Characterizing the Simplex vs. Complex Adjectives in Mandarin Chinese[1]

Qiongpeng LUO — *Nanjing University*

Abstract. The article develops and defends a novel kind-based analysis for Mandarin adjectives. We argue for a semantic distinction between adjectival heads (A/A^0) and their projections (AP/A^{MAX}): A^0s denote Cresswell-style state-subkind predicates, while APs denote properties of states. Degree morphemes (DEG) have a particularizing function that provide a point of view against which the state-kind is evaluated. The "A-to-AP" process, a special instance of the "type-to-token" conversion, underlies the famous distinction between the simplex vs. complex adjectives proposed by Zhu (1956), a topic that has plagued Chinese linguistics for more than half a century. Adopting a kind-based account for adjectives has not only enabled us to explain a range of empirical generalizations concerning adjectival modification in Mandarin which would otherwise remain elusive, but also brought the semantics in the adjectival domain closer to that of the nominal and verbal domains, where a similar "type-to-token" conversion is also proposed and defended.

Keywords: kind; adjectival modification; type-to-token conversion; adjective; Mandarin Chinese

1. Introduction

Cross-linguistically, there are a cluster of facts concerning adjectival modification that indicate morphosyntactic factors (e.g., word order) play a role in determining the interpretation of adjectives, a research topic used to be subsumed under the rubric of Bolinger Contrast (due to Bolinger 1967), which has been occupying a prominent position in studies of adjectives and adjectival modification (see Larson 1998; Cinque 2010; Leffel 2014, *et seq*.).

Surely word order is not the sole morpho-syntactic means that is responsible for the interpretational contrast of adjectival modification in natural language. Consider a well-known contrast in Mandarin Chinese, which is legendarily attributed to Kung-sun Long (a philosopher and sophist who lived around the same period as Aristotle): Kung-sun Long's Paradox. The example in (1a) has a non-contradictory and even true reading. The example in (1b), which is minimally different from (1a) in the presence of the modification marker *de*, has a contradictory reading (Krifka 1995).

(1) a. Bai ma fei ma (non-contradictory)
white horse not horse
b. #Bai de ma fei ma. (contradictory only)

[1] Special thanks goes to Thomas Grano and Anqi Zhang, who offered invaluable help at the earliest and last stages of the work reported here respectively. The work has been benefitted from discussions with Louise McNally, Chris Kennedy, James C.-T. Huang, Yi-Hsun Chen, Quan Wan, Chen Wang, among many others, and audiences at various conferences, including Sinn und Bedeutung 25 (Sept. 2020, virtual), Theoretical East Asian Linguistics 12 (TEAL 12) (July 2019, Macau), Degrees and Grammar: An East Asian Perspective (DeG 2019) (March 2019, Nanjing), to whose constructive feedbacks I am very grateful. The work is financially supported by the National Social Science Fund of China (NSSFC) under grant # 16BYY006 to Qiongpeng Luo. The author alone is responsible for any errors and mistakes in this article.

 In: P. G. Grosz, L. Martí, H. Pearson, Y. Sudo, and S. Zobel (eds.) *Proceedings of Sinn und Bedeutung 25*, pp. 600–617. University College London and Queen Mary University of London.

white DE horse not horse
Lit.: 'A white horse is not a horse.'

(Krifka 1995: ex. 17)

A linguistically significant solution to Kung-sun Long's paradox is proposed by Krifka (1995). According to him, the 'A-N' combination *bai ma* 'white horse' denotes a new type of entities, *concepts*. Concepts are abstract entities related to real objects and semantically akin to kinds. To implement this idea, Krifka defines a new semantic operator σ, which takes a property-denoting predicate P as its input, and returns the concept which has the objects in the extension of P as its realizations. The adjective *bai* 'white' is interpreted as a concept modifier. Since *bai ma* 'white horse' refers to a kind (a concept is a kind), and *ma* 'horse' refers to a kind, when interpreting the negation word *fei* 'not' as the negation of identity, Kung-sun Long's paradox, viz. (1a) has a true reading, is explained.

Despite its intuitive appeal and elegance, there are several remaining issues with Krifka's analysis. First, the difference between the *de*-less and the *de*-marked adjectival modifiers is left unexplained. Empirical evidence indicates that the *de*-marked modification structure refers to a *concept*/kind as well, as shown by the example in (2), which contains a kind-level predicate.

(2) Bai (se) de ma juezhong le.
white (color) DE horse extinct SFP
'The white horse/Horses that are white become(s) extinct.'

Here arises a question: if both the *de*-less and the *de*-marked structures reference kinds, how to explain the contrast between (1a) and (1b) then? How many *kinds* of kinds do we need?

To complicate the matter, the absence/presence of *de* is also correlated with another morphosyntactic characteristics concerning adjectives in Mandarin: the distinction between simplex vs. complex adjectives. The simplex adjectives (SA) are the adjectives in their base form, while the complex adjectives (CA) are derived from the simplex ones via certain morphosyntactic means, either by modifying the simplex adjective with an intensifying element (e.g., by the semantically bleached *hen* 'lit. very') or by reduplicating the simplex adjectival base (cf. Zhu 1980[1956]: 3-6, 1982: 72-75, *et seq*.). Some illustrative examples are provided in (3) (note that the distinction is not due to prosodic factors, since simplex adjectives can be either monosyllabic or disyllabic).

(3) a. Simplex Adjective: adjectives in their base form:
e.g.: *gao* 'tall', *ai* 'short', *bai* 'white', *congming* 'intelligent', *ganjing* 'clean', etc.
b. Complex Adjective: adjectives derived from the simplex ones:
(i) by modification with an intensifying element: *hen gao* 'very tall', *hen bai* 'very white', etc.
(ii) by reduplication: *gao-gao* 'extremely tall', *bai-bai* 'extremely white', etc.

Zhu takes the distinction to be responsible for a range of distributional as well as interpretational properties concerning adjectival modification in Mandarin, and one of the signature characteristics is about the optionality vs. obligatoriness of *de*: in the *de*-less modification structures, only simplex adjectives are allowed, and when the modifier is a

complex adjective, *de* is required (cf. also Sproat and Shih 1988, 1991; Cinque 2010, 2014; Huang 2006; Paul 2005, 2010, among numerous others).

(4) a. bai ma
white horse
b. hen bai *(de) ma
very white DE horse

What exactly distinguishes the simplex adjective and the *de*-less modification structure, on the one hand, from the complex adjective and the *de*-marked modification structure, on the other, has plagued Chinese linguistics for more than half a century. In this article, we offer a novel account in the light of recent advances in the studies of kinds and adjectival modification.

