

Semantics of pre-classifier adjectives¹

Xu-Ping Li

I argue in this paper that the pre-classifier adjectival modification of *big/small* is a distinctive linguistic phenomenon. Classifiers are ambiguous between a counting reading and a measure reading. The pre-classifier *big/small* modifies the quantity denoted by classifiers when they are characterized with the measure reading. From another perspective, the pre-classifier *big/small* deviates from adnominal and predicative *big/small* and they measure quantity only. This proposal correctly predicts that only a restricted set of adjectives like *big/small* can function as pre-classifier modifiers. Besides, I also claim that *big/small* quantifies over single atoms but not the plurality of atoms.

1. Introduction

The semantics of gradable adjectives has been extensively explored within the framework of ‘degree-based approach’ in the past decades (e.g. Montague 1970, Kamp 1975, Kennedy 1997, and many others). For example, according to Kennedy (1997), gradable adjectives denote measure functions from objects to abstract representations of measurement, or scales and degrees.

According to this approach, the semantics of size adjective of *big* can be used predicatively, as in (1.a), or attributively, as in (1.b).

- (1) a. John is big
b. John is a big student.

Big in (1.a) is a one-place predicate of type $\langle e, t \rangle$. But for the adnominal modifier *big* in (1.b), we assume that a standard shift operation from $\langle e, t \rangle$ to $\langle \langle e, t \rangle, \langle e, t \rangle \rangle$ applies to it, which allows predicate adjectives to be used attributively. In other words, the attributive *big* is of type $\langle \langle e, t \rangle, \langle e, t \rangle \rangle$. *Big* in both cases projects the scale of size and the entity *x* is larger than some context dependent standard d_s . Thus the attributive reading can be derived from the predicative reading. The semantics of predicative *big* and attributive *big* are represented as in (2.a) and (2.b) respectively.

¹ Abbreviations used in this paper: Cl—classifier, Perf—perfective, DE—modification marker *de*, Part—particle.

- (2) a. $\|big\| = \lambda x. size(x) > d_s$, where the degree of the individual x on the scale of size is larger than d_s , a contextually appropriate standard of comparison (cf. Kennedy 1997).
 b. $\|big\| = [\lambda P \lambda x. P(x) \ \& \ size(x) > d_s]$ (student), where x is a student and the Degree of x on the scale of size is larger than d_s , a contextually appropriate standard of comparison, with respect to other students.

One of the differences between these two uses of *big* is that the comparison domain of attributive *big* is usually provided by the nominal head it modifies, like *student* in (2.b), but for the predicative *big*, the choice of domain is open. Put explicitly, for attributive *big*, the individual *John* is compared in the domain of *students* only, but for predicative *big*, the domain of comparison is context dependent, and we can put *John* in the domain of men, students, boys etc for comparison.

In this paper, we will compare two types of adnominal and pre-classifier *da/xiao* ‘big/small’. The contrast is illustrated in (3). Then we will figure out whether the semantics of *big/small* in (2) is also applicable to them.

- (3) a. wo chi le yi tiao da huanggua.
 I eat Perf one Cl big cucumber
 ‘I ate a big cucumber.’
 b. wo chi le yi da tiao xiao huanggua.
 I eat Perf one big Cl small cucumber
 I ate a small cucumber, which is big (for my stomach).’

The size adjective *da* ‘big’ can either be located in the adnominal position, as in (3.a) or the pre-classifier position, as in (3.b). The interpretation of (3.a) is more or less equivalent to the attributive *big* in ‘a big cucumber’ in English. And the semantics of the attributive *big* in (2.b) is applicable to it. But *da* ‘big’ in (3.b) does not modify the cucumber itself, or else (3.b) would mean that the cucumber is big and small at the same time. Obviously, it is a contradiction to say so. What (3.b) asserts is that the quantity of the consumed cucumber is big with respect to some other standard, such as my consumption ability. Intuitively, pre-classifier adjectives behave very differently from adnominal adjectives, but how to represent this difference in a formal way? This is the core issue to be pursued in this paper.

Section 2 lists some of the striking differences between adnominal and pre-classifier adjectives, arguing that adjectives at these two different syntactic positions are characterized with fundamentally different semantic features. Section 3 examines the subtypes of pre-classifier adjectival modifications to figure out different functions of classifiers in internal measurement and external measurement. In section 4, we argue that classifiers are ambiguous between a topological reading and a measure reading. The pre-classifier adjectives modify the quantity denoted by classifiers when they are characterized with the measure reading. In section 5, I conclude the paper by summarizing the semantic distinctions between adnominal and pre-classifier *da/xiao*.

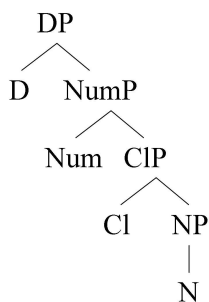
2. Adnominal and pre-classifier adjectival modifications

Chinese bare nouns are mass (Chierchia 1998a,b), and they cannot be counted directly without the aid of classifiers, as illustrated in (4).

- (4) a. yi *(ben) shu
 one CL-volume book
 a book
 b. liang *(ge) ren
 two CL man
 two men
 c. yi *(zhang) zhi
 one CL-piece paper
 a piece of paper

Chinese, being a classifier language, has a classifier projection between NP and NumP, as illustrated in (5). See Tang (1990) and A. Li (1999) for details.

(5)



We assume that adnominal adjectives are located below the node of CIP and pre-classifier adjectives are located above CIP. Although these two types of adjectives are within the nominal domain, they have very different syntactic and semantic properties.

