

The Adjective of Quantity *Duo* ‘many/much’ and Differential Comparatives in
Mandarin Chinese*

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ABSTRACT

This article discusses differential comparatives involving the adjective of quantity *duo* ‘many/much’ in Mandarin Chinese. We show that the obligatory construal of a post-adjectival *duo*-phrase as a differential phrase rather than a degree modifier is due to the interaction of four factors: (i) gradable adjectives denote measure functions rather than relations between degrees and individuals, (ii) post-adjectival *duo*-phrases are generalized quantifiers over degrees, (iii) the null positive degree morpheme is an independent functional head that takes AP as its complement and (iv) the null differential comparative morpheme is an affixal element adjoined to the adjective. In addition, this article also shows that the quantificational/attributive, predicative and differential *duo* can all be unified under the same semantics by analyzing *duo* as a function from degrees to sets of degrees, thus lending support to solt’s (2014) analysis of adjectives of quantity.

Key words: *duo* ‘many’; *yi dian* ‘a bit/a little’; differential comparatives; adjectives of quantity; measure phrases; low degree modifiers; vague quantity

1. Introduction

Duo ‘much/many’ in Mandarin Chinese is typically used as a predicate such as (1) or a quantificational/attributive nominal modifier such as (2).

(1) Wo-de shu hen duo.

my book very many

‘My books are many.’

(2) Wo mai-le hen duo shu

I buy-Asp very many book

‘I bought many books.’

Rarely mentioned in the literature is the fact that *duo* can be used as a differential phrase as illustrated by (3), which claims that the degree to which Zhangsan is clever/tall is greater than the degree to which Lisi is clever/tall and the gap is large.

(3) Zhangsan bi Lisi congming/gao duo le¹

Zhangsan than Lisi clever/tall much Par

‘Zhangsan is much cleverer/taller than Lisi is.’

Like the predicative and quantificational *duo*, the differential *duo* can be modified by a degree adverb as illustrated by (4), indicating that the differential *duo*-phrase is an AP.

(4) Zhangsan bi Lisi congming/gao hen/feichang duo

Zhangsan than Lisi clever/tall very/very.much much

‘Zhangsan is (very) much cleverer/taller than Lisi.’

In (3) and (4), the construction contains an overt standard of comparison indicated by an optional *bi*-constituent. Very interestingly, when the *bi*-constituent is not present, the construction is still understood as a differential comparative, as shown by (5), the only difference being that the standard of comparison is now a contextually provided individual.

(5) a. Zhangsan congming/gao duo le

Zhangsan clever/tall much Par

‘Zhangsan is much cleverer/taller (than a contextually relevant person).’

b. Zhangsan congming/gao hen/feichang duo

Zhangsan clever/tall very/very.much much

‘Zhangsan is (very) much cleverer/taller (than a contextually relevant person).’

Note also that the choice of a different gradable adjective does not affect the interpretations of the sentences in question. For example, *congming* ‘clever’ belongs to a class without a conventional measurement system, whereas *gao* ‘tall’ has a well-defined conventional measurement system. Whatever the choice of the adjective is, the construction is construed as a differential comparative rather than a positive construction. So, neither (5a) nor (5b) can mean ‘Zhangsan is very/extremely tall’. In what follows, I will refer to sentences such as (3)-(5) the *Adj-duo* construction.²

The *Adj-duo* construction raises many interesting questions. An obvious one is how the comparative meaning is derived, given that the *bi*-phrase is optional and there is no other morpheme indicating comparison. This question is a general question about Mandarin comparatives. I will discuss this issue in section 2 to facilitate our later discussion of the *Adj-duo* construction. A second question to ask is: What is the semantics of the post-adjectival *duo*? Does it have the same meaning as the predicative and quantificational *duo*? A third question is why an *Adj-duo* construction cannot be interpreted as a positive construction as noted above. Finally, as will be

‘Zhangsan is taller than Lisi.’

In (7), the adjective *gao* ‘tall’ is not morphologically marked by any comparative morpheme. It is of the same form as its positive use as illustrated by (8).

(8) Zhangsan *(hen) gao⁴

Zhangsan very tall

‘Zhangsan is tall.’

This being the case, it is tempting to say that the greater-than relation of a superiority comparative is part of the meaning of the *bi*-constituent as in Lin’s (2009) approach.⁵ Note, however, that this is not the only possibility to analyze *bi*-comparatives. Another possibility is to say that the greater-than relation is conveyed by a null comparative morpheme as in Liu’s (2010), Grano’s (2012) or Grano and Kennedy’s (2012) analyses of *bi*-comparatives. In this article I will adopt the second hypothesis.

There is independent piece of evidence that a null comparative morpheme is needed to express a comparative meaning in Mandarin Chinese. Consider the dialogue in (9).

(9) Question: Tamen liang-ge, shei gao?

they two-Cl who tall

‘As for the two people, who is taller?’

Answer: Lisi gao

Lisi tall

‘Lisi is taller.’

In (9), there is no *bi*-constituent in either the question or the answer but both express a comparative meaning. So the comparative meaning cannot come from *bi*, but it is possible that the source of the comparative meaning is a null degree morpheme. As a matter of fact, the constructions in (9) allow an overt comparative morpheme to appear. This morpheme is *bijiao* ‘more’, which appears right before the adjective. So, (10) is completely identical to (9) as far as the meaning is concerned.

(10) Question: Tamen liang-ge, shei bijiao gao?

they two-Cl who more tall

‘As for the two people, who is taller?’

Answer: Lisi bijiao gao

Lisi more tall

‘Zhangsan is taller.’

I conclude that examples such as (9) motivate postulation of a null comparative morpheme in Mandarin Chinese. Although the morpheme *bijiao* may not appear in *bi*-comparatives such as (3) and (4), it is reasonable to assume that the greater-than relation of a *bi*-comparative is also conveyed by a null comparative morpheme and the function of *bi* is arguably restricted to indicating the standard of comparison just like English *than*. Later I will argue that the null comparative morpheme is a bound affixal morpheme that is adjoined to an adjective, whereas overt morphemes such as *bijiao* are free morphemes that appear before the adjective.

In addition to *bijiao*, the morpheme *geng* is another overt morpheme that has a comparative implication. However, *geng* differs from *bijiao* in that the former may appear in a *bi*-comparative, whereas the latter may not as is illustrated below.

(11) a. *Zhangsan bi Lisi bijiao gao

Zhangsan than Lisi more tall

‘Zhangsan is taller than Lisi’

b. Zhangsan bi Lisi geng gao

Zhangsan than Lisi even.more tall

‘(Both Zhangsan and Lisi are tall.) Zhangsan is taller than Lisi.’

In this article, I will not investigate the difference between *bijiao* and *geng* but will discuss how they differ from null comparative morphemes. Note also that I will assume that *bijiao* and *geng* are both free morphemes and hence they project an independent degree head.

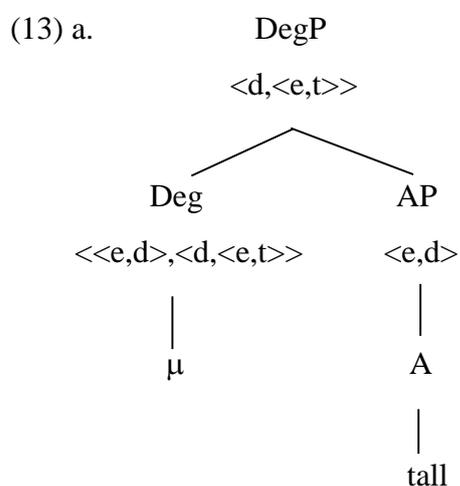
2.2 Adjectives as denoting measure functions

There are two analyses of gradable adjectives available in the literature. In one analysis, gradable adjectives denote relations between individuals and degrees, that is, they are expressions of type $\langle d, \langle e, t \rangle \rangle$ as exemplified by (12), where the bold **tall** is a measure function which maps an individual to a degree along the dimension of height (Cresswell 1977, von Stechow 1984a, Bierwisch 1989, Kennedy 2001, Schwarzchild and Wilkinson 2002, Heim 2006, Bale 2009).

