On the Morpho-Semantic Puzzle of Superlative Modifiers

Yi-Hsun Chen, Rutgers University
yc565@linguistics.rutgers.edu

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Outline

- Main ideas
- The morpho-semantic puzzle
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- Explaining the morpho-semantic puzzle
- Concluding remarks
Main Ideas
Main ideas

- The **degree morphology** and **quantity adjectives** involved in superlative modifiers (e.g., *at least & at most*)
  - NOT a morpho-semantic coincidence in natural language;
  - Deeply connected with the semantics.
  - More than one strategy mapping out the morpho-semantics of superlative modifiers.

In this talk, I focus on the **superlative** strategy in Chinese (see also English and other languages).
Main ideas

- The morpho-semantics of *zuiduo* ‘at most’:
  - **The Q-adjective**: A measure function mapping the focus alternatives to their corresponding positions along a contextually given scale.
  - **The superlative component**:
    - A strict comparison relation between the prejacent and its alternatives.
    - A domain restrictor, structurally embedded under an existential operator E-OP.
  - **The (covert) existential operator E-OP**: An existential statement over a anti-specific domain.

- The ordering between focus alternatives is a strict comparison, instantiating a structure of phrasal comparatives.
The morpho-semantic puzzle
A long-standing puzzle

- Why do focus particles such as *at least* and *at most* in English involve *quantity adjectives* (Q-adjectives) and *superlative morpheme* in their morphology?

(1) a. Adam climbed the *most* mountains.
   b. Adam climbed the *least* high mountain.

(2) a. Adam at *most* won a [silver]$_F$ medal.
   b. Adam at *least* won a [silver]$_F$ medal.
Morphology - Chinese

- The same expression *zui-duo* ‘at most’, consisting of a superlative morpheme *zui* and a Q-adjective *duo* ‘much’, is used as quantity superlatives and superlative modifiers.

(3) **Quantity Superlatives (Qs)**

Lee na-le *zui-duo* yin-pai.
Lee take-ASP SUP-much silver-medal
‘Lee won the most silver medals.’

(4) **Superlative Modifiers (SMs)**

Lee *zui-duo* na-le [yin]_F_-pai.
Lee SUP-much take-ASP silver-medal
‘Lee at most won a silver medal.’
Morphology – beyond Chinese

- Across languages, SMs involve degree morphology and quantity adjectives in general.

- A sample list (not exhaustive):
  - English: *at least*; *at most*
  - Brazilian Portuguese: *pelo menos*; *no maximo*
  - Chinese: *zui-shao*; *zui-duo*
  - German: *mindestens*; *am meisten*
  - Japanese: *sukunaku-temo*; *ooku-temo*
  - Italian: *al meno*; *al massimo*
  - Maghi, Hindi: *jyaadaa se jyaadaa*  *kam se kam*;
  - Turkish: *en az*; *en çok*
Q: What did Lee do for the party?

✓ A contextual ranking (on what Lee could contribute):
  - cook dinner > buy apples > clean house

Lee SUP-much buy-ASP apples
‘Lee at most bought apples.’

(6) #Lee zui-duo mai-le [pingguo]ₐ.
Lee SUP-much buy-ASP apples
‘Lee at most bought apples.’
Semantics – Focus-sensitivity

Q: What fruit did Lee buy for the party?

✓ A contextual ranking (on what fruit Lee could buy):
  cherries > apples > bananas

(7) #Lee zui-duo [mai-le pingguo]F.
  Lee SUP-much buy-ASP apples
  ‘Lee at most bought apples.’

(8) Lee zui-duo mai-le [pingguo]F.
  Lee SUP-much buy-ASP apples
  ‘Lee at most bought apples.’
Semantics – Variety of Scales

(9) **Numerical Scales** (e.g., …4 > 3 > 2…)  
Lee *zui-duo xie-le [san]_F-ben-shu.*  
Lee SUP-much write-ASP three-CL-book  
‘Lee at most wrote three books.’

(10) **Plurality Scales** (e.g., a⊕b⊕c > a⊕b > a, b)  
Lee *zui-duo yaoqing-le [Adam han Bill]_F.*  
Lee SUP-much invite-ASP Adam and Bill  
‘Lee at most invited Adam and Bill.’
Semantics – Variety of Scales

(11) **Lexical Scales** (e.g., gold $\succ$ silver $\succ$ bronze)

Lee zui-duo de-le [yin]_F-pai.
Lee SUP-much win-ASP silver-medal
‘Lee at most won a silver medal.’

(12) **Pragmatic Scales** (e.g., cherries $\succ$ apples $\succ$ bananas)

Lee zui-duo mai-le [pingguo]_F.
Lee SUP-much buy-ASP apples
‘Lee at most bought apples.’
Variety of Scales - English

(13) **Numerical Scales** (e.g., ...4 ≥ 3 ≥ 2...)  
John *at most* wrote [three]_F books.

