Degree Expressions in Chinese

Linmin Zhang[1, 2, *]

[1]NYU Shanghai
[2]NYU-ECNU Institute of Brain & Cognitive Science at NYU Shanghai
[*]Correspondence to: New York University Shanghai, 1555 Century Avenue, Shanghai 200122, China. E-mail address: zhanglinmin@gmail.com

Submitted to *The Oxford Research Encyclopedia of Linguistics (under review)*
Draft version, August 18, 2021. Comments are most welcome!

Summary and keywords

Summary: Degree expressions in natural language reflect how human cognition performs abstract tasks like **taking measurements** (i.e., mapping items to degrees on a certain scale) and **conducting comparison** between measurements. There is a great variation on how different languages encode the notions like **degrees** and **scales** and operate comparison, inspiring ongoing theoretical development in degree semantics. This article presents major empirical data on degree expressions in Mandarin Chinese and surveys current research on Chinese-specific phenomena.

Compared to well-known English phenomena, Chinese gradable predicates like 高 *gāo* ('tall, taller') seem rather syntactic-category-fluid, and due to the lack of comparative morphemes, their interpretation can be ambiguous between a comparative use and a positive/measurement interpretation. Typical degree expressions in Chinese, including the positive use, comparatives, equatives, and measurement constructions, demonstrate patterns different from those in English. Moreover, not only adjective-like words such as 高 *gāo* ('tall, high'), but also property nouns (e.g., 魅力 *mèi-lì* 'charm', 钱 *qián* 'money') and mental verbs (e.g., 喜欢 *xǐ-huān* *'like'*) have gradable meanings and can be used to form degree expressions.

With regard to these empirical phenomena, this article focuses on the following fundamental research questions in the literature: (i) **The encoding of comparison**: In a language lacking comparative morphemes, how is the distinction established between the positive and the comparative interpretation? (ii) **Compositional derivation**: How are Chinese comparatives distinct from well-studied English clausal comparatives? (iii) **Ontology of degrees**: How do various Chinese degree expressions reveal on the underlying ontological assumptions of scales and degrees?

Even though these are still hotly debated questions in the existing literature, and no firm conclusions can be drawn at this moment, research on Chinese empirical data suggests profound implications for theoretical development of degree semantics. In particular, this article suggests a new look at variations betwee languages with vs. without overt comparative morphemes (e.g., English *-er*).

Keywords: Measurement, Comparison, Degree semantics, Mandarin Chinese, Degrees, Scales, Gradable predicates, Positive use of gradable predicates, Measurement constructions, Comparatives, (Numerical) differentials, Equatives, Degree questions

1 Introduction

Natural language supports the expression of **measurement** and **comparison**. Measurement essentially means mapping an entity/individual or event (e.g., Brienne, the arrival of a guest) to a value on a relevant scale (e.g., a scale of height, a timeline). Values on the same scale can further undergo comparison (e.g., comparing two heights). **Scalar values** are often represented as **degrees**, i.e., elements that constitute a totally ordered set called **scale** (e.g., $37°C$ represents a degree on a celsius scale of temperature). Therefore, measurement- and comparison-related expressions are called **degree expressions**. Within formal linguistics, **degree semantics** has been developed to study these linguistic phenomena (see Seuren 1973, Cresswell 1976, Hellan 1981, Hoeksema 1983, von Stechow 1984, Heim 1985 among many others; see Beck 2011 for a review).

Degree semantics has been largely developed based on English data. However, the great cross-linguistic variation on degree expressions raises new research questions. This articles presents major empirical data on degree expressions in Mandarin Chinese, surveys current research on Chinese-specific phenomena, and addresses theoretical implications. This introduction starts with a brief presentation of degree semantics and then outlines the scope and roadmap of this article.

1.1 A brief presentation of degree semantics

Measurement and comparison involve abstracting individuals into a value along a **dimension** (or **scale**) such as height, velocity, temperature, or time. In natural language, **gradable adjectives** (e.g., *tall*, *fast*, *hot*, *early*) constitute a major way of encoding the meaning of gradable dimensions. Based on the use of gradable adjectives, typical degree expressions include the **positive use** (see (1a)), **measurement constructions** (see (1b)), **comparatives** (see (1c)), **equatives** (see (1d)), and **degree questions** (see (1e)).

(1) Typical degree expressions with the use of gradable adjectives:

a.	Brienne is tall.	**Positive use** of gradable adjective *tall*
b.	Brienne is 6 feet 3 inches tall.	**Measurement construction**
c.	Brienne is (1 inch) taller than Jaime (is).	**Comparative**
d.	Brienne is as tall as Jaime (is).	**Equative**
e.	How tall is Brienne?	**Degree question**

In analyzing the meaning of gradable adjectives, **the delineation approach** (represented by Klein 1980; see also McConnell-Ginet 1973, Kamp 1975, Lewis 1979, and see Burnett 2017 for a recent development) is an influential competing theory to degree semantics. A short detour to this competing theory will shed light on what ontological assumptions for the notions of degrees and scales are needed.

Within **the delineation approach**, the meaning of gradable adjectives (e.g., *tall*) is analyzed parallel to that of non-gradable ones (e.g., *red*): both denote **sets of individuals** (of type $\langle et \rangle$). For example, *tall* is considered a set with regard to a **comparison class** (i.e.,

similar, comparable items): depending on context, *tall* in (1a) can be interpreted as *tall for a woman* or *tall for a knight*. Suppose the comparison class is a set of knights, ordered along a dimension of height. Then a given context (say context c) corresponds to a **tripartite partitioning** of this **ordered set** of knights:

(2) a. the set '$\text{POS}_c(\text{TALL})$', the **positive extension** of *tall* in context c, includes those knights who are on the upper side of this ordering of knights;
b. the set '$\text{NEG}_c(\text{TALL})$', the **negative extension** of *tall* in context c, includes those knights who are on the lower side of this ordering of knights;
c. the set '$\text{GAP}_c(\text{TALL})$', the **extension gap** in context c, includes those knights who are between the upper and lower side of this ordering of knights.

Different contexts lead to different thresholds, cutting between $\text{POS}_c(\text{TALL})$ and $\text{GAP}_c(\text{TALL})$ and between $\text{GAP}_c(\text{TALL})$ and $\text{NEG}_c(\text{TALL})$), and yield different partitionings: a knight can be in $\text{POS}_{c_1}(\text{TALL})$ under context c_1, but $\text{NEG}_{c_2}(\text{TALL})$ under context c_2. However, all these context-dependent partitionings should be consistent with the original ordering of knights along the dimension of height: e.g., as far as Brienne is ranked higher than Jaime in this ordering, there can be no context c such that Brienne is in the set $\text{GAP}_c(\text{TALL})$ or $\text{NEG}_c(\text{TALL})$, but Jaime is in the set $\text{POS}_c(\text{TALL})$. Therefore, (1a) is true in a context c_0 iff Brienne is in the set $\text{POS}_{c_0}(\text{TALL})$. The comparative sentence (1c) is true iff there exists a context c such that Brienne is in the set $\text{POS}_c(\text{tall})$, while Jaime is not. The use of a measure phrase like *6 feet 3 inches* in (1b) can be considered a restriction on a set of individuals, yielding an **equivalence class** of all individuals with this height.

Within the delineation approach, a degree (e.g., $6'3''$) is not a conceptual primitive: it is considered a shorthand for an equivalence class of individuals sharing the same measurement. Therefore, measurement and comparison are considered performed along an **ordinal scale** (i.e., an **ordered set of equivalence classes**), which has **ordering**, but not necessarily other mathematical properties (see Stevens 1946).

However, a mere ordering of equivalence classes can only address inequalities, but cannot support the measurement of the difference between two equivalence classes (see Stevens 1946). Crucially, in natural language, the use of numerical differentials in comparatives (see *1 inch* in (1c)) relies on the notion of **measurable differences**, requiring the assumption of a scale with **both ordering and units**, i.e., an **interval scale**.

Different from the delineation approach, **degree semantics** assumes (sometimes implicitly) abstract, number-like degrees along an interval scale (see Kennedy 1999, Solt 2015, L. Zhang and Ling 2021 for discussion on the notion of scales in natural language).

We use d to represent the type of degrees. The meaning of a gradable adjective involves a **measure function** which maps an individual to a degree along a relevant scale, as illustrated in (3). The implementation in (3a) simply considers a gradable adjective a measure function (see Kennedy 1999), while the implementation in (3b) also includes an operation of comparison, '$\geq$' (see Cresswell 1976, Hellan 1981, von Stechow 1984, Heim 1985). In (3b), $[\![\text{tall}]\!]$ relates a degree d and an individual x, meaning that the height measurement of the individual reaches the degree d (i.e., x is tall to degree d).

(3) a. $[\![\text{tall}]\!]_{\langle ed\rangle} \overset{\text{def}}{=} \lambda x.\textsc{height}(x)$ a measure function of type $\langle ed\rangle$

b. $[\![\text{tall}]\!]_{\langle d,et\rangle} \overset{\text{def}}{=} \lambda d.\lambda x.\textsc{height}(x) \geq d$ a relation between a degree and an entity

Based on (3b), the semantics of major English degree expressions can be analyzed in a unified way. The derivation of the **positive use** (see (4)) and a **measurement construction** (see (5)) is straightforward. The positive use assumes a context-dependent **free variable**, **pos**, representing the threshold of being tall for a certain comparison class (see Bartsch and Vennemann 1972, Cresswell 1976, von Stechow 1984, Kennedy 1999).

(4) $[\![\text{Brienne is pos tall}]\!] \Leftrightarrow \textsc{height}(\text{Brienne}) \geq \textsc{pos}$ (1a)
(pos: a silent, context-dependent free variable serving as the degree argument of the gradable adjective and representing the threshold of being tall)

(5) $[\![\text{Brienne is 6 feet 3 inches tall}]\!] \Leftrightarrow \textsc{height}(\text{Brienne}) \geq 6'3''$ (1b)

With a lambda abstraction over a degree variable, the **degree question** in (6) denotes the set of all degrees reached by Brienne's height, i.e., the set of all fragment answers to this degree question (see L. Zhang and Ling 2021; see the categorial approach to questions represented by Hausser and Zaefferer 1978; see also Krifka 2011 for a review).

(6) $[\![\text{how tall is Brienne}]\!] \Leftrightarrow \lambda d.\textsc{height}(\text{Brienne}) \geq d$ (1e)
(This set is equivalent to $\{d \mid d \leq \textsc{height}(\text{Brienne})\}$)

For the derivation of **comparison constructions**, we focus on the syntactically much studied type: **clausal comparatives** shown in (7) and **equatives** shown in (8) (cf. **phrasal** comparatives and equatives, arguably qualitatively distinct from the clausal type). With the assumption of an elided gradable adjective in subordinate clauses (see Bresnan 1973, 1975, Chomsky 1977), the derivation in (7) and (8) involves **lambda abstraction over a degree variable** in both the matrix and the subordinate clause. Comparative morpheme *-er/more*, analyzed as a comparison operator, is like a quantificational determiner (e.g., *every*) and relates two sets of degrees. Eventually, the difference between comparatives and equatives amounts to whether the comparison yields a strict vs. non-strict inequality.

(7) $[\![\text{Brienne is tall}\textbf{er}\text{ than Jaime is }\sout{\text{tall}}]\!] \Leftrightarrow \textsc{height}(\text{Brienne}) > \textsc{height}(\text{Jaime})$ (1c)
(Consider this **subcomparative** sentence: *the bathtub is wider than the door is tall*.)
LF: -er$[[\lambda d.$Jaime is d-tall$]][[\lambda d'.$Brienne is d'-tall$]]$

a. **Matrix clause**: $[\lambda d'.\textsc{height}(\text{Brienne}) \geq d'] = \{d \mid d \leq \textsc{height}(\text{Brienne})\}$
Subordinate *than*-clause: $[\lambda d.\textsc{height}(\text{Jaime}) \geq d] = \{d \mid d \leq \textsc{height}(\text{Jaime})\}$

b. *-er* performs comparison: $[\![\text{-er}]\!]_{\langle\langle dt\rangle,\langle dt,t\rangle\rangle} \overset{\text{def}}{=} \lambda D_1.\lambda D_2.\textsc{max}(D_2) > \textsc{max}(D_1)$
($\textsc{max} \overset{\text{def}}{=} \lambda D.\iota d[d \in D \wedge \forall d'[d' \in D \rightarrow d' \leq d]]$)
(With a numerical differential, $[\![\text{-er}]\!] \overset{\text{def}}{=} \lambda d.\lambda D_1.\lambda D_2.\textsc{max}(D_2) \geq \textsc{max}(D_1) + d$)
(An alternative implementation: $[\![\text{-er}]\!]_{\langle\langle dt\rangle,\langle dt,t\rangle\rangle} \overset{\text{def}}{=} \lambda D_1.\lambda D_2.\exists d[d \in D_2 \wedge d \notin D_1]$)

(8) $[\![\text{Brienne is }\textbf{as}\text{ tall as Jaime is }\sout{\text{tall}}]\!] \Leftrightarrow \textsc{height}(\text{Brienne}) \geq \textsc{height}(\text{Jaime})$ (1d)
$[\![\text{as}]\!]_{\langle\langle dt\rangle,\langle dt,t\rangle\rangle} \overset{\text{def}}{=} \lambda D_1.\lambda D_2.\textsc{max}(D_2) \geq \textsc{max}(D_1)$ $\rightsquigarrow$ a non-strict inequality

1.2 Scope and roadmap of the article

The above presentation, though not entirely uncontested and ignoring many technical details, lays out basic ingredients of degree semantics for English phenomena:

(9)
a. Ontologically, comparison (as encoded by English comparatives) assumes an **interval scale**, supporting the potential measurement of differences;
b. Comparison is formally analyzed as an **inequality relation between (sets of) degrees** (along an interval scale), not between (sets of) individuals;
c. Gradable adjectives contribute a **measure function** from entities to degrees;
d. The positive use assumes a silent context-dependent free degree variable, **pos**;
e. The derivation of English clausal comparatives (and equatives) involves **lambda abstraction over a degree variable**;
f. The semantic contribution of **English comparative morpheme *-er/more*** is cosidered to perform comparison (between degrees).