(12) $\llbracket \text{tall} \rrbracket = \lambda d \lambda x. \mathbf{tall}(x) = d$

In contrast to the first analysis, Kennedy (1999, 2007) made a different proposal according to which gradable adjectives denote measure functions from individuals to degrees (also see Bartsch & Vennemann (1973), Corver (1997a,b) and Solt (2012)). So, gradable adjectives are type $\langle e, d \rangle$ rather than type $\langle d, \langle e, t \rangle \rangle$ as illustrated in (13c) below. Since adjectival phrases ultimately denote properties of individuals, something must turn an adjective of type $\langle e, d \rangle$ into an expression that can be predicated of the individual subject. This is achieved by extending Abney’s (1987) extended functional structure to the adjectival domain. The extended projection of gradable adjectives is headed by a degree morpheme such as the phonologically null positive morpheme μ , *-er/more, less, as, so, too, enough, how, this, that*, etc., with a

structure sketched in (13a). On this analysis, it is only after a degree morpheme is combined with a gradable adjective that a degree argument is introduced as is shown below.



- b. $\llbracket [\text{Deg } \mu] \rrbracket = \lambda G_{\langle e, d \rangle} \lambda d \lambda x. G(x) \geq d$
- c. $\llbracket \text{tall} \rrbracket = \mathbf{height}$
- d. $\llbracket [\text{Deg } \mu] \rrbracket (\llbracket \text{tall} \rrbracket) = \lambda d \lambda x. \mathbf{height}(x) \geq d$

This analysis of gradable adjectives is further supported by Svenonius and Kennedy’s (2006) study of Norwegian degree questions and Grano and Kennedy’s (2012) analysis of transitive comparatives in Mandarin Chinese. In this article I adopt this analysis and will refer to it as the EFSA hypothesis (an abbreviation of Extended Functional Structure of Adjectives).

2.3 Extending Kennedy’s analysis to Mandarin gradable adjectives

Under the EFSA hypothesis, a Mandarin sentence such as (14a) can be derived by analyzing the measure phrase *liang mi* ‘two meters’ as the specifier of DegP, as is shown by (15a). Note, however, that the measure phrase may also appear after the adjective as in (14b). Arguably, this is because the adjective is raised to a higher

functional head, as shown by (15b), perhaps to the position where the light verb *you* 'have' in (16) occupies (Also see Xiang (2005) for a movement analysis).⁶

(14) a. Zhangsan liang mi gao

Zhangsan two meters tall

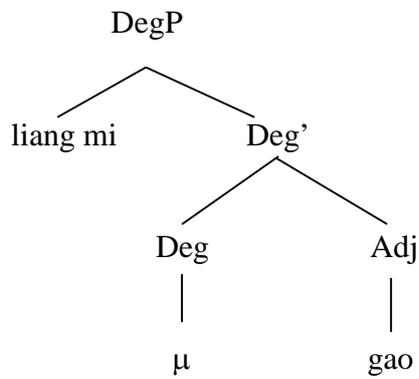
'Zhangsan is two meters tall'

b. Zhangsan gao liang mi

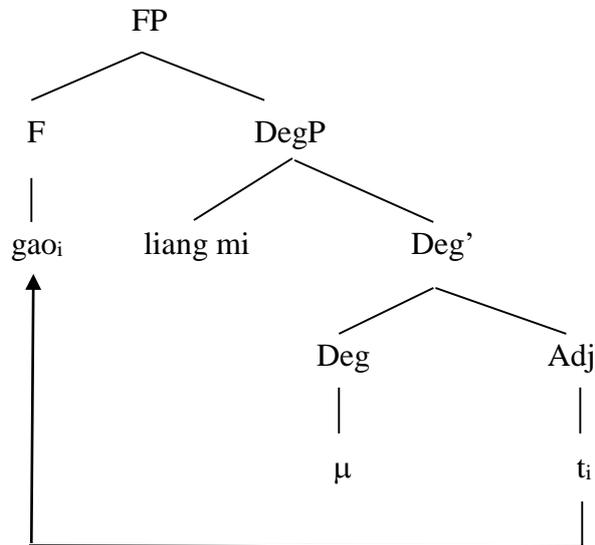
Zhangsan tall two meters

'Zhangsan is two meters tall'

(15) a.



b.



(16) Zhangsan you liang mi gao

Zhangsan have two meters tall

‘Zhangsan is two meters tall.’

I assume that *you* ‘have’ in (16) and its null counterpart in (15a) have a case-assigning function. A measure phrase needs to be assigned Case because it is a nominal argument (Chomsky 1981; Grano and Kennedy 2012). The raising of the adjective in (15b) is perhaps motivated by Case-assignment. It is generally assumed that adjectives do not assign structural Case. Suppose that in (15b), a V is projected in the position of *you* but is not filled by *you*. The adjective then moves to that empty V position, carrying the feature that μ projects on its way to V. I assume that such a configuration facilitates structural Case-assignment to a measure phrase.

Note that instead of a measure phrase, a degree adverb can be used to indicate the degree to which a subject possesses the property denoted by an adjective, as is illustrated by (17).

(17) Zhangsan hen/feichang gao

Zhangsan very/extremely tall

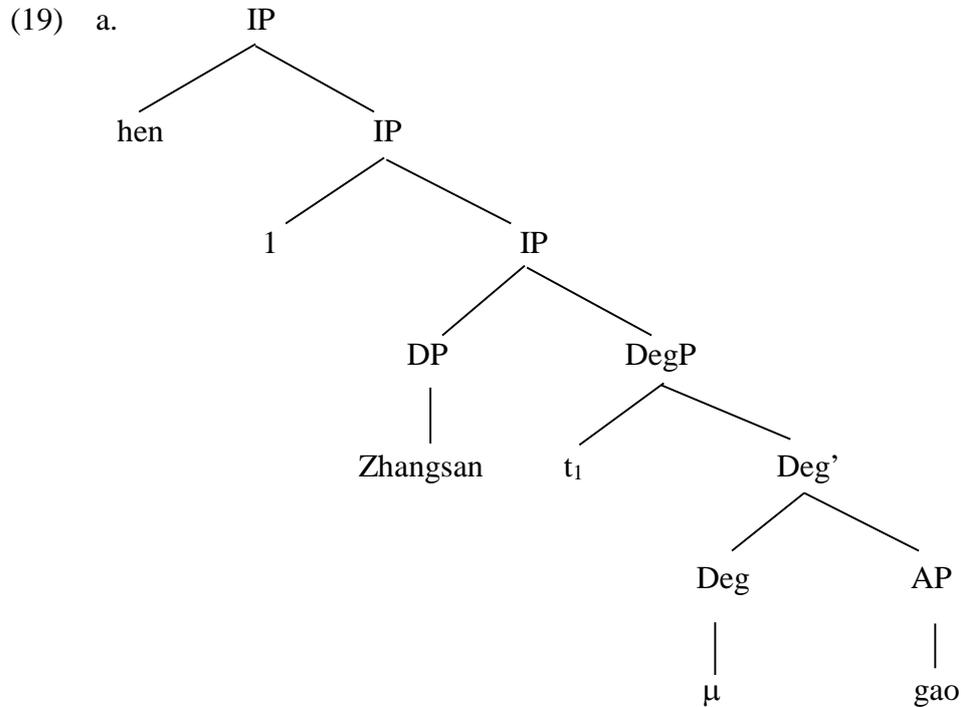
‘Zhangsan is very/extremely tall.’

In this article I assumed with Heim (2006) and Solt (2009, 2014) that degree adverbs are generalized quantifiers of type $\langle\langle d, t \rangle, t \rangle$, thus departing from Kennedy’s treatment of degree adverbs as degree heads. The semantic function of these degree adverbs, including the familiar positive POS morpheme, can be analyzed as adding a restriction to the degree argument as spelled out in (18).

- (18) a. $\llbracket \text{hen} \rrbracket = \lambda \varphi_{\langle d, t \rangle} \exists d. \varphi(d) \wedge d \geq \text{Std}^7$
b. $\llbracket \text{POS} \rrbracket = \lambda \varphi_{\langle d, t \rangle} \exists d. \varphi(d) \wedge d \geq \text{Std}$
d. $\llbracket \text{tai} \rrbracket = \lambda \varphi_{\langle d, t \rangle} \exists d. \varphi(d) \wedge d \geq n$, n a large number
d. $\llbracket \text{feichang} \rrbracket = \lambda \varphi_{\langle d, t \rangle} \exists d. \varphi(d) \wedge d \geq n$, n a very large number

In (18), *Std* stands for the contextually determined standard. As for what counts as large or very large is a matter of pragmatics which I will leave open. (18b) is the denotation of the familiar POS morpheme, which I assume is present in the *Adj-duo* construction when *duo* is not modified by an overt degree adverb.