Firstly, different adjectives, either gradable or absolute, either attributive or measuring, can be used in adnominal position, as in (6.a). But only a restricted set of adjectives can appear before classifiers. Generally speaking, only measuring adjectives like *da/xiao* ‘big/small’, *zheng* ‘whole’ are allowed, not attributive adjectives, like *xinxian* ‘fresh’ or *lüse* ‘green’, as in (6.b).

- (6) a. wo chi le yi tiao lüse-de / xinxian-de / da huanggua.
 I eat Perf one CL_{bar} green DE / fresh DE / big cucumber
 ‘I ate a bar of green/ fresh/ big cucumber.’
 b. wo chi le yi (*lüse-de) / (*xinxian-de) / da tiao huanggua.
 I eat Perf one green DE / fresh DE / big CL_{bar} cucumber
 ‘I ate a (*green)/(*fresh)/ big bar of cucumber.’

Secondly, relative clauses can only replace adnominal adjectives, not pre-classifier adjectives. As shown in (7), the relative clause [*that mum bought*] can only be an adnominal modifier not a pre-classifier modifier.

- (7) a. wo chi le yi tiao [_{RC} mama mai de] huanggua.
 I eat Perf one CL_{bar} mum bought DE cucumber
 ‘I ate a bar of cucumber that Mum bought.’

- b. *wo chi le yi [_{RC}mama mai de] tiao huanggua.
 I eat Perf one mum bought DE Cl_{bar} cucumber

Thirdly, adnominal adjectives can be modified by degree adverbials, like *hen* ‘very’, *geng* ‘more’ and *zui* ‘most’, as in (8.a), but pre-classifier adjectives cannot be modified by degree adverbials, as in (8.b).

- (8) a. wo chi le yi tiao hen / geng / zui da de huanggua.
 I eat Perf one Cl very / more / most big DE cucumber
 ‘I ate a very big/ a bigger/ the biggest cucumber.’
 b. *wo chi le yi hen / geng / zui da tiao huanggua.
 I at Perf one very / more / most big Cl cucumber
 ‘I ate a cucumber which is very big/ bigger/ biggest (for my stomach).’

Fourth, adnominal adjectives can be converted into predicative adjectives, but not pre-classifier adjectives. (9.c) can only be derived from the adnominal *da* ‘big’ in (9.a), not from the pre-classifier *da* ‘big’ in (9.b), because (9.c) only means that ‘the cucumber itself is big in terms of size’.

- (9) a. wo chi le yi tiao hen da de huanggua. →
 I eat Perf one Cl very big DE cucumber
 ‘I ate a big cucumber.’
 b. wo chi le yi da tiao huanggua. → //→
 I eat Perf one big Cl cucumber
 ‘I ate a cucumber that was big (for my stomach).’
 c. wo chi-de huanggua hen da.
 I eat cucumber very big
 ‘The cucumber I ate was very big.’

Finally, the adnominal *da/xiao* can only appear before nouns denoting what Rothstein (2004, 2007) called ‘naturally atomic entities’, like *man*, *book*, *apple* etc, which come into existence with discreteness, but the pre-classifier *da/xiao* doesn’t have this constraint.

- (10) a. *ta he le yi ping da shui.
 he drink Perf one Cl_{bottle} big water
 ‘He drank a bottle of big water.’
 b. ta chi le yi ge da pingguo.
 he eat Perf one Cl big apple
 ‘He ate a big apple.’
 (11) a. ta he le yi da ping shui.
 He drink Perf one big Cl_{bottle} water
 ‘He drank a bottle of water, which is big (for him).’
 b. ta chi le yi da ge pingguo.
 He eat Perf one big Cl apple
 ‘He ate an apple, which is big (for him).’

The adnominal *da/xiao* can only modify nouns denoting naturally atomic entities, i.e. discrete entities like *apple*, but not those denoting non-atomic entities, i.e. homogeneous entities like *water*, as in (10). Note that ontological feature of natural atomicity, i.e. the distinction of homogeneity/discreteness, is not consistently reflected as the mass/count distinction at the grammatical level (Rothstein 2007, cf. X.-P. Li 2008 for the discussion of natural atomicity in Chinese). But pre-classifier *da/xiao* are compatible with both ‘mass classifiers’ and ‘count classifiers’ in Cheng & Sybesma’s terms (1998), as in (11.a) and (11.b) respectively.

Relying on the above differences, X.-P. Li (2007) proposes that the adnominal and pre-classifier adjectives have distinctive semantic representations. That is, the adnominal adjectives are attributive, that is, they predicate a size property of an entity and are interpreted via intersection, while the pre-classifier adjectives do not have any modificational relation to the noun or the classifier and they express measure with regard to some standard.

As argued before, the attributive *big/small* in English is of type $\langle\langle e, t \rangle, \langle e, t \rangle\rangle$, which is type-lifted from the predicative *big/small* at $\langle e, t \rangle$. The adnominal adjectives *da/xiao* in Chinese shares the same semantics with attributive *big/small* in English. So the interpretation of attributive *big/small* represented in (2.b) is applicable to the adnominal *da/xiao*. The adnominal *da/xiao* are of $\langle\langle e, t \rangle, \langle e, t \rangle\rangle$ and denote functions from sets of entities to sets of entities that are only *da* ‘big’ or *xiao* ‘small’.

Recall the example of (3.b), *yi da tiao xiao huanggua* ‘one big CI small cucumber’. Firstly, we said before that pre-classifier *da* ‘big’ does not modify the noun *cucumber*; otherwise, we would express a contradiction by saying that ‘it is a big and small cucumber’. Secondly, the use of pre-classifier *da/xiao* has nothing to do with the actual size of the entity itself. For example, if I eat a very small cucumber (i.e. small in terms of size) but I am quite full, it is still legitimate to say ‘I eat a big CI cucumber.’ So it’s obvious that the pre-classifier *da/xiao* does not intersect with the noun and they don’t attribute the property of size. Instead, they denote some measure function with respect to some context-dependent criterion.

