

Superlative-modified numerals and negation: A negotiable cost

Introduction. Naively speaking, comparative-modified numerals (CMNs; *more/less than 3*) and superlative-modified numerals (SMNs; *at least/most 3*) are pairwise truth-conditionally equivalent (e.g., *less than 3 = at most 2 = 0 or 1 or 2*). However, they are known to exhibit interesting contrasts. In this talk we focus on gathering empirical data to better understand one such contrast in polarity sensitivity: CMNs are fine in a downward-entailing (DE) environment such as the scope of sentential negation whereas SMNs are not, (1-a). At the same time, both are fine in DE environments such as the antecedent of a conditional or the restriction of a universal, (1-b)-(1-c).

- (1) a. Jo didn't solve more than 2 / # at least 3 problems. (meaning: 0 or 1 or 2)
b. If Jo solved ✓more than 2 / ✓at least 3 problems, she passed.
c. Everyone who solved ✓more than 2 / ✓at least 3 problems passed.

Existing literature. In the literature on SMNs we find the following implicit or explicit theoretical positions relative to this contrast: (T0: The null hypothesis) There is no contrast. (T1: Processing cost) There is a contrast but it is not theoretically interesting: Superlatives and negation are both known to be difficult. (T2 and T3) There is a contrast and it is theoretically interesting. It can be cashed out by assuming that: (T2: Two lexical meanings: Cohen and Krifka 2014) SMNs have two lexical meanings, one plain meaning which crashes in DE environments, capturing (1-a), and one evaluative meaning, which doesn't crash in DE environments and thrives in conditionals/universals, capturing (1-b)-(1-c), and is only sensitive to whether the continuation is pragmatically positive. Or that: (T3: Two types of DE environments: Spector 2015) SMNs have one lexical meaning which crashes in plain but not in *Strawson*-DE environments, capturing (1-a)-(1-c).

This talk. We report on three offline experiments which engage with all of these positions. We show that this contrast is strongly supported, *pace* T0, but also that its full manifestation is much richer than anticipated by any one of T1-T3 on their own and requires insights from them all.

General methodology. (Participants) Amazon's Mechanical Turk. (Design - further justified in talk) Our items presented many specific design challenges. To address them, we decided to present our items in the context of a card-playing game (inspired from Cremers and Chemla 2014), to keep the epistemic state of the speaker constant, and to ask for binary *comprehensibility* judgments. Participants saw (only) items generated by crossing factors such as environment type, polarity type, modifier (obtained by crossing modifier type and modifier polarity), in random order, offline. For details see Fig. 1, left. (Raw results) See Fig. 1, right. (Statistical analysis) In R.

Exp. 1. (Goal) To test SMNs vs. CMNs in a positive/negative declarative/restriction/antecedent, as a way to check our starting patterns and also get a sense of which one of T1-T3 might be on the right track. (Participants-Raw results) See Fig. 1, top. The results (raw + statistical analysis) reveal that: (R1) In general, items with negative modifiers and with negation were rated worse for both CMNs and SMNs. (R2) For the same level of modifier polarity, SMNs (a) in a positive declarative are the same as CMNs; (b) in a negative declarative are much worse than CMNs (MoreThan-AtLeast: $OR = 6.41$, $CI = [2.57, 15.98]$, $z = 4.872$, $p < .0001$; LessThan-AtMost: $OR = 31.49$, $CI = [12.01, 82.56]$, $z = 8.569$, $p < .0001$); (c) in a positive antecedent/restriction are largely (except for *at most* in a restriction) the same as CMNs; and (d) in a negative antecedent/restriction are worse than CMNs, but (R3) less so than in a negative declarative – indeed, CMNs under negation degrade significantly from a declarative to an antecedent/restriction, but SMNs don't. (Discussion) R1 is consistent with other findings in the literature. R2(b-c) argue against T0 and in favor of T1-T3. R3 argues against T1 and in favor of some version of T2 or T3.

Exp. 2. (Goal) To check an expectation from T2, namely, that the felicity of an SMN in an antecedent/restriction depends on the pragmatic polarity of the consequent/scope. (Finding) It does, but also on the polarity of the environment and of the SMN itself.

Exp. 3. (Goal) To check an expectation from T3, namely, that an SMN under a negation should improve if further embedded under an additional DE operator, and equally so regardless of the operator. (Finding) It does, but not equally so – *not-not-SMN* was a little worse than *if-not-SMN*, as expected on T1. Additionally, *not-know-SMN* was rated very highly, against T1 or T2 and in favor of a refined version of T3 (where the factive presupposition of *know* counts).