Since degree adverbs are generalized quantifiers, they can undergo quantifier raising, leaving a trace of type *d*. Under this analysis, the structure of (17) is parallel to that of (15a), namely, the degree head μ first combines with the adjective *gao* ‘tall’ and the degree adverb *hen* ‘very’, parallel to measure phrases, is located in the specifier of DegP. Because *hen* is a generalized quantifier of type $\langle\langle d,t\rangle,t\rangle$, it undergoes quantifier raising, leaving a trace of type *d*.⁸ We thus have the following LF, which is computed as indicated.⁹



b. $\llbracket [\text{Deg } \mu] \rrbracket = \lambda G_{\langle e,d \rangle} \lambda d \lambda x. G(x) \geq d$

c. $\llbracket \text{gao} \rrbracket = \mathbf{height}$

d. $\llbracket [\text{Deg } \mu] \rrbracket (\llbracket \text{gao} \rrbracket) = \lambda d \lambda x. \mathbf{height}(x) \geq d$

e. $\llbracket [\text{DegP } t_1 \ \mu \ \text{gao}] \rrbracket = \lambda x. \mathbf{height}(x) \geq d_1$

f. $\llbracket [\text{IP } \text{Zhangsan } t_1 \ \mu \ \text{gao}] \rrbracket = \mathbf{height}(\text{Zhangsan}) \geq d_1$

g. $\llbracket [\text{IP } 1 \text{ Zhangsan } t_1 \mu \text{ gao }] \rrbracket = \lambda d_1. \mathbf{height}(\text{Zhangsan}) \geq d_1$

h. $\llbracket [\text{IP } \text{hen } 1 \text{ Zhangsan } t_1 \mu \text{ gao }] \rrbracket$

$= [\lambda \wp_{\langle d, t \rangle} \exists d. \wp(d) \wedge d \geq \text{Std}] (\lambda d_1. \mathbf{height}(\text{Zhangsan}) \geq d_1)$

$= \exists d [\mathbf{height}(\text{Zhangsan}) \geq d \wedge d \geq \text{Std}]$

Since both measure phrases and degree adverbs are the specifiers of the degree head, they are predicted not to occur with each other due to competition for the same position. This prediction is born out, as is shown below:

(20) a. *Zhangsan hen/feichang liang mi gao

Zhangsan very/very.much two meter tall

b. *Zhangsan liang mi hen/feichang gao

Zhangsan two meter very/very.much tall

c. *Zhangsan hen/feichang gao liang mi

Zhangsan very/extremely tall two meters

It is worth pointing out that analyzing degree adverbs as being parallel to measure phrases has an obvious advantage over treating them as the degree head of an extended functional structure. The latter analysis would wrongly predict that measure phrases and degree adverbs are able to occur with each other. For example, (21) is a possible denotation of *feichang* ‘very much’ as a degree head.

(21) $\llbracket \text{feichang} \rrbracket = \lambda G_{\langle e, d \rangle} \lambda d \lambda x. G(x) \geq d, d \text{ a very large number}$

Given this denotation of *feichang*, a sentence such as (20b) would be assigned the following truth conditions: The height of Zhangsan is at least as tall as 2 meters,

which is a very large number. Such truth conditions are pragmatically possible interpretations but are unattested ones.

Another point worth noting in passing is that unlike measure phrases, degree adverbs cannot be preceded by *you*, as the ungrammaticality of (22) shows.

(22) *Zhangsan you feichang gao

Zhangsan have very.much tall

'Zhangsan is very much tall'

The verb *you* in (22) is not allowed, because degree adverbs are not nominal expressions and hence do not need Case.

Before proceeding to next section, one comment from an anonymous referee is worth discussing. As proposed, μ is assumed to occur with measure phrases, degree adverbials and all types of gradable adjectives. However, not all gradable adjectives are compatible with measure phrases. For example, in contrast to *gao* 'tall', *ai* 'short' is incompatible with a measure phrase, as one cannot say **Zhangsan 150 gongfen ai* '*Zhangsan is 150cm short'. I do not have a specific account for this fact and will leave this issue open. Interested readers are referred to Grano and Kennedy (2012) for a concrete proposal and earlier works such as Seuren (1978), von Stechow (1984b), Bierwisch (1989) and Kennedy (2001) for some discussions. These authors have argued that although degrees of shortness are in some sense degrees of height, they are unmeasurable unlike degrees of tallness.

2.4 Differential comparatives

How are comparatives in Mandarin Chinese analyzed under the assumption that gradable adjectives denote measure functions? First, let us compare the interpretational difference between *bi*-comparatives and *geng*-comparatives illustrated below.

(23) a. Zhangsan bi Lisi gao

Zhangsan than Lisi tall

‘Zhangsan is taller than Lisi.’

b. Zhangsan bi Lisi geng gao

Zhangsan than Lisi even.more tall

‘Zhangsan is even taller than Lisi.’

For (23a) to be true, Zhangsan’s height must exceed Lisi’s height but there is no requirement that both Zhangsan and Lisi are tall. By contrast, with the additional morpheme *geng* ‘even more’, (23b) requires not only that Zhangsan’s height exceeds Lisi’s but also that both Zhangsan and Lisi are tall (Lin 2009, Liu 2010). Let us assume, for the time being, that the above interpretational difference between (23a) and (23b) is one between different comparative degree heads, that is, a null comparative morpheme vs. the overt comparative morpheme *geng*. Under Kennedy’s framework, this amounts to saying that both *geng* and the null comparative morpheme, represented as μ_{er} in what follows, are a degree head taking AP as its complement.

However, there are reasons to believe that the null comparative morpheme μ_{er} should not be analyzed the same way as the overt degree morpheme such as *geng* or *bijiao* ‘more’. Consider the contrast between (24a) and (24b).

(24) a. Zhangsan bi Lisi gao wu gongfen

Zhangsan than Lisi tall five centimeter

‘Zhangsan is five centimeters taller than Lisi’

b. *Zhangsan bi Lisi geng gao wu gongfen

Zhangsan than Lisi even.more tall five centimeter

‘Zhangsan is even five centimeters taller than Lisi, though both are tall.’

The above contrast shows that while the null comparative morpheme is compatible with a differential measure phrase, the overt comparative morpheme *geng* is not. First consider (24b). Under Kennedy's EFSA hypothesis, if *geng* is a degree head, then it is higher than AP and takes the latter as its complement. Since gradable adjectives are of type $\langle e,d \rangle$, it cannot directly combine with a measure phrase whose semantic type is either type d or type $\langle \langle d,t \rangle, t \rangle$. As a consequence, (24b) is ruled out, a desirable result.

Like *geng*-comparatives, *bijiao*-comparatives do not allow a differential measure phrase, as is shown by (25).

(25) *Zhangsan bijiao gao wu gongfen

Zhangsan more tall five centimeters

'Zhangsan is taller by five centimeters.'

Again, if *bijiao* is analyzed as a comparative degree head taking AP as its complement, the ungrammaticality of (25) is expected just like (24b).

Why is (24a) well-formed, then? If the null comparative morpheme μ_{er} in (24a) were also treated as a degree head taking AP as its complement parallel to *geng* and *bijiao*, then (24a) would be predicted to be ill-formed in the same way as (24b) and (25). Since (24a) is well-formed, μ_{er} must not head a DegP projection as *geng* and *bijiao* do. Instead, following Grano and Kennedy (2012), I propose that the null comparative morpheme μ_{er} is an affixal element that is adjoined to a gradable adjective and the measure phrase is the complement of the comparative adjective. So (24a) has a structure like the following:¹⁰

$$c. \llbracket \text{Zhangsan bi Lisi gao} + \mu_{er} \text{ wu gongfen} \rrbracket = \text{Max}(\lambda d'. \mathbf{height}(\text{Zhangsan}) = d') - \text{Max}(\lambda d''. \mathbf{height}(\text{Lisi}) = d'') = 5\text{cm}$$

Note that a differential phrase is an optional constituent. So *wu gongfen* in (26) can be removed. In this case, I assume that an implicit μ_{er} is still adjoined to the gradable adjective directly due to its status as a bound morpheme, but there are two possibilities for its denotation. One analysis is to assign the same denotation as given in (27) to the second μ_{er} but the differential degree argument is somehow filled in contextually. Another possibility is to assume that a different μ_{er} such as the one in (29) is employed to existentially close the differential degree argument.

$$(29) \llbracket \mu_{er} \rrbracket = \lambda G_{\langle e, d \rangle} \lambda x \lambda y. \exists d. \text{Max}(\lambda d_1. G(y) = d_1) - \text{Max}(\lambda d_2. G(x) = d_2) = d$$