Some parts of these theoretical characterizations might be cross-linguistic principles that reflect human language or cognitive universals, while others might be parameters allowing for variations (see, e.g., Beck et al. 2009's proposal of three parameters and relevant discussion in Section 6). Yet it is also likely that investigations based on cross-linguistic phenomena eventually lead to a substantial update of the theory.

With regard to measurement- and comparison-related expressions, Chinese, a morphologically impoverished language often with a blurry boundary among syntactic categories, demonstrates interesting patterns distinct from their translational equivalents in English. Most notably,

(10)
a. Gradable predicates in Chinese lack a comparative form and thus can be ambiguous between a positive/measurement use and a comparative use;
b. The positive use of gradable predicates (e.g., 高 *gāo* 'tall, high') often requires the presence of a semantically bleached adverbial modifier, 很 *hěn*;
c. Subcomparatives, which motivate the compositional analysis of English clausal comparatives (see (7)), do not exist in Chinese;
d. Some types of equatives and measurement constructions are based on the use of auxiliary 有 *yǒu* 'have', and they also show a semantic parallelism;
e. In addition to words like 高 *gāo* 'tall, high', property nouns that convey abstract concepts (e.g., 魅力 *mèi-lì* 'charm', 钱 *qián* 'money') and mental verbs (e.g., 喜欢 *xǐ-huān 'like'*) can also be used to form degree expressions;

These empirical observations give rise to hotly debated research questions, inspiring reflection on how dimensions, degrees, and operators of comparison can possibly be encoded in natural language and what kind of division of labor is possible.

Below, Section 2 presents a theory-neutral description of major Chinese data, illustrating the generalizations in (10). Based on these data, Sections 3–5 each address one of the following much discussed yet still largely unsettled research questions:

(11) a. **The encoding of comparison**: In a language lacking comparative morphemes, how is the distinction established between the positive and the comparative interpretation of gradable predicates (Section 3)?
b. **Compositional derivation**: How are Chinese comparatives distinct from well-studied English clausal comparatives (Section 4)?
c. **Ontology of degrees**: How do various Chinese degree expressions reveal on the underlying ontological assumptions of scales and degrees (Section 5)?

Section 6 is a general discussion, addressing the implications of Chinese data on the development of degree semantics. Section 7 concludes on further research needed.

This article does not aim to present a complete survey of all the degree-related phenomena in Chinese. Rather, it aims to show how cross-linguistic data from Chinese contribute new insights on formal linguistics. Therefore, many aspects of degree expressions are not included here. For example, superlatives, excessive expressions (e.g., with the use of 太 *tài* 'too, so much'), and the attributive use of gradable predicates will not be discussed. Some phenomena (e.g., degree modifier 更 *gèng*) will only be briefly mentioned in the discussion on the featured phenomena. Important theoretical issues like vagueness, subjectivity, and scale structures in interpreting gradable predicates, modality-related gradability, and scalar implicature will also not be dealt with here.

2 Empirical observations on Chinese degree expressions

This section presents a bird's eye view on major degree expressions in Chinese. Section 2.1 shows the ambiguity in interpreting gradable predicates like 高 *gāo* ('tall' vs. 'taller'). The next three subsections address with more details the positive use (Section 2.2), comparatives (Section 2.3), and degree expressions based on auxiliary *have*, including some types of equatives, measurement constructions, and degree questions (Section 2.4). Sections 2.5 and 2.6 presents degree expressions based on the use of property nouns and mental verbs, focusing on the patterns parallel with those based on gradable predicates.

2.1 Gradable predicates and their ambiguous interpretations

English gradable adjectives have a positive form and a comparative form. As illustrated in (12), the positive form, *long*, is used in the positive use (see (12a)) and the measurement use (see (12b)), while the comparative form, *longer* (which includes an inflectional morpheme, *-er*), is used in the comparative sentence (see (12c)). Cross-linguistically, many languages (e.g., Korean, Japanese, Swahili) lack a comparative morpheme that corresponds to English *-er*, and Chinese is among them.

(12) a. This movie is **long**. **Positive use**
b. That tennis match was 5 hours **long**. **Measurement construction**
c. That tennis match is **longer**. **Comparative**

Under the given context in (13), Chinese 高 *gāo* is interpreted as English *taller*, i.e., as the comparative form of a gradable predicate.

(13) Context: There are two knights, Brienne and Jaime, and I wonder who is taller.

a. 他们俩 谁 高?
tā-men-liǎ shéi gāo
3-PL-two who tall(-er)
***Wh*-question**: 'Between the two, who is taller?' ⇝ **Comparative**

b. 布蕾妮 高 还是 詹姆 高?
bùléiní gāo hái-shì zhānmǔ gāo
Brienne tall(-er) or Jaime tall(-er)
Alternative Q.: 'Between Brienne and Jaime, who is taller?' ⇝ **Comparative**

c. 布蕾妮 高
bùléiní gāo
Brienne tall(-er)
To answer the questions (13a) and (13b): 'Brienne is taller.' ⇝ **Comparative**

However, in (14), Chinese 高 *gāo* is interpreted as English *tall*, i.e., as the positive form of a gradable predicate.

(14) a. 布蕾妮 高 不 高?
bùléiní gāo bù gāo
Brienne tall(-er) NEG tall(-er)
A-not-A alternative question: 'Is Brienne tall?' ⇝ **Positive**

b. 布蕾妮 高
bùléiní gāo
Brienne tall(-er)
To answer the question (14a): 'Brienne is tall.' ⇝ **Positive**

Actually, the sentence (13c)/(14b) sounds a bit unnatural when uttered out of blue (see also Section 2.2 below). However, under their specific context, (13c) (with a stress on *bùléiní*) and (14b) (with a stress on *gāo*) are both natural but with different interpretations: a comparative interpretation for (13c) and a positive interpretation for (14b).

There are similar observations for sentences containing a measure phrase (e.g., *1 meter*). Based on our real-world knowledge about Huaihe River, in (15), 高 *gāo* is most naturally interpreted as English *higher*, and the entire sentence (15) has a comparative reading. However, in (16), 高 *gāo* is most naturally interpreted as English *high*, and the entire sentence (16) is considered a measurement construction.

(15) (和 过去 相比) 淮河 水位 高 (了) 一米
(hé guò-qù xiāng-bǐ) huái-hé shuǐ-wéi gāo (le) yī-mǐ
(with past compare) Huaihe-River water-level high(-er)(-PRF) one-meter
'(Compared with the past,) the water level of Huaihe River is 1 meter higher.'
(http://www.npc.gov.cn/wxzl/gongbao/2000-12/28/content_5002606.htm) ⇝ **Comparative**

(16) 今年 淮河 水位 高 26 米
jīn-nián huái-hé shuǐ-wéi gāo 26-mǐ
this-year Huaihe-River water-level high(-er) 26-meter
'This year, the water level of Huaihe River is 26 meters high.' ⇝ **Measurement**

A perfective marker 了 *le* can be optionally added after 高 *gāo* in the comparative-reading sentence (15), but not in the measurement construction (16) or sentences in (13) or (14). This optional presence of an aspectual marker[1] suggests that in (15), 高 *gāo* (here 'higher') behaves syntactically like a verb and semantically indicates a change (or increase) of one meter along a scale of height. In this sense, the comparative sentence (15), which includes a numerical differential, is reminiscent of a bounded event.

In brief, these examples (i.e., (13c) vs. (14b), (15) vs. (16)) show that Chinese gradable predicates lack a comparative form, and their interpretation can be ambiguous between a positive/measurement use and a comparative use. A few factors, such as **Question-under-discussion** (QUD), **world knowledge**, **the overt presence of comparison standard** (e.g., last year's (water level) in (15)), and **the use of aspectual markers** (e.g., an optional perfective marker 了 *le* for (15)), can help disambiguate.

2.2 The positive use and the almost obligatory presence of *hěn*

Though the use of a gradable predicate alone can have a positive interpretation under some context (see (14)), the default way of constructing the positive use is to include a semantically bleached degree modifier, 很 ***hěn***.

(17) illustrates the most natural way to translate *Brienne is tall* (or *Brienne is clever*). This presence of 很 *hěn* is disregard of whether the following gradable predicate is monosyllabic (e.g., 高 *gāo* 'tall') or bisyllabic (e.g., 聪明 *cōngmíng* 'clever'). Thus, the use of 很高 *hěn gāo* as a default way of constructing the positive use here is not due to the general preference for bisyllabic words in modern Chinese.

(17) 布蕾妮 很 { 高 / 聪明 }
bùléiní hěn { gāo / cōngmíng }
Brienne very { tall(-er) / clever(-er) }
'Brienne is tall / clever.' ⇝ **Positive**

This presence of 很 *hěn* in the positive use is **almost** obligatory, but still allowing some room for relaxation. On the one hand, as just addressed, the *hěn*-less examples in (14) still have a positive interpretation under their specific context.

On the other hand, 很 *hěn* in (17) can be replaced by other degree modifiers, as illustrated in (18). The meaning of 很 *hěn* is rather bleached in (17), while other degree modifiers (see (18)) contribute to address to what extent Brienne's height exceeds the context-dependent threshold of being tall.

[1] Actually, according to some native speakers, this perfective marker 了 *le* is preferably included in (15).

(18) 布蕾妮 { 非常 / 极其 / 相当 } 高
bùléiní { fēi-cháng / jí-qí / xiāng-dāng } gāo
Brienne { extraordinarily / extremely / quite } tall(-er)
'Brienne is very / extremely / quite tall.' ⇝ **Positive**

It is worth noting that there are two ways to negate the positive-reading sentence (17): (i) by replacing degree modifier 很 *hěn* with negation word 不 *bù* (see (19a)), and (ii) by directly inserting negation word 不 *bù* (see (19b)). These two sentences have different interpretations. (19a) means the negation of *Brienne is tall*, while (19b) means the negation of *Brienne is very tall* (i.e., true under a scenario where Brienne is a bit tall, but not to a great extent). These two negative sentences in (19) show that (i) different from the default positive use in (17), the negation of the positive use does not require the presence of a semantically bleached 很 *hěn*, and (ii) when 很 *hěn* is indeed present in the negative sentence (19b), its semantics as a degree modifier is not bleached.

(19) a. 布蕾妮 不 高
bùléiní bù gāo
Brienne not tall(-er)
'Brienne is not tall.' ⇝ Not reaching the threshold of being tall

b. 布蕾妮 不 很 高
bùléiní bù hěn gāo
Brienne not very tall(-er)
'Brienne is not very tall.' ⇝ Not reaching the threshold of being very tall

2.3 *Bǐ*-comparatives and transitive comparatives

Comparatives typically express comparisons that result in the existence of a difference between items under comparison (cf. **equatives**, which typically express comparisons that result in no difference). In addition to the above case in (13) and (15), Chinese has two main types of comparatives, both with an explicitly expressed **comparison standard**: (i) in a ***bǐ*-comparative**, the comparison standard is introduced by 比 *bǐ*, and (ii) in a **transitive comparative**, the comparison standard directly serves as the sentence's object.

As illustrated in (20), a ***bǐ*-comparative** includes a *bǐ*-expression before the gradable predicate, overtly indicating the comparison standard (cf. (13) and (15)). Similar to English comparatives (see (1c)), Chinese *bǐ*-comparatives can optionally contain a numerical differential (e.g., *one inch* in (20)). In (20), when this numerical differential is present, a perfective marker 了 *le* can be optionally inserted after the degree predicate 高 *gāo* here (see also (15)).

(20) 布蕾妮 比詹姆 高 (了) (一英寸)
bùléiní bǐ zhānmǔ gāo (le) (yī yīngcùn)
Brienne BI Jaime tall(-er)(-PRF) (1 inch)
'Brienne is (one inch) taller than Jaime (is).'