How the measure reading of pre-classifier adjectives is compositionally worked out is not worked out in detail in X.-P. Li (2007) and a formal semantic representation of the pre-classifier adjectives is still lacking there. In the next section, we will address this issue in detail.

3. Internal and external measurements of pre-classifier adjectives

Cheng & Sybesma (1998) argue that only ‘mass classifiers’, like *box*, *bottle* etc, can be modified by the pre-classifier *da/xiao*, because they are lexical and retain some nominal features, while the so-called ‘count classifiers’, like the general classifier *ge*, are functional and the pre-classifier *da/xiao* cannot be applied to them. X.-P. Li (2007) claims that the pre-classifier adjectival modification has nothing to do with the lexical/functional distinction of classifiers, but with the measurement constraint.² That is, any classifiers can be modified by

² In X.-P. Li (2007), I also argue against Cheng & Sybesma’s (1998) proposal of associating lexical/functional distinction with mass/count distinction at the classifier level and show that the classification of classifiers into individual CIs and mass CIs needs reconsideration.

X.-P. Li (2008) further argues that there are individual CIs and non-individual CIs in Chinese, which are distinguished according to the ontological distinction of discreteness and homogeneity. But there is no such a distinction of count CIs and mass CIs.

the pre-classifiers *da/xiao*, as long as an appropriate context can be construed to induce a measurement reading on the noun.

The pre-classifier *da/xiao* can evaluate two types of measurement with respect to different measurement standards—internal measurement (IM) and external measurement (EM) respectively. Specifically, in (12.a), the criterion of comparison for IM is provided internally by classifiers, but in (12.b), the criterion for EM is provided externally and is heavily context-dependent.

- (12) wo he le yi da ping shui.
 I drink Perf one big CL_{bottle} water
 a. ‘I drank a large portion of water out of that bottle.’ (IM)
 b. ‘I drank a bottle of water, which is big (too much) for me.’ (EM)

In (12.a), *da* ‘big’ is used in a partitive context, where some water is taken out of the whole bottle of water and the quantity of the water drunk is larger than that what is left in the bottle. In (12.b), the quantity of the water I drank is large with respect to my stomach, which is an external criterion, which says nothing about the absolute quantity of the water drunk out of the bottle.

3.1. Internal measurement

3.1.1. Partitive contexts

IM can be used in partitive contexts, where it asserts that the entities referred to by nouns are divided into two asymmetrical parts. These parts are marked as *big* or *small* with respect to the unit. The unit is introduced by the classifier.

- (13) a. zheli you yi ping shui, wo he le yi da ping, ta he le yi
 here have 1 CL_{bottle} water I drink Perf 1 big CL_{bottle} he drink Perf 1
 xiao ping
 small CL_{bottle}
 ‘There is a bottle of water. I drank a large part of it and he a small portion.’
 b. zhe ge xigua tai da le, wo zhi neng chi yi xiao ge.
 this Cl watermelon too big Part I only can eat one small Cl
 ‘This watermelon is too big, and I can only eat a small part.’

By partitive, we mean that a certain part of entity is taken from the unit or whole. As in (13.a), *yi ping shui* ‘a bottle of water’ is a unit formed by the classifier *ping* ‘bottle’, and this unit is divided into two parts—a large part for me and a small one for him. Note that *da/xiao* at pre-classifier position does not modify classifiers like *ping* ‘bottle’, or else there will be a small bottle of water and a big bottle of water. It is contradictory to the scenario described in (13.a). Similarly, nouns modified by individual classifiers like *ge* can also have a partitive reading. The appropriate reading of (13.b) is that I can only eat a small part of that big watermelon. It can never mean that ‘the watermelon itself or the unit of the watermelon is small’. The pre-classifier *xiao* has no modification relation on the individual classifier *ge*, though the classifier *ge* directly follows the adjective *xiao*.

3.1.2. Accumulation contexts

The opposite process of division or portioning-out is to fill in or to accumulate. IM can also be used in accumulation contexts, where it asserts that the entities represented by nouns are accumulated in certain containers introduced by classifiers. The pre-classifier *da/xiao* expresses the proportional relation of the capacity of container and the quantity of the entity stuff contained in it.

- (14) a. tamen jian le yi da dai laji
 they collect Perf one big CL_{bag} rubbish
 ‘They picked up a bag of rubbish, which is (almost) full.’
 b. ta xie le yi da ye de ‘wo ai ni’.
 he write Perf one big CL_{page} DE I love you
 ‘He wrote so many “I love you” that the paper is almost filled.’

By accumulation, we mean that things are accumulated into some container embodied by classifier. (14.a) can never imply that ‘the bag is big’ or ‘the rubbish is big’, so the pre-classifier *da* ‘big’ neither modifies the classifier *dai* ‘bag’ nor the noun *laji* ‘rubbish’. The most plausible interpretation of (14.a) is that the rubbish is accumulated in a bag and the rubbish makes the bag look full. In other words, we actually measure the (quantity of) rubbish with respect to the capacity of the bag. Along the same line, in (14.b), the paper can be seen as a metaphorical container and the characters are accumulated inside. The number of characters is evaluated with respect to the space of the paper. The paper is almost full of characters.

