ADJECTIVES AND THE *LAW OF EXCLUDED-MIDDLE*

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A pair of antonyms (A, B) is truth-functional for negation ¬ if the *law of excluded-middle* **holds**, that is if

(1) A is true **iff** ¬B is *true*.

The *law of excluded-middle* **does not** hold if the statement ¬A ∧ ¬B is possibly true. Binary antonymic predications satisfy the *law of excluded-middle*, while gradable, comparative and superlative predications violate it. Here are examples:

(2) Binary Antonymic Predications | The *law of excluded-middle* holds
   a. *John is neither alive nor dead.
   b. *John neither passes nor fails the test.

(3) Gradable Antonymic Predications | The *law of excluded-middle* **<u>does not</u>** hold
   a. Today's weather is neither cold nor warm.
   b. 张三不老，也不年轻。

(4) Comparative Predications | The *law of excluded-middle* **<u>does not</u>** hold
   a. Today's weather is neither warmer nor colder than yesterday's.
   b. 张三不是比李四老，也不是比李四年轻。

(5) Superlative Predications | The *law of excluded-middle* **<u>does not</u>** hold
   a. Today's weather is neither the coldest nor the warmest on record.
   b. 张三不是最老，也不是最年轻。

In this talk, I develop a trivalent logical calculus which captures antonymic relations. Because of the law of excluded-middle we cannot characterize gradable, comparative, superlative predications truth-functionally in a bivalent logic. Mainstream formal semantic studies on gradable predicates (Cresswell, 1976; Seuren, 1978; von Stechow 1984; Kennedy 2001) have not analyzed gradable predicates with respect to the law of excluded-middle.

We assume that adjectives qualify values of descriptive variables such as *temperature* or *age*. Descriptive variables are nominal, ordinal or continuous in nature. The values of the variable can be normed as real numbers of the interval [0, 1] for which the canonical order < is available. For each variable, individuals can be rated according to subjective or objective standards:

(6) **EVAL**: **D** → [0, 1]

Nominal Variable 'Existence':	0 = dead | 1 = alive
Ordinal Variable 'Legal Status':	0 = forbidden | 0.5 = permissible | 1 = obligatory
Continuous Variable 'Age':	0-100 years

Depending on the discourse context, a pair of antonymic predicates (A, B) is mapped on the extreme segments of [0, 1]: the positive polarity adjective A on [a, 1], the negative polarity adjective on [0, b].

(7) **EVAL**: **P** → $\wp$([0,1])

A → [a, 1]	A is an adjective of positive polarity (e.g. 'tall')
B → [0, b] (b < a)	B is an adjective of negative polarity (e.g. 'short')

There are three truth values that must be distinguished in order to characterize antonymic predicates in a truth-functional manner: 1 (true), 0.5 (undecided) and 0 (false).

(8) a.	*A(j)* 'John is tall' is	1 (true)	if EVAL(j) $\in$ EVAL(A) = [a, 1]
		0.5 (undecided)	if EVAL(j) $\in$]b, a[
		0 (false)	if EVAL(j) $\in$ EVAL(B) = [0, b]
b.	*B(j)* 'John is small' is	1 (true)	if EVAL(j) $\in$ EVAL(B) = [0, b]
		0.5 (undecided)	if EVAL(j) $\in$]b, a[
		0 (false)	if EVAL(j) $\in$ EVAL(A) = [a, 1]
(9) a.	*COMP-A(j,b)* 'John is taller than Bill' is	1 (true)	if EVAL(j) > EVAL(b)
		0.5 (undecided)	if EVAL(j) = EVAL(b)
		0 (false)	if EVAL(j) < EVAL(b)
b.	*COMP-B(j,b)* 'John is smaller than Bill' is	1 (true)	if EVAL(j) < EVAL(b)
		0.5 (undecided)	if EVAL(j) = EVAL(b)
		0 (false)	if EVAL(j) > EVAL(b)
(10) a.	*SUP-A(j)* 'John is the tallest' is	1 (true)	if $\forall$x EVAL(j) > EVAL(x)
		0.5 (undecided)	if $\exists$x,y EVAL(x) < EVAL(j) < EVAL(y)
		0 (false)	if $\forall$x EVAL(j) < EVAL(x)
b.	*SUP-B(j)* 'John is the smallest' is	1 (true)	if $\forall$x EVAL(j) < EVAL(x)
		0.5 (undecided)	if $\exists$x,y EVAL(x) < EVAL(j) < EVAL(y)
		0 (false)	if $\forall$x EVAL(j) > EVAL(x)

It is not difficult to check the truth values of negation, conjunction and disjunction for two independent predicates A (e.g. 'tall', 'taller', 'tallest') and C (e.g. 'old', 'older', 'oldest').

(11) a. Truth Table for ¬

A	¬A
1	0
0.5	0.5
0	1

b. Truth Table for $\wedge$

	$\wedge$	C: 1	C: 0.5	C: 0
	1	1	0.5	0
A	0.5	0.5	0.5	0
	0	0	0	0

c. Truth Table for $\vee$

	$\vee$	C: 1	C: 0.5	C: 0
	1	1	1	1
A	0.5	1	0.5	0.5
	0	1	0.5	0

In logic, the definitions in (8)-(10) define three confidence measures SENT $\rightarrow$ {0, 0.5, 1}. All three confident measures are fully truth-functional. Each confidence measure verifies the following properties.

(12) The confidence measure *g* is fully truth-functional iff

a. $g(\neg\phi) = 1 - g(\phi)$;	Truth-functional for negation
b. $g(\phi \wedge \psi) = \min(g(\phi), g(\psi))$.	Truth-functional for conjunction
c. $g(\phi \vee \psi) = \max(g(\phi), g(\psi))$;	Truth-functional for disjunction

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Workshop on Varieties of Adjectival Modification

17th-18th Oct 2015

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Workshop on Varieties of Adjectival Modification

Hangzhou, 2015

Program

(会议日程)

