November 19, 2011
University of Göttingen
Indefinites and Beyond

Remarks on class B numeral modifiers

Bernhard Schwarz
McGill University

1. Introduction

Nouwen (2010) (building on Geurts and Nouwen 2007) identifies a family of numeral modifiers, called "class B", which introduce ignorance implications.

(1)

	upper bound	lower bound
superlative	*at most*	*at least*
directional	*up to*	—
(other	*maximally*	*minimally*)

(2) a. Li hired at most ten students.
b. Li hired at least ten students.

(3) Li hired up to ten students.

(4) Ignorance implication:
The speaker does not know how many students (exactly) Li hired.

I will present semantic contrasts between *up to* and *at most*, which motivate the derivation of ignorance implications with *up to* as a lexical plurality condition (Nouwen 2010, as elaborated in Penka 2010). (This part reports on joint work with Brian Buccola and Michael Hamilton.)

I will explore the view that ignorance implicatures with superlative modifiers are Gricean inferences (see Büring 2008, Cummins and Katsos 2010, Nouwen 2011), applying the "standard recipe" for quantity implicatures (e.g. Sauerland 2004, Fox 2007, Geurts 2011).

2. Starting point: a version of Nouwen's (2010) proposal

2.1 Syntax-semantics of modified numerals (Hackl 2000)

(5) Li hired ten students.
(6) Li hired [[ten many] students]

(7) $||\text{many}_w|| = \lambda d_d .\lambda f_{et} .\lambda g_{et}.\exists X[\ |X| = d\ \&\ f(X)\ \&\ g(X)]$

(8) $\exists X[\ |X| = 10\ \&\ S(X)\ \&\ H(X)]$
'Li hired ten or more students'

Nouwen posits a strong counting quantifier *many* in addition to Hackl's weak version.

(9) $||\text{many}_s|| = \lambda d_d .\lambda f_{et} .\lambda g_{et}.\exists! X[\ |X| = d\ \&\ f(X)\ \&\ g(X)]$
(Nouwen 2010)

(10) $\exists!X[\ |X| = 10\ \&\ S(X)\ \&\ H(X)]$
'Li hired exactly ten students'

Modified numerals are generalized quantifiers over degrees that move for interpretability.

(11) $||MOD|| = \lambda d_d.\ \lambda f_{dt}.\ R_{MOD}(d,f)$

(12) Li hired [MOD ten] students →
[MOD ten] λd[Li hired [d many] students]

2.2 Superlative modifiers (Nouwen 2010, 2011; Penka 2010)

Nouwen (2010) explores an analysis of class B modifiers as maximum/minimum markers; focusing on superlative modifiers, Penka (2010) amends this analysis by positing a plurality condition.

(13) a. $||\text{at most}|| = \lambda d_d.\ \lambda f_{dt}.\ \max(f) = d\ \&\ \text{plural}(f)$
b. $||\text{at least}|| = \lambda d_d.\ \lambda f_{dt}.\ \min(f) = d\ \&\ \text{plural}(f)$

Provided only strong *many* is available, this semantics routinely derives contradictory truth conditions.

(14) [at.most ten] λd[Li hired [d many_s] students]

(15) $\max(\{d: \exists!X[\ |X| = d\ \&\ S(X)\ \&\ H(X)]\}) = 10\ \&$
$\text{plural}(\{d: \exists!X[\ |X| = d\ \&\ S(X)\ \&\ H(X)]\})$

(16) [at.least ten] λd[Li hired [d many_s] students]

(17) $\min(\{d: \exists!X[\ |X| = d\ \&\ S(X) = H(X) = T\ ]\}) = 10\ \&$
$\text{plural}(\{d: \exists!X[\ |X| = d\ \&\ S(X) = H(X) = T\ ]\})$

Contradiction can be prevented by letting the modified numeral scope over a (silent) epistemic possibility operator.[1]

(18) [at.most ten] λd[◇ Li hired [d many_s] students]

