

Mandarin has subjectivity-based adjective ordering preferences in the presence of *de*

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Abstract. We investigate adjective ordering preferences in Mandarin, a language that has been claimed to have English-like preferences, but only in the absence of the linking particle *de* (Sproat & Shih 1991). Extending the experimental methodology of Scontras et al. (2017), we find evidence of robust adjective ordering preferences in Mandarin when *de* is present. Moreover, the Mandarin preferences are predicted by adjective subjectivity, as in English and other unrelated languages.

Keywords. Mandarin; adjective ordering preferences; LINKER; subjectivity

1. Introduction. Adjective ordering preferences determine the relative order of adjectives in multi-adjective nominals, for example *big blue box* vs. *blue big box*. These preferences have received considerable attention in the linguistics literature thanks to their robustness not only in English, but also cross-linguistically. Several authors report the same preferences across a host of unrelated languages (e.g., Dixon 1982; Sproat & Shih 1991). Recently, Scontras et al. (2017) showed adjective subjectivity to be a reliable predictor of ordering preferences in English: less subjective adjectives are preferred closer to the modified noun. Using the same methodology as Scontras et al., Samonte & Scontras (2019) found subjectivity-based ordering preferences in Tagalog, a language with obligatory linking particles in modification structures. Kachakeche & Scontras (2020) found subjectivity-based preferences in Arabic, and Scontras et al. (2020) found these preferences in Spanish. Arabic and Spanish are languages with post-nominal adjectives that follow the modified noun; their preferences are the mirror-image of the English preferences.

The current work investigates adjective ordering in Mandarin, a language with pre-nominal adjectives that has been claimed to optionally feature linking particles in modification structures. Sproat & Shih (1991) claim that Mandarin has English-like preferences, but only in cases where modification proceeds without a linking particle. In (1) (ex. (2a) from Sproat & Shih 1991), the adjectives appear with the linking particle *de*, and either order is reported to be acceptable; in (2) (ex. (4a) from Sproat & Shih 1991), the adjectives appear without *de* and only one order—the preferred order in English—is reported to be acceptable.

(1) *With de:*

- a. *xiaǒ-de lǜ-de huāpíng*
small-DE green-DE vase
'small green vase'
- b. *lǜ-de xiaǒ-de huāpíng*
green-DE small-DE vase
'green small vase'

(2) *Without de:*

- a. *xiaǒ lǜ huāpíng*
small green vase
'small green vase'

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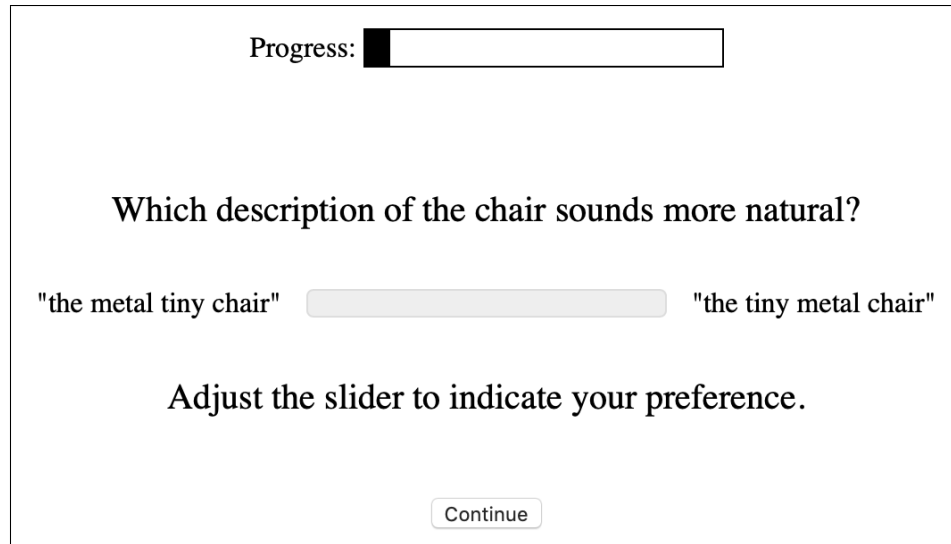


Figure 1: Sample trial from *Experiment 1: Ordering preferences* from Scontras et al. (2017).