Schedule: 17 Oct -18 Oct Saturday & Sunday

（2015 年 10 月 17 至 18 日 周六-周日）

Place（地点）: Café bar （浙江大学西溪校区人文学院咖啡吧，由图书馆进）

Time（时间）: 8:30-17:30 Saturday

8:30-12:00 Sunday

8:20-8:30 **Opening speech** （开幕致辞）

Time		Speaker	Titles
Section 1			
17 Oct Morning	8:30-9:20	Rick Nouwen	Numerals and modification: form and meaning
	9:20-10:10	Qiongpeng LUO Zhiguo XIE	Choosing among the Many Theories of Many: *Duo* Comparative Quantifiers in Chinese
	10:10-10:20	**Coffee Break**	
	10:20-11:10	Yicheng WU Xuping LI	On the so-called "Number Phrase" in Mandarin Chinese
	11:10-12:00	Chuansheng HE	A mathematical argument for the number denoting property of numerals: Evidence from transcendental numbers
Lunch Time			

Section 2			
17 Oct Afternoon	14:00-14:50	Hongyong LIU Xiao LI	An affectedness-based analysis of the Chinese excessive resultative construction
	14:50-15:40	Jie GUO	On adjectival modifiers in Mandarin
	15:40-15:50	**Coffee Break**	
	15:50-16:40	Fang WANG Fuyun WU	Distributions and discourse functions of non-canonical postnominal relative clauses in Chinese: A preliminary study
	16:40-17:30	Tim Osborne	Dependency Dominance Distance: the Distribution of Adjective Phrases in NPs
Banquet			
Section 3			
18 Oct Morning	8:30-9:20	Susan Rothstein	Numericals as modifiers, numericals as arguments
	9:20-10:10	Xuping LI	Two types of attributive measure phrases in Mandarin
	10:10-10:20	**Coffee break**	
	10:20-11:10	Wenshan LI	On the Three Puzzles Concerning only-like Adverbs and Their Opposites in Mandarin Chinese
	11:10-12:00	Matthias Gerner	Adjectives and the Law of Excluded-Middle

Note: Generally, there will be 40 minutes for each presentation plus 10 minutes for discussion.

Numerals and modification: form and meaning

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In this talk I provide an overview of current issues in the syntax, semantics and pragmatics of modified numerals. Starting point is the observation that numeral modifiers are: (i) plentiful and (ii) never constitute specialised vocabulary, but that they are instead borrowed from a myriad of other grammatical domains. For instance, English has (among many others) superlative ("at least 100"), comparative ("more than 100") and prepositional ("up to 100") modified numerals.

Until recently, standard semantic accounts of quantification assumed that modified numerals express relatively simple concepts, namely simply the standard arithmetic comparison relations between two numbers (x is strictly greater than y, x is strictly smaller than y, x is greater or equal than y, etc.). Over the past decade, however, semanticists have grown to realise that that picture greatly oversimplifies matters. The main issue is that modified numerals fall into two distinct classes with respect to a number of semantic and pragmatic properties, not just in English, but in many other languages too. An illustration of these classes in English is the contrast between "fewer than 10" and "at most 9", which were previously thought to be synonymous. They are clearly not in (1) and (2): whereas (1) seems to be true and acceptable, most people will have trouble accepting (2) as true.

(1) A triangle has fewer than 10 sides.
(2) A triangle has at most 9 sides.

I will argue that the particular vocabulary used in numeral modifiers is directly relevant to their semantics and pragmatics. In particular, I will zoom in on prepositional modified numerals and ask the question whether there is any sense in which an expression like "over 100" or "up to 100" can be said to have aspects of the spatial semantics of the prepositions involved.

Choosing among the Many Theories of Many: *Duo* Comparative Quantifiers in Chinese

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Recent studies in measurement have yielded many proposals regarding the semantics of *many/much*. Besides the traditional Generalized Quantifier Theory rendition of *many/much* in English as a relation between two sets, many recent proposals claim — in one way or another — that *many/much* is related to degrees (1). Though these proposals all assume measurement along a certain dimension (cardinality) in the semantic representation, they are by no means the same:

(1) The many theories of *many*:
a. Hackl (2001): [[MANY]] =λdλPλQ. ∃x[#x=d∧P(x)∧Q(x)]
b. Wellwood et al. (2012), Wellwood (2015): [[MANY]] = λdλx.μ(x)=d
c. Solt (2015): [[MANY]] = λdλD.D(d)

Lin (2014) offers a semantic analysis of *duo* in Chinese and takes *duo* as a predicate of sets of degrees, in the same spirit as Solt's analysis of English *many/much*. In this paper we examine *duo* in comparative quantifiers and argue that at least in this case, it is better treated as a comparative that calls for a decompositional analysis. Through this study, we attempt to make a modest contribution to the research enterprise of semantic universals and variations in face of surface differences across languages.

***Duo* in comparative quantifiers**: Chinese comparative quantifiers involving *duo* behave differently from English comparative quantifiers of the form *more than N*. First, Chinese comparative quantifiers involving *duo* contain no counterpart of the comparative marker "than". Thus, in surface syntax *duo* in Chinese comparative quantifiers is indistinguishable, for example, between *many/much* and *more*. However, the semantic interpretation of this use of *duo* is unambiguously comparative:

(2) a. shi duo ge xuesheng b. shi duo ping jiu c. shi ping duo jiu
10 DUO CL student 10 DUO bottle wine 10 bottle DUO wine
'more than ten students' (10<n<20) 'more than ten bottles of wine' (10 <n<11)

A second difference is that unlike English comparative quantifiers uniformly giving rise to a reading about cardinality, Chinese comparative quantifiers are open to two different interpretations, depending on whether the accompanying classifier is a count classifiers or massifier (Cheng and Sybesma 1999, 2012) and where *duo* appears relative to the classifier. When *duo* is immediately preceded by a numeral N (2a-b), *duo* appears equivalent to a subpart of N. When *duo* is immediately preceded by a

massifier, it appears equivalent to a subportion of the entity measured by means of the measurement unit contributed by the massifier. (2b) means 10<n<20 bottles of wine, and (2c) means 10<n<11 bottles of wine.

In addition, when the classifier is a massifier, *duo* in a comparative quantifier can immediately follow either the numeral or the "Num-CL" chunk ((2a-b), with different interpretations). However, when the classifier is a count classifier, *duo* in a comparative quantifier can immediately follow the numeral, but not the "Num-CL" chunk ((2a) vs. (3)):

(3) *shi ge duo student
10 CL DUO student

The unequivocal comparative reading of *duo* in comparative quantifiers means that it cannot be taken as a counterpart of English *many/much*. This, in turn, indicates that any attempt (e.g., Lin 2014) to straightforwardly extend Solt's (2015) analysis of *many/much* would run into difficulty explaining Chinese comparative quantifiers involving *duo*. Taking *duo* as a measure function alone, as Wellwood does in (1b), also face challenges: Applying (1b) to (2a) would yield a wrong reading of "as many as ten students," rather than "more than ten students."

