

# Q-adjectives in Mandarin and the Interpretation of Nominal Phrases

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In Mandarin, predicative gradable adjectives of quantity adjectives (henceforth, Q-adjectives; e.g., *duō* ‘many’ and *shǎo* ‘few’; henceforth, predicative Q-adjectives), but not ordinary adjectives (e.g., *cōngmíng* ‘smart’), may influence the interpretation of the nominals they are predicates of; while the Mandarin counterpart of *speaking of the students one taught, Zhangsan many* can (and only can) mean that the students that Zhangsan taught are many, that of *speaking of the students one taught, Zhangsan smart* can only mean that Zhangsan, but not the student/s that Zhangsan taught, is/are smart. This paper is to show how this previously unnoticed contrast may be accounted for in current theories of degree syntax and semantics. The proposal is couched on Solt’s (2015) analysis of Q-adjectives, according to which measurement of cardinality is introduced via a covert functional head rather than the Q-adjectives *per se*. The main idea is that in Mandarin the covert functional head that introduces measurement of cardinality semantically encodes a contextually provided function from individuals to individuals. Crucially, although the content of this function is context-dependent, various syntactic and semantic factors may be at play.

## 1 Introduction

Kayne (2005) claims that the syntax of quantity adjectives (e.g., *many/much/few/little*; henceforth, Q-adjectives) involves an extra covert functional head; on the other hand, that of ordinary adjectives, such as *good* or *numerous*, don’t. One piece of arguments he provides has to with the license of ‘unpronounced’ NPs. As shown in (1), while an unpronounced NP after a prenominal Q-adjective is grammatical, one after *good* and *numerous* leads to ungrammaticality.

- (1) a. Many linguists like phonology, but many don’t.  
b. \*Good linguists like phonology, but bad don’t.  
c. \*Numerous linguists like phonology, but numerous don’t.

Various research on the semantics and syntax-semantics interface of quantity, since then, have been developed along these lines; e.g., Schwarzschild (2006), Rett (2008), Solt (2015) and others.

Q-adjectives, just like ordinary adjectives, may occur in predicate position, as shown in the English examples (2) and the Mandarin examples (3).<sup>1,2</sup>

- (2) a. John’s friends are many/few.  
b. John’s friends are more/fewer than Mary’s.
- (3) a. Zhāngsān jiāo-guò dé xuéshēng hěn duō/shǎo.  
Zhangsan teach-EXP REL student very many/few  
‘The students Zhangsan taught are many/few.’  
b. Zhāngsān jiāo-guò dé xuéshēng bǐ Lǐsì jiāo-guò dé xuéshēng duō/shǎo.  
Zhangsan teach-EXP REL student COMP Lisi teach-EXP REL student many/few  
‘The students Zhangsan taught are more/fewer than those that Lisi taught.’

One might wonder whether Kayne’s (2005) claim may be extended to predicative adjectives; to be more specific, does there exist any evidence cross-linguistically that suggests that predication

<sup>1</sup>In Mandarin, there is neither *many/few* vs. *much/little* distinction nor obligatory plural marking (like English *-s*).

<sup>2</sup>The following abbreviations are used in the gloss:

CL: classifier      COMP: comparative      EXP: experiential      MOD: modification marker  
PERF: perfective      REL: relativizer      SFP: sentence-final particle

I treat the morpheme *bǐ* as carrying the function of expressing degree comparison, though this choice has no effect on the discussion below. See Lin (2009), Liu (2011) and the references cited therein on this matter.

with Q-adjectives and that with ordinary adjectives involve different syntactic structures. This paper is intended to shed light on this issue; it suggests that there is indeed a need to assume different syntactic structures for predication with Q-adjectives and that with ordinary adjectives; this is motivated by an unnoticed contrast between these types of adjectives in Mandarin.

## 1.1 Mandarin Q-adjectives and the ‘Association Effect’

Something that has gone unnoticed in the literature is the fact that the predicative Q-adjectives may give rise to an ‘association effect’ on the nominal phrases they are predicates of: in (4), while on the surface it looks as if the Q-adjectives are predicates of the proper names *Zhāngsān* and *Lǐsì*, these Q-adjectives, with the sentential adverbial *speaking of the students that one taught*, are in fact predicated of the students that Zhangsan taught and those that Lisi taught.<sup>3</sup>

- (4)    shuōdào    jiāo-guò    de    xuéshēng,  
          speaking.of teach-EXP REL student  
          ‘speaking of the students that one taught’
- a.    Zhāngsān hěn    duō/shǎo  
          Zhangsan very many/few  
          ‘The students that Zhangsan taught are many/few.’
- b.    Zhāngsān bǐ      Lǐsì duō/shǎo  
          Zhangsan COMP Lisi many/few  
          ‘The students Zhangsan taught are more/fewer than the students Lisi taught.’

(5) shows that it is possible in a comparative for the association effect to target only the nominal after the comparative morpheme *bǐ* (i.e. the post-*bǐ* nominal; see (5a)) or only the subject of the comparative (see (5b)).

- (5)    a.    Zhāngsān jiāo-guò    de    xuéshēng bǐ      Lǐsì duō/shǎo.  
          Zhangsan teach-EXP REL student    COMP Lisi many/few  
          Intended: ‘The students Zhangsan taught are more/fewer than the students Lisi taught.’
- b.    Zhāngsān bǐ      Lǐsì jiāo-guò    de    xuéshēng duō/shǎo.  
          Zhangsan COMP Lisi teach-EXP REL student    many/few  
          Intended: ‘The students that Zhangsan taught are more/fewer than those that Lisi taught.’

More examples of this kind can be found in Academia Sinica Balanced Corpus of Modern Chinese (see (6)).<sup>4</sup> These examples show that the presence of the adverbial *speaking of* ... is not necessary to induce this effect. With an appropriate context, this effect arises naturally: in (6a) the number of women for one to marry in Zhoushan is being compared; in (6b), what is in comparison is the number of people who got liver cancer or lung cancer; (6d) concerns the number of linguistic people in different areas of Taiwan; (6e) further shows that in a comparative, this effect can be seen at the same time on the target of comparison and the post *bǐ*-nominal. These examples also show that this effect is not limited to cases where the nominal of which a Q-adjective is a predicate is the agent; the of which the Q-adjectives are predicates refer to a location in (6a)-(6d) and a theme in (6b).

- (6)    a.    Zhōushān chéng-lè      guǎfùcūn,      ‘nàshí      rénmen chángshuō yào    zhǎo  
          Zhoushan become-PERF widow.village that.time people    often.say    want find  
          lǎopuó, zhōushān hěn    **duō**.  
          wife      Zhoushan very many

<sup>3</sup>This observation holds for other degree constructions, such as superlatives and equatives.

<sup>4</sup><http://asbc.iis.sinica.edu.tw/>

- ‘The place Zhoushan became a widow village; “at that time people often said that if you want to find a wife, there are many in Zhoushan.”’
- b. pìrú xiànzài gānyán fèiyán hěn **duō**, jiùshì yīnwèi chōuyān  
for-example now liver.cancer lung.cancer very many just because.of smoking  
(bāoguā èrshǒuyān).  
including second-hand-smoke  
‘For instance, nowadays people who got liver cancer and lung cancer are many just because of smoking (including second-hand smoke).’
- c. jiù gāi-xi-dè kèchéng éryán, èr-niánjí-dè  
As.for this-department-POSS curriculum speaking.of, two-year-POSS  
bìxiūkè bǐ yì-nián-jí **shǎo** hěn duō, suǒyǐ jīnnián sìhū  
required.course COMP one-year few POS many, therefore this.year seemingly  
bùrú yǐqián mánglù.  
unlike before busy  
‘Speaking of the curriculum of the department, the required courses for sophomores are much fewer than those for freshmen; hence, this year students are not as busy as before.’
- d. dìyù éryán jiǔchéng dé yǔyán xuéshù rénkǒ jízhōng zài  
region in.terms.of ninety.percent MOD language academics population gather in  
Xīnzhú yǐběi, nánbù hěn **shǎo**.  
Hsinchu northern.to the.South very few ...  
‘In terms of regions, ninety percent of the linguists are gathered in regions north to Hsinchu; there are very few in the South.’
- e. bàogào-zhōng zhǐchū, yī lùnwén bèi SCI yǐyòng piānshù zēngjiā  
report-inside point.out, according.to paper PASS SCI cite CL.number increase  
de. fúdù láikàn, wǒguó bǐ dièshí míng dé fēnlán zhǐ **shǎo** 81  
of degree in.view.of, our.country COMP 20th MOD Finland only few 81  
piān.  
CL  
‘As the report points out, based on the increase of the number of the papers cited by SCI, the papers from our country cited by SCI are 81 fewer than those from Finland.’

