CONCEPTUAL NETWORK IN CREATIVE MORPHOLOGY:

THE LINGUISTIC REPRESENTATION OF THE QUALITY OF PERCEPTION IN CHINESE

by

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DISSERTATION ABSTRACT

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Title: Conceptual Network in Creative Morphology: The Linguistic Representation of the Quality of Perception in Chinese

Sensory language, the linguistic conveyance of sensory perception and experience, has attracted considerable scholarly interest in linguistics and linguistic anthropology. In particular, recent anthropological research on the representation of qualia, the subjective or qualitative properties of sensory experiences, and the revival of linguistic research on mimetic language, including but not limited to sound symbolism, have greatly energized scholarly engagement with the linguistic representation of sensory perception and cross-modal conceptualization of senses. To this date, however, there is no systematic research that explores the role of morphology or word formation in the representation of qualia in Chinese based on large-scale usage data.

This dissertation aims to fill this major gap in the research by exploring the dynamic and complex nature of perceptually based conceptualization in a family of reduplication-based mimetic morphological constructions in Chinese. Using a data-driven method, I show that the Chinese morphological pattern [A-BB] is a creative and productive linguistic device of qualia representation in a wide range of sensory perceptual and related experiential domains that form a complex, intertwining conceptual network. Taking a constructionist approach, which argues that the meaning of the whole is larger than the sum of the meanings of the parts, I demonstrate that the schema [A-BB] is associated with the function of psychomimetic conveyance of perceptual

qualities. Using sophisticated methods of data analysis and visualization, this dissertation makes new discoveries in Chinese morphology in the representation of sensory perception. In doing so, this dissertation breaks a new path in Chinese sensory language research and offers rich and valuable datasets for future studies.

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CHAPTER I

INTRODUCTION

Qualia (Latin, singular: *quale*) refers to subjective or qualitative properties of sensory experiences (Wright, 2008). The term "qualia" was first introduced by C. I. Lewis in 1929 to refer to properties of sense-data in the sense of experiences intrinsically distinct from states of consciousness with regard to phenomenal qualities (e.g., the color and shape to vision, the smoothness to touch, and the sweetness to taste) (Lewis, 1929). The sense-datum is considered the carrier of the phenomenal qualities that the subject is immediately aware of (i.e., conscious experience), even if it is a perceptual illusion or hallucination. In contemporary literature, the term "qualia" has been broadened to cover various properties of experience with qualitative aspects, including perceptual experiences, bodily sensations, emotions and moods (Kind, 2008). The phenomenal properties of experience have received considerable critical attention, especially in anthropology and linguistics. Empirical studies that bear on the conceptualization of qualia in language are, however, few and far apart. It is the goal of this dissertation to examine the linguistic representation of qualia in Chinese through the lens of a productive morphological construction.

1.1 Motivation and Problem Statement

In recent years, the study of embodiment and sensory representation in language has garnered considerable critical attention in cognitive linguistics. Researchers have explored the differential codability of sensory categories, especially in English (e.g., Levinson & Majid, 2014; Majid et al., 2018; Strik Lievers & Winter, 2018; Winter, 2019; Winter et al., 2018). Nevertheless, at the outset of this dissertation, the linguistic representation of sensory perception in Chinese has attracted very little attention from the scholarly community. The existing body of

research has mainly focused on sensory language within lexical categories, such as the relationship between sensory modalities within sensory adjectives (Zhao et al., 2018, 2019, 2022). However, research on the subject has been mostly restricted to small-scale investigation and comparison of sense-related words in isolation. Much of the research up to now has been conducted in a descriptive and introspective manner.

To date, no research has investigated the linguistic representation of perceptual sensory qualities or qualia at the morphological level in Chinese, leaving a vast area of qualia representation by way of reduplication-based mimetic constructions unexplored. The reasons for this oversight are twofold: 1) the received wisdom that reduplication is a minor morphological process in Chinese word formation has been taken for granted and, relatedly, 2) there is a persisting lack of theoretical interest in mimetic language and iconicity in Chinese linguistics. Consequently, even highly productive patterns that form a family of reduplication-based morphological constructions commonly used in everyday descriptions of perceptual qualia have been overlooked. This dissertation seeks to fill this research gap by providing a systematic usage-based empirical analysis of this family of qualia constructions.

1.2 The ABB Reduplication in Chinese

In Chinese, there are structurally marked words as ideophones that underwent the reduplication-based morphological processes in the form of [A-BB] for qualia conveyance. Previous research on ABB considered this kind of reduplication-based words as a unique type of adjective in Sinitic languages that enrich the expression of a particular feeling or sensation, e.g., 直挺挺 *zhí-tǐngtǐng* 'straight and stiff.' Hsieh (2017) proposed that adjectival reduplication such as the ABB pattern denotes the degree of a perceptible vivid state, where A is a head-modifier adjective, and the reduplication of BB is a suffix that contributes to the "contexts" for evaluating

the degree of adjective.

Wang (2014) argued that a majority of ABB adjectives are compound and "only a minority of ABB adjectives is derivational and has suffixation" based on the following reasons (p. 353). First, most BB constituents are not suffixes and have concrete lexical meanings. Some examples are 茫茫 *mángmáng* 'vast expanse' and 悄悄 *qiāoqiāo* 'quiet.' Only a limited number of BB constituents, such as 乎乎 *hūhū* and 巴巴 *bābā*, can be regarded as suffixes due to their loss of lexical meanings. Second, most BB constituents cannot be regarded as suffixes because they cannot be freely attached to a variety of distinct words. For instance, the BB constituent 皑皑 *ǎiǎi* 'pure white' can solely be combined with the word 白 *bái* 'white' as in 白皑皑 *bái-ǎiǎi*. Furthermore, Wang (2014) pointed out that the word stems on the left of ABB adjectives can be an adjective (懒洋洋 *lǎn-yángyáng* 'lazy'), a noun (汗津津 *hàn-jīnjīn* 'sweaty'), or a verb (醉醺醺 *zuì-xūnxūn* 'drunk'). Nevertheless, the BB constituents as the reduplicated part in the ABB adjectives are difficult to define because most of them cannot be used freely as an adjective. For instance, the BB constituent 醺醺 *xūnxūn* in 醉醺醺 *zuì-xūnxūn* 'drunk' cannot be used freely to construct a phrase as 醺醺的爸爸 *xūnxūn de bàba* 'drunk father' (Wang, 2014, p. 352).

The proposal that the semantic meaning of ABB adjectival compounds can be derived from the sum of the meanings of the participating A and BB morphemes (e.g., 白皑皑 *bái-ǎiǎi* 'pure white') is weak and inconclusive. It is worth emphasizing that many BB constituents have lost their lexical meanings when undergoing the morphological process of reduplication. As a result, the ABB reduplication words such as the reduplication of 洋 *yáng* 'ocean; vast; foreign' in 懒洋洋 *lǎn-yángyáng* 'lazy' does not contribute to the meanings of the whole. Research to date has not yet clarified what Chinese ABB reduplication words are and why a reduplicated

morpheme can reveal a speaker's experience of sensory qualities.

In this dissertation, I argue that Chinese ABB reduplication words are not adjectival compounds, but a reduplication-based morphological construction in the form of [A-BB] as a form-meaning pair. The meaning of the whole comes from the idiosyncratic combination of the A part and the reduplication of the BB part that transforms the sensory properties into an ideophone, eliciting a vivid and figurative impression of certain sensations that cannot be attributed to either the A morpheme or the reduplicated BB morpheme. I will further explain this argument in the following sections. The next section presents the theoretical frameworks to set out the rationale for the studies in this dissertation.

1.3 The Aim and Structure of This Dissertation

This dissertation draws on usage-based Construction Grammar in analyzing the linguistic representation of the qualitative aspects of sensory experiences in Mandarin Chinese (henceforth Chinese), focusing on a productive family of reduplication-based mimetic morphological constructions that share the schema [A-BB]. Based on a data-driven method, I show that the Chinese morphological pattern [A-BB] is a form-meaning pair that is associated with certain morphological, phonological, semantic, and pragmatic properties. It conveys a wide range of subjective perceptual qualities or qualia, which cannot be accounted for by simply adding the meanings of A and BB. Specifically, I propose that the constructional meaning of [A-BB] is a psychomimetic conveyance in the sense of the speaker feeling about a percept whereby the lexical input in A specifies the perceptual property being described and the lexical input in BB provides phonomimetic or phenomimetic expressions. Figure 1.1 illustrates the hierarchical structure of the constructional meaning of [A-BB].

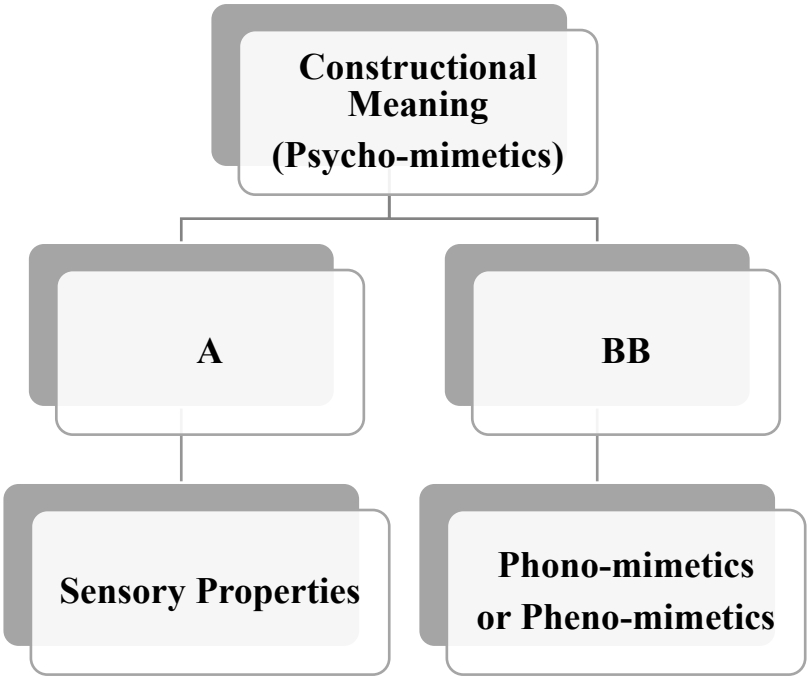

Figure 1.1. The hierarchical structure of the constructional meaning of [A-BB]

Take the term 硬梆梆 *yìng-bāngbāng* as an example. While it is typically translated as 'hard,' the perceptual qualities and the speaker feeling encoded in this word are lost. The syllable in the A slot *yìng* designates the perceptual property of being hard to the touch. The reduplicated part *bāngbāng* is a phonomimetic expression that imitates the sudden loud noise from striking a hard object. Interacting with the lexical input in A and BB, the abstract constructional meaning of the ABB word *yìng-bāngbāng* is a 'psychomimetic conveyance,' expressing an unfavorable feeling or dislike toward the object being described.

Another example has to do with color, 白花花 *bái-huāhuā,* which describes the visual quality of something white and bright that dazzles the eye with an overwhelming glare. Here *bái* is the color name 'white' and *huāhuā* is a phenomimetic expression that conveys the sensation of a glare from a strong and dazzling light. Together the whole word conveys a psychomimetic

impression that the percept being described exercises on the speaker. It is worth noting that *huāhuā* is the reduplication of *huā* which has the lexical meaning of 'blossom.' However, when undergoing the morphological process of reduplication, its lexical meaning is bleached into the phenomimetic property of a dazzling effect. As this example shows, the meaning of the whole cannot be derived from the sum of the meanings of the participating morphemes.

1.3.1 Central research questions

As this dissertation will demonstrate, the ABB construction is highly productive as a family resemblance network of psychomimetic expressions. It is not only used to convey qualia in all sensory domains but also forms synesthetic semantic networks in trans-domain qualia conveyance. In analyzing the networks of ABB expressions using a data-driven method, this dissertation provides an abundance of linguistic data that is heretofore unmined and unexplored. The analysis unravels some of the mysteries surrounding sensory linguistics from the perspective of Chinese, a language that is woefully under-researched in the research area of linguistic conceptualization of sensory perception. Accordingly, this dissertation is guided by the following three central questions:

1. Which sensory modalities stand out in the conveyance of qualia by ABB?
2. How qualitative properties of sensory experiences are depicted in the Chinese ABB morphological construction?
3. Are there any schematic and substantive patterns in the interaction of A and BB in expressing qualia?

The existing research on this productive family of ABB construction has been mostly restricted to a morpheme-based perspective, which examines the grammatical properties and

semantic compositions of reduplicated adjectives and has been generally conducted in a descriptive and introspective manner (e.g., Liu, 2013; Wang, 2014). The research to date has failed to employ rigorous and systematic research methods based on large-scale corpus data that represents language use in real contexts.

This dissertation seeks to fill a major gap in the research on qualia by showing the dynamic and complex nature of perceptually based conceptualization. To do so, this dissertation applies data-driven research methods and statistical measures in corpus linguistics to investigate the usage patterns, frequency of occurrence, strength of collocation, and semantic-pragmatic properties of the [ABB] morphological constructions. In particular, this dissertation focuses on exploring the linguistic representation of the quality of perception in two aspects: color-vision experience and synesthesia.

1.3.2 Overview of this dissertation

The overall structure of the dissertation takes the form of eight chapters:

Chapter I begins by introducing the concept of qualia and identifying a major knowledge gap in the field of Chinese Linguistics. The aim of the research and the research questions are also provided to contextualize the following studies in this dissertation.

Chapter II reviews related studies and situates the current research from three interdisciplinary aspects. The first aspect presents how conscious experiences regarding perceptual qualities have been studied in Philosophy and Cognitive Science. The second aspect reviews how anthropologists study qualia based on the semiotics of embodied material culture. The last aspect discusses sensory depictions in linguistic forms, focusing on ideophones and synesthesia.

Chapter III presents the theoretical frameworks to highlight the rationale for the studies in

this dissertation.

Chapter IV describes the current research methods by which the data processing and analyses were conducted. Specifically, I document the procedures of data collection and corpus construction for the studies in this dissertation. This chapter also presents both quantitative and qualitative approaches for analyzing ABB morphological patterns in Chinese, including corpus-based collocation measures and collostructional analysis, as well as cross-lingual WordNet analyses for semantic clustering.

Chapter V and Chapter VI focus on the linguistic representation of the phenomenal qualities of the color vision experience. Chapter V demonstrates the interaction of A and BB for qualia conveyance in a conceptual semantic network. In this chapter, I investigate whether there are universal constraints on color language and categorization in Chinese morphological constructions, which depict the perceptual qualities of color vision experience. I also explore the primary colors that are frequently used to express qualia in Chinese morphological construction [A-BB]. Moreover, this chapter discusses the psychophysical effect on the creation of color expressions in Chinese.

Chapter VI explores the phenomenal qualities of perceptual color vision experience encoded in Chinese morphological construction [A-BB]. I focus on five primary [ABB] color-vision constructions and examine their color referents and usage contexts in Chinese. In addition, I investigate whether there are schematic and substantive patterns that Chinese speakers use to describe phenomenal qualities of perceptual color-vision experience. In this chapter, I demonstrate how the constructional meaning of [A-BB] as psychomimetic convenyance is constructed by the intercorrelations between perceptual properties described in A and the phonomimetic or phenomimetic expressions portrayed in BB.

Chapter VII delves into trans-domain qualia conveyance in Chinese morphological construction [A-BB]. In this chapter, I explore the distribution of cross-modal intersensory transfer patterns in Chinese lexical networks, which constitute a productive family of ABB morphological constructions. In particular, I compare cross-modal intersensory transfers in the interaction of A and BB in expressing qualia and present the hierarchy of intersensory transfers based on the results of the study.

Chapter VIII concludes the dissertation by drawing together the main findings and explaining the significance of the current research. The final chapter also indicates the limitation of the dissertation and discusses the implications for future research.

CHAPTER II

RELATED STUDIES

2.1 The Study of Conscious Experiences

2.1.1 The metaphysics of consciousness

Philosophers study the epistemological status of sensory experiences, debating the idea of "what-it-is-likeness" in one's perceptual experiences of the material properties of entities in the external world (Block, 1990, 1994; Dennett, 1988, 1991, 2017; Nagel, 1974; Tye, 1995, 2000). Two traditional theories in the philosophy of mind, dualism and materialism (or physicalism), are commonly applied to the study of the qualitative character of conscious experience. Dualism holds that there is a radical difference between *res cogitans* 'the thinking thing' (the mind and consciousness) and *res extensa* 'the extended thing' (the physical world) (Cottingham, 2013), while materialism regards the mind simply as the brain engaging in neural activity (Gennaro, 2012). However, both dualism and materialism have suffered from a lack of well-grounded theoretical considerations.

Dualism fails to explain the interaction between the non-physical properties of conscious mental states and the physical body (Hume, 2000; Kant, 1998; Nagel, 1986). For example, the mind-body dualism cannot account for mental defects or disorders that are caused by damage to the brain. In other words, cognitive disorders resulting from brain damage serve as strong evidence in support of the existence of the conceptual connection between the conscious mind and the physical body. On the other hand, materialism fails to clarify the connection between physical processes in the brain and the phenomenal properties of subjective conscious experiences (Chalmers, 1995; Jackson, 1982, 1986; Levine, 1983, 2001). For instance, Chalmers (1995) opposes the view that consciousness is physical, arguing that a zombie replica could be

physically identical to a conscious human being, but it lacks phenomenal consciousness and fails to conceive qualitative experience.

The advances in computer science after 1950 have facilitated the computational theories of mind and several thought experiments in the fields of philosophy and psychology (Gennaro, 2017). Functionalism, which holds that mental states are identified by their functions or what they do in the system of mind, has led to the belief that a disembodied computer program can model one's conscious experience (Block, 1978; Chalmers, 1995; Searle, 1980). On the other hand, Thomas Nagel's (1974) "what it is like" sense focusing on the subjective or first-person experiential phenomenal concepts has triggered a renewed interest in the scientific study on the experiential dimension of phenomenal consciousness (Clark, 1997; Varela et al., 1991; Varela & Ura, 1996).

2.1.2 Phenomenology

Phenomenology, a descriptive method to study the structural features of experience, is established by Edmund Husserl in an effort to contest psychologism in the twentieth century. Husserl (1900/2001) argues against the psychologistic notion that the laws of logic or the validity of human knowledge can be reduced to psychological facts or laws, calling upon *auf die Sachen selbst zurückgehen* 'going back to the things themselves.' That is, phenomenology focuses on the intrinsic description of what is given in experience rather than on the presuppositions about metaphysical entities. Phenomenologists study specific experiential structures of perception and how they relate to the world in which a perceiver or an embodied agent is situated (Gallagher & Zahavi, 2021). Following Husserl, the study of phenomenal consciousness as a philosophical-scientific approach has been adapted and extended by several influential scholars, including Martin Heidegger, Jean-Paul Sartre, and Maurice Merleau-Ponty.

Heidegger (1927/1962) considers phenomenology as a metaphysical ontology and analyzes *Dasein* (i.e., the structures of human existence) with regard to its temporal and historical features. Sartre (1939/1970) emphasizes the emptiness of conscious experience, arguing that bodily sensation is not a non-intentional, purely subjective quality, but the directness toward worldly objects. Most notably, Merleau-Ponty (1945/2012) challenges Descartes' Cartesian Dualism of mind and body and establishes the primacy of sensory perception as an embodied experience central to consciousness and self. Varela, Thompson and Rosch (1991) further build on Merleau-Ponty's embodied phenomenology, introducing the enactive approach that accentuates the physical environment of a given living body, and treats the living body as a self-producing and self-maintaining system that enacts situated mind-body states and a domain of distinctions out of a perceiver-dependent world. Gallagher and Zahavi (2021) share the view of embodied consciousness and underline the internal environment of body as a continuation of how the body responds to the external environment.

Cognitive scientists and experimental psychologists explain consciousness through investigating physical or neurophysiological concepts from the third-person perspective. By contrast, phenomenologists argue that scientific knowledge is embedded in the experiential world and underscore the importance of examining experiential phenomenal concepts primarily from the first-person perspective. Both Husserl and Merleau-Ponty highlight perceptual intentionality and the fact that "our perceptual acquaintance with the world is a permanent condition of and a source for linguistic meaning" which is prior to language acquisition (Gallagher & Zahavi, 2021, p. 121). The phenomenology of perception supports the concept of enactive perception which values the coordination of sensorimotor system and views the movement of body as the primacy determining the qualitative properties of sensory experiences

(Dewey, 1896).

2.2 The Anthropological Studies on Qualia

The term *qualia* is defined by Lewis (1929) as "recognizable qualitative characters of the given, which may be repeated in different experiences, and are thus a sort of universals" (p. 121). Qualia is commonly described as the phenomenal properties of an individual's experience. Such properties may be universal in terms of their subjectivity. However, the symbolic representation of qualia varies across languages (Chumley & Harkness, 2013). While philosophers regard qualia as subjective properties of consciousness or "the way things seem" for individuals, anthropologists consider qualia as the intersubjective products of socialization to culture or "the way things are" for social groups (Harkness, 2020). The anthropological reformulation of qualia is initiated by Charles Peirce (1897/1940) whose trichotomy of categorization of signs (i.e., icons, indices, and symbols) conceptualizes qualia under the term of "firstness" that refers to the pure abstraction of sensuous qualities (Chumley, 2017; Harkness, 2020). Rather than studying the facts of firstness, anthropologists are interested in cultural emergents, such as sensory expressions that arise from the interaction between individuals and demonstrate a sociocultural systematicity of sensuous qualities (Chumley, 2013, 2017; Hankins, 2013; Harkness, 2013; Manning, 2012; Munn, 1986).

2.2.1 The semiotics of embodied material culture

Central to the anthropological study on qualia is the employment of semiotic approaches to materiality, analyzing cultural qualisigns of value that mediate one's sensorial and somatic experiences (Gal, 2013; Harkness, 2015). Qualisign refers to a quality that functions as a sign (Peirce, 1897/1940). According to Harkness (2015), "all sociocultural practice is fundamentally semiotic, constituted by sign processes" (p. 574). From his perspective, qualia are pragmatic

signals or indexes that materialize phenomenally as sensuous qualities. Anthropologists highlight the sociocultural aspect of qualia, arguing that the experience of sensuous qualities is intertwined with sociocultural events (e.g., Hankins, 2013; Harkness, 2013; Munn, 1986).

The seminal work of Munn (1986) offers an exemplary approach to examining the conventional qualisigns of value on Gawa (a small island at the southeast coast of Papua New Guinea) and illustrates how qualia are indexically realized via culturally framed social practices, contributing to the cultural semiotic analysis of apperception. Hankins' (2013) study on the politics of scents and stigma in Japan illuminates the indexical semiotic process of olfactory qualia, attributing the smell of leather to people who work in or live near stigmatized industries (i.e., *Buraku*) as a sign of filth. Harkness' (2013) study on liquor consumption in South Korea illustrates how the experience of softness as an abstract quality is conceptualized through the sociocultural practice of drinking soju in various sensory modalities (e.g., visual, olfactory, gustatory). This anthropological line of research has established the cultural boundedness of qualia, accentuating the role of sociocultural context in sensory perception.

2.2.2 Qualia in linguistic practices

Linguistic anthropologists explore lexical registers of sensuous attribution associated with co-occurring signs in speech forms. The anthropological study on color terminology (e.g., color nomenclature) is one of the examples that demonstrate the enregisterment of linguistic forms with the cultural regimentation of indexes (Berlin & Kay, 1969; Casson, 1994, 1997; Conklin, 1955; Heider, 1972a, 1972b). Enregisterment is a term used in the field of sociolinguistics for describing the process where certain linguistic items become associated with particular ways of speaking (i.e., registers), indexing styles and identities (Johnstone, 2016). In their ground-breaking work on *Basic Color Terms: Their Universality and Evolution*, Berlin and

Kay (1969) investigate cross-linguistic color categorization and naming, indicating the crucial role of evolutionary sequence in cultural semiosis that affects or even determines the number of basic color terms in a language. Following Berlin and Kay's work, several cross-linguistic studies have been conducted to understand color nomenclature systems cross-culturally.

Heider (1972a, 1972b) discovers that Dani, a tribal language in New Guinea, has as few as two basic color terms *mili* 'dark' and *mola* 'light' due to limited exposure to complex and industrialized societies. Casson (1994, 1997) argues that colorants and textiles, which are proximate and contiguous resources, evoke the innovation of English secondary color terms (e.g., russet, crimson, and scarlet) as the response of culture members to the increasingly complex and diverse array of culturally substantial colors. Conklin (1955) identifies four color categories in Hanunó'o (i.e., a language spoken in the island of Mindoro, Philippines) on the spectrum of differentiation between lightness (*malagti*) and darkness (*mabi:ru*), dryness or desiccation (*marara*) and wetness or freshness (*malatuy*). The four color terms in Hanunó'o are used to express the phenomenal qualities of perceptual color and physical experience, associating with nonlinguistic phenomena in the natural environment. These color terms cannot be simply identified by Berlin and Kay's (1969) color categorization and naming experiment.

In a more recent study, Kay and Regier (2006) compared results from modal color naming by speakers of Berinmo, a language of Papua New Guinea with five color terms, and color naming results by speakers of eight genetically and geographically separate languages in the World Color Survey (WCS) database, each with five colors terms. They found that the actual boundaries of color categories matched across these languages, concluding that the actual location of color category boundaries is constrained by universal forces. Existing studies on color terms have challenged the hypothesis of linguistic relativity (also known as the Sapir-Whorf

hypothesis) of color conceptualization, showing that it is the physiology of color perception and the experience of referents that shape color language.

In auditory perception, phonetic signals, such as phonetic and prosodic variation, voice quality, and onomatopoeia, also serve as the indexical mode of language, attributing sensuous qualities to speech registers via semiotic processes (Gal, 2013; Inoue, 2003, 2006; Lahti et al., 2014; Zhang, 2005, 2008). The sensuous properties of speech are manifested by metapragmatic labels drawing from a lexicon of qualities and characterizing from either insider or outsider perspectives (Gal, 2013). Take the insider perspectives on styles of political speech as examples: American contrasts '*plain* speaking' with the grand or high style (Cmiel, 1990); Fijian Indian distinguishes *shudh hindi* '*sweet* Hindi' (i.e., a rhetorically fashioned register) with *jangli bat* 'jungle talk' (as in *Talanoa* 'male gossip' with a rhythmic and rapid style) (Brenneis, 1984; Silverstein, 2005).

Take the outsider perspectives on language attitudes as illustrations: For English speakers, German sounds *ugly* and *harsh* due to their guttural consonants while Italian sounds *beautiful* and *soft* because of their euphonious vowels (Brown & Lenneberg, 1954; Giles & Niedzielski, 1998; Schoel et al., 2013). For male intellectuals of the Meji-era (i.e., in the late nineteenth and early twentieth centuries), Japanese schoolgirls' speech (teyo-dawa speech) was *sugary* and *shallow* owing to its fast, contracting, and bouncing with a rising intonation (Inoue, 2003, 2006). Beijing teenage girls' dentalization of palatals is interpreted as their phonetic performance of femininity (Hu, 1991). For Southern Chinese speakers, Beijing Mandarin is *oily* due to a lot of rhotacization or heavy r-sounding. Beijingers are commonly called as *jīng yóu-zi* 'Beijing Smooth Operator,' associating the lexical term *yóuhuá* 'oily and slippery' with the cultural icon of smooth and worldly-wise (Zhang, 2005, 2008).

The examples mentioned above reflect the semiotic processes by which the enregistered linguistic practices instantiate the iconic representations of specific social groups or activities, linking the situated enactment of conventional forms of abstract qualities with sense modalities, such as color to vision, taste, texture, and sound.

2.3 Sensory Depictions in Linguistic Forms

As indicated previously, Charles Peirce (1897/1940) identified three semiotic strategies, namely icons, indices, and symbols. His categorization specifies the types of signs used in the meaning-making process. In doing so, it laid the conceptual foundation for understanding the designation of perceptual contents as a vital part of the larger inventory of linguistic concepts. Several scholars have proposed that the three forms of semiotic strategies (i.e., iconicity, indexicality, and symbolism characterized by arbitrariness) are composite signals that combine two or more types of semiotic elements (e.g., Clark, 1996; Enfield, 2009; Kendon, 2014).

Among the semiotic strategies, iconicity has the strongest connection to the conceptualization of sensory perception via resemblance in the sense that the form of a sign resembles what that sign designates. In Japanese, there is a special class of words called mimetics, also known as ideophones or onomatopoeia, which can be used to describe a variety of meanings, such as animal sounds (にゃー *nyaa* 'meow'), textual experience (ねばねば *neba-neba* 'gluey; sticky'), and bodily-sensational experience (むずむず *muzu-muzu* 'itchy') (Iwasaki et al., 2016). These mimetic words are iconic form/sound-meaning associations represented by marked morphophonological forms.

Winter et al. (2017) explored the iconicity of 3,001 English sensory words and found that auditory and tactile words are more iconic than visual, olfactory and gustatory words. The results of the study suggest that certain perceptual qualities are more likely to be expressed iconically

than others. To better understand the linguistic codability of perceptual qualities across senses, Levinson and Majid (2014) address the importance of studying ineffability – "the difficulty or impossibility of putting certain experiences into words" (p. 408). Through the exploration of type and token frequencies, for instance, sight has been found to be the most codable sensory modality with more distinct perceptual qualities, whereas smell has been discovered to be the least codable sensory modality (Huisman & Majid, 2018; San Roque et al., 2015; Winter, 2019; Winter et al., 2018). It must be noted that "whatever the semiotic strategy, whatever the perceptual quality, there will always be things that are truly ineffable" (Winter, 2019, p.49).

The following subsections will introduce how sensory perceptions are encoded into words in terms of two linguistic practices: ideophone and synesthesia.

2.3.1 Ideophones

As far as the conceptualization of sensory experience is concerned, ideophone is a key concept in Linguistics. However, in parallel to the concept of qualia that has only recently started garnering attention in anthropology and related fields, ideophone has not received broad scholarly attention until recently. Ideophones, also known as mimetics or expressives, are formally marked words that depict sensory experiences and evoke vivid sensory imagery (Dingemanse, 2012, 2019). Ideophones have long been considered a peripheral phenomenon that can be attributed to two main reasons: 1) the immense impact of Saussurean's sign theory that prioritizes the arbitrary relationship between the signifier and the signified – a relationship that is the opposite of that held between the signifier and the signified in iconic and ideophonic signs, and 2) the scarcity of ideophones in most European languages, which have dominated in both theoretical and empirical research in modern linguistics (Akita & Pardeshi, 2019).

A substantive body of scholarly work on ideophones in non-European languages has been

ignored except when mimetics are referred to as curiosities of some "exotic" languages in contrast to the "rational" languages of Europe. It is unsurprising but ironic that European scholars are given much of the credit for the recent revival of ideophone studies after decades of work continued to accumulate, especially on Japanese. While a complex classification of ideophones into phonomimes, phenomimes and psychomimes has long been proposed in Japanese linguistics (e.g., Kakehi et al., 1996; Kita, 1997; Tamori, 1980; Tsujimura, 2001, 2005), the recent literature credited for the revival of ideophone studies has focused on onomatopoeia that depicts and mimics sounds in languages (e.g., Dingemanse, 2018; Thompson et al., 2021; Thompson & Do, 2019).

Ideophones are commonly regarded as iconic linguistic signs, presenting "a direct, unmediated connection between sound and meaning" (Dingemanse, 2019, p. 18). Winter (2019) points out two constraints to iconic expression in sensory language: selectivity and availability. First, iconic expression is selective in that "only parts of the perceptual whole are represented," lacking the complete resemblance between form and intended meaning (p. 21). Second, iconic expression is restricted by the availability and affordances of sounds and sound patterns in a language. As the inventories of conventionalized ideophones become enormous, it is arduous to exhibit direct and unmediated iconic associations. Therefore, not all iconic linguistic signs are ideophones and all ideophones may not be iconic to the same degree. This suggests that the association between ideophones and iconicity is shaped by language-specificity and mediated by social convention, extending beyond depictions of sound.

Through reviewing cross-linguistic studies on ideophones, Dingemanse (2019) indicated five key properties of ideophones that characterize natural language in general: open lexical class, structurally marked, conventionalized words, depictive mode, and sensory meanings. First,

ideophones are an *open lexical class* that welcomes new idiophonic additions. Second, ideophones are *structurally marked* words that are distinctive from other lexical words. Some common examples of marked forms are special phonotactics (e.g., *vroom* 'the sound of a car engine'), prosody (e.g., vowel lengthening as in *baaaang*), and morphological processes such as reduplication, which is particularly prominent in Japanese mimetics (i.e., sound-symbolic words). For instance, ざあざあ *zaa-zaa* is an inanimate phonomime (擬音語 *giongo*) that describes the sound of pouring rain or white noise; ぴかぴか *pika-pika* 'sparkling' is a phenomime (擬態語 *gitaigo*) that depicts the states or conditions of an object; わくわく *waku-waku* 'excited' is a psychomime (擬情語 *gijōgo*) that portrays the psychological state of feeling excitement (Akita, 2009, 2010; Akita & Pardeshi, 2019; Iwasaki et al., 2016). These structural properties mark the unique semiotic dimension and iconic representations of eventualities. Third, ideophones are *conventionalized words* that can be identified and defined. Fourth, ideophones are *depictive* in that they represent iconicity through the form-meaning mappings of their structural properties. Lastly, the meanings of ideophones reside in *sensory imagery*, involving both external perceptions and internal sensations.

While these five crucial properties of ideophones serve as the general criteria for characterizing cross-linguistic diversity in sensory depictions and allow identification and systematic comparisons between ideophones, they can be complemented by Akita's (2009) classification of mimetics into phonomimes, phenomimes, and psychomimes, which have proved to be productive in analyzing East Asian mimetics. As will become clear throughout this dissertation, the tripartite classification can be usefully applied. At the same time, the data from the Chinese language will in turn enrich our understanding of these concepts by showing the levels on which they operate in Chinese expressions of sensory perceptual qualities.

2.3.2 Synesthesia

Synesthesia is a sensory and neurological phenomenon in which stimulation of one sensory modality evokes another unstimulated sensory modality (Hubbard & Ramachandran, 2005). For instance, *sweet voice* as a cross-modal sensory experience describes an auditory stimulus in terms of taste. Synesthesia is a specific type of figurative language concerning the fluidity of sensory perception whereby the perception of one sensory domain is expressed by way of a concept from another sensory domain in a process of cross-modal interaction (e.g., Ramachandran & Hubbard, 2001; Ronga et al., 2012; Shen & Cohen, 1998; Strik Lievers, 2015; Strik Lievers & Winter, 2018).

While language conveys synesthetic transfers, such transfers are not limited to language. Synesthesia pertains more generally to perception and cognition. Scholars of aesthetics define synesthesia as a harmony of diverse sense impulses (Ogden et al., 1925) or a "unified sensibility so profound that the boundaries of the senses actually merge, and the multivariate sense qualities - colors, sounds, flavors, scents, tactile and thermal sensations - all seem to melt into a continuum of feeling" (Odin, 1986, p. 256).

What we know about synesthesia in the English language literature of linguistics is largely based on Ullmann's (1945, 1957) hierarchical and directional principle of sense transfers. Along this line of research, scholars have focused on the distribution and directionality of synesthetic metaphors in Indo-European languages (Ronga et al., 2012; Shen, 1997; Ullmann, 1945, 1957, 1964; Williams, 1976). Based on data from Chinese, Zhao et al. (2019) tested the directionality of synesthetic transfer and found language-specific directionality of cross-modal mapping in linguistic synesthesia. In a subsequent study, Zhao et al. (2022) investigated the similarities between linguistic synesthetic mappings and conceptual metaphoric mappings. They

argued that linguistic synesthesia is of metaphorical nature because mapping across sensory domains can be considered mapping across conceptual domains.

Previous studies on synesthesia primarily focused on modifier-head collocations at the phrasal level such as *sweet voice* and *loud color.* When the sensory modality of the modifier and that of the head noun do not match, a synesthetic transfer is clearly at work. For this reason, the phrasal level is the most obvious linguistic level at which to identify synesthesia. The directionality of synesthetic transfer can then be determined in terms of the mapping from the sensory domain of the modifier concept onto the sensory domain of the concept represented by the head noun. Thus, *sweet voice* exemplifies a direction from taste to sound, and *loud color* instantiates a direction from sound to vision. Do languages convey intersensory experience at other linguistic levels? As this dissertation will show, Chinese encodes synesthetic transfers in lexical networks that constitute a productive morphological construction representing the quality of sensory perception.

Overall, there is a dearth of research that has a bearing on the linguistic conceptualization of perceptual sensory qualities or qualia. There is also a lack of empirical systematicity both in terms of the type and the size of data used for analysis. For example, studies on Chinese synesthesia mainly draw on introspective data and dictionary entries and are therefore not representative of the linguistic usage in naturally occurring language.

CHAPTER III

THEORETICAL FRAMEWORKS

3.1 Construction Grammar

Central to the field of Cognitive Linguistics is the role of constructions that provide speakers with a mental network of schematic and substantive patterns in language. Language is believed to be grounded in embodied human experience and language-independent cognitive processes, consisting of form-meaning pairings of symbolic structures (Langacker, 1987, 1988). Construction Grammar views language as a system of constructions defined as:

> "Any linguistic pattern is recognized as a construction as long as some aspect of its form or function is not strictly predictable from its component parts or from other constructions recognized to exist. In addition, patterns are stored as constructions even if they are fully predictable as long as they occur with sufficient frequency."
>
> (Goldberg, 2006, p. 5)

Constructions are not restricted to phrases and sentences but span the entire lexicon-syntax continuum (Fillmore et al., 1988; Goldberg, 1995, 2006, 2019). Construction Grammar eliminates the artificial boundaries between the lexicon and the grammar and as such can account for the totality of our linguistic knowledge including formulaic and idiomatic structures that are jettisoned in "words and rules" binary approaches to language. No two languages have the exact same constructions. Croft (2001) argues that all grammatical categories are language-specific and construction-specific. At the heart of constructionist approaches to grammar is the notion that the meaning of the construction as a whole symbolic unit is larger than the sum of the meanings of its components. This view distinguishes Construction Grammar from compositionist structural linguistics and rule-based generalist linguistics.

Along with the development of constructionist approaches, scholars have pursued a variety of research topics, such as speakers' construal of situations (Goldberg, 1995; Lakoff, 1987; Langacker, 1987, 1988; Michaelis, 2004), the interrelationship among semantics, information structure and pragmatics (Goldberg, 1995; Lakoff, 1987; Lambrecht, 1994; Langacker, 1988; Talmy, 1988), categorizations or generalizations over exemplars (Abbot-Smith & Tomasello, 2006; Lakoff, 1987; Talmy, 2000; Taylor, 1989), and the role of social cognition and bodily experience (Croft, 2009; Lakoff & Johnson, 1980; Tomasello, 2008).

Constructionist approaches, considering language as a system of conceptual representations, have been proposed to study all aspects of grammar, including low-frequency or unusual constructions that might be regarded as periphery or residue in other theories. Within constructional approaches, each approach has distinctive perspectives in terms of psychological plausibility, the role of motivation and rigid formalization despite sharing several general concepts and principles (Boas, 2013). In contrast to generative grammar which relies on innate universal principles, constructionist approaches highlight crosslinguistic variability in constructions. In other words, unlike generative grammar, which postulates a certain set of rules innate to humans, constructionist approaches propose constructions are diverse in languages, emerging from generalizations over language use and contextualized events.

Construction Grammar has been widely applied to the study of phrasal and grammatical constructions across languages including Chinese. However, constructionist research on morphology is still scarce. Booij (2005, 2009) showed that construction grammar can be productively applied to morphological analysis. Tsujimura and Davis (2011) applied the framework to a family of innovative denominal verb constructions in Japanese. Systematic constructionist studies on Chinese morphology remain few and far apart. Research on Chinese

ABB morphological construction is drastically neglected perhaps due to its trisyllable as the continuum between word and syntax. As this dissertation will illustrate, the meaning of Chinese ABB morphological construction should be studied as a whole, rather than merely depending on its head-adjective.