In the meantime, the fact that the distribution of *duo* is sensitive to the type of classifiers suggests that some structure-preserving measure function may be needed to interpret *duo*. Count classifiers atomize a set of individuals (Cheng & Sybesma 1999; Chierchia 1998; Krifka 1995). Atomic individuals are not cumulative and do not track part-of relation. By contrast, massifiers create a unit of measurement (e.g., bottle, kilogram) for masses, which are cumulative and track part-of relation in the domains associated with the measurement. Hence, the distributional sensitivity of *duo* to the type of classifiers is orthogonal to whether a classifier encodes cumulativity. Thus, the restriction can be straightforwardly captured in an analysis that assumes some non-trivial homomorpic measure function.

Implementation: Our proposal regarding *duo* in comparative quantifiers essentially combines Wellwood-style measure function with Hackl-style decomposition of *more* (cf., Bresnan 1972). The fundamental idea is *duo* = MANY/MUCH + *er*. The measure function μ in the semantics of MANY/MUCH carries the requirement that it be homomorphic.

(4) a. [[MANY/MUCH]] = λdλPλQ. ∃x[μ(x)=d ∧ P(x) ∧ Q(x)]
b. [[-er]] = λDλD'. MAX(D')>MAX(D)

We take the assumptions that a numeral denotes cardinality and cardinality is a degree notion. At the same time, a degree is standardly represented as an interval on a relevant scale (Kennedy 2001). Thus, numerals track part-of (i.e., degree sub-interval) relation, and as such, they can always constitute an appropriate domain for

homomorphic measure functions. The units of measurement contributed by massifiers also track part-of relation in the relevant domains associated with the measurement. Hence, numerals and massifiers can immediately precede *duo* so as to satisfy the homomorphic measure functions requirement of *duo*. By contrast, atomic individuals are not cumulative, and are undefined by the part-of relation. It comes as no surprise that count classifiers, whose function is to atomize, cannot appear immediately before *duo*.

The semantic derivations in (5-6) illustrate the compositional semantics of (2a) and (2c), respectively. The semantic representation of (3), which can be given in a fashion parallel to *shi ping duo jiu* in (6), is ruled out by the count classifier *ge* not being able to provide an appropriate homomorphic measure function for *ren*.

(5) [shi duo ge xuesheng] xuan-le zhe men ke.
ten DUO CL student register-ASP this CL course
'More than ten students registered for this course.'
a. [[[-er than 10] MANY] student
b. [[-er than 10] [λ1 [[d1 MANY] student] registered for this course]]]]
i. [[MANY]] = λdλPλQ. ∃x[μ(x)=d∧P(x)∧Q(x)]
ii. [[[d_1 MANY student]]] = λQ. ∃x[μ(x)=d_1∧student(x)∧Q(x)]
iii. [[λ1 [[d_1 MANY student] registered for this course]]]
= λd_1 ∃x[μ(x)=d_1∧student (x) ∧ registered_for_this_course (x)]
iv. [[[-er than 10]]] = λD. MAX(D)>MAX{λd_2: d_2=10}
v. [[[[shi duo ge xuesheng] xuan-le zhe men ke]]] =1 iff MAX{λd_1 ∃x[μ(x)=d_1∧student(x)∧registered_for_this_course(x)]>MAX{λd_2 : d_2=10}

(6) Zhangsan he-le [shi ping duo jiu].
a. [[[-er than 10 bottles] MUCH] wine]
b. [[-er than 10 bottles] [λ1 [Zhangsan drank [[d_1 MUCH] wine]]]]
i. [[MUCH]] = λdλPλQ. ∃x[μ(x)=d∧P(x)∧Q(x)]
ii. [[[d_1 MUCH wine]]] = λQ. ∃x[μ(x)=d_1∧wine (x)∧Q(x)]
iii. [[λ1 [Zhangsan drank [d1 MUCH wine]]]]
= λd_1 ∃x[μ(x)=d_1∧wine (x)∧Zhangsan_drank (x)]
iv. [[[-er than 10 bottles]]] = λD. MAX(D)>MAX{λd_2: d_2=10 bottles}
v. [[[Zhangsan he-le [shi ping duo jiu]]]] =1
iff MAX{λd_1 ∃x[μ(x)=d_1∧wine(x)∧Zhangsan-drank (x)]>MAX{λd_2: d_2=10 bottles}

Conclusion: Comparative quantifiers in Chinese, which is a classifier language, draws upon different resources (i.e., classifiers) than English to constitute measurement domains. However, what remains invariant between the two languages is a strong monotonicity constraint: two entities that are properly ordered in terms of part-of

relation are similarly ordered in terms of their measurement. A corollary of this constraint is that only those domains that respect the part-of relation are measurable. This seems to hold in both English and Chinese, despite their remarkable differences in surface syntax.

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On the so-called "Number Phrase" in Mandarin Chinese

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This paper investigates the distribution and interpretation of Chinese nominal phrases containing numerals, which are termed as Number Phrases (NumPs) in the literature (see, e.g., Li 1998; Huang, Li and Li 2009). The subject NPs in (1a-b), namely *wuge xiaohai* 'five children' and *sange ren* 'three people', are treated as NumPs.

(1) a. Wu-ge xiaohai chibuwan shi-wan fan. (Li 1998: 695)
five+CL child eat+not+finish ten+bowl rice
'Five children cannot finish ten bowls of rice.'

b. San-ge ren taibudong zhe-jia gangqin. (Li 1998: 699)
three+CL people lift+not+move this+CL piano
'Three people cannot lift up this piano.'

In this paper, two characteristic properties for the so-called NumPs are discussed: (i) NumPs can only be read collectively but not distributively; (ii) NumPs can act as antecedent, but the anaphoric expressions refer back to the noun complement of NumP but not the whole NumP, and the predicates of the anaphoric pronouns are individual-level ones only.

To account for the two special properties of NumPs, we claim that sentences with NumPs should be characterized as generic sentences, more precisely, characterizing generics (Krifka et al. 1995). Contrary to Li's analysis of the Number Phrases as projecting an independent NumP without a dominating DP, we argue that the numeral indefinites can be analyzed as generic DPs in the sense of Longobardi (1994, 2001, 2003). Hence, a unified DP analysis of all types of numeral phrases in Chinese. It is concluded that the Number Phrases in Chinese, albeit not special, reveal a universal property of human languages, namely the affinity between indefinite generics and characterizing sentences.