(19) $\max(\{d: \Diamond\ \exists!X[\ |X| = d\ \&\ S(X)\ \&\ H(X)]\}) = 10\ \&$
$\text{plural}(\{d: \Diamond\ \exists!X[\ |X| = d\ \&\ S(X)\ \&\ H(X)]\})$
'◇ [Li hired exactly 10 students] & ¬◇ [Li hired more than 10 students] &
¬∃n □[Li hired exactly n students]'

(20) [at.least ten] λd[◇ Li hired [[d many_s] students]]

(21) $\min(\{d: \Diamond\ \exists!X[\ |X| = d\ \&\ S(X) = H(X) = T\ ]\}) = 10\ \&$
$\text{plural}(\{d: \Diamond\ \exists!X[\ |X| = d\ \&\ S(X) = H(X) = T\ ]\})$
'◇ [Li hired exactly 10 students] & ¬◇ [Li hired fewer than 10 students] &
¬∃n □[Li hired exactly n students]'

[1] This account is similar in structure to Mendez-Benito's (2010) analysis of universal free choice items.

2.3 Ignorance obviation

Epistemic/ignorance implications sometimes vanish under modals (Geurts and Nouwen 2007, Nouwen 2010, 2011; Penka 2010).

at most plus ⟐

(22) Li is allowed to hire at most ten students. [obviation – predicted]

(23) [at.most ten] λd[⟐ Li hired [d many_s] students]

(24) $\max(\{d: \Diamond\, \exists! X[\ |X| = d \ \&\ S(X)\ \&\ H(X)]\}) = 10\ \&$
$\text{plural}(\{d: \Diamond\, \exists! X[\ |X| = d \ \&\ S(X)\ \&\ H(X)]\})$
'⟐ [Li hires exactly 10 students] & ¬⟐ [Li hires more than 10 students] &
¬∃n ⊡[Li hires exactly n students]'

at least plus ⊡

(25) Li is required to hire at least ten students. [obviation – not predicted]

(26) [at.least ten] λd[⊡ Li hired [[d many_s] students]]

(27) $\min(\{d: \Box\, \exists! X[\ |X| = d \ \&\ S(X)\ \&\ H(X)]\}) = 10\ \&$
$\text{plural}(\{d: \Box\, \exists! X[\ |X| = d \ \&\ S(X)\ \&\ H(X)]\})$

at most plus ⊡

(28) Li is required to hire at most ten students. [obviation[2] – not predicted]

(29) [at.most ten] λd[⊡ Li hired [[d many_s] students]]

(30) $\max(\{d: \Box\, \exists! X[\ |X| = d \ \&\ S(X)\ \&\ H(X)]\}) = 10\ \&$
$\text{plural}(\{d: \Box\, \exists! X[\ |X| = d \ \&\ S(X)\ \&\ H(X)]\})$

at least plus ⟐

(31) Li is allowed to hire at least ten students. [no obviation – not predicted]

(32) [at.least ten] λd[⟐ Li hired [[d many_s] students]]

(33) $\min(\{d: \Diamond\, \exists! X[\ |X| = d \ \&\ S(X)\ \&\ H(X)]\}) = 10\ \&$
$\text{plural}(\{d: \Diamond\, \exists! X[\ |X| = d \ \&\ S(X)\ \&\ H(X)]\})$
'⟐ [Li hires exactly 10 students] & ¬⟐ [Li hires fewer than 10 students] &
¬∃n ⊡[Li hires exactly n students]'

---

[2] Geurts and Nouwen (2007) assume that necessity modals cannot obviate epistemic implications introduced by *at most*. I follow Nouwen (2011) in assuming that they can.

2.4 Nouwen's class B hypothesis

Nouwen hypothesizes that all upper bound/lower bound class B modifiers share a semantic interpretation.