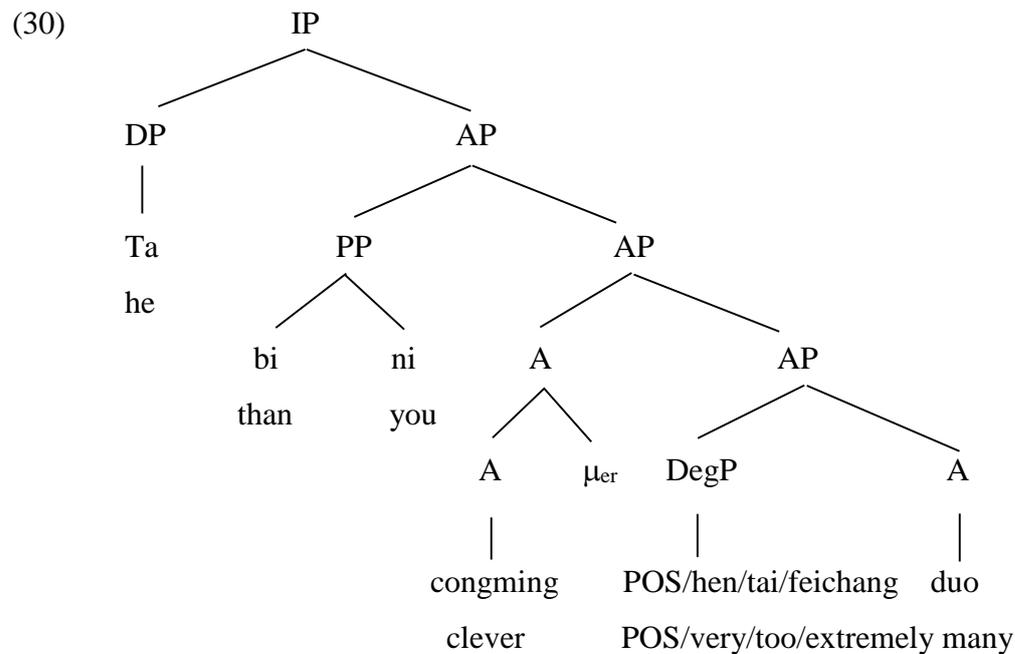
This second analysis is often assumed in the literature. In this article I will not try to argue for one analysis over the other, as both can serve our purpose.

Another comment in order is that the idea that the null comparative degree morphemes in Mandarin Chinese are affixes adjoined directly to gradable adjectives is also proposed in Grano and Kennedy (2012). However, their analysis assumes that a null degree morpheme is present only when a measure phrase is present and there is no hierarchical distinction for the position of a null degree morpheme no matter whether the adjective is comparative or positive. I will not be able to review their analysis in details due to space constraint. It suffices to mention that their assumption is not adopted in this article because it is not able to capture the fact that the *Adj-duo* construction is always interpreted as a differential comparative.

I conclude that the null comparative morpheme μ_{er} is an affixal element directly adjoined to a gradable adjective with no projection of its own. This is in contrast with the null μ discussed earlier, which projects an independent degree head that takes AP as its complement.

3. The Syntax of the *Adj-duo* Construction

If we compare regular differential comparatives and the *Adj-duo* constructions, we will find that their semantic interpretations are actually very similar. For a regular differential comparative, the differential phrase denotes a precise degree such as *wu gongfen* ‘five centimeters’. The *Adj-duo* construction differs from the former only in the way how the gap between the two degrees being compared is interpreted. While the former has a precise value for the gap between the two degrees being compared, the latter has a vague number *n* as the value for the gap depending upon which degree adverb modifies the post-adjectival *duo*. Given this, it is reasonable to extend the analysis of (26) involving a regular differential measure phrase to the *Adj-duo* construction; namely, the *Adj-duo* construction has a syntactic structure quite similar to (26) except that instead of a nominal measure phrase we have a differential AP acting as the complement of the gradable adjective as shown in (30), where *hen*, *tai*, *feichang* and the POS morpheme are analyzed as the specifier of *duo*.



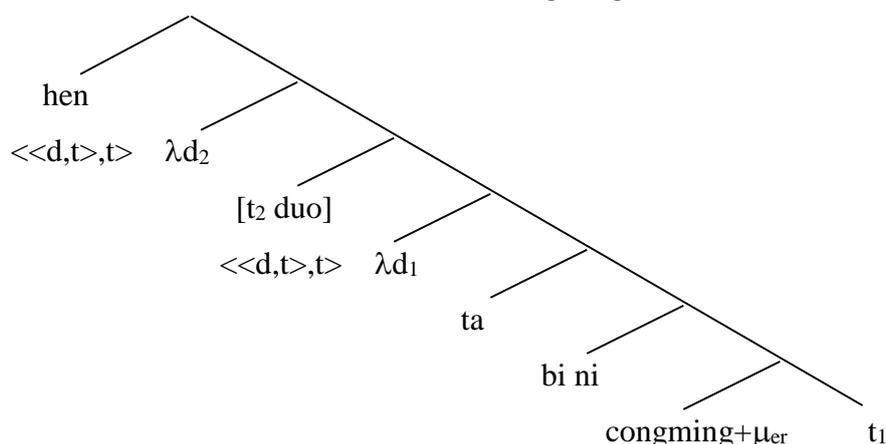
4. The Semantics of the *Adj-duo* Construction

With the above theoretical assumptions and analysis in mind, let us now consider how the meaning of the *Adj-duo* construction can be compositionally derived. The most simple analysis is that the *Adj-duo* construction is not only syntactically similar to

regular differential comparatives but is semantically minimally different from the latter. This in turn suggests that a *duo*-phrase such as *hen duo* ‘very many’ in (30) should be interpreted the same way as a regular measure phrase. At first glance, this seems impossible because a measure phrase is traditionally analyzed as an expression of type *d* denoting a degree on a relevant scale, whereas the expression *hen duo* does not seem to denote degrees. The parallelism can be established, however, if *hen duo* is analyzed as a generalized quantifier over degrees. Under this assumption, *hen duo* can undergo quantifier raising and its trace will combine with the comparative adjectival predicate. Indeed, such type of analysis has been proposed by Heim (2006) for English *little* and Solt (2014) for English *many/much*. Heim proposes that being gradable, *little* takes a degree argument and forms a generalized quantifier over degrees. Let us assume that the same is true of *duo*. *Duo* takes a degree argument such as *feichang* ‘very much’ or *hen* ‘very’. Following Heim and Solt, let us also assume that degree expressions such as *feichang* and *hen* are generalized quantifiers of type $\langle\langle d,t\rangle,t\rangle$. Thus, they have to move at LF, too, leaving a trace of type *d*. So the eventual LF of a sentence such as (30) is (31a) with the tree representation in (31b).

(31) a. LF:[_{IP} [_{hen}] [₂ [_{IP}[_{AP} _{t₂} _{duo}] [_{IP} 1 [_{IP} _{ta bi ni congming}+ μ_{er} _{t₁}]]]]]]

b. (The LF tree of the sentence ‘Ta bi ni congming hen duo’)



To successfully interpret the tree in (31b), a crucial ingredient is the meaning of ‘[*t₂ duo*]’, which is equivalent to ‘*d many*’. What does ‘*d many*’ mean? I propose that it means ‘to the degree *d*’. So *duo* can be assigned the following denotation.¹¹

$$(32) \llbracket \text{duo} \rrbracket = \lambda d \lambda \wp_{\langle d, t \rangle}. \wp(d)$$

As can be seen from (31b), ' t_2 duo' takes as its argument the set of degrees formed by lambda abstraction over the trace left behind by quantifier-raising *hen duo*. The application of $\llbracket t_2 \text{ duo} \rrbracket$ to this set of degrees returns the same proposition as *ta bi ni congming* t_1 except that the variable t_1 is now replaced by t_2 . Subsequently, lambda abstraction of the trace t_2 of *hen* produces a set of degrees again, which is identical to the first set of degrees. This amounts to saying that the function of *duo* is almost semantically inert, an analysis which is in the same spirit as Solt's (2014) analysis of English *many* and *much*.

Now what is the semantics of degree words such as *hen* 'very', *tai* 'too', *feichang* 'very much' and the positive morpheme POS? As discussed earlier, the semantic function of these degree words can be regarded as adding a restriction to the degree argument. The relevant definitions are reproduced below:

- (33) a. $\llbracket \text{hen} \rrbracket = \lambda \wp_{\langle d, t \rangle} \exists d. \wp(d) \wedge d \geq \text{Std}$
 b. $\llbracket \text{POS} \rrbracket = \lambda \wp_{\langle d, t \rangle} \exists d. \wp(d) \wedge d \geq \text{Std}$
 c. $\llbracket \text{tai} \rrbracket = \lambda \wp_{\langle d, t \rangle} \exists d. \wp(d) \wedge d \geq n$, n a large number
 d. $\llbracket \text{feichang} \rrbracket = \lambda \wp_{\langle d, t \rangle} \exists d. \wp(d) \wedge d \geq n$, n a very large number

Given the above assumptions, the step-by-step semantic computation of (31b) can now be given below.