## 1.2 The *quantity vs. quality* distinction

The way of mapping from form to meaning shown in the examples above is far from common in Mandarin. As shown in (7), while it is possible to omit the head noun in a complex nominal phrase, a proper name by itself is never interpreted the way it is in (4)-(5), even when a proper antecedent is present to recover the unpronounced material.

- (7) Wángwǔ mà-lè Zhāngsān jiāo-guò dé xuéshēng, yěi mà-lè {Lǐsì  
Wangwu scold.at-PERF Zhangsan teach-EXP REL student also scold.at-PERF Lisi  
jiāo-guò dé/\*Lǐsì}.  
teach-EXP REL/Lisi  
Intended: ‘Wangwu scolded at the students that Zhangsan taught, and he also scolded at the students that Lisi taught.’

Furthermore, no such effect is observed with a gradable adjective of quality; with the gradable adjective *smart*, the degree constructions in (8) only have a reading in which the intelligence of Zhangsan himself and that of Lisi himself are being compared.

- (8) *Speaking of the students that one taught,*

- a. Zhāngsān hěn cōngmíng.  
Zhangsan very smart  
✓‘Zhangsan is smart.’ ✗‘The student/s that Zhangsan taught is/are smart.’
- b. Zhāngsān bǐ Lǐsì cōngmíng.  
Zhangsan COMP Lǐsì smart  
✓‘Zhangsan is smarter than Lisi.’  
✗‘The student/s Zhangsan taught is/are smarter than that/those that Lisi taught.’

The fact that (9) can only be judged false in the scenario in (10) is another indication of the lack of the interpretation in which the intelligence of the student(s) Lisi taught is being compared.

- (9) Zhāngsān jiāo-guò dé xuéshēng bǐ Lǐsì cōngmíng.  
Zhangsan teach-EXP REL student COMP Lisi smart  
✓‘The student/s taught by Zhangsan is/are smarter than Lisi.’  
✗‘The student/s Zhangsan taught is/are smarter than the student/s Lisi taught.’
- (10) Scenario: the IQ of the students that Zhangsan taught is 115-119; the IQ of the students that Lisi taught is 106-109; Lisi’s IQ is 125.

The difference between gradable adjectives of quality and the Q-adjectives is further evidenced by the contrast between (6a) and (11): with the adjective *piàoliàng* ‘beautiful’, (11) can only mean that the place Zhoushan is beautiful, which in turn results in oddity in the given linguistic context.

- (11) (with the same linguistic context as in (4b) ...) #zhōushān hěn **piàoliàng**.  
Zhoushan very beautiful  
✗‘...if you want to find a wife, there are beautiful ones in Zhoushan.’  
✓‘...if you want to find a wife, Zhoushan is beautiful.’

There might be some examples that seemingly pose challenge to the generalization I have reached here. For now I will temporarily put them aside and return to them in Section 4.2, the discussion of which shows that they are irrelevant to the concern in this paper after all after a careful scrutiny.

### 1.3 The association effect in a comparative

At first glance, it seems that the association effect from the Q-adjectives arises as long as the context of utterance permits. A closer look at the comparatives with the Q-adjectives however suggests that other factors might be at play. We have seen in (5) that the association effect may target only one of the subject and the post-*bǐ* nominal. Unexpectedly however, in (12), the association effect is required to target both the subject of the comparative and the post-*bǐ* nominal.

- (12) shuōdào jiāo-guò dé nǚpéngyǒu, Zhāngsān jiāo-guò dé xuéshēng bǐ Lǐsì  
speaking.of had-EXP REL girlfriend, Zhangsan teach-EXP REL student COMP Lisi  
duō.  
many  
a. ✗‘Speaking of the girlfriends one had, the student(s) Zhangsan taught are more than the girlfriends Lisi had.’  
b. ✓‘Speaking of the girlfriends one had, the girlfriends that the student(s) taught by Zhangsan had are more than the girlfriends that Lisi had.’

(12) carries a reading in which the number of the girlfriends that the student(s) taught by Zhangsan had and that of the girlfriends that Lisi had are in comparison. Crucially, it does not carry a reading in which the number of the students that Zhangsan taught and that of the

girlfriends that Lisi had are compared. This cannot be due to semantic oddity; after all, this reading is a sensible one.

#### 1.4 Not due to deletion; not due to coercion

One very quick response to the association effect observed above is that in an example like (4a), where the association effect is observed, the Q-adjectives are in fact predicates of a nominal phrase that contains a phonetically null head, which may result from PF-deletion (as indicated by striking through in (13a)) or a base-generated empty category (as indicated by *e* in (13b)); these unpronounced material function like a null pronoun and are interpreted the way they are through the information provided by the context of utterance.

- (13) a. [ *Zhāngsān* ~~*teach-EXP*~~ *dě* ~~*student*~~ ] *very duō/shǎo*  
 b. [ *Zhāngsān e* ] *very duō/shǎo*

Analyses along these lines however not only lack empirical support, as already shown in (9), but also leave unexplained the contrast between the Q-adjectives and the ordinary adjectives.

Another possible response to the observation presented above is to see this effect as a consequence from some semantic-shifting operation. It has been suggested that the Q-adjectives pose a non-atomic requirement on the nominals they are predicates of, according to which a nominal they are predicates of should not be inherently semantically atomic (Hackl 2000; Wellwood et al. 2012). Along with this assumption, one may think of the association effect observed above as a result from coercion: in the examples where the association effect is observed, since the nominals a Q-adjective is a predicate of, namely *Zhangsan* and *Lisi*, are semantically inherently atomic, a coercion operation, perhaps along the lines of de Swart (1998) and Sawada and Grano (2011), may have applied to guarantee interpretability and consequently gives rise to this effect. Analyses along these lines, however, do not seem to be sound theoretically or empirically. First, assuming that coercion is a last-resort operation, such analyses predict that the association effect does not arise as long as the non-atomicity requirement is met. Contrary to this prediction, the association effect is observed with plural subjects as well, as shown in (14) where the quantity of the books of the students is compared.

- (14) *shuōdào shū, zhè-xiē xuéshēng hěn duō.*  
 speaking.of book these-CL<sub>PL</sub> student very many  
 ‘speaking of books, the books of these students are many.’

Moreover, under such analyses, one may expect that the association effect should be seen with ordinary adjectives that pose a non-atomicity requirement on the nominal they are predicates of. This prediction is not borne out: the association effect is not seen with the gradable predicate *tuánjié* ‘united’ (see (16)), which poses a non-atomicity requirement on the nominal it is a predicate of (see (15)).<sup>5</sup>

- (15) *zhè-xiē xuéshēng/\*zhè-gè xuéshēng hěn tuánjié.*  
 this-CL<sub>PL</sub> student/ this-CL student very united  
 ‘These students/\*this student are/is united.’

<sup>5</sup>The fact that (i) may be used to compare two groups with respect to their degree of being united suggests that *tuánjié* is gradable.

- (i) *zhè-xiē xuéshēng bǐ nà-xiē xuéshēng tuánjié.*  
 this-CL<sub>PL</sub> student COMP that-CL<sub>PL</sub> student united  
 ‘These students are more united than those students.’

- (16) shuōdào jiāo-gùo de xuéshēng, \*Zhāngsān hěn tuánjié.  
speaking.of teach-EXP REL student, Zhangsan very united  
Intended: ‘Speaking of the students one taught, the students that Zhangsan taught are united.’

It is not clear, either, how such analyses may account why, for instance, (12) lacks a reading in which the quantity of the students that Zhangsan taught and that of the girlfriends Lisi had are compared; the absence of such a reading would be unexpected if the association effect were simply a side-effect of obviating via coercion the violation of the non-atomicity requirement.