(34) ||at most|| = ||maximally|| = ||up to|| = …
||at least|| = ||minimally|| = …

3. Two types of class B modifiers: *at most* vs. *up to*[3]

3.1 NPI licensing and downward inferences

(35) At most three people had ever been in this cave.
(Krifka 2007)
(36) At most three students give a damn about Pavarotti.
(Chierchia & McConnell-Ginet 2000, p. 522)

(37) a. At most three students smoke. [inference from (a) to (b) judged valid]
b. At most three students smoke cigars.
(Chierchia & McConnell-Ginet, 2000, p. 522)

(38) *Up to three people had ever been in this cave.
(39) *Up to three students give a damn about Pavarotti.

(40) a. Up to three students smoke. [inference from (a) to (b) judged invalid]
b. Up to three students smoke cigars.

Nouwen's semantics makes class B modified numerals non-monotone; this is correct for *up to*, but not for *at most*.

3.2 Bottom-of-the-scale effect

(41) a. At most ten people died in the crash.
b. Up to ten people died in the crash. (Nouwen, 2008, p. 580)

(42) a. At most one person died in the crash.
b. #Up to one person died in the crash.

In the absence of a zero-individual, the equivalence below holds; so with bottom-of-the-scale numerals, the plurality requirement is contradictory.

(32) $\max(\{d: \diamond\ \exists!X[\ |X| = d \ \&\ P(X) = D(X) = T\ ]\ \}) = 1$ iff
$\{d: \diamond\ \exists!X[\ |X| = d \ \&\ P(X) = D(X) = T\ ]\ \} = \{1\}$

Under suitable contextual assumptions, numerals greater than *one* can act as the bottom of the scale.

[3] This part reports on collaborative work with Brian Buccola and Michael Hamilton.

(43) Assumption: eggs can be bought in half-dozen cartons only
a. Li bought at most a dozen eggs.
b. Li bought up to a dozen eggs.

(44) Assumption: eggs can be bought in half-dozen cartons only
a. Li bought at most half a dozen eggs.
b. #Li bought up to half a dozen eggs.

In cases where the scale has no bottom, the bottom-of-the-scale effect is expectedly absent.

(31) a. Li ate at most one (whole/entire) cake.
b. Li ate up to one (whole/entire) cake.

3.3 Conclusions

The data presented exclude Nouwen's (2010) analysis for *at most*, but strengthen the case for applying a version of it to *up to*. They support the derivation of ignorance implications with *up to* through a plurality condition.

4. Superlative modifiers and quantity implicatures

4.1 Büring's semantics for superlative modifiers

Büring (2008) assigns to *at least* what would seem the obvious semantics under Hackl's (2000) assumptions.

(45) a. $||\text{at most}|| = \lambda d_d.\ \lambda f_{dt}.\ \max(f) \leq d$
b. $||\text{at least}|| = \lambda d_d.\ \lambda f_{dt}.\ \max(f) \geq d$ (cf. Büring 2008)

(46) a. Li hired at most ten students.
b. [at.most ten] λd[Li hired [[d many_w] students]]
c. $\max(\{d: \exists X[\ |X| = d\ \&\ S(X) = H(X) = T\ ]\}) \leq 10$
write: max(λd. Li hired d many students]) ≤ 10

(47) a. Li hired at least ten students.
b. [at.least ten] λd[Li hired [[d many_w] students]]
c. $\max(\{d: \exists X[\ |X| = d\ \&\ S(X) = H(X) = T\ ]\}) \geq 10$
write: max(λd. Li hired d many students]) ≥ 10

Büring writes the semantics of *at least* as a disjunction, suggesting that *at least* gives rise to the same quantity implicatures that the corresponding disjunction would.

(48) a. $||\text{at most}|| = \lambda d_d.\ \lambda f_{dt}.\ \max(f) = d \text{ or } \max(f) < d$
b. $||\text{at least}|| = \lambda d_d.\ \lambda f_{dt}.\ \max(f) = d \text{ or } \max(f) > d$ (Büring 2008)

What follows is an attempt to spell out such an account under the "standard recipe" for quantity implicatures (e.g. Sauerland 2004, Fox 2007, Geurts 2011).