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A mathematical argument for the number denoting property of numerals: Evidence from transcendental numbers

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This paper presents a mathematical argument defending for the Fregean view that numerals can denote numbers per se. We argue that though most numbers currently familiar to us (natural numbers, fractions, decimals, and even some irrational numbers) can be reduced to sets or relations of sets, it is impossible to reduce transcendental numbers to sets or relations of sets. The consequence is that numerals standing for transcendental numbers should denote numbers directly, not sets. Considering the overwhelming majority of transcendental numbers in the number domain (though very few are proven), it follows that all numerals denote numbers and that the construction nine planets is not an adjectival modification structure (The Adjective Strategy, Dummett 1995).

Key words: transcendental numbers; numbers; numerals; Fregean; ontology

An affectedness-based analysis of the Chinese excessive resultative construction

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Back in 1990, Lu (1990) observed that there is a special resultative construction in Mandarin Chinese, which could be ambiguous. For example,

(1) toufa jian duan le.
hair cut short LE
a. Her hair was cut short.
b. Her hair was cut shorter.
c. Her hair was cut shorter than expected.

Depending on the choice of the standard of comparison, (1) could have different readings (Shen & Peng 2010). Take the following two scenarios as examples: (I) Mary's hair was originally 150 centimeters long. She wanted her hair to be 100 centimeters long. She went to a barber's shop and had a haircut. **After the haircut, her hair became 20 centimeters long.** (II) Mary's hair was originally 150 centimeters long. She wanted her hair to be 100 centimeters long. She went to a barber's shop and had a haircut. **After the haircut, her hair became 120 centimeters long.** Example (1) can be uttered to describe either of the two scenarios. To determine the truth value of (1), we need to compare four degrees: $d_{initial}$; d_{final}; d_{ideal}; d_c.

(2) a. $d_{initial}$: Mary's original hair length (150cm)
b. d_{final}: May's final hair length (20cm in Scenario I/120cm in Scenario II)
c. d_{ideal}: May's intended hair length (100cm)
d. d_c: the hair length which is considered short by the general public (30cm)

Interpretations	Scenario I	Scenario II
a. $d_{final} < d_c$	T (20cm < 30cm)	F (120cm ≮ 30cm)
b. $d_{final} < d_{initial}$	T (20cm < 150cm)	T (120cm < 150cm)
c. $d_{final} < d_{ideal}$	T (20cm < 100cm)	F (120cm ≮ 100cm)

If what is compared is d_{final} and d_c, the adjective is used in the positive form. If what is compared is d_{final} and $d_{initial}$, the adjective is used in the comparative form, and the whole sentence is an implicit comparative sentence. If what is compared is d_{final} and d_{ideal}, the adjective is used in the comparative form, and the whole sentence is an example of the excessive resultative construction, which typically describes events of affectedness consisting of two participants, a theme participant and a scale participant

measuring the degree of affectedness (Beavers 2011). The action script of (1c) is as follows:

(3) A theme participant, serving as the grammatical subject, was **unintentionally** affected by a covert (not phonetically realized) agent or **was internally affected** to such an extent that the degree associated with the final result **has surpassed** an expected degree which is set by **the agent** or by **general knowledge** before the onset of the action. The **dimension** of the comparison and its **direction** are determined by the action denoted by the verb.

This action script informs us of the following properties about the excessive resultative construction:

(4) a. First, it helps to differentiate the excessive resultatives from other types of resultatives such as the passives and the BA-construction. It regulates that the subject of the construction must be a theme, and the agent is not syntactically detectable from any grammatical markers.

b. Secondly, the action script predicts that an expected value about the final state of the theme must have set before the action.

c. Thirdly, the prescribed value should be a gradable value, because it will be compared with the actual value associated with the final state of the affected theme at the end of the action. The construction is in actuality a comparative construction, although there is no degree morphology in the construction.

d. Fourthly, the initial state of the theme is irrelevant in this construction.

e. Fifthly, the difference between the final value and the expected value can be overtly realized by a differential phrase of degrees (such as *liangmi* '2 meters'; *sandu* 'three degrees', etc.).

f. Finally, the sentence final le is a perfective aspect marker, the use of which guarantees the completion of the action of the final value surpassing the expected/required value.

The excessive resultatives must satisfy all the requirements listed in (4). Some other types of constructions may also satisfy some, but not all, of the requirements listed in (4), which may lead to the ambiguous interpretations associated with the Chinese excessive resultative construction.

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On adjectival modifiers in Mandarin

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Adjectival modification in English generally surfaces in the form of [A N] and [N A]. In Chinese, however, [N A] form does not exist, but another form [A de N] is very common. The previous work have provided a unified analysis of [A N] and [A de N] forms in Chinese, the former being a compound and the latter involving a relative clause, explaining the grammatical and interpretational properties of them. On the basis of more data, this paper finds some inadequacies in the unified analysis and proposes that the two forms each have a dual status: compounds vs. phrases and phrases vs. relative clauses. The status of compounds, phrases or relative clauses depends on the subcategory of adjectives and nouns. Without postulating new lexical or syntactic rules, the dual status analysis of the two forms fares better in accounting for not only the syntactic behaviors of adjectives but also the interpretations these adjectives entail in the two forms. This paper will also compare and contrast the adjectival modification in English in an attempt to find out and explain the similarities and differences between the two languages.

Distributions and discourse functions of non-canonical postnominal relative clauses in Chinese: A preliminary study

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Chinese is a VO language, but its relative clause (RC) typically precedes the head noun, as in (1). This prenominal RC structure, though canonical in Chinese, is typologically rare, as it is cross-linguistically unusual to combine VO word order with head-final properties (Dryer 2014). However, in spoken Chinese, a head noun can take the initial position followed by a modifying RC, yielding a non-canonical postnominal RC, as in (2).

(1) [Luxun xie e_i de] naben shu_i
Luxun write REL that-CL book
'the book that was written by Luxun'
(2) naben shu [Luxun xie e_i de], (hen haokan)
that-CL book Luxun wrote REL, (very good)
'The book that was written by Luxun (is very good).'