The introduction of kinds into the ontology of natural language semantics, since at least Carlson (1977a, 1977b), has given rise to a flourishing research enterprise (see Mari et al. (2013) for an overview). While most of the classic studies in the semantics of kinds concentrate more or less on bare nouns and their cross-linguistic variants (cf. Krifka et al. 1995; Chierchia 1998; Dayal 2004, among many others), recent studies have witnessed two encouraging and stimulating tributaries. The first one is towards a broader, more generalized conceptualization of kinds, that is, kinds are regularities that occur in nature (Chierchia 1998). Once we envision kinds as a collection of objects that share certain properties, it is a natural step to extend the notion of kinds from the domain of individuals to other domains. Just like the individual-kind DOG is the (maximal) plurality of individuals that is characterized by being a dog in every possible world, there also exist event-kinds, state-kinds, degree-kinds, etc. (Berit 2015, 2019). The second one is towards a more fine-grained classification of kinds, or kinds of kind reference, and an explicit and formal semantics of them.

Integrating insights from both tributaries has rendered it possible a better understanding of adjectival modification in Mandarin. More specifically, our account will be couched in a theory that identifies two compositional means for subkind formation. One type of modification denotes complex, compositionally derived concepts which (the discourse participants take to) express some institutionalized, highly conventionalized property of the objects under discussion, e.g., *sedan cars*, *sports cars*, *political disputes*, *American linguists*, *white horses*, etc. while the other type of modification denotes complex, compositionally derived concepts which (the discourse participants take to) express some *ad hoc*, temporal, accidental, or contextually imposed-on properties of the objects under discussion, e.g., *cars that are white*, *lions that bite people*, *linguists that work on kinds*, etc., The latter are *ad hoc* in the sense that even if the discourse participants know that they do not belong to a natural or well agreed-upon class, language users can still talk about them as if they are "grouped together" by imputing to them some contextually salient behavior (e.g., *the linguists that work on kinds are very rare*). Following Dayal (2004), Carlson (2003, 2010), Mendia (2017, 2019) and many others, we contend that these different conceptualization strategies to construct subkinds from kinds are grammatically relevant, and it is this distinction that lies beneath the *de*-less vs. *de*-marked adjectival modification structures in Mandarin, which is a special instance of the broader Bolinger Contrast (i.e., a cross-linguistic correlation between interpretational contrast and morpho-syntactic (un)markedness) in natural language.

The rest of the paper proceeds as follows. In Section 2, we consider some foundational phenomena which are particularly relevant for the present discussion. In Section 3, we familiarize the readers with some recent advances in the theory of kinds, esp. the partition-based account of kinds as proposed in Mendia (2017, 2019). In Section 4, we suggest simplex adjectives as adjectival heads (A^0s) denote state-subkind predicates, and complex adjectives as APs denote properties of states, the "A-to-AP" process is essentially a "type-to-token" process. Section 5 provides a concrete, kind-based account of the *de*-less and the *de*-marked adjectival modification structures. Section 6 concludes.

2. Some foundational phenomena

Adjectival modification in Mandarin is interrelated with and complicated by two factors: (i) whether the modifier takes on the form of a simplex adjective (SA) or a complex adjective (CA), and (ii) when the modification marker *de* is present or absent. This section is devoted to showing how these two factors affect the distribution and interpretation of adjectival modification structures.

The first set of facts concern about the optionality vs. obligatoriness of *de* in adjectival modification structures. Consider the contrast between (5a) and (5b-c): when the modifier is a CA, the modification marker *de* is obligatory to intervene in between the modifier and the modified noun, while it is optional when the modifier is a SA.

(5) a. bai (de) ma
white DE horse
b. hen bai *(de) ma
very white DE horse
c. bai bai *(de) ma
white white DE horse

Most, if not all, syntactic analyses adopt a simplifying assumption that *de* is semantically vacuous. The contrast between (5a) and (5b) suggests that this "innocuous" assumption may not work in a formal semantic perspective. Let us follow standard knowledge to assume adjectives are property-denoting predicates and have type <*e*, *t*> (*e* for entities and *t* for truth values). On this assumption, (5a), (5b) and (5c) should behave the same with respect to the occurrence of *de*, since the result of the composition of two property-denoting predicates is another property-denoting predicate, e.g., $[\![bai]\!] \cap [\![ma]\!]$ = {x: x is white and x is a horse}. This would leave the contrast between (5a), where *de* is optional, on the one hand, and (5b) and (5c) where *de* is required, on the other, a mystery.

That *de* is not an innocuously meaningless element in adjectival modification structures is supported by another set of facts: the presence/absence of *de* leads to a series of interpretational contrasts. For instance, the *de*-less modification structures, i.e., the sequences of 'SA-N', can give rise to non-restrictive, non-intersective interpretations, in contrast to the *de*-marked ones, which are always restrictive and intersective. One famous example that is frequently mentioned in the literature is *lao pengyou* 'old friend' vs. *lao de pengyou* 'old DE friend'. The former is ambiguous in being both non-restrictive and restrictive: (i) non-restrictive: the friendship is old; (ii) restrictive: the age of my friend is old. By contrast, the latter is unambiguous: it can only

mean the age of my friend is old, a restrictive interpretation (cf. Cinque 2010; Paul 2010; Liu 2016, among many others).

Another contrast is the one between idiomatic vs. literal interpretations. Idiomatic meanings are available with *de*-less combinations but not with *de*-marked combinations. For example, when the adjective *ji* 'quick' is used as a modifier, it may have both a literal meaning and an idiomatic meaning. The latter of which arises only when *de* is absent. Witness the following contrast (the examples are reproduced from Liu (2016: ex. (14b), (15b)).

(6) a. Ta you ji xingzi, zuoshi hen chongdong.
he has quick temper act very impulsively
'He has quick temper, and acts very impulsively.'
b. *Ta you ji de xingzi, zuoshi hen chongdong.

Moreover, the *de*-less combinations are subject to more severe restrictions than the *de*-marked ones. As has been pointed out by Zhu (1982) and many subsequent works, not all simplex adjectives can be used as modifiers to nouns. Consider the contrast between (7a) and (7b), the latter of which are judged by Zhu to be degraded or unnatural combinations (the examples are reproduced from Zhu (1982: 73-74)).

(7) a. gui dongxi
expensive commodity
'expensive commodity'
b. %gui shoujuan
expensive handkerchief
'expensive handkerchief'

The degraded combinations get improved in the presence of *de*, as shown in (8a). Replacing the simplex adjectives with complex ones plus *de* also turns them into perfectly acceptable combinations, as shown in (8b).

(8) a. gui de shoujuan
expensive DE handkerchief
b. hen gui de shoujuan
very expensive DE handkerchief
'very expensive handkerchief'

This does not mean that the *de*-less and the *de*-marked structures are nothing alike. They have at least one thing in common: both of them can be kind-referring, a fact that has been neglected in the literature.

First, both the *de*-less and the *de*-marked adjectival modification structures in general are compatible with kind-level predicates, just like bare nouns in Mandarin or kind-denoting terms (say, bare plurals) in English.