- b. **lǜ* *xiǎo huāpíng*
 green small vase

We bring quantitative behavioral data to bear on the judgments reported in (1), namely the absence of ordering restrictions in the presence of *de*. To do so, we measure Mandarin ordering preferences for multi-adjective nominals where *de* appears with both adjectives; we then measure the perceived subjectivity of Mandarin adjectives, and evaluate the extent to which subjectivity predicts ordering preferences in Mandarin. However, before we get to the details of our study, we present the relevant empirical and theoretical background.

2. Background. We begin by reviewing the empirical findings and theoretical claims regarding subjectivity-based preferences and adjective ordering in Mandarin.

2.1. SUBJECTIVITY PREDICTS ADJECTIVE ORDERING PREFERENCES. Scontras et al. (2017) use behavioral and corpus data to support the hypothesis that subjectivity is a reliable predictor of adjective ordering preferences: less subjective adjectives are preferred closer to the modified noun (Hetzron 1978; Tucker 1998; Hill 2012). To measure ordering preferences, Scontras et al. presented naive participants with multi-adjective strings that differed in the relative order of adjectives; participants were instructed to indicate the order that sounded more natural (Figure 1). To validate their behavioral measure, the authors used 38,418 naturally-occurring multi-adjective strings from English corpora to measure, on average, how far a given adjective appears from the nouns it modifies. The behavioral measure was strongly correlated with the corpus measure ($r^2 = 0.83$), so Scontras et al. concluded that their behavioral measure of adjective ordering successfully captures the preferences speakers use when constructing multi-adjective strings.

Scontras et al. operationalized adjective subjectivity in terms of faultless disagreement: is it possible for two speakers to faultlessly disagree about a property ascription for a given adjective? To measure subjectivity, the authors presented participants with a series of dialogues

Progress:

Consider the following situation:

Eric and Kevin see the same cheese.

Eric says: "**That cheese is not rotten.**"

Kevin responds: "**You're wrong. That cheese is rotten.**"

Can both Eric and Kevin be right?

No, somebody must be wrong. Yes, it's a matter of opinion.

Figure 2: Sample trial from *Experiment 2: Faultless disagreement* from Scontras et al. (2017).

in which two speakers disagree about a property; the task was to evaluate whether both speakers could be right while they disagreed (Figure 2). To the extent that both speakers can be right while disagreeing, the adjective admits that degree of faultless disagreement, an index of subjectivity.

To test the hypothesis that subjectivity predicts ordering preferences, Scontras et al. used their faultless disagreement subjectivity scores to predict the ordering preferences they measured behaviorally. Subjectivity was found to account for 88% of the variance in the ordering preferences ($r^2 = 0.88$, 95% CI [0.77, 0.95]), providing strong support for the claim that subjectivity predicts adjective ordering in English. Subsequent work has extended the methodology of Scontras et al. to other languages, finding subjectivity-based adjective ordering in Arabic, Spanish, and Tagalog (Samonte & Scontras 2019; Scontras et al. 2020; Kachakeche & Scontras 2020).

In an attempt to explain why subjectivity should play the role it does in adjective ordering preferences, several authors have suggested that ordering adjectives with respect to decreasing subjectivity maximizes communicative success (Hahn et al. 2018; Simonič 2018; Franke et al. 2019; Scontras et al. 2019). In other words, a speaker is more likely to successfully communicate the intended message to a listener when less subjective adjectives appear closer to the modified noun. The details of the various accounts differ, but they share a similar prediction: the pressures delivering subjectivity-based ordering preferences should apply cross-linguistically.

2.2. ADJECTIVE ORDERING IN MANDARIN. Sproat & Shih (1991) investigate adjective ordering cross-linguistically, with a particular focus on Mandarin. They begin with observations like those in (1) and (2), showing that with *de* Mandarin ordering is unrestricted, but without *de* Mandarin has stable preferences (and those preference match the preferences observed in

English).

The authors analyze *de* as a relative clause marker (Huang 1982), such that adjectives appearing with *de* serve as relative clause predicates. As relative clause predicates, *de*-adjectives are said not to modify nouns directly. This leads to the authors' claim that adjective ordering preferences obtain just in case the adjectives involved are "hierarchical direct modifiers." Moreover, the preferences that obtain are universal across languages. In Mandarin, only without *de* do adjectives participate in hierarchical direct modification, which is why only without *de* do we find ordering preferences—or so Sproat & Shih claim. The remainder of this paper tests the empirical claim from Sproat & Shih that *de*-adjectives do not exhibit ordering preferences in Mandarin.