Existing work on Chinese RCs have almost exclusively focused on the canonical prenominal form (e.g. Hsiao 2003; Pu 2007; Tang 2005; Ming 2009; Wu 2011a, b). In contrast, only a few work discussed non-canonical postnominal RCs, the instances of which were rather random, restricted to a certain genre (e.g., legal texts: Dong, 2003), to a specific grammatical structure (e.g., some serial verb constructions: Li and Thompson, 1981; Tang, 2006), or to some property corresponding to its counterpart in English (e.g., 3rd-person pronouns serving as relative pronouns in Peking dialect: Fang, 2004). Thus much remains to be known about the postnominal RC regarding its distribution patterns in discourse and the functional motivations for such usage.

We aim to better our understanding of non-canonical postnominal RCs in Chinese (as versus to widely-studied prenominal RCs), by examining the adnominal *de*-clauses extracted from the monologues and dialogues of the National Broadcast Media Language Corpus. We identified 141 postnominal RCs based on two diagnostic tests. First, *de*-clauses must be syntactically dependent on the immediately preceding head noun, without which they cannot stand alone as a predicate, as shown in (3). Second, the adnominal *de* is obligatory as a relativizer for postnominal RCs; otherwise the sentence would be ungrammatical, as illustrated in (4).

(3) meige *(ren)$_i$, [women jia neng xiangqie$_i$ de],...
every-CL person our home can remember REL...
'every person that my family can remember,...'
(4) qinglai jige dangdi de xiucai$_i$, [e_i you dian xuewen *(de)]

invite several-CL local NOM scholar have a little knowledge REL
'(I) invited several local scholars who are rather knowledgeable'

Building on existing work on prenominal RCs, we manually coded the postnominal RCs by extraction types, syntactic positions of head nouns in main clauses, animacy configurations formed by the two arguments of the RC, structural and semantic properties of RCs. Our analyses show some distributional patterns of postnominal RCs similar to those of prenominal RCs: Subject-extracted postnominal RCs occur more frequently than object-extracted ones, consistent with the Noun Phrase Accessibility Hierarhcy (Keenan and Comrie, 1977). The contrastive animacy configuration consisting of an animate subject and inanimate object occurs most frequently.

Importantly, we also observe some distinct patterns specific to postnominal RCs. Different from a subject-modifying bias reported in prenominal RCs, postnominal RCs in our spoken corpus tend to modify the object of main clauses more frequently than other syntactic positions. We attribute this to genre difference. We argue that the "one-new-concept constraint" (Chafe, 1987; 1994) and "Heaviness Serialization Principle" (Hawkins 1994; Arnold et al. 2000) are the motivations for the existence of postnominal RCs in Chinese spoken corpus.

Furthermore, postnominal RCs are structurally simple (6.5 syllables per clause on average), with little aspectual marker on the predicate of RC. They are more likely to be non-restrictive than restrictive, suggesting an inherent nature of after-thoughts associated with postnominal RCs. Interestingly, the head noun of postnominal RCs is more likely to be additionally modified by a determiner phrase (consisted of demonstrative/numeral-classifier phrases) or an adjectival phrase than being bare. Taken as a whole, we suggest that postnominal RCs in Chinese are increments of utterance (Ford, Fox and Thompson, 2002).

Given that postnominal RCs conform to the preferred parameter setting based on VO word order, we discuss the possible influence of this non-canonical structure to Chinese RCs and other modifiers from a diachronic perspective.

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Dependency Dominance Distance
The Distribution of Adjective Phrases in NPs

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The following acceptability contrasts involving attributive adjective phrases in English and German demand an explanation:

English	German
a. a proud father	a. ein stolzer Vater
b. *a father proud	b. *ein Vater stolz
c. ??a proud of his children father	c. *ein stolzer auf seine Kinder Vater
d. *an of his children proud father	d. ein auf seine Kinder stolzer Vater
e. a father proud of his children	e. *ein Vater auf seine Kinder stolz

The German examples are word-for-word translations (with some minor ordering differences) of their English counterparts. The adjective *proud/stolz* alone can precede the noun it modifies in both languages, as illustrated in the a-examples, but it cannot follow the noun, as shown with the b-examples. When the adjective takes the post-argument of *his children / auf seine Kinder*, the adjective phrase can no longer precede the noun, as illustrated in the c-examples. When this argument precedes the adjective, however, the word order is acceptable in German but not in English, as shown in the d-examples. Finally, English allows the entire adjective phrase to follow the noun, whereas German does not, as demonstrated with the e-examples. What is responsible for the differences in distribution of adjective phrases across these closely related languages?

A similar type of data concerns reduced relative clauses. Reduced relative clauses exist in English, where they follow their noun, whereas they may be absent from German entirely. German does, though, have extended participle phrases that precede the noun, whereas English lacks these phrases:

English	German
f. the books read by Peter	f. *die Bücher von Peter gelesen
g. *the read by Peter books	g. die von Peter gelesenen Bücher

The reduced relative clause *read by Peter* follows the noun it modifies in the English f-example, whereas no such relative clause is possible in German, and the past participle phrase *von Peter gelesenen* precedes the noun it modifies in the German g-example, whereas no such participle phrase is possible in English.

A dependency grammar (DG) approach to syntax is used to examine these data. A simple quantificational metric helps to account for the varying positions of adjectival phrases in NPs. This metric is called *dependency dominance distance*:

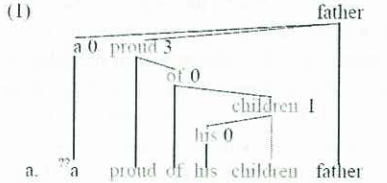
Dependency dominance distance (DDD)

The number of words that a given word dominates and that intervene in the linear dimension between that word and its head

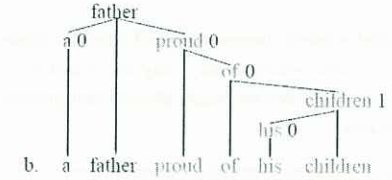
DDD is a new metric that to my knowledge is introduced here for the first time. There is, though, a significant tradition of using similar metrics to quantify traits of syntactic structures, in particular simple *dependency distance* (Hudson 1995, Liu 2008) and now quite recently hierarchical distance (Yingqi and Liu 2015). Furthermore, the phenomenon illustrated with the above examples has been explored (e.g. Williams 1982, Osborne 2003), although a solid understanding of the phenomenon has to my knowledge not yet been established.

