the message). The corpus evidence presented in Winter (2016b) suggests that if the evaluative content of the adjective is strong, speakers can be more “loose” in their perceptual content. Thus, there is a trade-off between evaluation and (perceptual) denotation, with more emotional expressions affording less perceptual overlap. Crucially, the same way that we would not call the use of *good* in *good deed* versus *good movie* two uses that metaphorically extend the meaning of the word *good*, we do not have to call *sweet* in *sweet fragrance* metaphorical either. In both cases, we are simply dealing with two facets of the same core emotional meaning of positivity.

There is, however, an even more important issue than evaluative uses of sensory adjectives, and this issue relates deeply to how language and perception are related: When researchers use the term “synaesthesia” to talk about perceptual metaphors, they commonly mean mappings between *distinct* sensory modalities, as the Strik

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1. If emotional valence is a factor in explaining metaphorical associations, then why are adjectives such as *snarling* or *whimpering* not used as much in synaesthetic metaphors? Winter (2016b, Chapter 8) discusses other reasons for the dispreference of sound and provides evidence that iconicity constrains how these metaphors are used (adjectives that are echoic of sound concepts are used less), as well as their frequency (words such as *loud* and *quiet* that are highly frequent are also used frequently in metaphor).

Lievers' (2016) discussion of "conceptual conflict" between modalities clearly highlights. However, the next sections explore the idea that with many and perhaps most cases commonly subsumed under the category "synaesthetic metaphor", there is in fact no such conflict.

#### 4. Beyond synaesthesia

It clearly is the case that sensory perception is highly multimodal (e.g., Spence & Bayne, 2015), involving all of the senses simultaneously. When it comes to language *about* this multisensoriality, it is commonly assumed that linguistic encoding imposes a different format, as expressed in the following quote by Fainsilber and Ortony (1987, p. 240): "Language partitions the continuity of experience into discrete units comprised of words and phrases having a relatively narrow referential range."

The encoding of perceptual multisensoriality in language is often thought as involving some kind of compression, that is some loss of information, or some profiling of certain aspects of the overall sensorial experience. Rakova (2003) presents an analysis of sensory adjectives having richer, more extensive perceptual meanings (see also Paradis & Eeg-Olofsson, 2013). According to her proposal, sensory adjectives are linked to supramodal concepts that involve multiple modalities, similar to the actual perceptions that are involved in the concepts they describe. A case in point is the sensory adjective *hot*, which dictionaries commonly describe as being literally about heat and metaphorically about food (*hot food*, with the meaning of 'spicy food'). Rakova (2003, Chapter 3) proposes an alternative analysis under which *hot* literally refers to *both* heat and spiciness. She cites neurophysiological research on capsaicin receptors in the mouth (Julius & Basbaum, 2001) which respond to *both* heat and chemical compounds that are characteristic of spicy food. Thus, for human perception, heat and spiciness are *literally* associated with each other by virtue of sharing partially overlapping neurophysiological structures.

My proposal is thus that the use of *hot* in *hot temperature* and *hot food* (as in 'spicy food') is not different from two uses of the colour term *red*, when applied to *red brick* or *red rose*. The two colours denoted by *red brick* and *red rose* fall under the referential scope of *red*, and perceiving both colours involves slightly different but also partially overlapping neural networks. The same way that the colour term encompasses a whole range of light frequencies, all of which receive the same label, the gradable adjective *hot* encompasses a whole range of sensations. In this case, the sensations may be seen as more different than two types of colours, as 'heat' and 'spiciness' are conceptually distinguished by language users, but unaware to the user themselves is the fact that heat-spiciness – just like colour – is processed

by a perceptual system that is partially overlapping. This underlying neurological and perceptual integration of heat and spiciness is one explanatory factor behind the frequent use of heat adjectives to denote spicy sensations in a number of the world's languages (Rakova, 2003).

The argument made for *hot* here and in Rakova (2003) carries over to words such as *sweet*, which is a word that similarly denotes a whole range of perceptual experiences, including both taste and smell, which are neurologically and behaviourally integrated. Taste and smell are linguistically associated with each other (Lynott & Connell, 2009; Louwerse & Connell, 2011; Winter, 2016a, 2016b, p. Chapter 7). As noted by Classen (1993, p. 52), “gustatory terms, such as sour, sweet, or pungent, usually double for olfactory terms”, with expressions such as *sweet fragrance* having been analysed as “synaesthetic metaphors” by, for example, Shen and Gil (2007). The seemingly “synaesthetic” association between taste and smell words can easily be explained with recourse to taste-smell continuity within the underlying perceptual machinery. The two modalities share partially overlapping brain networks (De Araujo, Rolls, Kringelbach, McGlone, & Phillips, 2003; Delwiche & Heffelfinger, 2005; Rolls, 2008) and in fact, use some of the same macro-physiological structures, with smells being perceived through the so-called retronasal pathway at the back of the mouth (for discussion see Spence, Smith, & Auvray, 2015). The widespread idea that we only smell through the nose is an entirely cultural one. The perceptual construct of flavour is co-determined by taste and smell together (Auvray & Spence, 2008; Spence et al., 2015), i.e., flavour cannot be considered independently of both of these modalities.<sup>2</sup> To the extent that words such as *sweet* and *sour* are literally about flavour, we have to recognise that these words are jointly gustatory and olfactory.