- (34) a. $\llbracket \text{congming} + u_{\text{er}} \rrbracket = \lambda d \lambda x \lambda y. \text{Max}(\lambda d_5. \mathbf{cleverness}(y) = d_5) - \text{Max}(\lambda d_6. \mathbf{cleverness}(x) = d_6) = d$
 b. $\llbracket \text{congming} + u_{\text{er}} \ t_1 \rrbracket = \lambda x \lambda y. \text{Max}(\lambda d_5. \mathbf{cleverness}(y) = d_5) - \text{Max}(\lambda d_6. \mathbf{cleverness}(x) = d_6) = d_1$

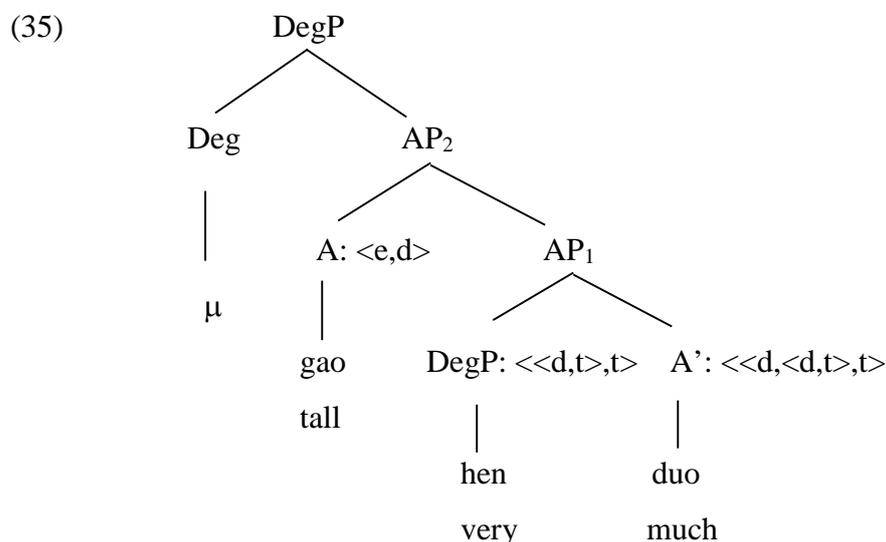
- c. $\llbracket \text{ta bi ni congming} + u_{er} \ t_1 \rrbracket = \text{Max}(\lambda d_5. \mathbf{cleverness}(\text{he}) = d_5) - \text{Max}(\lambda d_6. \mathbf{cleverness}(\text{you}) = d_6) = d_1$
- d. $\llbracket 1 \ \text{ta bi ni congming} + u_{er} \ t_1 \rrbracket = \lambda d_1. \text{Max}(\lambda d_5. \mathbf{cleverness}(\text{he}) = d_5) - \text{Max}(\lambda d_6. \mathbf{cleverness}(\text{you}) = d_6) = d_1$
- e. $\llbracket t_2 \ \text{duo} \rrbracket = [\lambda d \lambda \wp_{\langle d, t \rangle}. \wp(d)](d_2)$
 $= \lambda \wp_{\langle d, t \rangle}. \wp(d_2)$
- f. $\llbracket t_2 \ \text{duo} \ 1 \ \text{ta bi ni congming} + u_{er} \ t_1 \rrbracket =$
 $\text{Max}(\lambda d_5. \mathbf{cleverness}(\text{he}) = d_5) - \text{Max}(\lambda d_6. \mathbf{cleverness}(\text{you}) = d_6) = d_2$
- g. $\llbracket 2 \ t_2 \ \text{duo} \ 1 \ \text{ta bi ni congming} + u_{er} \ t_1 \rrbracket =$
 $\lambda d_2. \text{Max}(\lambda d_5. \mathbf{cleverness}(\text{he}) = d_5) - \text{Max}(\lambda d_6. \mathbf{cleverness}(\text{you}) = d_6) = d_2$
- h. $\llbracket \text{hen} \rrbracket = \lambda \wp_{\langle d, t \rangle} \exists d. \wp(d) \wedge d \geq \text{Std}$
- i. $\llbracket \text{hen} \ 2 \ t_2 \ \text{duo} \ 1 \ \text{ta bi ni congming} + u_{er} \ t_1 \rrbracket =$
 $\exists d_2. \text{Max}(\lambda d_5. \mathbf{cleverness}(\text{he}) = d_5) - \text{Max}(\lambda d_6. \mathbf{cleverness}(\text{you}) = d_6) = d_2 \wedge d_2 \geq \text{Std}$

The last line of (34) says that the structure in (31b) is true if and only if there is a degree d_2 which is the difference between his maximal cleverness and your maximal cleverness and d_2 is greater than a contextually determined value. These truth conditions seem to be the right ones for the sentence in (31b).

5. Why Does the Adj-duo Construction Not Allow the Positive Reading?

An important consequence of the proposed analysis of the Adj-*duo* construction is that it explains why an Adj-*duo* construction may not be interpreted as a positive construction. The explanation is very simple: there is a type mismatch between the *duo*-phrase and the adjective. Recall that gradable adjectives do not carry an inherent degree argument. They are measure functions of type $\langle e, d \rangle$. Degrees are introduced as arguments only as a consequence of a degree morpheme that takes adjectives as its

complement. Therefore, gradable adjectives have no degree arguments. Now if an *Adj-duo* construction is to obtain a positive interpretation, then the extended functional structure of adjectives must be used as is shown below:



The above structure, however, is uninterpretable, because there is no way to combine the adjective *gao* with the meaning of AP_1 . The adjective *gao* is a measure function that requires an individual argument of type e , but AP_1 can never denote such an individual. As discussed earlier, though *hen duo* ‘very much’ and *hen* ‘very’ start out as a generalized quantifier, at LF they must be displaced to an interpretable position, leaving a trace of type d . However, in (35), a trace of type d may not be the right type of argument for the adjective *gao*, which requires an individual of type e as its argument. On the other hand, if the *duo*-AP does not move, but *hen* ‘very’ undergoes quantifier raising, then the semantic type of the *duo*-AP will be of type $\langle\langle d,t \rangle, t \rangle$, which is still not the right type to combine with the matrix adjective. So we see that Kennedy’s (1999, 2007) proposal that degrees are not lexical arguments of gradable adjectives but are only introduced by a null higher degree morpheme μ or an affixal comparative μ_{er} explains why the *Adj-duo* construction never has a positive interpretation.

To sum up, the fact that the *Adj-duo* construction must be construed as a differential comparative rather than a positive construction is the cooperation of several interacting factors. First, gradable adjectives denote measure functions rather than relations between degrees and objects. Second, a degree argument comes into the

syntax only after the null μ or μ_{er} is combined with the adjective. Third, the syntactic hierarchy of the positive null morpheme μ is different from that of the comparative null morpheme μ_{er} . μ projects an independent head that takes AP as its complement, whereas μ_{er} , being a bound morpheme, must be adjoined to the adjective directly. The interaction of the above assumptions entails that the degree argument of a positively interpreted adjectives should occur to the left of the null degree head μ . The adjective, which denotes measure functions, may not take an argument of type d or $\langle\langle d,t\rangle,t\rangle$ as its sister because of type mismatch. By contrast, a differential phrase may occur as the complement of a comparative gradable adjective because the first argument of the resulting combination of an adjective + u_{er} is a degree argument of type d .

6. Refutation of Adjectives as Expressions of Type $\langle d,\langle e,t\rangle\rangle$

Earlier we said that there were actually two analyses of gradable adjectives. One analysis treats them as measure functions of type $\langle e,d\rangle$. We showed in the last section that this analysis, together with some other assumptions, successfully derives the comparative reading of the *Adj-duo* construction and blocks the unwanted positive reading. In this section, I argue that the treatment of gradable adjectives as denoting relations between individuals and degrees is inferior to the first analysis because it fails to explain why the *Adj-duo* construction may not have a positive reading.

Reconsider the following examples introduced in the introduction section.

(36) a. Ta congming duo le

He clever much Asp

‘He is much cleverer (than some contextually relevant person).’

b. Ta congming hen duo

he clever very much

‘He is much cleverer (than some contextually relevant person).’