(14) **Plurality Scales** (e.g., a ⊕ b ⊕ c > a ⊕ b > a, b)  
John *at most* invited [Adam and Bill]_F.

(15) **Lexical Scales** (e.g., gold > silver > bronze)  
John *at most* won a [silver]_F medal.

(16) **Pragmatic Scales** (e.g., cherries > apples > bananas)  
John *at most* bought [apples]_F.
Semantics – The Bounding Property

(13) **Numerical Scales** (e.g., …4 \(\succ\) 3 \(\succ\) 2…)  
      John **at most** wrote \([three]_F\) books.

(14) **Plurality Scales** (e.g., \(a \oplus b \oplus c \succ a \oplus b \succ a, b\))  
      John **at most** invited \([Adam and Bill]_F\).

(15) **Lexical Scales** (e.g., gold \(\succ\) silver \(\succ\) bronze)  
      John **at most** won a \([silver]_F\) medal.

(16) **Pragmatic Scales** (e.g., cherries \(\succ\) apples \(\succ\) bananas)  
      John **at most** bought \([apples]_F\).
Interim Summary

- Some semantic properties of *zui-duo/ at most*:
  - Focus-sensitivity
  - Compatibility with various scales
  - The bounding property
    (the associate is the upper bound among the alternatives)

- The morpho-semantic puzzle:
  - How exactly is the semantics of *zui-duo/ at most* connected to its morphology (a superlative morpheme and a Q-adjective)?
  - Why do these focus particles (SMs) involve degree morphemes and Q-adjectives in their morphology cross-linguistically?
A Formal Proposal
Three morpho-semantic pieces

- The morpho-semantics of *zuiduo* has three pieces.
  - **The Q-adjective**: A measure function mapping the focus alternatives to their corresponding positions along a contextually given scale.
  - **The superlative component**:
    - A strict comparison relation between the prejacent and its alternatives.
    - A domain restrictor, structurally embedded under an existential operator E-OP.
  - **The (covert) existential operator E-OP**: An existential statement over a anti-specific domain.
- The **ordering** between focus alternatives is a **strict comparison**, instantiating a structure of **phrasal comparatives**.
The internal structure of zui-duo ‘at most’:

- Bobaljik (2012)’s Containment Hypothesis
The superlative component of \textit{zui-duo} ‘at most’

- Bobaljik (2012)’s \textbf{Containment Hypothesis}: A superlative construction structurally embeds a comparative construction.

\begin{equation}
(17) \left[ \text{SupP } \textit{zui} \left[ \text{Comp}^+ \text{P Comp}^+ \left[ \text{AdjP } \textit{duo} \right] \right]\right]
\end{equation}
Compositionality – Comp+P

Comp+P

Comp+P

Q-AdjP

duo

(18) $\left[duo\right]^c = \lambda \alpha.\mu_c(\alpha) \quad <\eta, d>$

✓ A measure function mapping the focus alternatives to their corresponding positions along a contextually given scale (cf. Wellwood et al. 2012, Wellwood 2014, 2015).

(19) $\left[\text{Comp}^+P\right]^c = \lambda \alpha \lambda \beta.\mu_c(\alpha) > \mu_c(\beta) \quad <\eta, <\eta, t>>$

✓ A comparison relation between the prejacent $\alpha$ and its alternatives $\beta$
The first argument is a comparison relation between the prejacent and its alternatives.

For all the alternatives $\beta$ non-identical to the prejacent, they are ranked lower than the prejacent $\alpha$. 

$$\exists \beta \in \mathcal{C} \land \beta \neq \alpha \Rightarrow \mu_c(\alpha) > \mu_c(\beta)$$
The internal structure of **zui-duo**

- The whole superlative component, serving as a domain restrictor, is structurally embedded under an (covert) existential operator: **E-OP**.

The internal structure of **zui-duo** ‘at most’:

(22) \([E-OP \ [SupP zui [Comp+P Comp^+ [AdjP duo]]]]\)

The semantics of **E-OP**

(23) \([E-OP]^w, c\)

\[= \lambda SUP <<st, t>, <st, t>> \lambda C <st, t> \lambda \alpha <st>. \exists \gamma[\gamma \in C \land \gamma_w \land SUP (C, \alpha)]\]

- There is one alternative in the domain (i.e., \(C \cap SUP\)) such that the alternative is true
Compositionality – The morpho-semantics of *zuiduo*

(23) $[[E-OP]]^w, c$

$= \lambda SUP_{<<s_t, t>>} \lambda C_{<s_t, t>>} \lambda \alpha_{<s_t>>} \exists \gamma [\gamma \in C \land \gamma_w \land SUP (C, \alpha)]$

✓ There is one alternative in the domain (i.e., $C \cap SUP$) such that the alternative is true.