In the following subsections, I will introduce two prevailing models of the representation of constructions as linguistic knowledge that can be fruitfully used for the study of the ABB morphological construction. They are 1) usage-based and 2) exemplar-based models, which explain the process of conventionalization of form-function pairings in linguistic representation. Both models indicate the crucial role of frequency of use and probabilistic learning in language, and offer important insights into how speakers generalize over utterances they have heard based on form-function correspondences (Bybee, 2006, 2010, 2013; Goldberg, 2006, 2019; Tomasello, 2003).

3.2 Usage-Based Model

Allying with Cognitive Linguistics and Construction Grammar, the usage-based model considers fundamental linguistic units, including syntactic schemas, idioms, morphology, word classes, and lexical items, as "constructions that vary along a continuum of specificity" (Ibbotson, 2013, p. 2). The usage-based model emphasizes the association between language experience and cognitive representations, arguing that a speaker's linguistic knowledge is based on actual usage and generalizations made over usage events (Bybee, 1995, 2006, 2010, 2013; Goldberg, 1995, 2006, 2019; Langacker, 1987; Tomasello, 2003).

The fundamental premise of the usage-based model is the application of domain-general cognitive processes in human language, e.g., categorization, cross-modal association, and neuromotor automation (Bybee, 2006, 2010, 2013). Bybee (2010) identified several cognitive

processes that influence the use of linguistic structure: categorization, chunking, rich memory, analogy, and cross-modal association. First, categorization refers to the identification of tokens as examples of a particular type. Next, chunking refers to the formation of sequential units through repetition and practice. Third, rich memory refers to the storage of detailed information based on experience. Fourth, analogy refers to the mapping of an existing structural pattern onto a novel instance. Last, cross-modal association refers to the cognitive capacity to connect form and meaning. These cognitive processes accentuate the importance of cognitive commitment in linguistic structure, formed by the repetition of specific linguistic patterns in language use.

From the perspective of the usage-based model, constructions are processing units, sequences of words or morphemes, that have been used frequently enough to be accessed together, even when they do not have idiosyncrasies of meaning or form (Bybee, 2006, 2010, 2013; Goldberg, 2006, 2019). It is through the interaction of cognition and usage, rather than language-specific instinct, that leads to the complexity of language. Since language users' mental representation and morphosyntactic structure are shaped by linguistic experiences, such as the frequency of use with certain constructions (e.g., Abbot-Smith & Tomasello, 2006; Bybee, 2013; Goldberg, 2013), this usage-based model provides an optimal theoretical approach for studying the creativity and productivity of the ABB morphological construction which portrays qualia in Chinese.

3.3 Exemplar-Based Model

Exemplar-based model, which focuses on individual category judgments in memory storage, has been adopted from the field of Psychology to Construction Grammar. The exemplar-based model argues that "each token of experienced linguistic behavior has an impact on cognitive representation" (Bybee, 2013, p.51). Exemplars refer to categories formed from tokens

of experience that are grouped together by similarity. In addition, exemplars may differ in strength, depending on the number of tokens that comprise them in that a large number of tokens forms the center of a category.

Central to the exemplar-based model of linguistic representations is the frequency of occurrence of tokens in linguistic experience. Token frequency is the number of times a particular string occurs in a text of corpus, while type frequency is the number of items that occur in a slot. The central members of the categories are determined by items with higher token frequency within a construction, which further leads to the extensions of the construction. Type frequency plays a significant role in the representation of a construction in that it relates to productivity. In particular, "the higher the type frequency of a construction, the more likely it is to occur with a novel item" (Bybee, 2013, p. 57).

In the view of exemplar-based models, memory storage for linguistic experience (e.g., the use of tokens, forms, and contexts) leads to the emergence of the general categories and units of grammar. An exemplar-based model of language links different domains based on co-occurrence in experience, creating the form and meaning correspondences that constitute constructions (Bybee, 2006, 2010, 2013). According to Bybee (2013), "with sufficient strength among the semantic exemplars for a construction, the inference can become conventionalized as part of the meaning of the construction" (p. 53). Exemplar-based representations of constructions preserve a list of all the words experienced in a schematic slot in a construction, which allows for the item-based extension of new lexical items. The extension leads to a family resemblance structure among the lexical items, constituting a schematic category in a construction (Bybee, 2006, 2010, 2013).

Exemplar-based representation, complementary to the usage-based model, clarifies the

dynamic properties of constructions, such as their emergence from other constructions and change with usage events. Drawing from both usage-based and exemplar-based models, this dissertation will display the conceptual network of ABB morphological construction in Chinese, where one exemplar can lead to another exemplar based on the family resemblance structure between the lexical items, and thus generate high type frequency. Having solidified the framework of construction grammar, the last subsection addresses the relationship between sensory perception and embodiment in languages.

3.4 Embodiment

Embodiment, the experiential and bodily substrates of language, plays a significant role in grounding and shaping human cognition. Johnson (1987, 1999) indicated that human conceptualization and reasoning are grounded in bodily experience, following three levels of embodiment: neurophysiological, cognitive unconscious, and phenomenological. According to Johnson (1999), "in the embodied mind, abstract reason is not separate from the sensorimotor system, but rather builds on it." It is through the metaphorical extensions of basic sensorimotor structures that human can acquire abstract concepts.

A great deal of experimental and neuropsychological research into language-induced perceptual simulation has supported embodied semantic representations, showing that language mirrors perception and engages modality-specific representations in the brain (Goldberg et al., 2006; González et al., 2006; Hauk et al., 2004; Lacey et al., 2012; Pulvermüller, 2005; Stanfield & Zwaan, 2016; Winter, 2016). For example, Goldberg et al. (2006) asked native American-English speakers to verify perceptual properties of word items from one of four sensory modalities. They found that the retrieval of sensory knowledge (i.e., tactile, gustatory, auditory, and visual knowledge) was associated with increased blood flow in brain regions that encode the

corresponding sensory experiences.

Most importantly, Winter (2019) proposed the Embodied Lexicon Hypothesis, arguing "the ways that sensory words are used should reflect patterns independently observed in perception *precisely* because words engage perceptual processes" (p. 59). The following commitments of the Embodied Lexicon Hypothesis is provided by Winter (2019):

(a) words activate sensory-motor representations, and

(b) those sensory-motor representations partly determine word choice. As a result of this,

(c) language comes to reflect sensory-motor processes in its structure, as well as in language use. (p. 59)

The Embodied Lexicon Hypothesis not only acknowledges the engagement of perceptual simulations in word processing, but also advocates the examination of linguistic patterns occurring in natural language as they follow embodied principles.

Focusing on the qualities of sensory perception, as this dissertation will show, the phenomenal qualities of experience encoded in the Chinese ABB morphological construction is truly an embodied experience. Because sensory perception is fundamentally embodied, the cognitive principle of embodiment introduced in this section offers a theoretical tool to account for the observation of linguistic facts regarding the depictions of the perceptual sensory qualities or qualia.

CHAPTER IV

METHODOLOGY

This chapter describes the data collection procedures and methods used in investigating the linguistic representation of qualitative aspects of sensory experiences in Chinese. As mentioned in Chapter 1.3, this dissertation concentrates on the schema [ABB] which is a productive family of reduplication-based morphological constructions frequently used to depict the qualitative properties of sensory experiences. In the section that follows, I will describe the procedures for collecting the linguistic data and compiling subcorpora for further analyses.

4.1 Corpus Data

The current study makes use of the Chinese Web Corpus (zhTenTen17), Simplified version on Sketch Engine.[1] The zhTenTen17 Simplified corpus, which comprises more than 13.5 billion words, is made up of texts (written language of standard Chinese, simplified character) crawled from 40 million web pages and 127,639 websites in 2017.[2] This web corpus is selected as data source due to its authenticity (language produced for sharing information among ordinary people), diversity (a broader range of texts), and size (the samples are large enough for addressing the linguistic phenomenon under investigation).

Since there is no part-of-speech (POS) tagging for identifying the ABB reduplication-based morphological constructions in Chinese on Sketch Engine, four procedures were performed to retrieve all the types of [ABB] pattern. First, I employed the "Thesaurus" function

[1] For details on zhTenTen17, see the corpus description https://www.sketchengine.eu/zhtenten-chinese-corpus/.

[2] The websites are crawled from 160 domains. The two main domains are .com (46.1%) and .cn (44%).

and input the 200 types of [ABB] pattern found in a pilot study,[3] as well as to examine all the synonyms or similar words that generated.[4] A total of 291 types of [ABB] pattern that collocate with nouns were discovered. Second, I analyzed the types of the A-part among the 291 items and retrieved 117 A-types (See Appendix A for the 117 A-types). To confirm that all types of [ABB] pattern are collected from the zhTenTen17 Simplified corpus, I conducted an advanced CQL concordance search by exploring each A-type with its context of two characters to the right (search query: [word = "A.."]) on Sketch Engine.[5] I then sorted all key word in context (KWIC) through the advanced frequency function and created a list of [A--] types where [--] was an open slot that might contain a duplicated character or two different characters. A maximum of 1,000 types ranked by frequency were generated based on the KWIC identified in the corpus.[6]

Third, I manually inspected and filtered all ABB types found in each [A--] list. Eliminated were the false-positive items that did not match the ABB reduplication-based morphological construction, such as words with two different characters in the open slot (e.g., *hónglǜdēng* red-green-light 'traffic light'), words that had the reduplicated BB-part but did not

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[3] For details on Thesaurus, see the blog https://www.sketchengine.eu/blog/automatic-thesaurus-synonyms-for-all-words/.

[4] Initially, BCC (Xun et al., 2016, http://bcc.blcu.edu.cn/), a large corpus of approximately 15 billion words collected from a variety of Chinese discourse types, was selected for this study. BCC has part-of-speech tagging for stative words (z) and onomatopoeic words (o). Through examining the refined search of 'Multiple Fields' and the search query of "(z){len($1)=3}" (155 types) and "(a)(o){len($1)=3}" (45 types), 200 types of [ABB] pattern are identified. However, only 37 types of [ABB] pattern with 30 A-part and 22 BB-part are found in a further search of the nouns that collocate with stative words "(z) *de* (n) {len($1)=3})" (*de* is a modifier). Thus, BCC is not selected for further research due to the limited contexts.

[5] The Corpus Query Language (CQL) is a unique code or query language for searching complex grammatical or lexical patterns on Sketch Engine.

[6] Only the first 1,000 items in a list can be generated for preloaded corpus on Sketch Engine. As the goal of this study is to identify common ABB types used in Mandarin, the limitation does not affect the process of identifying the ABB types. The first 1,000 items seem to be an ideal number because many low frequency ABB types with a frequency range between 1 to 50 were found in the lists.

qualify for a qualia construction (e.g., *yuándiăndiăn* circle-dot-dot 'dot'), and those that were not a three-character word (e.g., *lán-guāng'guāng* 'blue-light' which was found to be *lánguāng guāngpán* 'blue disk' in the context). Last, I compiled a list of ABB words with their frequencies for each A-type and downloaded a maximum of 10,000 concordance lines from each identified ABB word to create my own corpus and dataset.[7] Through combining all the ABB words from each list, I found a total of 1,007 types of [ABB] pattern (size: 1,245,789) that are used to express one's experience of sensuous qualities (i.e., qualic evaluation). The top-ranked 100 types of [ABB] pattern is shown in Appendix B.

4.2 Corpus-Based Collocation Measures

To investigate the collocations of the ABB reduplication-based morphological constructions, the 1,007 types of [ABB] pattern with their corpus frequencies (i.e., the total token frequencies found in the zhTenTen17 Simplified corpus) were imported and processed in Spyder (Python 3.9.7).[8] Since the meaning of the whole [ABB] construction cannot be derived from the sum of the meanings of the participating morphemes, it is crucial to assess whether and how the A-part and the BB-part contribute to the formation of a qualia construction. Therefore, I further retrieved the A-part and the BB-part from the 1,007 types of [ABB] pattern.

In total, 117 types of A-part and 507 types of BB-part were detected. I then created a "A_collocates" corpus which contains 117 subcorpora of [A--] constructions with their ABB

[7] Note that zhTenTen17 is a preloaded corpus which only allows to view 10 million and download 10,000 concordance lines from one concordance for free. In fact, most ABB types have less than 10,000 concordance lines. Therefore, I was able to retrieve all or most concordance lines from each ABB type.

[8] Spyder is an open-source integrated development environment (IDE) for scientific programming in Python.

types and concordance lines.[9] For example, the word *shī* 'wet' in [*shī*-BB] construction has 37 ABB types (e.g., *shī-lùlù* 'waterlogged' and *shī-línlín* 'drenched'). For each ABB type in each [A--] construction, I tokenized the words in its concordance lines and recalculated the token frequency of each ABB type, as well as the subcorpus size of each [A--] construction. By doing so, I ensure that the quantitative frequency data retrieved from the self-constructed "A_collocates" corpus are valid and informative.

According to both usage-based and exemplar-based models, the frequency of language use plays a significant role in shaping language users' linguistic representation and morphosyntactic structure (see theoretical frameworks in Chapter III). Thus, I extracted the collocates of each A-part within [A--] construction and the collocates of BB-part within [-BB] construction, as well as calculated their type frequencies, token frequencies and construction frequencies. Type frequency is the number of distinct lexical items that occur in a specific construction. It governs the strength of the [ABB] pattern in that higher type frequency in the input leads to greater productivity of the schema (Bybee, 1995, 2006; Goldberg, 2006, 2019). Token frequency is the number of times a particular type occurs in the corpus. It is an indicator of the degree of lexical strength and entrenchment. Construction frequency refers to the frequency of [A--] or [-BB] constructions in the corpus.

In this study, I evaluated collocations using four statistical measures that commonly employed in corpus linguistics research (Bestgen & Granger, 2014; Gablasova et al., 2017; Stefanowitsch, 2020; Xiao, 2015). The statistical measures are raw/absolute frequency counts and three strength-of-association measures – *t*-score, Mutual Information (MI) score, and the *G*

[9] Text files with a maximum of 10,000 concordance lines from each identified ABB word downloaded from Sketch Engine were classified into the 117 [A--] folders.

value of the log-likelihood ratio test. Raw frequency indicates the number of occurrences or the overall repetition of language use in a corpus. Although raw frequency helps understanding the frequency of a word or phrase, it does not take into account the size and frequency distribution of a word across different text types in a corpus. For instance, a corpus that has a vast range of words may have a relatively low frequency counts for any given word, but this does not imply a particular word is insignificant or irrelevant to the corpus. To gain information on the context and relationships between words, therefore, I adopt other three strength-of-association measures. The following subsections introduce each specific association measure and the aspect of formulaicity that it lays emphasis on.

4.2.1 T-test

The *t*-score measures the certainty that two words are associated, highlighting frequently occurring collocations or word pairs. The *t*-score is calculated by contrasting the actual observed frequency of a word or phrase within a corpus with what the expected frequency would be if it occurred by chance. The *t*-score, as an adjusted value of collocation frequency, is computed using the following equation (Xiao, 2015, p. 109):

$$t.score = \frac{\overline{x} - \mu}{\sqrt{\frac{S^2}{N}}} \quad (1)$$

In equation (1), $\overline{x}$ refers to the mean of the sample, μ represents the expected mean, S^2 is the sample variance, and *N* signifies the sample size. Despite considering the corpus size in identifying meaningful collocations, it is worth noting that the *t*-score, not operating on a standardized scale, cannot directly be used to compare collocations across different corpora (Gablasova et al., 2017).

4.2.2 Mutual Information

Another measure of collocational strength, which can be used to compare collocations across different corpora, is Mutual Information (MI) score. The MI-score is "a logarithmic scale to express the ratio between the frequency of the collocation and the frequency of random co-occurrence of the two words in the combination" (Gablasova et al., 2017, p. 163). In other words, the MI-score is a logarithmic index of the relationship between the frequency at which the two words appear together as a collocation and the frequency at which they would appear together randomly. The MI-score measures restrictive collocations (i.e., those that made up of infrequent words),[10] highlighting rare exclusivity of the two words associated. The MI-score is calculated as the logarithm by dividing the observed frequency of two co-occurring items with its expected frequency. The formula is presented as follows (Xiao, 2015, p. 109):

$$MI = \frac{\log\left(F_{n,cN} / F_{nF_c} S\right)}{\log 2} \qquad (2)$$

In equation (2), $F_{(n)}$ represents the frequency count of the node (i.e., a specific unit within a corpus). $F_{(c)}$ refers to the frequency of the collocate. $F_{(n,c)}$ stands for the co-occurrence frequency of the node and collocate in the defined span. *N* denotes the sample size or the overall number of words in a corpus. The higher the positive value of the MI-score, the stronger the exclusivity and the strength of association between adjacent combinations (Gablasova et al., 2017; Xiao, 2015).[11]

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[10] It should be noted that MI overemphasizes or overestimates some collocations over others due to rare events (i.e., infrequent nodes or collocates) (Gablasova et al., 2017, p. 160; Stefanowitsch, 2020, p. 227).

[11] According to Gablasova et al. (2017), exclusivity refers to "the extent to which the two words appear solely or

4.2.3 The log-likelihood ratio test

While collocations with high *t*-scores underscore high-frequency collocates, those with high MI-scores tend to overemphasize low-frequency collocates. To address the weaknesses found in association measures that are commonly used in collocational research, e.g., the overestimation of rare events or low-frequency items caused by the chi-square test and MI, Dunning (1993) suggests using the log-likelihood ratio test. By calculating the statistical test scores on a contingency table that includes both rare and common lexical items as collocates, the log-likelihood ratio test can effectively deal with a small sample size in a corpus, rather than assuming the normal distribution of data.

The *G* value of the log-likelihood ratio test has been regarded as a reliable association measure in collocational research that deals with small samples and small expected frequencies (Read & Cressie, 1988; Stefanowitsch, 2020). Specifically, the *G*-score of the log-likelihood ratio test is obtained through calculating for "each cell the natural logarithm of the observed frequency divided by the expected frequency and multiply it by the observed frequency," and then add up all the results in the contingency table and multiply the result by two (Stefanowitsch, 2020, p. 227). A commonly used formula for calculating the G value is shown as follows (Read & Cressie, 1988, p. 134):

$$G = 2\sum_{i=1}^{n} O_i \log_e\left(\frac{O_i}{E_i}\right) \quad (3)$$

predominantly in each other's company," considering the co-occurrence frequency of the two words are seen together in the corpus (p. 160).

To examine the words that collocate with each ABB type, I set a span of three characters on the right side of each ABB type and conducted the three strength-of-association measures mentioned above.[12] In addition, I retrieved a random sample of 50 concordance lines of each ABB type with its context of 15 words to both the left side and the right side for further qualitative analysis.

4.3 Collostructional Analysis

Collostructional Analysis (CA), a more advanced and complex association measure of frequency in constructions, is proposed by Stefanowitsch and Gries (2003). CA is an extension of existing collocation-based methods for studying the relationships between word constructions and the grammatical structures in which they occur (Gries, 2012; Stefanowitsch, 2013; Stefanowitsch & Gries, 2003, 2009). Traditional collocational analyses tend to manually inspect the node word's collocates, relying on high raw frequencies of collocates to sort out relevant results from accidental ones. However, this approach fails to recognize that "the more abstract constructions often do not contain any specific morphological or even lexical material that would allow the researcher to identify them" (Stefanowitsch & Gries, 2003, p. 214).

To solve the issue, Stefanowitsch and Gries (2003) developed collostructional analysis as a quantitative approach to the syntax-lexis interface. Adopting the perspective of constructionists, CA considers both lexicon and grammar as made up of linguistic signs, i.e., form-meaning pairs. Through targeting a particular construction and investigating which lexemes occur more or less frequently than expected, CA not only provides an objective way of identifying the meaning of a construction but also helps determine "which lexemes are strongly

[12] Most nouns in Mandarin are disyllabic words that are formed by two Chinese characters.

attracted or repelled by a particular slot in the construction" (Stefanowitsch & Gries, 2003, p. 214). CA offers a systematic and robust quantification of the degree of association between the collexeme and the construction, taking the overall frequencies of a given word in the corpus into account when measuring the strength of association. This greatly helps determine the cue validity or the most typical collocates of a construction as the basis for further qualitative semantic study.

To understand the relations between [ABB] patterns and the lexical items that occur inside a particular [A--] or [-BB] construction, I examined four types of frequency data and retrieved the G score of the log-likelihood ratio test by conducting a simple collexeme analysis.[13] The four types of frequency data are the frequency of collocation, the frequency of the A- or BB-collocate, the frequency of the [A--] or [-BB] construction, and the total token frequency of [ABB] patterns found in the corpus. A detailed description of how the simple collexeme analysis was conducted will be provided in the following chapter.

4.4 Semantic Clustering

In addition to the quantitative analysis of the [ABB] construction, this study analyzed semantic clusters, which are sets of semantically and syntactically similar words, as qualitative data to determine the schematicity of the [ABB] construction. Schematicity refers to the schematic patterns of mental structure or schema that extract from the commonality of specific experiences and organized information. For instance, the adjectives that are associated with temperature such as *rè* 'hot,' *nuǎn* 'warm' and *lěng* 'cold' can be classified into the same semantic cluster under the sensation of touch.

[13] In corpus analysis, the log-likelihood ratio test is a statistical method that is used to detect significant differences in word usage across two or more corpora. See Read and Cressie (1988) for more details on the log-likelihood ratio test.

Semantic clustering provides a window into the process of how related words or phrases are categorized and stored together in our mental lexicon. By investigating how the frequency of tokens of linguistic experience are clustered together, the results are expected to reveal the semantic conceptual relations underlying the [ABB] construction. In this study, the 117 A-types extracted from the [ABB] construction in the corpus are meaningful lexical words that could serve as prototype adjectives, forming various qualitative aspects of perceptual experiences. Hence, I explored the lexical semantics of each type of the A-part through WordNet, which is a lexical database that organizes and ranks words according to their semantic relationships. A major advantage of the WordNet analysis is that it provides a precise and systematic way to categorize semantically related words based on their ontological hierarchical structure rather than intuitive judgment. In the following paragraphs, I will describe how the semantic clusters are discovered and determined based on the 117 A-types found in the [ABB] construction.

4.4.1 WordNet

Perhaps the most comprehensive and widely used WordNet is the English lexical database provided by Princeton University.[14] Despite a few Chinese lexical databases being established, e.g., Chinese Open Wordnet (Wang & Bond, 2013) and Chinese Wordnet (Huang & Hsieh, 2010), the extent to which the source and richness of text collected remains underdeveloped. To identify the semantic meaning of 117 A-types within the [ABB] construction (shown in Appendix A), first, I searched the senses and lexical semantic relations of

[14] WordNet, as a machine-readable dictionary, is a lexical database that classifies English nouns, verbs, adjectives, and adverbs into sets of cognitive synonyms (synsets), each demonstrating a lexicalized concept (Miller, 1995). WordNet can be freely downloaded for natural language processing under WordNet 3.0 license or accessed through the online interface at http://wordnetweb.princeton.edu/perl/webwn.

each A character in Chinese Wordnet (CWN).[15] Specifically, I installed the Python package of CWN (CwnGraph 0.3.0) and queried the word senses of each A character. I then rewrote the query results as a list, which includes synonyms and word senses of each A character, to separate text files in a document named "A senses." Next, I annotated the hypernyms and synonyms of 117 A characters in a spreadsheet using Excel.

Although the sets of synonyms (i.e., synsets) and lexical semantic relations of each A character can be discovered via CWN, there are some issues in terms of retrieving hypernymy for further analysis. The term hypernym refers to a word that describes a broader concept or category than another word (hyponym). For example, "color" is a hypernym of "black," "white," "green," and "yellow." It is important to investigate hypernymy because it informs the hierarchical structure of words based on their semantic relations within synsets. A hypernym can be regarded as a schematic concept that helps determine semantic clusters and categorizes the 117 A-types within the [ABB] construction. In this study, however, the hypernyms of some A characters are missing from CWN. In addition, it is difficult to classify some A characters into semantic clusters because they have multiple hypernyms.

To provide each A character a rigorous hypernym, I looked up the textual data stored in "A senses" and scrutinized the word senses of each A-type. I then manually translated each Chinese A-type to its English lexical equivalents. Additionally, I consulted available online bilingual dictionaries (Chinese-English or English-Chinese) to ensure that the default lexical

[15] Chinese Wordnet (CWN) is a linguistic project developed by Huang and Hsieh (2010) that aims to offer a comprehensive database of sense distinction and lexical semantic relationships in Chinese. The corpus data of CWN is an open source that can be downloaded and processed in Python (CwnGraph) for academic purposes. The CWN website for online query can be found at https://lopentu.github.io/CwnWeb/#cwn-query.

meaning of each translation equivalent is accurate.[16] Next, I input the English lemmas, which are the lexical equivalents of 117 A-types in Chinese, into the search query of Open English WordNet.[17] Lastly, I manually examined and annotated the hypernym(s) found for each English lexical equivalent.

To put semantically similar words into groups, first, I did a cross-reference analysis and mapped the symmetric relations between word forms among 117 A-types. For example, *shī* 'wet,' *gān* 'dry' and *cháo* 'damp' are found to be synonyms or antonyms which have lexical semantic relations based on Chinese Wordnet. Although the hypernyms of these A-types cannot be found in Chinese Wordnet, further exploration of their English lexical equivalents through Open English WordNet showed that they share the hypernym 'humidity." Therefore, the results obtained from both wordnets, either based on synonyms or hypernyms, suggest that these three words should be classified into the same category.

As this dissertation seeks to investigate sensory depictions in linguistic forms, semantic clusters in this study are created in a broader sense, focusing on bodily sensations. Through inspecting the hypernyms annotated for the 117 A-types, as well as their ABB types in the "A_collocates" corpus, I created umbrella terms for categorizing sets of conceptually related hypernyms. Most importantly, I identified various perceptual qualities underlying the five senses. This semantic clustering analysis of 117 A-types plays a pivotal role in revealing the

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[16] Note that there is a Bilingual Ontological Wordnet (Sinica BOW) developed by the Academia Sinica in Taiwan (Huang et al., 2004): http://bow.sinica.edu.tw/. Through integrating three resources (i.e., WordNet, English-Chinese Translation Equivalents Database, and Suggested Upper Merged Ontology), Sinica BOW seems to be a good source for bilingual lexical access to knowledge. However, the site is closed and cannot be accessed at this point.

[17] Open English WordNet is an open-source model developed based on the Princeton WordNet (McCrae et al., 2019). Perhaps this open-source WordNet is the most up-to-date model because it has been continuously updated by people around the world via GitHub. See https://github.com/globalwordnet/english-wordnet.

schematicity and the sensation underlying the [ABB] construction. According to the analysis, a total of 67 A-types, which represent 57.3% of the whole A dataset, are directly associated with the five senses. The semantic clusters of the five senses with their perceptual qualities described by A-types are extracted and presented in Appendix C.

4.5 Summary

This dissertation is a data-driven interdisciplinary study to undertake systematic corpus-based quantitative and qualitative analyses based on data from a large corpus and the use of sophisticated computational analysis tools. The self-constructed "A_collocates" corpus, which gathered textual data from a large Chinese Web Corpus (zhTenTen17), permits in-depth semantic and collocational analyses of a productive family of reduplication-based morphological construction, as well as their frequency distribution in natural language. The corpus-based collocation measures were used to assess the strength of collocational relationships between words and capture the most typical collocates of a construction. The cross-lingual WordNet analyses were conducted to allow a deeper insight into the ontological hierarchical structure of each sensory adjective and clarify the word senses for further semantic clustering.

In this dissertation, two programming languages, Python and R, were used for data processing and visualization. Data processing and analyses were mainly conducted in Spyder (Python 3.9.7). Data visualization, including the color-vision network (Chapter V) and the distribution of synesthetic transfers (Chapter VII), was generated using RStudio (R version 4.2.2). The innovative methodological framework presented in this chapter provides one of the first investigations into how the qualitative properties of perceptual experiences are conceptualized in Chinese morphological constructions and enregistered in linguistic practices.

CHAPTER V

COLOR CATEGORIES IN CONCEPTUAL SEMANTIC NETWORK

Color, which plays an influential and essential role in human lives, has been a major area of interest across several disciplines, including anthropology, cognitive science, linguistics, philosophy, and psychophysics. A color lexicon, which consists of color terms used within a language community, is commonly applied along with other category terms associating with the color quale for color references, e.g., the blueness of the sky (Lindsey & Brown, 2021). The creation of color lexicons reflects the need for communication and allows language users to understand a color reference regardless of the variance between their color perception.

The existing literature on color is extensive and focuses particularly on color naming and color categories (Berlin & Kay, 1969; Heider, 1972a; Kay et al., 2009; Kay & McDaniel, 1978; Levinson, 1997; Wierzbicka, 1990, 2006). How colors are categorized and conceptualized across languages and cultures has long been a question of great interest in a wide range of fields. To date, various approaches have been developed and proposed to study color conceptualization, including but not limited to basic color term theory (Berlin & Kay, 1969), typological evolutionary model (Kay & Maffi, 1999), the Vantage theory (MacLaury, 1997), conceptual semantics (Jackendoff, 1997, 2010), cognitive grammar (Langacker, 2008), and the Natural Semantic Metalanguage (Wierzbicka, 1990, 2006).[18] Despite the advances in theoretical approaches, the linguistic mechanisms that underpin color conceptualization are not fully understood.

This chapter contextualizes the research by providing background information on color

[18] For a comprehensive collection of cross-linguistic studies on color language and categorization, see Paulsen et al. (2016).

perception and cognition. The first section of this chapter introduces how phenomenal qualities of perceptual color-vision experience are accessed from a psychophysical perspective. What follows is an overview of the existing literature on lexical color categories, debating the universal patterns in cross-cultural color naming. It will then identify research gaps and explain how the current study will help to address them.

5.1 Color Perception and Cognition

5.1.1 Color attributes

Human perception of color is highly related to qualia in that color is a byproduct of visual sensation and evaluation determined by the quality of light (i.e., wavelengths) in the visual spectrum. In general, there are three psychophysical dimensions of color: hue, saturation (chroma or purity), and value (brightness or lightness) (Burns & Shepp, 1988; Melara et al., 1993; Pridmore & Melgosa, 2015; Wyszecki & Stiles, 1982). Hue is the attribute of light manifested in wavelengths and perceived as a color of shade (e.g., red, green and blue). Saturation implies the purity or the dominance of a hue. Value refers to the lightness and darkness of a hue, indicating the quantity of light and the degree of reflectivity at present. These three attributes play a pivotal role in color communication, allowing speakers to describe variances between similar colors in a semi-systematic way.

5.1.2 The mechanisms of color vision

Color vision, a visual perceptual capacity found in animals, is mediated by the spectral distributions of light with the differential spectral sensitivity of the photoreceptor cells in the retina (Jacobs, 2013; Wooten & Miller, 1997). The photoreceptor cells can transform light into visual signals and allow us to detect different physical specifications of color (e.g., light absorption and reflection). Specifically, the visual perception of color is stimulated by the visual

photopigment sequestered in the outer segment of retinal photoreceptors: rods and cones.

Rod cells are sensitive to light levels and are responsible for vision under low light conditions (i.e., scotopic vision). It is the molecule of photopigment in the human retina that absorbs quanta and leads to the visual perception of light. The light-sensitive receptor protein in the rod cells, rhodopsin or visual purple, functions as the primary photoreceptor molecule of vision and helps us see things under dim-light conditions by increasing our light sensitivity. However, one can only experience shades of gray (i.e., achromatic color) under dim-light conditions because the photopigment in the rod cell cannot help us perceive chromatic colors.

On the contrary, cone cells are less sensitive to light and are responsible for vision at higher light conditions (i.e., photopic vision). They can detect a wide spectrum of light photons that are crucial to color vision. The perception of color is initiated by three types of photopigments located in the cone cells that detect various wavelengths of light. They are generally classified as L-cone (red, 640 nm), S-cone (blue, 470 nm), and M-cone (green, 530 nm).[19] The three-pigment system, differing in the relative spectral absorption curve, allows us to distinguish different spectral distributions of wavelength (i.e., the quality of light) and hue sensations (Wooten & Miller, 1997). It is worth noting that red, green, yellow, and blue are regarded as the four elemental, indivisible hue sensations which cannot be perceptually analyzed into further components (Sternheim & Boynton, 1966; Wooten & Miller, 1997).[20]

As far as the psychophysical mechanisms of color vision are concerned, color perception

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[19] The three quantal emission rates of wavelengths listed are considered good choices by Wooten and Miller (1997, p. 65).

[20] Hering's opponent-process theory considers colors as "perceptual blends resulting from varying degrees of chromatic (red or green and blue or yellow) and achromatic (black and/or white) activation" (Wooten & Miller, 1997, p. 70). However, the proposed model of the sensory process is questionable because hue sensations cannot be directly measured. See Jameson and D'Andrade (1997) for other arguments against the opponent-process theory.

should be the same across humans. The universalist view of color perception argues that human perception of hue is innate because all human beings share the same physiological processes in color cognition (Berlin & Kay, 1969; Bornstein et al., 1977; Kay et al., 1991; Ratliff, 1976). Questions have been raised about the diversity of linguistic expression of color across languages. A much-debated question is whether there are universal constraints on the development of color terms. The following section reviews the existing body of research on the two contradictory theories in the color naming debate: linguistic universality and linguistic relativity.

5.2 Color Naming and Categorization

5.2.1 Linguistic relativity

The investigation of color cognition is a continuing concern across several disciplines. Numerous studies have examined the influence of color lexicon on human perception and cognition, attempting to testify the Sapir-Whorf hypothesis by studying the system of color categories (Berlin & Kay, 1969; Brown & Lenneberg, 1954). The Sapir-Whorf hypothesis, also known as linguistic relativity, proposes that "the structure of anyone's native language strongly influences or fully determines the world-view he will acquire as he learns the language" (Brown, 1976, p. 128).

In general, there are three levels of potential influences of language: semiotic, structural, and functional levels (Lucy, 1997a). First, the semiotic-level concerns the general influence of any natural language on thought. Second, the structural-level concerns how speaking multiple languages with different morphosyntactic configurations of meaning influences thought. Third, the functional- or discourse-level concerns how patterns of language use or discursive practices in cultural context affect thought.

Despite a variety of linguistic relativity hypotheses being proposed, Lucy (1997a)

indicates that they all share three key elements:

(1) Certain properties of a given *language*, usually morphosyntactic (but may be phonological or pragmatic), have consequences for patterns of *thought* about *reality*.

(2) The pattern of *thought* may have to do with immediate perception and attention, with personal and social-cultural systems of classification, inference, and memory, or with aesthetic judgment and creativity.

(3) The reality may be the world of everyday experience, of specialized contexts, or of ideational tradition.

The three key elements cited above suggest how language embodies an interpretation of reality and influences thought through "the selection of substantive aspects of experience and their formal arrangement in the verbal code" (p. 294).

5.2.2 Basic color terms

It was not until Berlin and Kay's (1969) seminal work on *Basic Color Terms: Their Universality and Evolution* that the concept of linguistic relativity been tested empirically. Adapting Brown and Lenneberg's (1954) data collection methods, Berlin and Kay explored basic color terms in 20 languages by asking native speakers to indicate the typical color examples corresponding to each of their lexical color inventory from an array of 330 chromatic samples. To determine the basic color terms in each language, Berlin and Kay (1969) listed four primary criteria that define a color term:[21]

(i) It is *monolexemic;* that is, its meaning is not predictable from the meaning of its parts.

[21] There are additional four subsidiary criteria for dealing with uncertain cases. See Berlin and Kay (1969, pp. 5-7) for the detailed criteria on defining a basic color term.

(ii) Its signification is not included in that of any other color term.

(iii) Its application must not be restricted to a narrow class of objects.

(iv) It must be psychologically salient for informants. Indices of psychological salience include, among others,

(1) a tendency to occur at the beginning of elicited lists of color terms,

(2) stability of reference across informants and across occasions of use, and

(3) occurrence in the idiolects of all informants. (p. 6)

By criterion (i), expressions such as *bluish*, *lemon-colored*, *the color of the rust on my aunt's old Chevrolet* are not monolexemic and do not qualify as basic color terms. By criterion (ii), words such as *crimson* and *scarlet*, which are commonly considered different hues of red, are eliminated as basic color terms. By criterion (iii), for example, the word *blond,* which has restricted application to human hair, is excluded from basic color terms. According to criterion (iv), all the examples provided in this paragraph are eliminated due to their lack of psychological salience.

The results show that there is a universal inventory of 11 basic color categories with seven stages of evolutionary sequence where the basic color terms of any given language are extracted from:

Stage I:[22] Dark-cool (black) and light-warm (white)

Stage II: Red

Stage III: Either green or yellow

Stage IV: Both green and yellow

[22] Stage I not only covers the English terms "black" and "white" but also a larger set of colors related to "dark" and "light" as the general panchromatic terms.

Stage V: Blue

Stage VI: Brown

Stage VII: Purple, pink, orange, or gray

Berlin and Kay theorize that the basic color terms in a culture are predictable because its evolution of basic color terms strictly follows this chronological sequence. For instance, if "blue" (at Stage V) is found in a language, other five colors of the earlier stages should also be presented. Contrary to the hypothesis of linguistic relativity, the findings of Berlin and Kay's (1969) study support the hypothesis of linguistic universality that there are universal constraints on color naming and categorization across languages and cultures.

While Berlin and Kay's (1969) work has led to a proliferation of studies exploring cross-cultural diversity in color naming, their research methods suffer from some serious drawbacks (Lucy, 1997b; Saunders, 1995; Saunders & van Brakel, 1997). A central concern has been the representativeness of color naming data which consists of a small sample of 20 mostly written languages attested by a single speaker of each language in the San Francisco Bay area (i.e., outside of their native communities). A small sample of 20 languages studied through intuitive visual inspection and color-word mappings might not be representative of the diversity of color terms in the world. Moreover, it is possible that the informants' understandings of color terms in their native languages were affected by the English-speaking environment and are thus not representative of the color lexicons in each language studied.

5.2.3 The world color survey

The World Color Survey (WCS), a subsequent study to Berlin and Kay's *Basic Color Terms* (BCT), was undertaken to address the methodological concerns of BCT and advance the understanding of universal development in basic color-term systems (Kay et al., 1991, 1997,

2009). In the WCS, empirical data were collected from 110 mainly unwritten languages spoken by most monolingual informants in their local communities. Diverging from Berlin and Kay's (1969) data collection methods, approximately 25 informants for each language, who had little exposure to industrialized cultures, were asked to see individual color chip presentations from an array of 330 chromatic samples, and then select the focal color chips that best represent basic color words in their native languages. The results of the WCS further confirm the existence of 11 basic color categories and provide consistent evidence of the universal constraints on cross-linguistic color nomenclature.

The discovery of universal color categories in BCT and WCS has triggered a huge amount of innovative scientific inquiry through cross-linguistic, computational, or psychological studies (Belpaeme & Bleys, 2005; Loreto et al., 2012; Regier et al., 2005; Taylor et al., 2013). Notably, through computational simulation of cultural negotiation dynamics, Loreto et al. (2012) discovered that the region of the visible color spectrum plays a crucial role in the time needed for a population to develop a shared repertoire of color categories and lexicons. Based on this criterion, the researchers produced the expected emergence of hierarchical color categories, featuring a quantitative agreement with the empirical observations of the WCS. Furthermore, the findings not only strengthen the existence of universal patterns in cross-cultural color naming but also confirm the existence of color spectrum at a physical level of wavelengths. However, debate continues about the best theories and approaches for examining color lexicons and color categories across world languages.

5.2.4 Color categories in Mandarin Chinese

Although Mandarin Chinese is one of the most spoken languages in the world, the amount of work done on Chinese color perception and language is insignificant. Much of the

literature on color terms in Mandarin Chinese is concerned with the number of color categories, mostly adopting Kay et al.'s (2009) color naming approach in the WCS. As the brief overview below makes clear, there is no research that focuses on the conceptualization of sensory qualities of color perception, or the qualia of color perception.