In (36), the *bi*-phrase is not present and therefore a null comparative morpheme should not be forced to appear. Take (36b) for example. Assume that the null comparative morpheme u_{er} is not present in the structure. Then the semantic derivation of (36b) can proceed as given in (37).

(37) LF: [hen [2 [t₂ duo] [1 [ta congming t₁]]]

- a. $\llbracket \text{congming} \rrbracket = \lambda d. \lambda x. \mathbf{cleverness}(x) = d$
- b. $\llbracket \text{congming } t_1 \rrbracket = [\lambda d. \lambda x. \mathbf{cleverness}(x) = d](d_1)$
 $= \lambda x. \mathbf{cleverness}(x) = d_1$
- c. $\llbracket \text{ta congming } t_1 \rrbracket = \mathbf{cleverness}(\text{he}) = d_1$
- d. $\llbracket 1 \text{ ta congming } t_1 \rrbracket = \lambda d_1. \mathbf{cleverness}(\text{he}) = d_1$
- e. $\llbracket t_2 \text{ duo} \rrbracket = [\lambda d \lambda \wp_{\langle d, t \rangle}. \wp(d)](d_2) = \lambda \wp_{\langle d, t \rangle}. \wp(d_2)$
- f. $\llbracket t_2 \text{ duo } 1 \text{ ta congming } t_1 \rrbracket = [\lambda \wp_{\langle d, t \rangle}. \wp(d_2)](\lambda d_1. \mathbf{cleverness}(\text{he}) = d_1)$
 $= \mathbf{cleverness}(\text{he}) = d_2$
- g. $\llbracket 2 \text{ } t_2 \text{ duo } 1 \text{ ta congming } t_1 \rrbracket = \lambda d_2. \mathbf{cleverness}(\text{he}) = d_2$
- h. $\llbracket \text{hen} \rrbracket = \lambda \wp_{\langle d, t \rangle} \exists d. \wp(d) \wedge d \geq \text{Std}$
- i. $\llbracket \text{hen } 2 \text{ } t_2 \text{ duo } 1 \text{ ta congming } t_1 \rrbracket$
 $= [\lambda \wp_{\langle d, t \rangle} \exists d. \wp(d) \wedge d \geq \text{Std}] (\lambda d_2. \mathbf{cleverness}(\text{he}) = d_2)$
 $= \exists d. \mathbf{cleverness}(\text{he}) = d \wedge d \geq \text{Std}$

As shown above, if gradable adjectives were expressions of type $\langle d, \langle e, t \rangle \rangle$, nothing would prevent the adjective to directly take the trace of the raised *duo*-phrase as its argument. The denotation of this degree trace is later existentially closed and a condition is added to restrict it due to the meaning of *hen*. So the final truth conditions of sentence (36b) are: there is a degree d which is the degree of his cleverness and d is greater than a contextually determined standard, i.e., the average cleverness of people. In other words, (36b) would mean something equivalent to *Ta hen congming* ‘He is very clever’. However, it does not have this interpretation. It can only mean that the

degree of his cleverness is much higher than the degree of cleverness of a contextually relevant person. It is exactly due to this inadequacy that the author prefers to treating gradable adjectives as denoting measure functions rather than analyzing them as expressions denoting relations between degrees and individuals.

7. *Yi Dian* ‘a bit/little’ vs. *Hen Duo* ‘very much/many’

The treatment of differential *duo*-phrases as generalized quantifiers over degrees has one important prediction; namely, when an overt comparison morpheme such as *geng* or *bijiao* appears, a differential phrase is not allowed. This is illustrated by the examples below:

(38) a. *Zhangsan bi Lisi geng gao hen duo/wu gongfen
 Zhangsan than Lisi even.more tall very much/five centimeters

‘Zhangsan is very much/five centimeters taller than Lisi.’

b. *Zhangsan bijiao geng gao hen duo/wu gongfen

Zhangsan more tall very much/five centimeters

‘Zhangsan is very much/five centimeters taller (than some contextually relevant person)’

Examples such as (38a) and (38b) are ruled out because *geng* and *bijiao* are an overt degree head taking AP as their complement and adjectives denote measure functions of type $\langle e, d \rangle$, which are incompatible with a type d or $\langle \langle d, t \rangle, t \rangle$ complement. On the other hand, if the null comparative morpheme μ_{er} were assumed to be present, the differential phrase would be allowed. But then there would be two comparative morphemes, one being the null μ_{er} and the other being *geng/bijiao*. This, however, leads to un-interpretability due to type mismatch when *geng/bijiao* is to combine with the AP complement. Thus the ungrammaticality of (38a) and (38b) is evidence in support of the analysis made in previous sections.

Like *hen duo*, the low degree term *yi dian* ‘a bit/a little’ can also appear in a post-adjectival position, receiving a differential interpretation, as illustrated by (39).

(39) Zhangsan (bi Lisi) gao yi dian

Zhangsan than Lisi tall one point

‘Zhangsan is a little taller (than Lisi).’

Very interestingly, however, when *hen duo* and *wu gongfen* in (38a) and (38b) are replaced by *yi dian*, the sentences are acceptable, as is shown below.

(40) a. Zhangsan bi Lisi geng gao yi dian

Zhangsan than Lisi even.more tall a point

‘Zhangsan is a little taller than Lisi.’

b. Zhangsan bijiao gao yi dian

Zhangsan more tall a point

‘Zhangsan is a little taller (than some contextually relevant person).’

Do examples such as (40a) and (40b) challenge the proposed analysis of the differential *duo*-phrase? If not, why are they grammatical?

There are two possibilities to explain why (40a) and (40b) are well-formed in contrast to (38a) and (38b). One possibility is that *yi dian*, as opposed to *hen duo* and regular measure phrases, is not a post-adjectival complement but for some unknown reason can be attached to a position higher than a DegP headed by *geng* or *bijiao*. Thus, *yi dian* actually combines with a comparative predicate after a degree argument has been introduced. Another possibility is that *a dian* in (40a) and (40b) is located at the complement position of the adjective but has a more complex semantic type that allows it to take a measure function as the first argument and a comparative morpheme as the second argument. In this article I will not explore the second

possibility because there is evidence showing that *yi dian* can indeed be adjoined to a position higher than DegP. Consider (41).

- (41) Ni tai guanxin ta le yi dian
you too care him Asp a point
'You care about him a bit too much.'

In (41), *a dian* appears to the right of *le*, which is usually analyzed as an aspectual element or sentence-final particle. The exact analysis of *le* is not our concern. What is important is that *le* is a functional head that is higher than the DegP projected by *tai* 'too'. Since *yi dian* may occur to the right of *le*, this implies that *yi dian* can be adjoined to a position higher than DegP.

Note that *yi dian* may also occur in a pre-adjectival position, preceding a comparative predicate headed by *geng* or *bijiao*, as is shown by (42), though in this case it must be preceded by *you*.¹²

- (42) a. Zhangsan you (yi) dian bi Lisi geng jingzhang
Zhangsan have a point than Lisi even.more nervous
'Zhangsan is a little bit more nervous than Lisi is'
- b. Suiran juli you (yi) dian bijiao yuan,...
though distance have a point more far
'Though the distance is a little farther'

In contrast, *hen duo* is not able to precede a comparative predicate, hence the ungrammaticality of (43).

- (43) a. *Zhangsan (you) hen duo bi Lisi geng jingzhang

Zhangsan have very much than Lisi even.more nervous

‘Zhangsan is much more nervous than Lisi.’

b. *Suiran juli (you) hen duo bijiao yuan,...

though distance have very much more far

‘Though the distance is much farer,...’

The contrast between (42) and (43) clearly shows that the low degree modifier *yi dian* can be syntactically adjoined to a position higher than DegP, whereas the high degree modifier *hen duo* may not. We do not know what causes this difference, but clearly this difference is responsible for why there is no type mismatch in (40), as opposed to the examples in (38). In (40), *yi dian* is not a complement of the gradable adjective but is adjoined to a position higher than DegP headed by *geng* or *bijiao*.¹³ After *geng* or *bijiao* combines with AP, a degree argument is introduced. *Yi dian* or its trace then fills in this argument, requiring that the gap between the two compared degrees is a small number.

As a final note to *yi dian*, it is worth pointing out that it may also modify the predicative and quantificational *duo*, as is shown below.

(44) Wo-de shu duo-(le) yi dian

my book many-Asp one dot

‘My books are a little more.’

(45) Duo yi dian de ren lai bijiao hao

many a bit Rel people come more good

‘A little more people come is better.’

Such facts, as an anonymous reviewer pointed out, support a syntactic instead of a semantic account for the restriction under discussion.

