**Focusing on scales: superlatives as scalar modifiers**

**INTRODUCTION.** It is well known that Superlative Modifiers (SMs) like *at least* and *at most* differ from their comparative counterparts (like *more than*) in that the former gives rise to certain Inferences of Ignorance (IIs) (Nouwen 2010). These IIs are responsible for the illformedness of (2) compared to (1): (2a) conveys that the speaker is ignorant as to how many daughters she has, and (2b) conveys uncertainty about how many sides triangles have.

(1) a. I have more than one daughters.
b. Triangles have fewer than 11 sides.

(2) a. #I have at least two daughters.
b. #Triangles have at most 10 sides.

The goal of this paper is twofold: (i) to provide a unified account of IIs with SMs and (ii) to use these IIs as a window into the focus–sensitive nature of SMs. Building on recent accounts by Mayr (2013) and Schwarz (2013), I provide a neo–Gricean analysis of IIs with SMs as Primary Quantity Implicatures. I will make two novel claims. First, SMs form a Horn Set with *only*: $\langle$*at least, only*$\rangle$ and $\langle$*at most, only*$\rangle$. Second, I take the set of alternatives relevant for the Gricean calculus to be provided by two independent mechanisms. One of them is the familiar substitution method for implicature calculation, whereby elements participating in a Horn Set can be replaced with one or more of their scalemates (Sauerland 2004). The second alternative generation mechanism involves Association with Focus (AWF): a set of alternatives may be obtained by replacing the focus-bearing constituent with contextually relevant alternatives, as defended in Rooth (1985). Such an implementation successfully captures the epistemic effects of SMs for a wider range of scales, both numeral and non–numeral and thus offers greater empirical coverage.

**DESIDERATA.** The following patterns related to IIs in SMs need to be accounted for. (The examples all involve *at least*, but *at most* shows parallel effects).

**I.** SMs can combine with numerals as well as non–numeral scales. IIs arise with both:

(3) a. At least some students came to the party. ⇝ *the speaker is uncertain whether all students came*
b. At least Bill came to the party. ⇝ *the speaker is uncertain whether someone else came to the party*
c. Sue won at least the silver medal. ⇝ *the speaker is uncertain whether Sue won the golden medal*

**II.** IIs covary with the focus of the sentence. (4a) implies that the speaker is uncertain as to whether the chair also invited someone else to lunch. (4b) on the other hand implies that the speaker does not know whether the chair invited the postdoc also to some other meal as well.

(4) a. The chair at least invited the $[\text{postdoc}]_{\text{F}}$ to lunch
b. The chair at least invited the postdoc $[\text{to lunch}]_{\text{F}}$

**III.** IIs disappear in some contexts: (i) when the Maxim of Quantity is deactivated (5) and (ii) when the QuD does not require a concrete answer (6) (cf. Westera & Brasoveanu 2014). In (5), an SM is felicitous even though it is apparent that the speaker knows the exact number. The effect of the QuD is clear in (6): (6c) only conveys an II as an answer to (6a), but not to a polar question like (6b).

(5) [*Context: Playing a game about guessing a number I know, I provide a clue*]: It's at least two.

(6) a. Exactly how many students took Experimental Pragmatics?
b. Did at least ten students took Experimental Pragmatics?
c. At least ten students took Experimental Pragmatics.

**PROPOSAL.** SMs are scalar modifiers interpreted relative to some focalized constituent (Krifka 1999).

(7) a. $[\![\textit{at least}]\!] = \lambda C_{\langle st,t\rangle}.\lambda p_{\langle st\rangle}.\lambda w : \exists q[q \in C \wedge q \trianglelefteq p \wedge q(w)]$
b. $[\![\textit{at most}]\!] = \lambda C_{\langle st,t\rangle}.\lambda p_{\langle st\rangle}.\lambda w : \forall q[q \in C \wedge q(w) \rightarrow q \trianglelefteq p]$

[*where C is a contextually salient set of alternatives (Rooth 1985)*]

***Generating alternatives.*** There are two sources from which alternatives are generated. Consider (8a): it asserts that Liz won a medal (which is higher ranked than a diploma) and conveys that the speakers does not know which medal she won. From (7), standard focus semantics deliver an ordinary semantic value and a focus semantic value that consists of a set of alternative propositions, (8c). This constitutes the first set of relevant alternative propositions that the speaker could have uttered, (8d). Because *at least* is a part of a Horn Set, we can also generate scalar alternatives by substituting *at least* with its scalemate *only*, (8e).

(8) a. Liz won at least [the bronze medal]$_F$ = $[\geq \texttt{B}]$
b. $[\![\textit{Liz won [the bronze medal]}_F]\!]^O = \textit{won}(\textit{Liz, the bronze medal})$
c. $[\![\textit{Liz won [the bronze medal]}_F]\!]^F = \{\textit{won}(\textit{Liz, x}) \mid x \in D_e\}$ $[D_e = \{\textit{diploma, bronze, silver, gold}\}]$
d. $\{[\geq \texttt{D}], [\geq \texttt{B}], [\geq \texttt{S}], [\geq \texttt{G}]\}$
e. $\{[= \texttt{D}], [= \texttt{B}], [= \texttt{S}], [= \texttt{G}]\}$ [where $[= \texttt{S}]$ stands for *Only sue left*]

