

On the morpho-semantic puzzle of superlative modifiers

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Introduction: This paper studies the morpho-semantics of Chinese superlative modifier (SM): *zuiduo* ‘at most’. Three discoveries are presented. First, the same word *zuiduo*, morphologically consisting of a superlative morpheme *zui* and a quantity adjective *duo* ‘many/ much’, is used as SMs (cf. English *at most*) and in quantity superlatives (cf. English *the most*). (1a) conveys a relative reading of superlatives while (1b) an upper bound on the quantity of apples *Xishi* bought. Second, like English *at most* (Krifka 1998), *zuiduo* is focus-sensitive: the contribution of *zuiduo* depends on its focus associate and different positions of focus associates lead to truth-conditional differences. (2a) is felicitous as an answer to (3a) but not to (3b); by contrast, (2b) is felicitous as an answer to (3b) but not to (3a). Third, like English *at most*, *zuiduo* is compatible with various types of scales (see (1b), (2) and (4)).

- (1) a. *Xishi mai-le zui-duo (ke) pinguo.*
Xishi buy-ASP SUP-many CL apple
‘Xishi bought more apples than anybody else did.’ (cf. Xishi bought the most apples)
- b. *Xishi mai-le zui-duo [san]_F-ke pinguo.* [Numerical Scale]
Xishi buy-ASP SUP-many three-CL apple
‘Xishi bought at most three apples.’
- (2) a. *Xishi zui-duo mai-le [pinguo]_F.* [Pragmatic Scale]
Xishi SUP-many buy-ASP apple
‘Xishi at most bought apples.’ (a contextual ranking: cherries > apples > bananas)
- b. *Xishi zui-duo [mai-le pinguo]_F.*
Xishi SUP-many buy-ASP apple
‘Xishi at most bought apples.’ (a contextual ranking: make dinner > buy apples > boil water)
- (3) a. What did *Xishi* buy (for our plan tonight)? b. What did *Xishi* do (for our plan tonight)?
- (4) a. *Xishi zui-duo na [yin]_F-pai.* [Lexical Scale]
Xishi SUP-many take silver-medal
‘Xishi at most got a silver medal’.
- b. *Xishi zui-duo yaoqing [Adam he Bill]_F.* [Plurality Scale]
Xishi SUP-many invite Adam and Bill
‘Xishi at most invited Adam and Bill.’

Given the morphological transparency, the Chinese data above raise three questions: (i) Why are focus adverbs morphologically involved a superlative morpheme and a quantity adjective? (ii) How is the semantics of SMs related to their morphology? (iii) Can we give a compositional analysis of SMs?

This paper answers the three questions and proposes a decompositional analysis of Chinese SMs. The central proposal is twofold: (i) The internal structure of SMs is a degree construction; (ii) SMs can be structurally decomposed into two parts: one introduces a measurement over the focus alternatives along a contextually given dimension and the other establishes a comparison relation between the prejacent and its alternatives based on the measurement. For Chinese *zui-duo* ‘at most’, the former part is instantiated by the quantity adjective *duo* while the latter part by the superlative morpheme *zui*.

An analysis of quantity superlatives: For expository purposes, we follow Heim (1999) and Hackl (2009) in assuming (i) the relative reading is derived by the superlative morpheme taking scope over the verb phrase; (ii) the superlative morpheme takes three arguments: a domain restrictor $C_{\langle e, t \rangle}$, a gradable measuring predicate $P_{\langle d, et \rangle}$ and an individual $x_{\langle e \rangle}$; (iii) quantity adjectives in superlatives denote the cardinality measuring predicate; (iv) an existential closure over the individual variable of the object. (5) provides the lexical entries of *zui* and *duo* in superlatives. (6) presents the LF and truth-conditions of Chinese quantity superlatives, ignoring classifier and aspectual meanings for simplicity.

- (5) a. $[[\text{duo}]] = \lambda d_{\langle d \rangle} . \lambda x_{\langle e \rangle} . \mu_{\text{card}}(x) \geq d$
b. $[[\text{zui}]] = \lambda C_{\langle e, t \rangle} . \lambda P_{\langle d, et \rangle} . \lambda x_{\langle e \rangle} . \forall y_{\langle e \rangle} [y \neq x \wedge y \in C \rightarrow \max(\lambda d . P(d)(x)) > \max(\lambda d . P(d)(y))]$

- (6) a. The LF of (1a): [Xishi **zui**-C [$\lambda d \lambda x$ [x buy **d-duo** apples]]]
 b. $\llbracket(1a)\rrbracket = 1$ iff $\forall y [y \neq \text{Xishi} \wedge y \in C \rightarrow \max(\lambda d. \text{Xishi bought } d\text{-many apples}) > \max(\lambda d. y \text{ bought } d\text{-many apples})]$

Quantity adjectives and superlative morpheme in superlative modifiers: For simplicity and expository purposes, we assume that SMs are propositional operators. We propose (i) the internal structure of SMs is a degree construction; (ii) the quantity adjective *duo* denotes a contextually given measurement of the focus alternatives (μ_c is a measure function from the alternatives to their corresponding positions along a contextually given dimension); (iii) the superlative morpheme *zui* is defined when there is one relevant alternative such that it is true. When defined, it asserts that for all the alternatives non-identical to the prejacent, if it is true, it is ranked lower than the prejacent. (7) and (8) present a formalization of our ideas and (9) provides the morpho-semantics of *zuiduo* ‘at most’.