## 1.5 Roadmap

This paper aims to account for the puzzles around the ‘associative’ effect observed with Q-adjectives. As already hinted in the beginning of this section, this observation, to the extent that the analysis I propose is on the right track, provides further support for the claim the syntax of Q-adjectives differs from that of ordinary adjectives, or, at the very least, involves very different functional heads. The discussion below is structured as follows. In Section 2 I first briefly review the syntax and semantics of Q-adjectives along the lines of Kayne (2005) and Solt (2015) and then show how the association effect may be accounted for along with these proposals. Section 3 focuses on the association effect in comparatives and is intended to account for the constraints observed on the rise of this effect in a comparative. As shown in this section, the limit of the association effect in fact provides evidence in favor of the deletion-based analysis of the Mandarin comparative and against the phrasal one. Some theoretical implications and further issues are discussed in Section 4. The conclusion is in Section 5.

## 2 Locating the source of the association effect

Constructions involving Q-adjectives have been analyzed with degree syntax and semantics since Bresnan (1973). Along these lines, one recent approach suggests that there is a fundamental difference between Q-adjectives and ordinary gradable adjectives (Rett 2008; Solt 2015 a.o.). An ordinary gradable adjective, in this view, encodes a measure function  $\mu$  in its lexical meaning that maps individuals to degrees along the relevant dimension (see, e.g., (17) where  $\mu_{\text{intelligence}}$  maps an individual to a degree on the scale along the dimension of intelligence; see Creswell (1976) and others).

$$(17) \quad \llbracket \text{smart} \rrbracket = \lambda d_d. \lambda x_e. \mu_{\text{intelligence}}(x) \geq d$$

On the other hand, a Q-adjective such as English *many* does not encode a measure function in its lexical meaning. Measurement of quantity, in the various degree constructions with Q-adjectives, is introduced by a separate functional head instead (see also Kayne (2005) and Schwarzschild (2006)). Our discussion will be couched in this view; as far as we can see, analyses along these lines provide a straightforward way to locate the source of the association effect observed above. Specifically, the proposed analysis is built on Solt (2015).

Solt (2015) suggests that semantically a Q-adjective and a gradable adjective of quality differ in their second argument: while an ordinary gradable adjective like *smart* maps a degree  $d$  along the relevant dimension to a set of individuals (see (17)), a Q-adjective maps  $d$  to sets of degrees  $I$  that contains  $d$  (see (18)). In the following discussion, we assume that the lexical meaning in (18) is assigned to Mandarin *duō* ‘many’ as well.<sup>6</sup>

<sup>6</sup>The negative Q-adjective *few/shǎo* is analyzed along with the same idea; it maps a degree  $d$  to a set of sets of degrees that do not contain  $d$ .

$$(i) \quad \llbracket \text{few/shǎo} \rrbracket = \lambda d_d. \lambda I_{\langle d, t \rangle}. \neg I(d)$$

$$(18) \quad \llbracket \text{many}/du\bar{o} \rrbracket = \lambda d_d. \lambda I_{<d, t>}. I(d)$$

As noted by Solt (2015), a Q-adjective like *many* is much less contentful than it might initially seem to be. Once both arguments of *many* are saturated by a degree  $d$  and a set of degrees  $I$ , *many*, after  $\lambda$ -abstraction over its first argument, returns the set of degrees  $I$  itself (i.e.,  $\llbracket \lambda d. \llbracket \text{many} \rrbracket(d)(I) \rrbracket = \llbracket \lambda d. I(d) \rrbracket = I$ ).

Along with Solt's (2015) (and many others') idea, we assume that in natural language measurement of quantity involves a measure function of cardinality  $\mu_{\text{card}}$ , which maps an individual to some degree along the dimension of quantity or amount.  $\mu_{\text{card}}$ , in various constructions with predicative Q-adjectives, is introduced by a functional head termed MEAS.<sup>7</sup> We assume that MEAS heads its own projection and takes as its complement an AP headed by a Q-adjective (see (19)).

$$(19) \quad \llbracket \text{MP MEAS} \llbracket \text{AP } d \llbracket \text{A}' du\bar{o}/sha\check{o} \rrbracket \rrbracket$$

We suggest the lexical meaning in (20a) for MEAS, according to which it takes as its argument a set of sets of degrees and returns a set of individuals. Crucially, we assume that MEAS interpreted with a contextually provided function  $g_c(n)$  from individuals to individuals, the content of which, roughly speaking, is determined by the context of utterance.<sup>8</sup> The measurement function  $\mu_{\text{card}}$ , instead of applying to the individual argument  $x$  of MEAS, applies to the result of applying this contextually provided function  $g_c(n)$  to  $x$  instead, as shown in (20b).

$$(20) \quad \begin{aligned} \text{a.} \quad & \llbracket \text{MEAS}_n \rrbracket^{g,c} = \lambda D_{<<d, t>, t>}. \lambda x_e. D(\llbracket \lambda d_d. \mu_{\text{card}}(g_c(n)(x)) \geq d \rrbracket), \text{ where } g_c(n) \text{ is a} \\ & \text{contextually provided function from individuals to individuals} \\ \text{b.} \quad & \llbracket (19) \rrbracket^{g,c} = \llbracket \text{MEAS}_n \rrbracket^{g,c}(\llbracket \text{many} \rrbracket(d)) = \lambda x_e. \mu_{\text{card}}(g_c(n)(x)) \geq d \end{aligned}$$

The postulation of this contextually provided function is meant to map the reference of the nominal of which a Q-adjective is a predicate to the entities in comparison. For instance, in (4a), the individual Zhangsan is mapped by this function to a unique group of individuals who are the students he taught.

The content of the function  $g_c(n)$ , though being largely determined by the context of utterance, may be made explicit or restricted by a sentential modifier such as *speaking of...*, just as would be the conversational background of a modal statement such as *John must pay a fine*, which can be made explicit by a sentential modifier like *in view of the law* (Kratzer 2012; a.o.).<sup>9</sup> In (4a), the content of the function is made explicit by the sentential modifier *speaking of the students one taught*. In absence of any linguistic expression that explicitly restricts the content of this contextually provided function (e.g., (3)), the default option then is the identity function, which maps an individual  $x$  to  $x$  itself. In this case, applying  $\mu_{\text{card}}$  to  $g_c(n)(x)$  is the same as to apply  $\mu_{\text{card}}$  to  $x$  itself.<sup>10</sup>

A couple of words are in order before we move on: given that I am applying Solt's (2015) analysis of English *many/much* to characterize the semantic contribution of Mandarin *duo*,

<sup>7</sup>The structure in (19) and the semantics in (20) are for predicative Q-adjectives. For the reason that will be discussed in detail in section 4.3, this is not intended to be extended to prenominal modification with Q-adjectives.

<sup>8</sup>Technically, it is determined by applying a contextually provided assignment function  $g$  to the index  $n$  MEAS bears at LF.

<sup>9</sup>One may also see the *speaking of...* adverbial as a frame-setting modifier (Maienborn 2001; Morzycki 2013; a.o.), which functions at the pragmatic level restricting the domain of a sentence topic and targeting contextually-salient referents.

<sup>10</sup>Some variant of the non-atomicity requirement should be incorporated in the lexical meaning of MEAS; otherwise, we would wrongly predict that (4a), without the presence of the adverbial *speaking of...*, carries a meaning in which the quantity of the person Zhangsan is being compared. Given that this is irrelevant to the topic under discussion here (for we have seen that the non-atomicity requirement has nothing to do with the rise of the association effect), I simply assume that there are constraints that pose the non-atomicity requirement at play here and leave this aside.

one then expects that Mandarin *duō* behaves the same as English *many/much*. One goal Solt (2015) intends to achieve is to provide a unified analysis of the various uses of *many/much*: quantificational/attributive (see (21a)), predicative (see (22a)), and differential (see (23a)).

- (21) a. I bought many books.  
b. wǒ mǎi-lé hěn duō shū.  
I buy-PERF POS many/much book  
‘I bought many books.’
- (22) a. John’s friends are many.  
b. wǒ-dè shū hěn duō.  
I-POSS book POS much/many  
‘My books are many.’
- (23) a. John is much smarter than Mary.  
b. Zhāngsān bǐ Lǐsì cōngmíng hěn duō.  
Zhangsan COMP Lisi smart POS many/much  
‘Zhangsan is much smarter than Lisi.’

