

# Mandarin transitive comparatives and the grammar of measurement

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**Abstract** Mandarin Chinese has two strategies for forming comparatives of superiority: one in which the standard of comparison is introduced by the morpheme *bi*, and one that resembles a transitive verb construction, in which the standard of comparison directly follows a gradable adjective. The ‘transitive comparative’ exhibits two special restrictions: the predicate must be one that accepts differential measure phrases, and the measure phrase must be overt. We argue that these facts support an analysis of the syntax of the adjectival projection in which gradable adjectives do not project degree arguments, as typically assumed, but do so only in combination with a covert morpheme  $\mu$ . Building on the proposal that argument DPs in Mandarin require Case, we hypothesize that there are (at least) two case assigners for standards of comparison in Mandarin: the overt morpheme *bi* and the covert morpheme  $\mu$  found in transitive comparatives.

**Keywords** Mandarin Chinese · Comparatives · Measure phrases · Case

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## 1 Introduction

The canonical comparative construction in Mandarin Chinese involves the morpheme *bi*, which is followed by a term that provides a standard of comparison, then by a gradable predicate, and finally by an optional differential expression (for recent theoretical literature on the *bi*-comparative, see especially Liu (1996); Xiang (2005); Erlewine (2007); Lin (2009)):

- (1) a. Zhangsan *bi* Lisi *gao* (yi *dian*).  
 Zhangsan SM Lisi tall (one dot)  
 ‘Zhangsan is (a little) taller than Lisi.’  
 b. Zhangsan *bi* Lisi *piaoliang* (yi *dian*).  
 Zhangsan SM Lisi pretty one dot  
 ‘Zhangsan is (a little) prettier than Lisi.’

It is also possible to express certain kinds of comparisons using a structure which we will refer to as the TRANSITIVE COMPARATIVE, borrowing this term from Erlewine (2007), in which *bi* is absent, and the gradable predicate precedes the standard<sup>1</sup>:

- (2) a. Zhangsan *gao* Lisi *yi dian / san gongfen*.  
 Zhangsan tall Lisi one dot / three centimeters  
 ‘Zhangsan is a bit/three centimeters taller than Lisi.’  
 b. Zhangsan *zhong* Lisi *yi dian / san gongjin*.  
 Zhangsan heavy Lisi one dot / three kilograms  
 ‘Zhangsan is a bit/three kilograms heavier than Lisi.’

This structure is not freely available, however, as shown by (3a, b), which are superficially parallel to (2a, b) but are ungrammatical.

- (3) a. \*Zhangsan *piaoliang* Lisi *yi dian*.  
 Zhangsan pretty Lisi one dot  
*Intended:* ‘Zhangsan is a bit prettier than Lisi.’  
 b. \*Zhangsan *gaoxing* Lisi *yi dian*.  
 Zhangsan happy Lisi one dot  
*Intended:* ‘Zhangsan is a bit happier than Lisi.’

Xiang (2005) demonstrates that well-formed transitive comparatives must satisfy two conditions. The first condition is that the structure must contain an overt

<sup>1</sup> The same construction is called the “obligatory measuring comparative” by Mok (1998); the “absent marking construction” by Ansaldo (1999), who explores the construction in Sinitic languages in general; the “bare comparative” by Xiang (2005); and the “X A (Y) D comparative” by Liu (2007).

differential term, such as the phrase *yi dian* ‘a bit’ or an appropriate measure phrase, as shown in (2a, b).<sup>2</sup> In the absence of a differential term, transitive comparatives are impossible:

- (4) a. \*Zhangsan gao Lisi.  
       Zhangsan tall Lisi  
       *Intended:* ‘Zhangsan is taller than Lisi.’  
       b. \*Zhangsan zhong Lisi.  
       Zhangsan heavy Lisi  
       *Intended:* ‘Zhangsan is heavier than Lisi.’

The second well-formedness condition on transitive comparatives is that the gradable predicate must be one that uses a scale for which a conventional measurement system is defined. Whether this condition is met can be determined by examining the acceptability of measure phrases in regular *bi*-comparatives. Consider, for example, the contrast between (5a) and (5b).

- (5) a. Zhangsan bi Lisi gao san gongfen / san  
       Zhangsan SM Lisi tall three centimeters / three  
       cun / san ge shouzhǐ.  
       inches / three CL finger  
       ‘Zhangsan is three centimeters/three inches/three fingers taller than Lisi.’  
       b. \*Zhangsan bi Lisi piaoliang san du.  
       Zhangsan SM Lisi pretty three degree  
       *Intended:* ‘Zhangsan is three degrees prettier than Lisi.’

(5a) is acceptable because *gao* ‘tall(er)’ compares objects relative to their positions on a scale of height, which is one for which various measurement systems are defined (inches, centimeters, etc.). In contrast, *piaoliang* ‘pretty’ compares objects relative to the beauty scale, which is not one that has a conventional measurement system, and as a result, the differential measure phrases in (5b) are unacceptable.

<sup>2</sup> As pointed out by an anonymous reviewer, other possibilities for the differential term include *hen duo* ‘very much’ and *bu shao* ‘not little’:

- (i) Zhangsan gao Lisi {*hen duo* / *bu shao*}.  
       Zhangsan tall Lisi very much / not little  
       ‘Zhangsan is much taller than Lisi.’

The reviewer suggests that these terms are clausal. If this is correct, then these examples show that the differential term in a transitive comparative need not be syntactically nominal. Since nothing in our analysis requires differentials to be members of a particular grammatical category (instead, what will be crucial is that they have the right semantics, namely one which allows them to saturate a degree position), we will remain agnostic about their categorial status and will use the term ‘measure phrase’ to refer both to explicit unit terms like *san gongfen* ‘three centimeters’ and to vague quantity terms like *yi dian* ‘a little’, *hen duo* ‘very much’, and *bu shao* ‘not little’.

The groupings in (6a, b), taken (mostly) from Xiang (2005), exemplify the gradable predicates that are grammatical and ungrammatical, respectively, in the transitive comparative construction:

- (6) a. **Grammatical in transitive comparative:** *gao* ‘tall’, *ai* ‘short’ (opposite of ‘tall’), *zhong* ‘heavy’, *qing* ‘light’, *chang* ‘long’, *duan* ‘short’ (opposite of ‘long’), *cu* ‘thick’, *xi* ‘thin’ [not in Xiang’s list: *zao* ‘early’, *wan* ‘late’, *da* ‘big’/‘old’, *xiao* ‘small’/‘young’, *kuai* ‘fast’, *man* ‘slow’]
- b. **Ungrammatical in transitive comparative:** *piaoliang* ‘pretty’, *xixing* ‘careful’, *gaoxing* ‘happy’, *youqu* ‘interesting’, *ganjing* ‘clean’, *shufu* ‘comfortable’, *mingliang* ‘bright’

All of the predicates in (6a) use scales that are associated with conventional measurement systems (linear extent, weight, time, age, speed), and all allow differential measure phrases in the comparative. None of the predicates in (6b) has these properties.<sup>3</sup>

Some of the predicates in (6a) also allow measure phrases in their non-comparative, ‘positive’ uses. For example:

- (7) Zhangsan liang mi gao.  
Zhangsan two meter tall  
‘Zhangsan is two meters tall.’

However, as noted by Xiang, the crucial factor determining whether the predicate can be used in a transitive comparative is whether the comparative allows a dif-

<sup>3</sup> An anonymous reviewer raises two questions about the groupings in (6). First, the reviewer points out that the predicates in (6a) are all monosyllabic whereas those in (6b) are all disyllabic. However, it appears that this correlation is epiphenomenal. In particular, Liu (2007) notes that the disyllabic predicates *pianyi* ‘cheap’ and *anjing* ‘quiet’ are acceptable in transitive comparatives (with measure phrases indicating dollar amounts and decibels, respectively). Furthermore, there are monosyllabic predicates which use scales that do not have conventional measurement systems, such as *huai* ‘bad’. These predicates are generally not acceptable in transitive comparatives.

Second, the reviewer wonders whether it is possible to make up new units ‘on the fly’ for predicates that do not have conventional units associated with them so that predicates in the (6b)-class can be ‘coerced’ into being acceptable in the transitive comparative. The data in (i) suggest that the answer is yes. According to our informant, (ia) is acceptable in a context of comparing Zhangsan’s and Lisi’s proficiency at a game as measured in points, and (ib) is acceptable in a context where—as suggested by the reviewer—a milli-helen is defined as ‘a unit of beauty needed to launch one ship’.

- (i) a. Zhangsan hao Lisi liang fen.  
Zhangsan good Lisi two point  
‘Zhangsan is two points better than Lisi.’
- b. Zhangsan piaoliang Lisi yi milli-helen.  
Zhangsan pretty Lisi one milli-helen  
‘Zhangsan is one milli-helen prettier than Lisi.’

The data in (i) furthermore reinforce that mono- vs. di-syllabicity is irrelevant since coercion appears to work equally well for both monosyllabic adjectives (*hao* ‘good’) and disyllabic ones (*piaoliang* ‘pretty’).

ferential measure phrase. For example, *pang* ‘fat’ disallows measure phrases in non-comparative contexts (8a) but allows them when used comparatively (8b) and accordingly is grammatical in a transitive comparative (8c) (Xiang 2005, p. 167):

- (8) a. \*Zhangsan shi bang pang.  
 Zhangsan ten pound fat  
*Intended:* ‘Zhangsan is 10 pounds fat.’  
 b. Zhangsan bi wo pang shi bang.  
 Zhangsan SM 1sg fat ten pound  
 ‘Zhangsan is ten pounds fatter than me.’  
 c. Zhangsan pang wo shi bang.  
 Zhangsan fat 1sg ten pound  
 ‘Zhangsan is ten pounds fatter than me.’

While the set of gradable predicates that allow measure phrases in non-comparative forms varies idiosyncratically both within and across languages, it is generally the case that the corresponding comparative form allows them if the predicate uses a scale with a conventional measuring system and the language has measure phrases in the first place (Schwarzschild (2005); see also Svenonius and Kennedy (2006); Sawada and Grano (2011)). We return to this point in some detail in Sects. 2 and 5.

Before moving on, we need to say something about why the phrase *yi dian* ‘a bit’ is compatible both with adjectives like *gao* ‘tall’ and like *piaoliang* ‘pretty’ and yet does not license a transitive comparative in the latter: compare (9a, b) with (10a, b).

- (9) a. Zhangsan bi Lisi gao (yi dian).  
 Zhangsan SM Lisi tall (one dot)  
 ‘Zhangsan is (a little) taller than Lisi.’  
 b. Zhangsan gao Lisi yi dian / san gongfen.  
 Zhangsan tall Lisi one dot / three centimeters  
 ‘Zhangsan is a bit/three centimeters taller than Lisi.’  
 (10) a. Zhangsan bi Lisi piaoliang (yi dian).  
 Zhangsan SM Lisi pretty one dot  
 ‘Zhangsan is (a little) prettier than Lisi.’  
 b. \*Zhangsan piaoliang Lisi yi dian.  
 Zhangsan pretty Lisi one dot  
*Intended:* ‘Zhangsan is a bit prettier than Lisi.’

The answer is that vague degree terms like *a bit*, *a little*, etc. are ambiguous: they can function either as true measure phrases or as degree modifiers, which have different syntactic and semantic properties (see, e.g., Doetjes 1997; Neeleman et al. 2004; Kennedy and McNally 2005b). This is shown (for English) by the following examples, which demonstrate that *a bit* can appear with both predicates which allow the degree modifier *very* but disallow a measure phrase (11a–c) and with predicates which allow measure phrases but disallow *very*, such as the degree achievement verbs in (12a–c).

- (11) a. a bit/\*40°/very warm  
 b. a bit/\*35 kg/very heavy  
 c. a bit/\*20 kph/very slow
- (12) a. deepen the hole a bit/2 feet/\*very  
 b. raise the curtain a bit/1 inch/\*very  
 c. cool the soup a bit/3 degrees/\*very

A full discussion of the difference between measure phrases and modifiers is beyond the scope of the paper; for our purposes, it will be sufficient to adopt the position articulated in Kennedy and McNally (2005b), in which measure phrases saturate a (degree) argument position while modifiers map properties to properties.<sup>4</sup>

The purpose of this paper is to develop an account of Mandarin transitive comparatives that explains the two constraints noted by Xiang—why a differential phrase is obligatory and why the adjective in the transitive comparative must use a scale with a defined measurement system—and, in so doing, to argue for a syntactic analysis in which the distribution of measure phrases is mediated by both the semantic properties of gradable predicates and by the functional morphology of the adjectival projection. In particular, building on the proposal that argument DPs in Mandarin require Case, we argue that there are (at least) two case assigners for standards of comparison in Mandarin: the standard marker *bi* familiar from comparatives like those in (1) and a covert morpheme that is involved in the projection of a measure phrase, which combines only with predicates that use scales with defined measurement systems. Svenonius and Kennedy (2006) have previously argued for the existence of such a functional element based on the syntax of certain degree questions in a dialect of Norwegian; we claim here that the behavior of Mandarin transitive comparatives can also best be explained in terms of the syntactic properties of this functional expression, namely its case-assigning ability.

Although our focus in this paper is on the transitive comparative construction in Mandarin, it is worth pointing out that this construction is not unique to Mandarin but is in fact pervasive in Chinese languages and is found even in at least one non-Chinese language group. In a sampling of seven geographically representative

<sup>4</sup> One of the complexities in this domain is the fact that the degree modifiers do not themselves have uniform distributions but rather may be sensitive to semantic properties of the scalar predicates they modify. For example, Kennedy and McNally (2005a) argue that degree modifiers are sensitive to scale structure in such a way that some are compatible with comparative adjectives but not with unmodified adjectives; cf. English *\*much tall*, *\*slightly tall* vs. *much taller*, *slightly taller*. Thus contrasts like those in (i), pointed out by an anonymous reviewer, cannot be taken as evidence that *yi dian* must be analyzed as a measure phrase but rather just show that as a modifier, it is acceptable with comparative but not non-comparative adjectives:

- (i) a. Zhangsan *bi* Lisi *congming yi dian*.  
 Zhangsan SM Lisi smart one dot  
 ‘Zhangsan is a bit taller than Lisi.’  
 b. *\*Zhangsan yi dian congming*.  
 Zhangsan one dot smart  
 Intended: ‘Zhangsan is a bit smart.’

Chinese varieties (Standard Mandarin, Shaighainese, Hong Kong Cantonese, Taiwanese, Chaozhou, Fuzhou and Hakka), Ansaldo (1999) finds that all seven varieties have the transitive comparative construction.<sup>5</sup> Morev (1998) reports as well on an analogous construction found in languages of the Kam-Sui group of Tai-Kadai (data is cited from Mulao, Maonan, and Kam), spoken primarily in southern China but genetically unrelated to Chinese. In spite of its apparent ubiquity in the languages of China, however, the construction has received very little attention in theoretical literature. The basic descriptive generalization is found in descriptive grammars (e.g., Chao 1968), and also in recent theoretical work on Mandarin comparatives (Xiang 2005; Erlewine 2007), but Liu (2007) provides what is to our knowledge the only attempt at a theoretical account of the pattern of data. (However, see Mok (1998) for a syntactic analysis of the equivalent construction in Cantonese.)