- (7) $\llbracket \text{duo}_{SM} \rrbracket^{w,c} = \lambda d_{<d>} \lambda \alpha_{<s, t>} \mu_c(\alpha) \geq d$
 (8) $\llbracket \text{zui}_{SM} \rrbracket^{w,c} = \lambda m_{<d, <st, t>>} \lambda C_{<st, t>} \lambda \alpha_{<s, t>} : \exists \gamma_{<s, t>} [\gamma \in C \wedge \gamma(w)]. \forall \beta_{<s, t>} [\beta \neq \alpha \wedge \beta \in C \wedge \beta(w) \rightarrow \max(\lambda d. m(d)(\alpha)) > \max(\lambda d. m(d)(\beta))]$
 (9) The morpho-semantics of superlative modifiers: *zuiduo* ‘at most’
 a. $[\text{DegP} [\text{Deg } \text{zui}_{SM} [\text{AP} [\text{Adj } \text{duo}_{SM}]]]]$
 b. $\llbracket(9a)\rrbracket^{w,c} = \lambda C_{<st, t>} \lambda \alpha_{<s, t>} : \exists \gamma_{<s, t>} [\gamma \in C \wedge \gamma(w)]. \forall \beta_{<s, t>} [\beta \neq \alpha \wedge \beta \in C \wedge \beta(w) \rightarrow \max(\lambda d. \mu_c(d)(\alpha)) > \max(\lambda d. \mu_c(d)(\beta))]$

With (7) – (9) in mind, we further assume with Rooth (1985, 1992) that focus alternatives project until they meet the focus operator, where they are interpreted by the squiggle operator \sim and restricted by a contextual variable C . (10) demonstrates how (2a) is analyzed under our proposal. (10a) offers the LF and (10c) the truth-conditions. (10b) presents the presuppositions introduced by the squiggle operator.

- (10) a. The LF of (2a): [**zui**_{SM}-**duo**(C) [[Xishi bought [apples]_F \sim C]]]
 b. $\alpha \sim C$ is defined iff $\llbracket \alpha \rrbracket^o \in C \wedge \exists \alpha' [\alpha' \neq \alpha \wedge \llbracket \alpha' \rrbracket^o \in C] \wedge C \subseteq \llbracket \alpha \rrbracket^f$
 c. $\llbracket(2a)\rrbracket^{w,c} = 1$ iff $\forall \beta_{<s, t>} [\beta \neq \lambda w. \text{Xishi bought apples in } w \wedge \beta \in C \wedge \beta(w) \rightarrow \max(\lambda d. \mu_c(d)(\lambda w. \text{Xishi bought apples in } w)) > \max(\lambda d. \mu_c(d)(\beta))]$
 Defined iff $\exists \gamma_{<s, t>} [\gamma \in C \wedge \gamma(w)]$ **by the presupposition of *zui*_{SM}**

Because the prejacent is presupposed to be an element of the set of focus alternatives (see (10b)), the presupposition in (10c) captures the fact that the prejacent (*Xishi bought apples*) is possibly true but crucially not necessarily true. The assertion in (10c) excludes the relevant higher alternatives (e.g., *Xishi bought cherries*) from being true. Taken together, *zuiduo* ‘at most’ semantically makes the prejacent the upper bound among the set of focus alternatives along a contextually given dimension.

Two remarks: First, (7) is a relational version of English *much* analyzed in Wellwood et al. (2012) and Wellwood (2015). The difference between (5a) and (7) can be reduced to sortal differences (individuals vs. individuals and beyond) and dimensions of measurement (cardinality vs. cardinality and beyond). Second, (8) is a propositional version and a presuppositional variant of (5b). For SMs, *zui-duo* involves a degree structure of phrasal comparatives and takes scope as a whole (see 9a/10a).

Implications: If our decompositional analysis is on the right track, it has three implications. (i) An analysis capturing the compositionality below the level of the word is not only tenable but also desirable: The superlative morpheme and quantity adjectives involved in SMs are NOT a morphological coincidence; instead, they are deeply connected with the semantics of SMs. (ii) Insights and tools developed in studies on gradability can be applied to those on scalarity. By importing formal tools from degree syntax and semantics (Kennedy 1997; a.o.), we present a decompositional analysis of SMs. Similarly, Greenberg (2016, 2017) has recently argued for a gradability-based semantics of English *even*. (iii) Our analysis explains a wide range of linguistic facts. First, the role of quantity adjectives can be instantiated by other adjectives: see Coppock (2016) for English *at best/ worst* and *at the earliest/ latest*. Second, the role of superlative morpheme can be instantiated by other quantifiers such as *even (if)*; Japanese makes a case at hand: *sukunaku-tomo* ‘at least’ and *ooku-tomo* ‘at most’.

Extensions: In the full version of this talk, assuming The Containment Hypothesis (Bobaljik 2012), we demonstrate that the internal structure of *zuishao* ‘at least’ (and SMs in general) can be further

decomposed into three subparts: a quantifier over focus alternatives (**the superlative morpheme**) and an ordering relation instantiated by **a comparative head** combining with **a quantity adjective**.

Ref.: [1] Greenberg, A. 2017. A revised, gradability-based semantics for even. [2] Solt, S. 2015. Q-adjectives and the semantics of quantity. [3] Wellwood, A. 2015. On the semantics of comparison across categories.