As shown in (21b)-(23b), Mandarin *duō* has these uses as well. Along with Solt’s analysis, Lin (2014) has already provided an analysis to capture these uses of *duō* and shown that Mandarin *duō* provides strong evidence in support of Solt’s analysis. Given the space limit, I refer the readers to Lin (2014) for details. Note that as discussed below, to account for the association effect observed with the predicative use of *duō*, Solt (2015) and Lin’s (2014) analyses need to be modified. See Section 4.3 for further discussions.

## 2.1 The rise of the association effect

Consider first the positive degree sentences (3a) and (4a). In a positive construction, the degree in association with the object in comparison is compared with a contextually determined standard. In current theories of degree comparison, this intuition is cashed out by postulating a contextually given degree interval on the relevant scale, call it MIDDLE-GROUND<sub>c</sub>, that serves as the standard of comparison. Assuming that a positive construction contains a hidden degree morpheme *POS* (von Stechow 2005; Heim 2006; Morzycki 2013; a.o.), whose semantic contribution is characterized as in (24), the LF (25) may be assigned to these two examples.

- (24)  $\llbracket POS \rrbracket^c = \lambda D_{\langle d, t \rangle}. \text{MIDDLE-GROUND}_c \subset \{d: D(d)\}$
- (25)  $[\text{DegP } POS [1 [\text{MP the students that Zhangsan taught/Zhangsan} [\text{MP MEAS}_7 [\text{AP } d_1 \text{ duō} ]]]]]$

The truth conditions in (26) are then derived for (3a):  $\mu_{\text{card}}$  applies to the result of applying the contextually provided function  $g_c(7)$  to the unique set X of students that Zhangsan taught. With  $g_c(7)$  being an identity function (e.g.,  $[\lambda x_e. x]$ ), this is equivalent to applying  $\mu_{\text{card}}$  to X itself.

- (26)  $\text{MIDDLE-GROUND}_c \subset \{d: \mu_{\text{card}}(g_c(7)(\text{the students that Zhangsan taught})) \geq d\},$   
where  $g_c(7) = [\lambda x_e. x]$

(26) then says that all the degrees in MIDDLE-GROUND<sub>c</sub>, the contextually given interval that serves as the standard of comparison, are included in the degrees that are equal to or less than the cardinality of the students that Zhangsan taught. This amounts to saying that the cardinality of the students that Zhangsan taught exceeds a contextually given standard of comparison.

In (4a) (see the truth conditions (27)), the content of  $g_c(7)$  is made explicit by the sentential adverbial *speaking of the students one taught*. With  $g_c(7)$  being a function that maps an



individual  $x$  to the students  $x$  taught,  $\mu_{\text{card}}$  applies to the set of students that Zhangsan taught instead of Zhangsan itself: the truth conditions (27) say that the quantity of  $g_c(7)(\text{Zhangsan})$  exceeds the contextually provided standard, where  $g_c(7)(\text{Zhangsan})$  is the students that Zhangsan taught.

$$(27) \quad \text{MIDDLE-GROUND}_c \subset \{d: \mu_{\text{card}}(g_c(7)(\text{Zhangsan})) \geq d\}, \\ \text{where } g_c(7) = \lambda x_e. \iota y[y \text{ are the students that } x \text{ taught}]$$

To account for the association effect observed in a comparative, we assume the Reduction Analysis (Liu 1996; Hsieh 2015; a.o.), though nothing crucial depends on this choice: i) there is a gradable predicate (in the cases under discussion, an MP) inside the *bǐ*-constituent elided at the surface, and ii) the *bǐ*-constituent adjoins to *vP*, and iii) both the subject and the post-*bǐ* nominal are interpreted MP-internally. Along with these assumptions, the surface syntax and the LF of (4b) are represented as in (28a) and (28b).

$$(28) \quad \text{a. } [\text{TP } \text{Zhangsan}_2 \dots [\text{vP } [ \text{bǐ} [ \text{Lisi}_3 [\text{MP } \text{t}_3 \text{ MEAS } [\text{AP } \text{d}_1 \text{ duō} ]]]] \text{ v } [\text{MP } \text{t}_2 \text{ MEAS } [\text{AP } \text{d}_2 \text{ duō}]]] \\ \text{b. } \text{LF: } [[ \text{bǐ} [\text{MP } 1 [ \text{Lisi} \text{ MEAS}_7 [\text{AP } \text{d}_1 \text{ duō} ]]]] [\text{MP } 2 [ \text{Zhangsan} \text{ MEAS}_8 [\text{AP } \text{d}_2 \text{ duō} ]]]]$$

Given the two occurrences of MEAS, the subject of the comparative and the post-*bǐ* nominal each are associated with a contextually provided function. With the sentential adverbial *speaking of the students one taught*, these functions then map the individuals Zhangsan and Lisi to the students they taught respectively. Assuming the lexical meaning of *bǐ* in (29), the truth conditions of (4b) are presented as in (30), according to which the quantity of  $g_c(8)(\text{Zhangsan})$  outnumbers that of  $g_c(7)(\text{Lisi})$ .

$$(29) \quad \llbracket \text{bǐ} \rrbracket = \lambda f_{\langle d, t \rangle}. \lambda h_{\langle d, t \rangle}. \text{MAX}(h) > \text{MAX}(f) \\ (\text{for any } f_{\langle d, t \rangle}, \text{MAX}(f) = \iota d[\forall d' [f(d') \rightarrow d \geq d']])$$

$$(30) \quad \text{MAX}(\lambda d. \mu_{\text{card}}(g_c(8)(\text{Zhangsan})) \geq d) > \text{MAX}(\lambda d. \mu_{\text{card}}(g_c(7)(\text{Lisi})) \geq d), \\ \text{where } g_c(7) = g_c(8) = \lambda x_e. \iota y[y \text{ are the students that } x \text{ taught}]$$

With  $g_c(7)$  and  $g_c(8)$  being a function that maps an individual  $x$  to the students that  $x$  taught, the interpretation is derived in which the students that Zhangsan taught and those that Lisi taught are compared.

The cases where the association effect targets only one of the subject and the post-*bǐ* nominal (e.g., (5a)-(5b)) are analyzed along the same lines. For instance, along with the above assumptions, the truth conditions in (31b) may be assigned to (5a).

$$(31) \quad \text{a. } \text{LF of (5b): } [[ \text{bǐ} [\text{MP } 1 [ \text{Lisi} \text{ MEAS}_7 [\text{AP } \text{d}_1 \text{ duō} ]]]] [\text{MP } 2 [ \text{the students Zhangsan taught} \text{ MEAS}_8 [\text{AP } \text{d}_2 \text{ duō} ]]]] \\ \text{b. } \text{MAX}(\lambda d. \mu_{\text{card}}(g_c(8)(\text{the students that Zhangsan taught})) \geq d) > \\ \text{MAX}(\lambda d. \mu_{\text{card}}(g_c(7)(\text{Lisi})) \geq d), \\ \text{where } g_c(8) = [\lambda x_e. x], \text{ and } g_c(7) = [\lambda x_e. \iota y[y \text{ are the students that } x \text{ taught}]]$$

The subject *the students that Zhangsan taught* is associated with a contextually provided function  $g_c(8)$  that maps an individual to itself; the post-*bǐ* nominal *Lǐsì* is associated with another function  $g_c(7)$ , which maps an individual  $x$  to the students that  $x$  taught.

## 2.2 Predictions and seemingly loose ends

The analysis of the association effect suggested above immediately predicts that a degree construction with a predicative Q-adjective such as (3a) and (5b) may be associated with more than one interpretation, and the one intended may be made salient with the presence of, for

instance, the sentential adverbial *speaking of* . . . . This prediction, as shown in (32), is borne out.

- (32) shuōdào jiāo-guò de xuéshēng,  
speaking.of teach-EXP REL student  
‘speaking of the students that one taught’
- a. Zhāngsān jiāo-guò de xuéshēng hěn duō/shǎo.  
Zhangsan teach-EXP REL student very many/few  
Interpretation 1: ‘The students that the students taught by Zhangsan taught are many/few.’  
Interpretation 2: ‘The students that Zhangsan taught are many/few.’
- b. Zhāngsān jiāo-guò de xuéshēng bǐ Lǐsì duō/shǎo.  
Zhangsan teach-EXP REL student COMP Lisi many/few  
Interpretation 1: ‘The students that the student(s) taught by Zhangsan taught are more than the students Lisi taught.’  
Interpretation 2: ‘The students that Zhangsan taught are more than the students that Lisi taught.’