3. Experiment 1: Measuring ordering preferences in Mandarin. First, we need to determine whether Mandarin has ordering preferences in the presence of *de*, thereby testing the claim from Sproat & Shih (1991) that adjectives are freely ordered when appearing with *de*. We measured ordering preferences using an extension of the ordering preferences experiment from Scontras et al. (2017), using Mandarin translations of the original English materials.

3.1. PARTICIPANTS. We recruited 104 participants through Amazon.com's Mechanical Turk crowdsourcing service. All participants were compensated for their participation. On the basis of their responses to a post-test demographics questionnaire, we identified 32 Mandarin speakers (22 female, 10 male). The participants indicated Mandarin as their native language, and reported that they lived in a Chinese-speaking country for more than five years both before and after the age of eight; we included data from these 32 participants in the analyses reported below.

3.2. PROCEDURE. Participants indicated their preferences for pairs of multi-adjective strings formed from 26 adjectives from seven semantic classes, together with ten nouns. Adjectives and nouns were direct translations of the English materials from Scontras et al. (2017); where direct translation was not possible, we used Mandarin words from the same semantic class. The full set of materials appears in Table 1.

Participants encountered a series of multi-adjective nominals and indicated which multi-adjective nominal sounded more natural. Participants indicated their preference by adjusting a slider with endpoints labeled with multi-adjective nominals that differed on the relative order of the adjectives; all adjectives appeared with *de*. Participants also had the option to indicate that neither option sounded natural. A sample trial appears in Figure 3. Participants completed a total of 26 trials, with adjectives and nouns drawn randomly from the materials in Table 1; in a given multi-adjective string, the two adjectives came from different semantic classes.

We used these naturalness ratings to arrive at a single preferred-distance measure for each adjective; values ranged from 0 (preferred closest to the noun) to 1 (preferred farthest from the noun). In calculating average preferred distance, we ignored trials on which participants indicated that neither option sounded natural (cf. *Experiment 2: Ordering preferences* from Scontras et al. 2017); this process removed 27% of the data.

3.3. RESULTS. Figure 4 plots ordering preferences grouped by lexical semantic class. There, we see that Mandarin does have stable preferences, as evident in the significant deviation from chance (i.e., from 0.5) in several of the class distance measures: some classes are reliably preferred farther from the noun (e.g., *age*, *quality*), while others are reliably preferred closer to

adjective	translation	class	adjective	translation	class	noun	translation	class
新 xīn	new	age	好 hǎo	good	quality	苹 píng guǒ	apple	food
旧 jiù	old	age	圆 yuán	round	shape	香 xiāng jiāo	banana	food
蓝 lán	blue	color	方 fāng	square	shape	胡 hú luó bo	carrot	food
棕 zōng	brown	color	大 dà	big	dimension	芝 zhī shì	cheese	food
绿 lǜ	green	color	长 cháng	long	dimension	西 xī hóng shì	tomato	food
紫 zǐ	purple	color	窄 zhǎi	narrow*	dimension	椅 yǐ zi	chair	furniture
红 hóng	red	color	短 duǎn	short	dimension	沙 shā fā	sofa	furniture
黄 huáng	yellow	color	小 xiǎo	small	dimension	风 fēng shàn	fan	furniture
金属 jīn shǔ	metal	material	宽 kuān	wide*	dimension	桌 zhuō zi	table*	furniture
塑料 sù liào	plastic	material	干 gān	dry*	texture	电 diàn shì	TV	furniture
木制 mù zhì	wooden	material	硬 yìng	hard	texture			
坏 huài	bad	quality	软 ruǎn	soft	texture			
美 měi	beautiful*	quality	湿 shī	wet*	texture			

Table 1: Mandarin adjectives and nouns tested. Words marked with * are cases where direct translation of the original English materials from Scontras et al. (2017) was not possible.

进度:

哪个对于沙发的描述听起来更自然?

"旧的塑料的沙发" "塑料的旧的沙发"

调整滑块以表明你的选择。

选项听起来都不自然

Figure 3: Sample trial from Experiment 1. In this trial, participants adjusted the slider to indicate their preference between ‘old plastic sofa’ vs. ‘plastic old sofa’.