Berlin and Kay (1969) were one of the first to examine basic color terms in Mandarin, identifying Mandarin as Stage V with six basic color terms: black, white, red, green, yellow, and blue. Adopting Berlin and Kay's (1969) evolutionary sequence of basic color terms, some researchers maintain that Mandarin is a Stage VII language that has eight basic color terms (Liu, 1990; Sun & Chen, 2018; Wu, 2011) while Gao and Sutrop (2014) argue that Mandarin is a Stage VII language with nine basic color terms.[23] Other researchers, however, have found that there are 11 basic color terms with a slight variation of color categorization across studies (Hsieh & Chen, 2011; Hsieh et al., 2020; Lin et al., 2001a, 2001b, 2001c; Lu, 1997).

Drawing attention to the unique ideographic feature of Chinese written signs, which signal semantic categories that are lost when only their phonetic transliterations are considered, Lu (1997) collected a richer variety of written Mandarin color terms and identified a lack of investigation on low-saturation basic color terms, such as *hè* 'brown' and *cāng* 'grayish blue-green' in Berlin and Kay's (1969) study. Lin et al. (2001a) conducted cross-linguistic color naming experiments with an unconstrained method, verifying that both British English speakers ($N = 50$) and Taiwanese Mandarin speakers ($N = 40$) widely use the 11 basic color terms proposed by Berlin and Kay (1969). Hsieh and Chen (2011) identified 12 frequently used

[23] Based on the cognitive salience criterion, the nine color terms are ranked as follows: *hóng* 'red', *huáng* 'yellow', *lǜ* 'green', *lán* 'blue', *hēi* 'black', *bái* 'white', *zǐ* 'purple', *fěn* 'pink', and *huī* 'gray' (Gao & Sutrop, 2014). The researchers argue that the Stage VI term for 'brown' is absent due to two competing terms *zōng* and *hè* for 'brown' in Mandarin.

Mandarin color terms through a free-recall pretest,[24] and asked 44 Taiwanese Mandarin speakers to perform a forced-choice sorting task with 1,931 chromaticity diagrams across six luminance levels based on the 12 color categories. Different from the previous studies, Hsieh and Chen's (2011) research provides new insights into the categorical formation of Mandarin color terms, demonstrating careful consideration to the different degrees of the luminance effect regarding three color attributes (i.e., hue, lightness, and saturation).[25]

Focusing on the cognitive and pragmatic aspects, Xing (2008) examines the semantic extensions and functions of seven commonly used color terms in modern Chinese,[26] with regard to three types of meanings: original, extended and abstract. By comparing the semantic functions of the seven Chinese color terms with their English counterparts, Xing discovered that both languages share more similarities than differences in terms of semantic functions. Therefore, the study supports Wierzbicka's (1990) claim that "color concepts are anchored in certain universals of human experience" based on earthly experiences (e.g., day and night, fire, the sun and the sky) (p. 140). Furthermore, the results show that the idiosyncratic functions of color terms are "systematically developed based on the existential semantic functions of those color terms"

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[24] The 12 color terms, obtained from 133 native Mandarin speakers, are *hóng* 'red', *jú* 'orange', *huáng* 'yellow', *lǜ* 'green', *lán* 'blue', *zǐ* 'purple', *fěnhóng* 'light pink', *táohóng* 'dark pink', *kāfēi* 'brown', *huī* 'gray', *bái* 'white' and *hēi* 'black.'

[25] According to the participants' response time in the color sorting task, Hsieh and Chen (2011) found that (1) the concepts of green, blue, purple, and gray stably exist at most luminance levels, (2) red, orange, yellow, and pink are highly luminance-dependent, (3) The chromaticity areas designated as orange, partial yellow, red, and pink are recognized as brown in low luminance levels, and (4) brown and gray/black represent two distinct tints in the low saturation and luminance conditions.

[26] The seven color terms are *bái* 'white', *hēi* 'black', *hóng* 'red', *huáng* 'yellow', *lǜ* 'green', *lán* 'blue' and *zǐ* 'purple.' They are the most frequently used color terms identified by the Chinese National Language Committee (*Xiàndài hànyǔ Chángyòngzì Píndù Tǒngjì* 1989), see details in Xing (2008, p. 2).

(Xing, 2008, p. 13).[27]

Considering the existence of multiple synonyms for the same color category in Chinese, Sun and Chen (2018) adopted a corpus-based method,[28] and selected 32 single-character Mandarin color words in a Chinese balanced corpus in keeping with Berlin and Kay's (1969) monolexical criterion for BCT.[29] Distinct from the conventional methods for color naming, the researchers provided color terms and measured the association between color samples and each color term. Based on the results, the researchers found eight color categories in Mandarin that are similar to the findings in WCS: red, brown, green, black, orange, gray, yellow, and pink.

To briefly summarize research on color perception, several lines of evidence suggest that the number of color terms varies across languages,[30] whereas color categories characterized by the collection of color terms evince remarkable regularities among world languages (Berlin & Kay, 1969; Kay et al., 2009; Kay & Maffi, 1999; Ratliff, 1976; Wierzbicka, 1990). Overall, much of the previous research on color language and categorization has frequently adopted two methods, free naming (the unconstrained method) and sorting (the constrained method), to elicit the cross-linguistic chromatic range of color lexicons (Hsieh & Chen, 2011). Despite the quality of light (i.e., wavelengths) playing a crucial role in color perception and experience, most linguistic studies on color lexicons fail to consider the psychophysical aspect of color

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[27] For instance, *bái* 'white' is associated with "funeral" (negative) in Chinese and thus cannot develop a potential new meaning for "wedding" (positive) as in English (Xing, 2008).

[28] So far, only a few studies have employed corpus-based approaches to examine Chinese basic color terms (e.g., Hsieh et al., 2020; Lü, 1997; Sun & Chen, 2018; Wu, 2011).

[29] The 32 single-character Mandarin words were selected from 4430 Chinese characters that are most frequently used in the Academia Sinica Balanced Corpus of Modern Chinese: http://asbc.iis.sinica.edu.tw/.

[30] As was mentioned in Chapter II (Section 2.2.2), the number of basic color terms in a language is affected by sociocultural context.

specifications.

Although considerable studies have explored color naming and categories across different languages, far too little attention has been paid to the linguistic representation of the qualitative aspects of color perception. To date, no large-scale studies with systematic and quantitative analyses have been performed to investigate the experiential structures of color perception in Chinese. To conclude this subsection, the literature primarily focuses on color categories and identifies some controversies about the number of basic color terms and an absence of monolexemics for broader color categories in Mandarin Chinese.[31] There is no research on the linguistic representation of sensory perception of color in Chinese. In other words, the qualia of color perception have not been studied from a linguistic perspective.

5.3 The Current Study

The present study therefore aims to provide data to fill these research gaps with well-grounded theoretical and methodological considerations. Specifically, the following research questions will be addressed in this chapter:

1. What are the primary colors that are frequently used to describe perceptual qualities in Chinese morphological constructions?
2. Are there any universal constraints on color language and categorization in Chinese morphological constructions?
3. What is the relationship between the psychophysical specifications of color and the creation of color expressions in Chinese?

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[31] It should be noted that most color terms in Mandarin Chinese are not monolexemic, composed of at least two characters that represent single lexemes (e.g., *fěnhóng* 'pink' and *shuǐlán* 'water-blue, aqua').

To answer these questions, this study draws on both the usage-based constructionist approach and the connectionist approach in cognitive science. The usage-based constructionist approach will allow us to discover the underlying linguistic experiences in color perception. The connectionist approach will help advance our knowledge of language users' mental phenomena based on the connection strengths in interconnected linguistic networks. Through conducting corpus-based quantitative research on a productive qualia construction, this study makes an original contribution to the understanding of the linguistic representation of phenomenal qualities of perceptual color-vision experience in Chinese.

The rest of the chapter is organized as follows. Section 5.4 describes specific methods by which the data processing and analyses were conducted. Section 5.5 presents results that offer answers to research questions, followed by a general discussion of the findings in Section 5.6. Section 5.7 concludes the chapter by highlighting the significance of the findings.

5.4 Methods

5.4.1 Corpus data

This study applied the self-constructed "A_collocates" corpus which consists of 117 subcorpora of [A--] constructions with their ABB types and concordance lines.[32] As described in Chapter 4.4.1, the 117 types of A-part were manually annotated and classified into sensory categories and semantic subclasses based on the cross-lingual WordNet analyses of their synsets. To investigate the linguistic representations of the qualities of color perception, the semantic subclass of "color" under the vision category was selected for further analysis (See Appendix C:

[32] See Chapter IV (Section 4.1) for details on constructing the corpora.

I. Vision). Hence, this study focuses on a total of 15 types of A-part, which represent approximately 43% of the vision category and 13% of all the A types in the corpus, and a total of 76 types of BB collocates found within the 15 [A--] constructions.

5.4.2 Frequency

Based on the 15 A-types in the semantic subclass of color-vision, four types of frequency data were obtained from the dataset: type frequency, token frequency, construction frequency, and corpus frequency. First, type frequency refers to the number of distinct BB morphemes that occur in the open slot of a [A--] construction. It serves as an indicator of productivity in that the high type frequency facilitates the schematicity of a construction and leads to the productivity of novel items (Bybee, 2006, 2013; Ellis, 2002; Goldberg, 1995, 2006, 2019; Gries, 2012). Second, token frequency is the number of times a particular ABB string occurs in the corpus. It indicates the degree of lexical strength and the entrenchment of a linguistic form. Third, construction frequency refers to the number of times a certain [A--] construction is observed in the corpus. Fourth, corpus frequency is the number of times a certain BB morpheme occurs in the corpus. The construction frequency of 15 [A--] color constructions and the type frequency of their BB collocates are shown in Table 5.1.

A thorough examination of each ABB type within the 15 [A--] color constructions discovers that the ABB types of two constructions, [*chì* --] and [*sè* --], do not refer to colors. Although *chì* is originally used as a color term for ‘red’ in ancient Chinese, it has another semantic meaning that denotes ‘bare, naked.’ In terms of its BB collocate *luǒluǒ*, in fact, the word 裸 *luǒ* is a verb that means ‘be bare, naked, or exposed.’ Moreover, the term *chìluǒluǒ* ‘undisguised’ has the fourth highest token frequency within the whole [ABB] dataset. This indicates that the construction [*chì* --] is highly associated with the semantic meaning of *bare* or

naked.

Table 5.1. Construction and type frequencies of the 15 [A--] constructions in color-vision

Rank	[A--] construction			Construction Frequency	Type Frequency
1	灰	*huī*	gray	23,500	22
2	黑	*hēi*	black	52,116	19
3	绿	*lǜ*	green	25,670	15
4	白	*bái*	white	27,213	13
5	红	*hóng*	red	27,434	11
6	赤	*chì*	(ancient) red	31,951	9
7	碧	*bì*	bluish green	581	8
8	蓝	*lán*	blue	2,015	7
9	乌	*wū*	black	1,409	5
9	粉	*fěn*	pink	2,102	5
11	黄	*huáng*	yellow	13,204	3
11	金	*jīn*	gold	20,459	3
13	青	*qīng*	green	311	2
13	银	*yín*	silver	239	2
15	色	*sè*	color	1,930	1
Total				**230,134**	**125**

Note. The 15 [A--] constructions are ranked by type frequency, i.e., the number of distinct BB collocates in each [A--] construction. Two [A --] constructions that are shaded in gray, *chì* '(ancient) red' and *sè* 'color', will not be considered for further qualitative analyses.

Regarding the construction [*sè* --], the word *sè* ‘color’ is usually used as a suffix for Chinese color terms, e.g., *huī-sè* ‘gray.’ It is worth noting that the word *sè* ‘color’ also has another semantic meaning that refers to ‘lust’ in Chinese. In this study, the construction [*sè* --] has only one BB collocate *mímí*, and the word 迷 *mí* is a verb that means ‘be confused or be fascinated by (something).’ Furthermore, the term *sèmímí* ‘lustful’ found in the dataset suggests that the construction [*sè* --] is truly associated with the semantic meaning of *lust*.

As the meanings of their ABB types have diverged from colors, the constructions [*chì* --] and [*sè* --] presented above will not be considered for further qualitative analyses. A complete list of 125 types of [ABB] patterns, which are associated with perceptual color-vision experience, ranked by their token frequencies is provided in Appendix D.

5.4.3 Collostructional analysis

To investigate the association strength and the conditional probabilities of occurrence of [A-BB] color-vision constructions, a simple collexeme analysis was conducted in this study. Simple collexeme analysis, one of the variants of collostructional analysis, is developed by Stefanowitsch and Gries for investigating the co-occurrence relation between words and constructions. It was considered that collexeme analysis, which is framed in a construction-based approach to language, would usefully supplement and extend the collocational analysis by examining the co-occurrence relation between lexemes and grammatical constructions (Stefanowitsch & Gries, 2003). In this study, collexeme analysis offers an effective way of measuring the degree of attraction or repulsion of a BB morpheme in a certain [A--] color-vision construction. Most importantly, it helps determine the most typical BB collocates of a specific [A--] color-vision construction for further qualitative semantic analysis.

In corpus linguistics, it has been assumed that “similarity in distribution, of which co-

occurrence is the most frequent kind in corpus research, reflects similarity of meaning or function" (Gries & Ellis, 2015, p. 236). Therefore, measures of associations on the contingency of form-function mapping based on a 2x2 co-occurrence table have been widely employed in corpus linguistics research. As an extension of association measures, collostructional analysis is also based on 2x2 contingency tables of observed co-occurrence frequencies (Gries et al., 2005; Gries, 2012, 2015). Table 5.2 displays the schematic frequency table that is used to compute the association strength of [A-BB] morphological collocations. To demonstrate how the collostruction strength of a BB morpheme to a [A--] color-vision is computed, the word *huīméngméng* 'overcast (of weather)' is used as an example in Table 5.2.

Table 5.2. Schematic co-occurrence frequency table of two elements A and BB

	BB morpheme: *méngméng* 'drizzle'	Other BB morphemes	Totals
Construction: [*huī* 'gray'--]	***a*** (13,258)	*b* (10,242)	***a*** **+** ***b*** (23,500)
Other [A--] color constructions	*c* (4,916)	*d* (1,217,373)	*c* + *d* (1,222,289)
Totals	***a*** **+** ***c*** (18,174)	*b* + *d* (1,227,615)	***a*** **+** ***b*** **+** ***c*** **+** ***d*** **=** ***N*** (1,245,789)

Note. This table is adapted from Gries et al. (2005) and Gries (2012).

In this study, four major procedures of collexeme analysis are performed as follows. First, the frequency of each BB morpheme filling the constructional slot of a [A--] color-vision construction is obtained and put into ***a***. In Table 5.2, all occurrences of the collocation [*huī*

'gray' + *méngméng* 'drizzle'] are retrieved from the corpus (i.e., token frequency), represented by ***a***. Second, all occurrences of the BB morpheme – *méngméng* 'drizzle' – are extracted from the corpus (i.e., corpus frequency), represented by the frequency ***a*** **+** ***c***. Third, all occurrences of a [A--] color-vision construction in the corpus, e.g., [*huī* 'gray' --], are computed as construction frequency and put into ***a*** **+** ***b***. Fourth, the total number of color-vision constructions in the corpus is computed and represented by ***a*** **+** ***b*** **+** ***c*** **+** ***d*** **=** ***N***. As a result of these four steps, the frequencies in bold type in Table 5.2 are obtained. Through means of subtraction, the remaining frequencies in other columns are calculated. These steps are repeated for every BB morpheme occurring in a [A--] color-vision construction and every [A--] color-vision construction within the corpus under investigation.

According to the frequency computation in Table 5.2, the G score of the log-likelihood ratio test is calculated to understand the collostruction strength. That is, how strongly a BB morpheme is attracted to a certain [A--] color-vision construction. See Chapter 4.2.3 to an introduction of the log-likelihood ratio test. The higher the G score, the stronger the attraction of a BB morpheme to a certain [A--] color-vision construction. The statistical measure of the G score is computed by the following formula:

$$G^2 = 2 \cdot \sum_{1}^{4} obs \cdot log \frac{obs}{exp} \tag{4}$$

5.4.4 Semantic network analysis

Connectionism, also known as connectionist networks or artificial neural networks, is a theoretical approach to the study of cognition. A fundamental idea of connectionism is that cognitive processes are performed by large networks of simple processing units working together

to accomplish complex calculations. In connectionist models, information is processed and transmitted through interconnected nodes in a similar way to how the brain processes information, such as language processing, perception, and representation. A weighted connection represents the strength of the relationship between each of these processing units.

Goldstein and Slater (1998) highlight the role of connectionism as a sensory-motor processor, rather than a calculating device, that engages and connects "the symbiotic relationship between minds, words and the social world" (p. 314). Smolensky (1999) advocates employing grammar-based strategies in connectionist language research, addressing the methodological issues that view the theories of generative grammar and connectionism as incompatible research paradigms. He argues that the grammar-based strategy not only helps to explain linguistic theory, but also incorporates computational insights from connectionist theory regarding mental representation, mental processing, and learning.

Recent advances in semantic network analysis have facilitated the quantitative metrics that can support the qualitative analysis of semantic classes and the exploration of semantic structures (Drieger, 2013; Gries & Ellis, 2015). According to Doerfel (1998), "semantic network analysis is the use of network analytic techniques on paired associations based on shared meaning as opposed to paired associations of behavioral or perceived communication links" (p. 16). In general, semantic networks have been constructed via three means: (1) based on the relationship among words in a text; (2) based on traditional content analyses of text; and (3) based on overlapping perceptions measured with scales (Doerfel, 1998, p. 17).

Drawing from graph theory (Diestel, 2005) and network analysis (Brandes & Erlebach, 2005; Newman, 2010), Drieger (2013) advocates modeling and visualizing text as an interconnected system of signs to retrieve "a formal structure of word differences and relations

which corresponds to a graph $G = (V, E)$ with $E \subseteq [V]^2$" (p. 6):[33]

(1) *V* is a set of nodes that represents different words as unique keys.

(2) *E* is a set of edges that stand for relations between the different words to capture a given system of signs in a text.

(3) *G* is a formal model of a generalized semantic network that consists of different words related to each other.

To understand the conceptual association of color expressions in Chinese, in this study, I adopt the connectionist approach and examine the connection strengths in the interconnected color-vision network. Most importantly, I adapt Drieger's (2013) visual text analytics system to visualize a color-vision network of interconnected morphemes and the context of semantic structures grounded in the [ABB] qualia construction. To gain insights into the collocational strength and the relations between A-BB morphemes, a collocation/collostruction network is plotted by both an undirected, weighted graph and an interactive, directed, weighted graph consisting of nodes and edges using R (programming language).[34]

Figure 5.1 offers an undirected, weighted graph of [A-BB] color-vision network, consisting of 91 nodes and 125 edges (i.e., total type frequency).

[33] Drieger (2013) attempts to formalize text as a system of signs based on the theories of structuralism (de Saussure, 2011) and semiotics (Eco, 1986).

[34] In this study, three R packages are used for network visualization: igraph (Nepusz et al., 2022), ggraph (Pedersen, 2020), and visNetwork (Almende B.V. et al., 2021).

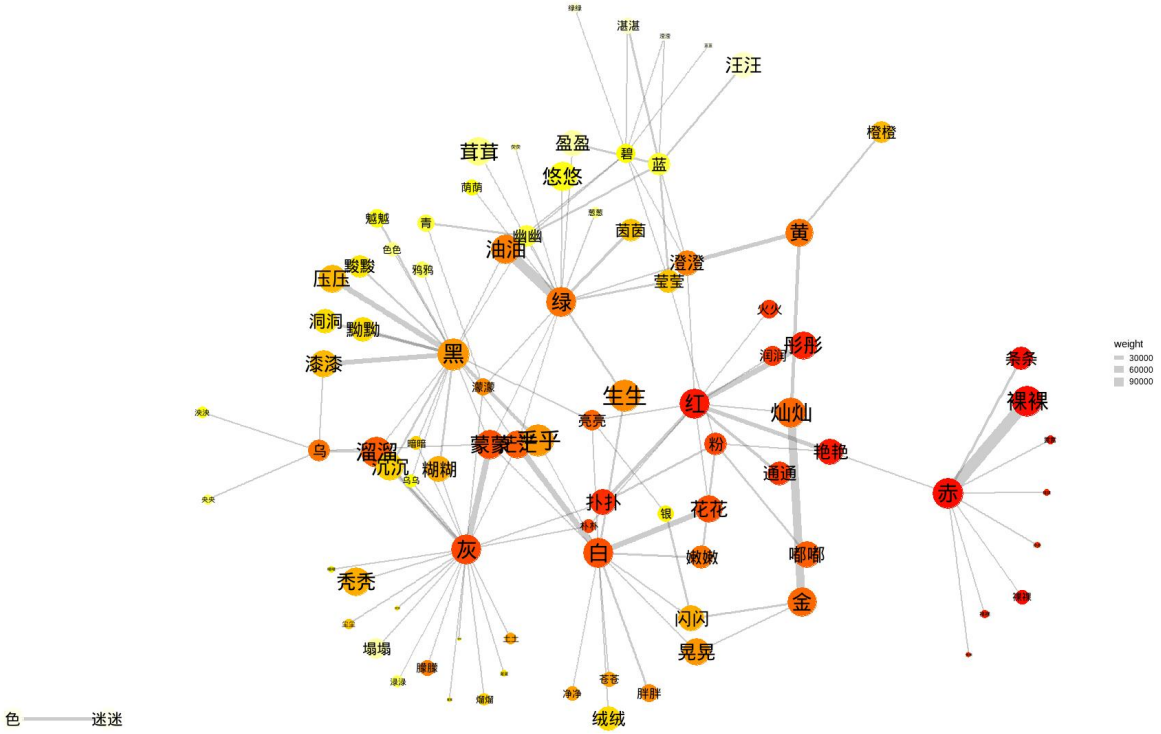

Figure 5.1. An undirected, weighted graph of [A-BB] color-vision network

This study also demonstrates a more advanced interactive visualization technique that allows for a user-centered visual exploration of interconnected semantic properties in a collostruction network. An interactive, directed, weighted graph is shown in Figure 5.2 and at https://hshung.github.io/abb_visnet_color/.

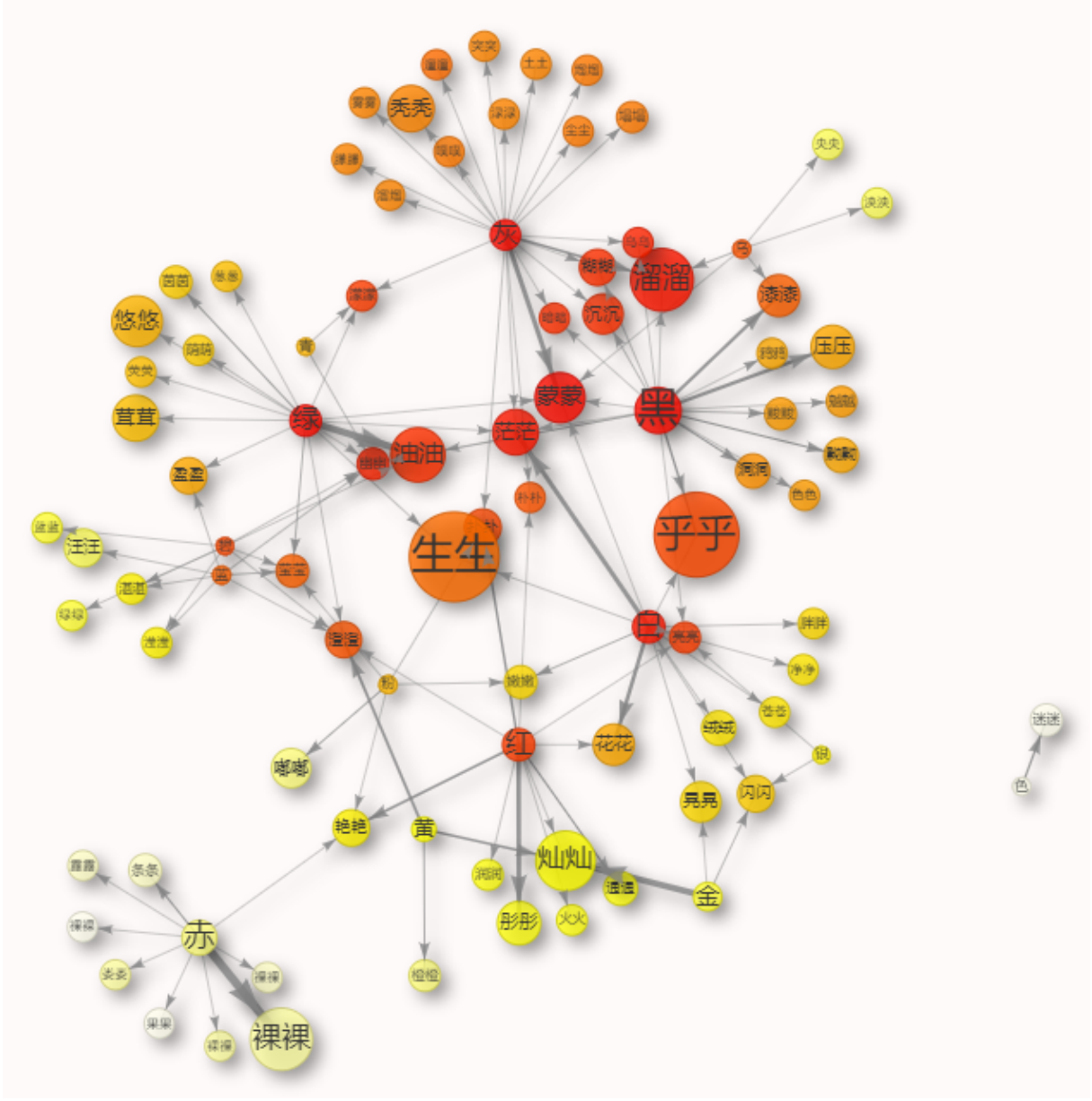

Figure 5.2. A directed, weighted graph of [A-BB] color-vision network

Nodes are attributed with 15 A morphemes and 76 BB morphemes, and are quantitatively assigned by construction frequency and corpus frequency. The higher the frequency of a morpheme, the larger the size of a node. In addition, the number of adjacent nodes offers qualitative insights into the connectivity and diversity of word senses. The highly connected nodes indicate local hubs, which imply the importance of nodes in a semantic network. To systematically measure the importance of a node in the context of the whole collostruction network, the eigenvector centrality is computed and assigned to the color attributes of the nodes along a heat continuum from reds (for higher centrality scores) to yellows (for lower centrality scores) (Desagulier, 2017, 2020).[35] The higher the centrality score, the more influential the node.

Edges characterize the relations between two nodes. To investigate various semantic relations that connect morphemes in the collostruction network, the edge links (shaded in gray in Figure 5.1) which connect at least two nodes are weighted and indexed according to the collostruction strength, i.e., the G score of the log-likelihood ratio test. The higher the G score, the thicker the edge link. The thicker the edge link, the stronger the association between A color morpheme and its BB collocates.

5.5 Results

5.5.1 [A-BB] color-vision network

In terms of network visualization, it is found that the interactive network serves best for visual text analytics in this study, allowing users to scrutinize a targeted subset of nodes and edges. In this subsection, the findings will be presented based on the interactive [A-BB] color-

[35] The eigenvector centrality is an algorithm that measures the influence of nodes. A high eigenvector score indicates the highly influential and diverse connectedness of a node.

vision network. Looking at the overall structure of the [A-BB] color-vision network, it is apparent that the prime colors in the visual spectrum, which are plotted in red for higher centrality scores, are the dominant hubs (i.e., important nodes) in the network. Moreover, there is a high density of adjacent nodes that are distributed and connected to the prime colors in the vicinity. This indicates the salience, complexity, and productivity of the [A-BB] morphological construction for the experiential structures of color perception.

5.5.1.1 Color nodes

Further analysis of the color nodes in the network shows that there are five influential colors with larger sizes of nodes in red. As provided in Table 5.1, the five important color nodes are ranked by construction frequencies as follows: 黑 *hēi* 'black', 红 *hóng* 'red', 白 *bái* 'white', 绿 *lǜ* 'green', and 灰 *huī* 'gray' A significant finding is that the colors identified from the [A-BB] color-vision constructions do correspond to the universal inventory of 11 basic color categories proposed by Berlin and Kay (1969). Regarding the evolutionary sequence of BCT, there are merely three-color categories absent in the data. They are 'brown' in Stage VI, and 'purple' and 'orange' in Stage VII. The most surprising aspect of the data is that the top four important color nodes match the first three stages of the evolutionary sequence of BCT with a close ranking between 红 *hóng* 'red' (frequency: 27,434) and 白 *bái* 'white' (frequency: 27,213).

As Berlin and Kay (1969) point out: "There is also a term for gray which is the same as the word for 'ashes'" in Mandarin (p. 42). It is worth noting that there is a controversy about 灰 *huī* 'gray' for basic color categories in Chinese. Besides the color 'gray', several color nodes are found to be the same shade of color in the visible light spectrum in this study. For instance, 黑 *hēi* 'black', 灰 *huī* 'gray', and 乌 *wū* 'black' are considered shades of black; 绿 *lǜ* 'green', 碧 *bì*

‘bluish green’, and 青 *qīng* ‘green’ are regarded shades of green. Focusing on the five significant color nodes, the following paragraphs present the findings on their collostruction strength and interconnected properties in the [A-BB] color-vision network.

Closer inspection of the [A-BB] color-vision network shows that the achromatic color 黑 *hēi* ‘black’ is the most influential node which has the largest node size (i.e., the highest construction frequency) among the color nodes. The color ‘black’ as the dominant hub also displays relatively more numbers of adjacent BB nodes and thicker edge links, suggesting stronger collostruction strength between the color morpheme *hēi* ‘black’ and its BB collocates. Figure 5.3 shows a subgraph of the [A-BB] color-vision network focusing on the color 黑 *hēi* ‘black.’ As shown in Figure 5.3, the color ‘black’ has a higher diversity of word collocations where the color node connects to many important adjacent BB nodes, represented by a larger size of nodes for high corpus frequencies and reds for high centrality scores, in the entire network.

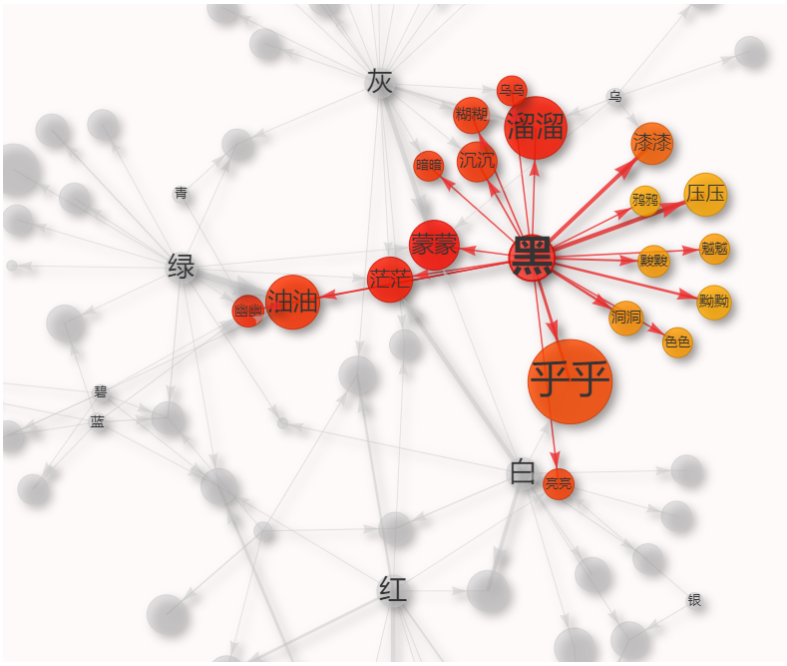

Figure 5.3. A subgraph of the [A-BB] color-vision network on the color 黑 *hēi* ‘black’

What is striking about the prime colors as the dominant hubs in the [A-BB] color-vision network is that three influential color nodes, 黑 *hēi* ‘black’, 白 *bái* ‘white’, and 灰 *huī* ‘gray’, are achromatic colors that have no saturation or vividness. In other words, they are neutral colors possessing little or no hue. From a physiological perspective, both black and gray are the achromatic colors of darkness that can be perceived by scotopic vision. An examination of the color node 灰 *huī* ‘gray’ reveals that it has many adjacent BB nodes where most of the important BB nodes in reds are shared with the color node 黑 *hēi* ‘black’ in the network. A subgraph of the [A-BB] color-vision network focusing on the color 灰 *huī* ‘gray’ is shown in Figure 5.4.

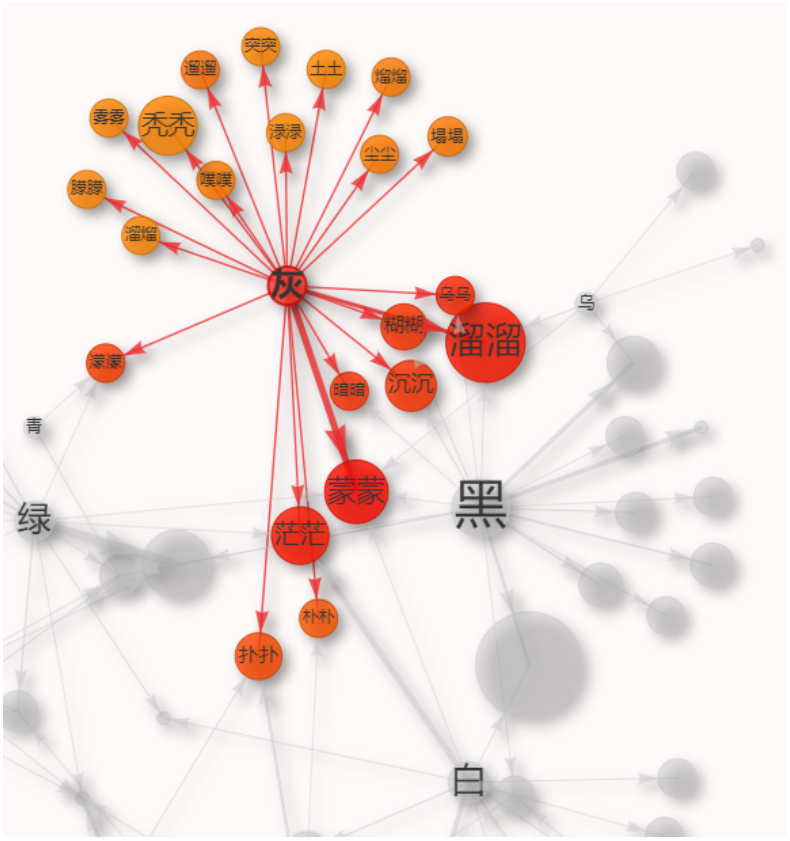

Figure 5.4. A subgraph of the [A-BB] color-vision network on the color 灰 *huī* ‘gray’

Contrasting with black and gray's absence of visible light, the achromatic color 白 *bái* 'white' has a complete absorption of visible light, comprising all hues in the color spectrum, and can be perceived by photopic vision. Interestingly, the sharp contrast between black and white is reflected in their adjacent BB nodes. Unlike 黑 *hēi* 'black' and 灰 *huī* 'gray' sharing most of the important BB nodes in the network, the color node 白 *bái* 'white' merely shares a few BB nodes with them. Figure 5.5 displays a subgraph of the [A-BB] color-vision network focusing on the color 白 *bái* 'white.'

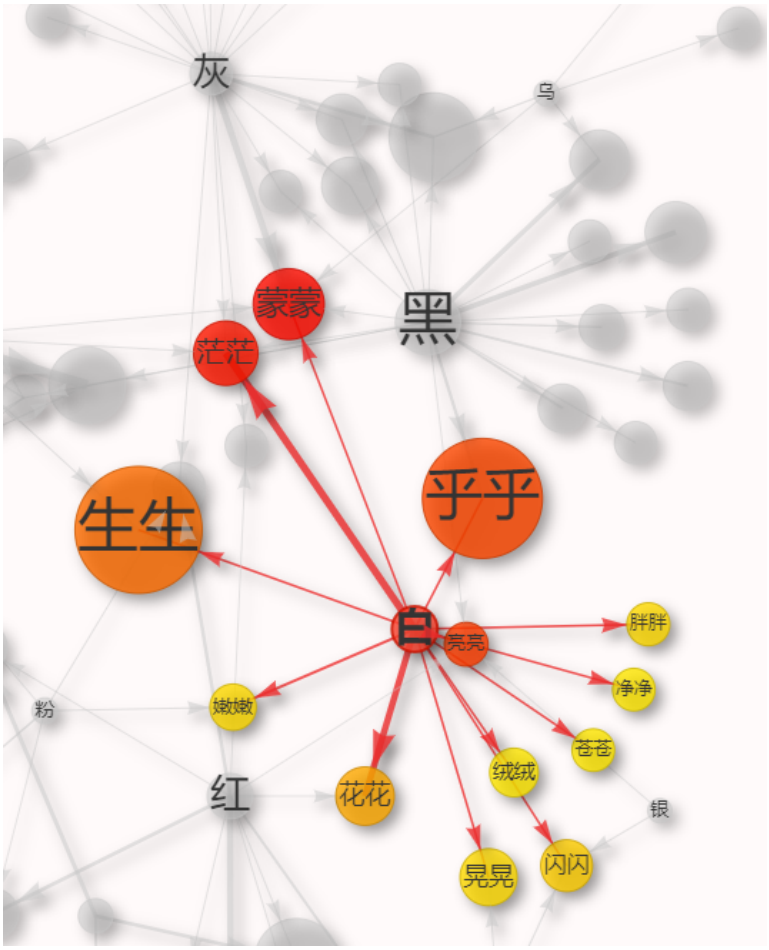

Figure 5.5. A subgraph of the [A-BB] color-vision network on the color 白 *bái* 'white'

Concerning the rest of the two important color nodes 红 *hóng* ‘red’ and 绿 *lǜ* ‘green’, both are chromatic colors having specific wavelengths of light and being considered fundamental, indivisible hue sensations. The subgraphs of the [A-BB] color-vision network targeting the color 红 *hóng* ‘red’ and 绿 *lǜ* ‘green’ are provided in Figure 5.6 and Figure 5.7. As can be seen from these two subgraphs, similar to the color node 白 *bái* ‘white,’ both 红 *hóng* ‘red’ and 绿 *lǜ* ‘green’ share few BB nodes with other color nodes. They tend to possess more adjacent BB nodes in yellows (i.e., less influential nodes), implying the idiosyncratic usage of a color construction in specialized contexts.