Of course, words do not directly refer to neurological structures. In fact, as argued by Miller and Johnson-Laird (1976) words do not even directly – without intervening conceptual links – refer to low-level perception. But words do refer to concepts that result from perceptual sensations. The lexical concept corresponding to the word form *hot* does not have to be restricted to just a temperature meaning. Concepts about perception can be supramodal, encompassing multiple sensory modalities (see, e.g., Lynott & Connell, 2009). Paradoxically, even though the literature on synaesthetic metaphors deals with cross-domain uses of sensory adjectives, it inherently assumes that sensory adjectives are relatively unimodal, referring only

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2. Although taste and smell as perceptual modalities are highly interacting in behavioural terms, and partially overlapping (neurologically and with respect to their sensory organs), the two senses are of course not coextensive. Not all things that can be tasted (such as bitterness) can easily be smelled, for example. Consider, for example, the fact that some people who appreciate the smell of coffee do not like its taste.

to very circumscribed perceptual experiences. Calling *sweet fragrance* a TASTE TO SMELL mapping implicitly assumes the distinctness of the two senses, and it imposes a unimodal analysis on the word *sweet* as being exclusively gustatory; something that is not supported by the neuropsychological evidence.

But what about our intuition that *sweet* is somehow best described as a “taste word”? The categorisation of sensory language into distinct senses may happen at a metalinguistic stage, i.e., when thinking *about* language as opposed to actually using language. The moment that we think *about* the word *hot*, we are compelled by the salience of the temperature dimension to disregard other perceptual dimensions. That is, if we asked a native speaker of English what *hot* means, she would presumably list the temperature meaning first. Another way to think about this is from the perspective of the accessibility of meanings: The temperature meaning of *hot* may be more accessible to native speakers, with the other meaning dimensions not as easily intuited. However, clearly, not all meaning is consciously accessible to speakers and we have to distinguish what a speaker thinks about her own vocabulary from how that vocabulary is actually used. Whereas the usage of words may be more strongly based on how the senses actually behave and how they are intermixed, thought *about* words may be relatively more influenced by cultural belief systems.

Thus, speakers (including linguists) are under the (illusionary) impression that sensory vocabulary is about clearly delimited sensory modalities. In many Western societies, speakers adhere to what is sometimes called the “five senses folk model”, otherwise known as the “Aristotelian senses” (Sorabji, 1971). A look towards either cultural anthropology or neuropsychology reveals that this model is a cultural construct. Cultures differ in how they carve up the sensorium, and whether they carve it up into distinct senses at all (see, e.g., Howes, 1991; Goody, 2002; Pink, 2011). And modern sensory science recognises many more than just five senses, including such senses as nociception (pain), kinesthesia, the internal senses, and more (Carlson, 2010; Møller, 2012). Many of these senses do not have direct reflections in the five senses folk model and also no direct reflections in vocabulary (see Pink, 2011: 265). Overall, it is a philosophically thorny issue to individuate and count the senses (Casati et al., 2015), with McBurney (1986, p. 123) saying that the senses “did not evolve to satisfy our desire for tidiness”. From this perspective, we have to recognise that calling *hot* a “temperature word”, *sweet* a “taste word” and *fragrant* a “smell word” is essentially using the fiction of the five senses folk model to categorise words, to fit them into an existing cultural model. Whereas perception is underlyingly continuous, metalinguistic judgments *about* perception categorise this continuity (cf. Spivey, 2007).

Empirical evidence for the underlying continuity of the senses carrying over to our comprehension of sensory adjectives comes from modality rating studies (Lynott & Connell, 2009). In these studies, native speakers of English rate words

according to their sensory modality on a numerical scale (in this case from 0 to 5). Crucially, the task allows participants to assign positive numerical values to multiple sensory modalities, potentially revealing whether they deem a word to be multisensory. In Lynott and Connell (2009), the word *sweet* turns out to have a gustatory strength rating of 4.9 and an olfactory strength rating of 3.9, both relatively high numbers in the context of this study. Hence, speakers shared the intuition that the word *sweet* is both gustatory and olfactory when prompted explicitly to think about the modalities. Lynott and Connell (2009) and Louwse and Connell (2011) show that the association between taste and smell across sensory words is characteristic of the entire set of 400+ sensory words rated, i.e., taste and smell ratings are correlated with each other.<sup>3</sup> However, if we asked a native speaker what kind of perceptual word a word such as *sweet* is best classified as, she would most likely go with the word's strongest modality, in this case taste, which received the highest rating. Hence, an expression such as *sweet fragrance* is only a mapping between distinct senses if we straitjacket words to belong to one and only one sensory modality. From this perspective, the adjective-noun pairs *sweet fragrance* and *abrasive touch* are not qualitatively different from each other, even though one is described as a synaesthetic metaphor and the other is not.