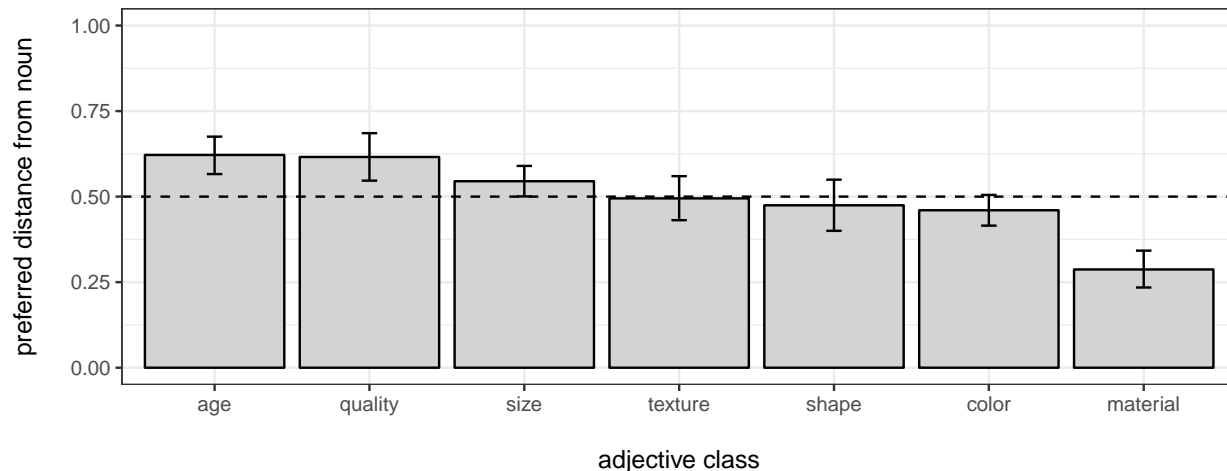


Figure 4: Average naturalness ratings from Experiment 1 grouped by lexical semantic class. Higher values indicate that a class’s adjectives are preferred farther from the modified noun; lower values indicate that a class’s adjectives are preferred closer to the noun. The dashed line indicates chance level, or the absence of stable preferences. Error bars represent bootstrapped 95% confidence intervals drawn from 10,000 samples of the data.

the noun (e.g., *material*). Despite the claim from Sproat & Shih (1991) that there are no ordering restrictions in Mandarin when adjectives appear with *de*, we find clear evidence of stable ordering preferences.

4. Experiment 2: Measuring subjectivity. Having measured Mandarin ordering preferences, we next measured adjective subjectivity using a faultless disagreement task (cf. *Experiment 1: Faultless disagreement validation* from Scontras et al. 2017).

4.1. PARTICIPANTS. We recruited 108 participants who did not take part in Experiment 1 through Amazon.com’s Mechanical Turk. All participants were compensated for their participation. On the basis of their responses to a post-test questionnaire, we used the same criteria as in Experiment 1 to identify 35 Mandarin speakers (21 female, 14 male); their data were included in the analyses reported below.

4.2. PROCEDURE. Participants read a series of dialogues in which two speakers disagreed in the evaluation of an adjectival property. For example, a trial might have speaker A state the Mandarin equivalent of ‘that cheese is yellow’. Speaker B would counter with, ‘you’re wrong, that cheese is not yellow’. Participants adjusted a slider to indicate whether both speakers could be right (coded as 1; maximally subjective), or whether one speaker must be wrong (coded as 0; minimally subjective). Figure 5 presents an example trial from the experiment. Participants completed a total of 26 trials, one for each adjective; on each trial, the noun was chosen at random from the list in Table 1.

4.3. RESULTS. Figure 6 plots average subjectivity scores grouped by adjective class. Having measured ordering preferences in Experiment 1 and subjectivity in Experiment 2, our final