An examination of the dependency structures of the examples given above reveals that average DDD values – averaged over all the words in the given structure – are lower for the acceptable examples and higher for the unacceptable examples. The dependency trees of two of the examples help illustrate that this is so:

(1)



Average DDD = (0+3+0+0+1)/5 = .8



Average DDD = (0+0+0+0+1)/5 = .2

The DDD value of each word (excepting the root) is given to the immediate right of the word. These values are then averaged for the entire structure, delivering the average DDD values .8 and .2.

The difference in the distribution of adjectival phrases across English and German then boils down to the difference in head-directionality. The head-initial adjectival phrases of English have lower DDD values when they follow their head noun, whereas the head-final adjectival phrases of German have lower DDD values

when they precede their head noun. In essence what the DDD metric is quantifying is the extent to which words are separated from the heads by their dependents. DDD values are higher with "zig-zag" structures, and they are lower with steadily climbing or steadily falling structures. At the same time, DDD values are low with flat structures, a point that is suggested by the fact that the DDD values for the determiners a and a in (1a-b) is 0 – determiners lack dependents.

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Numericals as modifiers, numericals as arguments

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Numericals such as *three* have been variously argued to be determiners (Barwise and Cooper 1981, Hofweber 2006), predicates (Landman 2003) and predicate modifiers (Ionin and Matushansky 2006). In this talk I shall argue that they are ambiguous between a modificational use as in (1) and an argument use as in (2):

(1) There are three cats in the room.
(2) Three is a prime number.

In (1) *three* is an adjective which appears in the left periphery of the adjectival field, as argued by Landman (2003), modifying the noun *cats*. It denotes a property of pluralities, the property that a plural object has if it has three atomic parts. In (2), it is an argument denoting an abstract object which itself has properties, for example, the property of being a prime number. I shall bring a number of arguments to support this claim, including the contrast between (3) and (4):

(3) I counted three (cats).
(4) I counted to three (*cats).

I will offer a semantic analysis of numericals which accounts for this dual usage, treating them as a particular kind of property in the sense of Chierchia and Turner (1987), analogous to adjectives like *blue*, which also have a dual mode of presentation as in (5)-(6):

(5) A blue sky is a sign of good weather.
(6) Blue is my favourite colour.

I will conclude by showing that the semantic interpretation of *three* explains its left-peripheral position: as a property of pluralities, it must be higher than other prenominal adjectives, which have a default distributive interpretation.

Two types of attributive measure phrases in Mandarin

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This paper investigates the use of measure phrases (MPs) in attributive constructions in Mandarin. We argue that (i) contra Schwarzschild (2006), attributive MPs are subject to both monotonic and non-monotonic readings, and (ii) Mandarin has two distinctive attributive MP constructions to encode the two meanings. Specifically, [$_{NP}$ [$_{MeasP}$ Num-Meas-de] N] is ambiguous between monotonic and non-monotonic readings, and [$_{NP}$ [$_{MeasP}$ Num-Meas-Adj-de] N] is monotonic only.

In light of Schwarzschild's (2006), Jiang (2009) argues that the Mandarin expression of "Num-Meas-de-N" in (1) is ambiguous between measure and attributive readings. On the measure reading, *wu gongjin* measures the weight of watermelon to be five kilos in (1a); on the attributive reading, *wu gongjin* restricts the watermelon to be the ones that come in the unit of five kilos in (1b). The nominal phrase has the structure of [$_{MeasP}$ *wu gongjin de* [$_{NP}$ *xigua*]] for (1a) and [$_{NP}$[$_{MeasP}$ *wu gongjin de] xigua*] for (1b) respectively.

1. ta mai-le wu gongjin de xigua
   she buy-Asp five kilo Mod watermelon
   a. 'She bought five kilos of watermelon(s).'
   b. 'She bought the five-kilo watermelon.'

We present three new facts concerning the interpretation of attributive MPs. First, [$_{NP}$ [$_{MeasP}$ Num-Meas-de] N] can have a monotonic reading that 'she bought some watermelon that happens to weigh five kilos'. This is to be distinguished from the non-monotonic reading (1b), where the MP *wu-gongjin* is a "classifying" adjective, which expresses properties that helps to establish (contextually distinguishable) subtypes of entities.

Second, Mandarin also has the expression of Num-Meas-Adj-*de*-N, which has the syntactic structure of [$_{NP}$ [$_{MeasP}$ Num-Meas-Adj-de] N]. The NP status of this nominal expression is evidenced by the fact that it can be preceded by Numeral-Classifier to form a classifier phrase, as in (2). It has an unambiguous monotonic reading that the watermelons in each package weigh five kilos. It does not refer to a particular type of watermelon in any case.

2. ta mai-le liang dai [[wu gongjin zhong de] xigua].
   she buy-Asp two CL_{bag} five kilo heavy Mod watermelon
   'She bought 2 bags of watermelons, each bag of which weighs five kilos.'
   [Monotonic]

Third, attributive MPs always have a distributive interpretation. It is distributive over individuals denoted by the head noun on a non-monotonic reading, and over the atomic entities denoted by Classifier-Noun on a monotonic reading. (3a) means each watermelon is supposed to be five kilos, so to speak (the five-kilo type); (2) and (3b) means that each bag of watermelon is five kilos.

3. ta mai-le liang dai [[wu gongjin de] xigua].
she buy-Asp two CL_{bag} five kilo Mod watermelon
a. 'She bought two bags of five-kilo watermelons.'
[Non-monotonic]
b. 'She bought two bags of watermelons, each bag of which weighs five kilos.' [Monotonic]

Concerning these three properties of MPs, we raise the following questions:

(i) Why does the dimensional adjective only induce a monotonic reading? What is its function?
(ii) Does the MP of *wu gongjin* in (3) have different syntactic status when being interpreted monotonic or non-monotonic? How can the two types of distributivity be captured?

As for the first question, we suggest that in the sequence of Num-Meas-Adj-de-N, the dimensional adjective denotes a measure function from degrees to individuals (Cresswell 1976, von Stechow 1984) and that the MP is interpreted as a name for a degree at type d, which saturates the degree argument of adjective and turn it into a predicate of individuals.