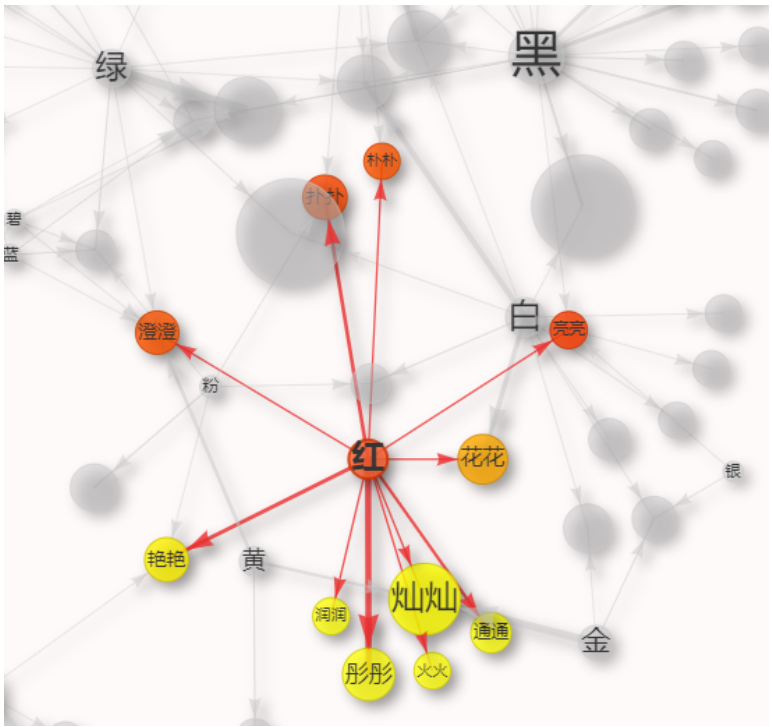

Figure 5.6. A subgraph of the [A-BB] color-vision network on the color 红 *hóng* ‘red’

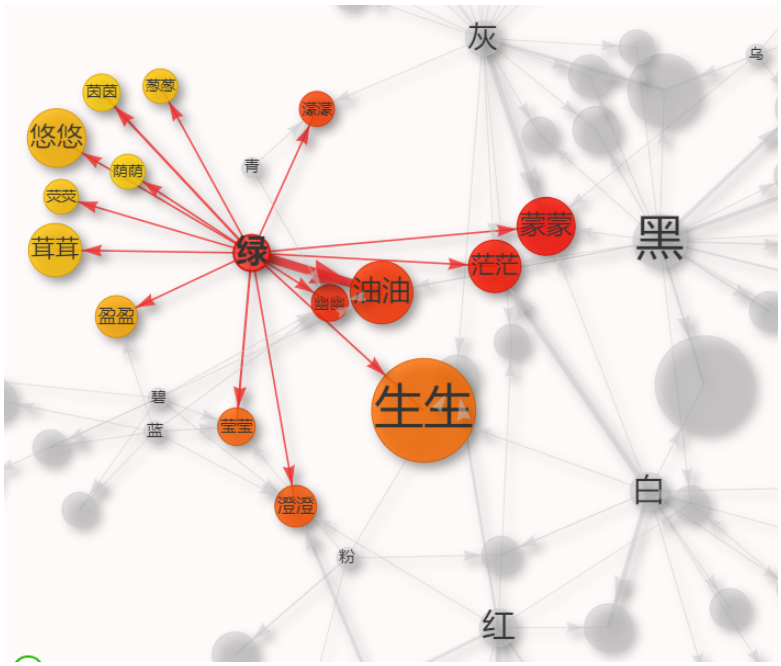

Figure 5.7. A subgraph of the [A-BB] color-vision network on the color 绿 *lǜ* 'green'

5.5.1.2 BB nodes

Turning now to the strongly connected BB nodes in the [A-BB] color-vision network. What stands out in the overall structure of the network are three noticeable huge sizes of BB nodes. The three BB nodes are ranked by corpus frequencies as follows: 生生 *shēngshēng* (frequency: 53,844), 乎乎 *hūhū* (frequency: 49,318), and 溜溜 *liūliū* (frequency: 29,465). A closer inspection of the data reveals that 溜溜 *liūliū* is the most influential BB node which is colored in red and connected to three color nodes: 黑 *hēi* 'black', 灰 *huī* 'gray', and 乌 *wū* 'black.' A subgraph of the collostructions between 溜溜 *liūliū* and the three-color nodes is displayed in Figure 5.8.

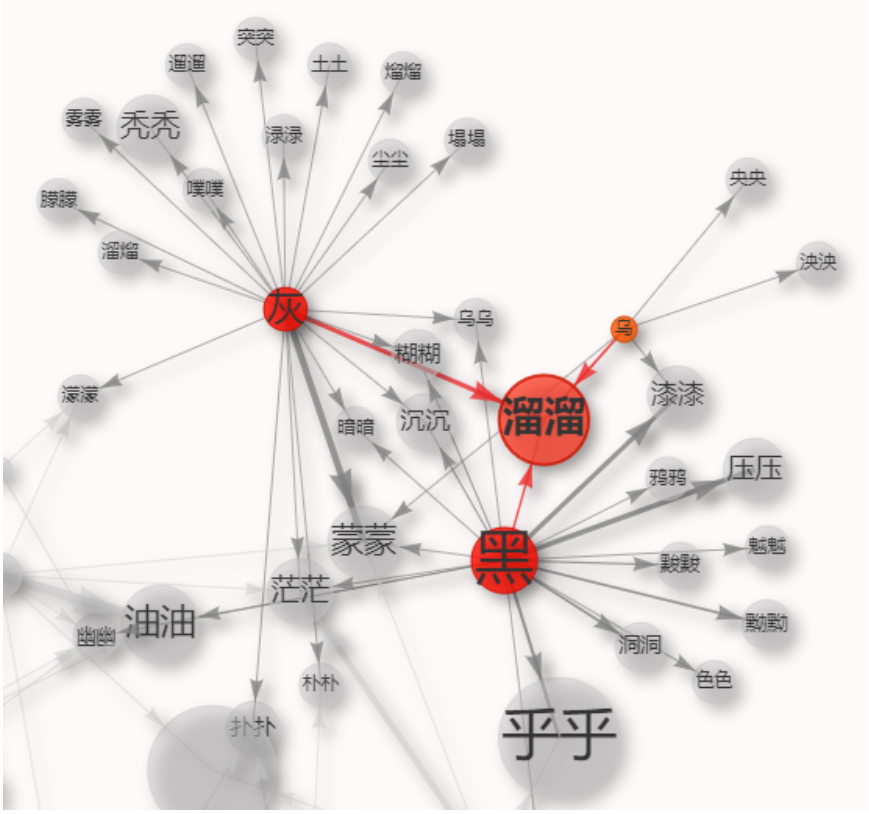

Figure 5.8. A subgraph of the [A-BB] color-vision network on the BB node 溜溜 *liūliū*

As indicated previously, 黑 *hēi* 'black', 灰 *huī* 'gray' and 乌 *wū* 'black' are achromatic colors without saturation and characterized by shades of black. It should be noted that 溜溜 *liūliū* is a repetitive morpheme where the monosyllabic word 溜 *liū* is a verb referring to 'slip away.' A further investigation of the usage contexts of 黑溜溜 *hēiliūliū* 'black and bright,' 灰溜溜 *huīliūliū* 'gloomy' and 乌溜溜 *wūliūliū* 'dark and liquid' is needed to elucidate the entrenchment between 溜溜 *liūliū* and shades of black.

In the entire [A-BB] color-vision network, 生生 *shēngshēng* has the highest corpus frequency (53,844) which is represented by the largest size of the node. However, the BB node 生生 *shēngshēng* has a lower centrality score than the BB node 溜溜 *liūliū*. An examination of

the collocations of 生生 *shēngshēng* shows that it is connected to two influential color nodes: 白 *bái* 'white' and 绿 *lǜ* 'green.' Figure 5.9 offers a subgraph of the collostructions between 生生 *shēngshēng* and the two-color nodes.

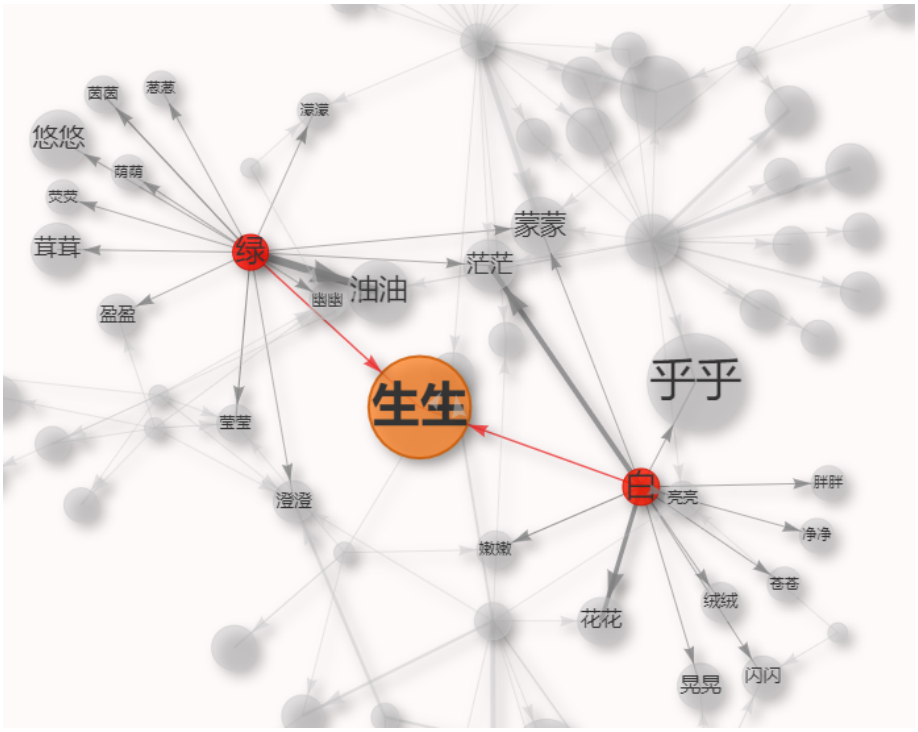

Figure 5.9. A subgraph of the [A-BB] color-vision network on the BB node 生生 *shēngshēng*

生生 *shēngshēng* is a repetitive morpheme where the monosyllabic word 生 *shēng* denotes 'life' or 'growth.' Interestingly, 生生 *shēngshēng* collocates with two of the basic color terms in Stage I (white) and Stage III (green) of the evolutionary sequence of BCT. From the view of physiology, both 白 *bái* 'white' and 绿 *lǜ* 'green' are related to the absorption of visible light and perceived by photopic vision. Further analysis of the usage contexts of 白生生 *báishēngshēng* 'white' and 绿生生 *lǜshēngshēng* 'green' as well as their similarities in usage is

required to better understand the collostructions between 生生 *shēngshēng* and visible light.

Being the second-largest node (frequency: 49,318) in the [A-BB] color-vision network, 乎乎 *hūhū* is connected to two significant color nodes with high construction frequencies: 黑 *hēi* 'black' (frequency: 52,116) and 白 *bái* 'white' (frequency: 27,213). Remarkably, both 黑 *hēi* 'black' and 白 *bái* 'white' are achromatic or hueless colors categorized in the first stage of the evolutionary sequence of BCT. A subgraph of the collostructions between 乎乎 *hūhū* and the two-color nodes is provided in Figure 5.10.

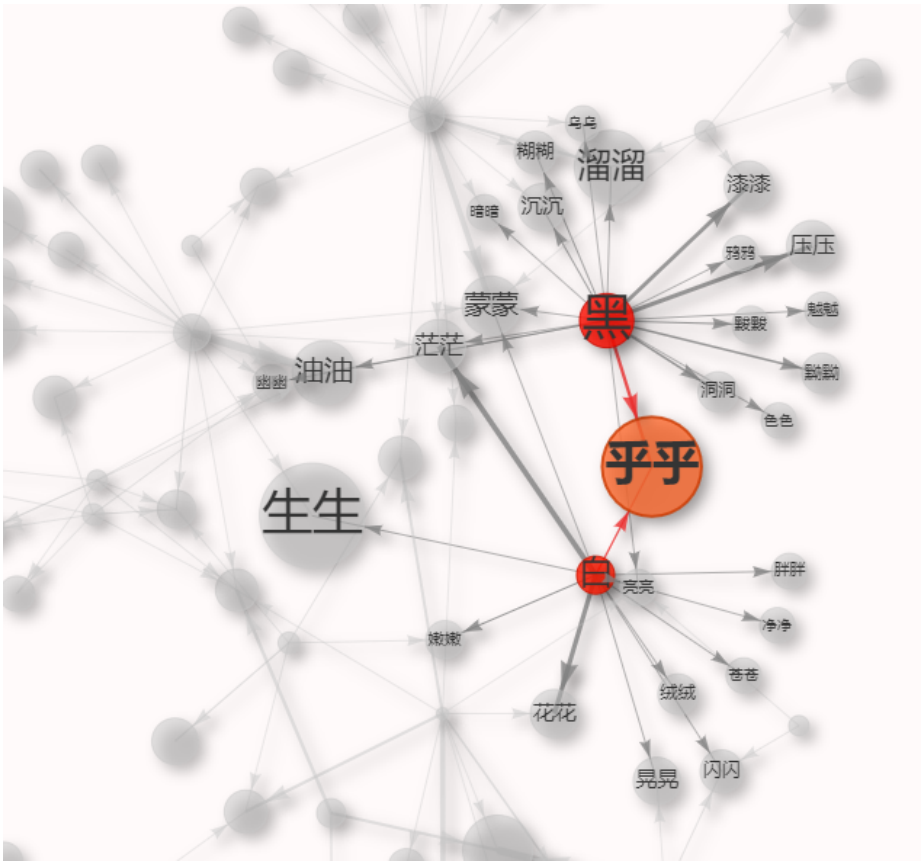

Figure 5.10. A subgraph of the [A-BB] color-vision network on the BB node 乎乎 *hūhū*

乎乎 *hūhū* is a repetitive morpheme where the monosyllabic 乎 *hū* is a classical final particle commonly used at the end of an interrogative or exclamatory sentence in ancient Chinese. Although 乎乎 *hūhū* only collocates with two A color morphemes in this study, it is found to be the most productive BB morpheme collocating with 26 A morphemes that represent 22.2% of all the A types in the whole corpus. This suggests the conventionalization of 乎乎 *hūhū* in the [ABB] reduplication-based morphological construction. A further examination of the usage contexts of 黑乎乎 *hēihūhū* 'black; dark' and 白乎乎 *báihūhū* 'white' is required to better understand the phenomenal qualities of perceptual color-vision experience in these two conventionalized patterns.

So far, this chapter has focused on studying the color categories and collocations between A and BB morphemes. As suggested by the current findings, further analyses of the typical color referents and usage contexts underlying the [ABB] color-vision constructions will be demonstrated in the following chapter.

5.6 Discussion

5.6.1 The primary colors in the [A-BB] color-vision network

The present study was designed to investigate how perceptual color-vision experiences are encoded in a productive family of [ABB] reduplication-based morphological constructions. The first question in this research sought to identify the primary colors that are frequently used to describe perceptual qualities in Chinese morphological constructions. As shown in Table 5.1, there are 13 [A--] constructions that are used to depict the qualitative properties of color-vision perception. Through visual text analytics, this study found that 黑 *hēi* 'black', 红 *hóng* 'red', 白 *bái* 'white', 绿 *lǜ* 'green', and 灰 *huī* 'gray' are the primary colors shown by nodes with a larger

size in reds within the [A-BB] color-vision network.

Among the five primary [A-] color constructions, *hēi* ‘black’ is the most significant color, displaying a higher diversity of word collocations and stronger collostruction strength with its BB collocates. It also has the highest construction frequency within the 13 [A-] color constructions. This serves as evidence for the high degree of collostruction strength and the entrenchment of [*hēi*-BB] color patterns in language users’ mental representation. Moreover, the most productive color *huī* ‘gray,’ which generates 22 different types of [*huī*-BB] color construction, is considered shades of black. The close relationship between *hēi* ‘black’ and *huī* ‘gray’ in [ABB] color constructions are supported by their overlaps in important BB collocates. Therefore, it could conceivably be hypothesized that *hēi* ‘black’ is the most perceivable color, and the most productive monolexemic in linguistic forms for describing the experiential structures of color perception in Chinese.

5.6.2 The universal constraints on color categories

The second question in this study investigates whether there are any universal constraints on color language and categorization in Chinese morphological constructions. I examined the 13 color nodes in the [A-BB] color-vision network, comparing them with Berlin and Kay’s (1969) universal inventory of 11 basic color categories, as well as their evolutionary sequence. Prior studies exploring color words in Chinese have strictly followed Berlin and Kay’s (1969) monolexical criterion. This neglects the fact that many color terms in Chinese are not monolexemic, consisting of at least two Chinese characters to represent single lexemes, e.g., *kāfēi* ‘brown’ and *fěnhóng* ‘pink.’

From a usage-based constructionist perspective, the knowledge of color language and categorization should be explored based on language-specific constructions, consisting of a

collection of form-function mappings (Bybee, 2006, 2010; Goldberg, 2006, 2019; Tomasello, 2003). However, very little was found in the literature on whether the formation of qualia constructions, which depict the qualitative properties of perceptual color-vision experiences, complies with the evolutionary sequence of basic color terms.

The findings of this research offer evidence that there are universal constraints on color language and categorization in Chinese morphological constructions. In accordance with the evolutionary sequence of basic color categories, the top four influential color nodes, i.e., *hēi* 'black,' *bái* 'white,' *hóng* 'red,' and *lǜ* 'green,' are consistent with the first three color evolutionary stages. The findings might further indicate the higher frequency of usage events, requiring speakers to describe the perceptual qualities of visual experiences with these four colors. Among the 13 color terms identified from "A_collocates" corpus, eight color terms are found to be aligned with Berlin and Kay's (1969) universal inventory of 11 basic color categories. *Brown*, *purple* and *orange* are the three universal color categories missing from the current data.

The absence of *brown* and *orange* in the current study might be explained by other competing color terms in use. As suggested by Gao and Sutrop (2014), there are other competing terms for 'brown' in Chinese, such as 棕 *zōng* and 褐 *hè*. It is worth noting that the disyllabic word *kāfēi* is also used as a color term for 'brown' in Chinese. Similarly, the color term 'orange' has other two competing terms in Chinese: 橘 *jú* and 橙 *chén*. Although the color term 紫 *zǐ* 'purple' has been recognized as a basic color term in Chinese (e.g., Gao & Sutrop, 2014; Hsieh & Chen, 2011; Xing, 2008), it has not found to be used for forming a qualia construction.

In this study, the lack of [A-BB] morphological constructions for describing the perceptual qualities of the three universal color categories – *brown*, *purple,* and *orange* – can be

explained by the usage-based constructionist approach to language. In the creation of new complex words, competition in context has been demonstrated to constrain generalizations. Even though some words can be added to construction for extended usage, these extensions are rarely completely productive regardless of the violation of general constraints (i.e., the lack of full productivity of constructions) (Goldberg, 2019).

According to Goldberg (2019), it is the accessibility that motivates a speaker's tendency to use familiar formulations rather than novel formulations to convey equivalent messages. It is possible to hypothesize that the existing color lexicons for *brown*, *purple,* and *orange* in Chinese are already appropriate and accessible to convey the intended message-in-context in speech communities. Therefore, the creativity and productivity of a qualia construction are inhibited. Nevertheless, further research on this topic is needed to confirm and validate the hypothesis.

5.6.3 The psychophysical effect on color language

As introduced in Section 5.1, color vision is a visual perceptual capacity shared by human beings. Color is a universal phenomenon and a byproduct of visual perception and evaluation based on the quality of light (i.e., wavelengths) in the visual spectrum. In terms of the psychophysical dimensions of color, hue, saturation, and value (brightness or lightness) are the three physical attributes of color. These color attributes play a crucial role in our perceptual experience of color, letting us distinguish and describe the differences between colors. Taking the psychophysical mechanisms of color into account, the physiological processes in color cognition and color perception should be consistent across human beings. In reviewing the literature, nonetheless, the way in which colors are expressed and portrayed varies greatly across different languages and cultures.

The third question in this study sought to understand the relationship between the

psychophysical specifications of color and the creation of color expressions in Chinese. According to the analysis of the [A-BB] color-vision network, one interesting finding is that several color nodes appear to share shades of the same color in the visible light spectrum. Among the 13 color nodes, there are three sets of the same color. 黑 *hēi* 'black', 灰 *huī* 'gray', and 乌 *wū* 'black' are regarded shades of black. 绿 *lǜ* 'green', 碧 *bì* 'bluish green', and 青 *qīng* 'green' are considered shades of green. 黄 *huáng* 'yellow' and 金 *jīn* 'gold' are recognized as shades of yellow. Moreover, this study found that the most influential BB node in the [A-BB] color-vision network is shared by the three-color nodes *hēi* 'black,' *huī* 'gray' and *wū* 'black.' These results reveal something about the nature of color perception and the experience of color referents, motivating Chinese speakers to create alternative color expressions to better portray the variances concerning similar colors based on the family resemblance.

With respect to the third research question, perhaps the most significant finding is the dominance of achromatic colors in the [A-BB] color-vision network. Regarding the five primary [A-] color constructions mentioned in Section 5.6.1, *hēi* 'black,' *bái* 'white' and *huī* 'gray' are achromatic colors having little or no hue. The current study found that these colors are highly salient and frequently used in the [ABB] color-vision constructions. From a physiological perspective, achromatic colors such as *hēi* 'black' and *huī* 'gray' are perceived by scotopic vision as achromatic shades of darkness under dim-light conditions. In contrast, the achromatic color *bái* 'white' is perceived by photopic vision as all hues in the color spectrum, being completely absorptive of all visible light. *Black* and *white*, as a sharp contrast at the opposite ends of the brightness spectrum, may create a stronger effect on one's mental representation of color concepts. The productivity of achromatic color constructions may help us to understand the potential cultural and psychological implications of color perception in Chinese.

The current findings corroborate the results of previous anthropological research in cross-cultural color nomenclature systems (ref., Casson, 1994, 1997; Conklin, 1955; Heider, 1972a, 1972b). While some languages may only have a few basic color terms (e.g., black, white, red, green), others may distinguish basic color terms in a more nuanced way (e.g., shades of green). This may be explained by the fact that the way people perceive and categorize colors is determined by their physiology of color perception. Moreover, the forms of color language are created within different speech communities, depending on the experience of referents or the events that need to be described in language.

The reason why achromatic color constructions are extremely productive may be explained by the experience of color referents in the natural environment. For example, as indicated by Casson (1994, 1997), with the emergence of colorants and textiles, English speakers are urged to create alternative color terms to better express the differences between similar colors in sociocultural contexts, e.g., russet, crimson, and scarlet. This suggests that cultural practices and the degree of color diversity present in the natural environment affect the usage and creation of color terms in a speech community.

The achromatic colors *black* and *white* are not only the initial creation of color terms but also the predominant colors present in our environment. As a sharp color contrast between darkness and brightness, these two colors are more likely to have dedicated color terms because they are easier to distinguish. Further studies, which focus on exploring what color referents and usage contexts that a particular achromatic [ABB] color construction is used to describe, are required to gain a better understanding of the productivity of achromatic color constructions in Chinese.

5.7 Summary

Overall, this study provides evidence for the existence of universal constraints on color categories in a productive family of [ABB] reduplication-based morphological constructions, which express the phenomenal qualities of perceptual experience in Chinese. The top five primary colors that are frequently used to describe perceptual qualities in the [ABB] patterns are *hēi* 'black,' *hóng* 'red,' *bái* 'white,' *lǜ* 'green' and *huī* 'gray' ranked by construction frequency. These colors correspond with the universal inventory of basic color terms proposed by Berlin and Kay (1969).

The current study also highlights the significance of shades of colors in color categorization in Chinese from a psychophysical perspective. A closer examination of the [A-BB] color-vision network suggests that three sets of color nodes belong to shades of the same color in the visible light spectrum. In addition, the stronger strength of association between shades of the same color such as 黑 *hēi,* 灰 *huī* and 乌 *wū*, which are considered shades of black, are supported by their mutual BB collocates (e.g., 溜溜 *liūliū*). Most importantly, the dominance of achromatic colors found in the creation of [ABB] patterns may reflect the perceptual salience and specific linguistic conventions in the Chinese language and culture. In the following chapter, I will further explore the cultural and psychological implications of Chinese color expressions by investigating the color referents and usage contexts of [ABB] color-vision constructions to better confirm and expand upon the current findings.

CHAPTER VI

THE PHENOMENAL QUALITIES OF COLOR VISION EXPERIENCE

6.1 Introduction

The aim of this chapter is to explore language-specific experiential structures of color-vision perception that are encoded in the [ABB] reduplication-based morphological constructions in Chinese. While the previous chapter has examined the formation of [ABB] color-vision constructions within a conceptual semantic network, a more in-depth investigation into the linguistic representations of the phenomenal qualities of perceptual color-vision experience in a perceiver-dependent world is required. As mentioned in Chapter 5.2.1, our pattern of thought is shaped by immediate perception and attention to the world of specialized contexts (Lucy, 1997a). Additionally, our perceptual experience with the world serves as the basis for linguistic meaning before the acquisition of language (Gallagher & Zahavi, 2021). The anthropological view of qualia, considering sensuous qualities as intersubjective products of the socialization to culture, supports studying how sociocultural semiosis mediates our lexical registers of sensuous attribution.

Building upon the findings discovered in the [ABB] color-vision network in Chapter V, this chapter delves deeper into the unique Chinese sociocultural contexts in which the schematic patterns of [ABB] color constructions have developed. This chapter is guided by two research questions presented as follows:

1. What are the phenomenal qualities of perceptual color-vision experience depicted in Chinese?
2. What are the schematic patterns speakers frequently use to describe phenomenal qualities of perceptual color-vision experience in Chinese?

By exploring these questions, this chapter aims to provide a more comprehensive understanding of the typical color referents and sociocultural contexts that account for the formation and productivity of [ABB] color-vision constructions.

6.2 Methods

6.2.1 Corpus data

The current study builds upon the corpus linguistics methods and analyses presented in the previous chapter. As discussed in Chapter V, a color lexicon is frequently applied along with other category terms for color referents, expressing the qualities of the surface appearance of an object (Davidoff, 1997). To gain a detailed understanding of what color referents and usage contexts that a particular [ABB] color construction is applied, I retrieved 15 subcorpora of [A--] color constructions in the self-constructed "A_collocates" corpus.[36] To better assess the usage contexts of [ABB] color-vision constructions, I combined the 15 subcorpora and constructed a "color_vision" corpus (corpus size: 287,484), comprising all the concordance lines of each ABB type in each [A--] color construction. See Appendix D for a complete list of 125 types of [ABB] color-vision constructions ranked by their token frequencies.

6.2.2 Context analysis

In the previous chapter, it was found that five primary colors are displaying a greater variety of word collocations and stronger collostruction strength with their BB collocates in the [A-BB] color-vision network. As shown in Table 5.1, the top five constructions ranked by type frequency are: [*huī* 'gray' --], [*hēi* 'black' --], [*lǜ* 'green' --], [*bái* 'white' --], and [*hóng* 'red' --].

[36] See Chapter 4.1 and 4.2 for a detailed description of the "A_collocates" corpus. The 15 [A--] color constructions are presented in Table 5.1.

To answer the research questions, this study selects the top five [A--] color constructions ranked by type frequency ($N > 10$) with their top five ABB types for further analyses on the usage contexts of [ABB] color-vision constructions. The top five ABB types in each [A--] color construction with their token frequencies are displayed in Table 6.1.

To understand color references underlying each [ABB] color-vision pattern, this study conducts two statistical measures: co-occurrence frequency and *t*-score. Co-occurrence frequency refers to the number of times two items (i.e., a particular ABB word and a collocate) co-occur in a corpus. T-score not only indicates the strength of association between two co-occurring items but also highlights frequent collocations. The higher the *t*-score, the higher strength of association between two co-occurring items. By searching a span of three characters precede and follow the top five ABB types in each [A--] color construction in the "color_vision" corpus, the typical collocates with their association strength based on the combined context frequencies,[37] as well as 100 random samples of concordance lines, are obtained for further qualitative analysis.[38]

6.3 Results

This section attempts to identify specific color referents and sociocultural contexts, accounting for the usage and creation of qualia constructions which share the schema [ABB] in Chinese. Focusing on the five significant [A--] color constructions with their top five ABB types (as shown in Table 6.1), the following paragraphs will demonstrate the frequent collocates and

[37] The combined context frequency refers to the co-occurrence frequency consisting of collocates in either the left or the right side of a certain ABB word.

[38] Random samples of 100 concordance lines based on the context of 20 items to the left and the right of each ABB type are extracted from the "color_vision" corpus.

Table 6.1. Top five ABB types with token frequencies in the five color-vision constructions

灰 *huī* 'gray'		黑 *hēi* 'black'		绿 *lǜ* 'green'		白 *bái* 'white'		红 *hóng* 'red'	
Type	**Freq**	**Type**	**Freq**	**Type**	**Freq**	**Type**	**Freq**	**Type**	**Freq**
蒙蒙 *méngméng* 'drizzle (of rain or snow)'	13,258	乎乎 *hūhū* '*hū*: (classical particle)'	12,512	油油 *yóuyóu* 'oily'	21,161	茫茫 *mángmáng* 'empty, boundless; vast and obscure'	12,547	彤彤 *tóngtóng* '*tóng*: red'	12,175
溜溜 *liūliū* '*liū*: to slip away'	8,447	压压 *yāyā* '*yā*: to press'	11,924	茵茵 *yīnyīn* '*lǜyīn*: grassy area'	2,019	花花 *huāhuā* '*huā*: flower; blossom'	10,038	艳艳 *yànyàn* '*yàn*: colorful; splendid'	5,612
扑扑 *pūpū* 'to pat'	701	漆漆 *qīqī* '*qī*: paint'	10,633	莹莹 *yíngyíng* '*yíng*: luster of gems'	1,466	嫩嫩 *nèn'nèn* '*nèn*: soft; delicate'	1,524	扑扑 *pūpū* 'to pat'	5,158
沉沉 *chénchén* 'deeply; heavily'	304	黝黝 *yǒuyǒu* '*yǒu*: black; dark green'	4,066	茸茸 *róngróng* 'downy; soft and thick'	576	晃晃 *huǎnghuǎng* '*huǎn*: to dazzle'	780	通通 *tōngtōng* '*tōng*: to go through'	3,221
茫茫 *mángmáng* 'boundless; vast and obscure'	215	洞洞 *dòngdòng* '*dòng*: cave; hole'	3,918	荫荫 *yīnyīn* '*lǜyīn*: shade (of a tree)'	180	蒙蒙 *méngméng* 'drizzle (of rain or snow)'	769	灿灿 *càncàn* '*càn*: glorious; bright'	505

their association strength, as well as their usage contexts for the five influential colors (i.e., *huī* 'gray', *hēi* 'black', *lǜ* 'green', *bái* 'white' and *hóng* 'red') to reveal the phenomenal qualities of perceptual color-vision experience depicted in Chinese.

6.3.1 The visual perception of "gray"

The first set of analyses examined the color construction [*huī* 'gray' --] which has the highest type frequency within the 15 [A--] color-vision constructions. The results obtained from the statistical analysis of the top five ABB types of [*huī* 'gray' --] are presented in Table 6.2. From the data in Table 6.2, it can be seen that the most frequent collocate and color referent is *tiānkōng* 'sky,' followed by the monosyllabic form *tiān* 'sky,' for *huīméngméng* 'dusky; overcast,' *huīchénchén* 'gloomy' and *huīmángmáng* 'gray, vast and obscure.' An inspection of the usage contexts of the three ABB types from their random samples of concordance lines reveals that they are highly contextualized with earthly experience, e.g., the sky and atmospheric condition. Three examples of usage contexts for each ABB type are provided in (1) below.

(1)

1a. 我们经常在早晨看到**灰蒙蒙**的天空，其实是一种叫雾霾的东西给笼罩了。

*Wǒmen jīngcháng zài zǎochén kàn dào **huī-méngméng** de tiānkōng, qíshí shì yì zhǒng jiào wùmái de dōngxī gěi lǒngzhàole.*

We often see a dusky sky in the morning, in fact, it is shrouded by something called haze.

1b. 有时连续几天甚至十几天都出现天空**灰沉沉**的，能见度不太好，但又没达到浓雾的程度。

*Yǒushí liánxù jǐ tiān shènzhì shí jǐ tiān dōu chūxiàn tiānkōng **huī-chénchén** de, néngjiàndù bú tài hǎo, dàn yòu méi dádào nóng wù de chéngdù.*

Sometimes the sky is overcast, and the visibility is not very good for several or even more

Table 6.2. Comparison of strength of association for collocates of the form [*huī* 'gray' - BB]

灰蒙蒙 *huīméngméng* 'dusky; overcast'			灰溜溜 *huīliūliū* 'gloomy'			灰扑扑 *huīpūpū* 'gray; ash'			灰沉沉 *huīchénchén* 'gloomy'			灰茫茫 *huīmángmáng* 'gray, vast and obscure'		
Coll.	Freq	*t*	Coll.	Freq	*t*	Coll.	Freq	*t*	Coll.	Freq	*t*	Coll.	Freq	*t*
tiānkōng 'sky'	2,634	51.32	*líkāi* 'to depart'	789	28.06	*liǎnshàng* 'on the face'	22	4.68	*tiānkōng* 'sky'	61	7.81	*tiānkōng* 'sky'	24	4.90
tiān 'sky'	1,584	39.55	*zǒu* 'to walk'	622	24.87	*chuānzhuó* 'apparel'	21	4.58	*tiān* 'sky'	36	5.96	*tiān* 'sky'	14	3.70
tiānqì 'weather'	443	21.00	*zǒu-le* 'to walk'	482	21.95	*yīfú* 'clothes'	17	4.11	*tiānqì* 'weather'	8	2.82	*yíqiè* 'everything'	10	3.15
chuāngwài 'outside the window'	208	14.42	*wǒ* 'I'	386	18.14	*rén* 'person'	19	3.93	*kōngqì* 'air'	8	2.82	*shìjiè* 'world'	8	2.79
tiānsè 'color of the sky'	179	13.38	*táozǒu* 'to escape'	296	17.20	*shíkuài* 'rock'	15	3.87	*yīnmái* 'haze'	6	2.45	*wàimiàn* 'outside'	7	2.64
wùqì 'fog; mist'	176	13.26	*rén* 'person'	321	16.66	*shítou* 'stone'	13	3.60	*wūyún* 'black cloud'	6	2.45	*dàdì* 'earth'	4	2.00
kōngqì 'air'	170	12.94	*huíqù* 'to return'	251	15.83	*yánsè* 'color'	13	3.59	*liǎnsè* 'complexion'	6	2.45	*tiāndì* 'heaven and earth'	4	2.00
wùmái 'haze'	159	12.60	*pǎo-le* 'to run away'	230	15.16	*shēnshang* 'on the body'	12	3.44	*tiānsè* 'color of the sky'	5	2.24	*yǎnqián* 'before one's eyes'	3	1.73

Note. **Coll**: collocates. **Freq**: co-occurrence frequency. ***t***: *t* score. Any items with frequency values below five are ignored for the calculation of strength of association. Only the top eight collocates (content words) of each ABB type are included in this table.

than ten days in a row, but it has not reached the level of dense fog.

1c. 当**灰茫茫**的天空弥漫着尘土和黑烟嘈杂的喧哗声充斥着你的耳畔, 你会怎么想?

*Dāng **huī-mángmáng** de tiānkōng mímànzhe chéntǔ hé hēi yān cáozá de xuānhuá shēng chōngchìzhe nǐ de ěrpàn, nǐ huì zěnme xiǎng?*

What do you think when the gray sky is filled with dust and black smoke, and the noise fills your ears?

The examples given above describe the phenomenal qualities of perceptual color-vision experience with the sky. As pointed out in Chapter V, 灰 *huī* 'gray' is an achromatic color associated with darkness. All three ABB types attempt to describe the visual quality of something gray that enshrouds the sky. As stated in 1b, the degree of *huīchénchén* 'gloomy' affects the visibility of the sky, but the degree of visibility is better than the visual perception of the sky with dense fog. This manifests the variation of the qualitative properties of perceptual color-vision experience with the sky in linguistic forms.

What is interesting about the data in Table 6.2 is the collocates of the ABB pattern *huīliūliū* 'gloomy.' Ranking the second-highest token frequency among the color construction [*huī* 'gray' --], *huīliūliū* 'gloomy' stands out in the table by mainly collocating with verbs (e.g., *líkāi* 'to depart' and *zǒu* 'to walk'). Distinct from other ABB patterns which primarily collocate with nouns, it is not apparent what the color referents of *huīliūliū* 'gloomy' are. In this pattern, the word *liū* is a verb that describes the action 'to slip away.' However, the meaning of the whole ABB pattern *huīliūliū* 'gloomy' cannot be derived from the sum of the meanings of *huī* 'gray' and *liū* 'to slip away.' Two examples of the usage contexts of *huīliūliū* 'gloomy' are retrieved from the random samples and presented in (2).

(2)

2a. 这些人被陶教授训斥得一句话也不敢说，**灰溜溜**的离开了。

Zhèxiē rén bèi táo jiàoshòu xùnchì de yíjù huà yě bù gǎn shuō, ***huī-liūliū*** *de líkāi le.*

These people were so reprimanded by Professor Tao that they dared not say a word and left gloomily.

2b. 想说些什么却什么话都说不出口，只好**灰溜溜**的离开，整个人越发沮丧了。

Xiǎng shuō xiē shénme què shénme huà dōu shuō bù chūkǒu, zhǐhǎo ***huī-liūliū*** *de líkāi, zhěng'ge rén yuèfā jǔsàng le.*

Want to say something but cannot say anything, had to leave gloomily, and become even more depressed.

Both examples provided above describe the qualitative properties of the mental phenomenon 'gloomy' by combining the darkness of *huī* 'gray' with the action *liū* 'to slip away.' Interacting with the lexical input in A and BB, the abstract constructional meaning of the word *huīliūliū* 'gloomy' conveys a psychomimetic impression of an unfavorable and ungraceful situation that urges someone to escape from a place. As supplemented in 2b, a person becomes even more depressed or distressed after leaving gloomily.

Despite having a low co-occurrence frequency in Table 6.2, the ABB pattern *huīpūpū* has the third-highest token frequency among the color construction [*huī* 'gray' --]. In this pattern, the word *pū* is a verb that depicts the action 'to pat; to pounce on.' Nevertheless, it is unclear why the color term *huī* 'gray' and the verb 'to pat; to pounce on' are combined, and what the function and usage context of *huīpūpū* are. Further analysis of the collocates of the ABB pattern *huīpūpū* in Table 6.2 reveals that the pattern refers to 'ash' and is strongly associated with visual perception toward one's appearance, e.g., face and apparel. Two examples of the usage contexts

of *huīpūpū* ‘gray; ash’ are obtained from the random samples and shown in (3).

(3)

3a. 少年穿着脏破的衣服，头发因为长时间没有清洗而打结翘起，脸上也是**灰扑扑**的掩盖了原本的长相。

*Shàonián chuānzhuó zāngpò de yīfú, tóufǎ yīnwèi cháng shíjiān méiyǒu qīngxǐ ér dǎ jié qiào qǐ, liǎn shàng yěshì **huī-pūpū** de yǎn'gài le yuánběn de zhǎngxiàng.*

The teenager wore dirty and shabby clothes, his hair was knotted up because he had not been washed for a long time, and his original appearance was covered up by his dusty face.

3b. 看着镜子中满脸雀斑，眼睛灰暗无光，蓬头乱发以及**灰扑扑**的衣服，我都觉得自己不认识自己了。

*Kànzhe jìngzi zhōng mǎn liǎn quèbān, yǎnjīng huī'àn wú guāng, pēng tóu luàn fǎ yǐjí **huī-pūpū** de yīfú, wǒ dōu juéde zìjǐ bú rènshì zìjǐ le.*

Looking in the mirror with freckles, gray eyes, dishevelled hair and dusty clothes, I felt like I didn't know myself.

The examples offered above describe the phenomenal qualities of visual perception toward one’s appearance. As expressed in 3a, *huīpūpū* ‘ash’ is used to describe something gray that covers a youth’s face and conceals his original appearance. It is highly possible that the collocation of *huī* ‘gray’ and *pū* ‘to pat’ is derived from the embodied experience of patting some gray substance (e.g., dirt or powdery residue) down from one’s face or clothes. Here *huī* is the the color name ‘gray’ and *pūpū* is a phenomimetic expression that conveys the contact of dirt or powdery residue. Together the whole word *huīpūpū* conveys a psychomimetic impression of an unfavorable feeling toward the object being described, such as a certain amount of ash that conceals something which needs to be pat down.

6.3.2 The visual perception of "black"

The second set of analyses investigated the color construction [*hēi* 'black' --] which has the highest construction frequency among the 15 [A--] color-vision constructions. Table 6.3 presents the results of the statistical analysis on the top five ABB types of [*hēi* 'black' --]. It can be seen from the data in Table 6.3 that three ABB types, i.e., *hēihūhū* 'black; dark,' *hēiyāyā* 'dense and dark' and *hēidòngdòng* 'pitch-dark,' have a significant strong association strength (*t*-score > 32) with their top collocates.