Adverbial degree modifier 更 ***gèng*** can be inserted before gradable predicate 高 *gāo* 'tall, high' in a comparative, bringing a presuppostional requirement. (21), which means *Brienne is taller even than Jaime*, presupposes that the comparison standard exceeds the context-dependent threshold of being tall, i.e., Jaime is already tall. The use of 更 *gèng* makes the comparative sentence (21) incompatible with a numerical differential.[2]

(21) 布蕾妮 比詹姆 更 高 (* 一英寸)
bùléiní bǐ zhānmǔ gèng gāo (*yī yīngcùn)
Brienne BI Jaime GENG tall(-er) (*1 inch)
Assertion: 'Brienne is taller than Jaime (is).'
Presupposition brought by the use of 更 *gèng*: 'Jaime is tall.' 更 *gèng* ≈ *even*

In **transitive comparatives**, the comparison standard follows the gradable predicate: either the gradable predicate 高 *gāo* directly works like a verb, taking a comparison standard as its object (see (22a)), or the gradable predicate first combines with 出 *chū*, a morpheme meaning 'exceed' (see (22b)). The numerical differential is obligatory here. Only monosyllabic gradable predicates can be used in these transitive comparatives.[3]

(22) 'Brienne is one inch taller than Jaime.'

a. 布蕾妮 高 詹姆 *(一英寸)
bùléiní gāo zhānmǔ *(yī yīngcùn)
Brienne tall(-er) Jaime *(1 inch)
(Only **monosyllabic gradable predicates** (e.g., 高 *gāo* 'tall', 矮 *ǎi* 'short', 多 *duō* 'many/much', 少 *shǎo* 'few/little') can be used in this construction.)

b. 布蕾妮 高出 詹姆 *(一英寸)
bùléiní gāo-chū zhānmǔ *(yī yīngcùn)
Brienne exceed in height Jaime *(1 inch)
(Only **positive monosyllabic gradable predicates** can be used in this construction (e.g., 矮 *ǎi* 'short' and 少 *shǎo* 'few/little' are excluded.))

[2]The insertion of 更 *gèng* does not require the overt presence of comparison standard. Thus, 更 *gèng* can also be inserted in the sentences in (13) and bring the presupposition that the comparison standard is already tall. However, due to its incompatibility with a numerical differential, 更 *gèng* cannot be inserted in (15), which contains 一米 *yī-mǐ* 'one meter' as a numerical differential.

[3]As shown in (i), in addition to 出 *chū*, morphemes like 过 *guò* and 于 *yú* can also be used to form transitive comparatives, though they are much less used in colloquial Chinese. The judgment on their compatibility with a numerical differential is also less clear: my informants tend to think that the presence of a numerical differential is possible (but not required) in (ia), but impossible in (ib) (cf. obligatory in (22)).

(i) 'Brienne is taller than Jaime.'

a. 布蕾妮 高过 詹姆 (一英寸)
bùléiní gāo-guò zhānmǔ (yī yīngcùn)
Brienne exceed in height *(Jaime) (1 inch)

b. 布蕾妮 高于 詹姆 (* 一英寸)
bùléiní gāo-yú zhānmǔ (*yī yīngcùn)
Brienne exceed in height Jaime (*1 inch)

2.4 Equatives, measurement constructions, and degree questions

English equatives like (1d) (repeated here as (23); see also the analysis in (8)) have a **non-evaluative** and **asymmetric** interpretation. The interpretation of (23) is non-evaluative, because it does not entail that the comparison standard reaches the context-dependent threshold of being tall (see Rett 2015 on the issue of evaluativity). It is asymmetric, because the comparee reaches the degree of the comparison standard, but not necessarily vice versa. In this sense, English equatives like (23) are similar to comparatives in conveying inequalities: while inequalities encoded by comparatives are strict, inequalities encoded by equatives are non-strict (see (7) and (8)).

(23) Brienne is as tall as Jaime (is). (1d)/(8): HEIGHT(Brienne) ≥ HEIGHT(Jaime)
Non-evaluative: (23) ⊭ Jaime is tall. (cf. evaluativity of negative antonym *short*)
Asymmetric: (23) ⊭ Jaime is as tall as Brienne is.

To convey the same meaning as English equative (23), Chinese adopts an **auxiliary-*have*-based equative construction** shown in (24a). Auxiliary 有 *yǒu* 'have' has the meaning of existence or possession. Literally, (24a) means that Brienne **has** the height of Jaime. Then **measurement constructions** and **degree questions** in Chinese can be constructed in this way as well, as illustrated by (24b) and (24c).

(24) Degree expressions based on auxiliary 有 *yǒu* 'have':

a. 布蕾妮 有 詹姆 那么 高
bùléiní yǒu zhānmǔ nà-me gāo
Brienne have Jaime that-kind tall(-er)
Equative: 'Brienne is as tall as Jaime is.' ⇝ **Non-evaluative and asymmetric**
(那么 *nà-me* can be replaced by 那样 *nà-yàng*, also meaning 'that kind'.)

b. 布蕾妮 有 6 英尺 3 英寸 高
bùléiní yǒu 6 yīngchǐ 3 yīngcùn gāo
Brienne have 6 foot 3 inch tall(-er)
Measurement construction: 'Brienne is 6 feet 3 inches tall.'

c. 布蕾妮 有 多 高?
bùléiní yǒu duō gāo(er)
Brienne have many/much/more tall(-er)
Degree question: 'How tall is Brienne?'

Chinese has other types of equatives, measurement constructions, and degree questions. (25a), an equative with a ***same*-based construction** 跟/和…一样 ***gēn/hé …yī-yàng*** 'as …as' has the same meaning as the *have*-based equative (24a).

(25) a. 布蕾妮 { 跟 / 和 } 詹姆 一样 高
bùléiní { gēn / hé } zhānmǔ yī-yàng gāo
Brienne { with / and } Jaime same tall(-er)
'Brienne is as as tall as Jaime (is).' ⇝ the same meaning as (24a)

b. % 布蕾妮 { 跟 / 和 } 山 一样 高
% bùléiní { gēn / hé } shān yī-yàng gāo
Brienne { with / and } mountain same tall(-34)
'Brienne is as tall as a mountain (is).'
For speakers that cannot get the metaphorical reading: (25b) sounds weird;
For speakers that can get the metaphorical reading: (25b) = (26b)

Similar to the *gēn*-construction in (25), ***xiàng*-construction** in (26) is also a *same*-based construction. Here it is 像 *xiàng* 'similar', instead of 跟 *gēn* 'with' (or 和 *hé* 'and'), that introduces the comparison standard.

(26) a. 布蕾妮 像 詹姆 一样 高
bùléiní xiàng zhānmǔ yī-yàng gāo
Brienne similar Jaime same tall(-er)
'Brienne is similar to Jaime in being tall.'
Evaluative: ⇝ Both Brienne and Jaime are tall.
b. 布蕾妮 像 山 一样 高
bùléiní xiàng shān yī-yàng gāo
Brienne similar mountain same tall(-er)
'Brienne is as tall as a mountain (is).' ⇝ metaphorical interpretation

Xiàng-constructions in (26) are different from *gēn*-constructions in (25) in two ways. First, while *gēn*-based sentence (25a) is non-evaluative, *xiàng*-based sentence (26a) is rather evaluative. (26a) has a presuppositional requirement (i.e., entails) that Jaime is tall. Second, while *xiàng*-based sentence (26b) has a felicitous metaphorical reading, this kind of metaphorical meaning seems less robust for the *gèn* construction. Thus, for native speakers who cannot get the metaphorical reading for (25b), (25b) simply sounds weird according to our world knowledge.

As addressed earlier in Section 2.1, gradable predicates followed by a measure phrase are ambiguous between a measurement interpretation and a comparative interpretation. Thus (27) illustrates another type of measurement construction and degree question. Obviously, factors like world knowledge and optional presence of perfective marker 了 *le* for the comparative reading can help disambiguate.

(27) a. 布蕾妮 高 6 英尺 3 英寸
bùléiní gāo 6 yīngchǐ 3 yīngcùn
Brienne tall(-er) 6 foot 3 inch
'Brienne is 6 feet 3 inches tall.' ⇝ ✓ **Measurement**; # Comparative
(The comparative reading is ruled out by our world knowledge.)
b. 布蕾妮 高 多少?
bùléiní gāo duō-shǎo
Brienne tall(-er) many/much/more-few/little/less
% **Measurement**: 'how tall is Brienne?' (available for some speakers);
✓ **Comparative**: 'by how much is Brienne taller?' (preferably with 了 *le*)

2.5 Degree expressions based on property nouns

In Chinese, property nouns that convey abstract concepts, e.g., 魅力 *mèi-lì* 'charm', 钱 *qián* 'money', 理智 *lǐ-zhì* 'sense', constitute another common way of encoding the meaning of gradable dimension/scale and forming degree expressions (see also Francez and Koontz-Garboden 2017 for relevant cross-linguistic observations).

These property nouns combine with 有 *yǒu* ('have') to form a gradable-adjective-like phrase (e.g., 有魅力 *yǒu-mèi-lì* 'charming', 有钱 *yǒu-qián* 'rich', 有理智 *yǒu-lǐ-zhì* 'sensible') to be used in the positive reading, comparatives, equatives, and degree questions.[4]

(28) a. 詹姆 有钱 还是 布蕾妮 有钱?
zhānmǔ yǒu-qián hái-shì bùléiní yǒu-qián
Jaime rich(er) or Brienne rich(er)
Alternative Q.: 'Between Jaime and Brienne, who is richer?' ⇝ **Comparative**

b. 詹姆 有钱
zhānmǔ yǒu-qián
Jaime rich(er)
To answer question (28a): 'Jaime is richer.' ⇝ **Comparative** (see also (13c))

(29) a. 詹姆 有 没 有钱?
zhānmǔ yǒu méi yǒu-qián
Jaime have NEG rich(er)
A-not-A question: 'Is Jaime rich?' ⇝ **Positive**

b. 詹姆 有钱
zhānmǔ yǒu-qián
Jaime have-money
To answer question (29a): 'Jaime is rich.' ⇝ **Positive** (see also (14b))

(30) 詹姆 {(很) / 非常 / 极其 / 相当} 有钱
zhānmǔ {(hěn) / fēi-cháng / jí-qí / xiāng-dāng} yǒu-qián
Jaime {(very) / extraodinarily / extremely / quite} have-money
Positive: 'Jaime is {- / very/extremely/quite} rich.' (see also (17) and (18))

(31) 詹姆 比布蕾妮 有钱
zhānmǔ bǐ bùléiní yǒu-qián
Jaime BI Brienne have-money
***bǐ*-comparative**: 'Jaime is richer than Brienne (is).' (see also (20))

(32) 詹姆 有 他的 父亲 那么 有钱
zhānmǔ yǒu tā-de fù-qīn nà-me yǒu-qián
Jaime have his father that-kind have-money
Equative: 'Jaime is as rich as his father (is).' ⇝ **Asymmetric and evaluative**

[4] 有钱 *yǒu-qián* is ambiguous between the meaning of 'rich' (i.e., 钱 *qián* is considered an abstract property) and 'have money' (i.e., 钱 *qián* is considered a kind of real entity). The latter reading cannot be used to form degree expressions (e.g., the positive use in (30), comparatives in (28) and (31), etc.). With the latter reading, 'have money', A-not-A question (29a) means 'Does Jaime have money?' We don't consider this reading here.

(33) 詹姆 有 多 有钱?
zhānmǔ yǒu duō yǒu-qián
Jaime have many/much/more have-money
Degree question: 'How rich is Jaime?' ≠ 'How much money does Jaime have?'

(34) 詹姆 { 跟 / 像 } 他的 父亲 一样 有钱
zhānmǔ { gēn / xiàng } tā-de fù-qīn yī-yàng yǒu-qián
Jaime { with / similar } his father same have-money
Equative: 'Jaime is as rich as his father (is).' (see (25) and (26))

Examples in (28)–(34) illustrate the parallelism between gradable predicates and '*yǒu*+property noun' constructions. They demonstrate the same pattern of ambiguity (between a positive use and a comparative interpretation) and can be used in the same way in forming the positive use, *bǐ* comparatives, equatives, and degree questions.

Different from gradable predicates like 高 *gāo* 'tall, high', '*yǒu*+property noun' constructions are incompatible with measure phrases, and their default positive form does not really require the presence of 很 *hěn*. Moreover, '*yǒu*+property noun' constructions are similar to negative antonyms like 矮 *ǎi* 'short' in assuming an evaluative presupposition for equatives (cf. (23)): i.e., here (32) and (34) presuppose that Jaime's father is rich (see Rett 2015's discussion on the evaluativity of negative antonyms).

2.6 Degree expressions based on mental verbs

In Chinese, mental verbs like 爱 *ài* 'love', 喜欢 *xǐ-huān* 'like', 怕 *pà* 'fear', and 讨厌 *tǎo-yàn* 'dislike' can also be used in degree expressions, with patterns greatly similar to those based on gradable predications or '*yǒu*+property noun' constructions.