With the presence of the sentential adverbial *speaking of the students one taught*, the positive construction (3a) (see (32a), Interpretation 1) may carry the meaning in which the quantity of the students that the student(s) taught by Zhangsan taught (rather than the students that Zhangsan taught) is under discussion; likewise, (32b) may carry a meaning in which the students that the student(s) taught by Zhangsan taught (Interpretation 1), rather than the students that Zhangsan himself taught, is in comparison with the students that Lisi taught. Along with the analysis given above, in these cases, these examples are interpreted with the contextually given mapping function:  $\lambda x. \iota y[y \text{ are the students that Zhangsan taught}]$ . As for the interpretation 2 of these examples, it is derived simply by having the mapping function be an identity function  $[\lambda x. x]$ .

It has brought to my attention that the first reading in (32b) is much less obvious than the second one. (33) however shows that this reading does exist for (32b). In fact, this is the only sensible reading once the subject *the student(s) that Zhangsan taught* is in contrast with *Zhangsan*, which straightforwardly follows from our analysis together with any theory of focus association in current semantic theory.

- (33) shuōdào jiāo-guò de xuéshēng,  
speaking.of teach-EXP REL student  
‘speaking of the students that one taught’
- lián [Zhāngsān jiāo-guò de xuéshēng]<sub>F</sub> dōu bǐ Lǐsì duō, gèng hé kuàng  
even Zhangsan teach-EXP REL student all COMP Lisi many, let.alone  
shì Zhāngsān běnrén.  
be Zhangsan self  
Intended: ‘Even the student(s) that the students taught by Zhangsan taught are more than the students Lisi taught, let alone the students that Zhangsan taught himself.’

(34) makes the same point as (33) does. (34) is only sensible if what are compared are the students that the student(s) taught by Zhangsan and the students Zhangsan taught himself. If the association effect may not target the subject *the students that Zhangsan taught*, (35) would be contradiction. The fact that (35) need not be contradiction-sounding indicates that this effect may be seen on the subject nominal.

- (34) shuōdào jiāo-guò de xuéshēng, Zhāngsān jiāo-guò de xuéshēng bǐ  
speaking.of teach-EXP REL student, Zhangsan teach-EXP REL student COMP

Zhāngsān běnrén duō.

Zhangsan self many

Intended: ‘Speaking of the students that one taught, the students that the student(s) taught by Zhangsan taught are more than those Zhangsan taught himself.’

Another example that is brought to my attention is (35); it seems that to some speakers, the comparative in (35) *Zhangsan bǐ Lisi many* lacks the reading (35b), according to which what are being compared are the quantity of those who like Zhangsan and that of those who like Lisi.

- (35) shuōdào xǐhuān de rén, Zhāngsān bǐ Lǐsì duō.  
 speaking.of like REL person Zhangsan COMP Lisi many  
 a. ‘Speaking of the people one likes, those that Zhangsan likes are more than those that Lisi likes.’  
 b. ‘Speaking of the people by whom one is liked, those who like Zhangsan are more than those who like Lisi.’

Not all speakers consulted share this intuition. Nevertheless, for those to which the reading (35b) is available, this reading is not quite salient. This may be somewhat surprising and unexpected under the analysis proposed, since the complex nominal phrase in the *speaking of...* adverbial is structurally ambiguous and may be parsed either as (36a) or (36b). In one (see (36a)), the subject position within the *speaking of...* adverbial is occupied by a null pronoun *pro*, and this structure gives rise to the interpretation (35a); in the other (see (36b)), *pro* is located in the object position, and this structure is expected to lead to the interpretation (35b).<sup>11</sup>

- (36) a. *speaking of* [NP [TP *e like t*<sub>1</sub>] REL] *people*<sub>1</sub>]  
 b. *speaking of* [NP [ [TP *t*<sub>1</sub> like *e*] REL] *people*<sub>1</sub>]

A close look however suggests that this might not have to do with the syntax and the semantics of the Q-adjectives *per se*. In fact (37) shows that, as the proposal predicts, the reading where the group of people who like Zhangsan and those who like Lisi does surface easily with some modification made.

- (37) shuōdào xǐhuān tāmen de rén, Zhāngsān bǐ Lǐsì duō.  
 speaking.of like 3<sup>rd</sup><sub>PL</sub> REL person, Zhangsan COMP Lisi many  
 ‘Speaking of those who like them<sub>{ZS, LS}</sub>, those who like Zhangsan are more than those who like Lisi.’

(38) shows that the reading (35b) is available once the null object inside the adverbial *speaking of...* is bound by a sentential topic (*e* indicates the occurrence of an empty category inside the relative clause).

- (38) [Zhāngsān hé Lǐsì]<sub>2</sub> zhè-liǎng-wèi gēshǒu, shuōdào [ *e*<sub>1</sub> xǐhuān *e*<sub>2</sub> ] de rén<sub>1</sub>,  
 Zhangsan and Lisi this-two-CL singer, speaking.of like REL person,  
 háishì Zhāngsān bǐ Lǐsì duō  
 still.be.the.case Zhangsan COMP Lisi many  
 Intended: ‘These two singers Zhangsan and Lisi, speaking of people who like them<sub>{ZS, LS}</sub>, it is still the case that those who like Zhangsan are more than those who like Lisi.’

All these suggest that the difference between the two logically possible readings (35a) and (35b) in the degree of availability may be due to some factors in sentence processing and has

<sup>11</sup>Here I use *e* to indicate the relevant gap in the relative clause, just to stay neutral among different theories on the relevant issues.

nothing to do with Q-adjectives *per se*. One possible way to explain this may be to appeal to the difference between subject-extracted and object-extracted relative clauses in sentence processing. It has been observed in Mandarin that a subject-extracted relative clause, where the head noun is interpreted in subject position inside the relative clause, is read more slowly than an object-extracted one, where the head noun is interpreted in object position, which suggests that subject-extracted relative clauses require more effort in processing than object-extracted ones (Gibson and Wu 2013; and others). Back to (35), with the reading (35a), the relative clause inside the *speaking-of* adverbial is parsed as an object-extracted one; on the other hand, with the reading (35b) it is parsed as a subject-extracted one. It is then expected that the reading (35a) is more easily available than (35b).

All the examples presented in this section, as I have shown, do not constitute counterexamples to the analysis and the observation I have presented. Furthermore, as far as I could see, these examples in fact provide support for one of the claims I have made, namely that the rise of the association effect highly depends the context, be it linguistic or extralinguistic. Although it is, in my analysis, a functional head syntactically presented that serves to introduce the various possibilities in the interpretation of a sentence with a predicative Q-adjectives, it depends on contextual information and the result of the delicate interaction among various syntactic and semantic constraints which one is available. Hence, neither is it surprising that this effect does not surface freely nor it is unexpected that some examples may require specific contextual information to be natural-sounding. Note also that some of these examples above (e.g., (32b)) are quite complex structurally and semantically and may involve more difficulty in processing, and this, I believe, may be the reason why some readings are logically possible given my analysis but on the contrary do not surface easily. Below through the discussion on the association effect observed in a comparative, we will see one more example that shows how other syntactic and semantic constraints may affect the rise of the association effect.

### 3 The Association Effect in a Comparative

#### 3.1 *e*-givenness and the association effect

It is already shown in (12) that the association effect in a comparative is further constrained; while this effect may target only the subject of the comparative or only the post-*bǐ* nominal (see (5)) or both, it needs to target both in (12).<sup>12</sup>

A closer look at (5a) and (12) suggests that the contrast between these two examples may be cast in the following way: in (5a), where the association effect targets only the post-*bǐ* nominal, the proper names *Lǐsì* and *Zhāngsān* are in contrast, and what is being compared is the students Zhangsan and Lisi taught respectively. In this case, the target of comparison (i.e., the students that Zhangsan taught) and the standard (i.e., the students that Lisi taught) share some property, namely being students that one taught. On the other hand, in (12), assuming that the association effect targets only the post-*bǐ* nominal (as indicated in the absent meaning (12a)), what are being compared are the students that Zhangsan taught and the girlfriends Lisi had, and these two (group of) entities do not seem to have a common property made explicitly in any way. Hence, the lack of a ‘common core’ between the target and the standard of comparison is what causes the absence of the meaning (12a). As shown in the following, this follows from the Reduction Analysis of the Mandarin *bǐ*-comparative together with general constraints on ellipsis. Specifically, we suggest that Merchant’s (2001) *e*-GIVENNESS condition, according to which an expression  $\alpha$  may be deleted only if  $\alpha$  is *e*-given (see (39)), might be at play here.