The argument presented so far has only considered taste-smell and heat-spiciness associations. However, the argument extends beyond these two example cases; for example, to cases where touch language is used to describe sound, as in *sharp sound*, *rough sound* and *smooth melody*. Tactile properties such as surface roughness can be perceived using audition alone (Lederman, 1979), and auditory stimuli directly affect the perception of surface qualities perceived through touch (Guest, Catmur, Lloyd, & Spence, 2002; Suzuki, Gyoba, & Sakamoto, 2008), showing that the two modalities are perceptually associated. In the so-called parchment-skin illusion, participants report to have dryer hands when the sound of their hands rubbing against each other is amplified in the high-frequency components (Jousmäki & Hari, 1998). Sound perception is furthermore influenced by what is simultaneously being touched (Schürmann, Caetano, Jousmäki, & Hari, 2004), showing that audio-tactile interactions in behaviour are bidirectional. There is also direct neurophysiological evidence for a shared neurological substrate of touch and sound:

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3. A concern might be that the argument is circular. It could be that speakers' modality judgments are based entirely on text associations, i.e., speakers think of linguistic use contexts where they could apply *sweet*. In that case, the high olfactory rating of *sweet* may actually be the result of speakers thinking of expressions such as *sweet fragrance*. However, this cannot be the whole story: van Dantzig et al. (2011) collected modality ratings paired with particular concepts, such as *abrasive sandpaper* versus *abrasive lava*, and the resulting average ratings correlate highly with the ratings collected on words in isolation (see Winter 2016b, Chapter 2), which suggests that linguistic context does not play a huge role in this particular case.

single-cell recordings of neurons in the macaque auditory cortex show that some neurons directly respond to both somatosensory and auditory stimuli (Schroeder, Lindsley, Specht, Marcovici, Smiley, & Javitt, 2001). Auditory cortex may also become co-opted to process vibrotactile stimuli in deaf humans (Levänen, Jousmäki, & Hari, 1998). The case of associations between sound and touch appears to be different from the association between taste and smell, which are arguably more coupled, in an almost unavoidable fashion. Yet, the evidence discussed here makes it clear that the auditory system and the touch system are highly interconnected in brain and behaviour. These findings are enough for language users to notice (explicitly or implicitly) the connections between touch and sound. All of this suggests that expressions such as *sharp sound*, *rough sound* and *smooth melody* do not involve the conceptual conflict between distinct sensory modalities that is often taken to be definitional of “synaesthetic metaphors” (Strik Lievers, 2017).

##### 5. Alternative analyses: Primary metaphors and metonymy

To appropriately understand the scope of the argument presented here, we need to contrast it with existing approaches within cognitive linguistics. The argument presented here bears some superficial resemblance to “primary metaphor theory” (Grady, 1997; Grady, Oakley, & Coulson, 1999), the theory that some metaphors, so-called primary metaphors, derive from repeatedly experiencing particular environmental correlations. For example, psychologically associating darkness with fear and danger throughout our lives is supposed to motivate linguistic expressions such as *these are dark times* (see Winter, 2014).

Many researchers now believe that such primary metaphors involve metonymy, for example, Kövecses (2013) discusses how the primary metaphor SADNESS IS DOWN can be understood as a DOWN FOR SADNESS metonymy. Metonymies commonly refer to within-domain conceptual mappings, as opposed to metaphors, which are cross-domain mappings (for an overview, see Littlemore, 2015). Downward-oriented body postures are associated with sadness in the same embodied scene, and so a speaker can use language about postures to metonymically refer to talk about emotions (Kövecses, 2013). One can easily see how this general line of thinking carries over to the sensory associations discussed above, such as between taste and smell: Since tastes and smells are so highly associated in our environment, we can use one to talk about the other, i.e., one may posit a TASTE FOR SMELL metonymy (rather than a metaphor) to account for expressions such as *sweet fragrance*. Within such an analysis, taste and smell are seen as part of the same conceptual domain.