Example (35) is parallel with (13) (based on gradable predicate 高 *gāo* 'tall') and (28) (based on '*yǒu*+property noun' construction, 有钱 *yǒu-qián*, 'rich'). With the use of degree modifier 更 *gèng*, sentences in (35) have an undoubted comparative reading. Without the use of 更 *gèng*, some speakers only get the positive interpretation, but, intriguingly, others claim that the comparative interpretation is also possible.

(35) With 更 *gèng*: # positive; ✓ comparative.
Without 更 *gèng*: ✓ positive; % comparative;

	(35a): Alternative question	(35b): to answer question (35a)
Positive	'Who loves reading, Jaime or Terion?'	'Terion loves reading.'
Comparative	'Who loves reading better, Jaime or Terion?'	'Terion loves reading better.'

a. 詹姆 (更) 爱 读书 还是 提利昂 (更) 爱 读书?
zhānmǔ (gèng) ài dú-shū hái-shì tílìáng (gèng) ài dú-shū
Jaime love GENG read-book or Terion GENG love read-book

b. 提利昂(更) 爱 读书
tílìáng (gèng) ài dú-shū
Terion GENG love read-book

In general, degree expressions based on mental verbs, as illustrated in (36)–(41), show the same pattern as corresponding degree expressions based on gradable predicates (see Sections 2.2–2.4) and *yǒu*+property noun' constructions (see Section 2.5).

Mental verbs are more similar to '*yǒu*+property noun' constructions (than to gradable predicates) in that (i) mental verbs are also incompatible with measure phrases, (ii) the positive use based on mental verbs does not require the presence of a semantically bleached 很 *hěn*, and (iii) mental-verb-based equatives are evaluative (see Section 2.5).

(36) a. 提利昂爱 不 爱 读书?
tílìáng ài bù ài dú-shū
Terion love NEG love read-book
A-not-A question: 'Does Terion love reading?' ⇝ **Positive**

b. 提利昂爱 读书
tílìáng ài dú-shū
Terion GENG love read-book
To answer question (36a): 'Terion loves reading.' ⇝ **Positive**

(37) 詹姆 {(很) / 非常 / 极其 / 相当} 爱 布蕾妮
zhānmǔ {(hěn) / fēi-cháng / jí-qí / xiāng-dāng} ài bùléiní
Jaime {(very) / extraodinarily / extremely / quite} love Brienne
Positive: 'Jaime loves Brienne {very much / very much / extremely /quite well}.'
(The presence of 很 *hěn* is not really required, and when present, it is not really semantically bleached.)

(38) 提利昂比詹姆 (更) 爱 读 书
tílìáng bǐ zhānmǔ (gèng) ài dú shū
Terion BI Jaime (better) love read book
Comparative: 'Terion loves reading better than Jaime does.'
(更 *gèng* brings the presupposition that Jaime already loves reading.)

(39) 提利昂有 山姆 那么 爱 读 书
tílìáng yǒu shānmǔ nà-me ài dú shū
Terion have Sam that-kind love read book
Equative: 'Terion loves reading as much as Sam does.'

(40) 提利昂有 多 爱 读 书?
tílìáng yǒu duō ài dú shū
Terion have many/much/more love read book
Degree question: 'To what extent does Terion love reading?"

(41) 提利昂{跟 / 像}山姆 一样 爱 读 书
tílìáng {gēn / xiàng} shānmǔ yī-yàng ài dú shū
Terion {with / similar} Sam same love read book
Equative: 'Terion loves reading as much as Sam does.' (see (25) and (26))

2.7 Interim summary

The empirical data presented in this section is summarized in Table (42).

Evidently, gradable predicates, '*yǒu*+property noun' constructions, and mental verbs are highly parallel in forming degree expressions in Chinese. They all demonstrate an ambiguity between a positive and a comparative interpretation. However, this ambiguity is somehow to a less extent for mental verbs (and even '*yǒu*+property noun' constructions): their positive reading is more readily available, loosening the requirement for a semantically bleached 很 *hěn* in the default positive use.

There is another distinction between gradable predicates, on the one hand, and mental verbs and property-noun-based expressions, on the other hand: the compatibility with measure phrases is only limited to (certain) gradable predicates.

(42) Summary of data:

	Gradable predicate 高 *gāo* 'tall'	**'*yǒu*+property noun'** 有钱 *yǒu-qián* 'rich'	**Mental verb** 爱 (读书) *ài* (*dú-shū*) 'love reading'
Ambiguity between positive and comparative	✓	✓	✓ for some speakers
Positive (+ degree modifiers)	✓	✓	✓
Requiring *hěn*?	Yes	Not really	No
***bǐ*-comparative**	✓	✓	✓
Transitive comparative	available for some predicates	—	—
***yǒu*-based equative**	✓	✓	✓
***yǒu*-based degree question**	✓	✓	✓
***gēn*/*xiàng*-based equative**	✓	✓	✓
Measurement construction	✓	—	—

Based on these data, the next three sections address existing formal semantics research on three fundamental issues: (i) the ambiguity issue and the encoding of comparison, (ii) compositional derivation, and (iii) underlying ontological assumptions.

3 Ambiguity between being positive and comparative

Languages like English make a morphological distinction between the comparative and the positive use of gradable adjectives: e.g., *taller* vs. *tall*. Bobaljik (2012) proposes the cross-linguistic generalization that the comparative form is either the same as or morphologically derived from the positive form.

At first sight, given that the default way of expressing the positive meaning involves a semantically bleached morpheme 很 *hěn* (see Section 2.2), Chinese seems a counter-example to this generalization: e.g., the default positive form 很高 *hěn-gāo* 'tall, high' is derived from 高 *gāo*, which often has a comparative reading 'taller, higher'. However, the ambiguity of 高 *gāo* between meaning 'tall, high' and 'taller, higher' (see Section 2.1) suggests that the underlying story might not be so simple.

After all, how does this ambiguity get resolved? What exactly encodes the operation of comparison in Chinese? Why does the default way of expressing the positive meaning involve a semantically bleached 很 *hěn*?

To address these issues, existing studies can be divided into two lines: those at the **syntax-semantics** interface, and those at the **semantics-pragmaticx** interface.

3.1 Accounts at the syntax-semantics interface

Following Bobaljik (2012)'s generalization, Grano (2012) and Liu (2018), two representative accounts at the syntax-semantics interface, assume that the same core semantics of gradable predicates, which is considered not including the operation of comparison, underlines both the positive and comparative use (see (43)). Then the positive and comparative meanings are derived based on the use of silent or overt operators – POS and COMP (see (44) and (45)). Though Grano (2012) and Liu (2018) basically agree on the lexical semantics of these operators POS and COMP, they differ with regard to the syntactic properties and semantic constraints of these operators.

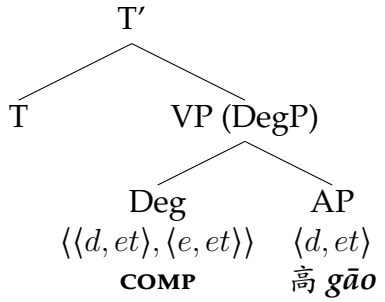
(43) **Gradable predicate**: $[\![\text{高 gāo}]\!]_{\langle d,et\rangle} \stackrel{\text{def}}{=} \lambda d.\lambda x.\textsc{height}(x) \geq d$ (see also (3b))
(A gradable predicate relates a degree and an individual.)
   a. **Positive** meaning is derived from [[高 gāo]] + (silent or overt) [[POS]]
   b. **Comparative** meaning is derived from [[高 gāo]] + (silent or overt) [[COMP]]

(44) **Positive operator**: $[\![\textsc{pos}]\!] \stackrel{\text{def}}{=} \lambda g_{\langle d,et\rangle}.\lambda x.\exists d[g(d)(x) \wedge d > s]$
(Here s denotes a silent, context-dependent free variable, representing a standard value for a certain comparison class along a relevant scale.)

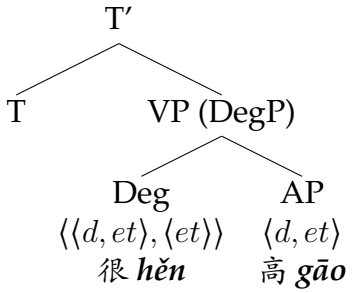
(45) **Comparative operator**: $[\![\textsc{comp}]\!] \stackrel{\text{def}}{=} \lambda g_{\langle d,et\rangle}.\lambda y.\lambda x.\exists d[g(d)(x) \wedge \neg g(d)(y)]$
(i.e., there exists a degree d such that the measurement of entity x reaches d along a scale associated with gradable predicate g, while the measurement of entity y does not reach this degree d along the same scale.)

According to Grano (2012), **(I)** A Chinese gradable predicate like 高 *gāo* 'tall(-er)' is syntactically an AP, smaller than a VP and unable to serve as the complement of a T head; **(II)** Comparative operator COMP is silent but syntactically visible in Chinese – as a projecting head, COMP heads a VP that can serve as the complement of a T head (see (46a)); **(III)** However, silent positive operator POS does not syntactically project, and consequently, for the positive use, a semantically bleached 很 *hěn* is needed to merge with an AP and project to a VP, satisfying the c-selection requirement of T (see (46b)).

(46) a. **Comparative use**:



b. **Positive use**:

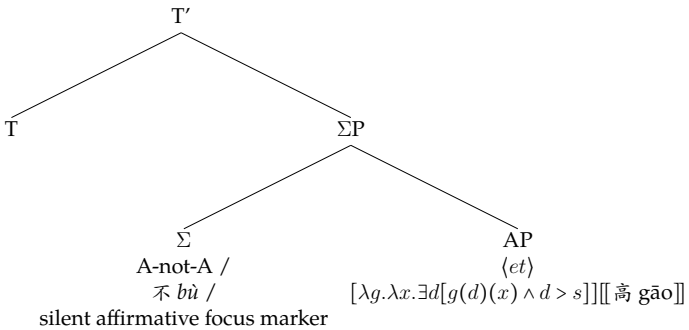


Under this approach, silent operators COMP and POS have different syntactic status: COMP is a zero affix, changing a gradable adjective into a verb, but POS is only a type-shifter. Thus Grano (2012) explains the obligatory presence of 很 *hěn* in the default positive use as a way of avoiding violating the c-selection requirement of T (see (47)).

(47) ?? 布蕾妮 高
?? bùléiní gāo
Brienne tall(-er)
⇝ Without 很 *hěn*, the c-selection requirement of T is violated (cf. (17)).

Grano (2012) suggests that for the positive use, the obligatory presence of 很 *hěn* is similar to the phenomenon of *do*-support. In English, while *do* is syntactically needed in forming negative sentences (e.g., *he didn't come*) and questions (e.g., (*when*) *did he come?*), its presence is not required in positive sentences (e.g., *he came*), and when *do* indeed appears in a sentence like *he did come*, its presence brings an emphasizing meaning. This parallelism explains that 很 *hěn* is not required if there are other elements syntactically able to merge with an AP and project to satisfy the c-selection requirement of T: e.g., negation word 不 *bù* in (19a), an A-not-A construction in (14a),[5] and a silent affirmative focus marker in (14b) (see (48)). When 很 *hěn* indeed appears along with another element that syntactically projects, similar to the use of *do* in *he did come*, 很 *hěn* brings an intensifying meaning, raising the threshold of the standard, as illustrated in (19b).

(48) Syntax of (19a) – 不高 *bù gāo*, (14a) – 高不高 *gāo bù gāo*, and (14b) – 高 *gāo*:



[5] In the term 'A-not-A', 'A' does not mean adjectives. 'A' is a verbal phrase or just its head (see C.-T. Huang et al. 2009 for a detailed discussion on the constructions 'VP-not-VP' and 'V-not-VP').

Moreover, as addressed in Sections 2.5 and 2.6, for the positive use, '*yǒu*+property noun' and mental-verb-based gradable predicates require the presence of 很 *hěn* to a less extent. Presumably, the c-selection requirement of T can already be satisfied by 有 *yǒu* or mental verbs. Thus these data also provide support for this analysis (see Grano 2019).

However, the analysis of Grano (2012) predicts that A-not-A question (49) should be similar to (19b), with the presence of 很 *hěn* bringing an intensifying meaning and leading to the interpretation 'Is Brienne very tall'. This prediction is nevertheless not borne out, and (49) is ungrammatical (cf. (50), which illustrates that a light verb like 打 *dǎ*, a V head, can be reduplicated to form an A-not-A question in Chinese).