4. a. [[wu gongjin zhong]]= [[zhong]] ([[wu gongjin]]) = λx. weight (x)=5 kilos
b. [[wu gonging zhong de xigua]] =λx. watermelon (x) & weight (x)=5 kilos

Our answer to the second question is positive. We assume that on a monotonic reading, the MP of *wu gongjin* has a 'silent' dimensional adjective HEAVY, so it is supposed to have the same semantics as in (4). Only on a non-monotonic reading can MPs be seen as true adjectival/attributive modifiers. We analyze [$_{AP}$ Num-Meas] in [Num-Meas-de-N] as properties of individuals. More precisely, we suggest that the predicate MP applies to kind entities and return subkind entities, as represented in (5). It not only accounts for its non-monotonicity but also the "seeming" distributivity over individuals in (3a).

5. [[wu gongjin de xigua]] =[[wu gongjin de]] ([[xigua]])
=λX. watermelon (X) & [[wu gongjin]] (weight (X))

On the Three Puzzles Concerning only-like Adverbs and Their Opposites in Mandarin Chinese

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The expressions such as *only, at least, at most, most than*, and *less than* in English and their synonyms in the same language or their counterparts in other languages have received great attention in semantic studies. But usually, studies of *only* and those of the latter expressions are conducted separately. In studying *only,* semanticists and pragmaticists are excited and challenged mainly by the various types of interpretations of sentences wherein *only* and their synonyms or counterparts occur (Horn, 1969; Atlas, 1991, 1993; Horn, 1996; Atlas, 1996; Von Fintel, 1997; Bonomi & Casalegno, 1993; Van Rooij, 2002; Beaver, 2004; Van Rooij & Schulz, 2005; Giannakidou, 2006; Riester, 2006; Coppock & Beaver, 2013). In studying *at least, at most, more than* and *less than,* linguists probe the semantic properties of and semantic similarities or dissimilarities between *at least* and *more than*, those between *at most* and *less than* (Breheny, 2008; Geurts & Nouwen, 2007; Nouwen, 2008; Büring, 2008). But barely have the studies on *only* and those on *at least, at most, more than* and *less than* converged. The current work is intended to bridge the gap between the studies on the two types of expressions. A comparison is to be made between the Chinese expressions semantically similar to only in English and the Chinese expressions semantically similar to *at least, at most, more than* and *less than* in English. Since there are more than one Chinese expression that roughly mean *only,* more than one Chinese expression meaning each of *at least, at most, more than* and *less than*, these expressions are categorically called ONLY -adverbs, AT LEAST -adverbs, AT MOST -adverbs, MORE THAN -adverbs and LESS THAN -adverbs, although some of them are phrasal expressions rather than simple adverbs . This comparison is motivated by three puzzling semantic facts. The first puzzle involves ONLY -adverbs (ONLY henceforth; other adverbs mentioned above are dubbed in the same way below), AT MOST, AT LEAST, MORE THAN and LESS THAN. As will be shown, ONLY can occur with MORE THAN or with LESS THAN but cannot occur with AT LEAST or with MORE THAN. The second puzzle concerns the entailment relationship between a sentence where two adverbs co-occur and a sentence where one adverb occurs. The third puzzle involves the adverbs on the one hand and, on the other hand, the sentence-final *le* (SF-LE), a morpheme frequently discussed in the literature. Specially, ONLY, AT LEAST and MORE THAN can occur with SF-LE. Through making this comparison, the following two questions will be answered.

First, what are semantic properties of ONLY, AT MOST, LEAST and LESS THAN and MORE THAN that make them exhibit particular patterns of co-occurrence.

Second, what semantic properties of SF-LE, together with the semantic properties of the adverbs at issue, make the determine their pattern of co-occurrence. By

answering these questions, we can deepen our understanding of the lexical semantics of all these morphemes.

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Adjectives and the Law of Excluded-Middle

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A pair of antonyms (A, B) is truth-functional for negation ¬ if the law of excluded-middle **holds**, that is if

(1) A is true **iff** ¬B is true.

The law of excluded-middle **does not** hold if the statement ¬A ∧ ¬B is possibly true. Binary antonymic predications satisfy the law of excluded-middle, while gradable, comparative and superlative predications violate it. Here are examples:

(2)	Binary Antonymic Predications	The law of excluded-middle holds
	a. *John is neither alive nor dead.	
	b *John neither passes nor fails the test.	
(3)	Gradable Antonymic Predications	The law of excluded-middle **does not** hold
	a. Today's weather is neither cold nor warm.	
	b 张三不老，也不年轻。	
(4)	Comparative Predications	The law of excluded-middle **does not** hold
	a. Today's weather is neither warmer nor colder than yesterday's.	
	b 张三不是比李四老，也不是比李四年轻。	
(5)	Superlative Predications	The law of excluded-middle **does not** hold
	a. Today's weather is neither the coldest nor the warmest on record.	
	b 张三不是最老，也不是最年轻。	

In this talk, I develop a trivalent logical calculus which captures antonymic relations. Because of the law of excluded-middle we cannot characterize gradable, comparative, superlative predications truth-functionally in a bivalent logic. Mainstream formal semantic studies on gradable predicates (Cresswell, 1976; Seuren, 1978; von Stechow 1984; Kennedy 2001) have not analyzed gradable predicates with respect to the law of excluded-middle.

We assume that adjectives qualify values of descriptive variables such as temperature or age. Descriptive variables are nominal, ordinal or continuous in nature.

The values of the variable can be normed as real numbers of the interval [0, 1] for which the canonical order < is available. For each variable, individuals can be rated according to subjective or objective standards:

(6)	**EVAL**: **D** → [0, 1]		
		Nominal Variable 'Existence':	0 = dead | 1 = alive
		Ordinal Variable 'Legal Status':	0 = forbidden | 0.5 = permissible | 1 = obligatory
		Continuous Variable 'Age':	0-100 years

Depending on the discourse context, a pair of antonymic predicates (A, B) is mapped on the extreme segments of [0, 1]: the positive polarity adjective A on [a, 1], the negative polarity adjective on [0, b].

(7)	**EVAL**: **P** → $\wp$([0,1])	
	A → [a, 1]	A is an adjective of positive polarity (e.g. 'tall')
	B → [0, b] (b < a)	B is an adjective of negative polarity (e.g. 'short')

There are three truth values that must be distinguished in order to characterize antonymic predicates in a truth-functional manner: 1 (true), 0.5 (undecided) and 0 (false).