This analysis of cross-modal uses of sensory words captures some of the essence of the approach outlined in this chapter. However, a metonymical analysis only goes half-way away from metaphor. Consider the case of the colour term *blue*. If we observe light with a wavelength of 470 nanometers, we call this *blue*. If we observe light with a wavelength of 475 nanometers, we call this *blue* as well. In this case, nobody would want to posit a metonymy “470nm-blue FOR 475nm-blue” because our intuition tells us that both instances are literal uses of *blue*. We do not need to posit a “mapping” within the domain of blueness. Colour terms in fact often have large referential scope. Consider the colour of a red brick, which would often be named *orange* outside the contextualised usage of a brick. Here, the colour term *red* encompasses a large range of wavelengths, none of which we would consider “metaphorical” uses in the sense of “involving mapping”. If we recognise the underlying continuity of wavelengths and the wide scope of colour terms, we see that the same argument must carry over to other perceptual cases where similarly, a sensory word applies to a whole range of continuous experiences, as with *hot* referring to heat-spiciness and *sweet* referring to taste-smell.

As opposed to a metonymy-based analysis, a primary metaphor analysis is even less appropriate for understanding expressions such as *sweet fragrance*. As argued for by Grady (2005, pp. 1605–1606), of the two domains involved in primary metaphors, the source domain has to be sensory, and the target domain has to be non-sensory. For the metaphors discussed in this chapter, both sources and targets are sensory. Hence, Grady’s definition of primary metaphors does not apply. Kövecses (2013, p. 75) talks about the “sufficient conceptual distance” that is necessary for a primary metonymy (e.g., DOWN FOR SADNESS) to result in a primary metaphor (e.g., SADNESS IS DOWN). As discussed above, this conceptual distance is not present in many cases of “synaesthetic metaphors”, for example, the concepts of taste and smell are highly interrelated. Hence the concept of primary metaphor – even though superficially related to the present discussion because of the presence of environmental correlations – does not apply to many of the examples discussed here.

From the perspective of this chapter, the problem with any analysis rooted in either primary metaphor or metonymy is that the gustatory meaning and the olfactory meaning of a word such as *sweet* are still seen as distinct, and expressions such as *sweet smell* would be seen as involving a (metaphorical or metonymical) mapping. Of course, the uses of *sweet* in *sweet cake* and in *sweet fragrance* are different from each other; but they can be seen as being related by virtue of engaging the same integrated perceptual system in slightly different ways, and the use of the term in both instances can be seen as literal. Thus, “the extent of the literal”, as discussed by Rakova (2003), may be much wider than commonly assumed by cognitive linguists.

Moreover, as stated above, even though more synaesthetic metaphors may be related to experiential contiguities than previously recognised (Marks, 1978, p. Chapter 8; Lehrer, 1978: 119; Shibuya et al., 2007; Sullivan & Jian, 2013), some adjective-noun pairs seem to involve genuinely dissimilar modalities, what Strik Lievers (2016, 2017) would count as “conflictual” mappings. Any metonymy-based or primary-metaphor based account is thus incomplete because these expressions cannot easily be explained by co-occurrence as in primary metaphor or primary metonymy. On this point, it is worth pointing out that precisely the examples that Strik Lievers (2017) discusses as genuine synaesthetic metaphors not easily explainable in terms of experiential contiguities (based on Taylor, 1995, p. 140) are cases such as *loud colour* and *sweet music*, which involve highly evaluative adjectives. In fact, Strik Lievers (2017) discusses Barcelona (2003, 2008)’s account of these expressions as involving evaluation in terms of deviancy or pleasure as a shared denominator (see also Bagli, 2016). Similarly, Shibuya et al. (2007) discuss synaesthetic metaphors as either being based on comprehension through sensory co-occurrence or as based on comprehension through emotional experiences. This suggests that precisely the most typical cases of synaesthetic metaphors, those involving dissimilar modalities, are perhaps more aptly treated as primarily evaluative expressions (Shibuya et al., 2007; Winter, 2016b). The phenomenon of synaesthetic metaphors thus falls apart in two directions: On the one hand, many cases seem to involve experiential contiguities or overlapping domains (although we need not analyse these cases as metonymies, as argued above). On the other hand, those cases that precisely do not involve such contiguities appear to be primarily evaluative.

## 6. Conclusions

The present proposal combines two ideas: First, that sensory perception is neurophysiologically and psychologically continuous. Second, that words describing those sensory perceptions *appear to be* categorical (cf. Spivey, 2007). Pink (2011: 266) speaks of “a rather less culturally structured flow of neurological information” that “becomes differentiated into categories that we call the senses”. She then says that “we tend to communicate linguistically about our embodied and sensory perception in terms of sensory categories”, but warns us that “because one category is never enough to express exactly what we have actually experienced, the illusion of ‘separate’ senses operating *in relation to* each other is maintained” (ibid. 266, italics in original). These quotes get at the core of the present argument: We only need to talk about senses *relating to each other*, i.e., metaphorical mappings, if we are operating within our culturally imposed system of distinguishing five senses. Once we step outside the boundaries of this system and look at the underlying

neurophysiology and studies on multisensory perception and multisensory integration, the continuity of the sensorium becomes apparent. Speakers, as perceptual beings, operate within this sensory continuum and this is, ultimately, what motivates their language use. However, when speakers, including linguists, think *about* the senses, they operate within the five senses folk model and impose categoriality. Only once this happens do we need to talk about metaphorical mappings.