(9) a. [Hen bai de ma] juezhong le.
very white DE horse extinct ASP

'The horses that are very white are extinct.'
b. [bai ma] juezhong le.
white horse extinct ASP
'White horses are extinct.'
c. Ma juezhong le.
horse extinct ASP
'Horses are extinct.'
(10) a. Horses are extinct.
b. Dodos are extinct.

Second, both the *de*-less and the *de*-marked modification structures retain their kind-referring properties with non-stative predicates like *chuxian* 'appear'. The same is true for both modified and non-modified nominals in English, as demonstrated in the translations.

(11) a. Yi-wan nian qian, zai feizhou, chuxian-le [hen bai de ma].
ten-thousand year ago in Africa appear-ASP very white DE horse
'Ten thousand years ago, in Africa, horses that were very white appeared.'
b. Yi-wan nian qian, zai feizhou, chuxian-le [bai ma].
ten-thousand year ago in Africa appear-ASP white horse
'Ten thousand years ago, in Africa, white horses appeared.'
c. Yi-wan nian qian, zai feizhou, chuxian-le ma.
ten-thousand year ago in Africa appear-ASP horse
'Ten thousand years ago, in Africa, horses appeared.'

One notable difference between (kind-denoting) bare plurals and individual-denoting NPs is that the former, but not the latter, always take narrow scope with respect to intensional verbs like *want* or scope-bearing elements like negation (cf. Carlson 1977a, b; Krifka et al. 1995; Chierchia 1998, *inter alia*).

(12) a. I didn't see spots on the floor. (unambiguous)
i) ×∃ > ¬; ii) ✓¬ > ∃
b. I didn't see a spot on the floor. (ambiguous)
i) ✓∃ > ¬; ii) ✓¬ > ∃
(13) a. Max is seeking rabbits in his yard. (unambiguous: opaque only)
i) ✓*de dicto*: SEEK > ∃; ii) ×*de re*: ∃>SEEK
b. Max is seeking three rabbits in his yard. (ambiguous)
i) ✓*de dicto*: SEEK > ∃; ii) ✓*de re*: ∃>SEEK

Exactly the same pattern of scopal interaction is attested between the *de*/less adjectival modification structures and those structures preceded by the 'Num-CL' sequences. The former are opaque when they occur in the scope of *want*-type verbs or negation. (14a) below is unambiguous: *hen bai de ma* 'very white DE horse' can only be interpreted as taking narrow scope wrt *want*, while (14b) allows a *de dicto*/*de re* ambiguity.

(14) a. Zhangsan xiang zhao [hen bai de ma]. (only opaque)
Zhangsan want seek very white DE horse
i) ✓*de dicto*: 'Zhangsan wants to seek horses that are very white.'

ii) ×*de re*: 'There are some white horses such that Zhangsan wants to seek them.'

b. Zhangsan xiang zhao [san pi hen bai de ma]. (ambiguous)
Zhangsan want seek three CL very white DE horse
i) ✓*de dicto*: 'Zhangsan wants to seek three horses that are very white.'
ii) ✓*de re*: 'There are three white horses such that Zhangsan wants to seek them.'

We note in passing that modified nominals can be kind-referring is a cross-linguistically attested fact. The modified nominals in the examples in (15) all refer to kinds (see Mendia (2017, 2019) for more details).

(15) a. [Lions that eat people] are widespread.
b. [Dogs that bite] are annoying.
c. It will take us the rest of our lives to find [the champagne that they spilled that evening].
d. [The rats that transmitted leptospirosis] reached Australia in 1770.

The aforementioned facts look paradoxical: on the one hand, the *de*-less and the *de*-marked adjectives are fundamentally different with respect to distribution and interpretation, while on the other, both of the *de*-less and the *de*-marked modificational structures behave the same in being kind-referring. In the following, we provide a formal and explicit account for these paradoxical facts in the light of recent advances in the theory of kinds. We demonstrate that such facts, though appearing paradoxical at first glance, follow from some more fundamental and general principles of grammar.

3. Towards a partition-based account of kinds

Since Carlson (1977a, 1977b), it has become widely accepted that *kinds* should be postulated as a type of ontological entities, distinguished from particulars or tokens, in the model-theoretical approaches to natural language meaning. The postulation of *kinds* has given rise to a flourishing research enterprise, covering topics ranging from the semantics of NPs/DPs to cross-linguistic parameterization (cf. Carlson 1977a, 1977b, 2003, 2010; Krifka et al. 1995; Chierchia 1998; Dayal 2004; Mari et al. 2013; Mendia 2019, among others).

The notion of kinds can be defined in various ways (see, for example, Carlson (2010) for the conceptual connection between conceptual structures and kind reference). To take as a safe start, we follow Carlson (1977a, 1977b), Chierchia (1998), Mendia (2019) and many others to assume kinds are regularities, that is, kinds are representative of perceivable commonalities that hold of a collection of objects, i.e., regularities that occur in nature. To cite from Chierchia (1998), the only property of kinds is that "we can impute to them a sufficiently regular behavior" (p. 348).

Chierchia (1998) defines kinds as functions from possible worlds to the maximal ⊕-individuals that share a certain property. We slightly modify this definition to make the *kind*-variable range over a variety of types. The new definition of kinds is provided as in (16).[2]

[2] Note that under this definition, the type for kind-denoting terms is <i, e> (where *i* stands for variables over possible worlds). For ease of exposition, sometime <i, e> is abbreviated as *k* instead.

(16) KIND $=_{def}$ $\lambda w[\iota o[{}^*\mathbf{P}_w(o)]]$, where for any predicate P, the following two conditions are met:

i. $[\![{}^*P]\!] = \{x \in P \mid x \text{ is atomic} \vee x \text{ is } \oplus\text{-sums}\}$

ii. $D_o = D_e \cup D_s \cup D_v \cup \ldots$ (*e* for entities, *s* for states, *v* for events, etc.)

Having settled on what (sub)kinds are, we now ask: can kinds be modified? If so, what is the result? We argue that kind modification is real and it results into subkind reference. We follow Mendia (2019) to model (sub)kinds by means of partitions, that is, collections of objects that are counted as equal with respect to some property. Partitions are defined by equivalence relations. An equivalence relation R is reflexive, symmetric, and transitive. Take $[x]_R$ to represent the equivalence class containing x defined by R, equivalence relations induce partitions.

(17) Equivalence Class: Let $[\ ]_R$ to be a function from a domain D to POW(D) such that:
$\forall x \in D\ [[x]_R = \{y: y \in D \wedge y \simeq_R x\}$

(18) Partition: Let A be a non-empty set. A partition is a collection of subsets of A iff

i. for any two subsets X and Y, $X \cap Y = \varnothing$, and

ii. the union of all subsets of A equals A.