3.1.3. Pre-classifier *da/xiao* as a partitive marker

IM in partitive contexts expresses how to divide a unit into parts and IM in accumulation contexts expresses how to form a unit or part of a unit. There are two steps to take in order to get an IM reading in both contexts. Firstly, the unit formed by the classifier is treated as a criterion, say, as a limit of a container, for partition or accumulation of the entities represented by the noun. Secondly, the pre-classifier *da/xiao* works as a partitive marker, which shows the part-whole relation of an atomic entity denoted by Cl+N.³ That is what we mean by internal measurement. We are going to provide the semantic representation of the pre-classifier *da/xiao* in Section 4.

Based on this account, we can make the prediction that only adjectives that show the part-whole relation are able to be used as pre-classifier modifiers. This prediction is born out by the use of adjective *zheng* ‘whole’ at the pre-classifier position. For example, the substitution of pre-classifier *da/xiao* by *zheng* ‘whole’ in (13.b) and (14.b) is illustrated as in (15).

- (15) a. tamen jian le yi zheng dai laji
 they collect Perf one whole CL_{bag} rubbish
 ‘They picked up a whole bag of rubbish.’
 b. zhe ge xigua tai da le, wo chi bu xia yi zheng ge.
 this Cl watermelon too big Part I eat not down one whole Cl
 ‘This watermelon is too big, and I cannot eat the whole.’

³ We will discuss the notions of atomic entities and atomizing function in detail in section 4.

3.2. External measurement

In EM, the norm of comparison is provided externally from the context. The pre-classifier *da/xiao* with an EM reading is at least available in the following two contexts.

3.2.1. Consumption contexts

The verbs used in consumption contexts are similar to those in partitive contexts. But the comparison criteria of the pre-classifier *da/xiao* in the consumption context come from some external sources not from classifiers.

- (16) a. wo chi le yi da tiao huanggua
 I eat Perf one big Cl_{bar} cucumber
 ‘I ate a cucumber which is big (for my stomach).’
 b. ni yi ge shangwu kan-wan le zheme yi da ben shu.
 you one Cl morning read-finish Perf such one big Cl-volume book
 ‘You finished reading such a book during one morning.’

Take (16.a) for an example, the pre-classifier *da* ‘big’ does not mean the cucumber is big and actually it may be of small size itself. The appropriate interpretation is that the cucumber consumed accounts for a large space in the stomach. In (16b), compared with the normal reading speed, the book was read in a fast speed. Put in a different way, the number of pages finished in a morning is large with respect to the expectation. But the book is not necessarily thick or big, because it can be a thin and small book but hard to follow and difficult to understand. It’s supposed to be finished within 3 full days, but you finished it within one morning. So it is true to say that you finished reading *yi da ben shu* in this case.

Note that in the case of (16.a), even if you only eat 1/3 of a cucumber, and that part of cucumber made you feel full, it is still true to say *yi da tiao huanggua*. What matters here is the proportional relation between the quantity of consumed entity and the external criterion, say, my consumption capacity. This clearly tells us that external measurement is neither related to the size of the entity itself nor the absolute quantity of the entity or part of entity. The decisive factor of licensing pre-classifier *da/xiao* is that the proportional relation must hold between some external criterion and the quantity of the entity, either part of an atom or a single atom, or even several atoms. We will discuss this issue in detail later on in Section 4.

3.2.2. Expectation contexts

The fourth type of measurement is not dependent on the choice of verbs. It is highly context-dependent.

- (17) a. wu-mao-qian mai le yi da ge mangguo
 50 cents buy Perf one big Cl mango
 ‘(I spent) 50 cents buying such a mango, which is bigger (than expected).’
 b. che shang you lai le yi da qun xuesheng.
 bus on again come Perf one big Cl-group student
 ‘Another big group of students got on the bus.’

In (17.a), suppose that there are three types of mangos—*da mangguo* ‘big mango’, *xiao mangguo* ‘small mango’ and *zhong mangguo* ‘medium-size mango’. Generally speaking, with 50 cents you can only buy a small mango, but today you get a medium-size mango. Put differently, compared to your past experience, today you spent 50 cents buying *yi da ge mangguo* ‘one big CI mango’.

Suppose that there is a group consisting of five students in the case of (17.b). It is neither the case that the students are big nor that the group itself is big, but the number of students is big with respect to some standard externally provided. When the bus is empty, the bus driver might think it is only a small group of passengers, but when the bus was already crowded, these five students might be seen as a big group. So the absolute size of the group itself is not responsible for the licensing of pre-classifier *da/xiao*, but what matters is the relation between the quantity/number of the entities denoted by CI+N and the contextually dependent standard.

The licensing of gradable adjectives like the pre-classifier *da/xiao* always requires a comparison between the entity represented by the noun and some standard. In the first three types of measurement, the standard of comparison can be implied by verbs. For example, in the partitive context, the atom/unit to be partitioned is considered to be the standard; in the accumulation context, the container into which the stuff is accumulated is seen as standard; in the consumption context, the consumption capacity or ability is taken as the standard. But for the fourth type of measurement, the standard of comparison is highly context-dependent and cannot be inferred from the verb. Generally speaking, when the speaker utters sentences like in (17), (s)he actually implies some expectation, with which to be compared with the entity(-ies) represented by CI+N. As in (17.a), the medium-size mango you bought with 50 cents is bigger than what I expected. In (17.b), the size of the group of students is bigger than what the bus driver expected. Thus I use the notion of expectation to characterize the context of the last type of measurement.

To sum up, in IMs, classifiers function as the standards of comparison, and the pre-classifier *da/xiao* is a partitive marker, which shows the part-whole relation of the theme denoted by nouns and standard denoted by classifiers. In EMs, the standard of comparison are provided externally and inferred from context and the pre-classifier *da/xiao* shows the relation between entities represented by CI+N and the external criteria.