The organization of this paper is as follows. Section 2 provides the theoretical background on the syntax and semantics of gradable predicates, with particular attention to competing accounts of the distribution of measure phrases. Section 3 presents our analysis of the Mandarin transitive comparative construction in detail, which we believe argues in favor of a theory of the distribution of measure phrases that is stated in terms of both syntactic and semantic factors. We provide independent support for the analysis and discuss further distinctions between transitive and *bi*-comparatives. Section 4 compares our analysis to prior proposals by Mok (1998) and Liu (2007), demonstrating that our analysis provides a more comprehensive and explanatory account of the data. Finally, Sect. 5 couples our syntactic analysis with a compositional semantics for measurement structures and extends our proposals to measure phrases in non-comparative predicates.

<sup>5</sup> Ansaldo (1999) and Xu (2007) also show that in some Chinese varieties, the measure phrase is not obligatory in the transitive comparative. For example, the following examples come from Chaozhou, spoken in south-eastern China:

- (i) a. i            tua      ua.  
       3sg        big      1sg  
       ‘S/he is older than me.’ (Xu 2007, p. 272)
- b. uã        pa      oi      uã      ma.  
       1sg-GEN father short 1sg-GEN mother  
       ‘My father is shorter than my mother.’ (Xu 2007, p. 272)
- c. i            ho      ua.  
       3sg        good    1sg  
       ‘He is better than me.’ (Ansaldo 1999, p. 43)

We are not aware of any documentation of such constructions other than the brief remarks in Ansaldo’s and Xu’s work, and so caution is in order in analyzing them. Nonetheless, we note that in (ic), it is not simply the case that a measure phrase is optional; it is also the case that the gradable predicate is one for which a measurement system is undefined. The analytical connection between comparatives in these languages and transitive comparatives in varieties that show the restrictions documented above (such as Mandarin) is something that we will unfortunately not be able to establish in this paper, but see the end of the final section of the paper for some initial speculation on this matter.

## 2 The syntax and semantics of gradability and measurement

### 2.1 Degree relations and the distribution of measure phrases

A common hypothesis about the semantics of gradable predicates—those predicates that are acceptable in comparative constructions—is that they denote relations between individuals and degrees, where degrees are values that provide a basis for ordering objects relative to some dimension (see Cresswell 1977; von Stechow 1984a; Bierwisch 1989; Kennedy 2001; Schwarzschild and Wilkinson 2002; Heim 2006; Bale 2009). The denotation of the English adjective *tall*, on this view, is (13), which is true of an individual  $x$  and a degree of height  $d$  just in case  $x$ 's height is at least as great as  $d$ .

$$(13) \quad \llbracket tall \rrbracket = \lambda d \lambda x. \mathbf{height}(x) \succeq d$$

This kind of lexical meaning provides a way of explaining the distribution and interpretation of gradable adjectives in various degree constructions, such as comparatives, superlatives, excessives, intensification structures, and so forth. In short, all of these constructions involve manipulating the value of the degree argument of the adjective, deriving properties of individuals which differ in how much of the measured property the individual has to have in order for the property to be true (see Kennedy and McNally 2005a). For example, combination of *tall* with the comparative *-er than Lee* (given appropriate assumptions about the meaning of the comparative) derives a property that is true of an individual just in case its height is equal to a degree which exceeds Lee's height.<sup>6</sup>

Of interest to us is the analysis of M(easure) P(hrase)/adjective combinations. The most straightforward account of collocations like *2 meters tall* is one which assumes as in (14a) that the measure phrase directly saturates the degree argument of the adjective, as in (14b).

$$(14) \quad \begin{array}{l} \text{a.} \quad \llbracket 2 \text{ meters} \rrbracket = \mathbf{2m} \\ \text{b.} \quad \llbracket tall \rrbracket(\llbracket 2 \text{ meters} \rrbracket) = \lambda x. \mathbf{height}(x) \succeq \mathbf{2m} \end{array}$$

The acceptability of MPs with comparatives, as well as their “differential” interpretations, can be accounted for in a similar way, by assuming that in addition to saturating the degree argument of the adjective, the comparative morphology introduces a second degree argument which represents the difference between two values on a scale, namely the positions of the “target” and “standard” of comparison (a more formal statement of this idea will be developed as we proceed).

<sup>6</sup> Paradoxically, the unmarked “positive” form of a gradable adjective turns out to have the most complicated semantic analysis. The usual assumption is that the adjective combines with a null morpheme which fixes the degree argument to a value that exceeds a contextually appropriate standard of comparison (see Kennedy (2007b) for detailed discussion). For the purposes of this paper, however, we will follow Grano (2012) (whose arguments are based on the grammar of the positive form in Mandarin) in assuming that the positive form is derived not via composition with null morphology, but via a type-shift which maps a degree relation to a property with the appropriate meaning.

This simple analysis cannot be the whole story, however, because not all adjectives combine with MPs. Some failures of composition have a straightforward explanation: if a MP denotes a degree on a scale that is distinct from the one used by a particular adjective, then composition will be ruled out as a kind of selectional restriction violation. This explanation accounts for the unacceptability of collocations like *??20 kilograms tall*, as well as the impossibility of measure phrases with adjectives like *intelligent, beautiful, happy*, etc., which (we may assume) use scales without defined measurement systems.

Slightly more complicated are cases like the ones in (15a), which show that MPs do not combine with negative-pole adjectives; compare the corresponding examples in (15b).

- (15) a. \*1 meter short, \*10 years young, \*3 fathoms shallow  
 b. 1 meter tall, 10 years old, 3 fathoms deep

We cannot simply say that, e.g., *short* uses a scale that is incompatible with the degrees picked out by MPs like *1 meter*: this would be conceptually problematic, given the intuition that we use *short* to talk about heights, and empirically problematic, given that MPs are acceptable with comparative forms of these adjectives:

- (16) 1 meter shorter, 10 years younger, 3 fathoms shallower

However, a number of authors have argued that although degrees of shortness are in some sense degrees of height, they are distinct from degrees of tallness precisely in being unmeasurable, e.g., because they do not include a fixed origin point (see Seuren (1978); von Stechow (1984b); Bierwisch (1989); Kennedy (2001); Sassoon (2010) for different ways of implementing this idea). Comparative forms such as those in (16), in contrast, do include such an origin point, namely the position on the scale of a standard degree, which is implicit in (16) but is normally introduced by *than*. If this is correct, then the unacceptability of the examples in (15a), in contrast to their counterparts in (15b) and (16), can be explained in much the same way as cases like *??20 kilograms tall*: the degrees denoted by the MPs are not part of the domain from which negative-pole adjectives select their degree arguments.

Unfortunately, this kind of explanation does not extend to the most problematic set of facts for the standard analysis, which involve positive-pole adjectives that clearly involve scales with defined measurement systems yet still forbid MP/adjective composition outside of comparatives. (17a) provides some examples from English; (17b) shows that the MPs are compatible with the adjectives' scales.

- (17) a. \*\$200 expensive, \*20° warm, \*100 tons heavy, \*60 kph fast, ...  
 b. \$200 dollars more expensive, 20° warmer, 100 tons heavier, 60 kph faster, ...

The situation is further complicated by the fact that the acceptability of collocations like the ones in (17a) differs cross-linguistically in what appears to be an arbitrary and

idiosyncratic way. (18) shows that MPs combine with *expensive* and *warm* in Norwegian, and (19) shows that MPs combine with *heavy* and *fast* in German.

- (18) a. ei 200 kroners dyr lampe  
 a 200 crowns expensive lamp  
 ‘a 20 dollar (\*expensive) lamp’  
 b. 20 grader varmt vann  
 20 degrees warm water  
 ‘20 degree (\*warm) water’ *Norwegian*

- (19) a. 100 Tonnen schwer  
 100 tons heavy  
 ‘100 tons (\*heavy)’  
 b. 60 Studentenkilometer schnell  
 60 hour.kilometers fast  
 ‘60 kilometers (\*fast)’ *German*

At the same time, some languages are even more restrictive than English. In Japanese, virtually all non-comparative adjectives resist composition with a measure phrase though the corresponding comparatives are fully acceptable<sup>7</sup>:

- (20) a. \*2-meetoru segataikai  
 2-meter spine.high  
 ‘2 meters tall’  
 b. \*5-inchi nagai  
 5-inch long  
 ‘5 inches long’
- (21) a. 2-meetoru sore yori segataikai  
 2-meter that than spine.high  
 ‘2 meters taller than that’  
 b. 5-inchi sore yori nagai  
 5-inch that than long  
 ‘5 inches longer than that’ *Japanese*

These facts are mysterious if gradable adjectives with meanings equivalent to English *tall*, *long*, *expensive*, *warm*, *fast*, and *heavy* all have the semantic analysis hypothesized above, as relations between degrees and individuals. While it might be possible to say that languages like Japanese simply assign different lexical meanings to such adjectives, in particular ones that do not involve degrees (though the fact that gradable adjectives in Japanese combine freely with other kinds of degree morphology would then need to be explained), the variation between otherwise similar languages like English, Norwegian, and German would remain a puzzle.

<sup>7</sup> See Sawada and Grano (2011) for a more nuanced discussion of the facts in Japanese.

## 2.2 Measure phrases as predicates of intervals

One solution to this puzzle is proposed by Schwarzschild (2005), who builds his analysis on the observation that Japanese-type languages seem to be the norm rather than the exception. Specifically, it is generally the case that if a language allows MPs to combine with gradable predicates at all, it will allow such combinations in comparatives, and the MPs will denote differences, as described above. Some languages in addition allow composition of MPs with noncomparative adjectives but only on a language-specific and idiosyncratic basis. Given this observation, Schwarzschild hypothesizes that, contrary to standard assumptions, the meaning of a lexical gradable adjective is not compatible with the meaning of a measure phrase though the meaning of its derived (comparative, excessive, etc.) forms may be.

Schwarzschild implements this hypothesis by modifying the simple analysis of MPs given above and replacing it with one in which MPs are predicates of scalar intervals, which are formally convex sets of degrees (sets of degrees without “gaps”; see Landman (1991, p. 110)). The measure phrases *2 centimeters* and *2 kilograms*, on this view, have meanings along the lines of (22), where their arguments are intervals on the appropriate scales. (We indicate the scale for *2 meters* as one of “linear extent”, to reflect the fact that it combines with any adjective that provides a perspective on this dimension, such as *tall, wide, long, deep*, etc.)

- (22) a.  $\llbracket 2 \text{ centimeters} \rrbracket = \lambda I \subset D_{\text{lin.ext.}} \cdot \mathbf{2cm}(I)$   
 b.  $\llbracket 2 \text{ kilograms} \rrbracket = \lambda I \subset D_{\text{weight}} \cdot \mathbf{2kg}(I)$

Comparatives, in Schwarzschild’s analysis, express relations between individuals and intervals: *a is more G than b* is true just in case there is a positive difference—an interval—between *a* and *b* on the *G*-scale. As long as the scale is one for which a measurement system is defined, composition with a MP is acceptable, and the semantic contribution of the MP is to measure the extent of the interval separating the compared objects.

For example, setting aside details of composition, the comparatives *taller than Kim* and *heavier than Kim* have the meanings in (23a, b), respectively.

- (23) a.  $\lambda I \lambda x. [I = \{d \mid \mathbf{height}(x) \succeq d \wedge \mathbf{height}(k) < d\}]$   
 b.  $\lambda I \lambda x. [I = \{d \mid \mathbf{weight}(x) \succeq d \wedge \mathbf{weight}(k) < d\}]$

Since these expressions select for intervals, they may combine with the MPs in (22a, b) via predicate modification and existential closure, deriving the properties in (24a, b).

- (24) a.  $\lambda x. \exists I [ \mathbf{2cm}(I) \wedge I = \{d \mid \mathbf{height}(x) \succeq d \wedge \mathbf{height}(k) < d\}]$   
 b.  $\lambda x. \exists I [ \mathbf{2kg}(I) \wedge I = \{d \mid \mathbf{weight}(x) \succeq d \wedge \mathbf{weight}(k) < d\}]$

(24a) is true of an object *x* just in case there is an interval that measures two centimeters and that is equal to the set of degrees that *x*’s height includes but that Kim’s height does not, and (24b) is true of an object *x* just in case there is an interval

that measures two kilograms and that is equal to the set of degrees that  $x$ 's weight includes but that Kim's weight does not.

For non-comparative adjectives, Schwarzschild maintains the standard analysis: lexical adjectives are type  $\langle d, et \rangle$  and so expect an argument that denotes a degree. Measure phrases, however, are predicates of intervals—sets of degrees—and so direct composition of a MP with a gradable adjective is ruled out on type-theoretic grounds (though see below for some questions about this result). This correctly predicts the unacceptability of *??2 kilograms heavy* but also predicts that *2 meters tall* should be ill-formed. This is actually a good result, according to Schwarzschild, given the fact that languages that allow MP+noncomparative adjective composition appear to be the exception rather than the rule, and when they do allow for such structures they do so in an idiosyncratic and language-specific way, as we have already seen. To account for such structures, Schwarzschild proposes the Homonym Rule in (25), which applies only to adjectives that are marked as undergoing it, the set of which can vary from language to language.

- (25) If  $\alpha$  has a meaning of type  $\langle d, et \rangle$  and  $\alpha \in A_{meas}$ , there is an  $\alpha'$  such that  

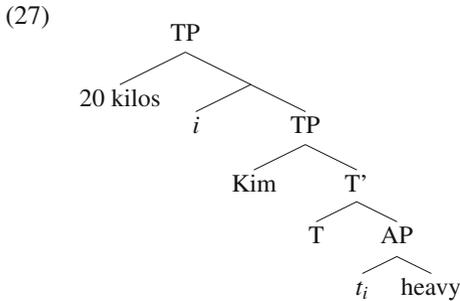
$$\llbracket \alpha' \rrbracket = [\lambda I \lambda x. I = \{d \mid \llbracket \alpha \rrbracket(d)(x)\}]$$

In English, for example,  $A_{meas}$  includes *tall*, *deep*, and *old* but not *heavy*; in German, it also includes *heavy*; in Japanese, it is empty (though see Sawada and Grano (2011)). If an adjective is marked to undergo this rule, then it will allow composition with a measure phrase via predicate modification and existential closure, deriving (26) as the meaning of *Kim is 2 meters tall*.

- (26)  $\exists I [2m(I) \wedge I = \{d \mid \mathbf{height(kim)} \succeq d\}]$

We fully agree with Schwarzschild's contention that the proper analysis of measure phrase composition is one which predicts that constructions like *2 meters tall* are the special case. However, there are two features of Schwarzschild's specific implementation of this idea that we wish to call attention to. The first involves a crucial but potentially problematic assumption that must be made in order to make the type-theoretic account of the distribution of MPs work. Specifically, Schwarzschild must stipulate that even though intervals are formally defined as sets of degrees, measure phrases *qua* predicates of such sets have a semantic type that is not based on the semantic type  $d$  of degrees. Without this stipulation, we would presumably want to analyze MPs as expressions of type  $\langle \langle d, t \rangle, t \rangle$ , on analogy with the semantic type  $\langle \langle e, t \rangle, t \rangle$  of quantified noun phrases, which are predicates of sets of individuals in Generalized Quantifier Theory (Barwise and Cooper 1981). Although such an analysis would still rule out direct composition of a MP (type  $\langle \langle d, t \rangle, t \rangle$ ) with a gradable adjective (type  $\langle d, et \rangle$ ) on type theoretic grounds, the particular type-mismatch that we find here is a familiar one: it is the same sort of mismatch that arises when a quantified noun phrase appears in an internal argument position. Such type mismatches are usually assumed to be repaired by a rule of Quantifier Raising (or the equivalent), and so the same should be true for a measure phrase.