All instances of kind reference in natural language require a suitable equivalence relation that projects a partition. A partition of a kind *K* is a set of subsets of $^{\cup}K$ that covers $^{\cup}K$ and whose members do not share any instantiating individuals. Modelling kinds on partitions enables us to provide a more explicit account of kind modification in natural language.

Using the partition function, a kind-to-subkind operator can be defined as in (19). The partition operator $\prod$ is defined as in (20). Applying the partition operator to a kind term returns the set of subkinds that are in the partition, as is shown in (21).

(19) $[\![\kappa]\!] = \lambda x_k \lambda y_k . \prod(x_k)(y_k)$ (Mendia 2019)
(κ targets a kind, and returns a subkind of it)

(20) Partition function: A partition function $\prod$ is a $\langle k, kt \rangle$ function such that for any kind *K*:

i. Cover: $\forall x_o[x_o \leq K \rightarrow \exists y_k \in \prod(K)[x_o \leq y_k]]$

ii. No overlap: $\forall x_o[\exists y_k \in \prod(K)[x_o \leq y_k] \rightarrow \neg\exists z_k \in \prod(K)[y_k \neq z_k \wedge x_o \leq z_k]$

(21) $[\![\kappa]\!]([\![dog]\!]) = \lambda y_k . \prod(\text{DOG})(y_k)$
$= \{\text{GREYHOUND, BORDER COLLIE, BEAGLE, } \ldots\}$

Because y_k is a partition of x_k, it follows that $y_k \leq x_k$. Kind modification constructs a subkind. Depending on the type of the modifiers and the relationship between the modifier and the modifiee, two ways to construct subkinds are to be distinguished: in one type, the modifier provides some natural, well agreed-upon properties that define the kinds denoted by the modifiee. The result of this is a well-established kind. In the other type, the modifier provides some *ad hoc*, contextually provided properties of the kinds. The *ad hoc* subkinds are not natural kinds proper, but we can talk about them as if they are *real* kinds under certain contextually salient circumstances. The latter results into a subkind which Mendia dubs as *ad hoc* kinds. In the next section, we show the conversion from kinds to *ad hoc* (sub)kinds is important to explain the adjectival modification structures involving complex adjectives and *de*.

4. The simplex vs. complex adjectives: kinds vs. properties

Recall Chierchia's (1998) definition of *kinds* of things: a *kind* of things is a plurality of all possible individuals of some type. This definition of *kinds* is particularly useful for current purposes: if we can construct individual-*kinds* from the pluralities of individuals in every possible world, we can also construct *state*-kinds from the pluralities of states across worlds, *event*-kinds from the plurality of events across worlds, and likewise for *degree*-kinds, and so on. We contend that adjectival heads denote Chierchia-style state-kinds. For instance, TALL can be viewed as all the possible states that can be characterized as tall, SMART as all the possible states that can be characterized as smart, and so on.

This attempt is not without predecessors. The kind-based account of adjectives can be traced back to Cresswell (1976), to our knowledge. Cresswell defines degrees as equivalence classes of objects on a weak order. A weak order, written as $\succcurlyeq_\delta$ (where δ stands for a certain dimension), is an order that is reflexive, transitive, and complete.

Following Baglini (2015), we recast Cresswell's approach in terms of ordered states rather than individuals. For example, an adjective like *white* could be defined through an equivalence relation based on $\succcurlyeq_{white}$, which ranks every state in its domain to any other state according to their level of whiteness.

Equivalency among states is defined by a substitution relation $\sim_\delta$: two states are equivalent in terms of the relation $\succcurlyeq_\delta$ if and only if they can substitute for one another without changing the truth values of the statements involving $\succcurlyeq_\delta$ (Cresswell 1976).

(22) Equivalence: For any q, r $\in S_{\succcurlyeq_\delta}$
q $\sim_\delta$ r iff $\forall p((q \succcurlyeq_\delta p) \leftrightarrow (r \succcurlyeq_\delta p) \wedge (p \succcurlyeq_\delta q) \leftrightarrow (p \succcurlyeq_\delta r))$

McNally and Boleda (2004) propose that relational adjectives (e.g., *political*, *international*, *technical*, etc.) denote properties of kinds, i.e., (sub)kind predicates. According to them, the expression *technical architect* describes a kind of architect that is characterized by being *technical*.

Integrating the analytic insights from both sides, we make a further step: adjectival heads (or bases, depending on the syntactic assumptions) denote state-subkind predicates, as in (23).

(23) a. $[\![A]\!] = \lambda k$: **state-kind** (k). $[k \leq (\lambda w[\iota s[\mathbf{A}_w(s)]])$: $\langle k, t \rangle$
b. $[\![$ *tall*$]\!] = \lambda k$: **state-kind**(k).$[k \leq$ TALL$]$: $\langle k, t \rangle$

To save space and for ease of exposition, sometimes we use ADJ as a shorthand for '$\lambda w[\iota s[\mathbf{A}_w(s)]$'. The lexical entry for the adjectival head (simplex adjective) *tall* is provided as in (23b), which states that *tall* will be true of those state-kinds *k* which are subkinds of the state-kind TALL. Because subkinds can be viewed as partitions, (24b) is equivalent to the following (24).

(24) $[\![$ *tall*$]\!] = \lambda k$: **state-kind**(k).$[k \leq$ TALL$]$: $\langle k, t \rangle$
($[\![$*tall*$]\!]$ = {FIVE-FEET, SIX-FEETL, SEVEN-FEET, EIGHT-FEET, …})

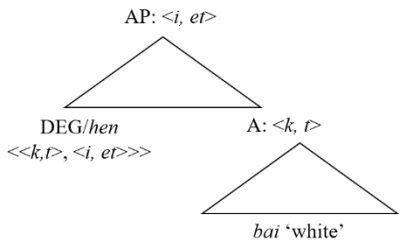
Having settled on the denotation of the simplex adjectives (as adjectival heads), we now move on to the conversion from simplex adjectives to complex ones.

We follow standard syntactic assumptions to take the conversion from simplex adjectives to complex one is a conversion from A^0 (adjectival head, A) to AP (e.g., [$_A$ *gao* 'tall'] → [$_{AP}$ [*hen* 'very' [A *gao* 'tall']]]). We contend that the "A-to-AP" process is essentially a process that converts a type description into a token reference (i.e., from kinds to properties). More specifically, the adjectival head A composes with DEG (often realized as overt intensifiers or degree words) which turns a kind-denoting predicate into a property-denoting predicate. Degree words have a generalized view-pointing function which introduces a viewpoint/reference point relative to which a state-kind is evaluated. (25) below is our lexical entry for the generalized degree word DEG (which may be realized by various forms across languages, e.g., by *hen* 'very' in Mandarin Chinese), modelled after Kennedy's (1999) definition of *very* (see also Kennedy and McNally 2005) (**standard**$_{s,c}$, the standard in the context *c* for the scale associated with the state *s*).