4. Semantics of pre-classifier adjectives

4.1. Semantics of adnominal adjectives

Before getting into the semantics of the pre-classifier *da/xiao*, we will firstly represent the semantics of adnominal *da/xiao* in the environment of numeral phrases.

According to Chierchia (1998a,b), Chinese nouns are mass and mass nouns are inherently plural. That means that we have no access to atoms in the denotation of Chinese bare nouns. Rothstein (2007) introduces the notion of M-ATOMs (Measured atoms) as the minimal atoms in the Boolean semi-lattice, which are what the counting function applies to. So it is more precise to say that Chinese nouns do not denote sets of M-ATOMs. Following Rothstein (2007), the M-ATOM makes a standard use of MEAS function from individuals to ordered pairs of $\langle n, U \rangle$, where the first element is a natural number and the second element is a unit of measurement U. This is also called the ‘atomizing function’.

She also argues that bare mass nouns are root nouns which are inherently plural, following Chierchia (1998a,b) and single count nouns are the result of applying the M-ATOM function to the root nouns and the operation yields a set of M-ATOMs, which implies that English count nouns have a covert lexicalized classifier built into the lexicon (see Borer 2004 for a syntactic proposal). The crucial point in her claim for us is that in order to count, the root nouns must be applied by the MEAS function to produce M-ATOMs.

I claim that Chinese classifiers are the spell-out of M-ATOM function. Classifiers apply to the root nouns, i.e. the mass domain denoted by Chinese bare nouns and they introduce measure units, which individuate atoms from the mass domain. Classifiers are lexical and they have topological properties, i.e. shape-based features, so the device of unit also attributes some property to the entities denoted by nouns.

- (18) a. yi duo hua
 one CL_{blossom} flower
 b. yi duo mogu
 one CL_{blossom} mushroom
 c. yi duo yun
 one CL_{blossom} cloud
 d. $\| \text{yi duo yun} \| = \lambda x. \text{cloud}(x) \ \& \ \text{MEAS}(x) = \langle 1, \text{blossom} \rangle$

The classifier *duo* ‘blossom’ in (18) is prototypically used to modify *flowers* and its use can be extended analogically from flowers to flower-like entities, like *cloud*, *mushroom* etc. For example, in (18.c), *duo* ‘blossom’ not only atomizes the denotation of bare noun *cloud* into an atomic unit but also attributes the property of being flower-like to *cloud*. Its interpretation is formalized as in (18.d), where *duo yun* ‘blossom of cloud’ is the M-ATOM for counting and the number of atom is one.

Now let’s represent the meaning of the adnominal *da/xiao* in the environment of NumPs.

- (19) $\| \text{yi-one tiao-Cl xiao-small huanggua-cucumber} \|$
 $= \lambda x. x \in \{ \lambda y. \text{cucumber}(y) \ \& \ \text{MEAS}(y) = \langle 1, \text{tiao} \rangle \} \ \& \ \text{size}(x) < d_s, \text{ a context-dependent standard.}$

The variable *y* has the properties of being a cucumber and being a unit introduced by *tiao*. In other words, *tiao huanggua* ‘Cl cucumber’ denotes a set of atomic cucumbers. And *x* is member of the set of atomic entities and the size of the atom *x* is small with regard to some context-dependent standard. It’s worth noting that adnominal adjectives *da/xiao* are intersected with atoms denoted by Cl+N not with entities denoted by N.

When the NumP denotes a plural entity, the semantic representation of (19) can still hold if we adopt the plurality operator * (Landman 1989), which applies to sets of atoms and turns them into corresponding sets of pluralities through sum. For example, *liang tiao xiao huanggua* ‘two small cucumbers’ can be represented as in (20).

- (20) $\| \text{liang-two tiao-Cl xiao-small huanggua-cucumber} \|$
 $= \lambda x. x \in * \{ \lambda y. \text{cucumber}(y) \ \& \ \text{MEAS}(y) = \langle 1, \text{tiao} \rangle \} \ \& \ |x| = 2 \ \& \ \text{size}(x) < d_s, \text{ a context-dependent standard.}$

The plurality operator * turns the set of atomic cucumbers into the set of pluralities of atomic cucumber by sum. Now x is member of the set of plural entities and whose cardinality is two. The atoms constituting the plural entity of x are small in terms of size with respect to some standard. Note that adjectives of *big/small* are distributive when they project a scale of size. For example, in expressions like ‘these two cucumbers are small or *these two small cucumbers*’, though the predicate of *being small* is predicated of the plural entity—*these two cucumbers*, this property is distributed over the proper parts of the plural entity. It implies that each cucumber must be *small*. Due to the distributivity of *big/small*, the semantics of adnominal *da/xiao* can be represented through the plural entity x , as shown in (20), by which we can get the entailment that each atom of the plural entity is *small* in terms of size.

4.2. Semantics of pre-classifier adjectives

Which constituent do pre-classifier adjectives modify? The noun or the classifier? Or something else? The example of (13) is repeated here as in (21).

- (21) a. zheli you yi ping shui, wo he le yi da ping, ta he le yi xiao
 here have 1 Cl water I drink Perf 1 big Cl he drink Perf 1 small
 ping
 Cl
 ‘There is a bottle of water. I drank a large portion and he a small portion.’
- b. zhe ge xigua tai da le, wo zhi neng chi yi xiao ge.
 this Cl watermelon too big Part I only can eat one small Cl
 This watermelon is too big, and I can only eat a small part.’