Consider for example (27), which would be a possible Logical Form for *\*Kim is 20 kilograms heavy* if the semantic type of the MP were  $\langle\langle d, t \rangle, t\rangle$  (assuming the general framework for LF construction and interpretation in Heim and Kratzer (1998)).



The sister of the raised MP in (27) denotes the degree function  $\lambda d.\mathbf{heavy}(\mathbf{kim}) \succeq d$ , which is the characteristic function of the convex set of degrees ranging from the lower limit of the weight scale to the degree corresponding to Kim's weight. This set is in turn equivalent to one of the intervals that *20 kilograms* is true of just in case Kim's weight is 20 kilograms. Given the unacceptability of *\*Kim is 20 kilograms heavy*, it must be the case that (27) is not a possible LF, a result that Schwarzschild achieves by stipulating that predicates of intervals are not type  $\langle\langle d, t \rangle, t\rangle$  but rather some independent type  $\langle t, d \rangle$ . But given the equivalence between sets of degrees and intervals—which the Homonym Rule in (25) crucially relies on—this stipulation is somewhat ad hoc.

The second feature of Schwarzschild's analysis that we wish to mention does not have the same kinds of consequences for the overall account of MP distribution, but it does raise a question about the kind of predictions that the analysis makes. At its core, Schwarzschild's analysis is a lexico-semantic one, in the sense that the distribution of MPs is fully a function of meanings: MPs may appear either with expressions that introduce intervals as a matter of meaning, such as comparatives, or with expressions that undergo the lexically-specified Homonym Rule, provided in both cases that the scales used by the relevant terms are scales for which measurement systems are defined and that the intervals that the terms introduce are of the right sort. (See Schwarzschild's account of *1 meter tall* vs. *\*1 meter short*.) This kind of analysis therefore does not lead us to expect any special syntactic features to be associated with the presence of a measure phrase. In the case of comparative constructions in particular, since all comparatives are type-wise compatible with measure phrases, and the distribution of measure phrases is fully determined by lexical semantics (i.e., whether the scale of comparison is one for which a measurement system is defined), there is no expectation that the class of comparatives that allow for measure phrases should be syntactically different in an interesting way from the class of comparatives that do not. But the facts that we outlined at the beginning of the paper demonstrated that in Mandarin, it is precisely the former class that shows a syntactic alternation between the *bi*-comparative and the transitive comparative, suggesting that the presence of a measure phrase is indicative

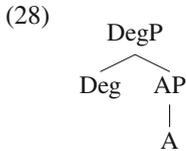
not only of special semantic features but also of special syntactic ones. The analysis we consider in the next section spells this idea out in more detail.

### 2.3 Severing the degree argument from the adjective

A different approach to the distribution of measure phrases is proposed in Svenonius and Kennedy (2006). Svenonius and Kennedy start from Schwarzschild's intuition that direct composition of a MP with a (noncomparative) gradable predicate should be ruled out on type-theoretic grounds but account for the "exceptional" cases of MP/adjective composition that we find in languages like English, German, and Norwegian in lexico-syntactic terms rather than lexico-semantic terms, i.e., in terms of selection rather than type shifting.

The first part of the analysis involves a "decompositional" variant of the traditional analysis of gradable adjective meaning: instead of treating them as relations between degrees and individuals, Svenonius and Kennedy follow a different tradition which analyzes gradable adjectives as *measure functions*: expressions of type  $\langle e, d \rangle$ , which map individuals to degrees that represent the extent to which they possess some scalar property (Bartsch and Vennemann 1973; Kennedy 1999). The adjective *tall*, on this view, just denotes the **height** function which formed a component of its meaning on the relational analysis discussed in Sect. 2.1 (see (13)). This hypothesis immediately derives the basic incompatibility between gradable adjectives and measure functions. If MPs are type  $d$  (or type  $\langle \langle d, t \rangle, t \rangle$ ) and saturate degree argument positions, then direct composition with a gradable adjective (type  $\langle e, d \rangle$ ) is ruled out on type-theoretic grounds: since gradable adjectives do not have degree arguments, direct composition with a degree-denoting term is impossible. And unlike what we saw with Schwarzschild's analysis, this is not the kind of type mismatch that could potentially be repaired by LF-movements, so there is no need to introduce extra stipulations designed to rule out such a move.

Instead, Svenonius and Kennedy propose that the type mismatch between a measure phrase and a gradable adjective is resolved through the mediation of functional morphology. Or, to put it another way, degree arguments are not lexical arguments of gradable adjectives but are rather introduced by a layer of functional morphology above the adjective much in the same way that external arguments of verbs are thought to be introduced by voice morphology (Kratzer 1996). This hypothesis is not ad hoc but is instead quite natural in the context of the measure function analysis of gradable adjectives, since such a theory is already committed to the position that a predicate headed by a gradable adjective must include some functional morphology: if lexical adjectives are type  $\langle e, d \rangle$ , they do not denote properties of individuals. Since full adjectival predicates do denote properties, something needs to "do the right thing" to the adjective. According to Kennedy (1999), this is the job of degree morphology, which in English occupies a functional head in the extended projection of the adjective (Abney 1987; Corver 1990, 1997; Grimshaw 1991):



Deg heads are generally of the semantic type  $\langle\langle e, d \rangle, \langle \dots \langle e, t \rangle \rangle\rangle$  (where “...” stands for any additional arguments that a particular Deg head might introduce). Elements of the category Deg include the question word *how*, degree *that*, excessive *too*, and, in many analyses, comparative morphology, though we will crucially not adopt that assumption here, for reasons to be explained shortly.

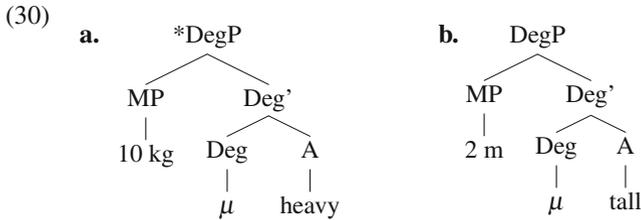
To account for the distribution of measure phrases, Svenonius and Kennedy propose that among the inventory of degree morphemes is a null head  $\mu$ , whose semantic and syntactic function is to introduce a degree argument. The denotation of  $\mu$  is spelled out in (29a); composition of  $\mu$  with a gradable adjective produces a meaning that is basically identical to the denotation of a gradable adjective on the relational analysis discussed in Sect. 2.1, as shown in (29c) for the adjective *tall*, and so allows for composition with a measure phrase.

- (29) a.  $\llbracket \llbracket_{\text{Deg}} \mu \rrbracket \rrbracket = \lambda g \lambda d \lambda x. g(x) \succeq d$   
 b.  $\llbracket \llbracket_{\text{tall}} \rrbracket \rrbracket = \mathbf{height}$   
 c.  $\llbracket \llbracket_{\text{Deg}} \mu \rrbracket \rrbracket (\llbracket \llbracket_{\text{tall}} \rrbracket \rrbracket) = \lambda d \lambda x. \mathbf{height}(x) \succeq d$

According to Svenonius and Kennedy,  $\mu$  differs from, e.g., the positive degree morpheme, which may combine with any gradable adjective, in having stricter selectional restrictions: it combines freely with comparative adjectives, but only idiosyncratically with non-comparative adjectives, in a way that must be listed in its lexical entry on a language-specific basis. Crucially, since  $\mu$  is the only means of introducing a degree argument, an account of the distribution of measure phrases can be reduced to an account of the distribution of  $\mu$ , so that language-specific idiosyncracies can be captured in a simple and straightforward way: in terms of the formal properties of a single functional head.<sup>8</sup>

In English, then, both (30a) and (30b) are fully interpretable and have the expected meanings (which is actually a good result because we know exactly what the former is supposed to mean even though it is ungrammatical), but (30a) is ill-formed given the assumption that  $\mu$  does not select for *heavy* in English.

<sup>8</sup> One question that Svenonius and Kennedy sidestep is whether the selectional properties of  $\mu$  are purely syntactic or whether they can be derived from its meaning. We return to this question in Sect. 5.



In German, the selectional properties of  $\mu$  allow for composition with *schwer* ‘heavy’, rendering the German version of (30a) grammatical; in Japanese,  $\mu$  selects for neither *segataikai* ‘tall’ nor *omoi* ‘heavy’, so both of (30a, b) are impossible.

Before discussing comparatives in more detail, we wish to highlight a feature of this analysis of measure phrase distribution that crucially distinguishes it from the one discussed in the previous section. In this analysis, the class of adjectival predicates that accept measure phrases are syntactically distinguished from the class of adjectival predicates that do not, in two ways. The first has to do with argument projection. Since  $\mu$  is (by hypothesis) the only way to project a degree argument, only the class of adjectives that accept measure phrases should have degree arguments. Svenonius and Kennedy show that this feature of the analysis explains an otherwise puzzling set of facts involving degree questions in Northern Norwegian. In this language, verb-initial questions of the form *verb subject gradable-adjective* can be assigned interpretations as degree questions, but only if the predicate is one that licenses measure phrases.

For example, (31a) can have either a yes-no interpretation (as expected for a verb-initial question) or a degree question that is parallel to the English translation.<sup>9</sup>

- (31)
- a. Er du gammel?  
are you old  
‘Are you old?’  
‘How old are you?’
- b. Er hun ung?  
‘Is she young?’  
‘\*How young is she?’
- c. Er du trøtt?  
‘Are you tired?’  
‘\*How tired are you?’

(31b, c), however, only have interpretations as yes-no questions. As shown in (32), only *gammel* ‘old’ allows a measure phrase: *ung* disallows one because it is a

<sup>9</sup> There is a stress difference associated with the two readings: the yes-no question involves stress on *gammel*; the degree reading has stress on *er*. See Endresen (1985).

negative adjective; *trøt* ‘tired’ disallows one because there is no measurement system for fatigue.

- (32) a. 8 maaneder gammel  
       8 months old  
       b. \*8 maaneder ung  
       8 months young  
       c. \*8 søvnløse netter trøtt  
       8 sleepless nights tired

Svenonius and Kennedy’s analysis of these facts runs as follows. In addition to the overt degree operator, which like English *how* combines directly with a gradable adjective (i.e., it is a member of the category Deg), the relevant dialects of Norwegian contain a null *wh*-operator which binds a degree argument position as an alternative means of creating a degree question reading. Only those adjectives that can combine with  $\mu$  project a degree argument; therefore, only those adjectives that support measurement permit verb-initial strings to be parsed as degree questions.

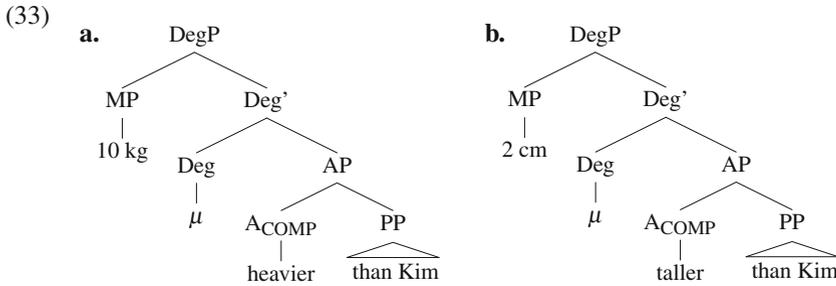
The second syntactic distinction between the Svenonius and Kennedy analysis and the Schwarzschild analysis involves formal morphosyntactic features. In addition to its semantic features,  $\mu$  could in principle have formal syntactic or morphological features which distinguish it from other degree morphemes; indeed, if  $\mu$  is an actual syntactic object, we expect to be able to find morphosyntactic evidence for its presence. Although the absence of such evidence would not provide a conclusive argument against it, all things being equal, we expect such evidence to exist. Furthermore, since the presence of a measure phrase entails the presence of  $\mu$  it follows that all and only those predicates that combine with measure phrases should manifest the formal morphosyntactic features associated with  $\mu$ . In other words, we expect the class of predicates that allow measure phrases to display morphosyntactic properties which can be linked to the formal features of  $\mu$  and which the class of predicates that do not allow measure phrases do not display. As we will show in Sect. 3, the Mandarin transitive comparative facts verify this expectation. Before we can explain how, though, we must say a bit more about the relation between  $\mu$  and comparatives in general.<sup>10</sup>

#### 2.4 The difference function analysis of comparatives

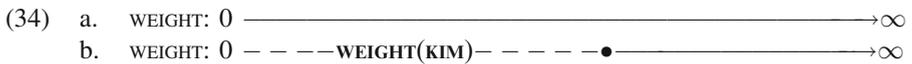
Before turning to our analysis of Mandarin transitive comparatives, we need to lay out our assumptions about the syntax and semantics of comparatives, in the context of the analysis of gradable adjectives and measure phrases presented in the previous section. As noted above, Svenonius and Kennedy assume that although  $\mu$  selects

<sup>10</sup> A reviewer asks whether the Norwegian facts can also be explained by Schwarzschild’s analysis, presumably by stipulating that the operator in null degree questions targets the interval argument of a comparative or an adjective that has undergone the rule in (25), but not a regular degree argument. The answer is yes although this assumption would be somewhat at odds with Schwarzschild’s claim that MPs are scopally inert. In any case, the fact that Schwarzschild’s analysis can potentially accommodate the Norwegian data makes the Mandarin transitive comparative facts all the more significant since their explanation (we claim) crucially relies on the “morphosyntactic” analysis of the distribution of measure phrases advocated by Svenonius and Kennedy.

only idiosyncratically for lexical adjectives, it combines freely with comparative adjectives. In making this claim, they follow Corver (1997) in assuming that comparative morphology is not in the category Deg (see also Bresnan 1973; Neeleman et al. 2004) but rather occupies a second functional layer between the adjective and Deg. Since the details of Corver’s analysis are not crucial for us, we will make the simplifying assumption that comparative morphemes are lexical affixes and that adjectives to which they have attached bear the feature [COMP], which is selected by  $\mu$ , licensing structures like (33a, b).



Semantically, we follow Faller (2000), Kennedy and McNally (2005a), Svenonius and Kennedy (2006), and Kennedy and Levin (2008) in analyzing comparative adjectives as special kinds of measure functions, called “difference functions”, which measure the degree to which two objects diverge relative to a scalar dimension (cf. Schwarzschild (2005), which is a different implementation of the same basic idea). The intuition underlying this analysis is the following: if *heavy* is a function from individuals to values on the weight scale, as in (34a), then *heavier than Kim* is a function from individuals to the subpart of the weight scale that begins with Kim’s weight (the non-dashed part of (34b)) and consequently measures the (positive) extent to which an object diverges from Kim in weight.



In (34b), Kim’s weight is a “derived zero point”: objects whose weights are less than or equal to Kim’s are mapped to this point (they have zero “heavier-than-Kim-ness”), and objects that are heavier than Kim are mapped to positive values that correctly reflect their ordering relative to the initial weight scale (they have positive degrees of “heavier-than-Kim-ness”).