(25) $[\![\text{DEG}]\!] = \lambda P_{<k,\,t>}\lambda w\lambda x[\exists s'[\exists z_k \in \textbf{state-kind}[P_w(z) \wedge z >_s \textbf{standard}_{s,\,c} \wedge s' \sqsubseteq z \wedge \textbf{hold}(x, s')]]]$ ($\sqsubseteq$ is the Carlsonian realization/instantiation; s'$\sqsubseteq$z means *s'* is an instantiation of *z*; **hold**: predicate between individuals and states)

The result of the composition of A with DEG is particularized properties, i.e., intensionalized predicates of individuals at the AP level. The "A-to-AP" process is illustrated in (26).

(26)



(i) $[\![A]\!] = \lambda k$: **state-kind** (k). [k≤WHITE]
(ii) $[\![\text{DEG}]\!] = \lambda P_{<k,\,t>}\lambda w\lambda x[\exists s'[\exists z_k \in \textbf{state-kind}[P_w(z) \wedge z >_s \textbf{standard}_{s,\,c} \wedge s' \sqsubseteq z \wedge \textbf{hold}(x, s')]]]$
(iii) $[\![AP]\!] = \lambda w\lambda x[\exists s'[\exists z_k \in \textbf{state-kind}[\text{WHITE}_w(z) \wedge z >_s \textbf{standard}_{s,\,c} \wedge s' \sqsubseteq z \wedge \textbf{hold}(x, s')]]]$

In the absence of overt degree words, we assume there is a covert type-shifter POS_s (the subscript *s* indicates that POS is operative in the domain of states) that converts (sub)kind predicates into property-denoing predicates. Our POS_s is modelled after Kennedy and associates' POS operator. POS_s invokes a different point-of-view/standard of comparison than DEG: it requires exceeding a contextually salient standard in a context *c*. We use **norm**$_{s,\,c}$ to refer to this standard (for complex adjectives that take on the reduplication forms, we could posit that there is a degree morpheme called REDUP which plays exactly the same role as DEG or POS. Space limitations prevent us from providing more details here).

(27) a. $[\![\text{POS}_s]\!] = \lambda P_{<k,\,t>}\lambda w\lambda x[\exists s'[\exists z_k \in \textbf{state-kind}[P_w(z) \wedge z >_s \textbf{norm}_{s,\,c} \wedge s' \sqsubseteq z \wedge \textbf{hold}(x, s')]]]$

b. $[\![AP]\!] = \lambda x[\exists s'[\exists z_k \in \textbf{state-kind}[\textbf{A}_{@}(z) \wedge z >_s \textbf{norm}_{s,c} \wedge s' \sqsubseteq z \wedge \textbf{hold}(x, s')]]]$

Summing up, we have distinguished the adjectival heads A^0s from their projections A^{max}/AP both syntactically and semantically. In syntax, distinguishing A from AP seems to be a truism. In semantics, though it is assumed (but without any further motivation) that A should be distinguished from AP, why and how the "A-to-AP" takes place hasn't been spelled out and properly addressed, at least to our knowledge. Taking the "A-to-AP" process as a special instance of "type-to-token" conversion offers fresh insights on the semantic composition of adjectival modification structures in Mandarin. We turn to this issue in the next section.

5. The semantics of adjectival modification in Mandarin Chinese

5.1. The semantics of the *de*-less adjectival modification structures

Adjectival heads (As) and adjectival phrases (APs) have different denotations, and consequently, they compose with nouns in different ways. For the syntax of adjectival modification structures, we basically follow Sadler and Arnold's (1993) dichotomy of head adjunction vs. phrasal adjunction. [3] We also assume Leffel's (2014) "two-domain theory" for the syntax and semantics of adjectival modifications.

(28 A two-domains theory for adjectival modification (Leffel 2014, Ch. 2)

(i) Head adjunction: Adjectival heads adjoin to the nominal head prior to the introduction of ϕ-features (number, gender, case, etc.) and the determiner DET, that is, $[_{NP}$ DET $[_{N}$ $[_{A}$ A] $[_{N}$ N]]];

(ii) Phrasal adjunction: Adjectival phrases (APs) adjoin to NPs, i.e., the nouns after the introduction of ϕ-features (number, gender, case, etc.) and the determiner DET, that is, $[_{NP2}$ [AP] $[_{NP1}$ DET $[_{N}$ N]]].

We are now in a position to tackle the compositionality issue of the *de*/less adjectival modification structures.

Consider the examples in (29), reproduced from previous discussions.

(29) a. bai ma
white horse

b. hen bai *(de) ma
very white DE horse

Following Dayal (2004) and Leffel (2014), we assume nominal heads in Mandarin denote subkind predicates, as in (30). Since adjectival heads (taking the form of simplex adjectives) also denote subkind predicates, they have the same type as nominal heads, that is, both have type <*k*, *t*>. Two predicates of the same type can be conjoined via the intersective rule:

[3] The syntactic assumptions are kept at a minimum in this article. This opens the door for more sophisticated syntactic implementations. It would be interesting to see how the idea presented here is accommodated in some other syntactic framework. Space considerations force us to set this issue aside.

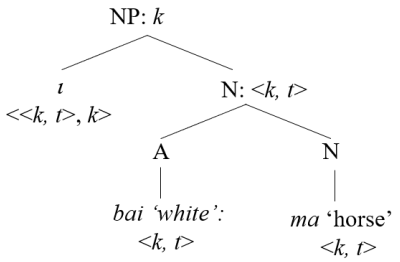
Predicate Modification (cf. Heim and Kratzer 1998; McNally 2016). We call this rule Kind Modification, modelled after that of McNally & Boleda (2004).

(30) Nominal heads denote subkind predicates:
[[*ma*]] = λk: **kind**(k).[k≤(λw[ιx[***horse**$_w$(x)]])]: <*k, t*>

(31) Kind Modification Rule (KMR) (cf. McNally & Boleda 2004)
If a nominal head *N* translates as λk: **kind**(k).[k≤**N**], and adjectival head *A* translates as λk: **kind**(k).[k≤**A**], then the 'A-N' combination is formed via head adjunction, i.e., [$_N$ [$_A$ A] [$_N$ N]], translates as λk: **kind**(k).[k≤**A** ∧ k≤**N**].

Head adjunction plus KMR yields the desirable result. The underlying structure and derivation of (90a) are provided as in (93).