Non-atomic entities like *water* cannot be modified by adjectives like *big/small*, so it is impossible for *da/xiao* in (21.a) to cross the classifier to modify the noun. Similarly, the pre-classifier *xiao* in (21.b) does not mean that the size of *watermelon* is small, because we already know from the adnominal adjective *big* that the watermelon is big. This tells us that there is no modificational relation between pre-classifier *da/xiao* and the noun. In other words, unlike the adnominal *da/xiao*, the pre-classifier *da/xiao* is not intersective with nouns.

What about classifiers? If they modify classifiers, then in (21.a) we would get two bottles of water—a big one for me and a small one for him. But this interpretation is contradictory to the scenario described by (21.a). The only plausible reading is that a bottle of water is divided into a large part and a small one. In (21.b), *yi xiao ge* can only mean ‘a small part of watermelon’. So it seems that the pre-classifier *da/xiao* does not modify the classifier either.

Note that it has been noted by many (Cheng & Sybesma 1998, Stavrou 2003, Landman 2004 and many others) that container classifiers like *bottle*, *box*, *cup* etc are ambiguous between a container reading and a measure reading. For example, *three bottles of water* can either mean ‘three concrete bottles of water’ or ‘as much water as three bottles’. In the container reading, container classifiers perform the MEAS function, which brings us a set of M-ATOMs for grammatical counting. In the measure reading, container classifiers denote an abstract measure function, which is responsible for quantity measurement. It is similar to the standard measure function denoted by *kilo* and *pint* etc. I dub the former as the counting reading, and the latter the measure function.

I extend their analysis of container classifiers into Chinese classifiers in general in two aspects. Firstly, the ambiguity between the measuring and counting readings not only holds of container classifiers but also of other types of classifiers, including individual classifiers, like *tiao* ‘bar’, *ben* ‘volume’ etc, and group classifiers, *qun* ‘group’. Secondly, the pre-classifier *da/xiao* is licensed only when classifiers express the measure reading.

We already know that the example of (22) is ambiguous between IM and EM readings.

- (22) wo chi le yi da tiao huanggua.
 I eat Perf one big Cl cucumber
 a. I ate a large part of a cucumber. (IM)
 b. I ate a cucumber, which is big (for my stomach). (EM)

We are not going to repeat the differences between IM and EM here. Let’s look first at the internal measurement. We first define the status of the classifier *tiao* before starting. The classifier *tiao* is a representative individual classifier in Chinese and it modifies nouns denoting natural atomic entities. It has the lexical meaning or ‘topological feature’ of being long and slender (X.-P. Li 2008). That means that count classifiers are not functional at all, as claimed by Cheng & Sybesma (1998), but lexical. In a precise way, just like container classifiers, individual classifiers are also nominal.

The counting reading of classifiers is closely related to the existing form or structure of the entities denoted by nouns. For example, to emphasize *a bottle of water* with the counting reading, the water must be contained in a real bottle, not in a glass or a cup. The containers of bottle, glass and cup are topologically distinctive and they introduce different measure units to the noun and thus different M-ATOMs are formed for counting. To emphasize *yi tiao huanggua* ‘one Cl_{bar} cucumber’ with a counting reading, the entity of cucumber must exist in its natural shape of being long and slender, which must be consistent with the topological features expressed by classifiers. Then an M-ATOM of cucumber can be introduced by *tiao* through the atomizing function and finally we can count. If I cut a *tiao* cucumber into small dices or pieces, its existing structure is changed and can no longer be measured as *tiao*. So we can no longer count M-ATOMs of *tiao* cucumber.

Now let’s turn to the measure reading of classifiers. Suppose that there is a cucumber in the fridge. I cut this cucumber into small dices and made a cucumber salad. I ate several spoons of the salad and then put the rest in the fridge. If the quantity of these several spoons of cucumber is as much as, say, $2/3$ of a cucumber. I can still say (22) to get an internal measurement. It means that the part of cucumber I ate is partitioned from a single atomic cucumber and the quantity of the part of cucumber that was eaten is larger than that of what is left. In the reading, the classifier does not introduce M-ATOMS for counting but introduce an abstract unit to measure quantities. For example, the quantity of the part of cucumber I ate is measured with respect to the unit introduced by the classifier *tiao*, so the final result can be $2/3$ *tiao*, $3/4$ *tiao* and so on. Container classifiers like *tablespoon* are accepted as a standard measuring unit, but the measuring unit implied by individual classifiers like *tiao* is non-standard, temporary and context-dependent. In this reading, the existing form of the entity denoted by N does not matter. For example, as long as the quantity requirement is satisfied, the cucumber I ate can be sliced, diced or smashed and whatsoever.

This measuring reading is used a lot in mathematics and recipes. For example, you will find from recipes something like ‘ $1/2$ red bell pepper, chopped’ or ‘ $1/4$ teaspoon lemon pepper’. In fact, in the first example, a measure unit is missing between $1/2$ and *red bell*

pepper. The right interpretation is that chopped red bell pepper is as much as half a unit of a normal bell pepper. The equivalent expression in Chinese is ‘1/2 *ge*-Cl *hongjiao*-red pepper, *qieshu*-chopped’, where the classifier *ge* can act as a temporary measuring unit in that context.

To summarize so far, classifiers in Chinese are always ambiguous between the counting reading and the measuring reading. The former emphasizes the consistency of the topology expressed by the classifier with the existing form of the entity denoted by the noun. The classifiers have the atomizing function and introduce M-ATOMS for counting. In the measure reading, classifiers are not to count but to measure. They introduce abstract measure units to entities denoted by nouns. The existing form or structure of the entity denoted by the noun is not related in this case.