An important difference between comparative and non-comparative adjectives is that the former have an extra “standard” argument, syntactically marked by *than* in English, which provides the basis for determining the zero point on the derived scale (i.e., the point relative to which differences are calculated). To keep things simple,

we will ignore a great deal of work on the syntax and semantics of comparative standards and assume that they always denote an expression of the same type as the external argument of the measure function.<sup>11</sup>

The comparative morphology thus turns a regular measure function of type  $\langle e, d \rangle$  into a difference function of type  $\langle e, \langle e, d \rangle \rangle$ , where the first argument (the standard) provides the basis for determining the derived zero point on the difference scale. We will use the notation  $\mathbf{m}_y^\uparrow$  to represent the difference function based on measure function  $\mathbf{m}$  and standard  $y$ , which maps entities in its domain onto the part of the  $\mathbf{m}$  scale that uses the position of  $y$  (i.e., the value that we get by applying  $\mathbf{m}$  to  $y$ ) as a zero point, in the way described above. The comparative morphology then can be assigned the denotation in (35a), which reflects the fact that it both introduces a standard argument and turns a measure function into a difference function; adding the standard as in (35b) returns a difference function.<sup>12</sup>

- (35) a.  $\llbracket \text{COMP} \rrbracket = \lambda g_{\langle e, d \rangle} \lambda y \cdot g_y^\uparrow$   
 b.  $\llbracket \text{heavier}_{\text{COMP}} \rrbracket (\llbracket \text{than Kim} \rrbracket) = \mathbf{weight}_{\text{kim}}^\uparrow$

Returning to the structures in (33), since difference functions are type-wise  $\langle e, d \rangle$  (after composition of the comparative adjective and the standard term), composition with  $\mu$  returns a denotation of the right sort. The DegP *10 kg heavier than Kim*, for example, has the meaning in (36), which is true of an object if the positive difference between its weight and Kim's weight is at least 10 kilograms.

- (36)  $\lambda x \cdot \mathbf{weight}_{\text{kim}}^\uparrow(x) \succeq 10\text{kg}$

In the absence of a measure phrase, a difference function (a comparative adjective plus standard) is converted to a property just like a regular measure function (i.e., a

<sup>11</sup> We thus ignore for the purpose of this paper the fact that in many languages (including English), standards can be provided either by a term of the same semantic type as the external argument of the comparative or directly by a degree-denoting expressions; this distinction is manifested in the syntax in the difference between “phrasal” and “clausal” comparatives (Hankamer 1973; Hoeksema 1983; Heim 1985; Bhatt and Takahashi 2007; Kennedy 2007a; Merchant 2009). Degree-denoting standards do not present a problem for the difference function analysis of comparatives generally; quite the contrary: such standards directly provide the derived zero point for a difference scale. Since our primary goal in this paper is to give an account of Mandarin transitive comparatives, our decision to ignore degree-denoting standards is justified by the fact that numerous researchers have concluded that this language does not allow them: see Xiang (2003), Erlewine (2007), and Lin (2009) for arguments to this effect. Regardless of whether Mandarin allows degree-denoting standards, however, a fully general account of comparatives cross-linguistically must countenance both degree-denoting standards and standards of other semantic types. See Kennedy (2007a) for general discussion of these issues.

<sup>12</sup> Two comments are in order here. First, we assume with most work on comparatives that standard morphemes like English *than* and Mandarin *bi* are semantically vacuous. See Liu (2010a) in particular for the view Mandarin *bi* is like English *than* in being semantically vacuous. This keeps things simpler for now and does not bear on our overall proposal, but we suspect that it is ultimately the wrong assumption, for reasons having to do with the distinctions mentioned in note 11: if a language makes a morphological distinction between individual-denoting standards and degree-denoting standards, it always does so in the standard morphology, never in the comparative morphology. This suggests that the standard morphology is playing a more prominent semantic role than is typically assumed.

Second, we will need to assume that the denotation for COMP given in (35a) can be freely shifted to accommodate gradable predicates with more than one argument (cf. Lin 2009).

lexical, non-comparative gradable adjectives): *heavier than Kim* is true of an object if the degree returned by applying the difference function  $\text{weight}_{\text{kim}}^{\uparrow}$  to it exceeds a standard of comparison appropriate for this kind of measurement. Difference functions are special in that they use scales with minimum degrees, namely the degree corresponding to the standard's position on the scale, as shown in (34b). As shown by Kennedy (2007b), the standard of comparison for such scales is systematically fixed to the minimum degree itself, so an object exceeds the standard of comparison for  $\text{weight}_{\text{kim}}^{\uparrow}$  and thereby counts as heavier than Kim, just in case it has a weight that is greater than Kim's, which is exactly what we want.

### 3 Analysis of Mandarin transitive comparatives

#### 3.1 A case-based account

As outlined at the beginning of this paper, the two important properties of the Mandarin transitive comparative construction are that it is compatible only with predicates that accept differential measure phrases ((37a) vs. (37b)), and the measure phrase must be overt ((37a) vs. (37c)).

- (37) a. Zhangsan gao Lisi yi mi / yi dian.  
 Zhangsan tall Lisi one meter / one dot  
 'Zhangsan is one meter / a little taller than Lisi.'
- b. \*Zhangsan congming Lisi (yi dian).  
 Zhangsan smart Lisi one dot  
 Intended: 'Zhangsan is (a little) smarter than Lisi.'
- c. \*Zhangsan gao Lisi.  
 Zhangsan tall Lisi  
 Intended: 'Zhangsan is taller than Lisi.'

Here, we develop an analysis of these facts in terms of Case assignment: the (un)acceptability of a transitive comparative is a function of whether or not the standard argument is assigned Case, which is in turn a function of whether or not the measure-phrase introducing functional head  $\mu$  is part of the structure. In what follows, we justify these claims and fill out the details of the analysis, starting with *bi*-comparatives and then moving to transitive comparatives.

Following Li (2008) and Huang et al. (2009), we assume that argument DPs in Mandarin need Case and that adjectives are not Case assigners.<sup>13</sup> Evidence for these assumptions comes from facts like (38).

<sup>13</sup> Whether or not Mandarin even has a class of lexical items that can be called 'adjectives' as distinct from 'verbs' is a contentious issue; see Paul (2005, 2010); Huang et al. (2009); Grano (2012) for the view that there is such a category, and see McCawley (1992) for an example of the opposing view. For the purpose of the present analysis, this issue may be orthogonal, and 'adjectives' could be understood to mean 'intransitive (stative) verbs' without losing the crucial idea that they are unable to assign Case (which is not to imply that stative verbs as a class cannot assign Case: in Cantonese, at least, there is a class of *transitive* stative verbs that assign Case to their internal arguments, according to Francis and Matthews (2005, pp. 281–282)).

- (38) a. \*wo feichang shangxin tade qushi.  
 Isg extremely sad his pass.away  
*Intended:* 'I am extremely sad about his death.'
- b. wo **dui** tade qushi feichang shangxin.  
 Isg on his pass.away extremely sad  
 'I am extremely sad about his death.' (Huang et al. 2009, p. 22)

According to Huang et al. (2009), (38a) is ungrammatical because the adjective *shangxin* 'sad' cannot assign Case to its thematic argument, the DP *tade qushi* 'his death.' The structure can be rescued, however, by inserting the dummy element *dui* as a Case-assigner, which appears with the object to the left of the main predicate.

Turning to comparatives, on the assumption that comparative adjectives are similar to other adjectives in not assigning Case, the ungrammaticality of examples like (39a, b) is straightforwardly explained: the standard arguments do not receive Case.

- (39) a. \*Zhangsan gao Lisi.  
 Zhangsan tall Lisi  
*Intended:* 'Zhangsan is taller than Lisi.'
- b. \*Zhangsan congming Lisi.  
 Zhangsan smart Lisi  
*Intended:* 'Zhangsan is smarter than Lisi.'

As we saw in (38), these structures can be rescued by adding a case assigner, which in comparatives is the morpheme *bi*.<sup>14</sup>

<sup>14</sup> We remain agnostic as to the actual syntactic status of *bi*, which has received different analyses by different researchers. Liu (1996) and Lin (2009) treat *bi* as a preposition which forms a constituent with the standard while Xiang (2005) and Erlewine (2007) analyze it as the head of a functional projection above AP. For reasons that will become clear shortly, our overall analysis is a slightly better fit with the second type of approach to *bi*, but it is also consistent with the first kind of approach.

Furthermore, it bears emphasizing that although we analyze *bi* as a case assigner, this does not entail that it assigns case each time it is projected. The following data, supplied by an anonymous reviewer, show that the standard in a *bi*-comparative may be, for example, a PP (ia) or a reason clause (ib), both of which are constituents that presumably are not assigned case.

- (i) a. wo dui ni bi dui ta keqi.  
 I to you SM to he friendly  
 'I am more friendly to you than to him.'
- b. laoban yinwei ta jingchang chidao bi yinwei  
 boss because he often late SM because  
 ta ou'er fan cuo haiyao shengqi.  
 he sometimes make mistake even angry  
 'The boss is even more angry because he is often late than because he sometimes makes mistakes.'

On this point, *bi* is no different from English *than*, which has also been analyzed as a case assigner in sentences like *I am taller than him* but which also may combine with non-DPs; see for example the provided free translations for (ia-b). Aside from *than*, English has other prepositions that may combine with clauses (e.g., *I left after Kim left*) or PPs (e.g., *It emerged from under the bridge*). See also note 29 below.

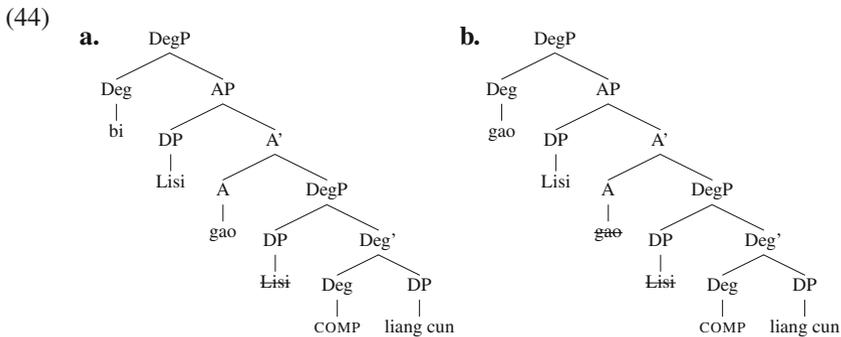


(2005), the measure term *yiban* ‘half’ in examples like those in (43) can only be understood as picking out a measure relative to the length of the standard, not relative to the length of the target.

- (43) a. Zhe-gen shengzi bi na-tiao bandeng chang yiban.  
 this-CL rope SM that-CL bench long half
- b. Zhe-gen shengzi chang na-tiao bandeng yiban.  
 this-CL rope long that-CL bench half  
 ‘This rope is longer than that bench by half (of the length of the bench/\*rope).’

Assuming that *yiban* contains an implicit argument variable (*half of x*) that is linked to the closest c-commanding antecedent, these facts indicate that differential measure phrases are asymmetrically c-commanded by the standard argument, in both *bi*- and transitive comparatives.

Xiang captures this structural relation by adopting a “DegP Shell” analysis of comparatives (cf. Larson 1988, 1991). In this analysis, the standard and differential terms are arguments of a Deg head which selects the differential term as its complement and the standard term as its specifier and introduces comparative semantics. The resulting DegP merges as the complement of an adjective, which itself projects a higher level of DegP structure. In both *bi*-comparatives and transitive comparatives, the standard term then raises to SpecAP; the difference between the two structures is that in *bi*-comparatives, the higher Deg projection is filled by *bi*, as shown in (44a), while in transitive comparatives, it is filled via head-movement of the adjective, as in (44b).<sup>16</sup>



<sup>16</sup> Xiang also claims that the lower Deg head, which she glosses as EXCEED, raises and incorporates into the adjective. Since this point is not relevant to the criticisms that we raise in the next paragraph, we do not represent it here.

The problem with this analysis, as Xiang acknowledges, is that it does not lead to an explanatory account of the restrictions on transitive comparatives. The problem is that each of the three main syntactic components of comparison—the upper and lower Deg heads and the adjective—are necessarily present in all comparatives, regardless of whether the adjective uses a scale with a defined measurement system and regardless of whether a measure phrase is projected: the lower Deg head introduces comparative semantics, the adjective introduces the scale, and the higher Deg head hosts *bi* or a raised adjective. Since there is no structural element that is unique to transitive comparatives, the best that can be done is to stipulate the conditions for adjective raising: only when the adjective uses the appropriate scale and only when a measure phrase is present. But such an analysis fails to explain why these restrictions hold.

Fortunately, we now have the pieces in place to modify Xiang's analysis in such a way as to achieve an explanatory account of the facts. The crucial move is to separate the semantics of comparison from the syntax of measurement so that we can associate the latter with the distribution of the morpheme  $\mu$ , thereby providing a means of syntactically distinguishing comparatives with measure phrases from those without. The first step in doing this involves adopting the assumption that we made earlier about comparative semantics in English and Norwegian: the move from a measure function to a difference function is not mediated by an element of the category Deg but rather by an affix or lexical feature.<sup>17</sup> The second step is to incorporate Svenonius and Kennedy's analysis of measure phrase syntax, whereby the presence of a measure phrase indicates the presence of  $\mu$ , and, crucially, to hypothesize further that  $\mu$  can value a Case feature on the standard DP, obviating the necessity of insertion of *bi* just in case a measure phrase is projected.

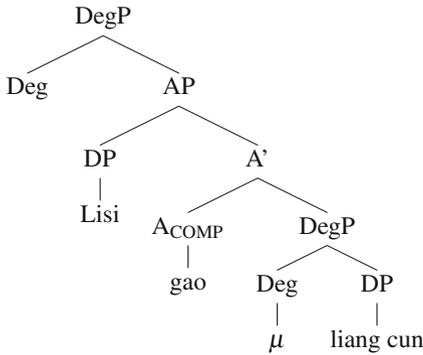
There are two potential implementations of this analysis that correctly derive the configurational relations identified by Xiang. The first maintains a Larson/Xiang DegP shell structure, with a single modification: the lower Deg head is headed by  $\mu$ , as in (45), and is projected only when a measure phrase is present.<sup>18</sup>

<sup>17</sup> In fact, this assumption is arguably even more justified in Mandarin, given that there is no morphological distinction between comparative and non-comparative adjectives (a feature that Mandarin shares with a large portion of the world's languages; see Ultan (1972)). Indeed, Sybesma (1999) argues that in Mandarin, the comparative form of the adjective is the morphologically unmarked option, and the positive form is derived (most neutrally, via the addition of *hen* 'very'). We do not need to make this assumption (and Grano (2012) explicitly argues against it) though it is compatible with our overall approach to transitive comparatives. See also Huang (2006); Gu (2008); Liu (2010b) for various approaches to the analysis of *hen*.

<sup>18</sup> On both this implementation and the second one below, our example representations use the measure phrase *liang cun* 'two inch', which we analyze as a DP. This raises the question of whether measure phrases themselves need Case and, if so, what the relevant Case assigner is. We do not have an answer to this question but simply note that it is largely independent of our concerns here since the same question arises in connection with measure phrases in any language.

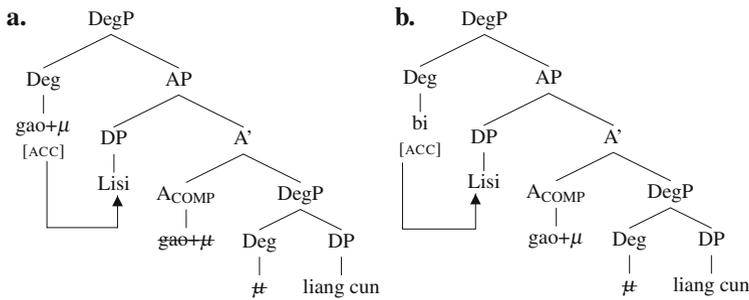
However, it also bears emphasizing that the measure phrase in this construction need not be a DP, as we established in note 2 above. And as discussed in Sect. 2.3 above (see also Sect. 5 below), the semantic function of  $\mu$  is to introduce a degree argument. This degree argument is dealt with by introducing a constituent, but the constituent need not be a DP as long as it has the right kind of semantics.