4.2 Deriving ignorance implications under the standard recipe

(49) Horn sets
a. {… nine, ten, eleven, …}
b. {at least, exactly, at most}

(50) $||\text{exactly}|| = \lambda d_d.\lambda f_{(dt)}.\ \max(f)=d$

4.2.1 Scalar implicature

(51) a. Li hired ten students.
b. Li hired [ten many_w] students

(52) a. Assertion
(□) Li hired **10** students
b. Scalar alternatives
Li hired **11** students
c. Primary implicatures
¬□ [Li hired **11** students]
d. Secondary implicatures
□¬ [Li hired **11** students]

4.2.2 Ignorance implications

Ignorance implications are derived in the same way as ignorance implications for disjunctions in Sauerland's (2004) analysis.

(53) a. Li hired at least ten students.
b. [at.least ten] λd [Li hired [d many_w] students]

(54) a. Assertion
(□) max(λd. Li hired d many students]) ≥ **10**
iff (□) Li hired **10** students
b. Scalar alternatives
max(λd. Li hired d many students]) **=** 10
max(λd. Li hired d many students]) ≥ **11**
c. Primary implicatures
¬□ [max(λd. Li hired d many students) **=** 10]
¬□ [max(λd. Li hired d many students) ≥ **11**]

Assertion entails disjunction of scalar alternatives:

d. Possibility implications
◇ [max(λd. Li hired d many students) **=** 10]
◇ [max(λd. Li hired d many students) ≥ **11**]
e. Ignorance implications
? [max(λd. Li hired d many students) **=** 10]
? [max(λd. Li hired d many students) ≥ **11**]
f. Secondary implicatures
none – blocked by ignorance/possibility implications

Possibility implications arise because the assertion entails the disjunction of the scalar alternatives.

4.3 Ignorance obviation by necessity modals

Applying the logic laid out in Fox (2007) (who applies it to disjunction), ignorance implications are predicted to be obviated by necessity modals.

(55) a. Li is required to hire at least ten students.
b. $\boxdot$ [at.least ten] λd [Li hire [d many_w] students]

(56) a. <u>Assertion</u>
($\Box$) $\boxdot$ max(λd. Li hires d many students) $\geq$ **10**
b. <u>Scalar alternatives</u>
$\boxdot$ max(λd. Li hires d many students) **=** 10
$\boxdot$ max(λd. Li hires d many students) $\geq$ **11**
c. <u>Primary implicatures</u>
$\neg\Box$ [$\boxdot$ max(λd. Li hires d many students) **=** 10]
$\neg\Box$ [$\boxdot$ max(λd. Li hires d many students) $\geq$ **11**]
Assertion does not entail disjunction of scalar alternatives:
d. <u>Secondary implicatures</u>
$\Box\neg$ [$\boxdot$ max(λd. Li hires d many students) **=** 10]
$\Box\neg$ [$\boxdot$ max(λd. Li hires d many students) $\geq$ **11**]

<u>4.3.1 Other predicted obviators</u>

Büring (2008) relies on a "local implicature scheme" ($\boxdot$[p v q] $\rightsquigarrow$ $\neg\boxdot$p & $\neg\boxdot$q) to derive obviation by necessity modals. But obviation is more general:[4]

(57) a. Every professor hired at least ten students.
b. every professor λx[[at.least ten] λd[x hired [d many_w] students]]

(58)

<u>professor</u>	<u># of students hired</u>
Albers	10
Büchner	11
Calw	13
Dornberger	13
Emmeling	14

As shown in Schwarz and Shimoyama (2011), this is predicted under the proposed application of the standard recipe.

[4] See Nouwen (2010, fn.3), Cummins and Katsos (2010, sec. 11), and Schwarz and Shimoyama (2011) for examples of this sort.