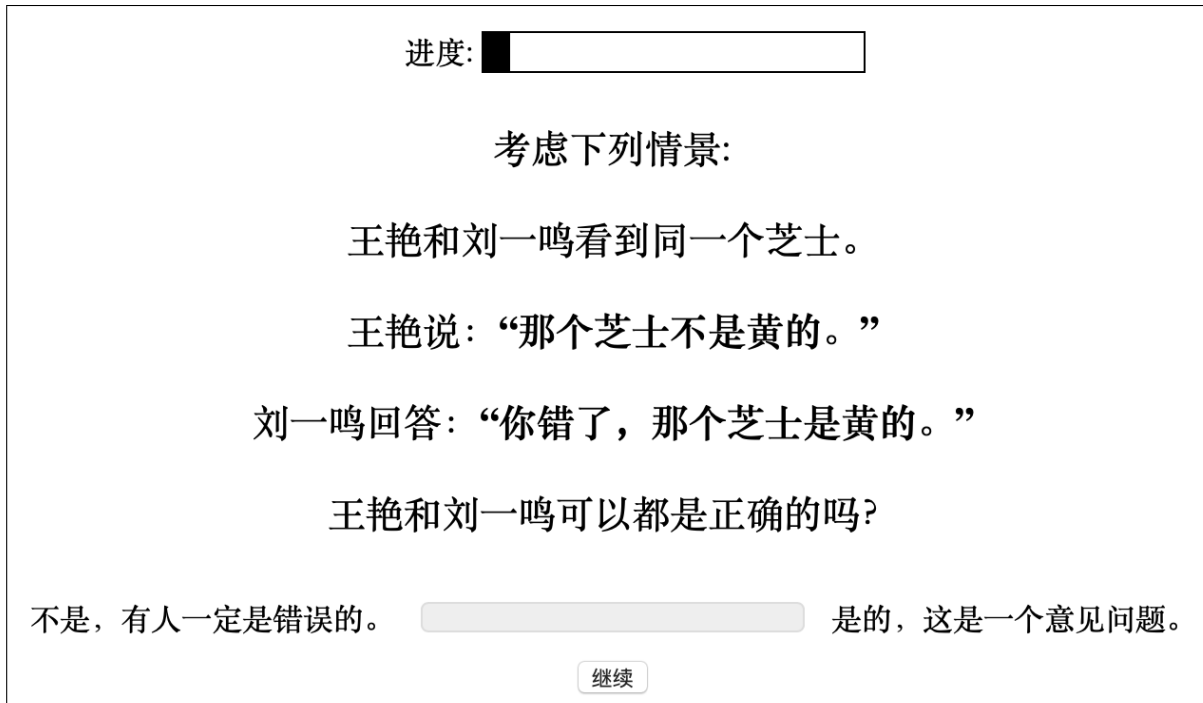


Figure 5: Sample trial from Experiment 2. In this trial, participants adjusted the slider to indicate whether two speakers could both be right while disagreeing about whether some cheese was yellow.

task is to evaluate the extent to which subjectivity predicts adjective ordering preferences in Mandarin. Figure 7 plots adjective naturalness ratings against adjective subjectivity scores. In Mandarin, as in English, subjectivity is a reliable predictor of adjective ordering preferences ($r^2 = 0.48$, 95% CI = [0.26, 0.67]).

5. General discussion. We have found clear evidence that Mandarin does have adjective ordering preferences in the presence of *de*, and that those preference are predicted by adjective subjectivity. Thus, we fail to find support for the empirical claims from Sproat & Shih (1991). Instead, Mandarin adjectives with *de* pattern as in English, with speakers preferring less subjective adjectives closer to the modified nouns.

Adding the current results to the developing cross-linguistic picture, Mandarin appears similar to Tagalog, another language with linking particles in the presence of adjectives (Samonte & Scontras 2019). In Mandarin, the linking particle is often optional; in Tagalog, the linking particle is obligatory (Scontras & Nicolae 2014). However, both languages have subjectivity-based ordering preferences.

There remains the possibility that the pattern of results reported by Sproat & Shih (1991) in fact reflects a difference in the strength of ordering preferences: without *de*, speakers have stronger preferences than when *de* is present. In other words, we might expect to find a stronger correlation between subjectivity and the ordering preferences for multi-adjective phrases without *de*. If one did find that ordering preferences are stronger without *de*, it might be possible