Throughout this chapter, multiple arguments have been presented that suggest that calling expressions such as *sweet melody* or *rough taste* “synaesthetic metaphors” reflects assumptions that are difficult to maintain. These expressions have relatively little connection with synaesthesia as talked about in the neuropsychological literature. Many cases of allegedly “synaesthetic” metaphors actually turn out to involve combinations of sensory modalities that are not only highly associated within our ecology, but that are actually partially the same when looked at from the perspective of neurophysiology and perceptual psychology. Those cases that do seem to involve mappings between relatively dissimilar modalities, such as *sweet melody*, do appear to involve evaluative uses of sensory adjectives rather than concrete perceptual content. Thus, the argument presented here suggests that the notion of “synaesthetic metaphors” is a cultural construct that stems from categorising something that is underlyingly continuous. In short, “synaesthetic metaphors” are neither synaesthetic nor metaphorical.

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## References

- Auvray, M., & Spence, C. (2008). The multisensory perception of flavor. *Consciousness and Cognition*, 17(3), 1016–1031. <https://doi.org/10.1016/j.concog.2007.06.005>
- Bagli, M. (2016). “Shaking off so good a wife and so sweet a lady”: Shakespeare’s use of taste words. *Journal of Literary Semantics*, 45(2), 141–159. <https://doi.org/10.1515/jls-2016-0010>
- Barcelona, A. (2003). On the plausibility of claiming a metonymic motivation for conceptual metaphor. In A. Barcelona (Ed.), *Metaphor and Metonymy at the Crossroads* (pp. 31–58). Berlin & New York: Mouton de Gruyter. <https://doi.org/10.1515/9783110894677.31>
- Barcelona, A. (2008). Metonymy is not just a lexical phenomenon: On the operation of metonymy in grammar and discourse. In C. Alm-Arvius, N., Johannesson & D. C. Minugh (Eds.), *Selected Papers from the Stockholm 2008 Metaphor Festival* (pp. 3–42). Stockholm: Stockholm University Press.

- Bond, B., & Stevens, S. S. (1969). Cross-modality matching of brightness to loudness by 5-year-olds. *Perception & Psychophysics*, 6(6), 337–339. <https://doi.org/10.3758/BF03212787>
- Buck, C. D. (1949). *A Dictionary of Selected Synonyms in the Principal Indo-European Languages: A Contribution to the History of Ideas*. Chicago: University of Chicago Press.
- Carlson, N. R. (2010). *Physiology of Behavior* (10th Edition). Boston: Allyn & Bacon.
- Casati, R., Dokic, J., & Le Corre, F. (2015). Distinguishing the commonsense senses. In D. Stokes, M. Matthen & S. Biggs (Eds.), *Perception and its Modalities* (pp. 462–479). Oxford: Oxford University Press.
- Classen, C. (1993). *Worlds of Sense: Exploring the Senses in History and across Cultures*. London: Routledge.
- Cytowic, R. E. (1993). *The man who tasted shapes*. New York: Putnam Press.
- Day, S. (1996). Synaesthesia and synaesthetic metaphors. *Psyche*, 2(32), 1–16.
- Davies, M. (2008) The Corpus of Contemporary American English: 450 million words, 1990-present. Available online at <http://corpus.byu.edu/coca/>
- de Araujo, I. E., Rolls, E. T., Kringelbach, M. L., McGlone, F., & Phillips, N. (2003). Taste olfactory convergence, and the representation of the pleasantness of flavour, in the human brain. *European Journal of Neuroscience*, 18(7), 2059–2068. <https://doi.org/10.1046/j.1460-9568.2003.02915.x>
- De Houwer, J., & Randell, T. (2004). Robust affective priming effects in a conditional pronunciation task: evidence for the semantic representation of evaluative information. *Cognition & Emotion*, 18(2), 251–264. <https://doi.org/10.1080/02699930341000022>
- Delwiche, J. F., & Heffelfinger, A. L. (2005). Cross-modal additivity of taste and smell. *Journal of Sensory Studies*, 20(6), 512–525. <https://doi.org/10.1111/j.1745-459X.2005.00047.x>
- Deroy, O., & Spence, C. (2013). Why we are not all synesthetes (not even weakly so). *Psychonomic Bulletin & Review*, 20(4), 643–664. <https://doi.org/10.3758/s13423-013-0387-2>
- Erzsébet, P. D. (1974). Synaesthesia and poetry. *Poetics*, 3(3), 23–44. [https://doi.org/10.1016/0304-422X\(74\)90021-7](https://doi.org/10.1016/0304-422X(74)90021-7)
- Fainsilber, L., & Ortony, A. (1987). Metaphorical uses of language in the expression of emotions. *Metaphor and Symbol*, 2(4), 239–250. [https://doi.org/10.1207/s15327868ms0204\\_2](https://doi.org/10.1207/s15327868ms0204_2)
- Galton, F. (1880a). Visualised numerals. *Nature*, 21(533), 252–256. <https://doi.org/10.1038/021252a0>
- Galton, F. (1880b). Visualised numerals. *Nature*, 22, 494–495. <https://doi.org/10.1038/021494e0>
- Goody, J. (2002). The anthropology of the senses and sensations. *La Ricerca Folklorica*, 45, 17–28. <https://doi.org/10.2307/1480153>
- González, J., Barros-Loscertales, A., Pulvermüller, F., Meseguer, V., Sanjuán, A., Belloch, V., & Ávila, C. (2006). Reading cinnamon activates olfactory brain regions. *Neuroimage*, 32(2), 906–912. <https://doi.org/10.1016/j.neuroimage.2006.03.037>
- Grady, J. (1997). Theories are buildings revisited. *Cognitive Linguistics*, 8(4), 267–290. <https://doi.org/10.1515/cogl.1997.8.4.267>
- Grady, J. (2005). Primary metaphors as inputs to conceptual integration. *Journal of Pragmatics*, 37(10), 1595–1614. <https://doi.org/10.1016/j.pragma.2004.03.012>
- Grady, J., Oakley, T., & Coulson, S. (1999). Blending and metaphor. In R. W. Gibbs & G. Steen (Eds.), *Metaphor in Cognitive Linguistics* (pp. 101–124). Amsterdam: John Benjamin. <https://doi.org/10.1075/cilt.175.07gra>
- Guest, S., Catmur, C., Lloyd, D., & Spence, C. (2002). Audiotactile interactions in roughness perception. *Experimental Brain Research*, 146(2), 161–171. <https://doi.org/10.1007/s00221-002-1164-z>