(45)



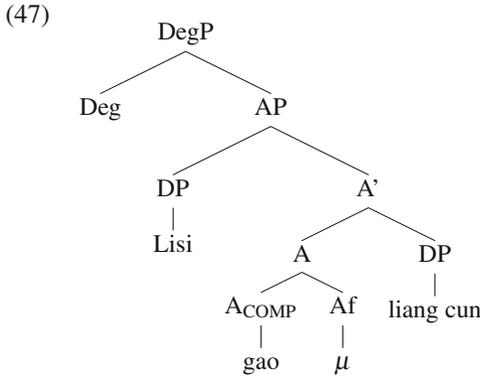
The two surface word orders can then be derived by hypothesizing that  $\mu$  optionally raises to the higher Deg position, pulling the adjectival head along with it and putting it in a position to assign Case to the standard. (We assume with Koopman (1984), Travis (1984), Li (1990) that Case in Mandarin is assigned from left to right.) When this movement occurs, the output is the transitive comparative structure shown in (46a); when it does not occur, *bi* must be inserted as usual, as shown in (46b).<sup>19</sup>

(46)



<sup>19</sup> If it turns out that *bi* is better analyzed as a preposition that forms a constituent with the standard, as argued by Liu (1996) and Lin (2009), then we can eliminate the higher projection of Deg and assume instead that in transitive comparatives, the adjective+ $\mu$  head raises to some other functional projection above AP, and in *bi* comparatives it does not. Furthermore, it is not crucial to our analysis that the head projecting above AP be Deg; it may turn out to be some other category instead.

The second implementation of our analysis involves the hypothesis that in Mandarin, unlike English and Norwegian,  $\mu$  does not head its own functional projection but is instead an affix that attaches directly to the adjective, deriving a new head which selects for a measure phrase:



The underlying structure in (47) can then be mapped onto surface representations that are configurationally identical to (46a, b) except for the absence of a lower DegP projection, so the two implementations equally well derive the asymmetric structural relation between the standard and the differential observed by Xiang.

Although our core proposals are compatible with both the DegP-shell structure in (45) and the  $\mu$ -affix approach in (47), in what follows we will adopt the latter  $\mu$ -affix approach because it has the advantage of reducing the syntactic difference between English-type measure constructions and Mandarin-type measure constructions to a familiar point of cross-linguistic variation. In particular, on this view,  $\mu$  is a morpheme that gets realized in some languages (including English) as a functional head that projects over a particular lexical category (AP) and in other languages (including Mandarin) as an affix that attaches to that lexical category.<sup>20</sup>

To summarize, our analysis (on either implementation) consists of two core proposals. First, as proposed in Svenonius and Kennedy (2006), projection of a measure phrase both requires and is required by the presence of the degree morpheme  $\mu$ , which may combine only with gradable adjectives (comparative or otherwise) that use scales with defined measurement systems. Second, in addition to licensing projection of a measure phrase,  $\mu$  has its own unique syntactic properties, which in Mandarin include the ability to value Case on the standard DP. These two proposals together successfully derive the fact that transitive comparatives are

<sup>20</sup> The proposed syntax in (47) will require us to modify somewhat the denotation for  $\mu$  as presented in Sects. 2.3–2.4 above. See Sect. 5 for details.

acceptable only with comparative adjectives that use defined measurement systems and only when a differential measure phrase is projected.<sup>21</sup>

We close this subsection by responding to an argument by Lin (2009) against Xiang's head-movement approach to transitive comparatives. Lin (2009) presents the asymmetry in (48). In (48a), we see that in the *bi*-comparative, the morpheme *hai* 'more'/'still' may appear before the adjective. If transitive comparatives are derived via head movement of the adjective into the position otherwise occupied by *bi*, then this leads us to expect that (48b) should be grammatical, contrary to fact. Instead, in order to use *hai* in the transitive comparative, *hai* must be placed before the entire predicate (which is also an option in the *bi*-comparative) as illustrated in (49).

- (48) a. ta bi wo **hai** zhong san gongjin.  
 he SM I more heavy three kilogram
- b. \*ta zhong wo **hai** san gongjin.  
 he heavy I More three kilogram  
 'He is three kilograms heavier than I am.'

- (49) a. ta **hai** bi wo zhong san gongjin.  
 he more SM I heavy three kilogram
- b. ta **hai** zhong wo san gongjin.  
 he more heavy I three kilogram  
 'He is three kilograms heavier than I am.'  
 (adapted from Lin 2009, p. 10)

In fact, we see two potential ways of reconciling the data in (48)–(49) with Xiang's (and our) view that transitive comparatives are derived via head movement of the adjective.

The first option involves adopting Lin's own view that *hai* is an adjunct but with the condition that it may adjoin either to a phrase or a head. On this approach, the

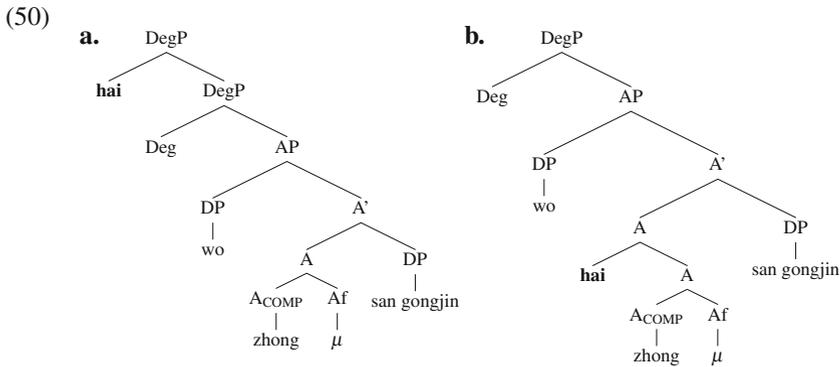
<sup>21</sup> An audience member at the 2009 Annual Research Forum of the Linguistic Society of Hong Kong asks whether this account predicts that a gradable transitive verb such as *xihuan* 'like' should allow both a regular *bi* comparative like (ia) and a "ditransitive comparative" like the ungrammatical (ib) since transitive verbs are Case assigners.

- (i) a. Zhangsan bi Lisi xihuan Wangwu (yi dian).  
 Zhangsan SM Lisi like Wangwu one dot  
 'Zhangsan likes Wangwu (a bit) more than Lisi does.'
- b. \*Zhangsan xihuan Wangwu Lisi (yi dian).  
 Zhangsan like Wangwu Lisi one dot  
*Intended:* 'Zhangsan likes Wangwu (a bit) more than Lisi does.'

In fact, our analysis does not predict (ib) to be well-formed, assuming that a transitive verb assigns Case only to its thematic arguments. Comparatives always involve the addition of an argument (the comparative standard) and so necessitate one additional instance of Case-assignment.

Furthermore, given that the scale used by *xihuan* 'like' is not one for which a conventional measurement system is defined, we analyze *yi dian* 'a bit' in (ib) as a degree modifier rather than a measure phrase; see section 1 above on the basis for this distinction. Therefore, even when *yi dian* is present,  $\mu$  is not projected, and so the standard of comparison does not receive Case, resulting in ungrammaticality.

sentences in (49) have the structure in (50a): *hai* adjoins to DegP, and Deg is filled in the fashion described above, either by insertion of the standard marker *bi*, thus yielding a *bi*-comparative (49a), or by head-movement of *zhong*, thus yielding a transitive comparative (49b). When *hai* adjoins to the adjectival head, on the other hand, the structure is that in (50b). When Deg is filled by *bi*, then the resulting sentence is that in (48a). (48b), on the other hand, is correctly ruled out as ungrammatical since it would require breaking up the complex head consisting of *hai* and *zhong*+ $\mu$ . We expect that grammaticality can be saved by ‘pied-piping’ *hai* along with the adjectival head, and indeed this yields the grammatical word order in (49b), which is surface-string identical to the structure in which *hai* adjoins to the DegP of a transitive comparative.<sup>22</sup>

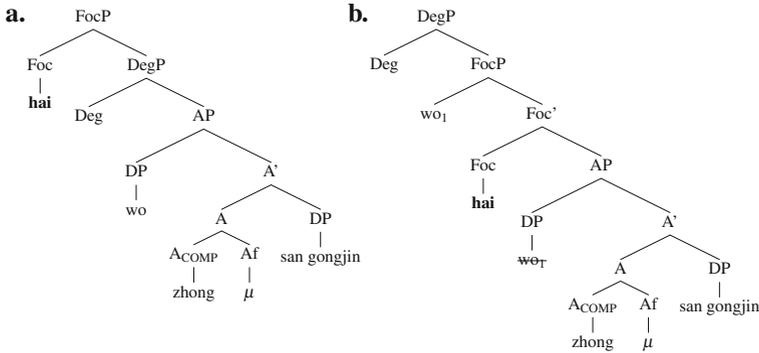


The second option is to hypothesize that *hai* is not an adjunct but rather a Focus head in the main spine of the tree that may project either over DegP or over AP. When it projects over DegP, then the resulting structure is that in (51a) and is consistent both with the *bi*-comparative and the transitive comparative, yielding the sentences in (49). When *hai* projects over AP, its status as a head makes available a new specifier position to which the standard DP can raise in order that it may remain adjacent to its Case-assigner in Deg. This is illustrated in (51b). If *bi* is inserted in Deg, then the resulting sentence is that in (48a). Crucially, what accounts for the ungrammaticality of the transitive comparative counterpart in (48b) is that it incurs a Relativized Minimality violation (Rizzi 1990): the adjectival head in A cannot raise to Deg because Foc intervenes.

<sup>22</sup> Note that a third possible adjunction site for *hai*—namely adjunction to AP—is ruled out for both *bi*-comparatives and transitive comparatives on the grounds that it disrupts the adjacency between the Case-assigner in Deg and the standard DP in [Spec,AP], and indeed the corresponding strings are ungrammatical:

- (i) a. \*ta bi     **hai**    wo zhong san     gongjin.  
       he SM    more I    heavy three     kilogram  
       b. \*ta zhong **hai**    wo san     gongjin.  
       he heavy more I    three     kilogram  
       Intended: ‘He is three kilograms heavier than I am.’

(51)



In summary, there are two plausible ways of analyzing *hai*, both of which afford a treatment of the ungrammaticality of (48b) using only familiar principles. We conclude from this that Lin’s data do not undermine the head-movement approach to transitive comparatives.

3.2 Independent evidence: *chu* and *guo*

Additional support for the two parts of our analysis—the Case-based account of “bare” standards and the hypothesis that Case in transitive comparatives is assigned specifically by  $\mu$ —comes from the interaction of Mandarin comparatives with two overt morphemes in the language. Evidence that transitive comparatives involve a case-assigning functional head that is linked to the distribution of measure phrases comes from the behavior of the overt affix *chu*, whose lexical meaning is ‘exit’ or ‘go beyond.’ As the following examples show, this affix may combine with a gradable adjective in both the *bi*-comparative and the transitive comparative but only when a measure phrase is also projected:

- (52) a. Zhangsan gao **chu** Lisi liang cun.  
           Zhangsan tall CHU Lisi two inch  
           ‘Zhangsan is two inches taller than Lisi.’
- b. \*Zhangsan gao **chu** lisi.  
           Zhangsan tall CHU Lisi

- (53) a. Zhangsan bi Lisi gao **chu** liang cun.  
           Zhangsan SM Lisi tall CHU two inch  
           ‘Zhangsan is two inches taller than Lisi.’
- b. \*Zhangsan bi Lisi gao **chu**.  
           Zhangsan SM Lisi tall CHU

The ungrammaticality of (52b) is unsurprising given the independent fact that transitive comparatives require a measure phrase; more striking is the ungrammaticality of (53b), which shows that *chu* is in general disallowed when there is no

measure phrase. We believe that this indicates that *chu* is a member of the same class of morphemes as  $\mu$  and interpret facts like those in (52)–(53) as support for our analysis.<sup>23</sup>

Independent evidence for a Case-based account of the distribution of bare standards comes from the behavior of the morpheme *guo* ‘exceed’/‘surpass’, discussed in some detail by Liu (2007).<sup>24</sup> As shown by (54), this morpheme can combine with an adjective to license a comparative construction with a bare standard:

- (54) Zhangsan gao **guo** Lisi (liang cun).  
 Zhangsan tall EXC Lisi two inch  
 ‘Zhangsan is (two inches) taller than Lisi.’

Unlike *chu*, however, *guo* cannot be analyzed as belonging to the same class of morphemes as  $\mu$ , for three reasons. First, as seen in (54), the measure phrase is optional in this construction. Second, as shown in (55), *guo* can be used even with adjectives that are not associated with a measurable scale, such as *piaoliang* ‘pretty’:

<sup>23</sup> The distribution of *chu* is actually more restricted than its null counterpart  $\mu$ . First, *chu* may not combine with negative antonyms like *ai* ‘short’:

- (i) Zhangsan ai (\*chu) Lisi liang cun.  
 Zhangsan short (\*CHU) Lisi two inch  
 ‘Zhangsan is two inches shorter than Lisi.’

Second, *chu* cannot appear with noncomparative adjectives:

- (ii) \*Zhangsan {liang mi} gao (\*chu) {liang mi}.  
 Zhangsan two meter tall (\*CHU) two meter  
 ‘Zhangsan is two meters tall.’

Third, the obligatory status of *chu* in the following sentence, supplied by an anonymous reviewer, suggests that *chu* is required in order for transitive comparatives to be used in a dynamic (non-stative) context.

- (iii) suiran zhichu buduande gao \*(chu) yusuan yi-xie,  
 though expenditure continuously high \*(CHU) budget a-little.bit  
 danshi women haishi keyi yinfu de guoqu.  
 but we still can handle DE pass  
 ‘Although the expenditure keeps being a little bit higher than the budget, we can still manage.’

These facts can be explained by assuming that *chu* has selectional requirements that are different from (although overlapping with)  $\mu$ , something that is not unexpected if both are independent lexical items in a particular affixal class. We return to this issue in Sect. 5 (see note 30), where we provide a semantics for  $\mu$  and the constructions in which it appears.

<sup>24</sup> Liu (2007) in fact argues that the *guo*-comparative and transitive comparative are closely related, with the latter involving a covert ‘weak’ version of *guo* which Liu argues is responsible for the obligatory status of the measure phrase. See Sect. 4 below, where we review this approach in more detail and argue that it is not adequate.

- (55) zhangsan piaoliang **guo** Lisi.  
 Zhangsan pretty EXC Lisi  
 ‘Zhangsan is prettier than Lisi.’

Finally, *guo* can co-occur with *chu* in the same construction:

- (56) Zhangsan gao **chu guo** Lisi liang cun.  
 Zhangsan tall CHU EXC Lisi two inch  
 ‘Zhangsan is two inches taller than Lisi.’

We conclude that although it is not a realization of  $\mu$ , *guo* provides yet another means for assigning Case to the standard.<sup>25</sup> This supports the general idea that when the morpheme *bi* is absent from a comparative, something else must be present to assign Case to the standard: this can be the silent morpheme  $\mu$ , its overt counterpart *chu*, or the morpheme *guo*.