(59) a. Assertion
$(\Box)$ every prof x: max(λd. x hired d many students) ≥ **10**

b. Scalar alternatives
every prof x: max(λd. x hired d many students) **=** 10
every prof x: max(λd. x hired d many students) ≥ **11**

c. Primary implicatures
$\neg\Box$ [every prof x: max(λd. x hired d many students) **=** 10]
$\neg\Box$ [every prof x: max(λd. x hired d many students) ≥ **11**]

Assertion does not entail disjunction of scalar alternatives:

d. Secondary implicatures
$\Box\neg$ [every prof x: max(λd. x hired d many students) **=** 10]
$\Box\neg$ [every prof x: max(λd. x hired d many students) ≥ **11**]

As predicted, other operators that break the entailment between the assertion and the disjunction of the scalar alternatives also obviate ignorance.

(60) Most of the professors hired at least ten students.

(61) a. Li always hired at least ten students.
b. Li usually hired at least ten students.

4.4 Ignorance (non-)obviation by possibility modals: *at least*

Recall that possibility modals cannot obviate ignorance implications with *at least*. This is correctly predicted.

(62) Li is allowed to hire at least ten students.
(63) $\diamond$ [at.least ten] λd [Li hires [d many_w] students] "narrow scope"

(64) a. Assertion
$(\Box)$ $\diamond$ max(λd. Li hires d many students) ≥ **10**
iff $(\Box)$ $\diamond$ Li hires 10 students

b. Scalar alternatives
$\diamond$ max(λd. Li hires d many students) **=** 10
$\diamond$ max(λd. Li hires d many students) ≥ **11**

c. Primary implicatures
$\neg\Box$ [$\diamond$ max(λd. Li hires d many students) **=** 10]
$\neg\Box$ [$\diamond$ max(λd. Li hires d many students) ≥ **11**]

Assertion entails disjunction of scalar alternatives:

d. Possibility implications
$\Diamond$ [$\diamond$ max(λd. Li hires d many students) **=** 10]
$\Diamond$ [$\diamond$ max(λd. Li hires d many students) ≥ **11**]

e. Ignorance implications
? [$\diamond$ max(λd. Li hires d many students) **=** 10]
? [$\diamond$ max(λd. Li hires d many students) ≥ **11**]

f. Secondary implicatures
none – blocked by ignorance/possibility implications

This particular interpretation does not seem to be attested. But it is in fact expected to be masked by another, attested, interpretation:

(65) [at.least ten] λd[⟐ [Li hires [d $many_w$] students]]   “wide scope”

(66) a. <u>Assertion</u>
(□) max(λd. ⟐ [Li hires d many students]) **≥ 10**

b. <u>Scalar alternatives</u>
max(λd. ⟐ [Li hires d many students]) **=** 10
max(λd. ⟐ [Li hires d many students]) ≥ **11**

c. <u>Primary implicatures</u>
¬□ [max(λd. ⟐ [Li hires d many students]) **=** 10]
¬□ [max(λd. ⟐ [Li hires d many students]) ≥ **11**]

Assertion entails disjunction of scalar alternatives:

d. <u>Possibility implications</u>
◇ [max(λd. ⟐ [Li hires d many students]) **=** 10]
◇ [max(λd. ⟐ [Li hires d many students]) ≥ **11**]

e. <u>Ignorance implications</u>
? [max(λd. ⟐ [Li hires d many students]) **=** 10]
? [max(λd. ⟐ [Li hires d many students]) ≥ **11**]

f. <u>Secondary implicatures</u>
none – blocked by ignorance/possibility implications

Note that (i) the narrow scope reading derives a strong, unattested, ignorance implication; (ii) the narrow and wide scope interpretations are equivalent, except for the presupposition of the wide scope interpretation introduced by max; (iii) if the presupposition is true, the wide scope reading derives a weaker, attested, ignorance implication; (iv) if the presupposition is false, the narrow scope reading is trivial.

<u>4.4.1 The absence of free choice interpretations with *at least*</u>

Failure of possibility modals to obviate epistemic implications with *at least* indicates that *at least* does not participate in free choice readings of the sort found with disjunctive paraphrases.