$[[zui-duo \ (C)]]^w, c =$

$\lambda \alpha_{<s_t>>} \exists \gamma [\gamma \in C \land \gamma_w \land \forall \beta [\beta \in C \land \beta \neq \alpha \rightarrow \mu_c (\alpha) > \mu_c (\beta)]]$
The morpho-semantics of *zui-duo*

- A propositional version

\[
\left[ zui-duo \left( C \right) \right]^{w,c} = \\
\lambda \alpha_{<st>} . \exists \gamma \left[ \gamma \in C \land \gamma_w \land \forall \beta \left[ \beta \in C \land \beta \neq \alpha \rightarrow \mu_c(\alpha) > \mu_c(\beta) \right] \right]
\]

The internal structure of *zui-duo* ‘at most’:

(22) \[
\textbf{E-OP} \left[ \text{SupP } \textbf{zui} \left[ \text{Comp+P Comp+} \left[ \text{AdjP duo} \right] \right] \right]
\]

The \textbf{E-OP} is overt in English *at most*:

(24) \[
\textbf{at} \left[ \text{SupP -est} \left[ \text{Comp+P Comp+} \left[ \text{AdjP much} \right] \right] \right] \]
Explaining the morpho-semantic puzzle
Focus-Sensitivity

(25) Lee zuiduo [bought apples]_F.

✓ A contextual ranking: cook dinner > buy apples > clean house


(26) a. LF: [vP zui-duo(C) [vP[vP Lee [bought apples]_F]~C]]

b. \( \alpha \sim C \) is defined iff

\[
[\alpha]^o \in C \land \exists \alpha' [\alpha' \neq \alpha \land [\alpha']^o \in C] \land C \subseteq [\alpha]^f
\]

c. \([23a)]^w_c = 1 \) iff

\[
\exists \gamma [\gamma \in C \land \gamma_w \land \forall \beta [\beta \in C \land \beta \neq (\lambda w. \text{Lee bought}_{w} \text{ apples} ) \rightarrow \mu_c(\lambda w. \text{Lee bought}_{w} \text{ apples}) > \mu_c(\beta)]]
\]

d. \( C \cap \text{SUP}: \{\text{Lee bought apples, Lee cleaned house}\} \)
Focus-Sensitivity

(27) Lee zuiduo bought [apples]_F.

✓ A contextual ranking: cherries > apples > bananas


(28) a. LF: [vP zui-duo(C) [vP[vP Lee bought [apples]_F]~C]]

b. α ~C is defined iff

\[ [\alpha]^{o} \in C \land \exists \alpha'[\alpha' \neq \alpha \land [\alpha']^{o} \in C] \land C \subseteq [\alpha]^{f} \]

c. \[(25a)]^{w,c} = 1 \text{ iff}

\[ \exists \gamma[\gamma \in C \land \gamma_{w} \land \forall \beta[\beta \in C \land \beta \neq (\lambda w. \text{Lee bought}_{w} \text{ apples}) \rightarrow \mu_{c}(\lambda w. \text{Lee bought}_{w} \text{ apples}) > \mu_{c}(\beta)]] \]

d. \(C \cap \text{SUP}: \{\text{Lee bought apples, Lee bought bananas}\}\)
Variety of Scales

**Numerical Scale** (e.g., \( \ldots 4 > 3 > 2 \ldots \))

**Plurality Scale** (e.g., \( a \oplus b \oplus c > a \oplus b > a, b \))

**Lexical Scale** (e.g., gold > silver > bronze)

**Pragmatic Scale** (e.g., cherries > apples > bananas)

- The dimension of the measure function \( \mu_c \) encoded in the Q-adjective is contextually-valued (Wellwood 2014, 2015).

- An observation:
  The ordering between alternatives **cannot** be **reversed** in the case of **numerical scales** and **plurality scales**, even with contextual manipulations.
The bounding property of SMs

Traditional wisdom: it is done by a non-strict comparison relation.

(29) The degree approach (e.g., Nouwen 2010, Kennedy 2015)

a. \([\text{at least}] = \lambda m_{<d} \lambda P_{<d, t}. \max\{n \mid P(n)\} \geq m\]
b. \([\text{at most}] = \lambda m_{<d} \lambda P_{<d, t}. \max\{n \mid P(n)\} \leq m\]

(30) The discourse-based approach

a. \([\text{at least (C)}]^{w, g} = \lambda p_{<s, t}. \exists q [q \in C \land q(w) \land q \geq_i p]\]
b. \([\text{at most (C)}]^{w, g} = \lambda p_{<s, t}. \forall q [q \in C \land q(w) \land q \leq_i p]\]

✓ E.g., Coppock & Brochhagen 2013, among others
The bounding property of SMs

- The **non-strict comparison** raises many questions:
  - What is the nature of the non-strict comparison relation?
  - Where does the non-strict comparison come from?
  - Is it a semantic primitive or a derived result?