(32)



(i) [[*bai*]] = λk: **kind** (k). [k≤WHITE]
(ii) [[*ma*]] = λk: **kind** (k). [k≤HORSE]
(iii) [[*bai ma*]] = λk: **kind**(k).[k≤WHITE ∧ k≤HORSE] (via KMR)
(iv) [[*[ι [bai ma]]*]] = ιk: **kind**(k).[k≤WHITE ∧ k≤HORSE]

We assume the ι-operator carries the uniqueness and maximality presupposition, just like its overt counterpart *the*. The formula in (32iv) states that the NP *bai ma* 'white horse' denotes a most general kind defined by WHITE and HORSE. It consists in two parts: (i) *k* is a subkind of things which are characteristically white, and (ii) *k* is a subkind of horses. Because the kind WHITE-HORSE that is defined by both WHITE and HORSE does not equal the kind HORSE, we correctly predict the sentences like *bai ma fei ma* 'white horse NOT horse' have a non-contradictory and true reading, thus explaining Kong-sun Long's paradox. Krifka (1995) observes *the white wine is not wine* in English also has a non-contradictory reading, giving rise to the same paradoxical effect.

The generic flavor of the *de*-marked adjectival modification structures is also captured in the current analysis. *bai ma* 'white horse' on the present account denotes a subkind of horses which are characteristically white. In other words, the adjective *bai* 'white' contributes an equivalence relation "have the same color as white" that partitions the horses into the white ones vs. the ones of different colors. In this way, *bai ma* denotes a well-established subkind. Being a kind-denoting term, the truth-conditions of *bai ma* will not necessarily be affected by the occasional or accidental factors This correctly predicts that a white horse which is painted black by accident will still be considered as belonging to the subkind of white horses. So to speak, painting a white horse black will not necessarily change the kind status of the horse. We believe it is from this property that the generic flavor of the *de*-marked, well-established kind terms arises.

Like bare nouns, *bai ma* allows a type/token ambiguity, as shown in (33). When the *de*-less structures like *bai ma* enter predication relation with object-level predicates, as in (33b), The rule DKP would apply to derive the existential reading. (34a) and (34b) provide the truth-conditions for the reference-to-kind reading and the reference-to-object reading respectively.

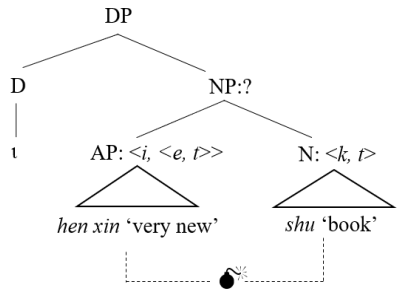
(33) a. Bai ma jue-zhong le.
white horse extinct SFP
'White horse is extinct.'
b. Bai ma zai waimian chi-cao.
white horse at outside eat-grass
'White horses are eating grass outside.'

(34) a. The reference-to-kind reading
Be-Extinct (ιk: **kind**(k).[k≤WHITE ∧ k≤HORSE])
b. The reference-to-object reading
Eat-Grass-Outside (ιk: **kind**(k).[k≤WHITE ∧ k≤HORSE])
via DKP: ∃x[x≤WHITE-HORSE ∧ **Eat-Grass-Outside** (x)]

5.2. The semantics of the *de*-marked adjectival modification structures

We now turn to the syntax and semantics of the "CA-*(de)-N" combinations. We have suggested that CAs are adjectival phrases (APs), which denote intensionalized properties of individuals and have type *<i, et>*. Since nominal heads denote kinds, the composition between APs and nouns would crash, as is illustrated in (35).

(35)



In principle, there are two ways to salvage the composition problem between a property-denoting term and a kind-denoting term: we could either type-shift one of them to grant it an appropriate type to combine with the other or mediate the composition via some morpho-syntactically marked, overt means. We follow Chierchia (1998) and others to assume the choice between the two strategies is governed by an economy constraint: whenever morpho-syntactic means are available, type-shifting should be the dispreferred one. This is illustrated in Chierchia's Blocking Principle.

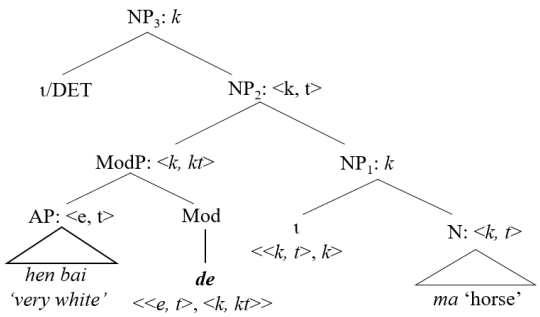
(36) Blocking Principle (Chierchia 1998)
For any type-shifting operation τ and any X: $*\tau(X)$ if there is an overt linguistic element D s. t. for any set X in its domain, [[D]] (X) = τ(X).

In essence, *de* is required because the semantic types of the two sorts of expressions it connects are different from those of the expressions that combine without *de*. In the light of Mendia's (2019) *ad hoc* kinds, we propose the *de*-marked adjectival modification is a means by which *ad hoc* (sub)kinds are constructed from the kinds denoted by the head noun. The lexical entry for *de* is provided in (37) (adopted after Mendia's (2019) κ^{+} operator), which states that *de* takes both a property predicate *P* and a kind k_1 as its argument, and returns a subkind k_2 of k_1 whose instantiated objects have the property *P* and are members of k_1.

(37) $[\![de]\!] = \lambda P_{<e,\,t>}\lambda k_1\lambda k_2.\Pi(k_1)(k_2)\wedge\forall z_o[(P_{@}(z_o)\wedge z_o\sqsubseteq k_1)\leftrightarrow z_o\sqsubseteq k_2]$

On this new assumption of *de*, the composition of the 'CA-*de*-N' combination is straightforward. Syntactically, 'CA-*de*', or more precisely, 'AP-*de*', constitute a ModP headed by *de*. The ModP is combined with the noun via phrasal adjunction, that is, it adjoins to the noun which has already been transformed into a full-fledged phrase (NP/DP, depending on the syntactic assumptions). The underlying structure and semantic derivation of the 'AP-*de*-N' sequence *hen bai de ma* 'very new DE horse' is provided in (38).

(38) [$_{NP2}$ [$_{ModP}$ [$_{AP}$ *hen bai*] [$_{Mod}$ *de*]][$_{NP}$ *ι* [$_{N}$ *ma*]]]



(i) $[\![\,[_{NP1}\ [\iota\ ma]]\,]\!] = \iota k\text{: }\mathbf{kind}\ (k).[k\leq(\lambda w[\iota x[\mathbf{*horse}_w(x)]])]$

(ii) $[\![\,[_{AP}\ hen\ bai]\,]\!] = \lambda w\lambda x[\exists s'[\exists z_k\in\mathbf{kind}[\mathrm{WHITE}_w(z)\wedge z >_s \mathbf{standard}_{s,\,c}\wedge s'\sqsubseteq z\ \wedge \mathbf{hold}\ (x, s')]]]$

(iii) $[\![\,[_{NP3}\ [_{NP2}\ [_{ModP}\ hen\ bai\ de]\ [_{NP1}\ ma]]]\,]\!]$
$= \lambda k_2.\Pi(\mathrm{HORSE})(k_2)\wedge\forall z_o[([\![\,[_{AP}\ hen\ bai]\,]\!]_{@}(z_o)\wedge z_o\sqsubseteq[\![\,[_{NP}\ [\iota\ ma]]\,]\!])\leftrightarrow z_o\sqsubseteq k_2]$

The formula in (38iii) consists in two components: (i) there is some kind *k*, *k* is a subkind of horses, and (ii) for any object z_o that instantiates *k*, z_o has both the property of being very white and being a member of horses. This amounts to a restrictive/intersective statement. The subtle but important truth-conditional difference between the (non-)restrictive/(non-)intersective *de*-less adjectival modification structures, on the one hand, and the restrictive/intersective *de*-marked ones, on the other, is thus intuitively captured in the current analysis.