<sup>12</sup>This observation also holds for cases where the association effect is meant to target only the subject of the comparative. For instance, even with the adverbial *speaking of the girlfriends one had*, (5b) does not have a reading in which the girlfriends that Zhangsan had are more than the students that Lisi taught.

- (39) a. *e*-GIVENNESS  
 An expression E counts as *e*-given iff E has a salient antecedent A, and modulo  $\exists$ -type shifting,<sup>13</sup>  
 (i) A entails F-clo(E), and  
 (ii) E entails F-clo(A)  
 b. F-clo( $\alpha$ ), the focus closure of  $\alpha$ , is the result of replacing the F-marked parts of  $\alpha$  with  $\exists$ -bound variables.  
 c. An expression  $\alpha$  can be deleted only if  $\alpha$  is *e*-given.

In the variant of the Reduction Analysis adopted here, an MP inside the *bǐ*-constituent is elided at the surface. Given the *e*-GIVENNESS condition, it then follows that the elided constituent must be *e*-given.

Now consider (5a) and its LF (40); here we assume that the nominals in contrast, in this case *Zhāngsān* and *Lǐsì* (as well as their MP-internal copies), are F-marked.

$$(40) \quad [ [ \textit{bǐ} [_{\text{MP}_E} 1 [ \textit{Lǐsì}_F \text{ MEAS}_7 [_{\text{AP}} d_1 \textit{duō} ] ] ] ] [_{\text{MP}_A} 2 [ \textit{the-students-Zhangsan}_F \textit{taught} \text{ MEAS}_8 [_{\text{AP}} d_2 \textit{duō} ] ] ] ]$$

Modulo  $\exists$ -type shifting and having the degree variables presented at LF existentially bound,  $\text{MP}_A$ , the antecedent MP, and F-clo( $\text{MP}_E$ ), the focus closure of the elided MP (i.e., the MP inside the *bǐ*-constituent), are represented as in (41a). With the content of the contextually provided functions in (41) encoded in each occurrence of MEAS,  $\text{MP}_A$  entails F-clo( $\text{MP}_E$ ). Likewise,  $\text{MP}_E$  entails F-clo( $\text{MP}_A$ ) (see (41b)). The conditions (39a-i)-(39a-ii) are met, and consequently  $\text{MP}_E$  is *e*-given and may be elided.

- (41) a.  $\text{MP}_A$ :  $\exists d [\mu_{\text{card}}(g_c(8)(\text{the students that Zhangsan taught})) \geq d]$   
 (i.e., there is some degree d such that  $g_c(8)(\text{the students that Zhangsan taught})$  is at least d-many)  
 F-clo( $\text{MP}_E$ ):  $\exists x \exists d [\mu_{\text{card}}(g_c(7)(x)) \geq d]$   
 (i.e., there is some x and some degree d such that  $g_c(7)(x)$  is d-many)  
 b.  $\text{MP}_E$ :  $\exists d [\mu_{\text{card}}(g_c(7)(\text{Lisi})) \geq d]$   
 F-clo( $\text{MP}_A$ ):  $\exists x \exists d [\mu_{\text{card}}(g_c(8)(\text{the students that x taught})) \geq d]$   
 (where  $g_c(8) = [\lambda x_e. x]$ , and  $g_c(7) = [\lambda x_e. \iota y [y \text{ are students that x taught}]]$ )

The comparative in (12) may be assigned the very same LF as in (40). To derive the absent meaning (12a), the contextually provided functions introduced by each occurrence of MEAS must have the following contents: the function  $g_c(8)$  associated with the subject *the students that Zhangsan taught* is an identity function (i.e.,  $g_c(8) = [\lambda x_e. x]$ ), and the function  $g_c(7)$  associated with the post-*bǐ* nominal, with the presence of the adverbial *speaking of the girlfriends one had*, maps an individual x to the girlfriends x had (see (42)).

- (42) a.  $\text{MP}_A$ :  $\exists d [\mu_{\text{card}}(g_c(8)(\text{the students Zhangsan taught})) \geq d]$   
 F-clo( $\text{MP}_E$ ):  $\exists x \exists d [\mu_{\text{card}}(g_c(7)(x)) \geq d]$   
 b.  $\text{MP}_E$ :  $\exists d [\mu_{\text{card}}(g_c(7)(\text{Lisi})) \geq d]$   
 F-clo( $\text{MP}_A$ ):  $\exists x \exists d [\mu_{\text{card}}(g_c(8)(x)) \geq d]$   
 (where  $g_c(8) = [\lambda x_e. x]$ , and  $g_c(7) = [\lambda x_e. \iota y [y \text{ are the girlfriends that x had}]]$ )

With the intended specification of the contextually provided functions and modulo  $\exists$ -type shifting over the degree variables, as shown in (42b),  $\text{MP}_E$  entails F-clo( $\text{MP}_A$ ): that there is a d such that the cardinality of Lisi's girlfriends is equal to or greater than d entails that there is

<sup>13</sup> $\exists$ -type shifting is a type-shifting operation that raises expressions to type t and existentially binds unfilled arguments.

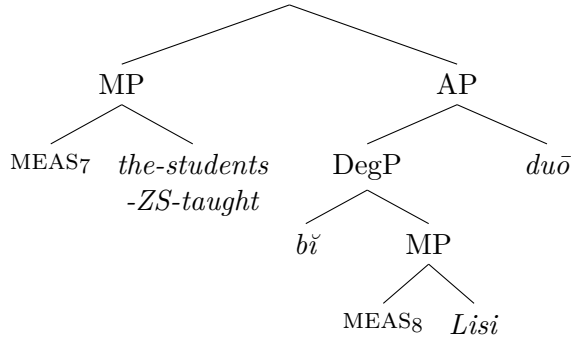
an  $x$  and there is a  $d$  such that the cardinality of  $x$  is equal to or greater than  $d$ . Nevertheless, with the same specification, as shown in (42a),  $MP_A$  fails to entail  $F\text{-clo}(MP_E)$ : that there is a  $d$  such that the cardinality of Zhangsan's students does not entail that there is an  $x$  and there is a  $d$  such that the cardinality of  $x$ 's girlfriends is equal to or greater than  $d$ . Consequently, the meaning (12a) cannot be available. This shows that in a comparative the association effect is subject to general constraints on ellipsis in addition to the context, which further indicates that the rise of the association effect is subject to delicate interaction of various constraints in syntax and semantics.

### 3.2 Direct Analysis and the association effect

One might wonder how the competing approach of the Reduction Analysis, the Direct Analysis, fares with the data above. In the Direct Analysis, the size of the post- $b\check{y}$  constituent is exactly what it looks like on the surface, and no elliptical operation is involved in the derivation. As far as I can see, Lin's (2009) variant of the Direct Analysis, coupled with the modified lexical meaning of MEAS in (43), may well capture the association effect in a comparative like (5a).<sup>14,15</sup> With the LF (44) and the semantics of  $b\check{y}$  from Lin (2009) (see (45a)), the truth conditions derived from this approach to Mandarin  $b\check{y}$ -comparatives are given in (45b).