A closer examination of the collocates of *hēihūhū* 'black; dark' shows that *dōngxī* 'thing(s)' is the most frequent collocate and color referent (t = 33.16). Being a general term that can refer to any object, the collocation between *hēihūhū* 'black; dark' and *dōngxī* 'thing(s)' indicates the high degree of openness of *hēihūhū*. As shown in Table 6.3, the collocates of *hēihūhū* are extremely diverse. The term *hēihūhū* 'black; dark' seems to be conventionalized and used to express the visual perception of something black or dark. Two examples of the usage contexts of *hēihūhū* 'black; dark' are extracted from the random samples and shown in (4).

(4)

4a. 他爬到一处山坡时，看到一个石洞下有一团**黑乎乎**的东西，还没等他看清楚，突然一只黑熊冲了出来。

*Tā pá dào yí chù shānpō shí, kàn dào yíge shídòng xià yǒu yì tuán **hēi-hūhū** de dōngxī, hái méi děng tā kàn qīngchǔ, túrán yì zhī hēixióng chōng le chūlái.*

When he climbed to a hillside, he saw a mass of black things under a cave. Before he could see it clearly, a black bear rushed out.

Table 6.3. Comparison of strength of association for collocates of the form [*hēi* 'black' - BB]

黑乎乎 *hēihūhū* 'black; dark'			黑压压 *hēiyāyā* 'dense and dark'			黑漆漆 *hēiqīqī* 'pitch-dark'			黑黝黝 *hēiyǒuyǒu* 'dark; swarthy'			黑洞洞 *hēidòngdòng* 'pitch-dark'		
Coll.	Freq	*t*	Coll.	Freq	*t*	Coll.	Freq	*t*	Coll.	Freq	*t*	Coll.	Freq	*t*
dōngxi 'thing(s)'	1,104	33.16	*rénqún* 'crowd'	1,067	32.64	*sìzhōu* 'all around'	358	18.91	*pífū* 'skin'	235	15.31	*qiāngkǒu* 'muzzle'	1,059	32.54
fángjiān 'room'	135	11.56	*wūyún* 'black cloud'	381	19.52	*yǎnjīng* 'eye(s)'	207	14.33	*dòngkǒu* 'cave mouth'	117	10.82	*pàokǒu* 'cannon's mouth'	121	11.00
wǎn 'bowl'	98	9.87	*réntóu* 'person; head'	348	18.65	*zhōuwéi* 'surround-ings'	181	13.41	*yǎnjīng* 'eye(s)'	106	10.26	*sìzhōu* 'all around'	86	9.27
shǒu 'hand'	102	9.86	*tiānkōng* 'sky'	286	16.89	*yèwǎn* 'night'	151	12.28	*liǎn* 'face'	94	9.67	*yǎnjīng* 'eye(s)'	83	9.07
quánshēn 'whole body'	93	9.61	*dàjūn* 'army'	89	9.42	*tiānkōng* 'sky'	147	12.10	*qiāngkǒu* 'muzzle'	56	7.48	*shǒuqiāng* 'pistol'	59	7.68
yǐngzi 'shadow'	92	9.58	*yǎn* 'eye'	90	9.39	*wǎnshàng* 'night'	144	11.92	*tǔdì* 'land'	50	6.99	*yǎnkuàng* 'eye socket'	53	7.28
yǎnjīng 'eye(s)'	88	9.27	*guānzhòng* 'audience'	86	9.17	*fángjiān* 'room'	136	11.61	*nítǔ* 'earth; soil'	46	6.78	*wūzi* 'house; room'	50	7.07
wǎnshàng 'night'	88	9.26	*yúncéng* 'cloud layer'	79	8.89	*wūzi* 'house; room'	130	11.39	*liǎnpáng* 'face'	44	6.63	*chuānghù* 'window'	44	6.63

Note. **Coll**: collocates. **Freq**: co-occurrence frequency. ***t***: *t* score. Any items with frequency values below five are ignored for the calculation of strength of association. Only the top eight collocates (content words) of each ABB type are included in this table.

4b. 刘女士感觉很奇怪，随即吐了出来，是块**黑乎乎**的东西。我仔细研究了半天才发现这是一块黑色的纸屑。

*Liú nǚshì gǎnjué hěn qíguài, suíjí tǔ le chūlái, shì kuài **hēi-hūhū** de dōngxī. Wǒ zǐxì yánjiū le bàntiān cái fāxiàn zhè shì yíkuài hēisè de zhǐxiè.*

Ms. Liu felt very strange and immediately spitted it out. It was a black thing. I studied it carefully for a long time before I found that it was a black scrap of paper.

Both examples offered above illustrate the usage context of *hēihūhū* 'black; dark.' In both examples, the term *hēihūhū* is used to describe the phenomenal qualities of perceptual color-vision experience: something black that is unknown to a person. No matter what the object is, language users tend to use *hēihūhū* to emphasize the qualitative properties of their visual perception, i.e., the quality of being dark in color.

The next analysis was concerned with the collocates of the ABB pattern *hēiyāyā* 'dense and dark.' It is apparent from Table 6.3 that the most frequent collocate and color referent of *hēiyāyā* is *rénqún* 'crowd' (t = 33.16). In the ABB pattern, *yā* is a verb that refers to the action 'to press.' Nonetheless, the meaning of the whole ABB pattern *hēiyāyā* 'dense and dark' cannot be derived from the sum of the meanings of *hēi* 'black' and *yā* 'to press.' To exemplify the function and usage context of *hēiyāyā*, two random samples are retrieved and presented in (5).

(5)

5a. 面对台下**黑压压**的观众，长华脑子里一片空白。

*Miànduì táixià **hēiyāyā** de guānzhòng, Chánghuá nǎozi lǐ yípiàn kòngbái.*

Facing a dense crowd of audience in dark under the stage, Changhua's mind went blank.

5b. 每天下班后，李力在国贸桥下的公交车站等车时，永远是**黑压压**的乘客，多的时候有上千人排队绕过栅栏好几圈。

*Měitiān xiàbān hòu, Lǐlì zài Guómào qiáo xià de gōngjiāo chēzhàn děng chē shí, yǒngyuǎn shì **hēiyāyā** de chéngkè, duō de shíhòu yǒu shàng qiān rén páiduì ràoguò zhàlán hǎo jǐ quān.*

Every day after work, when Lili waits at the bus stop under the International Trade Bridge, there is always a dense cloud of passenger, and there are times when thousands of people queue around the fence in several circles.

The examples given above display the usage context of *hēiyāyā* 'dense and dark,' showing that it is highly contextualized with *rénqún* 'crowd', e.g., audience and passengers. While the term *hēiyāyā* is commonly translated as 'dense and dark,' the perceptual qualities and the speaker feeling encoded in this word are lost. Here *hēi* is the color name 'black' and *yāyā* is a phenomimetic expression that conveys the sensation of feeling pressure from the object being described. In both examples, the abstract constructional meaning of the word *hēiyāyā* is a psychomimetic conveyance that expresses an unfavorable feeling toward the crowd. It is likely that the collocation of *hēi* 'black' and *yā* 'to press' is derived from the embodied experience of feeling pressure from a high degree of crowd density. This finding is supported by the concordance line in 5a. It is the visual perception of a dense and dark crowd of audience under the stage that makes one's mind goes blank.

Another ABB pattern that stands out in Table 6.3 is *hēidòngdòng* 'pitch-dark' which has a significantly strong association strength with its top collocate *qiāngkǒu* 'muzzle' ($t = 32.54$). In the pattern *hēidòngdòng*, *dòng* is a noun that refers to 'cave or hole.' From the collocates in Table 6.3, it can be seen that *hēidòngdòng* 'pitch-dark' is highly associated with arms, e.g., *qiāngkǒu* 'muzzle', *pàokǒu* 'cannon's mouth' and *shǒuqiāng* 'pistol.' To understand the function

and usage context of *hēidòngdòng*, two random samples are obtained and shown in (6).

(6)

6a. 头戴钢盔，身穿迷彩服的士兵**黑压压**的涌出来，**黑洞洞**的枪口瞄准舱门。

*Tóu dài gāngkuī, shēn chuān mícǎi fú de shìbīng **hēiyāyā** de yǒng chūlái, **hēidòngdòng** de qiāngkǒu miáozhǔn cāngmén.*

The soldiers in helmets and camouflage uniforms poured out in black, and the black muzzle aimed at the hatch.

6b. 虽然被对方的一双**黑洞洞**的眼眶吓了一跳，但随后又是不把对方放在眼里了。

*Suīrán bèi duìfāng de yīshuāng **hēidòngdòng** de yǎnkuàng xià le yí tiào, dàn suíhòu yòu shì bù bǎ duìfāng fàng zài yǎn lǐ le.*

Although he was startled by each other's dark eye sockets, they soon turned a blind eye to each other.

Both examples presented above illustrate the usage contexts of *hēidòngdòng* 'pitch-dark,' describing the phenomenal qualities of visual perception toward a certain object. Interacting with the color term *hēi* 'black' and the phenomimetic expression *dòngdòng*, where *dòng* refers to 'cave; hole,' the constructional meaning of the word *hēidòngdòng* conveys a psychomimetic impression that the object being described has the visual quality of being deep and dark as a cave or hole. This finding is supported by the concordance line in 6b. According to 6b, the visual perception of one's eye socket can be better described by *hēidòngdòng* 'pitch-dark' to highlight the feature of being deep and dark. Most importantly, the example in 6a serves as great evidence that demonstrates how language users apply different ABB patterns, *hēiyāyā* 'dense and dark' and *hēidòngdòng* 'pitch-dark,' to describe the qualitative properties of their perceptual color-vision experience.

Having the third-highest token frequency among the color construction [*hēi* 'black' --], the ABB pattern *hēiqīqī* 'pitch-dark' also has a unique function to describe qualitative properties of color perception. An inspection of the collocates of *hēiqīqī* 'pitch-dark' reveals that *sìzhōu* 'all around' is the most frequent collocate and color referent (t = 18.91). In the ABB pattern, *qī* refers to either a verb 'to paint' or a noun 'paint.' From the data in Table 6.3, it can be seen that *hēiqīqī* 'pitch-dark' is mainly used to describe one's visual perception of certain locations or surroundings, e.g., *sìzhōu* 'all around,' *zhōuwéi* 'surroundings' and *fángjiān* 'room.' To assess the function and usage context of *hēiqīqī*, two random samples are extracted and presented in (7).

(7)

7a. 一个人被关在**黑漆漆**的房间里，不知道有多害怕。

*Yíge rén bèi guān zài **hēiqīqī** de fángjiān lǐ, bù zhīdào yǒu duō hàipà.*

I don't know how scared a person is when he is locked up in a dark room.

7b. 原来小区内没有路灯，楼道间晚上**黑漆漆**的，伸手不见五指，晚上散步给老人小孩带来不便。

*Yuánlái xiǎoqū nèi méiyǒu lùdēng, lóudào jiān wǎnshàng **hēiqīqī** de, shēnshǒu bùjiàn wǔzhǐ, wǎnshàng sànbù gěi lǎorén xiǎohái dài lái búbiàn.*

It turned out that there were no street lights in the community, and the corridor was dark at night, and walking at night brought inconvenience to the elderly and children.

The examples provided above describe the phenomenal qualities of visual perception toward certain locations or surroundings: *fángjiān* 'room' and *lóudào jiān* 'corridor; passageway.' As supplemented in 7b, the degree of darkness has reached the level that one cannot even see five fingers when stretching out a hand. It is highly possible that the collocation of *hēi* 'black' and *qī* 'paint' is derived from one's experience with paint colors, i.e., the darkness

of black paint. Interacting with the color name *hēi* 'black' and the phenomimetic expression *qīqī*, the constructional meaning of the word *hēiqīqī* is a psychomimetic conveyance that describes an insecure feeling toward the environment being described. The term *hēiqīqī* 'pitch-dark' seems to be conventionalized and associated with the visual quality of having a certain degree of darkness that is as dark as the black paint.

The last analysis of the color construction [*hēi* 'black' --] was concerned with the term *hēiyǒuyǒu* 'dark; swarthy.' In the ABB pattern of *hēiyǒuyǒu*, *yǒu* is a morpheme that refers to the color black or dark green. Further examination of the collocates of the ABB pattern *hēiyǒuyǒu* in Table 6.3 reveals that it is strongly associated with visual perception toward one's body parts, e.g., *pífū* 'skin,' *yǎnjīng* 'eye(s)' and *liǎn* 'face.' To evaluate the function and usage context of *hēiyǒuyǒu*, two random samples are retrieved and provided in (8).

(8)

8a. 男孩们可不怕热，一个个打着赤膊露出**黑黝黝**的皮肤，散发出光泽。

*Nánháimen kě búpà rè, yígege dǎzhe chìbó lòuchū **hēiyǒuyǒu** de pífū, sànfā chū guāngzé.*

The boys were not afraid of the heat, showing their swarthy skin that emanates glow by being shirtless.

8b. 在烈日酷暑下的暴晒，皮肤变成**黑黝黝**的，但我觉得这是一种快乐，一种更好地朝人生目标前进的勇气。

*Zài lièrì kùshǔ xià de pùshài, pífū biànchéng **hēiyǒuyǒu** de, dàn wǒ juédé zhè shì yì zhǒng kuàilè, yì zhǒng gèng hǎo de cháo rénshēng mùbiāo qiánjìn de yǒngqì.*

Under the exposure of scorching sun, the skin becomes swarthy, but I think this is a kind of happiness, a better courage that motivates moving forward towards the goal of life.

Both examples presented above depict the phenomenal qualities of visual perception toward one's skin color. As stated in 8a, the dark-skinned described by the term *hēiyǒuyǒu* 'dark; swarthy' not only indicates the quality of being dark in color but also visualizes the quality of being luster or glowing. Interacting with the color term *hēi* 'black' and the phenomimetic expression *yǒuyǒu*, the constructional meaning of the word *hēiyǒuyǒu* conveys a psychomimetic impression that one's skin color has the visual quality of being tan, which is caused by excess sun exposure.

6.3.3 The visual perception of "green"

The third set of analyses examined the color construction [*lǜ* 'green' --] which has the third-highest type frequency within the 15 [A--] color-vision constructions. The results attained from the statistical analysis of the top five ABB types of [*lǜ* 'green' --] are displayed in Table 6.4. Closer inspection of the data in Table 6.4 shows that [*lǜ* 'green' --] is a salient color construction which is primarily associated with 'vegetation.' As shown in Table 6.4, *cǎodì* 'lawn' is the most frequent collocate and color referent for *lǜyóuyóu* 'lush green' and *lǜyīnyīn* 'verdant.' In addition, *cǎodì* 'lawn' is found to be the second frequent collocate for *lǜyíngyíng* 'glittering green' and *lǜróngróng* 'lush green.' To understand the variances between the top five ABB types of [*lǜ* 'green' --], the following paragraphs investigate their functions and usage contexts based on the current corpus data.

What is striking about the data in Table 6.4 is *lǜyóuyóu* 'lush green' which has a significantly strong association strength with its top collocate *cǎodì* 'lawn' (t = 37.97). As can be seen from Table 6.1, the ABB pattern *lǜyóuyóu* 'lush green' has the highest token frequency (N = 21,161) among the top five [A--] color-vision constructions. In this pattern, *yóu* is either a noun or an adjective that refers to 'oil' or 'oily.' However, it is unknown why the color term *lǜ* 'green'

Table 6.4. Comparison of strength of association for collocates of the form [*lǜ* 'green' - BB]

绿油油 *lǜyóuyóu* 'lush green'			绿茵茵 *lǜyīnyīn* 'verdant'			绿莹莹 *lǜyíngyíng* 'glittering green'			绿茸茸 *lǜróngróng* 'lush green'			绿荫荫 *lǜyīnyīn* 'verdant'		
Coll.	Freq	*t*	Coll.	Freq	*t*	Coll.	Freq	*t*	Coll.	Freq	*t*	Coll.	Freq	*t*
cǎodì 'lawn'	1,442	37.97	*cǎodì* 'lawn'	537	23.17	*yǎnjīng* 'eye(s)'	91	9.53	*xiǎocǎo* 'grass'	78	8.83	*cǎodì* 'lawn'	17	4.12
xiǎocǎo 'grass'	774	27.82	*cǎopíng* 'lawn'	271	16.46	*cǎodì* 'lawn'	42	6.48	*cǎodì* 'lawn'	64	8.00	*shù* 'tree'	14	3.74
yèzi 'leaf'	753	27.43	*xiǎocǎo* 'grass'	96	9.80	*yèzi* 'leaf'	40	6.32	*cǎopíng* 'lawn'	49	7.00	*shùmù* 'tree'	6	2.45
cǎopíng 'lawn'	721	26.85	*dìtǎn* 'carpet'	49	7.00	*guāngmáng* 'radiance'	35	5.91	*dìtǎn* 'carpet'	32	5.66	*pútáojià* 'grape trellis'	4	2.00
dàotián 'paddy'	594	24.37	*zúqiúchǎng* 'soccer field'	46	6.78	*cǎopíng* 'lawn'	23	4.79	*qīngtái* 'moss'	26	5.10	*shānxià* 'the foot of a mountain'	4	2.00
shūcài 'vegetable'	438	20.88	*cǎoyuán* 'grassland'	39	6.24	*zhītiáo* 'branch; twig'	18	4.24	*dìshàng* 'on the ground'	18	4.24	*shùlín* 'forest'	4	2.00
màitián 'cornfield'	387	19.67	*cāochǎng* 'sports ground'	37	6.08	*xiǎocǎo* 'grass'	18	4.24	*dàsǎn* 'large umbrella'	11	3.32	*dàshù* 'tree'	3	1.73
tiányě 'field'	385	19.62	*shù* 'tree'	27	5.18	*liǔtiáo* 'willow'	17	4.12	*táixiǎn* 'moss'	11	3.32	*cǎopíng* 'lawn'	3	1.73

Note. **Coll**: collocates. **Freq**: co-occurrence frequency. ***t***: *t* score. 绿荫荫 *lǜyīnyīn* (shaded in gray) is the homophone of 绿茵茵 *lǜyīnyīn*. Any items with frequency values below five are ignored for the calculation of strength of association. Only the top eight collocates (content words) of each ABB type are included in this table.

and the word *yóu* ‘oil or oily’ are entrenched together. To assess the function and usage context of *lǜyóuyóu*, two random samples are extracted and provided in (9).

(9)

9a. 一路上欣赏城乡交界处的风光，**绿油油**的草地，金灿灿的稻田。

*Yílùshàng xīnshǎng chéngxiāng jiāojiè chǔ de fēng’guāng, **lǜyóuyóu** de cǎodì, jīncàncàn de dàotián.*

All the way to enjoy the scenery at the junction of urban and rural areas, green grass, golden rice fields.

9b. 没有成熟的青果，像八、九岁孩子的拳头大小，在阳光的照射下闪烁着**绿油油**的光。

*Méiyǒu chéngshú de qīng’guǒ, xiàng bā, jiǔ suì háizi de quántóu dàxiǎo, zài yáng’guāng de zhàoshè xià shǎnshuòzhe **lǜyóuyóu** de guāng.*

There is no ripe green fruit, like the fist size of an eight- or nine- year-old child, shining green in the sun.

Both sentences given above demonstrate the usage context of *lǜyóuyóu* ‘lush green.’ In both sentences, the term *lǜyóuyóu* is used to highlight the qualitative properties of perceptual color-vision experience: the quality of being lush green in color. As described in 9b, the visual perception of *lǜyóuyóu* ‘lush green’ is strengthened by the sunlight. Interacting with the color name *lǜ* ‘green’ and the phenomimetic expression *yóuyóu*, the constructional meaning of the psychomimetic word *lǜyóuyóu* is consolidated to convey the visual quality, emphasizing the lightness aspect of green (i.e., the quantity of light and the degree of reflectivity) by projecting the luster of the oil onto lush greenery.

The next analysis was concerned with the homophones *lǜyīnyīn* ‘verdant’ in different Chinese characters: 绿茵茵 and 绿荫荫. In the ABB pattern 绿茵茵 *lǜyīnyīn*, 绿茵 *lǜyīn* is a

disyllabic word that refers to a grassy area. In the ABB pattern 绿荫荫 *lǜyīnyīn*, 绿荫 *lǜyīn* is a disyllabic word that refers to the shade (of a tree). Further inspection of the statistical data reveals that the collocates of 绿茵茵 *lǜyīnyīn* have higher co-occurrence frequencies and stronger association strength than those of 绿荫荫 *lǜyīnyīn*. This indicates the possibility that 绿荫荫 *lǜyīnyīn* is a relatively novel variant of 绿茵茵 *lǜyīnyīn*.

What is interesting about the collocates of the homophones of *lǜyīnyīn* 'verdant' is their consistency in terms of color reference. It can be seen from the data in Table 6.4 that both the homophones of *lǜyīnyīn* 'verdant' are used to express the phenomenal qualities of visual perception toward greenery, e.g., *cǎodì* 'lawn', *cǎopíng* 'lawn' and *shù* 'tree.' It is worth noting that most collocates of 绿荫荫 *lǜyīnyīn* are related to trees, suggesting the derivation of the semantic meaning from the word 绿荫 *lǜyīn* 'the shade (of a tree). Two examples of the usage contexts of each homophone of *lǜyīnyīn* 'verdant' are retrieved from the random samples and shown in (10).

(10)

10a. 基地内有**绿茵茵**的草地，树木葱笼，环境优美，空气清新。

*Jīdì nèi yǒu **lǜyīnyīn** de cǎodì, shùmù cōnglóng, huánjìng yōuměi, kōngqì qīngxīn.*

Inside the base, there are green grass, lush trees, beautiful environment and fresh air.

10b. 树木个个枝繁叶茂**绿荫荫**的在校园里称起了一把巨大的绿伞遮住了酷炎的夏日。

*Shùmù gè gè zhīfányèmào **lǜyīnyīn** de zài xiàoyuán lǐ chēngqǐ le yì bǎ jùdà de lǜsǎn zhēzhù le kùyán de xiàrì.*

Trees with luxuriant foliage on campus has put up a huge green umbrella to cover the scorching summer.

As shown in 10a, the term 绿茵茵 *lǜyīnyīn* 'verdant' is used to highlight the qualitative properties of color perception: the lush green of the luxuriant lawn. Moreover, the description in 10b, which depicts the luxuriant foliage of trees as a huge umbrella, supports the hypothesis that 绿荫荫 *lǜyīnyīn* 'verdant' is derived from 绿荫 *lǜyīn* 'the shade (of a tree). Therefore, the findings suggest that the term 绿荫荫 *lǜyīnyīn* is a psychomimetic impression that expresses the visual quality of being lush green and luxuriant, casting a shadow or a dark area at the same time.

Having the third-highest token frequency among the color construction [*lǜ* 'green' --], the ABB pattern *lǜyíngyíng* 'glittering green' is also used to describe the phenomenal qualities of visual perception toward greenery. What is striking about the term *lǜyíngyíng* 'glittering green' is its most frequent collocate *yǎnjīng* 'eye(s)' (t = 9.53). From the data in Table 6.4, it can be seen that *yǎnjīng* 'eye(s)' is a unique color referent of *lǜyíngyíng* 'glittering green,' which is not found to be collocated with other ABB types of [*lǜ* 'green' --]. To evaluate the function and usage context of *lǜyíngyíng*, three random samples are obtained and offered in (11).

(11)

11a. 她的眼睛**绿莹莹**的，活像两颗绿宝石。

*Tā de yǎnjīng **lǜyíngyíng** de, huóxiàng liǎng kē lǜ bǎoshí.*

Her eyes are green, like two emeralds.

11b. 我连忙猛踩刹车，定睛一看，一只黑猫闪着**绿莹莹**的眼睛端坐在小巷中间。

*Wǒ liánmáng měng cǎi shāchē, dìng jīng yí kàn, yì zhī hēi māo shǎnzhe **lǜyíngyíng** de yǎnjīng duānzuò zài xiǎoxiàng zhōngjiān.*

I slammed on the brakes and looked intently. A black cat was sitting in the middle of the alley with glittering green eyes.

11c. 在儿童院的校园里到处是鸟语花香，**绿莹莹**的草地和参天的大树。

Zài értóngyuàn de xiàoyuán lǐ dàochù shì niǎoyǔhuāxiāng, ***lǜyíngyíng*** *de cǎodì hé cāntiān de dàshù.*

The campus of the children's home is full of birds, flowers, green grass and towering trees.

Both sentences in 11a and 11b demonstrate what contexts the term *lǜyíngyíng* 'glittering green' is used to describe *yǎnjīng* 'eye(s).' According to the example in 11a, it suggested that the term *lǜyíngyíng* is a psychomimetic expression that is used to describe the qualitative properties of color perception: the quality of being glittering green in color as that of an emerald. As can be seen from the example in 11b, the term *lǜyíngyíng* 'glittering green' can be used to describe both human and animal eyes. Similar to other ABB types of [*lǜ* 'green' --], the example in 11c shows that *lǜyíngyíng* 'glittering green' is also applicable to *cǎodì* 'lawn.'

The last analysis of the color construction [*lǜ* 'green' --] was concerned with the term *lǜróngróng* 'lush green.' As shown in Table 6.4, the most frequent collocate and color referent of *lǜróngróng* 'lush green' is *xiǎocǎo* 'grass' (t = 8.83). Although *lǜróngróng* 'lush green' seems to share several collocates with *lǜyóuyóu* 'lush green,' it can be seen from Table 6.4 that *lǜróngróng* 'lush green' has its unique collocates that are not shared with other ABB patterns, i.e., *qīngtái* 'moss' and *táixiǎn* 'moss.' In the pattern *lǜróngróng*, *róng* is an adjective that means 'downy.' However, it is unclear why the color term *lǜ* 'green' and the word *róng* 'downy' are collocated together. To analyze the function and usage context of *lǜróngróng*, two random samples are retrieved and shown in (12).

(12)

12a. 操场上长出了一层**绿茸茸**的小草，躺在上面多舒服呀！

*Cāochǎng shàng zhǎngchū le yì céng **lǜróngróng** de xiǎocǎo, tǎng zài shàngmiàn duō shūfú ya!*

There is a layer of green grass growing on the playground. How comfortable it is to lie on it!

12b. **绿茸茸**的青苔长满了石阶下沿的阴湿处。

***Lǜróngróng** de qīngtái zhǎngmǎn le shíjiē xiàyán de yīnshī chù.*

The green moss covered the damp places at the bottom of the stone steps.

The examples presented above describe the phenomenal qualities of visual perception toward vegetation: *xiǎocǎo* ‘grass’ and *qīngtái* ‘moss.’ Both examples in (12) demonstrate the usage contexts of *lǜróngróng* ‘lush green,’ indicating a certain amount of plants that provide the view of *lǜróngróng*: a layer of grass (in 12a) and a lot of moss that covers the stone step (in 12b). It is possible that the collocation of *lǜ* ‘green’ and *róng* ‘downy’ is derived from one’s embodied experience of touching an assemblage of plant species (e.g., grass or moss) that provides the sensory of soft and thick. The term *lǜróngróng* ‘lush green’ is a psychomimetic conveyance that is conventionalized and used to highlight the sensory qualities of being lush green in vision, as well as being downy in touch at the same time.

6.3.4 The visual perception of “white”

The fourth set of analyses studied the color construction [*bái* ‘white’ --] which has the third-highest construction frequency (N = 27,213) among the five [A--] color-vision constructions under investigation. Table 6.5 presents the results of the statistical analysis on the top five ABB types of [*bái* ‘white’ --]. As can be seen from the data in Table 6.5, there is almost no overlap between the collocates of the top five ABB types, besides the collocate *dàxuě* ‘snow’

for *báimángmáng* ‘a vast expanse of whiteness’ and *báiméngméng* ‘hazy; misty,’ and the collocate *tàiyáng* ‘sun’ for *báihuāhuā* ‘shining white’ and *báihuǎnghuǎng* ‘gleaming; glaring.’ This indicates the unique function and usage context of each ABB type of [*bái* ‘white’ --]. The following paragraphs examine the functions and usage contexts of the top five ABB types of [*bái* ‘white’ --].

Looking at the data in Table 6.5, the ABB pattern *báihuāhuā* ‘shining white’ and its top collocate *yínzi* ‘money; silver’ stands out in the Table by having the highest co-occurrence frequency (N = 1,679) and the strongest association strength (t = 40.97). In the pattern *báihuāhuā*, *huā* is a noun that means ‘flower.’ Nevertheless, the meaning of the whole ABB pattern *báihuāhuā* ‘shining white’ cannot be derived from the sum of the meanings of *bái* ‘white’ and *huā* ‘flower.’ Closer inspection of the term *báihuāhuā* ‘shining white’ reveals the diversity of its collocates, being able to describe the whiteness of body parts, i.e., *dàtuǐ* ‘thigh,’ *húzi* ‘beard’ and *pìgǔ* ‘butt.’ To understand the function and usage context of *báihuāhuā*, two random samples are obtained and shown in (13).

(13)

13a. 虽然**白花花**的大米不能换来**白花花**的银子，但是又有什么办法呢？

*Suīrán **báihuāhuā** de dàmǐ bùnéng huànlái **báihuāhuā** de yínzi, dànshì yòu yǒu shéme bànfǎ ne?*

Although white rice cannot be exchanged for white silver, what else can be done?

Table 6.5. Comparison of strength of association for collocates of the form [*bái* 'white' - BB]

白茫茫 *báimángmáng* 'a vast expanse of whiteness'			白花花 *báihuāhuā* 'shining white'			白嫩嫩 *báinèn'nèn* *'fair and clean; delicate'*			白晃晃 *báihuǎnghuǎng* 'gleaming; glaring'			白蒙蒙 *báiméngméng* 'hazy; misty'		
Coll.	Freq	*t*	Coll.	Freq	*t*	Coll.	Freq	*t*	Coll.	Freq	*t*	Coll.	Freq	*t*
dàdì 'earth'	642	25.33	*yínzi* 'money; silver'	1,679	40.97	*xiǎoshǒu* 'small hand'	107	10.34	*yáng'guāng* 'sunshine'	62	7.87	*wùqì* 'fog; mist'	59	7.68
shìjiè 'world'	570	23.64	*dàtuǐ* 'thigh'	343	18.52	*pífū* 'skin'	102	10.09	*tàiyáng* 'sun'	26	5.09	*qìxí* 'breath'	46	6.78
dàochù 'everywhere'	442	21.01	*dàmǐ* 'rice'	134	11.57	*jīfū* 'skin'	53	7.27	*dēng'guāng* 'light'	23	4.79	*wù* 'fog; mist'	27	5.19
yǎnqián 'before one's eyes'	390	19.73	*tàiyáng* 'sun'	128	11.27	*ròu* 'flesh'	38	6.15	*yǎnjīng* 'eye(s)'	15	3.86	*tiānkōng* 'sky'	16	3.99
xuědì 'snowland'	307	17.52	*mǐfàn* 'rice'	127	11.26	*xiǎoliǎn* 'small face'	36	6.00	*cìyǎn* 'to dazzle'	14	3.74	*shuǐwù* 'fog; mist'	15	3.87
tiāndì 'heaven and earth'	301	17.32	*húzi* 'beard'	123	11.09	*liǎndàn* 'face'	36	6.00	*rìguāng* 'sunlight'	14	3.74	*guāngmáng* 'radiance'	14	3.74
xuě 'snow'	288	16.95	*dōngxi* 'thing(s)'	122	10.88	*dòufǔ* 'tofu'	33	5.74	*yuèliàng* 'moon'	14	3.74	*dàxuě* 'snow'	10	3.16
sìzhōu 'all around'	225	14.98	*pìgǔ* 'butt'	110	10.48	*liǎn* 'face'	24	4.88	*dāo* 'knife'	14	3.73	*yǔwù* 'rain and fog'	9	3.00

Note. **Coll**: collocates. **Freq**: co-occurrence frequency. ***t***: *t* score. Any items with frequency values below five are ignored for the calculation of strength of association. Only the top eight collocates (content words) of each ABB type are included in this table.

13b. 大街上行走的姑娘衣服穿得一个比一个危险，举目看去**白花花**全是大腿。

Dàjiē shàng xíngzǒu de gūniáng yīfú chuān de yíge bǐ yíge wéixiǎn, jǔmù kàn qù ***báihuāhuā*** *quán shì dàtuǐ.*

The girls, walking on the street, dress in a sexy and competitive way. When you raise your eyes and look, there are shining white thighs everywhere.

Both sentences given above demonstrate the usage context of *báihuāhuā* 'shining white.' In both sentences, the term *báihuāhuā* is used to highlight the qualitative properties of visual perception: the quality of being shining white in color vision. Further analysis of the usage contexts of *báihuāhuā* reveals that the term is specifically used to describe something white in a large amount, highlighting the lightness aspect of white in terms of the reflectivity of bright light. It is the large number of a certain object that provides the visual perception of 'shining': a large amount of rice and silver (in 13a), and several legs/thighs (in 13b).

It is possible that the collocation of *bái* 'white' and *huā* 'flower, blossom' is derived from one's visual experience of an assemblage of white flowers that establishes the mental representation of 'shining white.' As introduced in Chapter 1.3, the lexical meaning of *huā* 'blossom' is bleached into the phenomimetic property of a dazzling effect when undergoing the morphological process of reduplication. Interacting with the color name *bái* 'white' and the phenomimetic expression *huāhuā*, the constructional meaning of *báihuāhuā* is a psychomimetic conveyance, expressing the visual quality of something white and bright that dazzles the eye with an overwhelming glare.

The following analysis investigates the ABB pattern *báihuănghuăng* 'gleaming; glaring' which emphasizes the brightness aspect of white as *báihuāhuā* 'shining white.' In this pattern, *huăng* is either a verb or an adjective that means 'to dazzle' or 'dazzling.' Further analysis of the

data in Table 6.5 discovers that the most frequent collocate and color referent of *báihuǎnghuǎng* is *yáng'guāng* ‘sunshine’ (t = 7.87). Despite having relatively low co-occurrence frequencies than the collocates of other ABB patterns in Table 6.5, most collocates of *báihuǎnghuǎng* seem to be consistent in that they all possess the quality of being bright, e.g., *tàiyáng* ‘sun’, *dēng'guāng* ‘light’ and *yuèliàng* ‘moon.’ It is likely that the collocation of *bái* ‘white’ and *huǎng* ‘to dazzle; dazzling’ is derived from one’s earthly experience of the reflectivity of bright light from the sun and the moon. To support this hypothesis, three examples of the usage contexts of *báihuǎnghuǎng* ‘gleaming; glaring’ are extracted from the random samples and displayed in (14).

(14)

14a. 看到小姑娘一阵风一般进来了，脸上的笑容还是像阳光一样**白晃晃**的耀眼。

*Kàndào xiǎogūniáng yīzhènfēng yìbān jìnlái le, liǎnshàng de xiàoróng háishì xiàng yáng'guāng yíyàng **báihuǎnghuǎng** de yàoyǎn.*

Seeing the little girl coming in as a gust of wind, the smile on her face was still as glaring as the sun.

14b. 大地发出**白晃晃**的光刺得人眼睛生疼。

*Dàdì fāchū **báihuǎnghuǎng** de guāng cì de rén yǎnjīng shēng téng.*

The glaring light of the earth hurts people's eyes.

14c. 一开门被漫天的星光满地、**白晃晃**的月光迷住，呆了片刻才记起该做什么。

*Yì kāimén bèi màntiān de xīng'guāng mǎn dì, **báihuǎnghuǎng** de yuèguāng mí zhù, dāi le piànkè cái jìqǐ gāi zuò shénme.*

As soon as I opened the door, I was fascinated by the starry and glaring moonlight all over the sky. I stayed for a moment before I remembered what to do.

The examples presented above illustrate the usage contexts of *báihuǎnghuǎng* 'gleaming; glaring' which relates to one's earthly experience. Both examples in 14a and 14b indicate the high degree of reflectivity from the sunlight that dazzles one's eyes. The sentence in 14c also underscores the lightness aspect of the moon. The term *báihuǎnghuǎng* seems to be conventionalized for describing the phenomenal qualities of visual perception toward the light. Interacting with the color name *bái* 'white' and the phenomimetic expression of *huǎnghuǎng*, the constructional meaning of the word *báihuǎnghuǎng* is a psychomimetic conveyance that depicts the visual quality of something white and bright that dazzles the eye.

The third analysis was concerned with the collocates of the ABB pattern *báimángmáng* 'a vast expanse of whiteness.' As can be seen from Table 6.5, the most frequent collocate and color referent of *báimángmáng* is *dàdì* 'earth' (t = 25.33). In the pattern *báimángmáng*, *mángmáng* is an adjective that refers to 'boundless and indistinct; vast and obscure.' An examination of the data in Table 6.5 reveals that the collocates of *báimángmáng* are highly related to the experience with earth and surroundings, e.g., *dàdì* 'earth,' *shìjiè* 'world,' *xuědì* 'snow land' and *tiāndì* 'heaven and earth.' To exemplify the function and usage context of *báimángmáng*, two random samples are retrieved and presented in (15).

(15)

15a. 清晨阳光透过淡薄的云层照耀着<u>白茫茫的大地</u>，反射出银色的光芒，连空气都变得温暖起来。

*Qīngchén yáng'guāng tòuguò dànbó de yúncéng zhàoyàozhe **<u>báimángmáng</u>** <u>de dàdì</u>, fǎnshè chū yínsè de guāngmáng, lián kōngqì dōu biàn de wēn'nuǎn qǐlái.*

The early morning sun shines on <u>the vast expanse of white earth</u> through the thin clouds, reflecting the silver light, and even the air becomes warm.

15b. 如果你是在屋内透过窗子向外看的话会看到一个白茫茫的世界，像是雪把整个世界吞噬了，骄傲地炫耀着它们的成果。

*Rúguǒ nǐ shì zài wūnèi tòuguò chuāngzi xiàng wài kàn dehuà huì kàndào yíge **báimángmáng** de shìjiè, xiàng shì xuě bǎ zhěng'ge shìjiè tūnshì le, jiāo'ào de xuànyàozhe tāmen de chéng'guǒ.*

If you are in the house looking out through the window, you will see a vast expanse of white world, like snow engulfing the whole world, proudly showing off their achievements.

Both examples offered above illustrate the usage contexts of *báimángmáng* 'a vast expanse of whiteness' which relates to one's earthly experiences. Interacting with the color name *bái* 'white' and the phenomimetic expression of *mángmáng*, the constructional meaning of *báimángmáng* conveys a psychomimetic impression that the environment being described has the qualities of being white and bright, as well as being vast and obscure in visual perception at the same time. In both sentences, the term *báimángmáng* 'a vast expanse of whiteness' seems to be conventionalized for describing a substantial area covered by snow which affects one's visibility.

The fourth analysis investigates the ABB pattern *báiméngméng* 'hazy; misty' which also implies the degree of invisibility in visual perception as *báimángmáng* 'a vast expanse of whiteness.' In the pattern *báiméngméng*, *méngméng* is an adjective that means 'misty.' An inspection of the data in Table 6.5 reveals that the most frequent collocate and color referent of *báiméngméng* is *wùqì* 'fog; mist' (t = 7.68). Although the term *báiméngméng* has a relatively low co-occurrence frequency, most collocates of *báiméngméng* seem to be consistent in that they can be defined as atmospheric conditions. To exemplify the function and usage context of *báiméngméng*, three random samples are retrieved and presented in (16).

(16)

16a. 清晨**白蒙蒙**一片似薄纱的雾气笼罩着田野，好像在给水稻最后的滋润。

*Qīngchén **báiméngméng** yípiàn shì bóshā de wùqì lǒngzhàozhe tiányě, hǎoxiàng zài gěi shuǐdào zuìhòu de zīrùn.*

Early in the morning, a misty gauze-like fog hung over the fields, as if to give the rice the last moisture.