The other two 'AP-*de*-N' combinations, i.e., the 'AP_p-*de*-N' (whose AP involves a silent type-shifter POS) and the 'AP_r-*de*-N' (whose AP involves a (morphological) reduplication process) can be analyzed in the same vein. The truth-conditions of *bai de ma* 'white DE horse' and *bai-bai de ma* 'white-white DE horse' are provided as (39) and (40) respectively. Note that the only difference between them lies in the choice of the viewpoint/standard of comparison: for the POS-induced AP, the standard is a contextually salient one, while for the REDUP-induced AP,

the standard is the one the reaches the extent that impressed the speaker. Nothing else hinges upon our analysis. [4]

(39) a. [$_{NP2}$ [$_{ModP}$ [$_{AP}$ *POS bai*] [$_{Mod}$ *de*]][$_{NP1}$ *ι ma*]]
b. $\lambda k_2.\Pi(\text{HORSE})(k_2)\wedge\forall z_o[([\![\,[_{AP}\ \textit{POS bai}]\,]\!]_@(z_o)\wedge z_o\sqsubseteq[\![\,[_{NP}\ [\textit{ι ma}]]\,]\!])\leftrightarrow z_o\sqsubseteq k_2]$

(40) a. [$_{NP2}$ [$_{ModP}$ [$_{AP}$ *bai-bai*] [$_{Mod}$ *de*]][$_{NP1}$ *ι ma*]]
b. $\lambda k_2.\Pi(\text{HORSE})(k_2)\wedge\forall z_o[([\![\,[_{AP}\ \textit{bai-bai}]\,]\!]_@(z_o)\wedge z_o\sqsubseteq[\![\,[_{NP}\ [\textit{ι ma}]]\,]\!])\leftrightarrow z_o\sqsubseteq k_2]$

5.3. Constraint on well-establishedness

The present account correctly predicts that the *de*-less adjectival modification structures will be subject to more severe restrictions than the *de*-marked ones. Zhu observes that not all 'A-N' combinations are natural (though he does not explain why). To repeat some of our previous examples.

(41) a. %gui shoujuan
expensive handkerchief
'expensive handkerchief'
b. %zang tang
dirty candy
'dirty candy'

In the current analysis, the 'A-N' combinations are the means by which well-established kinds are constructed. As Prasada and Dillingham (2005) suggest, for well-established kind terms, there is a PRINCIPLED connection between the type of thing something is and some of its properties (see also Carlson 2010). For the handkerchiefs, the properties related to the value (cheap, expensive, etc.) are less principled than the properties related to color, size, shape, etc. Thus the degraded status of (41a) as a (well-established) kind-denoting term; similarly for (41b). By contrast, *ad hoc* kinds do not impose a principled connection between the type of thing something is and some of its properties. Rather, "they rely on regularities that are not immediately obvious, in the sense that they are not agreed upon in the same way as well-established kinds" (Mendia 2019: 2). This means contextual manipulation to construct *ad hoc* kinds is always available.

The same pattern holds in English as well. Krifka et al. (1995) observe that "green bottle" is infelicitous to be used as a well-established kind-denoting term, as shown in (42a). However, after appropriate contextual manipulation and pragmatic enrichment, it can be turned into an *ad hoc* kind-denoting term. (42b) (due to Dayal 2004) is much improved.

(42) a. %The green bottle has a narrow neck. [odd on kind interpretation]

[4] We basically follow Grano (2012) to assume that POS and *hen* are two ways that take an adjective meaning and return a property. Grano suggests that POS is a universally available shifting operation: "POS and the other overt forms have a similar function in that they all serve to fix the standard of comparison" (Grano 2012: 532). The choice between POS and overt forms is regulated by a general economy principle (say, Chierchia's (1998) "Avoid Structure").

b. The factory produces two kinds of bottles, a green one for medicinal purposes […] The green bottle has a narrow neck. [OK on *ad hoc* kind interpretation]

Similar facts are attested in other languages. Gehrke (2015) discusses a similar case in German.

(43) Flachbildschirm, Weißwurst, Schwzarzbier
flat-screen white-sausage black-beer

Flachbildschirm refers to a particular kind of screen (a flat screen) but cannot be used to refer to a screen that has been flattened. Hence, the flatness of this object is a characterizing, principled rather than an accidental property. Similarly, *Weißwurst* does not refer to a sausage that happens to be white; rather, it refers to a particular kind of sausage that is lighter than other sausages. In the same vein, *Schwzarzbier* refers to a German dark lager beer.

6. Conclusion

In this article, we motivate and develop a kind-based account for adjectival modifications in Mandarin. The core elements of our analysis are summarized as below.

(44) A summary of the core analysis

i. **The semantics of adjectives**: simplex adjectives are adjectival heads (A^0), which denote "non-specific", "general" state-kinds, while complex adjectives are APs, which denote (intensionalized) properties. DEG morphemes (covert or overt) have a particularizing function that provide a point of view against which the state-kind is evaluated. In other words, DEGs convert a type description into a token reference;

ii. **The syntax of adjectival modification**: A^0s and APs occupy different domains when combining with nouns: head adjunction for A^0s, and phrasal adjunction for APs. Because APs are of different type from the nouns (which denote kinds), *de* is required to mediate the composition. Head adjunction results into well-established kind-denoting terms, while phrasal adjunction results into *ad hoc* kind-denoting ones;

iii. **A novel semantics for *de***: In our analysis, *de* connects a property-denoting term and a kind-denoting term, and the result of this composition is an *ad hoc* kind-denoting term. The occurrence of *de* follows from some economy constraint of grammar.

There are several open issues with existing studies on kinds, for example, can kinds be modified, and if any, how? In what sense the grammar is sensitive to different kinds of *kinds*? Mandarin is a particularly interesting language to investigate these questions, because it has long been accepted that bare nouns (as nominal heads) in Mandarin are kind-denoting (Krifka 1995; Chierchia 1988, among many others). However, despite this well-accepted wisdom, the modification of kind-denoting terms by adjectives (or any other modifiers, e.g., relative clauses) has received very little attention in the formal semantics literatures and remained a theoretical gap to date. The present account fills this gap by treating adjectival modification as an instance of kind modification, i.e., grammatically relevant means to constructing subkinds from kinds. And in doing so, the present analysis bridges two lines of research, viz., the semantics of kinds which are mostly restricted to bare nouns and their cross-linguistic variants (cf. Carlson 1977a, 1977b; Krifka et al. 1995; Chierchia 1998; Dayal 2004, among numerous others), on the one hand, and the studies of adjectival modifications which are mostly restricted to the domain of individuals (cf. Bolinger 1967; Larson 1998; Cinque 2010, among many others), on the other.