8. A unified analysis of *duo*

So far, I have provided an analysis which is capable of explaining the semantics of the differential Adj-*duo* construction. It was argued that the differential *duo* is a gradable adjective, whose first argument is of type *d* and the second argument ranges over sets of degrees. This analysis raises a curious question; namely, does the proposed semantics of the differential *duo* have any relation to the predicative and quantificational/attributive use of *duo*? Can the different uses of *duo* be unified under a single analysis? Very interestingly, the same question has been asked by Solt's (2014) recent paper. She pointed out that 'adjectives of quantity' (Q-adjectives for short) in English occur in positions that can be called quantificational (46a), predicative (46b), attributive (46c) and differential (46d) as illustrated below.

- (46) a. Many students attended the lecture.
b. John's friends are many.
c. The many students who attended enjoyed the lecture.
d. Many more than 100 students attended the lecture.

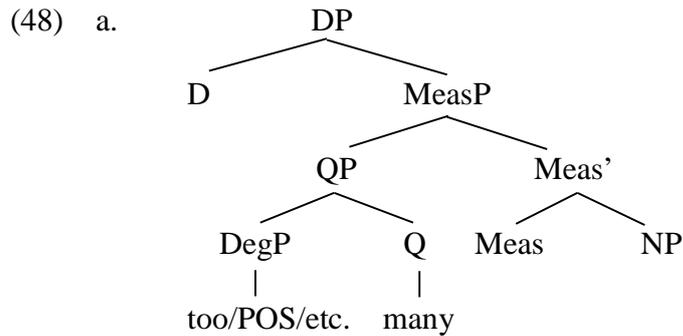
(Solt 2014: 2)

She argues that previous approaches which treat *many* as quantificational or predicative are not able to cover all uses of *many*. Instead, she proposes that across all of their uses, Q-adjectives denote functions from degrees to sets of degrees. Under her analysis, the denotation of *many* and *much* is the following:

$$(47) \llbracket \text{many/much} \rrbracket = \lambda d \lambda I_{\langle d, t \rangle} . I(d) \quad (\text{Solt 2014: 13})$$

She shows that the above semantics of *many/much* can be extended to all positions of *many/much*.

Take the quantificational *many* for example. Being a type $\langle d, \langle \langle d, t \rangle, t \rangle \rangle$ expression, *many* may not modify common nouns directly as the latter are type $\langle e, t \rangle$ expressions. Thus, she suggests that the modification relation is mediated through a functional head called *Meas*, for ‘measure’, whose semantics is given in (48b). The *many*-phrase, postulated as QP, is the specifier of MeasP, as is shown by (48a).



b. $\llbracket \text{Meas} \rrbracket = \lambda x_e \lambda d_d. \mu_s(x) \geq d,$

(where *s* is a variable over measure scales which is contextually determined.) (Solt 2014: 15-16)

The idea of the functional head *Meas* is quite similar to the proposal made by Kayne (2005), who argues that a phonologically null functional noun NUMBER or AMOUNT is between *many* and the noun it modifies, and this implicit NUMBER licenses NP ellipsis, as is evidenced by the contrast between *many* and the ordinary adjective *good* and *bad* (also see Schwarzschild (2006) for a similar idea.)

(49) a. Many linguists like phonology, but many don't.

b. *Good linguists like phonology, but bad don't.

In addition, Solt adopts a semantic composition rule called Degree Argument Introduction, whose spirit is similar to Kratzer's (1996) rule of Variable Identification. What the rule does is to demote the individual argument to second position when a noun of type $\langle e, t \rangle$ is combined with *Meas* (cf. the RESTRICT operation of Chung & Ladusaw 2003)

(50) Degree Argument Introduction (DAI):¹⁴

If α is a branching node, $\{\beta, \gamma\}$ are the set of α 's daughters, and $\llbracket \beta \rrbracket = \lambda x_e.P(x)$,
 $\llbracket \gamma \rrbracket = \lambda x_e \lambda d_d.Q(d)(x)$, then $\llbracket \alpha \rrbracket = \lambda d_d \lambda x_e. \llbracket \beta \rrbracket(x) \wedge \llbracket \gamma \rrbracket(x)(d)$

(Solt 2014: 14)

Solt argues that the above analysis of *many*, together with the semantics of *Meas* and the rule of DAI, may then explain the quantificational, attributive as well as the predicative uses of *many* in a unifying manner. I show below that her approach can be extended to Mandarin Chinese, too.

Consider sentence (2) first, reproduced below, which involves a quantificational/attributive *duo*.

(2) Wo mai-le hen duo shu

I buy-Asp very many book

'I bought many books.'

Let us assume that like its English counterpart, *hen duo* 'very many' does not modify the noun *shu* 'book' directly but is mediated through *Meas*. Moreover, the object DP, being quantificational, undergoes quantifier raising. Therefore, the LF of (2) is (51).

(51) [Hen [3 [[t₃ duo] [2 [DP \emptyset [MeasP t₂ [Meas' Meas shu]]] [1 [wo mai-le t₁]]]]]]]]

In (51), the object DP, being quantificational, undergoes quantifier raising. As in our previous discussion, the AP *hen duo* is a generalized quantifier over degrees. So it has to undergo quantifier raising and similarly for the degree adverb *hen*, hence the LF we

saw in (51). Given this LF, the step-by-step semantic composition then proceeds as follows:

- (52) a. $\llbracket 1 \text{ wo mai} - \text{le } t_1 \rrbracket = \lambda x. \text{ I bought } x$ by Lambda Abstraction (LA)
- b. $\llbracket \text{Meas shu} \rrbracket = (\lambda x \lambda d. \mu_s(x) \geq d)(\lambda x. x \text{ are books})$
 $= \lambda d \lambda x. x \text{ are books} \wedge \mu_s(x) \geq d$ by DAI
- c. $\llbracket [_{DP} \emptyset t_2 \text{ Meas shu}] \rrbracket = \lambda x. x \text{ are books} \wedge \mu_s(x) \geq d_2$
by Functional Application (FA)
 $\Rightarrow \lambda P_{\langle e, t \rangle}. \exists x [x \text{ are books} \wedge \mu_s(x) \geq d_2 \wedge P(x)]$
by Type Lifting
- d. $\llbracket [_{DP} \emptyset t_2 \text{ Meas shu}] \llbracket 1 \text{ wo mai} - \text{le } t_1 \rrbracket \rrbracket$
 $= \lambda P_{\langle e, t \rangle}. \exists x [x \text{ are books} \wedge \mu_s(x) \geq d_2 \wedge P(x)] (\lambda x. \text{ I bought } x)$
 $= \exists x [x \text{ are books} \wedge \mu_s(x) \geq d_2 \wedge \text{ I bought } x]$ by FA
- e. $\llbracket [2 [_{DP} \emptyset t_2 \text{ Meas shu}] \llbracket 1 \text{ wo mai} - \text{le } t_1 \rrbracket \rrbracket \rrbracket$
 $= \lambda d_2. \exists x [x \text{ are books} \wedge \mu_s(x) \geq d_2 \wedge \text{ I bought } x]$ by LA
- f. $\llbracket t_3 \text{ duo} \rrbracket = [\lambda d \lambda \wp_{\langle d, t \rangle}. \wp(d)](d_3)$
 $= \lambda \wp_{\langle d, t \rangle}. \wp(d_3)$ by FA
- g. $\llbracket \llbracket t_3 \text{ duo} \rrbracket [2 [_{DP} \emptyset t_2 \text{ Meas shu}] \llbracket 1 \text{ wo mai} - \text{le } t_1 \rrbracket \rrbracket \rrbracket$
 $= [\lambda \wp_{\langle d, t \rangle}. \wp(d_3)] (\lambda d_2. \exists x [x \text{ are books} \wedge \mu_s(x) \geq d_2 \wedge \text{ I bought } x])$
 $= \exists x [x \text{ are books} \wedge \mu_s(x) \geq d_3 \wedge \text{ I bought } x]$
- h. $\llbracket [3 \llbracket t_3 \text{ duo} \rrbracket [2 [_{DP} \emptyset t_2 \text{ Meas shu}] \llbracket 1 \text{ wo mai} - \text{le } t_1 \rrbracket \rrbracket \rrbracket \rrbracket$
 $= \lambda d_3. \exists x [x \text{ are books} \wedge \mu_s(x) \geq d_3 \wedge \text{ I bought } x]$ by LA
- i. $\llbracket \text{hen } [3 \llbracket t_3 \text{ duo} \rrbracket [2 [_{DP} \emptyset t_2 \text{ Meas shu}] \llbracket 1 \text{ wo mai} - \text{le } t_1 \rrbracket \rrbracket \rrbracket \rrbracket \rrbracket$

$$\begin{aligned}
&= [\lambda \wp \langle d, t \rangle \exists d. \wp(d) \wedge d \geq \text{Std}] (\lambda d \exists x [x \text{ are books} \wedge \mu_s(x) \geq d \wedge \text{I bought } x]) \\
&= \exists d \exists x [x \text{ are books} \wedge \mu_{\text{cardinality}}(x) \geq d \wedge \text{I bought } x \wedge d \geq \text{Std}] \quad \text{by FA}
\end{aligned}$$

As mentioned by Solt (2004: 16), one particular choice of the dimension introduced by *Meas* is cardinality. Therefore, the last line means that there is a degree d and d is the cardinality of books that I bought and d is greater than the standard. This is exactly the reading of (2) that we want. So we see that the proposed semantics of *duo* in this article can be extended to quantificational or attributive use of *duo* as long as we adopt Solt's assumption of *Meas* and the rule of DAI.