(49) * 布蕾妮 很 (高) 不 很 高?
* bùléiní hěn (gāo) bù hěn gāo
Brienne very (tall(-er)) not very tall(-er)
Intended reading: 'Is Brienne very tall?' ⇝ 很高 *hěn gāo* does not seem a VP

(50) 你 打 (电话) 没 打 电话?
nǐ dǎ (diàn-huà) méi dǎ diàn-huà
you make/do (telephone) NEG make/do telephone
'Have you made a call?' ⇝ VP or V head can be used to form an A-not-A question

Liu (2018) proposes that **(I)** Syntactically, both positive and comparative operators in (44) and (45) are realized as projecting degree morphemes, heading a DegP (see also Liu 2010b and N.N. Zhang 2015b); **(II)** Both the positive and comparative morphemes have an overt and a silent allomorph; **(III)** The overt allomorph of POS is 很 *hěn*, and the overt allomorph of COMP is 比较 *bǐ-jiào*; **(IV)** Overt comparative allomorph 比较 *bǐ-jiào* and silent POS are subject to distribution constraints in (51), which, according to Liu (2018), follow independently motivated focus-related constraints in Chinese.[6]

[6] Liu (2018) also mentions that silent comparative allomorph COMP requires a syntactically overt standard of comparison. However, this view seems questionable and at odds with (13c), which has a clear comparative reading in its context but there is no syntactically overt comparison standard. It is unclear whether assuming an ellipsis of a syntactically overt comparison standard can be helpful without introducing over-generations.

With regard to the constraint on 比较 *bǐ-jiào* in (51a), Liu (2018) focuses on its incompatibility with overt comparison standards, and thus explains why the use of 比较 *bǐ-jiào* is ungrammatical in *bǐ*-comparatives and transitive comparatives (see Section 2.3). Actually, other markers of comparatives, including overt numerical differentials or aspectual marker 了 *le*, are also incompatible with 比较 *bǐ-jiào*, as shown example (i):

(i) (和 詹姆 相比) 布蕾妮 比较 高 (* 了) (* 一英寸)
(hé zhānmǔ xiāng-bǐ) bùléiní bǐ-jiào gāo (*le) (*yī yīngcùn)
(with Jaime compare) Brienne COMP tall(-er) (*-PRF) (*1 inch)
'(Compared with Jaime), Brienne is taller.' (For some speakers: 'Brienne is relatively tall.')

Some native speakers's intuition suggests that 比较 *bǐ-jiào* might not be a comparative operator at all, but rather a degree modifier similar to English *relatively* or *comparatively*. For these speakers, (i) means rather 'Brienne is relatively tall', i.e., a positive interpretation. Below, this article leaves these issues aside.

(51) a. Overt 比较 *bǐ-jiào* is incompatible with other overt markers of comparatives.
b. Silent POS is only compatible with a focused gradable predicate.

Evidently, the empirical generalization that Chinese bare gradable predicates have a comparative reading can be explained by the availability of silent COMP, and the generalization that the default positive reading in Chinese needs the presence of 很 *hěn* can be explained by a limited distribution of silent POS (see (51b)).

In particular, the presence of 很 *hěn* is required in the default positive use because, in this kind of case, a gradable predicate is not focused. On the other hand, in a negative sentence like (19a) ('Brienne is not tall'), with a gradable predicate targeted by a focus sensitive item – here negation word 不 *bù*, the presence of 很 *hěn* is not required.

The use of silent POS and silent COMP provides an account for the ambiguity of the sentence (13c)/(14b). In (14), the interpretation of the A-not-A question (14a) and its answer (14b) is built on the alternative set {tall, not tall}, and with a focused gradable predicate here, an overt 很 *hěn* is not required for the positive reading. In contrast, in (13), the questions (13a)/(13b) and their answer (13c) address who between Jaime and Brienne is taller, and their interpretation is thus built on the alternative set {Brienne, Jaime}. The gradable predicate is not focused in this case, ruling out the use of silent POS, thus leading to a comparative interpretation.

The connection between focus and a positive interpretation of bare gradable predicates is a great observation and worthy of further follow-up. However, the current analysis of Liu (2018) also makes problematic predictions. For example, in (52), the question and the answer are built on the alternative set {mom, dad, …}, without focusing the gradable predicate 聪明 *cōngmíng*. Thus the use of silent POS is predicted to be ruled out. However, (52) still has a clear positive reading.

(52) Q: 谁 夸 你 聪明? A: 妈妈 夸 我 聪明.
shéi kuā nǐ cōngmíng māmā kuā wǒ cōngmíng
who praise you clever(-er) mom praise me clever(-er)
'Who praises you for being clever?' 'Mom praises me for being clever.' ⇝ positive

Among other works addressing the syntax and/or semantics of 很 *hěn* and gradable predicates, precursors of Grano (2012)'s syntax-based account include Dong (2005) and Gu (2008), which consider 很 *hěn* a kind of aspect/tense marker. N.N. Zhang (2015b) also provides more evidence arguing that syntactically, 很 *hěn* is a projecting head. The connection between focus and the interpretation of Chinese gradable predicates is also investigated in Liu (2010b). In addition, S.-Z. Huang (2006) analyzes gradable predicates as nominalized properties of type e and proposes that 很 *hěn* is a type-shifter (of type $\langle e, et\rangle$), turning nominalized properties into predicates of type $\langle et\rangle$, but the comparative use of gradable predicates is left unaccounted for.

It is worth noting that the view of requiring overt or silent operators to generate a positive/comparative interpretation of gradable predicates and considering 很 *hěn* a positive marker is adopted by more works (e.g., Sybesma 2013, Lin 2014, Cao and Hu

2020). However, in general, the positive reading is not overtly marked across languages, making such a view dubious (see Rett 2015 for more discussion on the positive reading).

3.2 Accounts at the semantics-pragmatics interface

Krasikova (2008) and L. Zhang (2019), two accounts at the semantics-pragmatics interface, assume that the core semantics of gradable predicates already includes the meaning of comparison, and both the positive and comparative interpretation involve a contextually provided standard of comparison.

Both Krasikova (2008) and L. Zhang (2019) analyze the meaning of a gradable predicate as a relation among three items, addressing **the distance/difference** between the measurement of **an individual** and **a standard value** along a relevant scale (see (53)).[7]. The distinction between the positive and the comparative interpretation consists in the standard of comparison. L. Zhang (2019) points out that the standard involved in a comparative reading has discourse salience, and the standard involved in a positive reading lacks discourse salience (see also L. Zhang and Ling 2021).

(53) $[\![\text{高 gāo}]\!]_{\langle d,\langle d,et\rangle\rangle} \overset{\text{def}}{=} \lambda\sigma_d.\lambda\delta_d.\lambda x_e.\textsc{height}(x) - \sigma = \delta$ (from Zhang 2019)
σ: the **standard** in a comparison; δ: the **difference** in a comparison

	σ (standard)	δ (difference)
Positive	without discourse salience (often overtly marked by *hěn*)	always unspecified
Comparative	with discourse salience (covert or overt)	optionally specified (covert or overt)

Based on this understanding of gradable predicates, Krasikova (2008) analyzes 很 *hěn* as a modifier of the comparison standard σ, raising an original value σ to a higher, unspecified value σ' (see (54)). Thus the semantics of 很 *hěn* is the same as English *very*. With this unspecified standard σ', naturally, the distance to it can never be specified.

(54) $[\![\text{很 hěn}]\!]_{\langle dd\rangle} \overset{\text{def}}{=} \lambda\sigma_d.\sigma'$ (such that $\sigma' > \sigma$)

According to the pragmatic accounts of Krasikova (2008) and L. Zhang (2019), (55a), which has a specified difference *one inch*, is clearly a comparative sentence, and the interpretation requires a discourse salient standard value, pragmatically provided by HEIGHT(Jaime) here. In contrast, in (55b), the use of 很 *hěn* raises the standard from the contextually provided value HEIGHT(Cersei) to an unspecified higher value, yielding a standard value without discourse salience and leading to a positive interpretation.

[7] The implementation of Krasikova (2008) is slightly different from the one in (53) and (54). In particular, Krasikova (2008) analyzes a comparison standard as an interval (of type $\langle dt\rangle$), which is adapted into a degree (of type d) in this article for presentation simplicity. See also L. Zhang and Ling (2021) for an interval-based implementation and **??** in Section 6).

(55) a. 比起 詹姆，布蕾妮 高 一 英寸
bǐ-qǐ zhānmǔ bùléiní gāo yī yīngcùn
compared-with Jaime Brienne tall(-er) one inch
'Compared with Jaime, Brienne is one inch **taller**.' ⇝ **Explicit comparison**
Standard σ = HEIGHT(Jaime); **Difference** δ = 1″

b. 比起 瑟曦，布蕾妮 很 高
bǐ-qǐ sèxī bùléiní hěn gāo
compared-with Cersei Brienne very tall(-er)
'Compared with Cersei, Brienne is **tall**.' ⇝ **Implicit comparison**
Standard σ is an unspecified value exceeding HEIGHT(Cersei);
Difference δ is an unspecified positive value

Krasikova (2008) explains the requirement of 很 *hěn* in a positive sentence and its general absence in the negation as a case of Grice's Quantity Maxim: Speakers prefer to make a strong claim. Thus the use of 很 *hěn* in a positive sentence does not make a substantial difference to truth conditions, but rather emphasizes the strength of the claim. Then in the negation of a positive sentence, since the use of 很 *hěn* weakens a claim (e.g., with $\sigma' > \sigma$, 'not taller than σ'' is less informative, i.e., weaker, than 'not taller than σ'), the emphasizing effect of 很 *hěn* is lost, and thus 很 *hěn* is generally absent.

L. Zhang (2019) explains the practice of using 很 *hěn* as a kind of Rational Speech Act: Speakers and listeners reason about each other's reasoning to communicate **literal** and **likely** interpretations. Without 很 *hěn*, the literal interpretation of a gradable predicate is ambiguous between being positive and comparative. Since the use of 很 *hěn* can disambiguate and lead to a positive reading, if this disambiguating marker is not used, most likely, it is the comparative reading that interlocutors intend to convey. This mechanism explains why a bare gradable predicate is more likely to convey a comparative meaning and the presence of 很 *hěn* is often required in the expression of a positive meaning. L. Zhang (2019) further extends this explanation to sentences with overt numerical differentials, accounting for their literal ambiguity between a comparative and a measurement reading and the mechanism of disambiguation.

For the pragmatic accounts, a remaining issue is why such an emphasizing modifier like 很 *hěn* is not required in other languages. Presumably, in English, the use of comparative morpheme *-er*/*more* already contributes to making a distinction between a positive and comparative reading (as well as between explicit vs. implicit comparison, see the translation in (55)), and thus English *very* is not so much needed to play this kind of disambiguating role. However, the almost obligatory presence of such a disambiguating item like 很 *hěn* is not observed in other comparative-morpheme-less languages like Japanese or Korean either. Therefore, this issue still remains.

Another related issue is why, even in Chinese, the presence of 很 *hěn* is required to a less extent in the positive interpretation of mental verbs and '*yǒu*+property noun' constructions. An answer to this issue might also help shed light on the above-mentioned issue on cross-linguistic differences.

4 Compositional derivation of Chinese comparatives

4.1 *bǐ*-comparatives: phrasal comparatives or clausal comparatives?

English has two kinds of comparatives: **phrasal comparatives** and **clausal comparatives**, as evidenced by the contrast in (56). (56a) shows scope ambiguity, while (56b) does not, arguing against the view that (56a) is derived from (56b) with an ellipsis (see also e.g., Heim 1985, Larson 1988, Kennedy 1999, Schwarzchild and Wilkinson 2002).[8] Thus English data motivate two kinds of comparatives and two kinds of semantic analyses.

(56) a. Someone is smarter than everyone. **Phrasal comparative**: ✓∃ > ∀; ✓∀ > ∃
b. Someone is smarter than everyone is. **Clausal comparative**: ✓∃ > ∀; #∀ > ∃

As addressed in Section 1.1, based on the existence of subcomparatives, the semantic analysis of clausal comparatives involves (i) the assumption of elided gradable adjectives in *than* clauses, (ii) lambda abstraction over degree variables, and (iii) a comparison operator, *-er*, that works like a quantificational determiner (e.g., *every* of type $\langle\langle et\rangle,\langle et,t\rangle\rangle$) and relates two sets of degrees (see (57)). However, for a phrasal comparative, the above points (i) and (ii) are not motivated, and *-er* is proposed to perform comparison directly between two individuals (see e.g., Heim 1985, Bhatt and Takahashi 2007, and implementations in (58)).

(57) In a clausal comparative, $[\![\text{-er}]\!]_{\langle\langle dt\rangle,\langle dt,t\rangle\rangle} \stackrel{\text{def}}{=} \lambda D_1.\lambda D_2.\exists d[d \in D_2 \wedge d \notin D_1]$ (see (7))

(58) In a phrasal comparative, $[\![\text{-er}]\!] \stackrel{\text{def}}{=} \lambda g_{\langle ed\rangle}.\lambda x.\lambda y.g(y) > g(x)$ (see (3a) for g)
Alternatively, $[\![\text{-er}]\!] \stackrel{\text{def}}{=} \lambda g_{\langle d,et\rangle}.\lambda x.\lambda y.\exists d[g(d)(y) \wedge \neg g(d)(x)]$ (see (3b) for g)

With regard to Chinese data, there has been a hot debate on how to compositionally derive the semantics of *bǐ* comparatives: Are they phrasal comparatives or clausal comparatives? More specifically, are there elided gradable predicates? Is there lambda abstraction over degree variables? What does a comparison operator do?