We hope the integration of these two lines of research has advanced our understanding of the issues such as the nature of modification, the ontological representation of kinds, the semantic nature of the phrasal vs. lexical distinction, etc.

References

Baglini, R. (2015). *Stative Predication and Semantic Ontology: A Cross-linguistic Study*. Ph.D. dissertation, The University of Chicago.

Bolinger, D. (1967). Adjectives in English: Attribution and predication. *Lingua* 18: 1-34.

Carlson, G. (1977a). Amount relatives. *Language* 53(3): 520-542.

Carlson, G. (1977b). *Reference to Kinds in English***.** Ph.D. dissertation, University of Massachusetts at Amherst.

Carlson, G. (2003). Interpreting asymmetries in major phrases. In *Asymmetry in Grammar: Syntax and Semantics*, pp. 301-314. Amsterdam: John Benjamins.

Carlson, G. (2010). Generics and concepts. In F. J. Pelletier (Ed.), *Kinds, Things and Stuff*, pp. 16-35. Oxford: Oxford University Press.

Cinque, G. (2010). *The Syntax of Adjectives: A Comparative Study*. Cambridge, MA: The MIT Press.

Cinque, G. (2014). The semantic classification of adjectives. A view from syntax. *Studies in Chinese Linguistics* 35 (1): 1-30.

Chierchia, G. (1998). Reference to kinds across languages. *Natural Language Semantics* 6: 339-405.

Cresswell, M. J. (1976). The semantics of degree. In B. H. Partee (Ed.), *Montague Grammar*, pp. 261-292. New York: Academic Press.

Dayal, V. (2004). Number marking and (in)definiteness in kind terms. *Linguistics and Philosophy* 27(4): 393-450.

Huang, S.-Z. (2006). Property theory, adjectives, and modification in Chinese. *Journal of East Asian Linguistics* 15: 343-369.

Jiang, J. L. (2012). *Nominal Arguments and Language Variation.* Ph.D. dissertation, Harvard University.

Kennedy, C. (1999). *Projecting the Adjective: The Syntax and Semantics of Gradability and Comparison*. New York: Garland Publishing.

Kennedy, C. and L. McNally (2005). Scale structure, degree modification, and the semantics of gradable predicates. *Language* 81: 345-381.

Krifka, M. (1995). Common nouns: a contrastive analysis of English and Chinese. In G. Carlson, and F. J. Pelletier (Eds.), *The Generic Book*, pp. 398-411. Chicago: The University of Chicago Press.

Krifka, M.. *et al*. (1995). Genericity: an introduction. In G. Carlson and F. J. Pelletier (Eds.), *The Generic Book*, pp. 1-124. Chicago: The University of Chicago Press.

Gerhke, B. (2015). Adjectival participles, event kind modification and pseudo-incorporation. *Natural Language and Linguistic Theory* 33: 897-938.

Gehrke, B. (2019). Event kinds. In R. Truswell (Ed.), *The Oxford Handbook of Event Structure*, pp. 205-236. Oxford: Oxford University Press.

Grano, T. (2012). Mandarin *hen* and Universal Markedness in gradable adjectives. *Natural Language and Linguistic Theory* 30:513-565.

Larson, R. (1998). Events and modification in nominals. In *Proceedings of SALT* 8, 145-168.

Leffel, T. (2014). *The Semantics of Modification: Adjectives, Nouns and Order*. Ph.D. dissertation, New York University.

Liu, F.-H. (2016). Syntactic sources of adjectives in Mandarin Chinese. *Studies in Chinese Linguistics* 37 (1): 38-55.
Mari, A., Beyssade, C., and F. D. Prete (2013). Introduction. In A. Mari, C. Beyssade, and F. D. Prete (Eds.), *Genericity*, pp. 1-93. Oxford: Oxford University Press.
Mendia, J. A. (2017). *Amount Relatives Redux*. Ph.D. dissertation, University of Massachusetts at Amherst.
Mendia, J. A. (2020). Reference to *ad hoc* kinds. *Linguistics and Philosophy* 43: 589-631. (published online: September 26, 2019).
McNally, L. (2016). Modification. In M. Aloni and P. Dekker (Eds.), *The Cambridge Handbook of Formal Semantics*, pp. 442-466. Cambridge: Cambridge University Press.
McNally, L. & G. Boleda (2004). Relational adjectives as properties of kinds. In O. Bonami and P. C. Hofherr (eds.), *Empirical Issues in Formal Syntax and Semantics* 5, pp. 179-186.
Paul, W. (2005). Adjectival modification in Mandarin Chinese and related issues. *Linguistics* 43: 757-793.
Paul, W. (2010). Adjectives in Mandarin Chinese. In P. Hofherr and O. Matushansky (Eds.), *Adjectives*, pp. 115-154. Amsterdam: John Benjamins.
Sadler, L. and D. J. Arnold (1994). Prenominal adjectives and the phrasal/lexical distinction. *Journal of Linguistics* 30: 187-226.
Sproat, R. and C. Shih (1988). Prenominal adjectival ordering in English and Mandarin. In J. Blevins, and J. Carter (Eds.), *Proceedings of the 18th Annual Meeting of the North East Linguistics Society (NELS 18)*, vol. 2, pp. 465-489. Amherst, MA: GLSA.
Sproat, R. & C. Shih (1991). The cross-linguistic distribution of adjective ordering restriction. In C. Georgopoulos and R. Shihara (eds.), *Interdisciplinary Approaches to Language. Essays in Honor of S.-Y. Kuroda*, pp. 562-592. Dordrecht: Kluwer.
Vergnaud, J.-Roger & M. L. Zubizarreta (1992). The definite determiner and the inalienable constructions in French and in English. *Linguistic Inquiry* 23: 595-652.
Yang, R. (2001). *Common Nouns, Classifiers and Quantification in Chinese*. Ph.D. dissertation, Rutgers University.
Zamparelli, R. (2000). *Layers in the Determiner Phrase*. New York: Garland Publishing.
Zhu, D. (1956). *Xiandai hanyu xingrongci yanjiu* [A study of adjectives in modern Chinese]. *Yuyan Yanji* [Research in Linguistics]1. [In Chinese]
Zhu, D. (1982). *Yufa Jiangyi* [Lectures on Grammar]. Beijing: Shangwu Yinshuguan [The Commercial Press]. [In Chinese]