The predicative use of *duo* can be analyzed in a similar way. Following Solt's analysis of *John's friends are many*, which is assigned the structure of (53), we propose that the Chinese sentence (1) has the structure in (54).

(53) [IP [MeasP Meas [DP John's friends]] are many]

(54) [IP [MeasP Meas [DP wo-de shu]] hen duo]

That is, on top of the subject DP *wo-de shu*, the MeasP is projected. Moreover, let us also assume as before that *hen* must undergo quantifier raising due to interpretation requirement. This will give us the following LF.

(55) [hen [1[[MeasP Meas [NP wo-de shu]] [t₁ duo]]]]]

Assuming that the denotation of *wo-de shu* is an entity of type e , '[MeasP Meas [DP wo-de shu]]' then denotes (56), an expression of type $\langle d, t \rangle$.

(56) [$\lambda x \lambda d. \mu_s(x) \geq d$](my-books')

$$= \lambda d. \mu_{\text{cardinality}}(\text{my-books}) \geq d$$

On the other hand, ‘*t*₁ duo’ denotes $\lambda \wp_{\langle d,t \rangle}. \wp(d_1)$, which is a $\langle \langle d,t \rangle, t \rangle$ expression requiring an expression of type $\langle d,t \rangle$ as its argument. In other words, ‘*t*₁ duo’ in (56) may directly take the denotation of MeasP as its argument, as is shown below.

$$(57) [\lambda \wp_{\langle d,t \rangle}. \wp(d_1)](\lambda d. \mu_{\text{cardinality}}(\text{my-books}) \geq d) \\ = \mu_{\text{cardinality}}(\text{my-books}) \geq d_1$$

The degree variable d_1 is then abstracted over by the index 1 of the raised degree adverb *hen* and the resulting denotation is then combined with *hen*, yielding the following truth conditions.

$$(58) [\lambda \wp_{\langle d,t \rangle} \exists d. \wp(d) \wedge d \geq \text{Std}] (\lambda d_1. \mu_{\text{cardinality}}(\text{my-books}) \geq d_1) \\ = \exists d. \mu_{\text{cardinality}}(\text{my-books}) \geq d \wedge d \geq \text{Std}$$

What (58) says is that there is a degree d which is the cardinality of my books and d is greater than the standard, which seems to be the right interpretation of the sentence.

I conclude that the quantificational/attributive, predicative and the differential *duo* can all be unified under the same semantics. This is a very desirable result and it lends very strong support to Solt’s (2004) analysis of *many/much* in English

9. Conclusion

This article discusses the syntax and semantics of differential *duo*-comparatives. It was argued that the post-adjectival *duo* projects an AP which takes a degree modifier or POS as its specifier. The syntactic structure of differential *duo*-comparatives are parallel to standard differential comparatives except that instead of a measure phrase denoting a precise value, we have an AP denoting a vague value. It was argued that

such differential APs are generalized quantifiers over degrees of type $\langle\langle d,t\rangle,t\rangle$. So they have to undergo quantifier raising, leaving a trace of type d . Degree adverbs are also treated as generalized quantifiers that are raised to a higher position at LF and leave another trace of type d . It was proposed that the meaning of ‘ d many’ after the quantifier-raising of degree adverbs is to take a set of degrees as its argument and returns the same set of degrees. So *duo* is almost semantically empty, parallel to Solt’s (2014) analysis of English *many/much*. On the other hand, gradable adjectives are assumed to denote measure functions rather than relations between degrees and arguments. Degree arguments are introduced only as a result of their combination with the null μ for the positive reading or the null μ_{er} for the comparative reading. The null μ is syntactically projected as an independent head taking AP as its complement, whereas the comparative μ_{er} is an affixal element that is directly adjoined to the gradable adjective. We showed that the above theoretical assumptions not only successfully accounts for the differential meaning of the Adj-*duo* construction but also derives the lack of the positive reading as a natural consequence. The positive reading is excluded because the semantic type of gradable adjectives is incompatible with that of a post-adjectival *duo*-phrase. Finally, on the basis of Solt’s (2014) work on *many/much*, it was shown that the predicative, quantificational and the differential *duo* may all be unified under the same lexical entry.

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¹ The particle *le* here is obligatory. However, when *duo* is modified by a degree modifier such as *hen* or *feichang* as in (4), *le* need not appear. The cause for this is not clear, but it might have to do with the fact that *duo* is a monosyllabic word. In this article I will leave the issue of *le* open.

² In this article, I will not discuss whether adjectives in Mandarin Chinese are verbs. For the purpose of this paper, the categorical distinction is semantically insignificant. For the debate on this issue, I refer the reader to Zhu (1956/1980), Chao (1968), Li & Thompson (1981), McCawley (1992), Sze-Wing Tang (1998) and Shen (2007) for the position that Mandarin adjectives are verbs, and to Lü (1944), Zhu (1982), Huang & Liao (1979), Ding et al. (1979), T.-C. Tang (1988), Xing (1991), Guo (2002), Lu (2005), Shi (2009), Paul (2005, 2010) and Liu (to appear) for the view that adjectives are a separate category in Mandarin Chinese.

³ For more recent discussions of *bi*-comparatives in Mandarin Chinese, see Xiang (2005), Lin (2009), Grano and Kennedy (2012), Erlewine (2012) and references cited therein.

⁴ In Mandarin Chinese, a positive adjective is obligatorily accompanied by the degree word *hen* ‘very’ in an affirmative sentence.

⁵ (i) below is Lin’s (2009) non-final version of the semantics of *bi*, which clearly shows that the greater-than relation is part of the denotation of *bi*.

(i) $\llbracket bi \rrbracket = \lambda x \lambda P_{\langle d, \langle e, t \rangle \rangle} \lambda y [\iota_{\max} d [P(d)(y) > \iota_{\max} d [P(d)(x)]]]$

⁶ As far as I can see, the truth conditions of (16) are no different from the truth conditions of (14a) or (14b).

⁷ Alternatively, one may assume *hen* ‘very’ denotes the following:

(i) $\llbracket hen \rrbracket = \lambda \wp_{\langle d, t \rangle} \exists d. \wp(d) \wedge d \geq n$, n a contextually determined number

⁸ Measure phrases can be assumed (type-shifted) to be generalized quantifiers, too, without affecting the meaning of the sentence.

⁹ In this article, I assume with Heim & Kratzer (1998) that the index of a moved item is a number adjoined to the phrase which the moved item targets.

¹⁰ The relative order between the adjective and μ_{er} is insignificant.

¹¹ Although *duo* is treated as an adjective, its semantics is different from that of ordinary adjectives, which are assumed to be expressions of type $\langle e, d \rangle$. The same position has been adopted for English *many/much* by Solt (2014), who proposes that ordinary adjectives are relations between individuals and degrees, whereas adjectives of quantity denote functions from degrees to sets of degrees. It is worth exploration why adjectives of quantity should be different from ordinary adjectives with respect to their denotations and this seems to be cross-linguistically true. Readers are referred to Solt for some motivation of this assumption.

¹² Some people might not like sentences such as (42), but it is easy to find such sentences by searching on google.

¹³ Note that I am not claiming that *yi dian* can never be a complement. I am only claiming that in this particular construction, *yi dian* is not in the complement position of the adjective.

¹⁴ In Solt's original formulation, the denotation of α is $\lambda d \lambda x. P(x) \wedge Q(x)(d)$. I think this might be a mistake. P and Q here should be $\llbracket \beta \rrbracket$ and $\llbracket \gamma \rrbracket$, respectively.