Incremental semantic restriction and subjectivity-based adjective ordering

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Adjective ordering preferences (e.g., *big blue box* vs. *blue big box*) are robustly attested in many unrelated languages (Dixon, 1982). Scontras et al. (2017) showed that adjective subjectivity is a robust predictor of ordering preferences in English: less subjective adjectives occur closer to the modified noun. In a follow-up, Scontras et al. (to appear) claimed that pressures from successful reference resolution and the hierarchical structure of modification explain subjectivity-based ordering preferences (see also Simonič, 2018). In cases of restrictive modification, adjectives that compose with the nominal later will classify a smaller set of potential referents (e.g., the set of boxes vs. the set of blue boxes in (1a)). To avoid alignment errors where a listener might mis-characterize the intended referent, speakers introduce the more error-prone (i.e., more subjective) adjectives later in the hierarchical construction of nominal structure; the structure linearizes such that subjectivity decreases the closer you get to the modified noun. The current study explores the predictions of this reference-resolution story by examining adjective ordering cross-linguistically: when adjectives incrementally restrict a nominal denotation, there should be pressure toward subjectivity-based orderings, but, in the absence of incremental restriction, such pressures should not obtain.

First, **Tagalog**, where adjectives require a linking particle (*-ng/na*) to participate in modification structures (Foley, 1975; Rubin, 1994). However, even if linker discharges the semantics of modification (Rubin, 1994; Scontras and Nicolae, 2014), adjectives still compose incrementally with the nominal (1b). If subjectivity-based preferences derive from incremental semantic composition, these preferences should surface in Tagalog. We replicated Expt. 1: *Ordering preferences* from Scontras et al. (2017) using Tagalog translations of the original English materials. 24 Tagalog-speaking participants indicated their preferences for pairs of multi-adjective strings formed from 26 unique adjectives from seven semantic classes; the pairs differed on the relative order of the adjectives (e.g., *maliit na itim na silya* 'small black chair' vs. *itim na maliit na silya* 'black small chair'). We used these ratings to calculate a single preferred distance measure for each adjective; values ranged from 0 (always preferred closest to the noun) to 1 (always preferred farthest from the noun). Fig. 1 (*green bars*) summarizes these distance measures by semantic class; there, we see that Tagalog does indeed have stable preferences, as is evident in the significant deviation from chance (i.e., from 0.5) in all but one of the class distance measures. We then measured adjective subjectivity in Tagalog using a faultless disagreement task (cf. Expt. 1: *Faultless disagreement validation* from Scontras et al., 2017): to the extent that two speakers can be right while disagreeing about a property, the property admits that degree of faultless disagreement, which indexes adjective subjectivity. In Tagalog, as in English, subjectivity is a reliable predictor of individual adjective ordering preferences ($r^2 = 0.54$, 95% CI $= [0.22, 0.74]$). Despite using diverging strategies to form modification structures, in both languages adjectives compose incrementally with the modified noun, which leads to subjectivity-based ordering preferences.

Next, **Spanish**, where multi-adjective strings are post-nominal and commonly formed via conjunction (e.g., *la caja grande y azul* 'the big blue box'). Some adjectives may occur pre-nominally; however, this strategy is not fully productive in the language. We therefore focused only on post-nominal multi-adjective strings. We used Spanish translations of the original English materials to measure ordering preferences; 48 native speakers participated.

In a separate faultless disagreement task, 21 native speakers rated adjective subjectivity. In Spanish, subjectivity fails to predict ordering preferences ($r^2 = 0.01$, 95% CI = $[0.00, 0.06]$). This prediction failure arises because there are no preferences to predict in Spanish. Fig. 1 plots preferred distance measures grouped by lexical semantic class for Spanish; in all but one of the classes (i.e., *quality*), participants fail to provide systematic ratings that would evidence stable ordering preferences. One might worry that post-nominal adjectives were to blame for the absence of ordering preferences in Spanish, so we used the same method to test ordering preferences in 24 speakers of **Arabic**, a language with post-nominal adjectives that does not require conjunction. As Fig. 1 shows, Arabic does have stable subjectivity-based ordering preferences. Finally, we re-ran the **English** ordering experiment with and without conjunction. The results from 59 English speakers are plotted in Fig. 1; the English conjunction ratings replicate the qualitative results from the conjunction-free baseline. With conjunction, English speakers continue to have robust subjectivity-based ordering preferences ($r^2 = 0.68$; 95% CI $[0.40, 0.83]$). This finding stands at odds with previous claims about the role of conjunction in English ordering preferences (Ford and Olson, 1975; Byrne, 1979).

Our results provide support for the role of incremental semantic composition in subjectivity-based ordering preferences. In Tagalog and Arabic, where adjectives incrementally restrict the nominal denotation, we find subjectivity-based preferences. In Spanish, conjunction neutralizes ordering preferences. This effect makes sense if the pressure for ordering preferences comes from a desire to compose less subjective adjectives earlier with the modified noun; with conjunction, (1c), the adjectives make their semantic contribution together after they are conjoined, so pressures mediating the order in which adjectives compose cannot apply. (It is not clear how one would explain this result under a memory-based ordering account, given that relative distance is preserved with conjunction; *pace* Hahn et al., 2018.) But in English, preferences weaken but persist in the presence of conjunction. One way to understand this result is that in languages where multi-adjective strings optionally feature conjunction (as in English), the regularity introduced in conjunction-less strings can bleed over to strings with conjunction. English speakers thus internalize the statistical ordering regularity from non-conjoined adjective strings and use that knowledge to inform preferences for conjoined strings. In Spanish, where multi-adjective strings often call for conjunction, there is less of a source for an ordering regularity that could be extended by analogy to the conjoined strings.
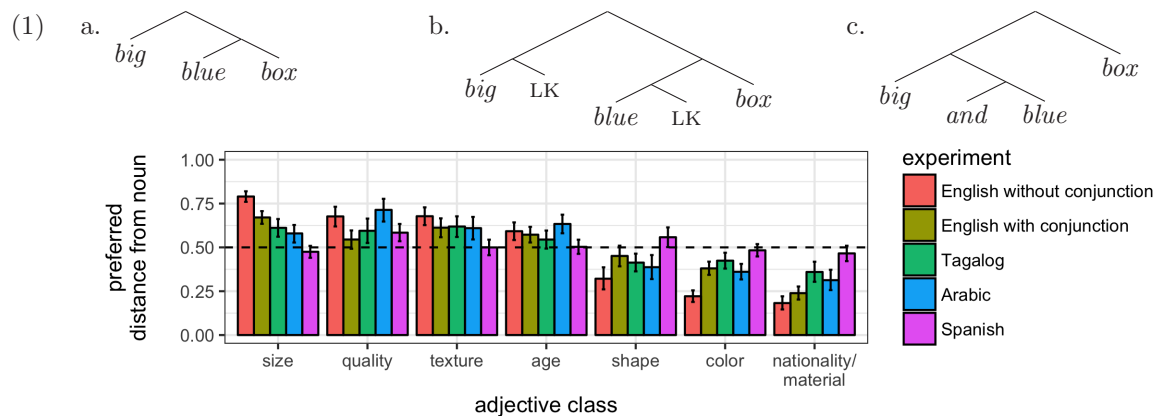
(1) a. [big [blue box]]   b. [big LK [blue LK box]]   c. [big [and blue] box]

Fig. 1: Ordering preferences grouped by semantic class. Higher values indicate that a class's adjectives are preferred farther from the modified noun. The dashed line indicates the absence of stable preferences. Error bars represent bootstrapped 95% confidence intervals.

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