Advocates of the 'phrasal comparative' view include Xiang (2003, 2005), Erlewine (2007), Krasikova (2008), Lin (2009, 2019). There are at least two pieces of empirical evidence in support of this view. First, as illustrated in (59), subcomparatives are unavailable in Chinese, suggesting that *bǐ* comparatives cannot involve a two-clausal construction with the ellipsis of one gradable predicate. Otherwise, an elided gradable predicate should be able to be put back, and at least one of (59a) and (59b) should be good. Second, as illustrated in (60), unlike English *than*, Chinese *bǐ* has to be followed by a nominal expression. In (60), the use of nominalization marker 的 *de* is obligatory, yielding a relative clause which literally means 'what I imagine'. The obligatory presence of this nominalization marker suggests that there are only *bǐ*-phrases, but no *bǐ*-clauses.

[8] Suppose that A is smarter than B in solving mathematical problems, while B is smarter than A in playing violin. Then the '∀ > ∃' reading of (56a) is true under this context, i.e., for each individual x, there is someone smarter than x. Clausal comparative (56b) lacks this inverse scope reading.

(59) Intended meaning: 'This table is longer than that door is wide.' (subcomparative)

a. * 这 张 桌子 比那 扇 门 宽 长
zhè zhāng zhuō-zi bǐ nà shán mén kuān cháng
this CLASSIFIER table BI that CLASSIFIER door wide(-r) long(-er)

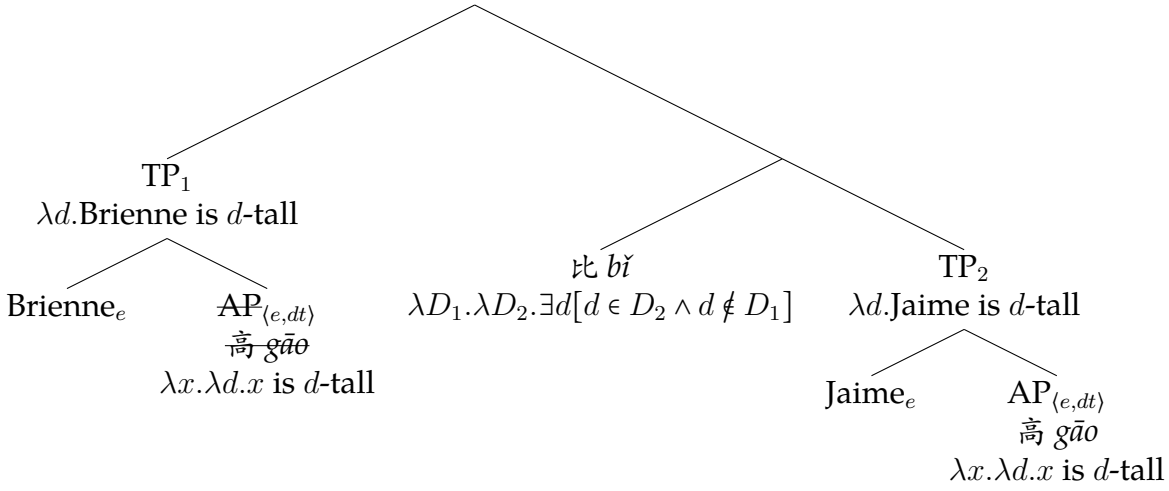
b. * 这 张 桌子 长 比那 扇 门 宽
zhè zhāng zhuō-zi cháng bǐ nà shán mén kuān
this CLASSIFIER table long(-er) BI that CLASSIFIER door wide(-r)

(60) 布蕾妮 比我 想象 *(的) 富有
bùléinì bǐ wǒ xiǎng-xiàng *(de) fù-yǒu
Brienne BI I imagine *(DE) rich(-er)
'Brienne is richer than I imagine.' Literal: 'Brienne is richer than what I imagine'

Advocates of the 'clausal comparative' view include Tsao (1989), Liu (1996, 2011, 2014), Luo (2017), Hsieh (2017), Erlewine (2018). In Erlewine (2018), a most recent account of this view, the derivation of a *bǐ*-comparative involves (i) a two-TP construction and (ii) the obligatory deletion of one instance of the gradable predicate. Lambda abstraction of a degree variable is not involved. 比 *bǐ* performs comparison just as *-er* does in English clausal comparatives (see (57)). According to Erlewine (2018), the unavailability of subcomparatives is due to the above-mentioned obligatory deletion: with this deletion, it is impossible to recover a gradable predicate different from the one overtly expressed. However, Lin (2019) points out that this is a stipulation: Why isn't there a similar obligatory deletion in English comparatives?

(61) 布蕾妮 比詹姆 高
bùléiní bǐ zhānmǔ gāo
Brienne BI Jaime tall(-er)
'Brienne is taller than Jaime (is).' (see (20))

$\exists d[d \in \{d \mid 0 < d \leq \text{HEIGHT}(\text{Brienne})\} \wedge d \notin \{d \mid 0 < d \leq \text{HEIGHT}(\text{Jaime})\}]$



Moreover, Lin (2019) shows that Erlewine (2018)'s analysis leads to problematic predictions. For example, (62), with a downward-entailing quantifier 没人 *méi rén* 'no one', is predicted to be trivially true in any context, contradicting our intuition.

(62) 没人 比詹姆 富有
méi-rén bǐ zhānmǔ fù-yǒu
No-one BI Jaime rich(-er)
'No one is richer than Jaime (is).' ⇝ Jaime is the richest
Erlewine (2018)'s analysis: $\exists d[d \in \{d \mid \neg\exists x[x \text{ is } d\text{-rich}]\} \wedge d \notin \{d \mid \text{Jaime is } d\text{-rich}\}]$
⇝ A too weak truth condition: true even in a context where Jaime is the poorest

It is worth noting that examples in (63) are often used to support the 'clausal comparative' view, because it seems difficult for a phrasal-based account to derive their meaning. (63a) compares 'how I did in today's maths test' with 'how you did in yesterday's physics test', and each of the two bracketed parts needs to be interpreted along with 'did well/better in a/the test', suggesting a two-TP construction plus deletion. Similarly, (63b) compares 'how fast Zhāng Sān runs' with 'how fast an airplane flies', and each of the two bracketed parts needs the gradable predicate 快 *kuài* 'fast(er)' for interpretation. However, as claimed by Lin (2019), a phrasal-based account does not necessarily require that compared items conjoined by 比 *bǐ* are themselves constituents.

(63) a. [我 今天 数学] 比[你 昨天 物理] 考 得 好
[wǒ jīn-tiān shù-xué] bǐ [nǐ zuó-tiān wù-lǐ] kǎo de hǒo
[I today maths] BI [you yesterday physics] exam DE good/better
'I did better in today's maths test than you did in yesterday's physics test.'
b. [张三 跑 得] 比[飞机 飞 得] 快
[zhāng-sān pǎo de] bǐ [fēi-jī fēi de] kuài
[Zhāng Sān run DE] BI [airplane fly DE] fast(-er)
'Zhāng Sān runs faster than an airplane flies.'

Presumably, as proposed in Krasikova (2008) and L. Zhang (2019) (see Section 3.2), in a comparative, items undergoing comparison can be provided by context, instead of syntactically integrated into the structure of a sentence and allowing for lambda abstraction over degree variables. Combined with this view, a phrasal based account can also derive the semantics of (63a) and (63b) (see Lin 2009 for an analysis of examples like (63a)). As for their syntax, examples in (63) are not cross-linguistically unique in conjoining parallel non-constituents. (64) is an English example. Here the two bracketed non-constituents are conjoined by *and*, and the interpretation of this sentence argues against a 'two-clause construction plus deletion' analysis (see e.g., L. Zhang 2015a, Kubota and Levine 2015 for more discussion).

(64) [Mary caught] and [John cooked] the same fish.
↛ Mary caught the same fish and John cooked the same fish.

The 'clausal comparative' view also faces a technical issue. The gradable predicate in a *bǐ*-comparative has a comparative interpretation, not a positive interpretation (e.g., 高 *gāo* in (61) means 'taller', not 'tall'). However, the assumption of a 'two-clause' construction would further require to adopt a positive interpretation for the gradable predicate involved, bringing new trouble for compositional derivation.

In addition, given that under a certain context, a Chinese gradable predicate can independently have a comparative reading (see Section 2.1), without relying on the presence of a *bǐ*-expression, it cannot be the particle 比 *bǐ* that performs comparison (cf. Erlewine 2018's analysis in (61)).

To sum up, arguments in existing studies are in favor of the 'phrasal comparative' view for Chinese *bǐ*-comparatives. The compositional derivation of a *bǐ*-comparative does not involve elided gradable predicates or lambda abstraction over degree variables.

4.2 Transitive comparatives

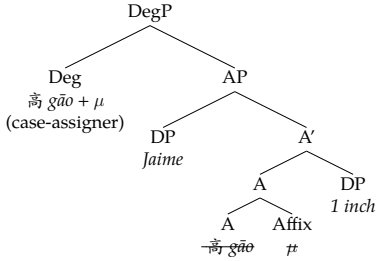
Compared with other types of comparatives (see e.g., (13) and *bǐ*-comparatives), transitive comparatives are special in that (i) they require an obligatory presence of measure phrases to specify differences, and (ii) only a small subset of gradable predicates, typically monosyllabic, high-frequency ones, can be used in this construction (see Chao 1968, Xiang 2005, Liu 2007, Erlewine 2007, Grano and Kennedy 2012 for more discussion on the data).

Grano and Kennedy (2012) proposes a case-based account, with the assumptions that (i) in a transitive comparative, the DP serving as comparison standard needs to be assigned case, but (ii) Chinese gradable predicates like 高 *gāo* 'tall(-er)' are not transitive verbs and cannot assign case. Thus Grano and Kennedy (2012)'s proposal consists of (i) taking away the degree argument slot from the core meaning of a gradable predicate (see (65a)) and (ii) using a covert morpheme μ that semantically introduces a degree argument for the measure phrase and syntactically assigns case to the comparison standard (see (65b)). Then as shown in (66) ('1 inch taller than Jaime'), with an A-to-Deg movement in (66a), '高 *gāo*+μ' directly assigns case to the standard DP, here *Jaime*; then without this movement, 比 *bǐ* is inserted in (66b) to play the role of case-assigner.

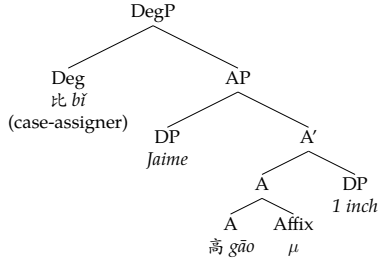
(65) a. $[\![\text{高 gāo}]\!]_{\langle ed\rangle} \stackrel{\text{def}}{=} \lambda x.\textsc{height}(x)$ i.e., [[高 gāo]] is simply a measure function

b. $\mu \stackrel{\text{def}}{=} \lambda g_{\langle ed\rangle}.\lambda d.\lambda x.\lambda y.g(y) - g(x) \geq d$ (adapted for presentation simplicity)

(66) a. **movement**: gāo Jaime 1″



b. **no movement**: bǐ Jaime gāo 1″



The analysis of Grano and Kennedy (2012) has a problem. Essentially, the proposal of μ is to satisfy a case assignment requirement, and μ's own need for a measure phrase to serve as its degree argument seems a by-product. Then for bare gradable predicates with a comparative reading as well as *bǐ*-comparatives, where a measure phrase for specifying the differential is optional (see Table (67)), why doesn't this μ require an overt measure phrase? If we assume that a silent, unspecified measurement (or a contextually provided value) can serve as the degree argument of μ, then we still leave the obligatory presence of a measure phrase in transitive comparatives unaccounted for.

(67) Comparing various comparative constructions:

Constructions	**overt differential?**	**overt standard?**	**case assigner?**	更 ***gèng*?**
bare gradable predicates	optional	no	NA	compatible
bǐ comparatives	optional	yes	比 *bǐ*	compatible
transitive comparatives	required	yes	covert μ	incompatible

Another related issue is the incompatibility between the presence of 更 *gèng* and an overt measure phrase (see (21)). Grano and Kennedy (2012) claims that this incompatibility explains why 更 *gèng* cannot be used in a transitive comparative, which always requires the overt presence of a measure phrase. However, this incompatibility itself still remains a puzzle (see Liu 2010a for more discussion on 更 *gèng*).