(43)  $\llbracket MEAS_n \rrbracket^{c,g} = \lambda x_e. \lambda d_d. \mu_{card}(g_c(n)(x)) \geq d$  (to be coupled with the Direct Analysis)

(44) The LF of (5a):



- (45) a.  $\llbracket b\check{y} \rrbracket = \lambda \vec{a}_i. \lambda \mathcal{P}_{<d, <\vec{a}, t>}. \lambda \vec{a}_i'. \iota_{\max} d[\mathcal{P}(d)(\vec{a}_i)] > \iota_{\max} d[\mathcal{P}(d)(\vec{a}_i')]$ , where  $|\vec{a}| > 1$   
 b.  $\llbracket b\check{y} \rrbracket(\llbracket MEAS_8 \rrbracket^{c,g}(LS))(\llbracket duo \rrbracket)(\llbracket MEAS_7 \rrbracket^{c,g}(\text{the-students-ZS-taught}))$   
 $= \llbracket b\check{y} \rrbracket(\lambda d. \mu_{card}(g_c(8)(LS)))(\lambda d. \lambda I. I(d))(\lambda d. \mu_{card}(g_c(7)(\text{the-students-ZS-taught})))$   
 $= 1$  iff  $\iota_{d_{\max}}[\mu_{card}(g_c(7)(\text{the-students-ZS-taught}))] > \iota_{d_{\max}}[\mu_{card}(g_c(8)(LS))]$ ,  
 where  $g_c(7) = [\lambda x_e. x]$ , and  $g_c(8) = [\lambda x_e. \text{the students that } x \text{ taught}]$

It is unclear, however, in what way other than stipulation such an analysis may prevent the overgeneration of the reading (12a) from (12). In such an analysis, the possibility is allowed in (12) that the mapping function associated with the subject of the comparative *the students ZS taught* is  $[\lambda x_e. x]$  and that associated with the post- $b\check{y}$  nominal *LS* is  $[\lambda x_e. \iota y[y \text{ are the girlfriends that } x \text{ had}]]$ , as we have seen in (42). Hence, our observation provides a new piece of evidence in favor of the Reduction Analysis and against the Direct Analysis of the Mandarin  $b\check{y}$ -comparative; while the Reduction Analysis, along the proposal presented above, correctly predicts how the association effect may arise in a comparative, the Direct Analysis suffers from an overgeneration problem.

<sup>14</sup>This lexical meaning of MEAS shares the spirit along the lines of Solt (2015).

<sup>15</sup>It does not seem to me that there is any obvious way to extend other variants of the Direct Analysis (e.g., Xiang 2005; Erlewine 2007; a.o.) to the data discussed in this paper.

## 4 Some theoretical and empirical implications

### 4.1 The context dependency of the association effect

We have noted that the content of  $g_c(n)$ , the function from individuals to individuals encoded in the meaning of MEAS, is contextually determined, though it may be made explicit or restricted by a sentential adverbial such as *speaking of* . . . . As is already mentioned above, the presence of such an adverbial is not necessary to induce the association effect; the association effect easily arises in (6a)-(6b) despite the absence of such a sentential adverbial.

Note that there is nothing novel in the mechanism suggested to characterize the semantic contribution of the Q-adjectives. As already noted in footnote 8, the contextually given mapping function encoded in the lexical meaning of the functional head MEAS (see (20a)) is nothing but a contextually provided assignment function, which an expression whose meaning is context-dependent is interpreted against; for instance, pronominal expressions, possessives, and others.

- (20) a.  $\llbracket \text{MEAS}_n \rrbracket^{g,c} = \lambda D_{\langle \langle d, t \rangle, t \rangle} \cdot \lambda x_e \cdot D([\lambda d_d \cdot \mu_{\text{card}}(g_c(n)(x)) \geq d])$ , where  $g_c(n)$  is a contextually provided function from individuals to individuals

Therefore, we might expect to see some parallelism between the association effect observed with Mandarin predicative Q-adjectives and other context-dependent expressions. As shown below, there indeed is a parallelism between the association effect of Mandarin predicative Q-adjectives and the context-dependency of possessive expressions.

As noted by Barker (1995, 2011), Partee (1997) and others, when the head noun in a possessive NP is not relational, the relationship between the possessor and the object described by the head noun is pragmatically determined and may vary from one context to another. For instance, *Zhangsan's novel(s)* (and its Mandarin counterpart) may refer to the novel(s) Zhangsan collected (as in (46a)) or the novel(s) he wrote (as in (46b)).

- (46) a. Zhāngsān-dè xiǎoshuō dōu fàng-zài tā-dè shūjià-shàng.  
Zhangsan-POSS novel all put-LOC 3<sup>rd</sup>.SG bookshelf-above  
'Zhangsan's novels are all put on his bookshelves.'  
b. Zhāngsān-dè xiǎoshuō zuìjìn mài-dè hěn hǎo.  
Zhangsan-POSS novel recently sell-DE very well  
'Zhangsan's novel/s has/have sold very well recently.'

Just like the possessive NPs in (46), the comparative in (47), with the sentential adverbial *speaking of novels*, may be interpreted differently from one context to another. Continued with (47b), the most natural interpretation is that Zhangsan collected many novels. On the other hand, when continued with (47c), (47) is most naturally interpreted as Zhangsan wrote many novels.

- (47) shuōdào xiǎoshuō, Zhāngsān hěn duō.  
speaking.of novel Zhangsan very many  
Intended: 'Speaking of novels, Zhangsan's novels are many.'  
a. LF:  $[POS [1 [MP \text{Zhangsan} [MEAS_7 [AP d_1 \text{duō} ]]]]]$   
b. nǐ wúliáo dè-huà, kěyǐ gēn tā jiè jǐ-běn lái kàn.  
you bored if, can from 3<sup>rd</sup>.SG borrow several-CL come read  
'if you are bored, you can borrow a couple from him to read.'  
b'.  $g_c(7) = \lambda x. \iota y[y \text{ are the novels that } x \text{ collected}]$   
c. nǐ yǒu xìngqù dè-huà, túshūguǎn-lǐ yǒu yī-zhěng-tào tā-dè zuòpǐn.  
you have interest if library-inside have one-whole-set 3<sup>rd</sup>.SG work  
'if you are interested, there is a whole collection of his work in the library.'  
c'.  $g_c(7) = \lambda x. \iota y[y \text{ are the novels that } x \text{ wrote}]$

Along with the analysis outlined above, the functions that are at play in each of these examples have the content in (41b') and (41c') respectively. Crucially, in neither examples does the sentential adverbial fully specify the content of these functions.

It has been proposed that the context dependency of a possessive headed by a non-relational noun results from a relational variable whose value is contextually determined (e.g., Barker 1995; Partee 1997). The parallelism between a possessive NP and gradable predication of quantity shown above then lends support to the assumption that the content of the postulated function  $g_c(n)$  encoded in the lexical meaning of MEAS, which is responsible for the association effect, is context-dependent.

## 4.2 The Q-adjectives *vs.* ordinary adjectives

Along with the analysis suggested above, the contrast between the Q-adjectives and the ordinary adjectives with respect to the association effect then simply follows from their fundamental difference in syntax. Unlike the Q-adjectives, which involves the functional head MEAS that encodes a contextually provided function, ordinary gradable adjectives do not involve such a functional head; the association effect hence is not observed.

In another approach (Nakanishi 2007; Wellwood et al. 2012; a.o.), the Q-adjectives are treated as comparable to an ordinary gradable adjective and are taken to encode the measure function  $\mu_{card}$  in their lexical meaning. Along these lines, the association effect perhaps may be captured by incorporating a contextually provided function in the lexical meanings of the Q-adjectives *duō* and *shǎo* (see (48)).

$$(48) \quad \begin{array}{ll} \text{a.} & \llbracket duō_n \rrbracket^{c,g} = \lambda d_d. \lambda x_e. \mu_{card}(g_c(n)(x)) \geq d \\ \text{b.} & \llbracket shǎo_n \rrbracket^{c,g} = \lambda d_d. \lambda x_e. \mu_{card}(g_c(n)(x)) < d \end{array}$$

Analyses along these lines seem less preferable, for mainly conceptual reasons. Given that within this approach gradable predication with a Q-adjectives and that with an ordinary adjective are executed through the same structure, the only way to cash out their difference in the availability of the association effect seems to be to stipulate that in languages where this contrast is observed, the lexical meaning of a gradable adjective of quality like *smart* does not incorporate a contextually provided function in the way the Q-adjectives may possibly do. In other words, a gradable adjective like *smart* does not have a denotation like (49).

$$(49) \quad \llbracket smart_n \rrbracket^{c,g} = \lambda d_d. \lambda x_e. \mu_{intelligence}(g_c(n)(x)) \geq d$$

This may lead one to wonder whether there are languages in which a gradable adjective of quality can give rise to the association effect and hence might have a lexical meaning like (49). In my limited survey however, I have not encountered any language of this kind. If indeed there exists no such a language, it is then unclear how to capture the fact under this approach.<sup>16</sup>

An anonymous reviewer presents several examples and claims that these might pose challenges to the generalization I have reached that ordinary adjectives, unlike Q-adjectives, do not show the association effect. According to this reviewer, there are seemingly traces of the association effect in all the following examples: in (50) and (51), it is Zhangsan's grades and his ability, rather than the individual himself, that are compared; in (52) and (53), it is the resources in Taiwan and the activity of eating lobster in Boston that are compared.

$$(50) \quad \begin{array}{l} shuōdào \quad chéngjī, Zhāngsān zuì \quad hǎo / Zhāngsān bǐ \quad qítā \quad rén \quad dōu \quad hǎo. \\ \text{speaking-of grades, Zhangsan SUPL good / Zhangsan COMP other people all good} \\ \text{lit. 'Speaking of the grades, Zhangsan is the best / Zhangsan is better than all the} \\ \text{others.'} \end{array}$$

<sup>16</sup>Surely there is no way to proof things that do not exist.