Conclusion. We have shown that SMNs are indeed significantly worse than CMNs in a negative declarative, but also that the interaction of SMNs with negation is highly non-trivial – sometimes unexpectedly punitive and sometimes unexpectedly lenient, depending on a variety of factors. None of the existing accounts captures it in full, though insights from all seem indeed to be needed.

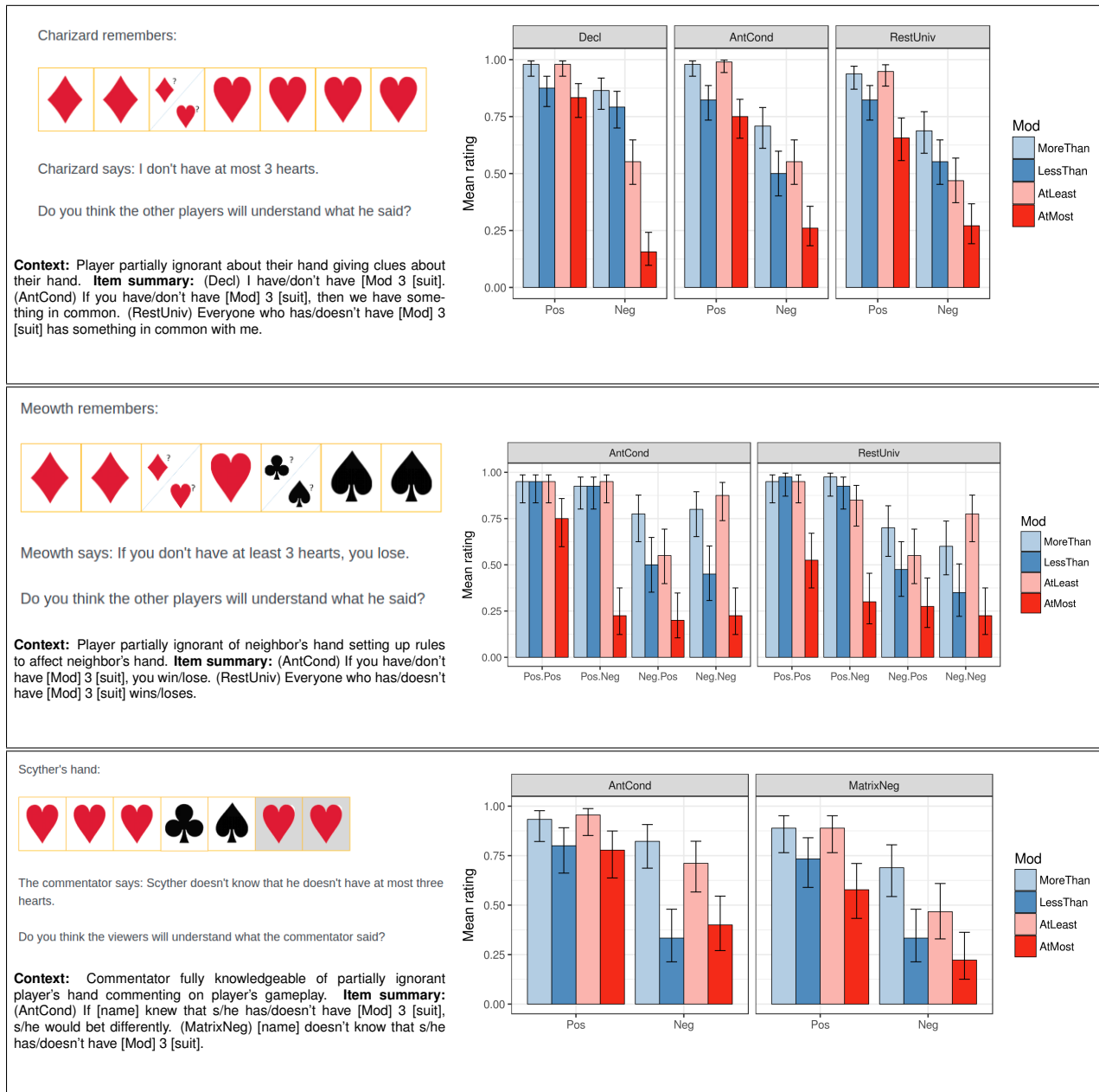


Fig. 1: Exp. 1-3 (top to bottom) items (left; answer options: yes/no) & results (right; raw means and associated 95% CIs, n = 99, 40, and 45, respectively).

References. Selected references Ariel Cohen and Manfred Krifka. 2014. Superlative quantifiers and meta-speech acts. Benjamin Spector. 2015. Why are class B modifiers global PPIs? Alexandre Cremers and Emmanuel Chemla. 2014. Direct and indirect scalar implicatures share the same processing signature.