5 Ontological assumptions of scales and degrees

Comparatives in natural language support the expression of measurable differences, e.g., *Brienne is 1 inch taller than Jaime* addresses how much the difference between their heights is (see Section 1.1). Thus according to Stevens (1946)'s theory on the ontology of scales (see Table (68)), the semantics of comparatives requires scales equipped with not only ordering, but also units, i.e., interval scales. Do various Chinese degree expressions assume the same kind of ontology of scales and degrees? This section explores two groups of Chinese data that lead to reflections on the ontological assumptions of scales and degrees.

(68) Stevens (1946)'s 4-level distinction of scales:

Scales	**Examples**	**Mathematical properties**
nominal scales	postal codes	$\neq$ is defined
ordinal scales	my preference ranking of ice cream flavors	with **ordering** i.e., $>, \geq, <, \leq$ are defined
interval scales	time, temperature	with **ordering**, **units** i.e., differences are measurable
ratio scales	temporal length	with **ordering**, **units**, **absolute zero**

5.1 Differential verbal comparatives and *yǒu*-based degree expressions

Li (2015) studies a special type of comparatives: **differential verbal comparatives**.[9] As illustrated in (69), a differential verbal comparative contains a non-gradable verb (here 读 *dú* 'read'), a gradable predicate 多 *duō* 'many/much/more' or 少 *shǎo* 'few/little/less', and a (definite) DP that serves as the differential (here *this book* or *Moby Dick*). These sentences express comparison between 'what he read' (the comparison standard) and 'what I read' and indicate that the difference consists in 'this book' (or '*Moby Dick*').

As pointed out by Li (2015), the comparison in differential verbal comparatives is performed along **a scale of quantity/amount**, requiring the use of gradable predicates 多 *duō* 'many/much/more' or 少 *shǎo* 'few/little/less'. Other gradable predicates (e.g., 快 *kuài* 'fast(-er)') cannot be used to form differential verbal comparatives. The differential is not necessarily a definite DP. Indefinite DPs like 一本书 *yī běn shū* 'one book' or measure phrases like 三页 *sān yè* 'three pages' can serve as differential as well.

(69) Context: He read *Anna Karenina* and *The Great Gatsby*, while I read *Anna Karenina*, *The Great Gatsby*, and *Moby Dick*.

a. % 我 比他 多 读 了 { 这 本 书 / Moby Dick}
wǒ bǐ tā duō dú le { zhè běn shū / Moby Dick}
I BI he many/much/more read PRF { this CLASSIFIER book / Moby Dick}
'Compared to what he read, I read something more – { this book / *MD* }.'

b. % 他 比我 少 读 了 { 这 本 书 / Moby Dick }
tā bǐ wǒ duō dú le { zhè běn shū / Moby Dick }
he BI I few/little/less read PRF { this CLASSIFIER book / Moby Dick }
'Compared to what I read, he read something less – { this book / *MD* }.'

Li (2015) proposes a degreeless account for (69a). As shown in (70), there is some entity y such that (i) 'y is *Moby Dick*' and 'I read y' hold true, and (ii) for each entity x such that 'he read x' holds true, there is a corresponding x' such that (ii-a) 'I read x'' also holds true, and (ii-b) there is no overlap between x' and y.[10]

(70) $[\![(69a)]\!] \Leftrightarrow \exists y[y = \text{MD} \wedge \text{read(I)}(y) \wedge \forall x[\text{read(he)}(x) \rightarrow$
$\exists x'[\text{read(I)}(x') \wedge \text{x' corresponds to x} \wedge \text{ no overlap between } x' \text{ and } y]]]$

Under this analysis, comparison involves (i) a correspondence mapping and (ii) the notion of non-overlap in mereology (similar to set difference in set theory). A definite DP that serves as the differential (e.g., *this book* in (69a)) refers to a non-overlap part. Thus

[9] Not all native speakers accept this type of comparatives, as indicated by the '%' marker in (69).

[10] The establishment of corresponding mapping is often context-dependent. Suppose I read *Emma* and *Ulysses*, and he read *Middlemarch*. *Compared to what he read, I read something more – Emma* is false here, because when the differential, *Emma*, is a specific novel, it seems problematic to establish a mapping between *Ulysses* and *Middlemarch*. However, *I read one more novel than he did* is true under this context. Here the differential is *one novel*, with details ignored, making it smooth to establish a correspondence mapping between the one novel he read and one of the two novels I read (see Li 2015 for more discussion).

items undergoing comparison (e.g., 'what I read', AK ⊕ GG ⊕ MD, vs. 'what he read', AK ⊕ GG) are not elements of an interval scale (i.e., number-like degrees).

Can this 'degree-less comparison' view be extended to account for other degree expressions so that eventually, the assumption of interval scales can be dropped?

As illustrated by measurement/possession constructions in (71) and degree questions on degrees/quantities in (72), there is a parallelism between *yǒu*-based degree expressions and possession expressions, suggesting that Chinese gradable predicates can be considered mass noun and analyzed in terms of possession.[11]

(71) a. 布蕾妮 有 6 英尺 高
bùléiní yǒu 6 yīngchǐ gāo
Brienne have 6 foot tall(-er)
Measurement construction: 'Brienne has 6 feet of tallness.' ⇝ 'She is 6' tall.'

b. 布蕾妮 有 3 匹 马
bùléiní yǒu 3 pǐ mǎ
Brienne have 3 CLASSIFER horse
Possession construction: 'Brienne has 3 horses.'

(72) a. 布蕾妮 有 多 高?
bùléiní yǒu duō gāo(er)
Brienne have many/much/more tall(-er)
Degree q.: 'How much tallness does Brienne have?' ⇝ 'How tall is she?'

b. 布蕾妮 有 几 英尺 高?
bùléiní yǒu jǐ yīngchǐ gāo(er)
Brienne have what-number foot tall(-er)
Degree q.: 'How many feet of tallness does she have?' ⇝ 'How tall is she?'

c. 布蕾妮 有 几 匹 马?
bùléiní yǒu jǐ pǐ mǎ
Brienne have what-number CLASSIFIER horse
Degree q.: 'How many horses does Brienne have?'

With this view, a comparative like (73) compares 'how much tallness Brienne has' and 'how much tallness Jaime has', meaning that the measurement of a non-overlap part between these two items under comparison is 1 inch.

(73) Brienne is 1 inch taller than Jaime. ⇝ Brienne has 1' more tallness than Jaime has.
[[(73)]] ⇔ $\exists y[\mu(y) = 1'' \wedge \text{tallness}(y) \wedge \text{possess(Br)}(y) \wedge \forall x[\text{possess(Ja)}(x) \rightarrow \exists x'[\text{possess(Br)}(x') \wedge$x' corresponds to x$\wedge$ no overlap between x' and y]]]

Compared to differential verbal comparatives in (69), comparison in (73) involves not only a correspondence mapping and the notion of non-overlap, but also a measure function μ. Then what is the ontological assumption of μ? This issue is still under debate.

[11] '*yǒu*+property noun' constructions (see Section 2.5) also seem to provide support for this view (though see Francez and Koontz-Garboden 2017 for a more detailed discussion).

On the one hand, if the output set of a measure function only needs to have orderings (i.e., an ordered set of equivalence classes), then the assumption of ordinal scales is sufficient (see e.g., Cresswell 1976).

On the other hand, given that the use of this measure function μ in comparative sentences like (73) conceptually relies on the existence of a non-overlap, the existence of an absolute zero is actually assumed. According to Stevens (1946) (see Table (68)), this means that the assumption of ratio scales is necessary. Actually, based on data like *this horse is twice as tall as that dog* (dubbed as ratio equatives), Sassoon (2010) argues that the assumption of ratio scales is needed in natural language semantics anyway. Thus most likely, even though differential verbal comparatives lead to a new analysis of comparatives, the assumption of interval scales (or even ratio scales) cannot be dropped.

5.2 Equatives with a metaphorical reading

Although the assumption of interval scales and a 'degree as number' view is needed in natural language (see also the discussion in Section 5.1), based on Chinese *xiàng*-equatives (see (26b), repeated here as (74)), L. Zhang (2020) argues that another ontology of scales and degrees is also needed.

The most natural interpretation of (74) is a metaphorical reading, felicitous and true under a context where Brienne measures 6 feet 3 inches tall, while mountains are generally above 1000 feet. *Xiàng*-equative (74) does not mean that Brienne and mountains literally share the same degree along a scale of height, but rather that they give **the same kind of impression** in being tall, with the same **manner** (i.e., **qualitatively similar** in being, e.g., strong, firm, and reliable) and to the same **extent** (i.e., **quantitatively similar** in being impressive – among humans, Brienn is impressively tall, while among various objects, mountains are also impressively tall).

(74) 布蕾妮 像 山 一样 高
bùléiní xiàng shān yī-yàng gāo
Brienne similar mountain same tall(-er)
'Brienne is as tall as a mountain (is).' ⇝ metaphorical interpretation

This metaphorical reading would be impossible if degrees in natural language semantics are always number-like items on a single-dimensional scale. Thus L. Zhang (2020) proposes a dual ontology of degrees. While comparatives with numerical differentials require **single-dimensional** interval scales (i.e., scales with units) and **number-like degrees**, *xiàng*-equatives require rather **multi-dimensional** scales and **kind-like degrees** (see e.g., Anderson and Morzycki 2015 for more discussion).

6 General discussion

Compared with the canonical theory of degree semantics (see (9)), research on Chinese degree phenomena raises at least two crucial questions: (i) How is comparison performed? (ii) Does a comparative morpheme like English *-er* perform comparison?

For the first question, within the canonical theory, comparison essentially means computing/measuring **the difference between two measurements**. For the difference to be computable or measurable, the two measurements undergoing comparison need to be degrees on the same interval scale. Then according to Li (2015), comparison essentially means **the measurement of a (non-overlapping) difference**. Thus what undergoes comparison is not degrees, but rather two entities or mass-like objects, and only one measurement (i.e., mapping a non-overlap part to a degree value) eventually takes place. The view of Li (2015) is based on part-whole relationship, but when items like temperatures or time points are involved in comparison, it is questionable whether there is part-whole relationship between items under comparison (e.g., for (75b), suppose the scheduled arrival time of the train is 3:05, then it is conceptually weird to consider that the actual arrival at 3:00 possesses lateness or even more lateness than my leaving).

(75) a. Moscow is cold now, but still 5 degrees warmer than Montreal.
b. The train arrived at 3 o'clock, 1 hour later than I left the station.

However, the view of Li (2015) indeed contributes new insight on cross-linguistic comparison-related phenomena. The comparison in (76) addresses a non-overlapping part in part-whole relationship, between depression and the entirety brought by war (see also Thomas 2010, Greenberg 2010, L. Zhang and Ling 2021 for relevant discussion).

(76) War brings depression. What is **more**, it brings chaos.

For the second question, within the canonical theory, comparative morphemes like English *-er* have a semantics of type $\langle \alpha, \alpha t \rangle$, relating items under comparison and performing comparison between them. However, according to Krasikova (2008) and L. Zhang (2019), gradable predicates already include the meaning of comparison, and no further overt operator is needed. Then for languages with an overt comparative morpheme, do their gradable predicates also include the meaning of comparison? If so, why is comparison still overtly marked by comparative morphemes?

Actually, the often adopted lexical semantics of English gradable adjectives (see (77)) already includes a comparison operator '$\geq$'. Examples like (76) and (78) also suggest that comparative morphemes probably should not be analyzed as an operator of type $\langle \alpha, \alpha t \rangle$.

(77) $[\![\text{tall}]\!] \stackrel{\text{def}}{=} \lambda d.\lambda x.\textsc{height}(x) \geq d$ (= (3b))

(78) The sooner the better.
$\rightsquigarrow$ *-er* means a differential or increase, and here one increase correlates with another increase (see also Brasoveanu 2008 for more discussion).

Then if comparative morphemes like *-er* are not themselves comparison operators, what would be their semantic contribution? Examples like (76) and (79) suggest that the meaning of *more* is similar to that of *another* in bringing an additive presupposition: both words mark increases on a presupposed value or entity. L. Zhang and Ling (2021) adopts this view on English *-er* and develops a new analysis of English comparatives.

(79) a. Mary ate **an** apple and drank **some** water. **without presupposition**
b. Mary ate **another** apple and drank **more** water. **with presupposition**

Under the canonical view on comparative morphemes, Chinese lacks such morphemes that work as comparison operator (of type $\langle \alpha, \alpha t \rangle$. Then if comparison is never performed by an overt operator, and morphemes like *-er* are actually similar to *another* in bringing an additive presupposition, then Chinese seems to have a counterpart of English *-er*. Liu (2010a) claims that 更 *gèng* is a presupposition trigger in Chinese comparatives (see (21)). The similarities and differences between Chinese 更 *gèng* and English *-er* need to be further investigated.

Finally, the canonical view on *-er* leads to a parallelism between comparison operator (of type $\langle \langle dt \rangle, \langle dt, t \rangle \rangle$) and quantificational determiners (of type $\langle \langle et \rangle, \langle et, t \rangle \rangle$), which further implicate the analysis of the compositional derivation of comparatives. With regard to this issue, Beck et al. (2009) proposes that languages vary on whether they allow for lambda abstraction over degree variables. A new view on the semantics of *-er* also invites a rethinking of this parameter. Presumably, lambda abstraction over degree variables is only motivated by the syntax of English clausal comparatives, but not a necessary component in the encoding of comparison in natural language.

