Teodora Mihoc (Harvard U) and Kathryn Davidson (Harvard U)

Testing a PPI analysis of superlative modified numerals

Introduction. Comparative modified numerals (CMs) and superlative modified numerals (SMs) have equivalent truth conditions: *John saw **less than 4** stars* = *John saw **at most 3** stars* = John saw 0/1/2/3 stars (Cohen & Krifka 2011). However, they're known to differ in other ways: SMs require ignorance (Geurts & Nouwen 2007; Nouwen 2010; Coppock & Brochhagen 2013; Mayr 2013; Kennedy 2015; Mendia 2015), and SMs appear to be worse than CMs under negation: *John didn't see less than 4/??at most 3 stars* (Nilsen 2007, Cohen & Krifka 2011, 2014 and Spector 2014, 2015). To account for this difference, Spector (2015) treats SMs as underlyingly disjunctive positive polarity items (PPIs). We present 3 experiments in which we test **whether SMs pattern with other PPI items**: (a) PPIs are anti-licensed/not acceptable under a negation operator; (b) PPIs are acceptable in restrictors even when those define a DE-environment; and (c) PPIs can again become acceptable if the anti-licenser is itself in the scope of a DE-operator / in a DE-environment (Szabolcsi 2004, Nicolae 2012, Spector 2014). For each prediction we test whether the ways that SMs diverge from CMs would have been expected on a PPI account, and show that to the extent that a PPI account remains tenable, there still remains much data to be accounted for.

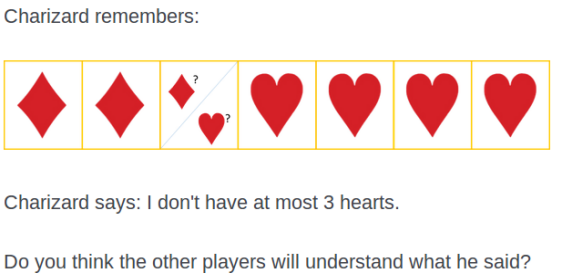
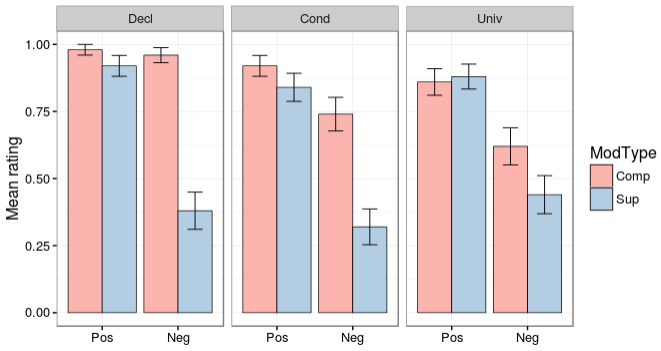


Fig. 1: Example trial: superlative modifier in negative declarative (Answers: Yes/No)



(Decl) I have/don't have [modifier] 3 [card suit].
(Cond) If you have/don't have [modifier] 3 [card suit], then we have something in common.
(Univ) Everyone who has/doesn't have [modifier] 3 [card suit] has something in common with me.

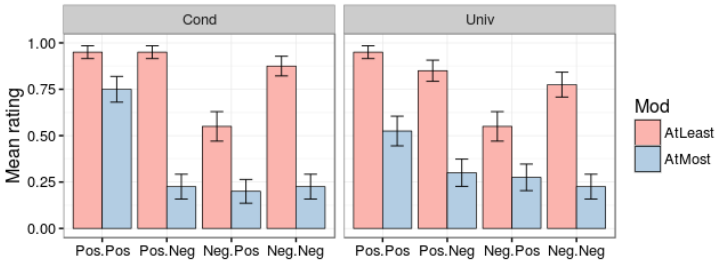
Fig. 2: Exp. 1 results grouped by sentence type, polarity, and modifier type

Experiment 1 (n = 25). Because SMs *require* ignorance and CMs *permit* it, our stimuli present (partial) ignorance via a card game, inspired by Cremers & Chemla (2016) (Fig. 1). Twenty-four acceptability judgments were presented which crossed modifiers (CMs: *less than*, *more than*, SMs: *at least*, *at most*), sentence type (declarative, conditional, universal) and polarity (positive, negative). Data were analyzed using mixed effects logistic regression.