- Holz, P. (2007). Cognition, olfaction and linguistic creativity: Linguistic synesthesia as a poetic device in cologne advertising. In Plümacher, M., & P. Holz (Eds.), *Speaking of colors and odors* (pp. 185–202). Amsterdam: John Benjamins. <https://doi.org/10.1075/ceclr.8.11hol>
- Howes, D. (1991) (Ed.). *The Varieties of Sensory Experience: A Sourcebook in the Anthropology of the Senses*. Toronto: University of Toronto Press.
- Hunston, S. (2011). *Corpus approaches to evaluation: Phraseology and evaluative language*. New York: Routledge.
- Jousmäki, V., & Hari, R. (1998). Parchment-skin illusion: sound-biased touch. *Current Biology*, 8(6), R190–R191. [https://doi.org/10.1016/S0960-9822\(98\)70120-4](https://doi.org/10.1016/S0960-9822(98)70120-4)
- Julius, D., & Basbaum, A. I. (2001). Molecular mechanisms of nociception. *Nature*, 413(6852), 203–210. <https://doi.org/10.1038/35093019>
- Kövecses, Z. (2013). The metaphor–metonymy relationship: Correlation metaphors are based on metonymy. *Metaphor and Symbol*, 28(2), 75–88. <https://doi.org/10.1080/10926488.2013.768498>
- Lakoff, G., & Johnson, M. (1980). *Metaphors we live by*. Chicago: University of Chicago Press.
- Lederman, S. J. (1979). Auditory texture perception. *Perception*, 8(1), 93–103. <https://doi.org/10.1068/p080093>
- Lehrer, A. (1978). Structures of the lexicon and transfer of meaning. *Lingua*, 45(2), 95–123. [https://doi.org/10.1016/0024-3841\(78\)90001-3](https://doi.org/10.1016/0024-3841(78)90001-3)
- Lehrer, A. (2009). *Wine & Conversation*. Oxford: Oxford University Press. <https://doi.org/10.1093/acprof:oso/9780195307931.001.0001>
- Levänen, S., Jousmäki, V., & Hari, R. (1998). Vibration-induced auditory-cortex activation in a congenitally deaf adult. *Current Biology*, 8(15), 869–872. [https://doi.org/10.1016/S0960-9822\(07\)00348-X](https://doi.org/10.1016/S0960-9822(07)00348-X)
- Levinson, S. C., & Majid, A. (2014). Differential ineffability and the senses. *Mind & Language*, 29(4), 407–427. <https://doi.org/10.1111/mila.12057>
- Littlemore, J. (2015). *Metonymy: Hidden shortcuts in language, thought and communication*. Cambridge: Cambridge University Press. <https://doi.org/10.1017/CBO9781107338814>
- Louwerse, M., & Connell, L. (2011). A taste of words: Linguistic context and perceptual simulation predict the modality of words. *Cognitive Science*, 35(2), 381–398. <https://doi.org/10.1111/j.1551-6709.2010.01157.x>
- Lynott, D., & Connell, L. (2009). Modality exclusivity norms for 423 object properties. *Behavior Research Methods*, 41(2), 558–564. <https://doi.org/10.3758/BRM.41.2.558>
- Majid, A. (2012). Current emotion research in the language sciences. *Emotion Review*, 4(4), 432–443. <https://doi.org/10.1177/1754073912445827>
- Marks, L. E. (1978). *The Unity of the Senses: Interrelations Among the Modalities*. New York: Academic Press. <https://doi.org/10.1016/B978-0-12-472960-5.50011-1>
- Martino, G., & Marks, L. E. (2001). Synesthesia: Strong and weak. *Current Directions in Psychological Science*, 10(2), 61–65. <https://doi.org/10.1111/1467-8721.00116>
- McBurney, D. H. (1986). Taste, smell, and flavor terminology: Taking the confusion out of the fusion. In H. L. Meiselman, & R. S. Rivkin (Eds.), *Clinical Measurement of Taste and Smell* (pp. 117–125). New York: Macmillan.
- Miller, G. A., & Johnson-Laird, P. N. (1976). *Language and Perception*. Cambridge: Harvard University Press. <https://doi.org/10.4159/harvard.9780674421288>
- Møller, A. (2012). *Sensory Systems: Anatomy and Physiology* (2nd Edition). Richardson: A. R. Møller Publishing.