### 3.3 Additional differences between transitive and *bi* comparatives

In the next section, we compare our analysis of Mandarin transitive comparatives to previous accounts. For the sake of completeness, however, we would like to document two additional differences between *bi*-comparatives and transitive comparatives before moving to this discussion. The first difference, observed by Xiang (2005, p. 206), has to do with the interpretation of indefinite standards. Xiang points out that whereas *bi*-comparatives allow generic standards (57a), transitive comparatives do not ((57b), cf. the non-generic standards in (58a, b), which are grammatical in both constructions):

- (57) a. zhe zhi gang-chusheng de xiao luotuo bi ma da (yi-dian).  
 this CL just-born PRT small camel SM horse big (one-dot)  
 ‘This new-born camel is (a little) bigger than a horse.’  
 b. \*zhe zhi gang-chusheng de xiao luotuo da ma yi-dian.  
 this CL just-born PRT small camel big horse one-dot  
*Intended:* ‘This new-born camel is a little bigger than a horse.’
- (58) a. zhe zhi gang-chusheng de xiao luotuo bi na  
 this CL just-born PRT small camel SM that  
 pu ma da (yi-dian).  
 CL horse big (one-dot)  
 ‘This new-born camel is (a little) bigger than that horse.’

<sup>25</sup> This of course entails that in examples like (56), where *chu* and *guo* co-occur, there are two potential case assigners for the standard of comparison, yet presumably only one of them is active in assigning case to the standard. This is consistent with our assumption that case assigners need not assign case each time they are projected; see note 14 above and note 29 for more on this assumption.

- b. zhe zhi gang-chusheng de xiao luotuo da na  
 this CL just-born PRT small camel big that  
 pu ma yi-dian.  
 CL horse (one-dot)  
 ‘This new-born camel is a little bigger than that horse.’

Xiang (2005) accounts for this difference by building on the idea that generic DPs are mapped onto the restriction of a generic operator and that the structure of a sentence determines a partitioning of material into restriction and scope (Diesing 1992). Xiang proposes that in Mandarin comparatives, the position of the adjective determines the partitioning and that only in the case of *bi*-comparatives, where the adjective stays low, can the standard (optionally) escape the scope and be mapped onto the restriction, thus yielding a generic reference. Our syntactic analysis also captures this difference, insofar as the structural configurations of *bi*-comparatives and transitive comparatives are the same as in Xiang’s analysis.<sup>26</sup>

The second difference has to do with the distribution of the additive morpheme *geng* ‘even (more)’, which, as Liu (2007) shows, is allowed in *bi*-comparatives but not transitive comparatives.

- (59) a. Zhangsan bi Lisi **geng** gao.  
 Zhangsan SM Lisi even.more tall  
 ‘Zhangsan is even taller than Lisi.’  
 b. \*Zhangsan **geng** gao Lisi liang cun.  
 Zhangsan even.more tall Lisi two inch

On our view, this difference follows from the independent fact that *geng* is in general semantically or pragmatically incompatible with measure phrases, as illustrated with the following *bi*-comparative:

<sup>26</sup> According to an anonymous reviewer, Xiang’s generalization that transitive comparatives disallow generic standards is challenged by the counterexample in (i).

- (i) yi-ban-lai-shuo, niu zongshi da ma yi-xie.  
 one-kind-come-say cow always big horse a-little.bit  
 ‘Generally speaking, cows are bigger than horses.’

(i) differs from the kind of data that motivated Xiang’s generalization in two potentially important ways. First, (i) contains overt quantificational elements (*yi-ban-lai shuo* ‘generally speaking’ and *zongshi* ‘always’) whereas Xiang’s examples do not. Second, in (i), both the target and the standard are generic whereas in Xiang’s examples, the target refers to a specific individual. Since the distribution of generic standards is not central to the claims in this paper, we leave it to further research to determine if either or both of these differences are crucial in licensing the generic standard and to assess how this kind of data bear on Xiang’s analysis.

- (60) \*Zhangsan bi Lisi **geng** gao liang cun.  
 Zhangsan SM Lisi even.more tall two inch

Since transitive comparatives grammatically require a measure phrase, we thereby explain the contrast in (59).

Liu entertains and ultimately rejects this explanation on the basis of the following minimal pair (Liu 2007, fn22), showing that *geng* is compatible with the differential *yi-xie* in the *bi*-comparative but not in the transitive comparative:

- (61) a. Zhangsan bi Lisi **geng** gao yi-xie.  
 Zhangsan SM Lisi even.more tall a-little.bit  
 ‘Zhangsan is a little bit taller than Lisi.’  
 b. \*Zhangsan **geng** gao Lisi yi-xie.  
 Zhangsan even.more tall Lisi a-little.bit

In light of this data, Liu suggests that *geng* is ungrammatical in transitive comparatives because transitive comparatives involve a silent version of the verb *guo* ‘exceed’ (see Sect. 4 below), which is dynamic and therefore conflicts with the restriction of *geng* to stative predicates.

We have two comments to make here. First, Liu’s suggestion is problematic because there is no independent evidence that transitive comparatives have a dynamic interpretation. Although it is conceivable that they involve a silent version of ‘exceed’, which etymologically may be a dynamic verb, we are not aware of any synchronic evidence that transitive comparatives have a dynamic interpretation, and they fail standard tests for dynamicity, such as compatibility with the progressive marker *zai*<sup>27</sup>:

- (62) \*Zhangsan zai gao Lisi liang cun.  
 Zhangsan PROG tall Lisi two inch  
 Intended: ‘Zhangsan is exceeding Lisi in height by two inches.’

<sup>27</sup> An anonymous reviewer points out that the progressive marker *zai* is also incompatible with achievements, which are dynamic. However, there is no reason to believe that transitive comparatives denote achievements. They cannot, for example, be used with the Mandarin equivalent of *in-time* adverbials, as shown in (ia) (cf. the grammaticality of the time adverbial in a true achievement like (ib)).

- (i) a. \*Zhangsan yi nian nei gao Lisi liang cun.  
 Zhangsan one year within tall Lisi two inch  
 Intended: ‘Within a year, Zhangsan was two inches taller than Lisi.’  
 b. Zhangsan yi nian nei zhao-dao le gongzuo.  
 Zhangsan one year within find-arrive PRF work  
 ‘Zhangsan found work within a year.’

These data confirm that transitive comparatives are stative. See also note 23 above for data suggesting that in order for transitive comparatives to be used in a dynamic sense, special morphology (in particular the morpheme *chu*) may be required.

Second, we believe that (61) is not sufficient for demonstrating the compatibility of *geng* with measure phrases. In particular, as we have argued above in Sect. 1, indefinite degree terms like *yi-xie* ‘a little bit’ are ambiguous between true measure phrases and degree modifiers which have different syntactic and semantic properties.<sup>28</sup> We therefore suggest that in (61a), the presence of *geng* forces a degree modifier interpretation of *yi-xie*, which is acceptable because *bi*-comparatives do not require measure phrases. In (61b), on the other hand, the degree modifier interpretation of *yi-xie* is not available because transitive comparatives require a measure phrase, but the measure phrase interpretation is also unavailable because of its semantic or pragmatic conflict with *geng*.

### 3.4 Summary

Summing up, we have argued that the acceptability of the *bi*- vs. transitive comparative construction in Mandarin is a function of whether the standard DP is able to receive abstract Case. For adjectives like *gao* ‘tall’ that are associated with measurable scales, the Case assigner can be either *bi*, as in (63a), or the functional element  $\mu$  (and its overt counterpart *chu*), which combines with the adjective if and only if a MP is projected, as in (63b). When neither of these elements is present, the resulting structure is ungrammatical, as in (63c).

- (63) *Adjectives with measurable scales*
- |  |                                      |
|--|--------------------------------------|
| a. $bi\ DP_{std}\ A_{[COMP]}(+\mu\ DP_{meas})$ | <i>bi</i> assigns Case to $DP_{std}$ |
| b. $A_{[COMP]}+\mu\ DP_{std}\ DP_{meas}$       | $\mu$ assigns Case to $DP_{std}$     |
| c. $*A_{[COMP]}\ DP_{std}$                     | $DP_{std}$ does not get Case         |

For adjectives that are not associated with a measurable scale, such as *gaoxing* ‘happy’ and *piaoliang* ‘beautiful’, *bi* is again an appropriate case assigner, as in (64a), but, as schematized in (64b),  $\mu$  (or *chu*) is independently ruled out since it is incompatible with this kind of adjective. (Both kinds of adjectives also permit combination with the morpheme *guo* ‘exceed’, as shown in Sect. 3.2, which also licenses a kind of transitive comparative structure, albeit one with slightly different distributional properties.)

- (64) *Adjectives without measurable scales*
- |   |                                      |
|---|--------------------------------------|
| a. $bi\ DP_{std}\ A_{[COMP]}$             | <i>bi</i> assigns Case to $DP_{std}$ |
| b. $*A_{[COMP]}+\mu\ DP_{std}\ DP_{meas}$ | $\mu$ cannot combine with A          |
| c. $*A_{[COMP]}\ DP_{std}$                | $DP_{std}$ does not get Case         |

The Case-assigning capacity of  $\mu$  invites a comparison to voice morphology. Semantically,  $\mu$  is similar to, e.g., little *v* in that its semantic function is to mediate between a lexical verb and an “extra” argument: the external argument in the case

<sup>28</sup> As pointed out by an anonymous reviewer, *yi-xie* is like *yi-dian* (see note 4 above) in being acceptable with a comparative adjective but not with an unmodified (noncomparative) adjective. See note 4 above for an explanation of why this fact does not undermine the claim that *yi-xie* is ambiguous between a measure phrase and a degree modifier.

of *v*, and the degree argument in the case of  $\mu$ . We have in effect proposed here that *v* and  $\mu$  (in Mandarin at least) share a syntactic property as well, in licensing Case on an internal argument of the lexical projection with which they combine: the theme argument of a transitive verb in the case of *v*, and the standard argument of a comparative adjective in the case of  $\mu$ .<sup>29</sup>

A further parallel between  $\mu$  and *v* that makes the analogy even stronger is that both may impose apparently arbitrary restrictions on the kinds of complements they combine with. Whereas most functional morphemes are indiscriminate in this regard (e.g., it would be odd to find a language in which a past tense morpheme may combine only with an arbitrarily restricted set of verbs), we pointed out in Sect. 2.1 above that not all non-comparative adjectives, even among those with appropriate scales, can combine with MPs (e.g., *2 meters tall* vs. *\*2 pounds heavy*). As discussed in Sect. 2.3, Svenonius and Kennedy (2006) capture this via a lexical selectional restriction on  $\mu$ . Similarly, not all verbs can be used transitively or take an external argument, and insofar as this is not entirely reducible to semantic differences among verbs, it can be captured by imposing lexical selectional restrictions on *v*. (See also, however, Sect. 5 below, where we discuss an alternative to the lexical selection view of  $\mu$ : Sawada and Grano (2011) argue for an account in terms of semantic domain restriction.)

#### 4 Comparison to previous approaches

In this section, we review previous theoretical approaches to the transitive comparative construction and compare them with the Case-based account presented in the previous section. Readers primarily interested in the syntactic and semantic implications of our proposal may skip directly to the next section, which is a progression of the discussion in the previous section and which will not rely on the conclusions drawn in this section.

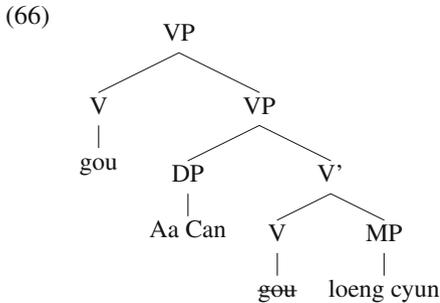
Aside from Xiang (2005), we are aware of two previous theoretical approaches to the transitive comparative construction: Mok (1998) and Liu (2007). Mok (1998) analyzes the Cantonese equivalent of the transitive comparative (his ‘obligatory measuring comparative’), which is illustrated in (65). As we see here, Cantonese is like Mandarin in requiring an overt differential measure phrase in this construction.

- (65) Keoi   gou   Aa   Can   \*(loeng   cyun).  
       3sg   tall   Aa   Can   \*(two   inch)  
       ‘He is two inches taller than Aa Can.’ (adapted from Mok 1998, p. 109)

<sup>29</sup> As pointed out in note 14 above, the overt case assigner *bi* need not assign Case each time it is projected, and the same holds for  $\mu$ :  $\mu$  assigns Case only when the adjective+ $\mu$  complex is in a structurally appropriate position to do so. This is another way in which  $\mu$  is parallel to *v*. On the assumption that the latter element is present in sentences containing unergative intransitive verbs, it typically does not assign Case, but it may do so in the presence of an argument that is introduced by a resultative secondary predicate:

- (i) a. John ran.  
       b. John ran **the pavement** thin.

Mok's analysis is concerned primarily with the syntax of this construction and in particular on establishing the right constituency. Mok argues that the predicate in a transitive comparative has the following structure (Mok 1998, p. 112):



Here, the adjective (or rather, verb, on Mok's view) forms a constituent with the measure phrase, with the standard of comparison sitting in specifier position; the surface word order is derived via head-movement of the verb to a higher V position. This proposed syntax shares a number of important properties with the structure we have advocated for the Mandarin transitive comparative (and Xiang's (2005) structure on which it is based), namely, the ideas that (1) the adjective (or verb) forms a constituent with the measure phrase, (2) the standard of comparison sits in [Spec,VP] (our [Spec,AP]), and (3) the surface word order is derived via head-movement of the adjective (verb) into a structurally higher position.

The important difference between our approach and Mok's, however, is that in Mok's approach, the measure phrase combines directly with the adjective or verb rather than being introduced by the degree morpheme  $\mu$ . Mok claims that the fact that the measure phrase is obligatory in the transitive comparative provides evidence for his proposed constituency: he reasons that because the measure phrase and the gradable predicate form a constituent, it is possible to say that they "jointly" license the standard of comparison and are thus both required. However, Mok does not have anything to say about *why* the standard of comparison must be licensed in this way or about how it is that a "joint" A+MP structure ends up having the licensing properties it does. Our analysis, in contrast, answers both of these questions: the standard DP must receive Case, and  $\mu$ , which is present if and only if a MP is also present, is a Case assigner.

We turn now to Liu (2007). Liu's approach involves a comparison between the transitive comparative (in Liu's terminology, the 'X A (Y) D comparative') and another comparative construction which Liu claims is closely related, namely, the *guo*-comparative mentioned in Sect. 3.2 above and exemplified in (67).

- (67) Zhangsan    gao    **guo**    Lisi    (san    gongfen).  
 Zhangsan    tall    exceed    Lisi    three    centimeter  
 'Zhangsan is (three centimeters) taller than Lisi.' (Liu 2007, p. 74)

Liu compares the *guo*-comparative with the transitive comparative with respect to a number of properties. Among the differences Liu points out between the *guo*-comparative and the transitive comparative are the following:

First, *guo*-comparatives are restricted to positive members of antonym pairs whereas transitive comparatives are not:

- (68) a. zhe tiao shengzi {chang / \*duan} **guo** na tiao  
 this CL rope long / short exceed that CL  
 liang yingchi.  
 two inch  
 ‘This rope is two inches longer than that one.’
- b. zhe tiao shengzi {chang / duan} na tiao liang yingchi.  
 this CL rope long / short that CL two inch.  
 ‘This rope is two inches longer/shorter than that rope.’