- A superlative typically involves **a strict comparison**:

1a) Adam climbed the highest mountain.

*Relative reading* (e.g., Heim 1999, Sharvit & Stateva 2002, a.o.): Adam climbed a mountain higher than anyone else did.

\[ \forall y[y \in C \land y \neq \text{adam} \rightarrow \max(\lambda d. \exists z[\text{mountain}(z) \land \text{high}(z) \geq d \land \text{adam climbed } z]) > \max(\lambda d. \exists z[\text{mountain}(z) \land \text{high}(z) \geq d \land y \text{ climbed } z]) \]
The bounding property of zuiduo

The current analysis:

✓ The non-strict comparison relation is derived from focus presuppositions combining with the superlative component.

(31) a. $\lbrack zui-duo (C) \rbrack^w, g =$

$\lambda \alpha_{<st>}. \exists \gamma[\gamma \in C \land \gamma_w \land \forall \beta[\beta \in C \land \beta \neq \alpha \rightarrow \mu_c(\alpha) > \mu_c(\beta)]]$

b. $\alpha \sim C$ is defined iff

$\lbrack \alpha \rbrack^o \in C \land \exists \alpha'[\alpha' \neq \alpha \land \lbrack \alpha' \rbrack^o \in C] \land C \subseteq \lbrack \alpha \rbrack^f$

c. $C \cap \textup{SUP}$: \{the prejacent $\alpha$, the lower alternatives of $\alpha$\}

d. There is one element in the domain $C \cap \textup{SUP}$ such that it is true.
Semantic parallels with disjunctions and epistemic indefinites

The current analysis captures two types of parallels:

- Patterning with epistemic indefinites, SMs (e.g., zuoduol at most) has an anti-specific domain (i.e., $C \cap \text{SUP}$).

  (cf. The anti-specific approach: Nouwen 2015)

- Patterning with disjunctions, SMs (e.g., zuoduol at most) makes an existential statement over the non-singleton domain.

  (cf. The disjunction approach: Büring 2008, among others)
Concluding Remarks

- Formal tools developed in the studies of **gradability** can be applied to those of **scalarity**.
  - In the current study, SMs make a case as well. What’s more, the degree morphology is obviously part of these focus operators.

- The **non-strict comparison** relation is not a semantic primitive, but derived from **focus presuppositions** and the **superlative** meaning (encoding a **strict comparison**).
Concluding Remarks

- More than one morpho-semantic route to the semantics of SMs:
  - **Q-adjectives** plus **even-if** (e.g., Japanese and Korean)
    a. *ooku-temo* ‘at most’ Japanese
    many-even.if
    b. *sukunaku-temo* ‘at least’
    few-even.if
  - **Q-adjectives** plus **comparatives** (e.g., Maghi, Hindi, Russian)
    a. *jaadaa se jaadaa* ‘at most’ Maghi
    more than more
    b. *kam se kam* ‘at least’
    less than less
Concluding Remarks

- The morpho-syntactic status of the E-OP:
  - Covert in Chinese;
  - Overt in English: *at least* and *at most*.
  - Overt in other languages:
    - Italian *almeno* ‘at least’ & *al massimo* ‘at most’;
    - French: *au moins* ‘at least’ & *au plus* ‘at most’;
  - Is the realization of the E-OP limited to the family of Indo-European languages?
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Thank you!
Zui-duo ‘at most’ & Type-shifting

A non-propositional version (by the Geach rule)

\[\llbracket \text{zui-duo } (C) \rrbracket_{w, c} = \lambda \alpha \llbracket_{\eta, \text{st}} \lambda P \llbracket_{\eta}. \exists \gamma [\gamma \in C \land \gamma_w (P) \land \forall \beta [\beta \in C \land \beta \neq \alpha \rightarrow \mu_c (\alpha) > \mu_c (\beta)]\]\n
A non-propositional version (by the backward Geach rule)

\[\llbracket \text{zui-duo } (C) \rrbracket_{w, c} = \lambda \alpha \llbracket_{\eta} \lambda P \llbracket_{\eta, \text{st}}. \exists \gamma [\gamma \in C \land P_w (\gamma) \land \forall \beta [\beta \in C \land \beta \neq \alpha \rightarrow \mu_c (\alpha) > \mu_c (\beta)]\]\n
See Coppock & Beaver (2014) for a similar treatment of English exclusive particles via type-shifting.
Selected References