16b. 那白龙嘴巴一张，一团**白蒙蒙**的气息便喷吐而出。

*Nà báilóng zuǐbā yì zhāng, yì tuán **báiméngméng** de qìxí biàn pēntǔ ér chū.*

As soon as the white dragon opened its mouth, a cloud of misty breath spurted out.

16c. 风一吹，屋顶上的水花一下子变成一层**白蒙蒙**的雨雾，宛如缥缈的素纱。

*Fēng yì chuī, wūdǐng shàng de shuǐhuā yīxiàzi biànchéng yìcéng **báiméngméng** de yǔwù, wǎnrú piāomiǎo de sùshā.*

As soon as the wind blew, the spray on the roof suddenly turned into a layer of misty rain and fog, just like an ethereal gauze.

The examples offered above demonstrate the usage contexts of *báiméngméng* ‘hazy; misty’ and highlight the phenomenal qualities of visual perception toward fog or mist. That is, the quality of being white that affects the visibility of a view. It is highly possible that the collocation of *bái* ‘white’ and *méngméng* ‘misty’ is derived from one’s experience with atmospheric conditions that establishes the mental representation of a view that is covered with mist.

The last analysis of the color construction [*bái* ‘white’ --] was concerned with the term *báinèn’nèn* ‘fair and soft; delicate.’ It can be seen from the data in Table 6.5 that the most frequent collocate and color referent of *báinèn’nèn* ‘fair and soft; delicate’ is *xiǎoshǒu* ‘small

hand' (t = 10.34), followed by *pífū* 'skin' (t = 10.09). Closer examination of the collocates of *báinèn'nèn* suggests that it is generally collocated with body parts, e.g., *xiǎoshǒu* 'small hand,' *pífū* 'skin' and *liǎn* 'face.' In the pattern *báinèn'nèn*, *nèn* is an adjective that means 'soft and delicate.' It can be postulated that the collocation of *bái* 'white' and *nèn* 'soft and delicate' is derived from one's embodied experience of touching the white, delicate skin of body parts. To maintain this hypothesis, three examples of the usage contexts of *báinèn'nèn* 'fair and soft; delicate' are obtained from the random samples and displayed in (17).

(17)

17a. 眼前的手**白嫩嫩**的，指甲修剪的十分齐整，看起来很健康。

*Yǎnqián de shǒu **báinèn'nèn** de, zhǐjiǎ xiūjiǎn de shífēn qízhěng, kànqǐlái hěn jiànkāng.*

(Her) hands are fair and soft, nails are neatly trimmed, and looks healthy.

17b. 走到聚会旁，我看到了一个皮肤**白嫩嫩**的小女孩。

*Zǒu dào jùhuì páng, wǒ kàndào le yíge pífū **báinèn'nèn** de xiǎonǚhái.*

Walking to the party, I saw a little girl with fair and soft skin.

17c. 他抚摸着两个孩子**白嫩嫩**的小脸蛋，禁不住潸然泪下。

*Tā fǔmōzhe liǎng ge háizi **báinèn'nèn** de xiǎoliǎndàn, jīnbúzhù shānránlèixià.*

He stroked the fair and soft faces of the two children and could not help but burst into tears.

The examples presented above illustrate the usage contexts of *báinèn'nèn* 'fair and soft; delicate.' The example in 17c indicates the action of touching two children's faces, supporting the hypothesis that the term *báinèn'nèn* is generated based on the sensory experience with touch. Notably, both the examples in 17a and 17b show that language users can recognize and describe the quality of being soft and delicate without touching one's hand or skin. Interacting with the color term *bái* 'white' and the phenomimetic expression *nèn'nèn*, the constructional meaning of

the term *báinèn'nèn* is a psychomimetic conveyance, describing a favorable feeling toward the object being described.

6.3.5 The visual perception of "red"

The last set of analyses investigated the color construction [*hóng* 'red'--] which has the second-highest construction frequency (*N* = 27,434) among the primary five [A--] color-vision constructions. The results obtained from the statistical analysis of the top five ABB types of [*hóng* 'red'--] are offered in Table 6.6. Closer inspection of the table shows that *píng'guǒ* 'apple' is a common collocate that appears across the five ABB patterns of [*hóng* 'red'--]. In addition, *píng'guǒ* 'apple' is the most frequent collocate and color referent for the homophones 红通通 *hóngtōngtōng* and 红彤彤 *hóngtóngtóng* 'bright red.' Another common collocate *tàiyáng* 'sun' is also shared by several ABB patterns of [*hóng* 'red'--], except for the pattern *hóngpūpū* 'rosy.' It is likely that both *píng'guǒ* 'apple' and *tàiyáng* 'sun' are the typical color referents of 'red.' The functions and usage contexts of the five ABB patterns of [*hóng* 'red'--] will be assessed in the following paragraphs.

What stands out in Table 6.6 is the ABB pattern *hóngpūpū* 'rosy' which has the highest co-occurrence frequency (*N* = 1,246) and the strongest association strength (*t* = 35.30) with the collocate *liǎndàn* 'face.' In the pattern *hóngpūpū*, the word *pū* is a verb that portrays the action 'to pat; to pounce on.' However, it is unknown why the color term *hóng* 'red' and the verb 'to pat; to pounce on' are constructed, and what the function and usage context of *hóngpūpū* are. Further inspection of the data reveals that most collocates of *hóngpūpū* seem to be consistent in that they are related to body parts focusing on the part of the face, e.g., *liǎn* 'face,' *liǎnjiá* 'cheek,' and *yǎnjīng* 'eye(s).' To understand the function and usage context of *hóngpūpū*, three random samples are obtained and shown in (18).

Table 6.6. Comparison of strength of association for collocates of the form [*hóng* 'red' - BB]

红彤彤 *hóngtóngtóng* 'bright red'			红艳艳 *hóngyànyàn* 'brilliant red'			红扑扑 *hóngpūpū* 'rosy'			红通通 *hóngtōngtōng* 'bright red'			红灿灿 *hóngcàncàn* 'bright red'		
Coll.	Freq	*t*	Coll.	Freq	*t*	Coll.	Freq	*t*	Coll.	Freq	*t*	Coll.	Freq	*t*
píng'guǒ 'apple'	1,105	33.21	*huā* 'flower'	289	16.95	*liǎndàn* 'face'	1,246	35.30	*píng'guǒ* 'apple'	271	16.45	*tàiyáng* 'sun'	42	6.48
tàiyáng 'sun'	545	23.32	*píng'guǒ* 'apple'	172	13.08	*xiǎoliǎn* 'small face'	870	29.50	*yǎnjīng* 'eye(s)'	157	12.51	*tiānkōng* 'sky'	32	5.65
dēnglóng 'lantern'	341	18.46	*cǎoméi* 'strawberry'	130	11.40	*liǎn* 'face'	684	26.14	*liǎn* 'face'	145	12.02	*làjiāo* 'hot pepper'	12	3.46
liǎndàn 'face'	321	17.91	*huāduǒ* 'flower'	115	10.72	*liǎnjiá* 'cheek'	218	14.76	*liǎndàn* 'face'	126	11.22	*zhèngshū* 'certificate'	12	3.45
liǎn 'face'	309	17.53	*táohuā* 'peach blossom'	100	9.99	*yǎnjīng* 'eye(s)'	110	10.45	*xiàoliǎn* 'smiling face'	75	8.66	*chāopiào* 'paper money; bill'	11	3.32
shìzi 'per-simmon'	271	16.46	*làjiāo* 'hot pepper'	83	9.10	*liǎnsè* 'comple-xion'	106	10.28	*tàiyáng* 'sun'	71	8.41	*píng'guǒ* 'apple'	11	3.30
xiǎoliǎn 'small face'	186	13.64	*tàiyáng* 'sun'	75	8.63	*píng'guǒ* 'apple'	97	9.80	*shìzi* 'persim-mon'	69	8.31	*fēngyè* 'maple leaf'	9	3.00
xīhóngshì 'tomato'	168	12.96	*guǒshí* 'fruit'	72	8.48	*xiàoliǎn* 'smiling face'	85	9.22	*dēnglóng* 'lantern'	57	7.55	*huā* 'flower'	9	2.98

Note. **Coll**: collocates. **Freq**: co-occurrence frequency. ***t***: *t* score. 红通通 *hóngtōngtōng* (shaded in gray) is the homophone of 红彤彤 *hóngtóngtóng*. Any items with frequency values below five are ignored for the calculation of strength of association. Only the top eight collocates (content words) of each ABB type are included in this table.

(18)

18a. 冬日里有些孩子的脸蛋儿总是**红扑扑**的。

*Dōngrì li yǒuxiē háizi de liǎndàner zǒngshì **hóngpūpū** de.*

Some children's faces are always rosy in winter.

18b. 一张圆圆的整天跟抹了胭脂一般**红扑扑**的小脸蛋。

*Yìzhāng yuányuán de zhěngtiān gēn mǒle yānzhī yìbān **hóngpūpū** de xiǎoliǎndàn.*

A round little face looking rosy all day as putting on rouge.

18c. 渐渐太阳**红扑扑**的脸便出现在地平线上。

*Jiànjiàn tàiyáng **hóngpūpū** de liǎn biàn chūxiàn zài dìpíngxiàn shàng.*

Gradually the rosy face of the sun appeared on the horizon.

The examples given above demonstrate the usage contexts of *hóngpūpū* ‘rosy.’ Both examples in 18a and 18b use the term *hóngpūpū* to describe the phenomenal qualities of color perception toward one’s face. That is, the quality of being rosy. As pointed out in 18b, the quality of being rosy can be created by applying rouge to one’s face. It is highly possible that the collocation of *hóng* ‘red’ and *pū* ‘to pat’ is derived from the embodied experience of applying some red blush powder to one’s face or cheeks. This finding is similar to the term *huīpūpū* ‘gray; ash’ which has been analyzed earlier. Furthermore, the sentence in 18c serves as an interesting example that uses the mental representation of one’s rosy face to express the visual perception of the sun. Interacting with the color name *hóng* ‘red’ and the phenomimetic expression *pūpū*, the constructional meaning of *hóngpūpū* conveys a psychomimetic impression that the object being described has the visual quality of being rosy. The term *hóngpūpū* ‘rosy’ seems to be conventionalized for describing a person’s facial skin that is colored in red.

The next analysis was concerned with the homophones for ‘bright red’ in different

Chinese characters: 红彤彤 *hóngtóngtóng* and 红通通 *hóngtōngtōng*. In the pattern 红彤彤 *hóngtóngtóng*, *tóng* is an adjective that means 'red; scarlet.' In the pattern 红通通 *hóngtōngtōng*, *tōng* is a verb that refers to 'open; go through.' While the adjective 彤 *tóng* 'red; scarlet' helps to entrench the form-function mapping between 红彤彤 *hóngtóngtóng* and the color perception of *red* in speakers' mental representation, it is unclear what the association between the color term 红 *hóng* and the verb 通 *tōng* is.

Further inspection of the statistical data reveals that the collocates of 红彤彤 *hóngtóngtóng* have higher co-occurrence frequencies and stronger association strength than those of 红通通 *hóngtōngtōng*. This suggests the possibility that 红通通 *hóngtōngtōng* is a relatively novel variant of 红彤彤 *hóngtóngtóng*. This alternative usage may be created and spread by the misuse of 红彤彤 *hóngtóngtóng* based on their homophones.

The most interesting aspect of the collocates of the homophones for 'bright red' is their consistency in terms of color reference. From the collocates of 红彤彤 *hóngtóngtóng* and 红通通 *hóngtōngtōng* 'bright red' in Table 6.6, it can be seen that there are several synonyms that refer to face, e.g., *liǎn* 'face' and *liǎndàn* 'face.' To discover the functions and usage contexts of 红彤彤 *hóngtóngtóng* and 红通通 *hóngtōngtōng* 'bright red,' five random samples are extracted and presented in (19).

(19)

19a. 我们先来到果园就看见**红彤彤**的苹果。

Wǒmen xiān láidào guǒyuán jiù kànjiàn ***hóngtóngtóng*** *de píng'guǒ.*

When we first came to the orchard, we saw the bright red apples.

19b. 在我准备上学的时候，妈妈看到我那**红彤彤**的脸时，用手摸了摸我那滚烫的额头。

*Zài wǒ zhǔnbèi shàngxué de shíhòu, māma kàndào wǒ nà **hóngtóngtóng** de liǎn shí, yòng shǒu mō le mō wǒ nà gǔntàng de étóu.*

When I was preparing to go to school, my mother saw my flushed face, she touched my hot forehead with her hand.

19c. 看小明由于用力过度，脸涨得**红通通**的，像一个大大的熟透了的红苹果。

*Kàn Xiǎomíng yóuyú yònglì guòdù, liǎn zhàng de **hóngtōngtōng** de, xiàng yíge dàdà de shóutòu le de hóng píng'guǒ.*

Look at Xiaoming's face flushed as a result of overexertion, like a big, ripe red apple.

19d. 来到了果园，我看到一个个**红通通**的苹果，像一个个小朋友**红通通**的笑脸。

*Láidào le guǒyuán, wǒ kàndào yígege **hóngtōngtōng** de píngguǒ, xiàng yígege xiǎopéngyǒu **hóngtōngtōng** de xiàoliǎn.*

When I came to the orchard, I saw every bright red apple, like the flushed smiling face of every child.

19e. 一双眼睛**红通通**的像兔子一样。

*Yìshuāng yǎnjīng **hóngtōngtōng** de xiàng tùzi yíyàng.*

His eyes are as red as a rabbit.

The examples provided above illustrate the usage contexts of 'bright red' 红彤彤 *hóngtóngtóng* (19a – 19b) and 红通通 *hóngtōngtōng* (19c – 19e). An examination of the usage contexts of both homophones from their random samples reveals that they are used to highlight the qualitative properties of visual perception. That is, the quality of being scarlet or bright red. It is likely that the color term *hóng* 'red' and the adjective *tóng* 'red; scarlet' is consolidated to

emphasize the color saturation, i.e., the intensity of red in an image. Both the ABB patterns 红彤彤 *hóngtóngtóng* and 红通通 *hóngtōngtōng* 'bright red' seem to be conventionalized and used to visualize a highly saturated image that possesses the quality of being vivid and bright red.

The following analysis investigates the ABB pattern *hóngyànyàn* 'brilliant red' which has the second-highest token frequency among the color construction [*hóng* 'red' --]. In the pattern *hóngyànyàn*, *yàn* is an adjective that means 'colorful; splendid.' An examination of the collocates of *hóngyànyàn* 'brilliant red' reveals that *huā* 'flower' is the most frequent collocate and color referent (t = 16.95). Further analysis of the collocates of the term *hóngyànyàn* in Table 6.6 reveals that *hóngyànyàn* is strongly associated with the visual perception of plants and fruits, e.g., *huā* 'flower,' *píng'guǒ* 'apple' and *cǎoméi* 'strawberry.' Two random samples of *hóngyànyàn* 'brilliant red' are provided in (20) to exemplify the function and usage context.

(20)

20a. 其它的花都到哪里去啦？ 满山遍野怎么就只有**红艳艳**的桃花啊？

*Qítā de huā dōu dào nǎlǐ qù la? Mǎnshānbiànyě zěnme jiù zhǐyǒu **hóngyànyàn** de táohuā a?*

Where are all the other flowers? Why are there only brilliant red peach blossoms all over the mountains?

20b. 苹果树上一个个**红艳艳**的苹果像小太阳似的，真想一口咬去。

*Píng'guǒ shù shàng yígege **hóngyànyàn** de píng'guǒ xiàng xiǎotàiyáng sì de, zhēn xiǎng yìkǒu yǎo qù.*

Every brilliant red apple on the apple tree is like the little sun. I really want to bite them off.

Both sentences displayed above depict the usage contexts of *hóngyànyàn* 'brilliant red' which express one's perceptual color-vision experience with flowers (in 19a) and apples (in 19b). The term *hóngyànyàn* 'brilliant red' seems to be conventionalized for describing the phenomenal qualities of plants and fruits. Similar to the term *hóngtóngtóng* 'bright red,' it is possible that the color term *hóng* 'red' and the adjective *yàn* 'colorful; splendid' is constructed to highlight the qualitative properties of visual perception. That is, the quality of being vivid and brilliant red.

The last analysis of the color construction [*hóng* 'red'--] was concerned with the term *hóngcàncàn* 'bright red.' In the pattern *hóngcàncàn*, *càn* is an adjective that means 'bright; brilliant.' It can be seen from the data in Table 6.6 that the most frequent collocate and color referent of *hóngcàncàn* 'bright red' is *tàiyáng* 'sun' (t = 6.48), followed by *tiānkōng* 'sky' (t = 5.65). Further analysis of the term *hóngcàncàn* reveals the diversity of the collocates, being able to describe the color perception of earth, plant and paper, e.g., *tàiyáng* 'sun,' *làjiāo* 'hot pepper,' and *zhèngshū* 'certificate.' To assess the function and usage context of *hóngcàncàn*, three random samples are obtained and offered in (21).

(21)

21a. 春天的颜色真是五彩缤纷，太阳是**红灿灿**的，天空是碧蓝蓝的。

*Chūntiān de yánsè zhēnshi wǔcǎibīnfēn, tàiyáng shì **hóngcàncàn** de, tiānkōng shì bìlánlán de.*

The colors of spring are really colorful, the sun is bright red and the sky is turquoise.

21b. 农舍房前、屋后晾晒着黄橙橙的玉米，**红灿灿**的辣椒。

*Nóngshèfáng qián, wū hòu liàngshàizhe huángchéngchéng de yùmǐ, **hóngcàncàn** de làjiāo.*

Yellow-orange corn and red chili peppers are drying in front of and behind the farmhouse.

21c. 中年男子很是嚣张的将一叠**红灿灿**的钞票拍在了桌上。

Zhōngnián nánzǐ hěn shì xiāozhāng de jiāng yìdié ***hóngcàncàn*** *de chāopiào pāi zài le zhuō shàng.*

The middle-aged man patted a pile of red banknotes on the table arrogantly.

The examples presented above portray the usage contexts of *hóngcàncàn* 'bright red' which relate to one's perceptual color-vision experiences. As pointed out in example 21a, the usage context focuses on the phenomenal qualities of color perception toward the view of spring. This sentence serves as great evidence that language users tend to apply the ABB color-vision constructions to depict the qualitative properties of their visual perception, e.g., the redness of the sun, and the blueness of the sky. The sentence in 21b also uses different ABB patterns to illustrate the qualitative properties of color perception of vegetables, i.e., the yellowness of corn, and the redness of hot pepper. Furthermore, the example in 21c suggests that *hóngcàncàn* 'bright red' is a conventionalized term that can be used to underline the lightness aspect of red concerning the reflectivity of bright light. Taken together, these examples suggest the function of *hóngcàncàn* 'bright red,' being able to highlight the quality of being red and bright in visual perception.

In summary, the results presented in this section have shown that each ABB pattern has its form-function mapping that is generated to describe different qualitative properties of the color-vision experience. The following section discusses the answers to research questions and underscores the significant findings and their implications.

6.4 Discussion

6.4.1 The phenomenal qualities of color perception

The first question in this study sought to understand what phenomenal qualities of perceptual color vision experience are depicted by Chinese speakers. The results of this study show that the top three ABB types of color construction [*huī* 'gray' --] are highly contextualized with earthly experience. The most frequent collocate and color referent, which is shared by *huī-méngméng*, *huī-chénchén* and *huī-mángmáng*, is *tiānkōng* 'sky.' This study found that the function of these ABB types that collocate with the word *sky* is to describe the visual quality of something gray that enshrouds the sky. Specifically, each ABB pattern is used to depict distinctive phenomenal qualities of color vision perception toward the sky, highlighting the different degrees of visibility present in the environment.

According to the measures of strength of association for the color referent *tiānkōng* 'sky,' which is shown in Table 6.2, this study found that *huīméngméng* is the typical pattern that is used by Chinese speakers to express perceptual color vision experience with the sky. In the pattern *huī-méngméng*, the adjective *méngméng* 'drizzly; misty' is added to the color term *huī* 'gray.' A further examination on the usage context of *huīméngméng* shows that the visual perception of the dusky sky is caused by haze, which is a tenuous cloud (of vapor or smoke in the air) that shrouds the sky and reduces the visibility of light (see example 1a). This linguistic form reflects speakers' construal of visual perception, emphasizing the atmospheric condition that led to the current phenomenon – a dusky, overcast weather.

In the pattern *huī-chénchén*, the adjective *chénchén* 'deeply; heavily' is added to the color term *huī* 'gray.' This study found that most collocates of the pattern *huīchénchén* are overlapped with those of the pattern *huīméngméng*. However, the pattern *huīchénchén* has a relatively low

token frequency. According to the usage context of *huīchénchén*, it seems that the pattern is used to depict "the sky was leaden with overcast," underlining the visual perception of thick and dense clouds covering a large part of the sky and blocking the visibility of the light.

Lastly, in the pattern *huī-mángmáng*, the adjective *mángmáng* 'boundless; vast and obscure' is added to the color term *huī* 'gray.' This study found that most collocates of *huīmángmáng* are related to surroundings and environment, e.g., *shìjiè* 'world,' *dàdì* 'earth' and *tiāndì* 'sky/heaven and earth.' It can thus be suggested that the pattern *huīmángmáng* is used to highlight the phenomenal quality of something being vast and obscure, as well as lacking visible light. Despite sharing the typical color referent *tiānkōng* 'sky,' the top three ABB types of color construction [*huī* 'gray' --] manifest the variation of the phenomenal qualities of color vision perception based on speakers' construals of the natural environment.

Besides the color construction [*huī* 'gray' --], the current study discovered that [*lǜ* 'green' --] is a salient color construction that is also highly contextualized with earthly experience. The most frequent collocate and color referent, which is shared by all the top five ABB types of color construction [*lǜ* 'green' --], is *cǎodì* 'lawn.' This study found that each ABB pattern is used to portray unique phenomenal qualities of color vision perception toward the lawn, underscoring different shades of green present in the environment.

Among the top five ABB patterns of the color construction [*lǜ* 'green' --], *lǜyóuyóu* 'lush green' is found to be the typical pattern that has the strongest strength of association with the collocate *cǎodì* 'lawn,' followed by *lǜyīnyīn* 'verdant.' See Table 6.4 for the statistical results of the strength of association. In the pattern *lǜyóuyóu*, the adjective *yóu* 'oily' is added to the color term *lǜ* 'green.' Through further investigation of its usage context, this study discovered that the pattern *lǜyóuyóu* reveals speakers' construal of visual perception, focusing on the lightness

aspect of green. Most importantly, the collocation between *lǜyóuyóu* ‘lush green’ and *cǎodì* ‘lawn’ serves as a great example that illustrates how the phenomenal qualities of visual perception with oil – being shining and showing a glow of reflected light – is projected to the color vision experience with lawn, i.e., being lush greenery.

In terms of the pattern *lǜyīnyīn* ‘verdant,’ as presented in Section 6.3.3, there are two different homophonic forms: 绿茵茵 *lǜyīnyīn* and 绿荫荫 *lǜyīnyīn*. While 绿茵 *lǜyīn* emphasizes grassy areas, 绿荫 *lǜyīn* underscores the shade (of a tree). Interestingly, even though both homophonic forms of *lǜyīnyīn* are used to portray the same color referent, e.g., verdant lawn, they are found to emphasize distinct phenomenal qualities of color vision perception in the natural environment.

Overall, the findings of this study broadly support the work of other anthropological studies in color nomenclature, offering evidence that demonstrates how forms of language are determined by our experience of color referents in the natural environment. Furthermore, the results corroborate the ideas of Wierzbicka (1990) and Xing (2008), showing that certain universals have governed color concepts, particularly those related to earthly experiences.

6.4.2 The schematic patterns of color expressions

The second question in this study explores what schematic patterns are frequently used by speakers to describe phenomenal qualities of perceptual color-vision experience in Chinese. Schematic patterns refer to our abstract mental structures or schemas that extract from our commonality of specific experiences and form our mental representations of concepts or cognitive frameworks. This cognitive organization of knowledge allows us to categorize new information and interpret our experiences.

As discussed in Section 6.4.1, some frequently used schematic patterns are those that

depict the phenomenal qualities of color vision perception toward the earth or atmospheric condition, such as *huīméngméng* ‘dusky; overcast’ and *huīmángmáng* ‘gray, vast and obscure.’ Besides these linguistic forms that depict speakers’ earthly experiences, in the previous chapter, the analysis of the [ABB] color-vision network has identified three BB nodes that have relatively higher corpus frequencies. The three BB nodes ranked by their corpus frequencies are 生生 *shēngshēng* (*N* = 53,844), 乎乎 *hūhū* (*N* = 49,318), and 溜溜 *liūliū* (*N* = 29,465). As shown in Figure 5.8, the previous study found that *liūliū* is the most important BB node, connecting to three achromatic color terms – *hēi* ‘black,’ *huī* ‘gray’ and *wū* ‘black.’ In fact, these color terms are regarded as different shades of black. Nevertheless, it is unclear why these achromatic color terms and the verb *liū* ‘to slip away’ are constructed and entrenched together.

In the current study, it can be seen from the data in Table 6.1 that *liūliū* has the second-highest token frequency within the color construction [*huī* ‘gray’ --]. This indicates a high degree of lexical strength and the entrenchment of the pattern *huīliūliū* ‘gloomy’ in Chinese speakers’ mental representation of color concepts. Further analysis of its usage context discovers that Chinese speakers associate the color perception of *huī* ‘gray’ with negative emotions, such as depressed and frightened. This provides some explanations as to why the verb *liū* ‘to slip away’ is added to the color term *huī* ‘gray,’ and why *huīliūliū* is mainly collocated with verbs, e.g., *líkāi* ‘to depart.’ It can be assumed that these emotions trigger the human instinct to escape from a negative situation. These findings thus support previous neuropsychological research into language-induced perceptual simulation (e.g., Goldberg et al., 2006; Lacey et al., 2012; Pulvermüller, 2005; Winter, 2016). It can be inferred that the linguistic pattern *huīliūliū* ‘gloomy’ prompts the collocation with other action words, which relate to the action of *liū* ‘to slip away,’ e.g., *líkāi* ‘to depart’ and *táozǒu* ‘to escape.’

Although *hēiliūliū* ‘black and bright’ was not listed as the top five ABB types of [*hēi* ‘black’ --], the analysis of its collocates found that the typical referent of *hēiliūliū* is *yǎnjīng* ‘eyes.’ An example of the usage context of *hēiliūliū* is retrieved from the random samples and presented in (22).

(22) 一对夫妻在自家宝宝的周岁宴上收获到了一堆赞叹，原来亲戚朋友们都被宝宝**黑溜溜**的大眼睛吸引住了。

*Yíduì fūqī zài zìjiā bǎobao de zhōusuìyàn shàng shōuhuòdào le yíduī zàntàn, yuánlái qīnqī péngyǒumen dōu bèi bǎobao **hēiliūliū** de dàyǎnjīng xīyǐnzhù le.*

A couple got a lot of compliments at their baby's first birthday banquet. It turned out that relatives and friends were attracted by the baby's big sparkling, black eyes.

Based on the usage context presented above, the term *hēiliūliū* ‘black and bright’ seems to be conventionalized and mainly used to describe speakers’ color vision perception focusing on the brightness of *eyes*. Perhaps the verb *liū* ‘to slip away’ is added to the pattern *hēiliūliū* based on the speakers’ experience of a slippery surface, which shows a certain quantity of light and a degree of reflectivity (i.e., the aspect of brightness).

In terms of the pattern *wūliūliū* ‘dark and liquid,’ the BB morpheme *liūliū* is found to be the top collocate with the color term *wū* ‘black.’ The analysis of its collocates uncovered that the typical referents of *wūliūliū* are *yǎnjīng* ‘eyes’ and *tóufǎ* ‘hair.’ Two examples of the usage contexts of *wūliūliū* are extracted from the random samples and displayed in (23).

(23)

23a. 尽管她尽量保持低调，但一双**乌溜溜**的大眼睛、白里透红的肌肤和出众的外形，还是被眼尖的公众一眼认出，引起小小的骚动。

*Jǐnguǎn tā jǐnliàng bǎochí dīdiào, dàn yìshuāng **wūliūliū** de dàyǎnjīng, báilǐtòuhóng de jīfū hé chūzhòng de wàixíng, háishì bèi yǎnjiān de gōngzhòng yìyǎn rènchū, yǐnqǐ xiǎo xiǎo de sāodòng.*

Although she tried to keep a low profile, her big liquid dark eyes, delicate skin and outstanding appearance were recognized at a glance by the sharp-eyed public, causing a little uproar.

23b. 一头**乌溜溜**的长发常盈溢着动人的发香，一看就知道是个不偷懒的女人。

*Yìtóu **wūliūliū** de chángfǎ cháng yíngyìzhe dòngrén de fǎxiāng, yí kàn jiù zhīdào shì ge bù tōulǎn de nǚrén.*

A long dark and liquid hair often brimming with moving hair fragrance. You can see that it is a woman who is not lazy.

Similar to the function of *hēiliūliū* ‘black and bright,’ Chinese speakers use the pattern *wūliūliū* ‘dark and liquid’ to portray the brightness of *eyes*, highlighting the phenomenal quality that is comparable to the clear shimmer of water. Despite both *wūliūliū* and *hēiliūliū* sharing the same typical color referent *yǎnjīng* ‘eyes,’ surprisingly, this study found that *tóufǎ* ‘hair’ is a unique color referent that merely collocates with the pattern *wūliūliū*. This finding suggests language-specific experiential structures that underlie the [ABB] color-vision constructions. Notably, the findings of this study indicate that the color construction [*wū* ‘black’ --] is less commonly used by Chinese speakers than the color construction [*hēi* ‘black’ --].

The current data shows that there are only five ABB patterns of the color construction [*wū* 'black' --]. The ABB patterns ranked by token frequencies are 乌溜溜 *wūliūliū* 'dark and liquid' (*N* = 1,232), 乌漆漆 *wūqīqī* 'pitch-black' (*N* = 57), 乌蒙蒙 *wūméngméng* 'dusky' (*N* = 51), and the homophones 乌泱泱 (*N* = 43) / 乌央央 (*N* = 26) *wūyāngyāng* 'black and magnificent.' Among the five ABB patterns, *wūqīqī* 'pitch-black' is found to be the most salient and conventionalized pattern, which is frequently used by Chinese speakers to express the qualitative properties of color perception upon *wū* 'black,' based on its relatively high token frequency.

In general, the current findings confirm the embodied lexicon hypothesis of Winter (2019), who suggested that "language comes to reflect sensory-motor processes in its structure, as well as in language use" (p. 59). By identifying the typical referents of each ABB pattern within usage contexts, this study shed light on the formation and productivity of [ABB] color-vision constructions in Chinese.

6.5 Summary

This chapter set out to explore the phenomenal qualities of perceptual color vision experience depicted in Chinese and the schematic patterns that speakers frequently use to describe them. Through inspecting five significant [A--] color constructions with their top five ABB types, as well as their concordance lines, this study has demonstrated a variety of phenomenal qualities of color perception that are encoded in the [ABB] morphological construction in Chinese. Most important of all, the present study found that Chinese speakers use unique schematic patterns to describe the phenomenal qualities of the color vision experience. These schematic patterns are language- and context-specific. The findings of this study have significant implications for cross-linguistic studies of color cognition and language typology.

Although the current study has successfully demonstrated a diversity of phenomenal

qualities of perceptual color vision experience depicted in Chinese, some limitations need to be acknowledged. The scope of this study was limited in terms of the [ABB] color-vision constructions presented in this chapter. This chapter has not been able to present the statistical results and general usage contexts for all [ABB] color-vision constructions in the "color_vision" corpus. The current study mainly discussed the findings of the five important [A--] color constructions with their top five ABB types. In addition, the present research has only examined the usage of [ABB] color-vision constructions based on corpus data. Further research needs to collect experimental data from Chinese native speakers, surveying their descriptions of perceptual color-vision experience, as well as their understanding of the ABB patterns found in the current study.

CHAPTER VII

SYNESTHESIA IN EXPRESSIVE MORPHOLOGY

Sensory language, the linguistic expressions that portray sensory perceptions and experiences, has received increased attention across a few disciplines in recent years. Traditionally, research on language and senses has adhered to the five senses folk model, investigating sensory language based on the categories of sight, hearing, touch, taste, and smell (Classen, 1993; Sorabji, 1970; Winter, 2019). In his second book of *De Anima*, Aristotle suggests that sensible qualities are related to the senses which should be defined by reference to their objects (Sorabji, 1970). However, this Aristotelian view of senses presumes that senses are separated, overemphasizing a sensory organ as a perceptual aspect without considering other perceptual features that may be perceived simultaneously. For instance, as shown in Chapter VI, the qualities of color, being perceived by the eyes, involve the perception of spatial features such as size, shape, and distance.

The perceptual experiences of sensation may not be distinctively categorized into the five senses. Day (1996) argues that there is no universal consensus on the number of senses due to the cultural relativity shaping one's sensory world and language. Furthermore, Winter (2019) addresses the phenomena of multisensoriality that pose difficulties for classifying the senses, e.g., the fuzzy boundary between taste and smell. The application of the five senses folk model in most linguistic research, classifying "an expression such as *sweet fragrance* as a taste-to-smell mapping," implies the imposition of categoricity and unisensoriality onto *sweet* as a taste word in part (Winter, 2019, p. 91).

The view that our perceptual experiences are comprised of specific sensations within the five sensory modalities allows us to further analyze each sensation based on its quality, intensity,

and extension (Miller & Johnson-Laird, 1976; Popova, 2005). While this linguistic analysis of categorization helps understand speakers' cognitive processes of sensory words, the results should be interpreted cautiously, being aware of the multisensory nature of sensory words in actual language use. Despite lacking valid criteria for determining and differentiating senses, the five senses folk model as a culture-specific model has provided a window into the perceptual basis of the sensory world and led to a proliferation of studies on sensory language.

7.1 Cross-modal Interactions Between Senses

Qualia as a theoretical construct has received little attention in the field of Linguistics. Research on sensory perception in cognitive semantics is mainly concerned with lexical codability of the senses (Winter, 2016, 2019), sensory metaphors (Cacciari, 2008; Speed et al., 2019; Sweetser, 1990), and synesthesia (Jo, 2019; Ronga et al., 2012; Strik Lievers, 2015; Zhao et al., 2018, 2019, 2022). Of these areas, the most relevant to the linguistic representation of the quality of perception is synesthesia.

7.1.1 Synesthesia

According to Shen and Cohen (1998), "A synaesthesia is a metaphorical expression in which the source and target domains represent concepts belonging to two different modalities or senses" (p. 124). For example, *loud color* is a synesthetic metaphor that maps the sound (source) domain onto the sight (target) domain, transferring the meaning of a sensory expression from one sensory modality to another. Werning, Fleischhauer, and Beseoglu (2006) further define synesthetic metaphors and differentiate between the weak and strong forms as follows:

> *A metaphor is synaesthetic if and only if its source domain is perceptual. It is only weakly synaesthetic if its target is not also perceptual, and strongly synaesthetic if its target domain, too, is perceptual.* (pp. 2365-2367)

In other words, a weak synesthetic metaphor possesses a perceptual source domain and a relatively less accessible (abstract) target domain (e.g., *cold anger*), while a strong synesthetic metaphor includes both perceptual source and target domains (e.g., *cold smell*) (Winter, 2019, p. 69).

Deroy and Spence (2013) address the confusion of considering all crossmodal sensory interactions as synesthesia. They advocate the differentiation between "canonical synesthesia" and "crossmodal correspondences" based on the role of consciousness, rather than superficial similarities (i.e., the association between different sensory modalities). Canonical synesthesia refers to a rare neuropsychological phenomenon "where the presentation or representation of one sensory feature in one modality elicits a conscious experience in another, nonstimulated modality, as in colored-hearing, or an extra-experience in the same modality, as in grapheme-color synesthesia" (Deroy & Spence, 2013, pp. 645-646). In contrast, crossmodal correspondences denote not-necessarily-conscious perceptual associations, matching certain sensory features or attributes across sensory modalities frequently by the general population, such as associating higher pitch sounds with brighter colors (Deroy & Spence, 2013; Marks, 1982). The distinction between canonical synesthesia and crossmodal correspondences highlights qualitative differences and specific dimensions of the sensory perceptions that lead to a variety of cross-domain sensory mappings.

Prior studies on sensory language have failed to offer an explicit definition for the term "synesthesia" in the context of metaphor (Winter, 2019). Some researchers have proposed distinguishing *linguistic synesthesia* (i.e., the combination of words derived from the lexicons related to different sensory domains) from *perceptual synesthesia* (i.e., the combination of sense impressions derived from different sensory domains) (Holz, 2007; Ronga, 2016; Tsur, 1992).

Others have studied the relationship between canonical synesthesia and synesthetic metaphors, arguing that they are superficially connected by the involvement of various sense domains (Ramachandran & Hubbard, 2001; Winter, 2019). Synesthetic metaphors are those ubiquitous and highly conventionalized expressions, generated from perceptually and environmentally coupled sensory modalities, e.g., *sweet smell*. In general, canonical synesthesia is different from synesthetic metaphors in that it refers to rare and idiosyncratic expressions which involve specific inducer-concurrent pairings derived from unassociated sensory modalities, e.g., colored sensation triggered by touch sensations or specific emotions.

Winter (2019) maintained that synesthetic metaphor is a misnomer and suggested using the term "crossmodal metaphors" rather than "synesthetic metaphors" to explain crossmodal uses of sensory words. The concept of synesthetic metaphor contradicts the continuity of our senses, as it involves creating connections between different sensory experiences that are normally distinct from one another. As argued by Rakova (2003), a sensory word may have rich supramodal semantic content that denotes broader, distinctive meanings. For example, the sensory word *hot* denotes both spiciness and noxious heat (temperature) sensations. Despite having different perceptual qualities, the perceptual meanings of hotness–spiciness are experienced to be phenomenologically similar and expressed by the word *hot*. This supramodal semantic concept might have resulted from the repeated embodied experience of sweating and feeling the heat on the skin when eating hot, spicy food.

7.1.2 Sensory adjectives

Adjectives, a lexical category that is commonly used to describe properties, are deemed an optimal linguistic device for studying the sensory language (Diederich, 2015; Lynott & Connell, 2009; Murphy, 2010; Williams, 1976; Winter, 2019; Zhao et al., 2018). According to

Dixon (1982, p. 16), there are seven universal semantic types of adjectives: *dimension* (big, large, little, small), *physical property* (hard, soft; rough, smooth; hot, cold), *color* (black, white, red), *human propensity* (jealous, happy, kind), *age* (new, young, old), *value* (good, bad), and *speed* (fast, quick, slow). This demonstrates the crucial role of adjectives in describing the qualities of either concrete or abstract things. What's more, Givón (2001) stated that prototype adjectives are "single properties of prototype noun entities, analytically abstracted from those more complex bundles of experience" (p. 53). In other words, a prototype adjective typifies a certain noun entity and captures its most salient characteristic. As evidenced in Chapter VI (see Table 6.5), for example, the perceptual experience of *báihuāhuā* 'shining white' in Chinese is an abstract concept that can only be experienced directly with physical properties of certain nouns, such as *yínzi* 'money; silver', *dàtuǐ* 'thigh' and *dàmǐ* 'rice' (i.e., noun-coded white entities).

Moreover, there are inherent degrees of intensity to both qualities of experience and properties of objects that are coded by adjectives (Popova, 2005). The categorization of gradability in adjectives, also named SCALARITY, is strongly connected to antonymy. According to Popova (2005), "there cannot be a conceptualization of an attribute without some implicit comparison with its opposite" (p. 404). Antonyms, such as *smooth* and *rough*, are typically considered to be different points on a scale. When paired with a proper noun, these adjectives indicate a specific attribute or quality. In contrast to the SCALE schema which has a relatively fixed directionality (Johnson, 1987), the CONTAINER schema structures non-gradable adjectives by dividing a specific domain into two absolute subsets, e.g., dead/alive (Mettinger, 1999). Furthermore, Popova (2005) indicated that color terms are "both absolute (chromatic versus achromatic) and non-binary (there are many varied and distinct instances of being colored)" (p. 405). Therefore, it should be noted that basic color terms, as discussed in

Chapter V and Chapter VI, cannot be clearly categorized under either the SCALE schema or the CONTAINER schema.