Our results confirmed prediction (a): we found a significant difference between CMs and SMs under negation in simple declaratives ($\beta = 4.28, z = 5.24, p < .0001$). Second, supporting prediction (b), the effect of negation on SMs does not generalize to other downward-entailing environments: there was no difference between CMs and SMs in positive conditionals and universals. However, we did not find the same support for prediction (c): the contrast between CMs and SMs under negation remained when the combination occured under conditionals ($\beta = 2.25, z = 4.48, p < .0001$), and universals ($\beta = 0.92, z = 2.01, p = 0.044$) (Fig. 2). However, it has also been suggested that judgments of SMs under negation that are further

embedded in a conditional/universal are subject to a pragmatic polarity match between the antecedent/restrictor and the consequent/scope (Cohen & Krifka 2014), which could account for the failure of Exp. 1 to support prediction (c). We therefore designed a follow-up study (Exp. 2) to vary the negative or positive valence of the continuation.

Experiment 2 (n = 40). Design was similar to Exp. 1 except with positive/negative continuations of conditionals and universals (see Fig. 3). Partially supporting the alternative hypothesis, *at least* in a negative antecedent/restriction improved with polarity match in the consequent/scope (in conditionals: $\beta = 1.92, z = 3.21, p = 0.003$; in universals: $\beta = 1.15, z = 0.026, p = 0.027$), but *at most* did not. Further support for the heterogeny of SMs comes from another Exp. 2 finding that *at most* is judged unacceptable in conditionals and universals even when the only negative meaning is in the verb *lose* in the second argument (conditionals: $\beta = 2.62, z = 4.71, p < .0001$; universals: $\beta = 1.07, z = 2.15, p = 0.031$), a surprise under any account that treats the interaction of SMs with negation as only due to PPI anti-licensing. Given the improvement of *at least* under negation in Exp. 2 when further embedded in conditionals/universals, Exp. 3 tests whether this improvement generalizes to another combination of two DE operators: matrix and embedded negation.



(Cond) If you have/don't have [modifier] 3 [card suit], you win/lose.
(Univ) Everyone who has/doesn't have [modifier] 3 [card suit] wins/loses.

Fig. 3: Exp. 2 results grouped by sentence type, polarity, and modifier

Experiment 3 (n = 45). Design was similar to Exp. 1-2 except for the introduction of clausal embedding (and its supporting experimental context) in order to directly compare the behavior of local negation in two DE contexts: one under matrix negation versus the other in the antecedent of a conditional. Sentences varied by crossing four modifiers (as above) with sentence type (negative declarative (*Scyther doesn't know that he ...*), conditional (*If Scyther knew that he ...*)) and polarity (positive, negative for embedded clause/scopes). Results did not uniformly support prediction (c) for *at least*: *at least* under two negations is significantly worse than in a negated antecedent ($\beta = -1.9, z = -2.5, p = 0.025$) and differences between SMs persisted such that *at most* was judged worse than *at least* in every condition.

Conclusions. Overall, our data found some support for the predictions of the PPI account of SMs, but also raised multiple unresolved issues. First, why are SMs not always "rescued" when the anti-licensor is in the scope of another DE operator (*contra* prediction (c))? Second, why does the positive/negative valence of the predicate in the consequent play a role in the acceptability of SMs? Finally, what accounts for the difference between *at least* and *at most*? The empirical pattern is predicted neither under a strict PPI account nor under a simple account of processing complexity (given that SMs are acceptable in conditionals and universals but not under negation). We conclude that a full account of how SMs differ from CMs is still an open question and needs to be sensitive to semantic, pragmatic, and processing factors.

Selected references: Cohen, A., & Krifka, M. (2014). Superlative quantifiers and meta-speech acts. Linguistics and philosophy. Cremers, A., & Chemla, E. (2016). Experiments on the acceptability and possible readings of questions embedded under emotive-factives. Spector, B. (2014). Global positive polarity items and obligatory exhaustivity. Semantics and Pragmatics. Spector, B. (2015). Why are Class B modifiers global PPIs? Hurford disjunctions as a model for Class B modifiers. Handout at Workshop on Negation and Polarity in Jerusalem.