(67) Li is allowed to hire exactly ten students or more than ten students.
free choice inference: ⟐ max(λd. Li hires d many students) = 10 &
⟐ max(λd. Li hires d many students) ≥ 11

This is consistent with the proposed analysis of *at least*, although it raises questions about the analysis of free choice disjunctions – and *at most* (see below).

<u>4.4.2 Other predicted non-obviators</u>

It appears that, as predicted, existential operators in general do not obviate ignorance implications.

(68) a. There was a professor who hired at least ten students.
predicted ignorance implications: ? [some prof x: max(λd. x hired d many students) = 10]
? [some prof x: max(λd. x hired d many students) ≥ 11]

b. Li once hired at least ten students.
predicted ignorance implications: ? [once max(λd. Li hires d many students) = 10]
? [once max(λd. Li hires d many students) ≥ 11]

Here the modified numeral is not expected to be able to take inverse scope over the existential (Heim 2000). This predicts strong ignorance implications, which appear consistent with intuitions.

4.5 Ignorance (non-)obviation by existentials: *at most*

Possibility modals can obviate ignorance implications with *at most*. This is not predicted.

(69) Li is allowed to hire at most ten students.

(70) ⟐ [at.most ten] λd [Li hires [d many_w] students] "narrow scope"

(71) a. Assertion
(□) ⟐ max(λd. Li hires d many students) **≤ 10**

b. Scalar alternatives
⟐ max(λd. Li hires d many students) **=** 10
⟐ max(λd. Li hires d many students) ≤ **9**

c. Primary implicatures
¬□ [⟐ max(λd. Li hires d many students) **=** 10]
¬□ [⟐ max(λd. Li hires d many students) ≤ **9**]

Assertion entails disjunction of scalar alternatives:

d. Possibility implications
◇ [⟐ max(λd. Li hires d many students) **=** 10]
◇ [⟐ max(λd. Li hires d many students) ≤ **9**]

e. Ignorance implications
? [⟐ max(λd. Li hires d many students) **=** 10]
? [⟐ max(λd. Li hires d many students) ≤ **9**]

f. Secondary implicatures
none – blocked by ignorance/possibility implications

This interpretation is probably not a possible reading: the assertion is too weak and the ignorance implications are too strong.

(72) [at.most ten] λd ⟐ [Li hires [[d many_w] students]] "wide scope"

(73) a. Assertion
(□) max(λd. ⟐ [Li hires d many students]) **≤ 10**
≈ (□) ¬⟐max(λd. Li hires d many students) > 10

b. Scalar alternatives
⟐ max(λd. ⟐ [Li hires d many students]) **=** 10
⟐ max(λd. ⟐ [Li hires d many students]) ≤ **9**

c. Primary implicatures
¬□ [max(λd. ⟐ [Li hires d many students]) **=** 10]
¬□ [max(λd. ⟐ [Li hires d many students]) ≤ **9**]

Assertion entails disjunction of scalar alternatives:

d. Possibility implications
◇ [max(λd. ⟐ [Li hires d many students]) **=** 10]
◇ [max(λd. ⟐ [Li hires d many students]) ≤ **9**]

e. Ignorance implications
? [max(λd. ⟐ [Li hires d many students]) **=** 10]
? [max(λd. ⟐ [Li hires d many students]) ≤ **9**]

f. Secondary implicatures
none – blocked by ignorance/possibility implications

This reading might be available (cf. (24)), but it does not account for ignorance obviation.

4.5.1 The scope of the problem

Ignorance obviation by existentials appears to be limited to modals.

(74) a. There was a professor who hired at most ten students. [no obviation]
b. Li once hired at most ten students. [no obviation]

4.5.2 A free choice effect?

(75) Li is allowed to hire exactly ten students or fewer than ten students.
free choice inference: $\Diamond$ max(λd. Li hires d many students) = 10 &
$\Diamond$ max(λd. Li hires d many students) ≤ 9

Obviation can also be seen to go along with a free choice effect in the case of "locative" modifier *between … and …* .