- Paradis, C., & Eeg-Olofsson, M. (2013). Describing sensory experience: The genre of wine reviews. *Metaphor and Symbol*, 28(1), 22–40. <https://doi.org/10.1080/10926488.2013.742838>
- Pecher, D., Zeelenberg, R., & Barsalou, L. W. (2003). Verifying different-modality properties for concepts produces switching costs. *Psychological Science*, 14(2), 119–124. <https://doi.org/10.1111/1467-9280.t01-1-01429>
- Pink, S. (2011). Multimodality, multisensoriality and ethnographic knowing: social semiotics and the phenomenology of perception. *Qualitative Research*, 11(3), 261–276. <https://doi.org/10.1177/1468794111399835>
- Prandi, M. (2012). A plea for living metaphors: Conflictual metaphors and metaphorical swarms. *Metaphor & Symbol*, 27(2), 148–170. <https://doi.org/10.1080/10926488.2012.667690>
- Rakova, M. (2003). *The Extent of the Literal: Metaphor, Polysemy and Theories of Concepts*. New York: Palgrave Macmillan. <https://doi.org/10.1057/9780230512801>
- Ramachandran, V. S., & Hubbard, E. M. (2001). Synaesthesia – a window into perception, thought and language. *Journal of Consciousness Studies*, 8(12), 3–34.
- Rolls, E. (2008). Functions of the orbitofrontal and pregenual cingulate cortex in taste, olfaction, appetite and emotion. *Acta Physiologica Hungarica*, 95(2), 131–164. <https://doi.org/10.1556/APhysiol.95.2008.2.1>
- Schroeder, C. E., Lindsley, R. W., Specht, C., Marcovici, A., Smiley, J. F., & Javitt, D. C. (2001). Somatosensory input to auditory association cortex in the macaque monkey. *Journal of Neurophysiology*, 85(3), 1322–1327. <https://doi.org/10.1152/jn.2001.85.3.1322>
- Schürmann, M., Caetano, G., Jousmäki, V., & Hari, R. (2004). Hands help hearing: facilitatory audiotactile interaction at low sound-intensity levels. *The Journal of the Acoustical Society of America*, 115 (2), 830–832. <https://doi.org/10.1121/1.1639909>
- Shams, L., Kamitani, Y., & Shimojo, S. (2000). Illusions: What you see is what you hear. *Nature*, 408(6814), 788–788. <https://doi.org/10.1038/35048669>
- Shen, Y. (1997). Cognitive constraints on poetic figures. *Cognitive Linguistics*, 8(1), 33–71. <https://doi.org/10.1515/cogl.1997.8.1.33>
- Shen, Y., & Aisenman, R. (2008). Heard melodies are sweet, but those unheard are sweeter: Synaesthetic metaphors and cognition. *Language and Literature*, 17(2), 107–121. <https://doi.org/10.1177/0963947007088222>
- Shen, Y., & Gadir, O. (2009). How to interpret the music of caressing: Target and source assignment in synaesthetic genitive constructions. *Journal of Pragmatics*, 41(2), 357–371. <https://doi.org/10.1016/j.pragma.2008.08.002>
- Shen, Y., & Gil, D. (2007). Sweet fragrances from Indonesia: A universal principle governing directionality in synaesthetic Metaphors. In W. van Peer, & J. Auracher (Eds.), *New Beginnings in Literary Studies* (pp. 49–71). Newcastle: Cambridge Scholars Publishing.
- Shibuya, Y., Nozawa, H., & Kanamaru, T. (2007). Understanding synesthetic expressions: Vision and olfaction with the physiological = psychological model. In M. Plümacher, & P. Holz (Eds.), *Speaking of colors and odors* (pp. 203–226). Amsterdam: John Benjamins. <https://doi.org/10.1075/celcr.8.12shi>
- Simner, J. (2012). Defining synaesthesia. *British Journal of Psychology*, 103, 1–15. <https://doi.org/10.1348/000712610X528305>
- Simner, J., Mulvenna, C., Sagiv, N., Tsakanikos, E., Witherby, S. A., Fraser, C., Scott, K., & Ward, J. (2006). Synaesthesia: The prevalence of atypical cross-modal experiences. *Perception*, 35(8), 1024–1033. <https://doi.org/10.1068/p5469>
- Sorabji, R. (1971). Aristotle on demarcating the five senses. *The Philosophical Review*, 80(1), 55–79. <https://doi.org/10.2307/2184311>