Second, *guo*-comparatives are compatible with any kind of gradable adjective (modulo the restriction just mentioned) whereas transitive comparatives require an adjective associated with a measurable scale:

- (69) a. zhe ge nühai piaoliang **guo** na ge nühai hen duo.  
 this CL girl beautiful exceed that CL girl very much  
 ‘This girl is a lot more beautiful than that one.’
- b. \*zhe ge nühai piaoliang na ge nühai san du.  
 this CL girl beautiful that CL girl three degree

Finally, in *guo*-comparatives, the standard is obligatory, and the measure phrase is optional whereas in transitive comparatives, the reverse is the case: the standard is optional, but the measure phrase is obligatory.

- (70) a. Zhangsan gao **guo** \*(Lisi) (shi gongfen).  
 Zhangsan tall exceed Lisi ten centimeter  
 ‘Zhangsan is (ten centimeters) taller than Lisi’
- b. Zhangsan gao (Lisi) \*(shi gongfen).  
 Zhangsan tall Lisi ten centimeter  
 ‘Zhangsan is ten centimeters taller (than Lisi).’

Liu’s analysis of these two comparative constructions builds on the idea in Schwarzschild and Wilkinson (2002) that gradable adjectives are relations between degree intervals and individuals and that comparison involves two predicates of intervals in addition to a predicate which asserts a gap between the two intervals. On this approach, a measure phrase is a way of overtly spelling out the “gap” predicate (in the absence of an overt measure phrase, a covert differential SOME asserts a contextually specified minimum gap). For example, the sentence in (71a) has the interpretation in (71b) (using the notation from Sect. 2.2), which is true just in case the interval separating Zhangsan’s height from Lisi’s height is equal to three centimeters (cf. Liu 2007, p. 80.)

- (71) a. Zhangsan gao **guo** Lisi san gongfen.  
 Zhangsan tall exceed Lisi three centimeter  
 ‘Zhangsan is three centimeters taller than Lisi.’  
 b.  $\exists I[3\text{cm}(I) \wedge I = \{d \mid \text{height}(z) \succeq d \wedge \text{height}(l) < d\}]$

From here, Liu argues that the differences noted between the transitive comparative and the *guo*-comparative follow from the proposal that transitive comparatives involve a “weak” version of the *guo* comparative morpheme. On his view, both positive and negative members of antonym pairs are allowed with the transitive comparative because “the ‘weakness’ of the covert verbal suffix . . . in the lexical meaning makes its selection restriction on the adjective less strict than that of the overt verbal suffix” (p. 82). The standard of comparison is optional with the transitive comparative because “the ‘semantic content’ of the covert verbal suffix . . . is so bleached that its ‘transitivity’ force becomes weaker than that of the overt verbal suffix *guo*” (p. 82). Finally, Liu suggests that the measure phrase in transitive comparatives is obligatory because the “semantic content [of the null weak version of *guo*] is bleached to an extent that . . . it is not strong enough to function as predicate to describe the interval argument of adjectives” (p. 81).

We have three criticisms of this analysis. The first is that Liu’s notions of “weak” and “bleached” are not well-defined, and the relation between weakness/bleachedness and overt vs. covert morphology is not formalized, making it impossible to test the broader predictions of the proposals and weakening its explanatory force. The second criticism is empirical and involves the differences between the morphemes *guo* and *chu* that we observed in Sect. 3.2 above. Both morphemes are overt, so (modulo the concerns about predictive power raised above), Liu’s analysis would seem to predict that they should pattern together with respect to the distribution of measure phrases and differently from his hypothesized null, “weak” morpheme in transitive comparatives. However, the data presented in Sect. 3.2 show that, in fact, *chu* patterns with transitive comparatives (and is in fact more restrictive, which would be surprising if overt morphemes are “stronger” than covert ones; see note 23).

Finally, a third problem with this approach is that it does not explain why it is in particular measure phrases, and not differential expressions more generally, that the use of Liu’s weak comparative morpheme is triggered. In Schwarzschild and Wilkinson’s system, upon which Liu’s analysis is based, measure phrases are just one subtype of a larger class of differentials that include for example *yi dian* ‘a little’, as in (72). Hence we lose the ability to explain the contrast in grammaticality between (72a) and (72b).

- (72) a. \*Zhangsan **congming** Lisi yi dian.  
 Zhangsan smart Lisi one dot  
 ‘Zhangsan is (a little) smarter than Lisi.’  
 b. Zhangsan **gao** Lisi yi dian.  
 Zhangsan tall Lisi one dot  
 ‘Zhangsan is one meter / a little taller than Lisi.’

In this minimal pair, the only difference is the gradable predicate. Under Liu's account, it is not clear why transitive comparatives are allowed with predicates like *gao* 'tall' but not with predicates like *congming* 'smart'. In the analysis presented in the previous section, on the other hand, this contrast follows automatically from the fact that *gao* but not *congming* uses a scale that supports measurement and so is able to combine with  $\mu$ .

## 5 The grammar of measurement

As we argued in the previous section, we believe that our analysis in its general form provides an account of transitive comparatives that has more explanatory power than previous alternatives. In this final section, we want to address some syntactic and semantic questions about our analysis that stem from our assumption that  $\mu$  in Mandarin is an affix rather than the head of an independent functional projection, as in Svenonius and Kennedy (2006), as well as some more general questions about cross-linguistic variation and the linguistic encoding of measurement.

As noted above, the central syntactic difference between our analysis of measurement constructions in Mandarin and the analysis proposed by Svenonius and Kennedy (2006) has to do with the morphosyntactic status of  $\mu$ : in the latter work,  $\mu$  is the head of an extended projection of A; in the current proposal, it affixes to A and does not head an independent functional projection. We made this modification to accommodate both the word order in Mandarin (in which the measure phrase appears on the right) and Xiang's (2005) observation that the standard asymmetrically c-commands the differential measure phrase, and in Sect. 3.1, we showed how the analysis supports an account of the distributional properties of Mandarin transitive comparatives. What we want to do now is show that the affixal analysis of  $\mu$  supports a more general account of the syntax and semantics of measure phrases in Mandarin, in both comparative and non-comparative predicates.

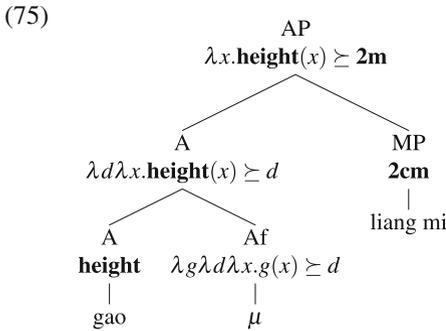
Let us begin with basic questions of semantic composition. The assumption that  $\mu$  is an affix in Mandarin is fully compatible with the semantic hypothesis that degree morphology turns a measure function into a property, which was the basis for the denotation that Svenonius and Kennedy proposed for  $\mu$  in English and Norwegian, repeated in (73).

$$(73) \quad \llbracket \mu \rrbracket = \lambda g_{\langle e,d \rangle} \lambda d \lambda x. g(x) \succeq d$$

This denotation correctly captures the interpretation of measure phrases in predicates formed out of non-comparative adjectives in Mandarin. As shown by (74), measure phrases surface to the right of a non-comparative adjective, in the same position that we saw in comparative constructions. (MPs may also precede non-comparative adjectives, a point to which we return presently.)

- (74) Zhangsan      gao      liang      mi.  
        Zhangsan      tall      two      meters  
        'Zhangsan is two meters tall.'

Assuming as above that  $\mu$  affixes to an adjective, licensing projection of a measure phrase, the structure of the AP in (74) is as shown in (75), and the denotation given for  $\mu$  in (73) derives the correct interpretation for the predicate.



However, unlike what was the case in Norwegian and English, the denotation of  $\mu$  given in (73) fails to derive a correct meaning for comparatives in Mandarin. Comparative adjectives in all three languages (and presumably universally) have an extra argument—the standard term—and so have a different semantic type from non-comparative adjectives:  $\langle e, \langle e, d \rangle \rangle$  instead of  $\langle e, d \rangle$ . In English and Norwegian, the standard argument is a complement of the comparative adjective and so is saturated prior to composition with  $\mu$ . This means that a comparative AP and a non-comparative AP have the same semantic type, and given the difference-function semantics of comparatives, are able to compose with  $\mu$  in exactly the same way to derive the correct truth conditions (see Sect. 2.4).

In contrast, the order of composition in Mandarin is different. In particular,  $\mu$  combines with the comparative adjective before the standard argument has been saturated. To accommodate this difference, we need to posit a second denotation for “comparative”  $\mu$  in Mandarin. The right denotation can be straightforwardly defined in terms of the basic meaning of  $\mu$  as shown in (76a), which simplifies to (76b).

- (76) a.  $\llbracket \mu_{\text{COMP}} \rrbracket = \lambda g_{\langle e, \langle e, d \rangle \rangle} \lambda d \lambda y. \llbracket \mu \rrbracket (d)(g(y))$   
 b.  $\llbracket \mu_{\text{COMP}} \rrbracket = \lambda g_{\langle e, \langle e, d \rangle \rangle} \lambda d \lambda y \lambda x. g(y)(x) \succeq d$

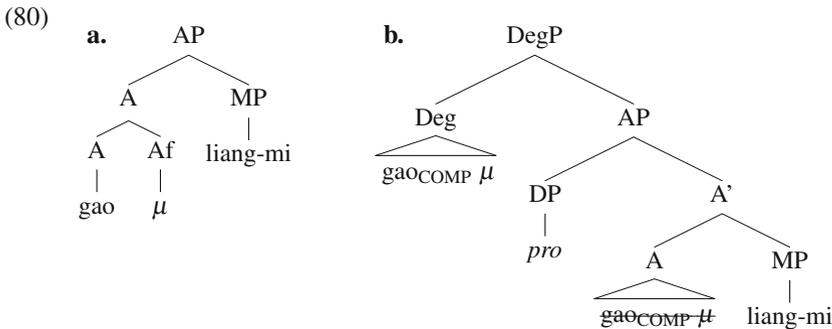
The move from  $\mu$  to  $\mu_{\text{COMP}}$  is thus a simple matter of type-shifting, which might look *ad hoc* at first but in fact is independently necessary for any kind of morphology that can combine with functors that have different numbers of arguments, such as transitive and intransitive verbs, or adjectives with different numbers of arguments. For example, if comparative morphology combines directly with an adjective, as we have assumed here, then we need to posit a similar kind of type-flexibility to accommodate the fact that COMP combines



- (79) Zhangsan liang mi gao.  
 Zhangsan two meter tall  
 ‘Zhangsan is two meters tall.’  
 NOT ‘\*Zhangsan is two meters taller.’

The descriptive generalization here is that when the measure phrase follows the gradable predicate, the interpretation can be either non-comparative or comparative (provided the adjective is one that allows measure phrases in its non-comparative form) whereas when the measure phrase precedes the gradable predicate, the interpretation is obligatorily non-comparative.

The fact that APs with post-adjectival measure phrases have both comparative and non-comparative interpretations is not surprising, given two independent facts about the language: comparative adjectives are identical to non-comparative adjectives in their surface morphology, as we have seen, and Mandarin generally allows for argument positions to be filled by the null pronoun *pro* (Huang 1984, 1989). It follows that the predicate in (78) can be parsed either as in (80a), which gives the non-comparative meaning, or as in (80b), which derives the comparative meaning.<sup>31</sup>

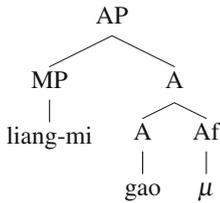


Turning to (79), the simplest explanation is to assume that a measure phrase can merge with a  $\mu$ -affixed non-comparative adjective either as its complement, as in (80a), or as its specifier, as in (81).

<sup>31</sup> We show the complex adjective- $\mu$  head as having undergone string-vacuous movement in (80b) because we assume that *pro*, like other DPs, must receive Case. Given the fact that *bi* insertion is incompatible with a null standard, as shown by (i), the only way to license Case on *pro* is for the adjective- $\mu$  head to raise, just as in transitive comparatives with overt standards.

- (i) \*Zhangsan bi gao liang mi.  
 Zhangsan SM tall two meter  
 Intended: ‘Zhangsan is two meters taller.’

(81)



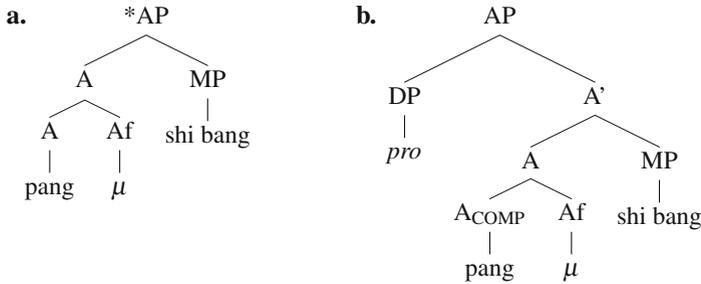
This option is not available for comparative adjectives, however, because the specifier of AP is filled by the standard argument. This explains the lack of ambiguity in (79).

We now turn to a more general question about the syntax and semantics of measurement constructions that arises in the context of the analysis we have adopted to explain Mandarin transitive comparatives. As we discussed initially in Sect. 2.1, there are idiosyncratic restrictions on measure phrase distribution with non-comparative adjectives. Mandarin is similar to English in that the distribution of measure phrases with non-comparative adjectives is somewhat idiosyncratic. For example, (78) and (79) above show that *gao* ‘tall’ allows for a measure phrase in the non-comparative form while (82a-b) shows that *pang* ‘fat’ allows measure phrases only in the comparative: (82a) is completely ungrammatical because the MP ADJ word order does not allow a comparative interpretation; (82b) is grammatical but unambiguous.

- (82) a. \*Zhangsan shi bang pang.  
       Zhangsan ten pound fat  
       Intended: ‘Zhangsan is 10 pounds fat.’
- b. Zhangsan pang shi bang.  
       Zhangsan fat ten pound  
       NOT: ‘\*Zhangsan is 10 pounds fat.’  
       ONLY: ‘Zhangsan is 10 pounds fatter than some salient individual.’

As discussed in Sect. 2.3, Svenonius and Kennedy (2006) account for cases like this by hypothesizing that  $\mu$  selects generally for comparative adjectives, but arbitrarily for non-comparative ones, in a way that can vary from language to language. Our hypothesis that  $\mu$  is an affix in Mandarin is fully compatible with this kind of explanation of facts like (82), albeit at the word level rather than phrasal level: we simply assume that affixal  $\mu$ , like its functional head variant, has selectional properties which allow it to combine freely with comparative adjectives and idiosyncratically with non-comparatives and that *pang* is not among the set of non-comparative adjectives that it selects for. On this view, the structure in (83a) is thus fully interpretable but is ungrammatical because it violates the selectional properties of  $\mu$ ; (83b), on the other hand, is both interpretable and grammatical, given the assumption that  $\mu$  selects generally for comparative adjectives.

(83)



This account certainly works and has the analytical advantage we noted earlier in Sect. 2.3: idiosyncratic distinctions like *\*10 pounds heavy* vs. *10 inches tall* are captured in the selectional properties of a single lexical item,  $\mu$ . However, it is worth asking whether such properties are purely formal or whether they are based in some aspect of the meaning of  $\mu$  and the meanings of the expressions it composes with: the adjectival head (a measure function) and the measure phrase (a degree, quantifier over degrees, or property of degrees, depending on one's analysis). On this alternative view, there would be nothing syntactically problematic about a structure like (83a), but there would be some crucial difference in meaning between non-comparative *pang* (or English *heavy*) and comparative *pang<sub>COMP</sub>* (or English *heavier*) which would render composition of  $\mu$  with the former uninterpretable but composition with the latter interpretable.