(76) Li hired [between five and ten] students.

(77) Li is allowed to hire [between five and ten] students.
free choice inference: $\Diamond$ max(λd. Li hires d many students) = 5 &
$\Diamond$ max(λd. Li hires d many students) = 6 &
…
$\Diamond$ max(λd. Li hires d many students) = 10

4.6 Conclusions

Deriving ignorance implications for superlative numeral modifiers under the standard recipe comes close to accounting for the complete pattern of obviation.

The implicature account improves on competing proposals (Geurts and Nouwen 2007, Nouwen 2010) by straightforwardly explaining obviation under non-modal universals.

The problematic case is *at most* under possibility modals. *At most* appears to participate in free choice readings, which are beyond the scope of the standard recipe. The contrast between *at least* and *at most* with regard to apparent free choice interpretations remains to be understood.

References

Büring, Daniel. 2008. The least at least can do. In Charles B. Chang & Hannah J. Haynie (eds.), Proceedings of the 26th West Coast Conference on Formal Linguistics, 114–120. Somerville, MA: Cascadilla Proceedings

Chierchia, Gennaro & Sally McConnell-Ginet. 2000. Meaning and grammar: an introduction to semantics. The MIT Press.

Cummins, C. and N. Katsos. 2010. Comparative and superlative quantifiers: Pragmatic effects of comparison type. Journal of Semantics 27(3), 271–305.

Fox, Danny. 2007. Free choice and the theory of scalar implicatures. In Uli Sauerland & Penka Stateva (eds.), Presupposition and implicature in compositional semantics, 71–120. Palgrave MacMillan.

Geurts, Bart. 2011. Quantity implicatures. Cambridge: Cambridge University Press.

Geurts, B. and R. Nouwen. 2007. At least et al.: the semantics of scalar modifiers. Language 83(3), 533–559.

Hackl, Martin. 2000. Comparative quantifiers: Massachusetts Institute of Technology dissertation.

Heim, Irene. 2000. Degree operators and scope. In Proceedings of SALT 10, Ithaca, NY: CLC Publications.

Heim, Irene. 2006. *Little*. In Proceedings of SALT XVI , M. Gibson and J. Howell (eds), 35-58, Ithaca, NY: Cornell University

Krifka, Manfred. 1999. At least some determiners aren't determiners. In K. Turner (ed.), The semantics/pragmatics interface from different points of view. (= Current Research in the Semantics/Pragmatics Interface Vol. 1). Elsevier Science B.V., 1999, 257-291.

Krifka, Manfred. 2007. More on the difference between more than two and at least three. Paper presented at University of California at Santa Cruz.

Ladusaw, William A. 1979. Polarity sensitivity as inherent scope relations: University of Texas, Austin dissertation.

Menendez-Benito, Paula. 2010. On Universal Free Choice Items. *Natural Language Semantics* 18(1), 33-64.

Nouwen, Rick. 2008. Directionality in modified numerals: the case of up to. In Proceedings of SALT 18.

Nouwen, Rick. 2010. Two kinds of modified numerals. Semantics & Pragmatics 3(3). 1–41.

Nouwen, Rick. 2011. Superlative modifiers, ignorance implicatures and modals, handout for talk given at MIT (April 8, 2011)

Penka, Doris. 2010. A superlative analysis of superlative scalar modifiers. Paper presented at Sinn und Bedeutung 15, Universität des Saarlandes, 9-11 September 2010.

Sauerland, Uli. 2004. Scalar implicatures in complex sentences. Linguistics and Philosophy 27(3). 367–391.

Schwarz, Bernhard and Junko Shimoyama. 2011. “Negative Islands and Obviation by *Wa* in Japanese Degree Questions”, Nan Li and David Lutz (eds.) Proceedings of SALT 20, CLC Publications, Ithaca, NY, 702–719.