7 Concluding remarks

In conclusion, this article presents major empirical data on degree expressions in Mandarin Chinese, focusing on the ambiguous interpretations of gradable predicates, the obligatory presence of 很 *hěn* in the default positive use, comparatives (e.g., *bǐ*-comparatives and transitive comparatives), equatives (e.g., *yǒu*-based constructions, *gēn*-equatives, *xiàng*-equatives), gradable predicates with mental verbs or '*yǒu*+property noun' constructions. Based on these data, this article also surveys existing studies on three fundamental issues: the encoding of comparison, compositional derivation, and underlying ontological assumptions. To this date, many specific research questions are still hotly debated. In particular, the obligatory presence of 很 *hěn* in the default positive interpretation and the obligatory presence of numerical differentials in transitive comparatives are still two great mysteries not fully solved.

This article also invites rethinking on cross-linguistic variations of degree expressions. For languages with comparative morphemes (e.g., English, French), whether comparative morphemes are operators of comparison or markers carrying other functions is worth further investigation.

Acknowledgement

For comments and discussion, the author thanks Yanyan Cui, Mingming Liu, …(TBA). The author also gratefully acknowledges financial support from Shanghai Municipal Education Commission (the Program for Eastern Young Scholar at Shanghai Institutions of Higher Learning).

Further reading

Review articles on degree semantics

Schwarzschild, R. (2008). The semantics of comparatives and other degree constructions. *Language and Linguistics Compass* 2(2), 308–331.

More empirical data on Chinese degree expressions

L u, S., et al. (1980). *Xiandai Hanyu Babai Ci* [*800 words in Chinese*]. The Commercial Press.

Huang, C.R., and D. Shi. (2016). *A Reference Grammar of Chinese*. Cambridge University Press.

More theoretical works on Chinese degree expressions

Lin, J.-W. (2007). On the semantics of comparative correlatives in Mandarin Chinese. *Journal of Semantics 24*(2), 169–213.

Liu, C.-S. L. (2008). The view from *yue*: Chinese comparative correlatives. *Lingua 118*(8), 1033–1063.

Lin, J.-W. (2014). The adjective of quantity duo 'many/much'and differential comparatives in mandarin chinese. *International Journal of Chinese Linguistics* 1(2), 163–191.

Liu, C.-S. L. (2012). Two notes on the chinese *bi* comparatives. *Concentric: Studies in Linguistics* 38(1), 69–91.

Liu, C.-S. L. (2013). Reduplication of adjectives in Chinese: a default state. *Journal of East Asian Linguistics* 22(2), 101–132.

References

Anderson, C. and M. Morzycki (2015). Degrees as kinds. *Natural Language & Linguistic Theory 33*(3), 791–828.

Bartsch, R. and T. Vennemann (1972). The grammar of relative adjectives and comparison. *Linguistische Berichte 20*, 19–32.

Beck, S. (2011). Comparative constructions. In C. Maienborn, K. von Heusinger, and P. Portner (Eds.), *Semantics: An International Handbook of Natural Language Meaning*, Volume 2, pp. 1341–1390. de Gruyter.

Beck, S., S. Krasikova, D. Fleischer, R. Gergel, S. Hofstetter, C. Savelsberg, J. Vanderelst, and E. Villalta (2009). Crosslinguistic variation in comparison constructions. *Linguistic Variation Yearbook 9*(1), 1–66.

Bhatt, R. and S. Takahashi (2007). Direct comparisons: Resurrecting the direct analysis of phrasal comparatives. In *Semantics and Linguistic Theory*, Volume 17, pp. 19–36.

Bobaljik, J. D. (2012). *Universals in comparative morphology: Suppletion, superlatives, and the structure of words*, Volume 50. MIT Press.

Brasoveanu, A. (2008). Comparative correlatives as anaphora to differentials. In *Semantics and Linguistic Theory*, Volume 18, pp. 126–143.

Bresnan, J. W. (1973). Syntax of the comparative clause construction in English. *Linguistic inquiry 4*(3), 275–343.

Bresnan, J. W. (1975). Comparative deletion and constraints on transformations. *Linguistic Analysis 1*(1), 25–74.

Burnett, H. (2017). *Gradability in Natural Language*. Oxford University Press.

Cao, D. and J. Hu (2020). On the predicative use of chinese gradable adjectives. *Lingua 247*, 102979.

Chao, Y. R. (1968). *A grammar of spoken Chinese*. University of California Press.

Chomsky, N. (1977). On *wh*-movement. In P. Culicover, T. Wasow, and A. Akmajian (Eds.), *Formal syntax*, pp. 71–132. Academic Press.

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

Dong, H. (2005). Gradable adjectives in Chinese and degree morphemes. Manuscript.

Erlewine, M. Y. (2007). A new syntax-semantics for the mandarin *bi* comparative. Master thesis, University of Chicago.

Erlewine, M. Y. (2018). Clausal comparison without degree abstraction in mandarin chinese. *Natural Language & Linguistic Theory 36*(2), 445–482.

Francez, I. and A. Koontz-Garboden (2017). *Semantics and Morphosyntactic Variation: Qualities and the Grammar of Property Concepts*. OUP.

Grano, T. (2012). Mandarin *hen* and universal markedness in gradable adjectives. *Natural Language & Linguistic Theory 30*(2), 513–565.

Grano, T. (2019). Stay positive: The Mandarin *hěn* puzzle meets possessed property concepts. Talk given at the *International Workshop on Degrees and Grammar*, Nanjing University.

Grano, T. and C. Kennedy (2012). Mandarin transitive comparatives and the grammar of measurement. *Journal of East Asian Linguistics 21*(3), 219–266.

Greenberg, Y. (2010). Additivity in the domain of eventualities (or: Oliver twist's *more*). In *Proceedings of Sinn und Bedeutung*, Volume 14, pp. 151–167.

Gu, Y. (2008). Shitai, shizhi lilun yu hanyu shijian canzhao [studies of tense, aspect and chinese time reference]. In *Dangdai yuyanxue lilun he hanyu yanjiu [Contemporary linguistic theories and related studies of Chinese]*, pp. 97–119. The Commercial Press.

Hausser, R. and D. Zaefferer (1978). Questions and answers in a context-dependent Montague grammar. In *Formal Semantics and Pragmatics for Natural Languages*, pp. 339–358. Springer.

Heim, I. (1985). Notes on comparatives and related matters. Unpublished ms., University of Texas, Austin.

Hellan, L. (1981). *Towards an integrated analysis of comparatives*. Tübingen: Narr.

Hoeksema, J. (1983). Negative polarity and the comparative. *Natural Language & Linguistic Theory 1*(3), 403–434.

Hsieh, I.-T. C. (2017). On arguments against comparative deletion in mandarin. *Tsing Hua Journal of Chinese Studies, New Series 47*(2), 255–287.

Huang, C.-T. J., Y.-h. A. Li, and Y. Li (2009). *The syntax of Chinese*. Cambridge University Press Cambridge.

Huang, S.-Z. (2006). Property theory, adjectives, and modification in chinese. *Journal of East Asian Linguistics 15*(4), 343–369.

Kamp, J. A. W. (1975). Two theories about adjectives. In E. Keenan (Ed.), *Formal semantics of natural language*, pp. 123–155. Cambridge, UK: Cambridge University Press.

Kennedy, C. (1999). *Projecting the adjective: The syntax and semantics of gradability and comparison*. Routledge.

Klein, E. (1980). A semantics for positive and comparative adjectives. *Linguistics and philosophy 4*(1), 1–45.

Krasikova, S. (2008). Comparison in chinese. *Empirical issues in syntax and semantics 7*, 263–281.

Krifka, M. (2011). Questions. In K. Heusinger, C. Maienborn, and P. Portner (Eds.), *Semantics: An international handbook of Natural Language Meaning*, Volume 2, pp. 1742–1785. Berlin: Mouton de Gruyter.

Kubota, Y. and R. Levine (2015). Against ellipsis: Arguments for the direct licensing of 'noncanonical' coordinations. *Linguistics and Philosophy 38*(6), 521–576.

Larson, R. K. (1988). Scope and comparatives. *Linguistics and philosophy 11*(1), 1–26.

Lewis, D. (1979). Score-keeping in a language game. *Journal of Philosophical Logic 8*, 339–359.

Li, X. (2015). Degreeless comparatives: The semantics of differential verbal comparatives in mandarin chinese. *Journal of Semantics 32*(1), 1–38.

Lin, J.-W. (2009). Chinese comparatives and their implicational parameters. *Natural Language Semantics 17*(1), 1–27.

Lin, J.-W. (2014). The adjective of quantity *duo* 'many/much' and differential comparatives in mandarin chinese. *International Journal of Chinese Linguistics 1*(2), 163–191.

Lin, J.-W. (2019). Comparatives in Mandarin Chinese: Phrasal or Clausal comparison? Talk given at the *International Workshop on Degrees and Grammar*, Nanjing University.

Liu, C.-S. L. (1996). A note on Chinese comparatives. In *Studies in the Linguistic Sciences*, Volume 26 (1-2), pp. 217–235.

Liu, C.-S. L. (2007). The weak comparative morpheme in mandarin chinese. *Concentric: Studies in Linguistics 33*(2), 53–89.

Liu, C.-S. L. (2010a). The chinese *geng* clausal comparative. *Lingua 120*(6), 1579–1606.

Liu, C.-S. L. (2010b). The positive morpheme in chinese and the adjectival structure. *Lingua 120*(4), 1010–1056.

Liu, C.-S. L. (2011). The chinese *bi* comparative. *Lingua 121*(12), 1767–1795.

Liu, C.-S. L. (2014). Comparatives. In C.-T. J. Huang, Y.-H. A. Li, and A. Simpson (Eds.), *The Handbook of Chinese Linguistics*, pp. 342–366. Wiley Online Library.

Liu, C.-S. L. (2018). Projecting adjectives in chinese. *Journal of East Asian Linguistics 27*(1), 67–109.

Luo, Q. (2017). Hanyu 'bi' Zi Bijiaoju de Jufa he Yuyi Wenti [The Syntax and Semantics of Mandarin *bi* Comparatives]. *Xiandai Waiyu 40*(3), 324–335.

McConnell-Ginet, S. (1973). *Comparative constructions in English: A syntactic and semantic analysis*. Ph. D. thesis, University of Rochester.

Rett, J. (2015). *The semantics of evaluativity*. OUP Oxford.

Sassoon, G. W. (2010). Measurement theory in linguistics. *Synthese 174*(1), 151–180.

Schwarzchild, R. and K. Wilkinson (2002). Quantifiers in comparatives: A semantics of degree based on intervals. *Natural language semantics 10*(1), 1–41.

Seuren, P. A. M. (1973). The comparative. In F. Kiefer and N. Ruwet (Eds.), *Generative grammar in Europe*, pp. 528–564. Springer.

Solt, S. (2015). Measurement scales in natural language. *Language and Linguistics Compass 9*(1), 14–32.

Stevens, S. S. (1946). On the theory of scales of measurement. *Science 103*(2684), 677–680.

Sybesma, R. (2013). *The mandarin VP*, Volume 44. Springer Science & Business Media.

Thomas, G. (2010). Incremental *more*. In *Semantics and Linguistic Theory*, Volume 20, pp. 233–250.

Tsao, F.-F. (1989). Comparison in chinese: A topic-comment approach. *Tsing Hua Journal of Chinese Studies 19*, 151–189.

von Stechow, A. (1984). Comparing semantic theories of comparison. *Journal of semantics 3*(1-2), 1–77.

Xiang, M. (2003). A phrasal analysis of chinese comparatives. In *Proceedings from the Annual Meeting of the Chicago Linguistic Society*, Volume 39, pp. 739–754. Chicago Linguistic Society.

Xiang, M. (2005). *Some topics in comparative constructions*. Ph. D. thesis, Michigan State University.

Zhang, L. (2015a). Decomposing English particles *and* and *or*. In *NELS 45: Proceedings of the 45th Meeting of the North East Linguistic Society*, Volume 3, pp. 261–270.

Zhang, L. (2019). The semantics of comparisons in mandarin chinese. In S.-Y. Cho (Ed.), *Proceedings of GLOW in Asia XII & SICOGG XXI*, pp. 643–652.

Zhang, L. (2020). Degrees as kinds vs. degrees as numbers: Evidence from equatives. In M. F. et al. (Ed.), *Proceedings of Sinn und Bedeutung*, Volume 24 (2), pp. 503–520.

Zhang, L. and J. Ling (2021). The semantics of comparatives: A difference-based approach. *Journal of Semantics 38*, 249–303.

Zhang, N. N. (2015b). Functional head properties of the degree word *hen* in mandarin chinese. *Lingua 153*, 14–41.