7.2 The Hierarchy and Directionality of Sensory Mappings

Investigating the directionality of the mapping of properties from one sensory modality to another (i.e., from source to target) is central to the study of cross-modal uses of sensory expressions. According to Ullmann's (1945) study on the directionality of mapping in poetic synesthesia, analyzing the synesthetic expressions retrieved from English, French and Hungarian poetry in the nineteenth century, terms of lower distinctive sensations are generally mapped onto terms of higher distinctive ones. For example, the expression "a sour note" combines sensory experiences that are not typically related, using the taste word "sour" to describe the quality of a musical note (sound). The target "note" (topic) is the most distinct modality (sound) while the source "sour" (modifier) is the least distinct one (taste). This unique expression creates an evocative image that stimulates multiple senses simultaneously and suggests a sense of unpleasantness in sensory experience.

Ullmann's (1945, 1957) analyses of the inter-sensorial transfer in literary synesthesia provide the hierarchical distribution of the senses, demonstrating a general trend of sensorial transfer tendency in Figure 7.1.

Touch → Heat → Taste → Scent → Sound → Sight

Figure 7.1. Ullmann's (1957) linear directionality of synesthetic transfers

This hierarchy and directionality of sensorial transfer, extracted from Ullmann's (1957, p. 281) illustrative tables of six sensory features, displays the linear movement of inter-sensory relations, transferring the sensory modalities from left (source) to right (target), and not vice versa.

Following Ullmann's (1945, 1957) studies, several modifications of the sensorial transfer patterns have been proposed. One of the most cited sensorial transfer patterns is that of Williams (1976) who studied the semantic change in English synesthetic adjectives by analyzing the sensory modalities of lexemes in the Oxford English Dictionary (OED) and the Middle English Dictionary (MED). Williams (1976, p. 463) offered an intricate hierarchy of synesthetic transfers, aiming to demonstrate the general diachronic movement of sensory meanings. Figure 7.2 presents the hierarchy of synesthetic transfers with examples added by Winter (2019, p. 100):

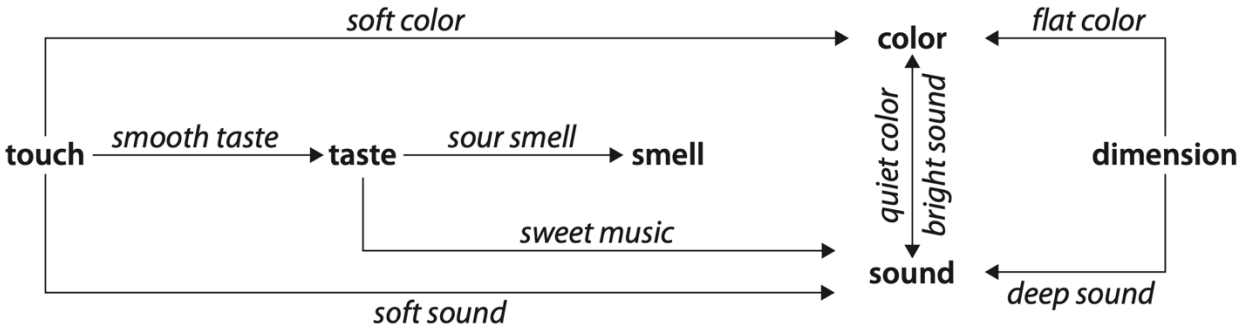

Figure 7.2. William's (1976) sensory metaphor hierarchy with examples

Williams (1976) argued that English synesthetic adjectives would conform to these directional tendencies when "a lexeme metaphorically transfers from its earliest sensory meaning to another sensory modality" (p. 463). In addition, Williams (1976) found that the sensorial transfer patterns in Japanese, which is a non-Indo-European language, also followed the hierarchy presented in Figure 7.2 based on two kinds of evidence. One is the synesthetic

expressions listed in 広辞苑 *Kōjien* 'wide garden of words' (a Japanese dictionary). The other is a small sampling of synesthetic collocations between sense adjectives and referents confirmed by native Japanese speakers intuitively.

Different from the sensory metaphor hierarchy of Ulmann (1957), Williams (1976) added spatial dimension, which characterizes properties such as size, shape and extent (e.g., *big, small, flat, thin, deep, shallow*), as a new category. Also, Williams (1976) de-emphasized both visual and spatial characteristics in the sensory domain of "sight" by merely labeling "color" as a visual category. Furthermore, the olfactory domain "smell" in the hierarchy of Williams (1976) cannot be transferred to other sensory domains, such as sound and sight indicated by Ulmann (1957).

Despite using different sense classifications and linguistic data, both Ulmann (1957) and Williams (1976) postulated metaphorical asymmetries in cross-modal sensorial transfers. In addition, they indicated the fuzzy boundary between the auditory (sound) and visual (sight/color) domains. This bidirectional connection has been presented in the hierarchy of Williams (1976). As shown in Figure 7.2, the synesthetic expressions "*quiet color* (sound-to-color) and *bright sound* (color-to-sound)" provided by Winter (2019) epitomizes the bi-directionality between sound and color.

The existing literature on synesthetic metaphors has revealed the metaphorical process of transfer, mapping from the lower sensory modalities (touch, taste, smell) as the source to the higher sensory modalities (sound/hearing and sight) as the target (e.g., Shen & Cohen, 1998; Shen & Gil, 2008; Strik Lievers, 2015; Ullmann, 1957; Yu, 2003; Zhao et al., 2018, 2019). While Ullmann (1957) found the directionality of synesthetic transfers based on the textual data in poetry, Prandi (2004) indicated that the synesthetic associations found in poetry are, to some extent, a result of the poet's imaginative and creative use of language where the concepts may

contradict widely accepted conceptual structures. Strik Lievers (2015) validated the general directionality of synesthetic transfers by extracting synesthetic metaphors in two non-poetic texts from the corpora of English and Italian. Nonetheless, more cross-linguistic research on this topic needs to be undertaken before we conclude that there is a cross-lingual universality of directional tendencies of sensory metaphors.

Winter (2019) further indicated that the central question of the cross-modal uses of sensory words is not about whether there is a cross-modal transfer between sensory modalities, but how "words with multiple meaning dimensions that get shifted in emphasis when they occur in specific contexts" (p. 103). For instance, how does the word *sweet* whose semantic prototype is comparatively more taste-related get shifted in the context of *sweet fragrance* that are comparatively more smell-related? In the following subsection, I will briefly discuss the approaches used to account for the metaphorical asymmetries between sensory words.

7.2.1 The explanatory accounts for the asymmetries between sensory words

A good summary of different explanatory accounts of sensory metaphor hierarchy has been provided by Winter (2019). Winter synopsized six explanatory accounts of the hierarchy: perceptual, lexical, evaluative, gradability, iconic, and idiosyncratic. Among these six explanatory accounts, the perceptual asymmetries between sensory words are by far the most widely studied (e.g., Shen, 1997; Shen & Cohen, 1998; Tsur, 1992; Williams, 1976). Several studies on the perceptual asymmetries have been conducted by Shen and his colleagues, who aimed to offer a global explanatory account that explains the hierarchy of synesthetic transfers with one perception-based principle (Shen & Aisenman, 2008; Shen & Gadir, 2009; Shen & Gil, 2008; Shen & Porat, 2017).

This perception-based directionality principle emphasizes not only the distance and

accessibility between different sensory modalities but also the distinction between experiencer-based sensations (i.e., the experiencer's physiological sensations) and object-based sensations (i.e., the external objects that cause the experiencer's sensation). For example, Shen and Aisenman's (2008) cognitive account provides the general direction of the cognitive structure of metaphorical mapping, stating that "mapping from a more concrete concept onto a less concrete one is more natural than the inverse" (p. 111). Shen and Aisenman (2008) argued that *touch* and *taste* are the two "lower" sensory modalities that are more concrete and accessible based on their proximal distance between the perceiver and the perceived object. On the other hand, *sound* and *sight* are the two "higher" sensory modalities that do not require a direct bodily experience (i.e., less concrete and less accessible).

Popova (2005) further explored the cross-modal nature of image schemas and underscored the role of embodied experience, "the experiential content of the sense data provided by the lower modalities (touch, and to a lesser extent, taste)," as an integral part of the way we construe quality (p. 407). In particular, Popova (2005) pointed out that touch is the most phenomenologically real and expressive sensory modality where "the surface or the interior of the body can serve as both an object and an act of perception" (p. 411).

7.3 Synesthesia in Mandarin Chinese

While some research has been carried out on synesthesia cross-linguistically, data about linguistic synesthesia have been mainly focused on Indo-European languages (Shen, 1997; Shen & Cohen, 1998; Strik Lievers, 2015; Strik Lievers & Winter, 2018; Ullmann, 1964; Williams, 1976). Although Williams (1976) attempted to account for the universality of directional tendencies of sensory metaphors by studying Japanese, it is only in the past ten years the studies of linguistic synesthesia in non-European languages have gained momentum (e.g., Jo, 2019;

Shen & Gil, 2008; Zhao et al., 2018, 2019, 2022).

The analysis of synesthetic metaphors in Chinese from a cognitive perspective was first demonstrated by Yu (1992, 2003). In his study on the usage of synesthetic metaphors from the works of a contemporary Chinese novelist, Yu (2003) found the extracted synesthetic expressions align with some general patterns observed in both ordinary and poetic language in prior studies regardless of their novel uses. Although Yu also found that *touch* is the predominant source of synesthetic transfers, his Chinese data did not present *sound* as the predominant destination for synesthetic transfers as suggested by Ullmann (1957). In addition, Yu (2003, p. 22) discovered that the dimension words in Chinese not only can be transferred to color and sound as proposed by Williams (1976), but also can be transferred to taste and smell.

A search of the literature revealed few studies which explore linguistic synesthesia in Chinese. By far, the most detailed account of linguistic synesthesia in Chinese is to be found in a series of studies conducted by Zhao and her colleagues in recent years (Zhao et al., 2018, 2019, 2022). Zhao et al.'s (2019) corpus-based study of 199 sensory adjectives in Chinese found that there are Chinese-specific directionality tendencies of cross-modal sensory transfers. In particular, the study identified three types of directional tendencies in Chinese synesthesia: uni-directional, biased-directional, and bi-directional.

The uni-directional tendency, proposed by Williams (1976), refers to the rule-based synesthetic transfers that have an exclusive linear direction between two sense domains, e.g., *shengyīn tiánměi* 'sweet voice" which displays synesthetic mappings from TASTE to SOUND. The biased-directional tendency is the tendency-based synesthetic transfers where the pair of senses are found to display a dominant directional tendency despite being able to transfer bi-directionally. For instance, synesthetic mappings from TOUCH to VISION, such as *róu-lǜ* 'soft

green,' are more frequently found than its reverse direction (*ròuzhí xì* 'meat-tender'). Lastly, the bi-directional tendency means the synesthetic transfers occur in both directions without any dominant direction, e.g., synesthetic mappings from TOUCH to TASTE (*lièjiǔ* 'scorching wine'), and from TASTE to TOUCH (*yāo suān* 'waist-sour') (Zhao et al., 2019, pp. 6-8). The general transfer directionality of Chinese synesthesia proposed by Zhao et al. (2019) is presented in Figure 7.3.

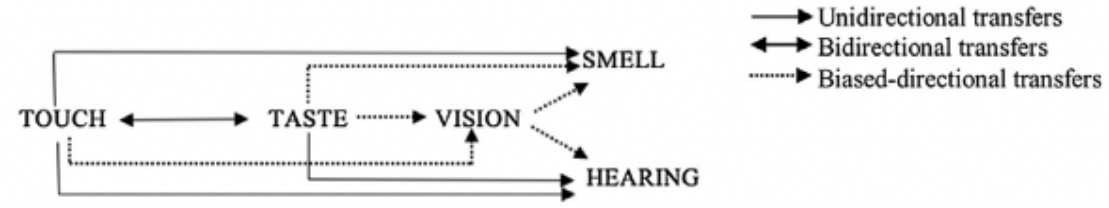

Figure 7.3. Zhao et al.'s (2019) general directionality of Chinese synesthetic transfers

Thus far, previous studies on Chinese synesthesia have shown that there are Chinese-specific synesthetic transfer patterns that do not conform to the cross-linguistic universal directionality of synesthetic transfers based on most linguistic data in Indo-European languages. As shown in Figure 7.3, for example, the synesthetic mappings between TOUCH and TASTE are bi-directional in Chinese, rather than uni-directional in Indo-European languages (cf., Figure 7.2). Although prior studies on Chinese synesthesia have found language-specific directionality of cross-modal sensory transfers, their results are predominantly based on the examination of modifier-head collocations at the phrasal level. No previous study has investigated the linguistic conceptualization of intersensory perceptual qualities or qualia at the morphological level.

The current study seeks to explore the cross-modal synesthetic transfers in Chinese lexical networks which constitute a productive family of ABB morphological constructions that represent the quality of sensory perception. This study aims to the existing research gaps by answering the following specific research questions:

1. Does synesthesia a privilege of poetic language?
2. Do languages convey intersensory experience at the morphological level as part of the lexicon?
3. Do we see the same BB in [A-BB] associated with different sensory categories encoded in A?
    3a. If so, how does this kind of intersensory representation tell us about the conceptualization of qualia in Chinese?
    3b. How does it inform our understanding of linguistic synesthesia?

7.4 Methods

The present research greatly complies with the "criteria for a study of synaesthesia" proposed by Strik Lievers (2015):

- *The data to be analysed have to come from texts that are not classifiable as poetic or domain-specific.*
- *Many occurrences of synaesthesia have to be analysed.*
- *The methodology has to be applicable to many languages.* (p. 73)

Data for this study were drawn from 1,007 [ABB] patterns in a corpus dataset (see the description of corpus data in Chapter IV). These patterns consist of 117 types of A-part and 507 types of BB-part. Referring to my proposal in Chapter 1.3, I suggest that the constructional meaning of [A-BB] depicts subjective perceptual qualities that are embedded in memory as

gestalts. The lexical input in A slot plays a crucial role in describing perceptual properties, and the lexical input in BB slot describes either the sound (i.e., phonomimetics) or the state of a referent (i.e., phenomimetics).

To investigate trans-domain qualia conveyance in ABB morphological construction, 98 BB types (19.3%), which collocate with at least three A types, were selected for further scrutinization. To identify cross-modal intersensory transfers in the ABB construction, I retrieved the results obtained from the preliminary WordNet analyses of 117 A types with their annotated perceptual qualities. I then conducted a cross-reference and assigned the perceptual qualities to each A type found within 98 [-BB] patterns. Next, the A types found in each [-BB] pattern were categorized into six sensory modalities in accordance with the semantic clusters shown in Appendix C. The six modalities are: TOUCH, TASTE, SMELL, VISION, HEARING, and EMOTION. The distribution of sensory modalities, based on the collostrcutions between the lexical input of A types and the selected 98 BB types, is displayed in Appendix E.

Data processing and visualization were conducted in RStudio (R version 4.2.2). The trans-domain qualia conveyance in the form of [A-BB] was illustrated through UpSet plots. An UpSet plot was selected for this study because it is an alternative to the Venn Diagram, being able to visualize data with more than three intersecting sets in a matrix (Lex et al., 2014). In this study, UpSet plots were created with R packages: *ggplot2* (Wickham, 2016) and *ComplexUpset* (Krassowski, 2021).

7.5 Results

7.5.1 The interaction of A and BB in qualia conveyance

To compare cross-modal sensory transfers in Chinese lexical networks, two UpSet plots were created to visualize the results of this study presented in Appendix E. Figure 7.4 shows the intercorrelations between sets of sensory modalities (encoded in different types of A) and 98 types of BB for trans-domain qualia conveyance in descending type frequency.

As shown in Figure 7.4, the UpSet plot exhibits cross-modal intersensory transfers in the interaction of A and BB in expressing qualia. The rows represent the 98 types of BB, and the columns represent their intersections of six sensory domains. For each type of BB that is part of an intersection, a circle that is filled with black color is positioned within the corresponding matrix cell. The relationships between the items in each column are highlighted by a black vertical line, connecting the topmost black circle to the bottommost black circle in that column.

The size of the intersections, computed based on the number of distinct BB types (i.e., type frequency) that share the same cross-modal intersensory transfers, is displayed by a bar chart at the top of the matrix with each column corresponding to a single bar in the chart. The size of each sensory modality, calculated based on the sum of type frequency of A in that row, is presented by a second bar chart at the bottom left of the matrix.

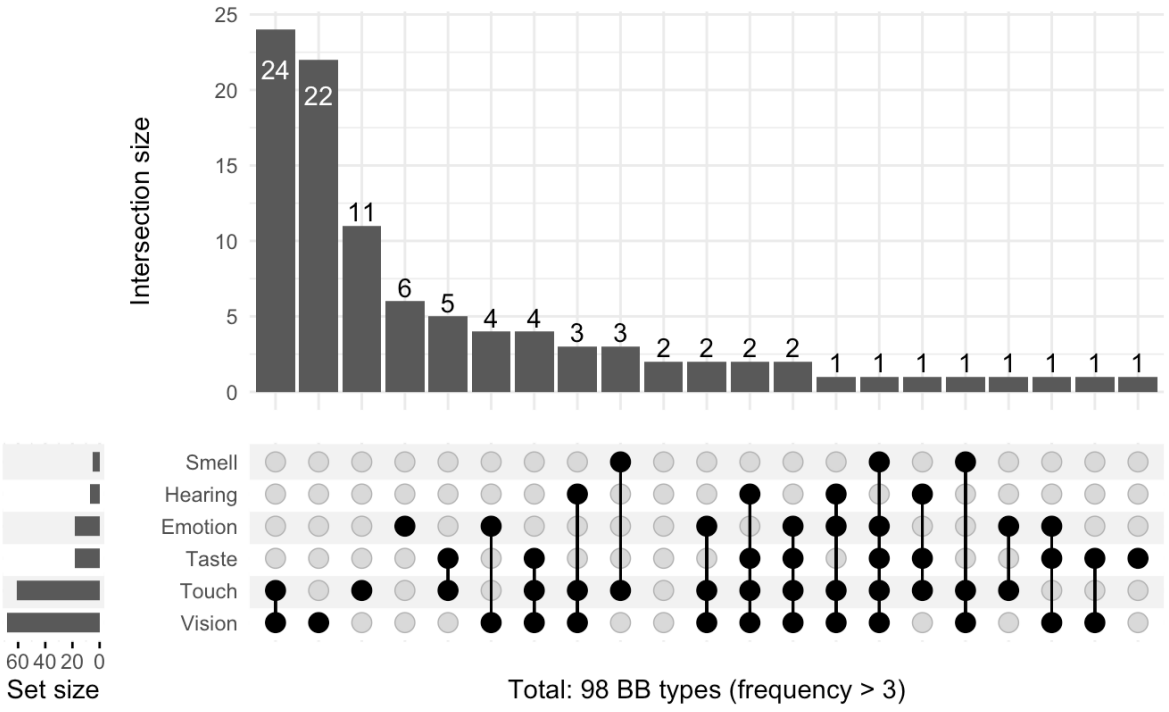

Figure 7.4. The interaction between sets of sensory modalities and 98 types of BB

In Figure 7.4, there are 16 out of 21 bars (76.2%) in the chart that demonstrate intersensory transfers across at least two sensory modalities. Four out of 21 bars (19%) in the chart were found to be non-synesthetic patterns, which exclusively represent a single sensory modality. These sensory modalities are VISION, TOUCH, EMOTION, and TASTE. There is only one bar in the chart that does not match any sensory modalities listed in the current study. An inspection of the data reveals that the bar represents two BB patterns (shaded in gray in Appendix E): 哗哗 *huāhuā* 'the sound of splashing water' and 唰唰 *shuāshuā* 'the sound of rustling.' This seems to suggest that onomatopoeic words are conventionalized and do not require a specific lexical word to signify their sensory properties in HEARING. However, further investigations on other onomatopoeic words in the [A-BB] construction are needed to confirm

and validate this postulation.

7.5.2 Synesthetic transfers in Chinese lexical networks

To better illustrate the distribution of 16 cross-modal intersensory transfer patterns with their BB types, the intersections of sets of sensory modalities (encoded in various A types) were first sorted by degree and then by cardinality. Figure 7.5 shows the distribution of cross-modal intersensory transfer patterns with 56 BB types, ranging from two-way to five-way intersections. The distinct types of BB in each cross-modal intersensory transfer pattern are provided in Chinese characters above their corresponding bar in the chart.

From the data in Figure 7.5, it can be seen that there are 56 BB types where qualia conveyed in BB describe at least two sensory modalities encoded in A. In addition, several types of BB describe properties of four or even five sensory modalities. It is apparent from the data in Figure 7.5 that there is a clear trend of cross-domain mappings involving multiple sensory categories. The results, as shown in Figure 7.5, indicate the shared representation of qualia or perceptual qualities across sensory modalities. These findings provide evidence for non-linear trans-categorial synesthetic conceptualization in Chinese ABB morphological construction.

What stands out in Figure 7.5 is 乎乎 *hūhū*, which is the most productive BB type in representing broadly shared perceptual qualities across five sensory modalities. It should be noted that the morpheme 乎 *hū* is a classical Chinese final particle used for expressing question, doubt, or astonishment, whose original meaning has been bleached to become a general phenomimetic sign in the morphological process of reduplication as part of the ABB construction. What is interesting about *hūhū* is that HEARING is the only sensory modality that is not expressed by *hūhū*. What is it about the sensory properties of HEARING that makes it incompatible with *hūhū*? What does this incompatibility tell us about the mimetic quality of

hūhū? Judging by the types of BB that are compatible with HEARING, there appears to be an onomatopoeic preference, which the highly generalized qualia represented by *hūhū* can not satisfy. Further research is needed to further address these questions raised by this study.

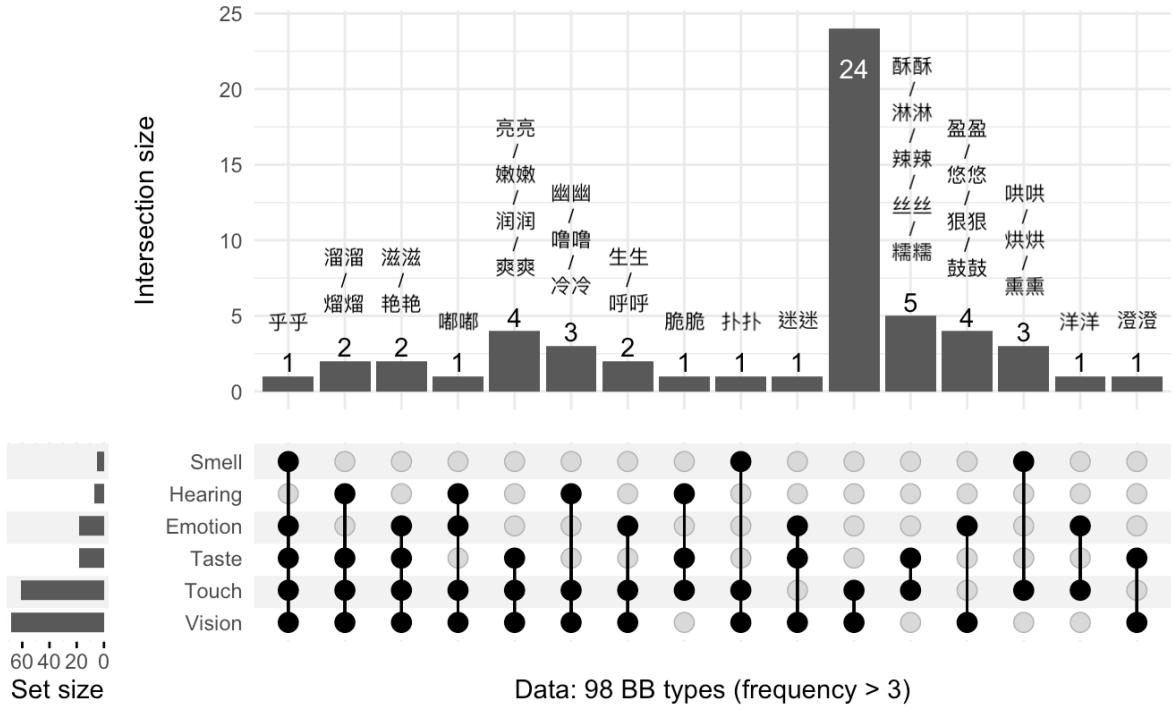

Figure 7.5. The distribution of cross-modal intersensory transfer patterns with 56 BB types

Table 7.1. The 24 distinct types of BB intercorrelate with VISION and TOUCH

BB (phono- or pheno-mimetics)	Type Freq.	BB (phono- or pheno-mimetics)	Type Freq.
嗒嗒 *tàtà* (*dā*: to despair)	8	汪汪 *wāngwāng* (*wāng*: expanse of water; ooze)	4
糊糊 *húhú* (*hú*: muddled)	7	笃笃 *dǔdǔ* (*dǔ*: sincere)	4
闪闪 *shǎnshǎn* (*shǎn*: to dodge; lightning; spark)	7	光光 *guāng'guāng* (*guāng*: light; bright)	3
塌塌 *tātā* (*tā*: to collapse)	6	噗噗 *pūpū* (onom.) 'plop'	3
濛濛 *méngméng* (*méng*: drizzle; mist)	6	朗朗 *lǎnglǎng* (*lǎng*: clear; bright)	3
腻腻 *nìnì* (*nì*: greasy; tired of)	6	渗渗 *shènshèn* (*shèn*: to seep)	3
腾腾 *téngténg* (*téng*: to soar)	6	漆漆 *qīqī* (*qī*: paint)	3
哒哒 *dādā* (*dā*: sound - command to a horse; clatter)	5	火火 *huǒhuǒ* (*huǒ*: fire)	3
滚滚 *gǔngǔn* (*gǔn*: to boil; to roll)	5	稠稠 *chóuchóu* (*chóu*: dense; thick)	3
花花 *huāhuā* (*huā*: blossom)	5	绒绒 *róngróng* (*róng*: velvet; woolen)	3
剌剌 *lálá* (*lá*: to slash)	4	绷绷 *bēngbēng* (*bēng*: taut)	3
板板 *bǎnbǎn* (*bǎn*: board)	4	茸茸 *róngróng* (*róng*: fluffy; luxuriant growth)	3

The most striking observation to emerge from the data comparison was the two-way cross-modal intersensory transfer pattern in VISION and TOUCH. This two-way pattern has the highest type frequency, including 24 out of 56 distinct types of BB (42.86%), among the 16 cross-modal intersensory transfer patterns in the UpSet plot. Table 7.1 presents the 24 types of BB that intercorrelate with the sensory properties in VISION and TOUCH. What is it about the sensory properties of VISION and TOUCH that makes this two-way intersensory transfer pattern schematic and substantive that leads to the productivity of novel items? This question will be addressed in the following discussion section.

According to the size of sensory modalities displayed in the second bar chart of Figure 7.5, the results show that VISION is the dominant sensory modality, and SMELL is the subordinate sensory modality in conveying cross-modal intersensory experience. Table 7.2 presents the participation of senses in synesthetic networks based on the findings of Figure 7.5.

Table 7.2. Participation of senses in synesthetic networks

Complexity of network	Number of network	Total counts of phono-/pheno-mimetics	Most active domain	Inactive domain
Two-domain network	6	38	Touch	Hearing
Three-domain network	6	12	Vision/Touch	Smell
Four-domain network	3	5	Vision/Touch	Smell
Five-domain network	1	1	Vision/Touch	Hearing

The current study found that VISION is the dominant sensory modality that has the highest type frequency of different perceptual qualities encoded in A (N = 115), intercorrelating with 46 out of 56 types of BB (82.14%). In addition, TOUCH is the second dominant sensory modality that has the second-highest type frequency of distinct perceptual qualities encoded in A (N = 99), intercorrelating with 50 out of 56 types of BB (89.29%).

What is striking about the data in Figure 7.5 is that SMELL is the subordinate sensory modality that has the lowest type frequency of different perceptual qualities encoded in A (N = 5), intercorrelating with merely five out of 56 types of BB (9%). What is it about the sensory properties of SMELL that make it the least productive in the creation of [A-BB] morphological patterns for expressing qualia or perceptual sensory qualities in Chinese? This will be further discussed in the next section.

Overall, these results indicate that there are language-specific cross-modal intersensory transfer patterns in Chinese [A-BB] morphological construction. Specifically, the current study demonstrates how the morphological construction of [A-BB] as a form-meaning pair is constructed by the intercorrelations between perceptual sensory properties described in A and the phonomimetic or phenomimetic expressions portrayed in BB.

7.6 Discussion

Previous studies on linguistic synesthesia mainly examined modifier-head collocations at the phrasal level, e.g., *sweet voice*. The present research provides the first extensive data on non-linear trans-categorial synesthesia. The Chinese morphological patterns in the form of [A-BB] conceptualize complex networks of perceptual qualities across sensory modalities. In these networks, synesthesia is ubiquitous, multi-directional, and multi-categorial. The current study, therefore, makes an important contribution to research on synesthesia by expanding our

knowledge of the mode of conceptual mapping in linguistic synesthesia through a productive morphological construction in Chinese.

According to Strik Lievers and Winter (2018), the asymmetric distribution of metaphorical mappings between sensory concepts can be linked to "the different properties of prototypical representatives" within different lexical categories, as well as the variations in phenomenological and perceptual experiences among the senses (p. 46). The results of this study broadly support the work of other studies in linguistic synesthesia, confirming that the linguistic encoding of different sensory modalities varies in degree (e.g., Levinson & Majid, 2014; Strik Lievers, 2015; Strik Lievers & Winter, 2018).

Although considerable literature suggests that TOUCH is the most embodied and predominant source of synesthetic transfers (e.g., Shen & Cohen, 1998; Ullmann, 1957; Williams, 1976; Yu, 2003; Zhao et al., 2019), the current study found that VISION is the most productive sensory modality that involves the most varieties of sensory properties encoded in the lexical input of A. This result may be explained by the fact that VISION is the dominant sense in human perception from a psychophysical perspective.

In visual perception, various features such as motion, depth, form, and color are integrated to create a unified or cohesive perceptual experience (Mayeli, 2019). To process visual information, it takes complicated higher-level processing of visual input across multiple brain regions, which involves the interaction of at least two major neural pathways (Henley, 2021; Mayeli, 2019; Palmer, 1999; Shimojo et al., 2001). Given the dominance of vision in human perception, it may be the case therefore that our perceptual visual experiences can be expressed using a broader range of lexemes than those available for other sensory experiences.

Furthermore, the current results corroborate the findings of Winter, Perlman, and Majid

(2018), which showed a clear prevalence of visual dominance in both the usage of sensory words and the composition of the sensory lexicon. As suggested by Winter et al. (2018), semantic domains that are more frequently verbalized also tend to exhibit a higher level of lexical differentiation when it comes to describing perceptual experiences. The overrepresented linguistic representation of sensory qualities in VISION found in this study reflects Chinese speakers' communicative needs for nuanced distinctions and precise expressions of perceptual visual experiences.

Besides VISION, the present study also found the productivity of sensory properties represented by A morphemes that are associated with the sensory modality of TOUCH. In the interaction of A and BB in expressing the perceptual qualities of tactile experience, one interesting finding is the productivity of lexical input in BB, which represents phonomimetics or phenomimetics. Although TOUCH does not possess as many lexical inputs in A as VISION, it has the highest type frequency of distinct phonomimetic or pheonomemtic expressions represented by BB among the six sensory modalities.

In human perception, TOUCH is a unique sensory modality where stimulation is acquired through active tactile experience rather than being imposed solely by the stimulus itself (Popova, 2005). The current finding could be explained by the fact that TOUCH is the most embodied sensory modality that provides more subjective and evaluative information. Accordingly, the need for more finer and expressive descriptions of perceptual tactile experiences leads to the productivity and creativity of the [A-BB] morphological patterns in Chinese.

Notably, the present study found that the two-way cross-modal intersensory transfer pattern in VISION and TOUCH is the most productive synesthetic pattern with overrepresented phonomimetic or pheonomemtic expressions of qualia represented by BB. The results offer

compelling evidence supporting the crucial roles of VISION and TOUCH as sensory modalities in our representation and evaluation of qualia.

Within the Chinese [A-BB] morphological patterns, this study discovered that the sensory modality of SMELL exhibited the least productivity in qualia representation, with the fewest distinct lexical inputs observed in both the A and BB components. Previous research has indicated ineffability or low effability of smell in the sense that there is a limited set of words associated with smell, which leads to the belief that SMELL is the most difficult to express in language due to its ineffable nature (Levinson & Majid, 2014; Strik Lievers & Winter, 2018). The current results are in line with those of previous studies, which suggested SMELL as a "muted sense" (Olofsson & Gottfried, 2015).

Human olfaction is able to detect and perceive a vast array of odors (McGann, 2017). However, "smell" is elusive to conceptual representation (Levinson & Majid, 2014). Olofsson and Gottfried (2015) attributed the ineffability of smells to deficient sensory interaction between olfaction as a "primitive" sense and higher-order representation by language. This difficulty in expressing olfactory experiences through language is well supported by the findings of this study. It is clear from the current study that the qualia of smell defy linguistic representation.

7.5 Summary

This chapter investigates trans-domain qualia conveyance in a productive family of ABB morphological construction in Chinese. While prior research on Chinese synesthesia has focused on modifier-head collocations at the phrasal level, the present study is the first to examine the cross-modal intersensory transfers in Chinese lexical networks at the morphological level. Through UpSet plots, this study provides a new data visualization method for analyzing cross-modal sensory transfers within Chinese lexical networks. The current study shows that linguistic

synesthesia is not restricted to modifier-head collocations at the phrasal level. It is extremely pervasive even at the morphological level. The findings of this chapter demonstrate the existence of shared qualia or perceptual qualities across six sensory modalities, providing evidence for language-specific patterns of cross-modal intersensory transfers within the Chinese [A-BB] morphological construction. Furthermore, the current study revealed a highly productive two-way cross-modal intersensory transfer pattern between VISION and TOUCH.

The results of this chapter advance our knowledge of what sensory modalities are productive and stand out in the conveyance of qualia by the ABB morphological construction. Significantly, this chapter provides valuable insights into the formation of psychomimetic expressions, highlighting the role of both sensory properties and phonomimetic or phenomimetic expressions in a family resemblance network of [A-BB].

CHAPTER VIII

GENERAL DISCUSSION AND CONCLUSION

This dissertation aimed to explore the linguistic representation of subjective perceptual qualities or qualia in a productive family of reduplication-based mimetic morphological constructions in Chinese. Specifically, this dissertation sought to investigate how the qualitative properties of sensory experiences are depicted within the conceptual semantic networks of [A-BB] morphological construction, as well as identify the sensory modalities that play a prominent role in the conveyance of qualia. In this chapter, I highlight the main research findings from the studies on color and synesthetic expressions in Chinese and provide a general discussion addressing the three central research questions of this dissertation. Furthermore, I discuss the novel contributions and strengths of the dissertation, as well as future directions and implications of the current research for sensory linguistics in Chinese.

8.1 General Discussion

Through a comprehensive analysis of 1,007 types of ABB morphological patterns identified from a large Chinese Web Corpus (zhTenTen17), this research sheds new light on the linguistic conceptualization of sensory perception from the perspective of Chinese. The following paragraphs address the three central questions in this dissertation.

The first central question in the present research was to identify the prominent sensory modalities that stand out in conveying qualia within the Chinese ABB morphological construction. Through the cross-lingual WordNet analyses of sensory properties encoded in A, this research detected six semantic clusters that are associated with different sensory modalities. These semantic clusters were determined based on the family resemblance structure observed among the word senses of lexical items. As shown in Appendix C, the findings reveal that

VISION and TOUCH are the two sensory modalities that play a significant role in representing qualitative properties of sensory experiences by the schema [A-BB].

Among the six semantic clusters, VISION is the most productive sensory modality, which has seven subclasses that categorize distinct sensory properties encoded in A morpheme. In addition to the productivity of sensory expressions in VISION, the current research discovered that TOUCH is also a productive sensory modality, exhibiting five subclasses that are differentiated by the family resemblance observed within their respective word senses. Moreover, the investigation of trans-domain qualia conveyance in the Chinese [A-BB] morphological construction has revealed a highly productive two-way cross-modal intersensory transfer pattern between VISION and TOUCH. Taken together, the studies in this dissertation provide solid evidence that demonstrates how the two sensory modalities, VISION and TOUCH, stand out in the conveyance of qualia by ABB.

The second central question in this research was to investigate how the qualitative properties of sensory experiences are depicted in the Chinese ABB morphological construction. In this dissertation, I argue that the constructional meaning of [A-BB] should be interpreted as psychomimetic conveyance, which refers to Chinese speakers' subjective experience of perceptual sensory qualities. Within the [A-BB] construction, the lexical input in A specifies the perceptual sensory property being described, while the lexical input in BB expresses phonomimetics (i.e., the sound of a perceptual phenomenon) or phenomimetics (i.e., the states or conditions of a perceptual phenomenon).

According to the results of semantic clustering shown in Appendix C, this research discovered that color-vision is the most productive sensory category, leading to the highest type frequency of Chinese morphological pattern [A-BB]. To better illustrate the formation of ABB

morphological construction for qualia conveyance, hence, the present research conducted a semantic network analysis on the ABB color-vision construction, which portrays the phenomenal qualities of perceptual color vision experience. Through investigating specific color referents and usage contexts of ABB color-vision patterns, this research successfully demonstrated a variety of phenomenal qualities of perceptual color vision experience depicted in Chinese.

The third central question in the current research sought to determine whether there are any schematic and substantive patterns in the interaction of A and BB in expressing qualia or subjective perceptual qualities. This research has demonstrated certain schematic patterns that are frequently used by Chinese speakers when describing the phenomenal qualities of perceptual color-vision experience. The statistical measures of collostruction strength visualized by the [A-BB] color-vision network reveal five primary color lexemes that display a greater variety of word collocations and stronger collostruction strength with its BB collocates in the [A-BB] color-vision network.

Through examining the color referents and usage contexts of the five primary color-vision constructions, the present research has exhibited language-specific experiential structures of color-vision perception that are encoded in the schema [A-BB]. Furthermore, through data visualization of the interaction of A and BB, this research has effectively identified language-specific cross-modal intersensory transfer patterns in the schema [A-BB].

8.2 Significance of This Dissertation

This dissertation makes several significant contributions to the field of Chinese Linguistics, particularly in the domains of construction grammar and sensory linguistics. By examining the Chinese morphological pattern [A-BB] as a form-meaning pair for qualia conveyance, this dissertation sheds light on unexplored aspects of sensory language and offers

rich and valuable datasets for further research. In the following paragraphs, I discuss the main contributions of this dissertation from four aspects.

First, this dissertation contributes to Construction Grammar by uncovering a hidden and unrecognized morphological construction in Chinese that is used to convey one's psychomimetic impression. That is, the subjective experience of perceptual sensory qualities. This productive family of ABB construction, which represents iconicity through the form-meaning mappings of their structural properties, has not been studied from a usage-based constructionist perspective before. Therefore, this work fills a major gap in the research on qualia by showing the dynamic and complex nature of perceptually based conceptualization within rich semantic networks of [A-BB]. Significantly, it demonstrates how exemplars in the [A-BB] networks are interconnected based on the family resemblance or similarity between the lexical items. Furthermore, the present work is the first to bridge the research gaps in Chinese mimetics by illuminating the constructional meaning of [A-BB], as well as its structural properties based on natural language data.