(8)			
a.	A(j) 'John is tall' is	1 (true)	if EVAL(j) ∈ EVAL(A) = [a, 1]
		0.5 (undecided)	if EVAL(j) ∈]b, a[
		0 (false)	if EVAL(j) ∈ EVAL(B) = [0, b]
b.	B(j) 'John is small' is	1 (true)	if EVAL(j) ∈ EVAL(B) = [0, b]
		0.5 (undecided)	if EVAL(j) ∈]b, a[
		0 (false)	if EVAL(j) ∈ EVAL(A) = [a, 1]

(9)			
a.	COMP-A(j,b) 'John is taller than Bill' is	1 (true)	if EVAL(j) > EVAL(b)
		0.5 (undecided)	if EVAL(j) = EVAL(b)
		0 (false)	if EVAL(j) < EVAL(b)
b.	COMP-B(j,b) 'John is smaller than Bill' is	1 (true)	if EVAL(j) < EVAL(b)
		0.5 (undecided)	if EVAL(j) = EVAL(b)

		0 (false)	if EVAL(j) > EVAL(b)

(10)			
a.	SUP-A(j) 'John is the tallest' is	1 (true)	if ∀x EVAL(j) > EVAL(x)
		0.5 (undecided)	if ∃x,y EVAL(x) < EVAL(j) < EVAL(y)
		0 (false)	if ∀x EVAL(j) < EVAL(x)
b.	SUP-B(j) 'John is the smallest' is	1 (true)	if ∀x EVAL(j) < EVAL(x)
		0.5 (undecided)	if ∃x,y EVAL(x) < EVAL(j) < EVAL(y)
		0 (false)	if ∀x EVAL(j) > EVAL(x)

It is not difficult to check the truth values of negation, conjunction and disjunction for two independent predicates A (e.g. 'tall', 'taller', 'tallest') and C (e.g. 'old', 'older', 'oldest').

(11) a. Truth Table for ¬ b. Truth Table for ∧ c. Truth Table for ∨

A	¬A
1	0
0.5	0.5
0	1

A \ ∧ C	1	0.5	0
1	1	0.5	0
0.5	0.5	0.5	0
0	0	0	0

A \ ∨ C	1	0.5	0
1	1	1	1
0.5	1	0.5	0.5
0	1	0.5	0

In logic, the definitions in (8)-(10) define three confidence measures SENT → {0, 0.5, 1}. All three confident measures are fully truth-functional. Each confidence measure verifies the following properties.

(12)	The confidence measure g is fully truth-functional iff	
a.	$g(\neg\varphi) = 1 - g(\varphi)$;	Truth-functional for negation
b.	$g(\varphi \wedge \psi) = \min(g(\varphi), g(\psi))$.	Truth-functional for conjunction
c.	$g(\varphi \vee \psi) = \max(g(\varphi), g(\psi))$;	Truth-functional for disjunction

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Constraints on Duplicated Adverbial Adjectives in Mandarin

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An adverbial adjective sentence contains an adjective which is used as an adverbial. An adverbial adjective sentence is very common in Mandarin, and it shows some interesting qualities that require explanation, such as some adverbial adjectives tend to take the form of duplication and some are to modify subjects, some to modify objects and some to modify predicates while they all take the same place as an adverbial in a sentence. Research on such sentences in Mandarin is mainly focused on duplicated adverbial adjectives and their corresponding semantic orientations. Previous discussions on these sentences have been carried out from the perspective of lexicology, syntax, semantics and pragmatics. Possible explanations have been given on the motivation of duplication of adverbial adjectives and the different semantic orientations of duplicated adverbial adjectives. However, it still requires a holistic description of how an adverbial adjective sentence is formed from the very beginning and what constraints have taken effect in the whole process. This paper explores the constraints on adverbial adjectives from lexical formation to sentential formation, proposing that an adjective confronts a series of constraints based on phonology, morphology, syntax, semantics and pragmatics along each step from its derivation in the lexicon to its entrance into the adverbial position in a sentence. Here are three typical sentences with duplicated adverbial adjectives in Mandarin: (1) *Liuqiang xizizi-de zha le yi pan huashengmi* "Liuqiang gladly fried a dish of peanuts." (2) *Liuqiang cuicui-de zha le yi pan huashengmi* "Liuqiang fried a dish of crisp peanuts." (3) *Liuqiang zaozao-de zha le yi pan huashengmi* "Liuqiang fried a dish of peanuts early."

The adverbial adjectives in the sentences above differ in their semantic orientations: *xizizide* is NP_{sub}-oriented, viz. linked to *Liuqiang*, *cuicuide* is NP_{obj}-oriented, viz. linked to *yi pan huashengmi*, and *zaozaode* is event-oriented, viz. linked to *zha le yi pan huashengmi*.

It is believed that duplicated adverbial adjectives such as *xizizide, cuicuide* and *zaozaode* originate respectively from monosyllabic attribute adjectives *xi*, *cui*, *zao* in the lexicon. The first constraint is the **phonological-morphological constraint** which changes the monosyllabic words into "AA" or "ABB" type, resulting in duplicated adjectives: *xizizi, cuicui, zaozao*. The next is the **morphological-semantic constraint** which transforms the state adjectives into "AA-de" or "ABB-de" such as *xizizide*, *cuicuide* and the adjectives of degree into "AA-de" such as *zaozaode*. The third is the **pragmatic constraint** which means speakers' subjectivity permits commendatory state adjectives and adjectives of degree to enter the sentences. This constraint excludes sentence such as **Liuqiang beiqiqide zhale yipan huashengmi*. The last is the **syntactical-semantic constraint** which decides that

the duplicated state adjectives enter the functional structure DeP pointing to the subject or object and duplicated adjectives of degree enter the functional structure DeP pointing to the event. The lexical entry information of the subject-oriented "De" is λ Q[λ P[λ e[P(e)∧Agt(e)=x∧∃e'[Q(e')∧Agt(e')=Agt(e)]]]]. The lexical entry information of the object-oriented"De"is λ Q[λ P[λ e[P(e)∧Th(e)=x∧∃e'[Q(e')∧Th(e')=Th(e)]]]]. The lexical entry information of the time-oriented/degree-oriented "De" is λ Q[λ P[λ e[P(e)∧Th (e)=x∧Q (e)]]].

In conclusion, this papers aims at offering an overall analysis of the multiple constraints involved in duplicated adverbial adjectives sentences from the very beginning of the adjectives in the lexicon to their entering the adverbial position in asentence.

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