The most salient semantic difference between *pang<sub>COMP</sub>/heavier* and *pang/heavy* is that the former is a difference function and the latter is a “regular” measure function. Among other things, this distinction has consequences for the scalar properties of the two terms: difference functions (by definition) use scales with minimal elements (the degree that corresponds to the position of the standard on the scale); regular measure functions may or may not use scales with minimal elements. The analytical question is whether this difference can be exploited in a way that can explain the (apparently) idiosyncratic variation we find across languages in the set of non-comparative adjectives that allow measure phrases. Sawada and Grano (2011) attempt to do exactly this. In particular, Sawada and Grano argue on the basis of data from Japanese, Spanish, Korean, and Russian that comparative adjectives pattern systematically with non-comparative adjectives that have a minimal element (i.e., adjectives with a lower closed scale in the sense of Kennedy (2007b); e.g., *bent*, *open*) in being acceptable with measure phrases cross-linguistically and propose to explain this in terms of a semantic domain restriction on  $\mu$ . On top of this, some languages such as English and Mandarin allow measure phrases with an idiosyncratic set of open scale adjectives, which might also be understood as involving a kind of domain restriction. We do not have the space here to fully assess this line of reasoning, but we see it as a plausible and potentially more explanatory variant of the selection-based analysis proposed in Svenonius and Kennedy (2006).

That said, we also want to emphasize that the selection-based account of measure phrase distribution is not the only theoretical advantage of the idea that measure phrases (and degree arguments more generally) are introduced by a special functional element  $\mu$ . As we pointed out in Sect. 2.3 (see also the discussion at the end of Sect. 2.2), a second feature of this proposal, and arguably the more important theoretical one, is that it associates a very specific type of syntactic representation to measurement constructions, one which includes a designated functional element  $\mu$ . As such, it provides a basis for explaining purely syntactic phenomena that correlate with the presence of measure phrases—and indeed generates the expectation that such phenomena should exist—something that distinguishes the analysis from purely semantic approaches to measure constructions, such as Schwarzschild (2005). Svenonius and Kennedy (2006) argue that null degree questions in Northern Norwegian are best explained in terms of this analysis of the grammar of measurement; in this paper, we have made the case that Mandarin transitive comparatives are another.

On a final note, a few words are in order on the matter of cross-linguistic variation in the acceptability of the transitive comparative construction. As stated in the introduction, transitive comparatives are not unique to Mandarin but are found as well in other varieties of Chinese (Ansaldo 1999) as well as in at least one language group genetically unrelated to Chinese (albeit spoken primarily in southern China), namely the Kam-Sui group of Tai-Kadai (Morev 1998). However, as we stated in note 5, in some varieties of Chinese, the transitive comparative is grammatical without an overt differential expression and even with predicates for which no conventional measurement system is defined, as in the following example from Chaozhou, repeated from above:

- (84) i        ho        ua.  
       3sg    good    1sg  
       ‘He is better than me.’ (Ansaldo 1999, p. 43)

At the other extreme, it appears that in most of the languages of the world, transitive comparatives are unacceptable regardless of whether a measure phrase is present. This includes both languages like English, in which predicative adjectives are introduced by a copula (85), and languages like standard Thai, where predicative adjectives do not require a copula (86).

- (85) \*John is tall Bill five inches.  
 (86) \*John suung Bill hohk niu.  
       John tall Bill six inch  
       Intended: ‘John is six inches taller than Bill.’

Our Case-based analysis of Mandarin transitive comparatives provides a framework for analyzing this kind of cross-linguistic variation. In particular, we hypothesize that in languages like Chaozhou, COMP itself, i.e., the morpheme that introduces comparative semantics, is able to assign Case to the standard of comparison. This

hypothesis captures the fact that in this language, the transitive comparative is possible without a measure phrase and can be used with any adjective that can participate in a comparative construction. As for languages like English, which lack transitive comparatives altogether, the natural hypothesis is that in these languages,  $\mu$  does not have the ability to assign Case (nor, for that matter, *-er/more/COMP*). This accurately derives the fact that in such languages, overt morphology (such as the standard marker *than* in English) must be used in the presence of a standard of comparison. We leave it to further research to establish the feasibility (or lack thereof) of this approach to understanding cross-linguistic variation in the acceptability of transitive comparatives.

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## References

- Abney, Steven P. 1987. The English noun phrase in its sentential aspect. Ph.D. diss., Massachusetts Institute of Technology.
- Ansaldò, Umberto. 1999. Comparative constructions in Sinitic: Areal typology and patterns of grammaticalization. Ph.D. diss., Stockholm University.
- Bale, Alan. 2009. A universal scale of comparison. *Linguistics and Philosophy* 31(1): 1–55.
- Bartsch, Renate, and Theo Vennemann. 1973. *Semantic structures: A study in the relation between syntax and semantics*. Frankfurt: Athänum Verlag.
- Barwise, Jon, and Robin Cooper. 1981. Generalized quantifiers and natural language. *Linguistics and Philosophy* 4: 159–219.
- Bhatt, Rajesh, and Shoichi Takahashi. 2007. Direct comparisons: Resurrecting the direct analysis of phrasal comparatives. In *Proceedings of Semantics and Linguistic Theory 17*, ed. M. Gibson and T. Friedman, 19–36. New York: CLC Publications.
- Bierwisch, Manfred. 1989. The semantics of gradation. In *Dimensional adjectives*, ed. Manfred Bierwisch and Ewald Lang, 71–261. Berlin: Springer.
- Bresnan, Joan. 1973. Syntax of the comparative clause construction in English. *Linguistic Inquiry* 4: 275–343.
- Chao, Y.R. 1968. *A grammar of spoken Chinese*. Berkeley: University of California Press.
- Corver, Norbert. 1990. The syntax of left branch extractions. Ph.D. diss., Tilburg University.
- Corver, Norbert. 1997. Much-support as a last resort. *Linguistic Inquiry* 28: 119–164.
- Cresswell, M.J. 1977. The semantics of degree. In *Montague grammar*, ed. Barbara Partee, 261–292. New York: Academic Press.
- Diesing, Molly. 1992. *Indefinites*. Cambridge: MIT Press.
- Doetjes, Jenny. 1997. Quantifiers and selection. Ph.D. diss., Rijksuniversiteit Leiden.
- Endresen, Øyalf. 1985. E a mang, klokka? *Maal og Minne* 3–4: 249–262.
- Erlewine, Michael. 2007. A new syntax-semantics for the Mandarin *bi* comparative. M.A. Thesis, University of Chicago.
- Faller, Martina. 2000. Dimensional adjectives and measure phrases in vector space semantics. In *Formalizing the dynamics of information*, eds. Martina Faller, Stefan Kaufmann, and Marc Pauly, 151–170. Stanford: CSLI Publications.
- Francis, Elaine, and Stephen Matthews. 2005. A multi-dimensional approach to the category ‘verb’ in Cantonese. *Journal of Linguistics* 41: 269–305.
- Grano, Thomas. 2012. Mandarin *hen* and universal markedness in gradable adjectives. *Natural Language and Linguistic Theory*. doi:10.1007/s11049-011-9161-1.
- Grimshaw, Jane. 1991. Extended projection. ms., Brandeis University.

- Gu, Yang. 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], ed. Shen Yang and Feng Shengli, 97–119. Beijing: Commerce Press.
- Hankamer, Jorge. 1973. Why there are two ‘than’s in English. In *Proceedings of the 9th annual meeting of the Chicago Linguistic Society*, ed. C. Corum, T.C. Smith-Stark, and A. Weiser. Chicago: Chicago Linguistic Society.
- Heim, Irene. 1985. Notes on comparatives and related matters. ms., University of Texas at Austin.
- Heim, Irene. 2006. little. In *Proceedings of Semantics and Linguistic Theory 16*, ed. M. Gibson and J. Howell, 17–34. New York: CLC Publications.
- Heim, Irene, and Angelika Kratzer. 1998. *Semantics in generative grammar*. Oxford: Blackwell.
- Hoeksema, Jack. 1983. Negative polarity and the comparative. *Natural Language and Linguistic Theory* 1: 403–434.
- Huang, C.T. James. 1984. On the distribution and reference of empty pronouns. *Linguistic Inquiry* 15: 531–574.
- Huang, C.T. James. 1989. Pro-drop in Chinese: A generalized control theory. In *The null subject parameter*, ed. Osvaldo Jaeggli and Kenneth Safir, 185–214. Dordrecht: Kluwer.
- Huang, C.T. James, Y.H. Audrey Li, and Yafei Li. 2009. *The syntax of Chinese*. Cambridge: Cambridge University Press.
- Huang, Shi-Zhe. 2006. Property theory, adjectives, and modification in Chinese. *Journal of East Asian Linguistics* 15: 343–369.
- Kennedy, Christopher. 1999. *Projecting the adjective: The syntax and semantics of gradability and comparison*. New York: Garland (1997 UCSC Ph.D. dissertation).
- Kennedy, Christopher. 2001. Polar opposition and the ontology of ‘degrees’. *Linguistics and Philosophy* 24: 33–70.
- Kennedy, Christopher. 2007a. Modes of comparison. In *Papers from the 43rd annual meeting of the Chicago Linguistic Society volume 1: The main session*, ed. M. Elliott, J. Kirby, O. Sawada, E. Staraki, and S. Yoon, 139–163. Chicago: Chicago Linguistic Society.
- Kennedy, Christopher. 2007b. Vagueness and grammar: The semantics of relative and absolute gradable predicates. *Linguistics and Philosophy* 30(1): 1–45.
- Kennedy, Christopher, and Beth Levin. 2008. Measure of change: The adjectival core of degree achievements. In *Adjectives and adverbs: Syntax, semantics and discourse*, ed. Louise McNally and Christopher Kennedy, 156–182. Oxford: Oxford University Press.
- Kennedy, Christopher, and Louise McNally. 2005a. Scale structure and the semantic typology of gradable predicates. *Language* 81(2): 345–381.
- Kennedy, Christopher, and Louise McNally. 2005b. The syntax and semantics of multiple degree modification in English. In *The proceedings of the 12th international conference on head-driven phrase structure grammar*, ed. S. Müller, 178–191. Stanford: CSLI Publications.
- Koopman, Hilda. 1984. *The syntax of verbs: From verb movement in the Kru languages to Universal Grammar*. Dordrecht: Foris.
- Kratzer, Angelika. 1996. Severing the external argument from the verb. In *Phrase structure and the lexicon*, ed. J. Rooryck and L. Zaring, 109–137. Dordrecht: Kluwer.
- Landman, Fred. 1991. *Structures for semantics*. Dordrecht: Kluwer.
- Larson, Richard. 1991. The projection of DP and DegP. ms., SUNY Stony Book.
- Larson, Richard K. 1988. On the double object construction. *Linguistic Inquiry* 19(3): 335–391.
- Li, Yen-Hui Audrey. 1990. *Order and constituency in Mandarin Chinese*. Dordrecht: Kluwer.
- Li, Y.H. Audrey. 2008. Case, 20 years later. In *Proceedings of the 20th North American conference on Chinese Linguistics (NACCL-20), volume 1*, ed. Marjorie K. M. Chan and Hana Kang, 41–68. Columbus: The Ohio State University.
- Lin, Jo-Wang. 2009. Chinese comparatives and their implicational parameters. *Natural Language Semantics* 17: 1–27.
- Liu, Chen-Sheng Luther. 1996. A note on Chinese comparatives. *Studies in the Linguistic Sciences* 26: 215–235.
- Liu, Chen-Sheng Luther. 2007. The weak comparative morpheme in Mandarin Chinese. *Concentric: Studies in Linguistics* 33: 53–89.
- Liu, Chen-Sheng Luther. 2010a. The Chinese *geng* clausal comparative. *Lingua* 120: 1579–1606.
- Liu, Chen-Sheng Luther. 2010b. The positive morpheme in Chinese and the adjectival structure. *Lingua* 120: 1010–1056.
- McCawley, James. 1992. Justifying part-of-speech assignments in Mandarin Chinese. *Journal of Chinese Linguistics* 20: 211–245.

- Merchant, Jason. 2009. Phrasal and clausal comparatives in Greek and the abstractness of syntax. *Journal of Greek Linguistics* 9: 134–164.
- Mok, Sui-Sang. 1998. Cantonese exceed comparatives. Ph.D. diss., University of California.
- Morev, Lev N. 1998. Expressing comparison in the Tai languages. *Mon-Khmer Studies* 28: 91–100.
- Neeleman, Ad, Hans van de Koot, and Jenny Doetjes. 2004. Degree expressions. *The Linguistic Review* 21: 1–66.
- Paul, Waltraud. 2005. Adjective modification in Mandarin Chinese and related issues. *Linguistics* 43: 757–793.
- Paul, Waltraud. 2010. Adjectives in Mandarin Chinese: The rehabilitation of a much ostracized category. In *Adjectives: Formal analyses in syntax and semantics*, ed. Patricia Cabredo Hofherr and Ora Matushansky, 115–151. Amsterdam: John Benjamins B.V.
- Rizzi, Luigi. 1990. *Relativized minimality*. Cambridge: MIT Press.
- Sassoon, Galit Weidman. 2010. The degree functions of negative adjectives. *Natural Language Semantics* 18(2): 141–181.
- Sawada, Osamu, and Thomas Grano. 2011. Scale structure, coercion, and the interpretation of measure phrases in Japanese. *Natural Language Semantics* 19: 191–226.
- Schwarzschild, Roger. 2005. Measure phrases as modifiers of adjectives. *Recherches Linguistiques de Vincennes* 35: 207–228.
- Schwarzschild, Roger, and Karina Wilkinson. 2002. Quantifiers in comparatives: A semantics of degree based on intervals. *Natural Language Semantics* 10: 1–41.
- Seuren, Pieter A.M. 1978. The structure and selection of positive and negative gradable adjectives. In *Papers from the parasession on the lexicon*, Chicago Linguistic Society, ed. D. Farkas, W.M. Jacobsen, and K.W. Todrys, 336–346. Chicago: Chicago Linguistic Society.
- Svenonius, Peter, and Christopher Kennedy. 2006. Northern Norwegian degree questions and the syntax of measurement. In *Phases of interpretation*, ed. Mara Frascarelli. Vol. 91 of *Studies in generative grammar*, 133–161. Berlin: Mouton de Gruyter.
- Sybesma, Rynt. 1999. *The Mandarin VP*. Boston: Kluwer.
- Travis, Lisa. 1984. Parameters and effects of word order variation. Ph.D. diss., Massachusetts Institute of Technology.
- Ulta, Russell. 1972. Some features of basic comparative constructions. In *Working papers on language universals*, no. 9, 117–162. Stanford: Language Universals Project, Committee on Linguistics.
- von Stechow, Arnim. 1984a. Comparing semantic theories of comparison. *Journal of Semantics* 3: 1–77.
- von Stechow, Arnim. 1984b. My reply to Cresswell's, Hellan's, Hoeksema's and Seuren's comments. *Journal of Semantics* 3: 183–199.
- Xiang, Ming. 2003. A phrasal analysis of Chinese comparatives. In *Proceedings of the 39th annual meeting of the Chicago Linguistic Society*, ed. A. Franklin, J. Cihlar, D. Kaiser, and I. Kimbara, 739–754. Chicago: Chicago Linguistics Society.
- Xiang, Ming. 2005. Some topics in comparative constructions. Ph.D. diss., Michigan State University.
- Xu, Hui Ling. 2007. *Aspects of Chaoshou grammar: A synchronic description of the Chaoshou variety*. Journal of Chinese Linguistics Monograph 22.