- (51) shuōdào nénglì, Lǐsì zuì qiáng/ Lǐsì hé Zhāngsān yíyàng qiáng.  
speaking-of capability, Lisi SUPL strong/ Lisi and Zhangsan equally strong  
lit. ‘Speaking of capability, Lisi is the strongest/ Lisi and Zhangsan are equally strong.’
- (52) shuōdào wùchǎn, táiwān hěn fēngfù/ táiwān bǐ shìjièshàng dàduōshù dìfāng  
speaking-of resources, Taiwan POS fengfu/ taiwan COMP worldwide most places  
fēngfù.  
rich  
lit. ‘Speaking of resources, Taiwan is rich/Taiwan is richer than most places worldwide.’
- (53) shuōdào chī lóngxiā, bōshìdùn zuì piányí.  
speaking-of eat lobsters, Boston SUPL cheap  
lit. ‘Speaking of eating lobsters, Boston is the cheapest.’

Such a conclusion apparently is an over-generalization. In the data we have looked at about the Mandarin Q-adjectives, the association effect arises only when the measurement of quantity applies to individuals other than the one denoted by the nominal phrase in question; for instance, in (4a), measurement of quantity does not apply to Zhangsan, the individual denoted by the subject, rather than some other one that is associated with Zhangsan, namely the students that Zhangsan taught. Therefore, it can be concluded that there is an ‘association effect’ in this example. On the other hand, in (50)-(53), the measure function in question simply applies to the individual contributed by the nominal phrase the gradable predicate combines with: (50) and (51), measurement of grades and measurement of ability apply to Zhangsan, rather than some other individual related to Zhangsan; in (52) and (53), measurement of richness and measurement of convenience apply to Taiwan and Boston respectively.

Furthermore, in all these examples, the sentential adverbial *speaking of . . .* serves to specify the dimension of measurement, rather than to specify how objects in comparison are related to the individual denoted by the nominal phrase in comparison. For instance, replacing the sentential adverbial in (50) with *shuōdào chúyì* ‘speaking of cooking skills’, the example then is interpreted with measurement of cooking skills rather than with grades. In the case of the Q-adjectives, the dimension of measurement is always quantity when there is an association effect, regardless the sentential adverbial.

Cross-linguistic data also suggest that these examples are irrelevant to what is called ‘association effect’ in this paper. As shown in the following data, the English counterparts of (50)-(53) are grammatical, whereas that of (4a) is not.

- (54) When it comes to the grades, Zhangsan is the best/Zhangsan is better than all the others.
- (55) Lisi is the strongest/Lisi and Zhangsan are equally strong is their capability.
- (56) Taiwan is rich/richer than most places in resources.
- (57) Boston is the cheapest to eat lobsters.
- (58) \*As for the students one taught, John is/are many.

All these suggest that the association effect we have seen with Mandarin Q-adjectives indeed is unique, and whatever effect there might be in (50)-(53), if there is any, is irrelevant to our concern here.

### 4.3 Predication vs. Prenominal Modification

We adopt Solt’s (2015) idea that i) the syntax of gradability of quantity, in addition to the Q-adjectives, involve a functional head MEAS, and ii) the measure function of quantity is encoded in the lexical meaning of MEAS rather than in that of the Q-adjectives. Nonetheless, my

analysis differs from Solt’s (2015) in several aspects. In Solt’s analysis, MEAS takes a DP as its complement (see (59b)); in my analysis, MEAS takes as its complement an AP headed by a Q-adjective (see (19) and (28)).

- (59) a. John’s students are many.  
 b. [TP [MP MEAS [DP *John’s students*] ] [DegP *POS* [AP *many*] ] ]  
 c. LF: [ *POS* [ 1 [MP MEAS [DP *John’s students*] ] [DegP *d*<sub>1</sub> [AP *many*] ] ] ]

Consequently, the lexical meaning assigned to MEAS by Solt differs from ours. In Solt’s analysis, MEAS denotes a function from individuals to sets of degrees (i.e., type  $\langle e, \langle d, t \rangle \rangle$ ; see (60)). On the other hand, the lexical meaning we assign to MEAS is a function from sets of sets of degrees to sets of individuals (i.e., type  $\langle \langle d, \langle d, t \rangle \rangle, \langle e, t \rangle \rangle$ ; see (19)).

$$(60) \quad \llbracket \text{MEAS} \rrbracket = \lambda x_e. \lambda d_d. \mu_{\text{card}}(x) \geq d \quad (\text{Solt (2015), with slight modification})$$

Most important of all, Solt’s proposal is intended for both prenominal and predicative Q-adjectives; in contrast, ours is designated only for the predicative Q-adjectives.

The decision to depart from Solt (2015) is based on the contrast between the predicative and prenominal Q-adjectives in Mandarin. Unlike those in predicate position, the prenominal *duō* and *shǎo* do not give rise to the association effect; the object nominal in (61) cannot refer to a group of students who, for instance, read many/few novels.

- (61) \*shuōdào dú-gùo de xiǎoshuō, Zhāngsān zuótiān jiàn-lé hěn  
 speaking.of read-EXP REL novel, Zhangsan yesterday meet-PERF very  
 duō/shǎo-de xuéshēng.  
 many/few-MOD student  
 Intended: ‘Speaking of novels, Zhangsan yesterday met (the) students who read many/few novels.’

In keep with a unified semantics of the Q-adjectives, what is to blame for the lack of the association effect in the prenominal modification with the Q-adjective then is the functional head involved in the prenominal modification of quantity. Crucially, the functional head in prenominal modification should not be the same as the one in predication.<sup>17</sup> If, along with Solt’s (2015) idea, gradable predication and prenominal modification with the Q-adjectives involve the same functional head (see, e.g., (62)), one wrongly predicts that the association effect may be seen in prenominal modification with the Q-adjectives.

$$(62) \quad \llbracket \text{MEAS}_n \rrbracket^{c,g} = \lambda x_e. \lambda d_d. \mu_{\text{card}}(g_c(n)(x)) \geq d$$

The contrast between predication and prenominal modification also suggests that an adequate theory of degree syntax and semantics, in addition to the contrast between the Q-adjectives and ordinary adjectives, should differentiate the case of predication and that of prenominal modification with the Q-adjectives.<sup>18</sup>

## 5 Conclusion

In this paper I have investigated the association effect observed with the Mandarin Q-adjectives and shown that to the extent that my analysis is on the right track, this phenomenon lends

<sup>17</sup>In accordance with the analysis proposed above, (61) may involve a functional head MEAS with the lexical meaning in (60).

<sup>18</sup>One may wonder whether there are languages that show association effect with prenominal Q-adjectives but not with the predicative ones. Due to the lack of data that have sufficient depths, this would have to be left for future research.

It is worth noting that the association effect and the contrast between the two types of gradable adjectives are not unique to Mandarin; my limited survey suggests that the association effect is observed with the Japanese Q-adjectives as well. In (63a)-(63b), Japanese *ooi* ‘many’ appears to be a predicate of the proper names *Taro* and *Hanako* on the surface; with the sentential adverbial *speaking of the students one taught* however, it is predicated of the students that Taro taught and those that Hanako taught.<sup>19</sup> (63c)-(63d) show that this effect disappears with the gradable adjective *kasikoi* ‘smart’.

- In contrast, this effect does not seem to exist, for instance, (64a), the English counterpart of (4a), is simply ungrammatical.

- There might be two possibilities to extend the proposed analysis of the Q-adjectives to languages where the association effect is not observed. One is that in those languages, the functional head MEAS does not encode in its lexical meaning a contextually provided function responsible for the association effect. Alternatively, we could give MEAS in those languages the same lexical meaning in (20a), but with an additional lexical restriction that the function  $g_c(n)$  must always be an identity function. Under either of these possibilities, this difference is reduced to one simple lexical variation.

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- 19

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