What I mean by that the pre-classifier adjectives, like *da/xiao*, do not modify classifiers is that they don’t modify classifiers when they have the counting reading. As explained above, in terms of IM, (22) means that the quantity of cucumber, either diced or sliced, is as much as, say, 2/3 of the whole unit. So the pre-classifier *da/xiao* modifies classifiers when they express the measure reading.

The semantics of pre-classifier *da/xiao* can be represented as in (23).

$$(23) \quad \parallel \text{yi}_{\text{-one}} \text{ da}_{\text{-big}} \text{ tiao}_{\text{-Cl}} \text{ huanggua}_{\text{-cucumber}} \parallel \\ = \lambda x. x \in \{ \lambda y. \text{apple}(y) \ \& \ \text{MEAS}(y) = \langle 1, \text{ge} \rangle \} \ \& \ \{ \forall z. z \leq x \ \& \ \text{Quantity}(z) > d_s, \text{ a} \\ \text{context dependent criterion} \}.$$

The semantic representation in (23) looks quite similar to that of adnominal *da/xiao* in (19). Their similarity is that both the adnominal and the pre-classifier *da/xiao* apply to atoms represented by Cl+N. They have more differences than similarities. One of the distinctions is that they project different scales of measurement. In particular, the adnominal *da/xiao* projects a scale of size, but the pre-classifier *da/xiao* projects a scale of quantity. Besides, we know that pre-classifier *da/xiao* can be used in partitive contexts, where *da/xiao* quantifies over part of an atomic entity. In other words, in order to show the semantics of pre-classifier *da/xiao* correctly, a part-whole relation must be shown and parts of atoms are measured along the scale of quantity, like the variable *z* in (23).

Let me elaborate the external measurement a bit. EM means that we use external comparison criterion to evaluate the entity denoted by Cl+N. For example, in (22), the criterion is my consumption ability. As long as I feel full after eating a cucumber, or part of a cucumber, it is legitimate to say something like (22). The absolute quantity of the cucumber is not a decisive factor, and the quantity of cucumber that made me full can be half or 2/3 of a cucumber. The existing form or structure is not related here, and the cucumber can either be sliced or diced and whatsoever. What the classifier *tiao* does here is first to introduce M-ATOM function to individuate atoms of cucumbers and then show the part-whole relation between the cucumber eaten and the cucumber atom, i.e. the cucumber eaten is a part of the cucumber atom, which is represented by ‘ $z \leq x$ ’ as in (23).

This analysis offers a quick answer to the question why only a restricted set of adjectives like *big/small* is licensed before classifiers. It is cross-linguistically true that the quantity is usually modified by measuring adjectives like *big/small*, as in (24). Note that in Chinese, as in (24.d), the notion of quantity can be realized by the noun *liang* ‘quantity’ in a more direct and obvious way, which can be modified by *da* ‘big’ too. So the quantity denoted by classifiers is equivalent to the noun *liang*. It is no surprise now that the pre-classifier *da/xiao* can be used before classifiers.

- (24) a. a large/small quantity of ... (English)
 b. une grande / petite quantité de... (French)
 a large / small quantity of
 c. kamud gedola / katana (Hebrew)
 quantity big / small
 d. da liang (Mandarin Chinese)
 big quantity

4.3. Distributive *da/xiao*

The reviewer points out that throughout the article each example contains the numeral *yi* ‘one’, so is it a mere accident or is it equivalent to the indefinite article as in English or French? I would say that it is a mere accident. Firstly, as predicted correctly by Chierchia (1998b), in classifiers languages like Mandarin Chinese, there is no definite/indefinite article at all. So the number *yi* ‘one’ before classifiers can not be taken as a counterpart of indefinite articles in Romance and Germanic languages. Secondly, ‘a large quantity’ can be directly expressed as *da liang* ‘large quantity’ without any numeral in Mandarin, as in (24.d). Thirdly, in addition to *yi* ‘one’, other numerals like *liang* ‘two’ or *san* ‘three’ can also be used, as in (25). Thus, *yi* ‘one’ before *da/xiao* is not an indefinite article but a numeral to modify classifiers.

- (25) a. wo ling le liang da xiang pingguo
 I carry Perf two big CL_{box} apple
 ‘I carried two full boxes of apples.’
 b. wo chi le liang da ge pingguo
 I eat Perf two big Cl apple
 ‘I ate two apples, each of which is big (for my stomach).’

Some readers may feel puzzled why you can put two quantifying elements like *liang* ‘two’ and *da*+quantity (denoted by classifiers) ‘a large quantity’ simultaneously before a noun. It is ungrammatical to say something like ‘*I ate two a large quantity of apples’ in English. It is a redundant quantification. This is indeed a puzzle.

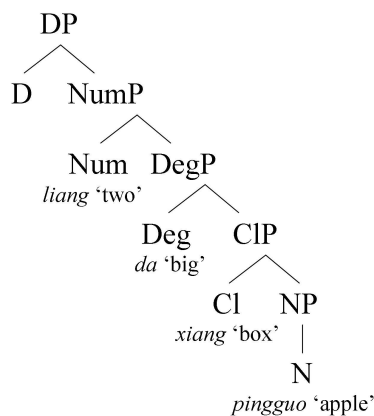
Expressions like *a large quantity of ...* in English express absolute quantities of entities, which is similar to quantifiers like *many*, *some* etc. Thus it is true that we cannot put *two* and *a large quantity of* together. Although we claim that the pre-classifier *da/xiao* modifies the quantity expressed classifiers, it does not express the absolute quantity of entities but shows relative quantities, i.e. different degrees of quantity. Put otherwise, the pre-classifier *da/xiao* only expresses ‘positive degrees’ and ‘negative degrees’ on the scale of quantity respectively (Kennedy 1999).