Second, this dissertation provides new insight into the color language and categorization by illustrating how the phenomenal qualities of color-vision experience are encoded in the Chinese ABB morphological construction. The current research explores, for the first time, the experiential structures of color perception in [A-BB] color-vison networks. It is the first study to identify the primary colors that are frequently used by Chinese speakers to describe the phenomenal qualities of color perception. It also provides strong empirical confirmation and evidence of the existence of universal constraints on color categories in the creation of [A-BB] color-vision expressions. Moreover, the present findings offer important insight into the

psychophysical effect on the creation of color language in Chinese, indicating the dominance of achromatic colors in the creation of [ABB] patterns for qualia conveyance.

Third, this dissertation contributes to the growing area of research in Sensory Linguistics by studying a productive family of ABB morphological constructions that conveys qualia in all sensory domains. The current research appears to be the first study to investigate the linguistic conceptualization of intersensory perceptual qualities at the morphological level. Notably, this is the first research on linguistic synesthesia that provides evidence for non-linear trans-categorial synesthetic conceptualization in Chinese ABB morphological construction. The findings from this research provide additional evidence for language-specific patterns of cross-modal intersensory transfers in qualia conveyance. Furthermore, the present study adds to the growing body of literature that indicates the differential linguistic codability of perceptual qualities across sensory modalities.

Last but not least, this dissertation makes a notable contribution to methodology in several ways. It demonstrates the methodological power of systematic corpus-based quantitative research using big data and sophisticated algorithms to present the interconnections in the networks of qualia. Also, it displays the methodological power of data visualization for illustrating linguistic results, which is essential to contemporary linguistic research. The data visualization and semantic network analytic techniques presented in this dissertation represent a major breakthrough in research methods, enabling the qualitative analysis of linguistic structures based on quantitative metrics. Remarkably, the present research is the first study that demonstrates the most advanced interactive visualization technique of semantic networks, allowing for a user-centered visual exploration of interconnected semantic properties in the conceptual networks of [A-BB]. Moreover, the current study is the first research that visualizes

linguistic data and structures through UpSet plot, which is a data visualization technique commonly employed in Bioinformatics.

8.3 Limitations and Future Directions

Although this dissertation has successfully presented substantial conceptual semantic networks that constitute a productive morphological construction representing the quality of sensory perception, it has certain limitations in terms of the scope of this study. The most important limitation lies in the fact that the scale of the corpus data collected for this study is so extensive that it is unlikely to examine the form-meaning or form-function pairings of each [A-BB] morphological pattern with its usage contexts in this dissertation. The current research has only focused on the context where the ABB morphological patterns are used to express the phenomenal qualities of color vision experience, and explicated what their constructional meanings are. Furthermore, this research has raised several questions regarding the linguistic codability of perceptual qualities across senses in need of further investigation.

A further study could explore the psychomimetic conveyance of onomatopoeic words in the schema [A-BB] to better understand the role of A and BB in expressing the perceptual qualities of auditory experience. In addition, further studies need to be carried out in order to understand why hearing is an under-represented sensory modality in expressing the perceptual qualities of sensory experiences. Further investigation into the constructional meanings of [A-BB] morphological patterns, which express Chinese speakers' subjective experience of perceptual qualities in different sensory modalities based on their usage contexts, is needed to provide a comprehensive picture of the formation of psychomimetic expressions.

Besides the valuable corpus data offered in this work, to better support and broaden the current findings, future research should collect elicited or experimental data from Chinese native

speakers. This could involve conducting surveys to learn about their subjective experience of perceptual sensory qualities, as well as their mental representation and interpretation of the ABB morphological patterns in diverse usage contexts.

The present work is the first data-driven interdisciplinary study to undertake systematic corpus-based quantitative and qualitative analyses of the linguistic representation of perceptual sensory qualities or qualia based on the Chinese ABB morphological construction. It is hoped that this research will advance the knowledge of linguistic conceptualization of sensory perception from the perspective of Chinese. By uncovering the constructional meaning of [A-BB] as psychomimetic conveyance, the current research provides a solid foundation and a unitary theoretical framework for future studies to build upon and delve deeper into the conceptual semantic networks of [A-BB]. I would like to conclude this dissertation by urging for more systematic research to investigate the linguistic representation of qualia in greater detail.

Appendix A

Ranked Frequencies of the 117 A-Types within [ABB] Construction

Rank	Type			Frequency	Rank	Type			Frequency
1	湿	*shī*	wet	37	52	怯	*qiè*	cowardly	7
2	颤	*chàn*	trembling	31	52	淅	*xī*	(sound) rain	7
3	亮	*liàng*	bright	25	62	水	*shuǐ*	water	6
4	笑	*xiào*	laugh	24	62	臭	*chòu*	stink	6
5	灰	*huī*	grey	22	62	慢	*màn*	slow	6
6	软	*ruǎn*	soft	21	62	肉	*ròu*	meat	6
6	暖	*nuǎn*	warm	21	62	明	*míng*	bright	6
6	扑	*pū*	flutter	21	62	响	*xiǎng*	loud	6
9	黑	*hēi*	black	19	62	鲜	*xiān*	fresh	6
10	嫩	*nèn*	tender; soft; inexperienced	18	62	孤	*gū*	solitary	6
10	傻	*shǎ*	silly	18	70	冷	*lěng*	cold	5
10	硬	*yìng*	hard	18	70	活	*huó*	live	5
13	气	*qì*	gas; angry	16	70	乌	*wū*	black	5
13	直	*zhí*	straight	16	70	干	*gān*	dry	5
15	绿	*lǜ*	green	15	70	闹	*nào*	noisy	5
15	甜	*tián*	sweet	15	70	粉	*fěn*	pink	5
15	阴	*yīn*	cloudy	15	70	凶	*xiōng*	fierce	5
15	急	*jí*	urgent	15	70	密	*mì*	dense	5
15	乱	*luàn*	messy	15	70	死	*sǐ*	die	5
15	凉	*liáng*	cool	15	70	香	*xiāng*	fragrant	5
15	雾	*wù*	fog	15	70	暗	*àn*	dark	5
22	圆	*yuán*	round	14	70	兴	*xìng*	excitement	5
22	油	*yóu*	oily	14	70	咕	*gū*	(sound) bird; stomach	5
22	懒	*lǎn*	lazy	14	70	辣	*là*	spicy	5
22	汗	*hàn*	sweat	14	84	毛	*máo*	hair	4
22	呆	*dāi*	dull	14	84	哗	*huā*	(sound) water	4
27	白	*bái*	white	13	84	大	*dà*	big	4

27	光	*guāng*	light	13	84	齐	*qí*	together	4
27	娇	*jiāo*	delicate	13	84	厚	*hòu*	thick	4
27	黏	*nián*	sticky	13	84	潮	*cháo*	damp	4
31	热	*rè*	hot	12	90	黄	*huáng*	yellow	3
31	清	*qīng*	clear	12	90	金	*jīn*	gold	3
31	肥	*féi*	fat	12	90	空	*kōng*	null; empty	3
34	红	*hóng*	red	11	90	火	*huǒ*	fire	3
34	胖	*pàng*	fat	11	90	文	*wén*	literal	3
34	羞	*xiū*	shy	11	90	顶	*dǐng*	top	3
34	泪	*lèi*	tears	11	90	晃	*huǎng*	dazzling	3
38	沉	*chén*	sink	10	90	麻	*má*	tingling	3
39	喜	*xǐ*	happiness	9	90	美	*měi*	beautiful	3
39	病	*bìng*	sick	9	90	怒	*nù*	angry	3
39	赤	*chì*	red	9	100	毒	*dú*	poisonous	2
39	脏	*zāng*	dirty	9	100	皱	*zhòu*	wrinkle	2
39	醉	*zuì*	drunk	9	100	青	*qīng*	green	2
39	脆	*cuì*	crisp	9	100	满	*mǎn*	full	2
39	粘	*nián*	sticky	9	100	俏	*qiào*	pretty	2
39	昏	*hūn*	faint	9	100	银	*yín*	silver	2
39	胀	*zhàng*	bulge	9	100	滴	*dī*	drop	2
48	乐	*lè*	happy	8	100	蓬	*péng*	fluffy	2
48	碧	*bì*	bluish green	8	100	温	*wēn*	warm	2
48	紧	*jǐn*	tight	8	100	平	*píng*	flat	2
48	轻	*qīng*	light	8	110	好	*hǎo*	good	1
52	蓝	*lán*	blue	7	110	假	*jiǎ*	fake	1
52	血	*xiě*	blood	7	110	雄	*xióng*	mighty	1
52	眼	*yǎn*	eye	7	110	色	*sè*	color	1
52	贱	*jiàn*	inexpensive; despicable	7	110	骨	*gǔ*	bone	1
52	静	*jìng*	quiet	7	110	慵	*yōng*	languor	1
52	滑	*huá*	slippery	7	110	糨	*jiàng*	thick	1
52	酸	*suān*	sour	7	110	荡	*dàng*	swing	1
52	恶	*è*	evil	7					

Appendix B

Top 100 Types of [ABB] Ranked by Token Frequency in the zhTenTen17 Corpus

Rank		Type	Frequency	Rank		Type	Frequency
1	眼睁睁	*yǎnzhēngzhēng* 'to look on helplessly'	42,118	51	活脱脱	*huótuōtuō* 'remarkably alike'	9,189
2	活生生	*huóshēngshēng* 'in real life'	37,969	52	灰溜溜	*huīliūliū* 'gloomy'	8,447
3	沉甸甸	*chéndiàndiān* 'heavy'	32,307	53	暖洋洋	*nuǎnyángyáng* 'comfortably warm'	8,429
4	赤裸裸	*chìluǒluǒ* 'undisguised'	29,199	54	美滋滋	*měizīzī* 'elated'	8,395
5	急匆匆	*jícōngcōng* 'hasty'	24,432	55	明晃晃	*mínghuànghuàng* 'shining	7,884
6	恶狠狠	*èhěnhěn* 'fiercely'	22,072	56	胖乎乎	*pànghūhū* 'chubby'	7,809
7	冷冰冰	*lěngbīngbīng* 'frigid'	21,978	57	甜蜜蜜	*tiánmìmì* 'very sweet'	7,676
8	空荡荡	*kōngdàngdàng* 'absolutely empty'	21,172	58	水灵灵	*shuǐlinglíng* '(of a person) healthy-looking; (of eyes) moist and bright'	7,670
9	绿油油	*lǜyóuyóu* 'lush green'	21,161	59	气呼呼	*qìhūhū* 'panting with rage'	7,635
10	火辣辣	*huǒlàlà* 'scorching; provocative'	19,776	60	直勾勾	*zhígōugōu* '(of one's gaze) fixed; staring'	7,384
11	静悄悄	*jìngqiāoqiāo* 'extremely quiet'	19,552	61	黄灿灿	*huángcàncàn* 'glorious; bright'	6,688
12	金灿灿	*jīncàncàn* 'golden-bright and dazzling'	18,991	62	圆滚滚	*yuángǔngǔn* 'plump'	6,405
13	乐呵呵	*lèhēhē* 'happily'	18,718	63	硬邦邦	*yìngbāngbāng* 'extremely hard'	6,200
14	笑嘻嘻	*xiàoxīxī* 'grinning'	18,704	64	喜滋滋	*xǐzīzī* 'pleased'	6,031
15	笑呵呵	*xiàohēhē* 'giddily'	18,365	65	干巴巴	*gānbābā* 'dry'	6,001
16	香喷喷	*xiāngpēnpēn* 'savory'	18,259	66	娇滴滴	*jiāodīdī* 'delicately pretty'	5,812
17	血淋淋	*xiělínlín* 'bloody'	16,886	67	水汪汪	*shuǐwāngwāng* 'watery'	5,674
18	响当当	*xiǎngdāngdāng* 'famous'	15,595	68	红艳艳	*hóngyànyàn* 'brilliant red'	5,612

Rank		Type	Frequency	Rank		Type	Frequency
19	慢悠悠	*mànyōuyōu* ‘unhurried’	15,125	69	阴森森	*yīnsēnsēn* ‘creepy; ghastly’	5,540
20	懒洋洋	*lǎnyángyáng* ‘lazily’	14,990	70	阴沉沉	*yīnchénchén* ‘dark (weather, mood)’	5,176
21	热腾腾	*rèténgténg* ‘steaming hot’	14,972	71	红扑扑	*hóngpūpū* ‘rosy’	5,158
22	孤零零	*gūlínglíng* ‘isolated and without help’	14,889	72	黄澄澄	*huángchéngchéng* ‘glistening yellow’	5,143
23	湿漉漉	*shīlùlù* ‘dripping wet’	14,876	73	笑盈盈	*xiàoyíngyíng* ‘smilingly’	4,740
24	光秃秃	*guāngtūtū* ‘bald’	14,739	74	直挺挺	*zhítǐngtǐng* ‘straight; erect’	4,445
25	毛茸茸	*máoróngrōng* ‘hairy’	13,911	75	光溜溜	*guāngliūliū* ‘slippery’	4,363
26	哗啦啦	*huālāla* ‘(onom.) crashing sound’	13,382	76	滴溜溜	*dīliūliū* ‘whirling’	4,330
27	灰蒙蒙	*huīméngméng* ‘overcast (of weather)’	13,258	77	颤巍巍	*zhànwēiwēi* ‘trembling’	4,263
28	笑眯眯	*xiàomīmī* ‘beaming’	12,961	78	假惺惺	*jiǎxīngxīng* ‘hypocritical’	4,257
29	白茫茫	*báimángmáng* ‘a vast expanse of whiteness’	12,547	79	胖嘟嘟	*pàngdūdū* ‘chubby’	4,237
30	黑乎乎	*hēihūhū* ‘black; dark’	12,512	80	黑黝黝	*hēiyǒuyǒu* ‘swarthiness’	4,066
31	轻飘飘	*qīngpiāopiāo* ‘light as a feather’	12,463	81	酸溜溜	*suānliūliū* ‘sour’	4,044
32	红彤彤	*hóngtōngtóng* ‘bright red’	12,175	82	雄赳赳	*xióngjiūjiū* ‘mighty’	3,963
33	齐刷刷	*qíshuāshuā* ‘uniform’	12,145	83	黑洞洞	*hēidòngdòng* ‘pitch-dark’	3,918
34	亮晶晶	*liàngjīngjīng* ‘gleaming’	12,124	84	气冲冲	*qìchōngchōng* ‘furious; enraged’	3,857
35	黑压压	*hēiyāyā* ‘forming a dense mass’	11,924	85	羞答答	*xiūdādā* ‘bashful’	3,844
36	乐融融	*lèróngróng* ‘in harmony’	11,798	86	气昂昂	*qìáng'áng* ‘full of vigor’	3,811
37	软绵绵	*ruǎnmiánmián* ‘flabby’	11,601	87	毛绒绒	*máoróngróng* ‘fluffy; furry’	3,771

Rank	Type		Frequency	Rank	Type		Frequency
38	兴冲冲	*xìngchōngchōng* ‘full of joy and expectations’	11,525	88	气鼓鼓	*qìgǔgǔ* ‘seething’	3,763
39	眼巴巴	*yǎnbābā* ‘waiting anxiously’	11,465	89	雾蒙蒙	*wùméngméng* ‘foggy; hazy’	3,711
40	脏兮兮	*zāngxīxī* ‘dirty’	11,305	90	油腻腻	*yóunìnì* ‘greasily’	3,668
41	热乎乎	*rèhūhū* ‘nice and warm’	11,212	91	凶巴巴	*xiōngbābā* ‘harsh; fierce’	3,351
42	笑吟吟	*xiàoyínyín* ‘smiling’	10,911	92	醉醺醺	*zuìxūnxūn* ‘drunk’	3,330
43	黑漆漆	*hēiqīqī* ‘dark’	10,633	93	圆溜溜	*yuánliūliū* ‘round’	3,316
44	好端端	*hǎoduānduān* ‘perfectly all right’	10,527	94	亮闪闪	*liàngshǎnshǎn* ‘shining’	3,300
45	乱糟糟	*luànzāozāo* ‘chaotic’	10,300	95	顶呱呱	*dǐng'guāguā* ‘excellent’	3,276
46	傻乎乎	*shǎhūhū* ‘feeble-minded’	10,207	96	乐滋滋	*lèzīzī* ‘contented’	3,263
47	硬生生	*yìngshēngshēng* ‘forcibly’	10,169	97	凉飕飕	*liángsōusōu* ‘cold’	3,242
48	喜洋洋	*xǐyángyáng* ‘radiant with joy’	10,103	98	红通通	*hóngtōngtōng* ‘bright red’	3,221
49	白花花	*báihuāhuā* ‘shining white’	10,038	99	黏糊糊	*niánhúhú* ‘sticky’	3,168
50	慢吞吞	*màntūntūn* ‘very slow’	9,732	100	闹哄哄	*nàohōnghōng* ‘clamorous’	3,143

Appendix C

The Semantic Clusters of the Five Senses with Perceptual Qualities

I. Vision (Total: 35 A-types, 30%)

Subclass	Type			Frequency
Color	灰	*huī*	grey	22
	黑	*hēi*	black	19
	绿	*lǜ*	green	15
	白	*bái*	white	13
	红	*hóng*	red	11
	赤	*chì*	red	9
	碧	*bì*	bluish green	8
	蓝	*lán*	blue	7
	乌	*wū*	black	5
	粉	*fěn*	pink	5
	黄	*huáng*	yellow	3
	金	*jīn*	gold	3
	银	*yín*	silver	2
	青	*qīng*	green	2
	色	*sè*	color	1
Shape	直	*zhí*	straight	16
	圆	*yuán*	round	14
	肥	*féi*	fat	12
	胖	*pàng*	fat	11
	胀	*zhàng*	bulge	9
Light	亮	*liàng*	bright	25
	光	*guāng*	light	13
	明	*míng*	bright	6
	暗	*àn*	dark	5
Appearance	娇	*jiāo*	delicate	13
	美	*měi*	beautiful	3
	俏	*qiào*	pretty	2
Atmospheric State	雾	*wù*	fog	15
	清	*qīng*	clear	12
	阴	*yīn*	cloudy	15
Dimension	厚	*hòu*	thick	4
	满	*mǎn*	full	2
	大	*dà*	big	4
Spatial	密	*mì*	dense	5
	空	*kōng*	empty	3

II. Touch (Total: 19 A-types, 16.24%)

Subclass	Type			Frequency
Texture	软	*ruǎn*	soft	21
	硬	*yìng*	hard	18
	嫩	*nèn*	tender; soft	18
	脆	*cuì*	crisp	9
	滑	*huá*	slippery	7
	平	*píng*	flat	2
	蓬	*péng*	fluffy	2
Temperature	暖	*nuǎn*	warm	21
	凉	*liáng*	cool	15
	热	*rè*	hot	12
	冷	*lěng*	cold	5
	温	*wēn*	warm	2

Subclass	Type			Frequency
Adhesive material	黏	*nián*	sticky	13
	粘	*nián*	sticky	9
	糨	*jiàng*	thick	1
Humidity	湿	*shī*	wet	37
	干	*gān*	dry	5
	潮	*cháo*	damp	4
Liquid	油	*yóu*	oily	14

III. Hearing (Total: 6 A-types, 5.13%)

Type			Frequency
淅	*xī*	(sound) rain	7
静	*jìng*	quiet	7
响	*xiǎng*	loud	6
咕	*gū*	(sound) bird; stomach	5
哗	*huā*	(sound) water	4
滴	*dī*	drop	2

IV. Taste (Total: 5 A-types, 4.27%)

Type			Frequency
甜	*tián*	sweet	15
酸	*suān*	sour	7
鲜	*xiān*	fresh	6
辣	*là*	spicy	5
麻	*má*	tingling	3

V. Smell (Total: 2 A-types, 1.7%)

Type			Frequency
臭	*chòu*	stink	6
香	*xiāng*	fragrant	5

*VI. Emotion (Total: 6 A-types, 5.13%)

Type			Frequency
笑	*xiào*	laugh; smile	24
气	*qì*	to get angry	16
喜	*xǐ*	to feel pleased	9
乐	*lè*	happy; cheerful	8
兴	*xìng*	excitement	5
怒	*nù*	fury	3

Appendix D

The 125 Types of [ABB] Color-Vision Constructions Ranked by Token Frequencies

Rank		Type	Frequency
1	赤裸裸	*chìluǒluǒ* 'undisguised; naked'	29,199
2	绿油油	*lǜyóuyóu* 'lush green'	21,161
3	金灿灿	*jīncàncàn* 'golden-bright and dazzling'	18,991
4	灰蒙蒙	*huīméngméng* 'dusky; overcast'	13,258
5	白茫茫	*báimángmáng* 'a vast expanse of whiteness'	12,547
6	黑乎乎	*hēihūhū* 'black; dark'	12,512
7	红彤彤	*hóngtóngtóng* 'bright red'	12,175
8	黑压压	*hēiyāyā* '(of a mass) dense and dark'	11,924
9	黑漆漆	*hēiqīqī* 'pitch-dark'	10,633
10	白花花	*báihuāhuā* 'shining white'	10,038
11	灰溜溜	*huīliūliū* 'gloomy'	8,447
12	黄灿灿	*huángcàncàn* 'glorious; bright'	6,688
13	红艳艳	*hóngyànyàn* 'brilliant red'	5,612
14	红扑扑	*hóngpūpū* 'rosy'	5,158
15	黄澄澄	*huángchéngchéng* 'glistening yellow'	5,143
16	黑黝黝	*hēiyǒuyǒu* 'dark; swarthy'	4,066
17	黑洞洞	*hēidòngdòng* 'pitch-dark'	3,918
18	红通通	*hóngtōngtōng* 'bright red'	3,221
64	碧油油	*bìyóuyóu* 'bright green'	150
64	灰濛濛	*huīméngméng* 'gray-drizzly'	150
66	白苍苍	*báicāngcāng* 'ash white'	132
66	白亮亮	*báiliàngliàng* 'bright white'	132
68	碧幽幽	*bìyōuyōu* 'bluish green and faint'	124
68	白闪闪	*báishǎnshǎn* 'glittering white'	124
70	赤裸裸	*chìguǎnguǎn* 'undisguised; naked'	115
70	碧莹莹	*bìyíngyíng* 'glistening green'	115
70	白净净	*báijìngjìng* '(of skin) fair and clear'	115
73	红澄澄	*hóngchéngchéng* 'bright red'	111
74	白生生	*báishēngshēng* 'white'	108
75	黑色色	*hēisèsè* 'black'	104
76	绿幽幽	*lǜyōuyōu* 'green-faint'	100
77	灰秃秃	*huītūtū* 'ash-bald'	75
78	青濛濛	*qīngméngméng* 'green-drizzly'	73
79	黑乌乌	*hēiwūwū* 'black'	67
79	红朴朴	*hóngpǔpǔ* 'rosy'	67
81	乌漆漆	*wūqīqī* 'pitch-dark'	57

Rank		Type	Frequency
19	赤条条	*chìtiáotiáo* ‘bare; naked’	2,572
20	黑沉沉	*hēichénchén* ‘pitch-black’	2,139
21	绿茵茵	*lǜyīnyīn* ‘verdant’	2,019
22	色迷迷	*sèmímí* ‘lustful’	1,930
23	黑黢黢	*hēiqūqū* ‘pitch-black’	1,749
24	黑糊糊	*hēihúhú* ‘black-viscous’	1,570
25	白嫩嫩	*báinèn'nèn* ‘(of skin) fair and clean; delicate’	1,524
26	绿莹莹	*lǜyíngyíng* ‘glittering green’	1,466
27	黄橙橙	*huángchéngchéng* ‘glistening yellow’	1,373
28	粉嘟嘟	*fěndūdū* ‘pink’	1,360
29	金闪闪	*jīnshǎnshǎn* ‘bright and dazzling; glistening with golden light’	1,285
30	乌溜溜	*wūliūliū* ‘(of eyes) dark and liquid’	1,232
31	黑溜溜	*hēiliūliū* ‘black and bright’	850
32	白晃晃	*báihuǎnghuǎng* ‘bright and shiny; gleaming; glaring’	780
33	白蒙蒙	*báiméngméng* ‘(of smoke, fog, steam, etc.) hazy; misty’	769
34	灰扑扑	*huīpūpū* ‘gray; ash’	701
35	蓝莹莹	*lányíngyíng* ‘bright blue’	665
36	黑油油	*hēiyóuyóu* ‘shiny black’	588
82	绿生生	*lǜshēngshēng* ‘green’	53
83	粉艳艳	*fěnyànyàn* ‘(of a woman, a flower, etc.) delicate colors’	52
84	乌蒙蒙	*wūméngméng* ‘black-drizzly’	51
85	灰土土	*huītǔtǔ* ‘dusty’	49
86	红花花	*hónghuāhuā* ‘shining red’	47
86	红亮亮	*hóngliàngliàng* ‘bright red’	47
88	黑暗暗	*hēiànàn* ‘dark’	46
89	乌泱泱	*wūyāngyāng* ‘black-vast’	43
90	蓝澄澄	*lánchéngchéng* ‘blue and clear’	30
90	绿葱葱	*lǜcōngcōng* ‘verdant’	30
90	绿盈盈	*lǜyíngyíng* ‘green and clean’	30
93	银亮亮	*yínliàngliàng* ‘shiny bright as silver’	26
93	乌央央	*wūyāngyāng* ‘black-vast’	26
95	灰朴朴	*huīpǔpǔ* ‘gray; ash’	25
96	灰尘尘	*huīchénchén* ‘dusty’	23
97	赤露露	*chìlùlù* ‘bare; naked’	20
97	灰暗暗	*huīàn'àn* ‘murky gray; gloomy’	20
99	灰塌塌	*huītātā* ‘ash’	18

Rank		Type	Frequency
37	绿茸茸	*lǜróngróng* ‘lush green’	576
38	红灿灿	*hóngcàncàn* ‘bright red’	505
39	蓝幽幽	*lányōuyōu* ‘blue-faint’	473
40	黑幽幽	*hēiyōuyōu* ‘dim; dark’	470
41	黑魆魆	*hēixùxù* ‘pitch-dark’	433
42	黑蒙蒙	*hēiméngméng* ‘(usually of the sky) dark and indistinct’	377
43	白胖胖	*báipàngpàng* ‘white-plump’	373
44	白乎乎	*báihūhū* ‘white’	369
45	粉扑扑	*fěnpūpū* ‘pink’	364
46	蓝汪汪	*lánwāngwāng* ‘blue, broad and deep’	341
47	粉嫩嫩	*fěn'nèn'nèn* ‘(of young girls or children’s skin) fair and soft’	312
48	灰沉沉	*huīchénchén* ‘gloomy’	304
49	红润润	*hóngrùnrùn* ‘(of a person’s face) ruddy; rosy’	283
50	蓝盈盈	*lányíngyíng* ‘bright blue’	276
51	黑亮亮	*hēiliàngliàng* ‘shiny dark; glossy black’	242
52	青幽幽	*qīngyōuyōu* ‘green-faint’	238
53	蓝湛湛	*lánzhànzhàn* ‘(of sky, sea, etc.) deep blue’	218

Rank		Type	Frequency
100	碧湛湛	*bìzhànzhàn* ‘bluish green and clear’	16
100	灰熘熘	*huīliūliū* ‘ash’	16
102	粉莹莹	*fěnyíngyíng* ‘bright pink’	14
102	碧绿绿	*bìlǜlǜ* ‘bluish green’	14
104	赤裸裸	*chìguǎnluǒ* ‘bare; naked’	13
105	蓝滢滢	*lányíngyíng* ‘bright blue’	12
105	绿悠悠	*lǜyōuyōu* ‘green, remote in time or space’	12
107	赤艳艳	*chìyànyàn* ‘brilliant red’	11
107	绿濛濛	*lǜméngméng* ‘green-drizzly’	11
109	绿荧荧	*lǜyíngyíng* ‘glimmering green’	10
110	赤裸裸	*chìluǒguǎn* ‘bare; naked’	8
110	绿蒙蒙	*lǜméngméng* ‘green-drizzly’	8
112	赤娄娄	*chìlóulóu* ‘bare; naked’	7
112	绿茫茫	*lǜmángmáng* ‘green, vast and obscure’	7
112	绿澄澄	*lǜchéngchéng* ‘green and clear’	7
112	碧蓝蓝	*bìlánlán* ‘green-blue; turquoise’	7
116	赤果果	*chìguǒguǒ* ‘bare; naked’	6

Rank		Type	Frequency	Rank		Type	Frequency
54	黑茫茫	*hēimángmáng* ‘pitch-dark all around’	217	116	灰乌乌	*huīwūwū* ‘ash’	6
55	灰茫茫	*huīmángmáng* ‘gray, vast and obscure’	215	118	灰遛遛	*huīliúliú* ‘ash’	5
56	银闪闪	*yínshǎnshǎn* ‘silver-glittering’	213	119	碧滢滢	*bìyíngyíng* ‘glistening green’	4
57	黑鸦鸦	*hēiyāyā* ‘(of a mass) dense and dark’	211	119	灰突突	*huītútú* ‘ash’	4
58	红火火	*hónghuǒhuǒ* ‘flourishing’	208	119	灰雾雾	*huīwùwù* ‘gray-foggy’	4
59	白绒绒	*báiróngróng* ‘white-velvet’	202	122	灰渌渌	*huīlùlù* ‘ash’	3
60	金晃晃	*jīnhuǎnghuǎng* ‘golden’	183	122	灰糊糊	*huīhúhú* ‘ash-viscous’	3
61	绿荫荫	*lǜyīnyīn* ‘verdant’	180	122	灰噗噗	*huīpūpū* ‘gray; ash’	3
62	灰朦朦	*huīméngméng* ‘gray and indistinct’	168	122	灰溜熘	*huīliūliū* ‘ash’	3
63	碧澄澄	*bìchéngchéng* ‘bluish green and clear’	151				

Note. The ABB types shaded in gray are those associated with the constructions [*chì* --] and [*sè* --]. These types are excluded from further qualitative analyses.

Appendix E

The Distribution of Sensory Modalities with 98 [-BB] Patterns

BB	type_freq	Touch	Taste	Smell	Hearing	Vision	Emotion
乎乎 *hūhū* (*hū*: classical final particle for expressing question, doubt or astonishment)	26	1	1	1	0	1	1
滋滋 *zīzī* (*zī*: to nourish)	11	1	1	0	0	1	1
生生 *shēngshēng* (*shēng*: to give birth)	10	1	0	0	0	1	1
盈盈 *yíngyíng* (*yíng*: filled; surplus)	10	0	0	0	0	1	1
艳艳 *yànyàn* (*yàn*: colorful)	10	1	1	0	0	1	1
酥酥 *sūsū* (*sū*: crunchy)	10	1	1	0	0	0	0
兮兮 *xīxī* (particle used to exaggerate certain adjectives)	9	1	0	0	0	0	0
呼呼 *hūhū* (*hū*: to breath out)	9	1	0	0	0	1	1
溜溜 *liūliū* (*liū*: to slip away)	9	1	1	0	1	1	0
亮亮 *liàngliàng* (*liàng*: bright)	8	1	1	0	0	1	0
嗒嗒 *tàtà* (*dā*: to despair)	8	1	0	0	0	1	0

BB	type_freq	Touch	Taste	Smell	Hearing	Vision	Emotion
嘟嘟 *dūdū* (*dū*: toot)	8	1	0	0	1	1	1
嫩嫩 *nèngnèng* (*nèng*: tender; inexperienced)	8	1	1	0	0	1	0
幽幽 *yōuyōu* (*yōu*: remote; serene)	8	1	0	0	1	1	0
悠悠 *yōuyōu* (*yōu*: leisurely; remote in time and space)	8	0	0	0	0	1	1
巴巴 *bābā* (*bā*: to long for; to stick to)	7	1	0	0	0	0	0
沉沉 *chéngchéng* (*chéng*: to submerge; heavy; deep)	7	0	0	0	0	1	0
润润 *rùnrùn* (*rùn*: to moisten)	7	1	1	0	0	1	0
澄澄 *chéngchéng* (*chéng*: limpid)	7	0	1	0	0	1	0
糊糊 *húhú* (*hú*: muddled)	7	1	0	0	0	1	0
闪闪 *shǎnshǎn* (*shǎn*: to dodge; lightning; spark)	7	1	0	0	0	1	0
呵呵 *hēhē* (onom.) ‘gentle laughter; chuckle’	6	0	0	0	0	0	1
塌塌 *tātā* (*tā*: to collapse)	6	1	0	0	0	1	0

BB	type_freq	Touch	Taste	Smell	Hearing	Vision	Emotion
晃晃 *huànghuàng* (*huàng*: to dazzle)	6	0	0	0	0	1	0
濛濛 *méngméng* (*méng*: drizzle; mist)	6	1	0	0	0	1	0
爽爽 *shuǎngshuǎng* (*shuǎng*: pleasurable)	6	1	1	0	0	1	0
腻腻 *nìnì* (*nì*: greasy; tired of)	6	1	0	0	0	1	0
腾腾 *téngténg* (*téng*: to soar)	6	1	0	0	0	1	0
蒙蒙 *méngméng* (*méng*: to cover)	6	0	0	0	0	1	0
冲冲 *chōngchōng* (*chōng*: to dash against; to flush)	5	0	0	0	0	0	1
哄哄 *hǒnghǒng* (*hǒng*: to coax)	5	1	0	1	0	0	0
哒哒 *dādā* (*dā*: sound - command to a horse; clatter)	5	1	0	0	0	1	0
扑扑 *pūpū* (*pū*: to pat; to pounce on)	5	1	0	1	0	1	0
敦敦 *dūndūn* (*dūn*: kindhearted)	5	0	0	0	0	1	0
浸浸 *jìnjìn* (*jìn*: to immerse)	5	1	0	0	0	0	0
淋淋 *línlín* (*lín*: to sprinkle)	5	1	1	0	0	0	0

BB	type_freq	Touch	Taste	Smell	Hearing	Vision	Emotion
滚滚 *gǔngǔn* (*gǔn*: to boil; to roll)	5	1	0	0	0	1	0
灿灿 *càncàn* (*càn*: glorious; bright)	5	0	0	0	0	1	0
熘熘 *liūliū* (*liū*: quick-fry)	5	1	1	0	1	1	0
花花 *huāhuā* (*huā*: blossom)	5	1	0	0	0	1	0
茫茫 *mángmáng* (*máng*: vast; hazy)	5	0	0	0	0	1	0
萌萌 *méngméng* (*méng*: to sprout; adorable)	5	1	0	0	0	0	0
辣辣 *làlà* (*là*: hot (spicy))	5	1	1	0	0	0	0
迷迷 *mímí* (*mí*: to bewilder; crazy about)	5	0	1	0	0	1	1
颠颠 *diāndiān* (*diān*: apex; inverted)	5	0	0	0	0	0	1
剌剌 *lálá* (*lá*: to slash)	4	1	0	0	0	1	0
吟吟 *yínyín* (*yín*: to chant)	4	0	0	0	0	0	1
噜噜 *lūlū* (*lū*: grumble)	4	1	0	0	1	1	0
塔塔 *tătă* (*tă*: tower)	4	1	0	0	0	0	0

BB	type_freq	Touch	Taste	Smell	Hearing	Vision	Emotion
忽忽 *hūhū* (*hū*: to neglect; suddenly)	4	1	0	0	0	0	0
暗暗 *ànàn* (*àn*: dark)	4	0	0	0	0	1	0
板板 *bǎnbǎn* (*bǎn*: board)	4	1	0	0	0	1	0
汪汪 *wāngwāng* (*wāng*: expanse of water; ooze)	4	1	0	0	0	1	0
渍渍 *zìzì* (*zì*: to be stained)	4	1	0	0	0	0	0
湛湛 *zhànzhàn* (*zhàn*: deep; clear (water))	4	0	0	0	0	1	0
滴滴 *dīdī* (*dī*: a drop; to drip)	4	0	0	0	0	1	0
灵灵 *línglíng* (*líng*: alert; efficacious; spirit)	4	0	1	0	0	0	0
烘烘 *hōnghōng* (*hōng*: to bake)	4	1	0	1	0	0	0
熏熏 *xūnxūn* (*xūn*: to smoke)	4	1	0	1	0	0	0
狠狠 *hěnghěng* (*hěng*: ruthless; determined)	4	0	0	0	0	1	1
笃笃 *dǔdǔ* (*dǔ*: sincere)	4	1	0	0	0	1	0
脆脆 *cuìcuì* (*cuì*: brittle; crisp)	4	1	1	0	1	0	0

BB	type_freq	Touch	Taste	Smell	Hearing	Vision	Emotion
莹莹 *yíngyíng* (*yíng*: luster of gems)	4	0	0	0	0	1	0
鼓鼓 *gǔgǔ* (*gǔ*: to swell; to bulge)	4	0	0	0	0	1	1
丝丝 *sīsī* (*sī*: silk; thread; a bit)	3	1	1	0	0	0	0
光光 *guāng'guāng* (*guāng*: light; bright)	3	1	0	0	0	1	0
冷冷 *lěnglěng* (*lěng*: cold)	3	1	0	0	1	1	0
凶凶 *xiōngxiōng* (*xiōng*: fierce)	3	0	0	0	0	0	1
哗哗 *huāhuā* (onom.) 'splashing of water'	3	0	0	0	0	0	0
唰唰 *shuāshuā* (onom.) 'rustling'	3	0	0	0	0	0	0
嗖嗖 *sōusōu* (onom.) 'whooshing'	3	1	0	0	0	0	0
噗噗 *pūpū* (onom.) 'plop'	3	1	0	0	0	1	0
嚷嚷 *rāngrang* (*rāng*: to shout)	3	0	0	0	0	1	0
坨坨 *tuótuó* (*tuó*: bound form)	3	0	0	0	0	1	0
墩墩 *dūndūn* (*dūn*: gate pillar)	3	0	0	0	0	1	0

BB	type_freq	Touch	Taste	Smell	Hearing	Vision	Emotion
实实 *shíshí* (*shí*: solid)	3	0	0	0	0	1	0
尘尘 *chénchén* (*chén*: dust)	3	0	0	0	0	1	0
崩崩 *bēngbēng* (*bēng*: to collapse)	3	1	0	0	0	0	0
微微 *wēiwēi* (*wēi*: slight)	3	0	0	0	0	0	1
愣愣 *lènglèng* (*lèng*: to stare blankly)	3	0	0	0	0	1	0
戳戳 *chuōchuō* (*chuō*: to poke)	3	0	0	0	0	1	0
朗朗 *lǎnglǎng* (*lǎng*: clear; bright)	3	1	0	0	0	1	0
歪歪 *wāiwāi* (*wāi*: askew)	3	1	0	0	0	0	0
油油 *yóuyóu* (*yóu*: oil)	3	0	0	0	0	1	0
洋洋 *yángyáng* (*yáng*: ocean; vast; foreign)	3	1	0	0	0	0	1
渗渗 *shènshèn* (*shèn*: to seep)	3	1	0	0	0	1	0
漆漆 *qīqī* (*qī*: paint)	3	1	0	0	0	1	0
火火 *huǒhuǒ* (*huǒ*: fire)	3	1	0	0	0	1	0
甸甸 *diàndiàn* (*diàn*: suburbs)	3	0	0	0	0	1	0

BB	type_freq	Touch	Taste	Smell	Hearing	Vision	Emotion
瞪瞪 *dèngdèng* (*dèng*: to glare at)	3	0	0	0	0	1	0
稠稠 *chóuchóu* (*chóu*: dense; thick)	3	1	0	0	0	1	0
糯糯 *nuònuò* (*nuò*: sticky rice)	3	1	1	0	0	0	0
绒绒 *róngróng* (*róng*: velvet; woolen)	3	1	0	0	0	1	0
绷绷 *bēngbēng* (*bēng*: taut)	3	1	0	0	0	1	0
胖胖 *pàngpàng* (*pàng*: fat)	3	0	0	0	0	1	0
茸茸 *róngróng* (*róng*: fluffy; luxuriant growth)	3	1	0	0	0	1	0
通通 *tōngtōng* (*tōng*: to go through)	3	0	0	0	0	1	0
飕飕 *sōusōu* (onom.) 'sound of the wind blowing'	3	1	0	0	0	0	0

Note. "*type_freq*" refers to the total number of distinct A collocates that occur in a certain [-BB] construction.

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