- Spence, C. (2011). Crossmodal correspondences: A tutorial review. *Attention, Perception, & Psychophysics*, 73(4), 971–995. <https://doi.org/10.3758/s13414-010-0073-7>
- Spence, C., & Bayne, T. (2015). Is consciousness multisensory? In D. Stokes, M. Matthen & S. Biggs (Eds.), *Perception and its Modalities* (pp. 95–132). Oxford: Oxford University Press.
- Spence, C., Smith, B., & Auvray, M. (2015). Confusing tastes and flavours. In D. Stokes, M. Matthen, & S. Biggs (Eds.), *Perception and its Modalities* (pp. 247–274). Oxford: Oxford University Press.
- Spivey, M. (2007). *The Continuity of Mind*. Oxford: Oxford University Press.
- Strik Lievers, F. (2015). Synaesthesia: A corpus-based study of cross-modal directionality. In R. Caballero, & C. Paradis (Eds.), *Functions of Language, Sensory Perceptions in Language and Cognition* (pp. 69–95). Amsterdam: John Benjamins.
- Strik Lievers, F. (2016). Synaesthetic metaphors in translation. *Studi e Saggi Linguistici*, 54(1), 43–70.
- Strik Lievers, F. (2017). Figures and the senses. Towards a definition of synaesthesia. *Review of Cognitive Linguistics*, 15(1), 83–101. <https://doi.org/10.1075/rcl.15.1.04str>
- Sullivan, K., & Jiang, W. (2013). When my eyes are on you, do you touch my eyes? A reclassification of metaphors mapping from physical contact to perception. In T. Fuyin Li (Eds.), *Compendium of Cognitive Linguistics Research Volume 2* (pp. 189–200). Hauppauge, NY: Nova Science Publishers.
- Suzuki, Y., Gyoba, J., & Sakamoto, S. (2008). Selective effects of auditory stimuli on tactile roughness perception. *Brain Research*, 1242, 87–94.
- Taylor, J. R. (1995). *Linguistic Categorization* (2nd Edition). Oxford: Oxford University Press.
- Tsur, R. (2012). *Playing by Ear and the Tip of the Tongue: Precategorical Information in Poetry*. Amsterdam: John Benjamins. <https://doi.org/10.1075/lal.14>
- Ullmann, S. (1945). Romanticism and synaesthesia: A comparative study of sense transfer in Keats and Byron. *Publications of the Modern Language Association of America*, 60, 811–827. <https://doi.org/10.2307/459180>
- Ullmann, S. (1959). *The Principles of Semantics* (2nd Edition). Glasgow: Jackson, Son & Co.
- Wilce, J. M. (2009). *Language and Emotion*. Cambridge: Cambridge University Press. <https://doi.org/10.1017/CBO9780511626692>
- Williams, J. (1976). Synaesthetic adjectives: A possible law of semantic change. *Language*, 52, 461–478. <https://doi.org/10.2307/412571>
- Winter, B., Marghetis, T., & Matlock, T. (2015). Of magnitudes and metaphors: Explaining cognitive interactions between space, time, and number. *Cortex*, 64, 209–224. <https://doi.org/10.1016/j.cortex.2014.10.015>
- Winter, B. (2014). Horror movies and the cognitive ecology of primary metaphors. *Metaphor & Symbol*, 29(3), 151–170. <https://doi.org/10.1080/10926488.2014.924280>
- Winter, B. (2016a). Taste and smell words form an affectively loaded part of the English lexicon. *Language, Cognition and Neuroscience*, 31(8), 975–988. <https://doi.org/10.1080/23273798.2016.1193619>
- Winter, B. (2016b). The sensory structure of the English lexicon. Unpublished PhD Thesis, University of California Merced.
- Yu, N. (2003). Synesthetic metaphor: A cognitive perspective. *Journal of Literary Semantics*, 32, 19–34.