I assume that the pre-classifier *da/xiao* projects as the head of a functional phrase, say, degree phrase, DegP. I don’t attempt to define formally what the DegP is, and I just want to demonstrate at which level pre-classifier *da/xiao* works. Since the pre-classifier *da/xiao* has its own projection, it won’t compete with numerals or quantifiers for a higher node. The redundant quantification does not exist now.

Now we also have to figure out whether the DegP sits above ClP or NumP. Recall the examples in (25). (25.a) means that each box of apples is heavy with respect to my energy or

ability, but not that the collectivity of two boxes of apples are heavy. Similarly, (25.b) expresses that each apple can potentially make me full. In spite of that, I still ate two of them and felt extremely full. It suggests that the pre-classifier *da/xiao* only modifies single atoms denoted by Cl+N but not the sum of atoms, i.e. plurality of atoms. It means that pre-classifier adjectival modification works at a local level. That is, the DegP can only have a scope over CIPs but not over NumP. It is only possible for *da/xiao* to be located above CIP but below NumP. If preceding the numeral, *da/xiao* would have a scope over the NumP, which can induce the collective reading rather than the distributive reading that we expect. So the structure of the NumP with pre-classifier *da/xiao* can be represented as in (26).

(26)



The semantics of pre-classifier *da/xiao* worked out in (23) can still hold of NumPs denoting plural entities if we adopt the plurality operator* (Landman 1989).

(27) $\| \text{liang}_{\text{-two}} \text{ da}_{\text{-big}} \text{ tiao}_{\text{-Cl}} \text{ huanggua}_{\text{-cucumber}} \|$
 $= \lambda x. x \in * \{ \lambda y. (\text{apple}(y) \ \& \ \text{MEAS}(y) = \langle 1, \text{ge} \rangle) \} \ \& \ |x| = 2 \ \& \ \{ \forall z. z \leq x \ \& \ \text{Quantity}(z) > d_s, \text{ a context dependent criterion} \}.$

The variable y represents a set of atoms. The plurality operator $*$ turns the set of atoms into the set of pluralities and x is a member of it. The cardinality of the plural entity is two. But what we want is not that the quantity of the plural entity is *big* but that the quantity of each atom constituting the plural entity is *big* with respect to some context dependent criterion. So it is of necessity to reflect this part-whole relation to the semantic representation of pre-classifier *da/xiao*, like ' $z \leq x$ ' in (27), i.e. z is a proper part of the plural entity x .

4.4. Small numbers only

Before concluding, I would like to point out another puzzle. I find that though both numerals and quantifiers can appear before classifiers to quantify atoms formed by classifiers, they don't behave in the same way when a pre-classifier adjective appears in-between.⁴

⁴ I use the term of quantifier a little bit different from the standard way. In this paper, quantifiers refer to non-numerals, including *some*, *many/much*, *a lot of*, *(a) few*, *(a) little* etc.

Quantifiers like *xuduo* ‘many’, *yixie* ‘some’ and numerals like *liang* ‘two’ can both be used to quantify atoms in the same manner, as in (28).

- (28) a. *liang ge pingguo*
 two Cl apples
 b. *xuduo ge pingguo*
 many Cl apples
 c. *yixie ge pingguo*
 some Cl apples

But only numerals are compatible with pre-classifier adjectives, as in (29.a), but quantifiers are not, as in (29.b) and (29.c).

- (29) a. *liang da ge pingguo*
 two big Cl apple
 b. **xuduo da ge pingguo*
 many big Cl apple
 c. **yixie da ge pingguo*
 some big Cl apple

I use the notion of vagueness to explain this asymmetry. Put briefly, though both numerals and quantifiers can quantify atoms, but numerals quantify precisely, from which we can get an exact number of atoms, and quantifiers quantify vaguely, from which no precise quantity of atoms is known. We know the pre-classifier *da/xiao* is to measure single atoms one by one in the contexts of IM or EM, so pragmatically small numerals are preferred and much easier to measure a limited number of atoms with regard to certain criterion.

This prediction is born out. Numerals larger than *ten* are not compatible with pre-classifier adjectives of *big/small*. Quantifier representing small numbers like *jige* ‘several’ is grammatical in the context of pre-classifier *da/xiao*. See the contrast in (30).

- (30) a. *shi da ge pingguo*
 ten big Cl apple
 b. *ji da ge pingguo*
 several big Cl apple
 c. **shi-yi da ge pingguo*
 eleven big Cl apple
 d. **ershi da ge pingguo*
 twenty big Cl apples

It is now answered why quantifiers like *many*, *some* are ungrammatical with pre-classifier *big/small*, because those quantifiers are really vague in number, less than to talk about measuring atoms one by one as big or small. So the troublemaking phenomenon does not undermine our analysis proposed above but finally support our argument from the perspective of pragmatics.

5. Conclusion

In this paper, I present a contrastive analysis of two different types of adjective modification in Chinese nominals—adnominal and pre-classifier adjectival modifications. The adnominal *da/xiao* is attributive and intersective, i.e. predicating a size property of the entity denoted by noun. The pre-classifier *da/xiao* is not attributive but measuring, more precisely, quantity measuring. Classifiers can denote a measure reading and a counting reading. The pre-classifier *da/xiao* modifies quantities denoted by classifiers when they express a measure reading. There are two subtypes of measurement—internal measurement and external measurement with regard to different comparison criteria. Another point that is worth mentioning is that the pre-classifier *da/xiao* modifies individual atoms not the plurality of atoms.

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Xu-Ping Li
Bar-Ilan University, Israel
lixuping@alumni.nus.edu.sg

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