***Calculating implicatures.*** IIs are derived as Primary Implicatures following a standard neo–Gricean calculus. Assuming the epistemic certainty operator $\mathsf{K}$ (Hintikka 1962), we say that a speaker $S$ is ignorant about whether $\phi$ *iff* $\neg\mathsf{K}_S[\phi] \wedge \neg\mathsf{K}_S\neg[\phi]$, that is, if it is not the case that $S$ knows $\phi$ and it is not the case that she knows $\neg\phi$. If $S$ is cooperative, and so she is following the Maxims of Quality, the addressee infers that utterance of $\phi$ by $S$ implicates that $\mathsf{K}_S[\phi]$. By the Maxim of Quantity, for every relevant proposition $\psi$, if $\psi$ conveys more information, i.e., it is a stronger alternative (*SA*), then the speaker should have said $\psi$ instead of $\phi$. Since she did not say $\psi$, the Primary Implicature that $\neg\mathsf{K}_S[\psi]$ may also be drawn by the addressee. Together with the assertion, $\neg\mathsf{K}_S[\psi]$ forms the Implicature Base, $\mathsf{K}_S[\phi] \wedge \neg\mathsf{K}_S[\psi]$. For (8a) the set of stronger relevant alternative propositions is in (9a), and the reasoning proceeds as in (9b) and (9c).

(9) a. $SA([\geq \texttt{B}]]) = \{[\geq \texttt{S}], [\geq \texttt{G}], [= \texttt{B}], [= \texttt{S}], [= \texttt{G}]\}$
b. PRIMARY IMPLICATURES: $\neg\mathsf{K}_S[\geq \texttt{S}] \wedge \neg\mathsf{K}_S[\geq \texttt{G}] \wedge \neg\mathsf{K}_S[= \texttt{B}] \wedge \neg\mathsf{K}_S[= \texttt{S}] \wedge \neg\mathsf{K}_S[= \texttt{G}]$
c. IMPLICATURE BASE: $\mathsf{K}_S[\geq \texttt{B}] \wedge \neg\mathsf{K}_S[\geq \texttt{S}] \wedge \neg\mathsf{K}_S[\geq \texttt{G}] \wedge \neg\mathsf{K}_S[= \texttt{B}] \wedge \neg\mathsf{K}_S[= \texttt{S}] \wedge \neg\mathsf{K}_S[= \texttt{G}]$

The Implicature Base (9c) logically entails that two –and only two– of the *SA*s are epistemic possibilities: $\neg\mathsf{K}_S\neg[= \texttt{B}]$ and $\neg\mathsf{K}_S\neg[\geq \texttt{S}]$: For instance, if $\neg\mathsf{K}_S\neg[= \texttt{B}]$ were not true, $\mathsf{K}_S\neg[= \texttt{B}]$, it would entail that $\mathsf{K}_S[\geq \texttt{S}]$ is true, which contradicts the Primary Implicature that $\neg\mathsf{K}_S[\geq \texttt{S}]$. So, $\neg\mathsf{K}_S\neg[= \texttt{B}]$ must be true. A similar reasoning holds for $\neg\mathsf{K}_S\neg[\geq \texttt{S}]$. Thus, the propositions $[= \texttt{B}]$ and $[\geq \texttt{S}]$ must be epistemic possibilities: $\neg\mathsf{K}_S\neg[= \texttt{B}]$ and $\neg\mathsf{K}_S\neg[\geq \texttt{S}]$. These, together with the Primary Implicatures constitute IIs: $\neg\mathsf{K}_S\neg[= \texttt{B}] \wedge \neg\mathsf{K}_S[= \texttt{B}]$ and $\neg\mathsf{K}_S\neg[\geq \texttt{S}] \wedge \neg\mathsf{K}_S[\geq \texttt{S}]$. However, notice that no other *SA* is entailed by (9c), and so no other epistemic possibility is entailed. For instance, $\mathsf{K}_S\neg[= \texttt{S}]$ is consistent with the Implicature Base, and so the addressee cannot conclude an II about whether the speaker knows or not whether Liz won the silver medal.

**<u>RESULTS</u>.** Properties **I** and **II** follow from the focus–semantic analysis given above. AWF allows SMs to convey IIs about constituents that may not be part of a Horn Set (3), and to covary with the focalized constituent it may associate with at a distance (4). The properties in **III** are a consequence of deriving IIs via Gricean reasoning. The Gricean calculus relies on the assumption that the speaker is being maximally informative; dropping this assumption makes IIs disappear (5) and (6b)/(6c), while focusing on it prompts the presence of IIs (6a)/(6c). (The analysis applies all the same to *at most*.)

**<u>PREDICTIONS</u>.** The present account makes two main predictions about the kind of knowledge sentences with SMs are compatible with. We expect the following to *mandatorily* constitute epistemic possibilities: (i) the exclusive interpretation of the proposition expressed by the prejacent and (ii) the proposition expressing the immediately stronger alternative to the prejacent. This prediction is borne out: (10a) and (10b) are odd because they violate these requirements. This account also predicts that there are no other mandatory epistemic possibilities. The wellformedness of sentences like (10c), then, is also accounted for.

(10) Bill ate at least two apples, and I know that he didn't eat… a. #{exactly/only} two.
b. #{more than two/at least three}.
c. {three/four/three or four…}.

**<u>IMPLICATIONS</u>.** There is an ongoing debate in the literature as to whether SMs are to be treated as degree constructions (Hackl 2000, Nouwen 2010) or focus–sensitive operators (Krifka 1999, Beck 2010). Both approaches have been shown to cover similar empirical ground. In taking a closer look at IIs with SMs, this paper helps adjudicate between these two approaches and makes a case for the focus–sensitive approach. With respect to IIs, the results obtained replicate those in Schwarz (2013) for numerals and extends them to a wider range of scales. The empirical coverage is wider than that of other focus–sentivity based analysis, such as Mayr (2013) and Coppock & Brochhagen (2013), who fail to predict the patterns in (10). The next step is to extend this account to SMs in embedded environments (see Nouwen 2015 and Kennedy 2015).