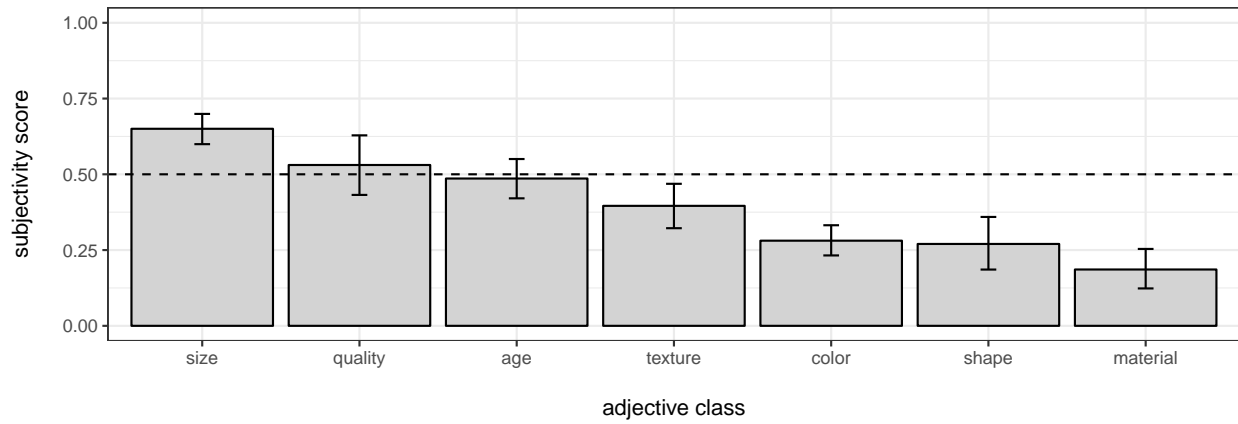


Figure 6: Faultless disagreement scores from Experiment 2 grouped by adjective semantic class. Higher values indicate that a class’s adjectives are perceived as more subjective. Error bars represent bootstrapped 95% confidence intervals drawn from 10,000 samples of the data.

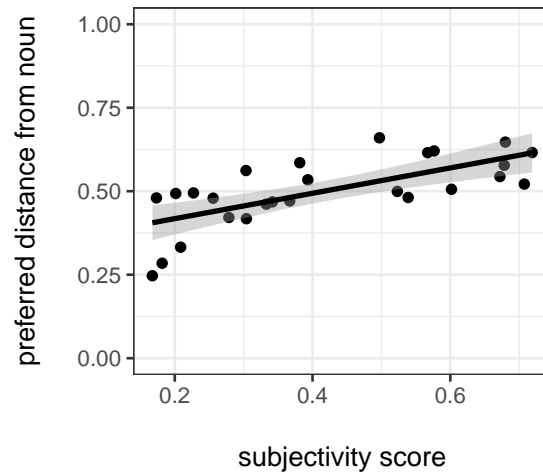


Figure 7: Ordering preferences (obtained in Experiment 1) plotted against subjectivity scores (obtained in Experiment 2) for each of the 26 adjectives tested. Subjectivity accounts for 48% of the variance in the ordering preferences.

to preserve the account of Sproat & Shih, but with some added nuance. Perhaps *de*-less adjectives are the only ones subject to the communicative pressures delivering subjectivity-based preferences, but the ordering regularity from the *de*-less strings gets extended by analogy to multi-adjective strings with *de*—a case of cross-contamination, as it were. Indeed, Scontras et al. (2020) have made a similar claim for ordering preferences with conjunction in English, where subjectivity-based preferences weaken but persist.

References

- Dixon, R.M.W. 1982. *Where have all the adjectives gone? And other essays in semantics and syntax*. Berlin: Mouton.
- Franke, Michael, Gregory Scontras & Mihael Simonič. 2019. Subjectivity-based adjective ordering maximizes communicative success. In Ashok Goel, Colleen Seifert & Christian Freksa (eds.), *Proceedings of the 41st Annual Conference of the Cognitive Science Society*. 344–350. Montreal, QB: Cognitive Science Society.
- Hahn, Michael, Judith Degen, Noah D. Goodman, Dan Jurafsky & Richard Futrell. 2018. An information-theoretic explanation of adjective ordering preferences. In Charles Kalish, Martina Rau, Jerry Zhu & Timothy T. Rogers (eds.), *40th Annual Conference of the Cognitive Science Society*. 1766–1771. Austin TX: Cognitive Science Society.
- Hetzron, Robert. 1978. On the relative order of adjectives. In Hansjakob Sella (ed.), *Language universals*. 165–184. Tübingen: Narr.
- Hill, Felix. 2012. Beauty before age? Applying subjectivity to automatic English adjective ordering. *Proceedings of the NAACL HLT 2012 Student Research Workshop*. 11–16.
- Huang, C.-T. James. 1982. *Logical relations in Chinese and the theory of grammar*: Cambridge, MA: MIT dissertation.
- Kachakeche, Zeinab & Gregory Scontras. 2020. Adjective ordering in Arabic: Post-nominal structure and subjectivity-based preferences. *Proceedings of the Linguistic Society of America (PLSA)* 5(1). 419–430. <https://doi.org/10.3765/plsa.v5i1.4726>.
- Samonte, Suttera & Gregory Scontras. 2019. Adjective ordering in Tagalog: A cross-linguistic comparison of subjectivity-based preferences. *Proceedings of the Linguistic Society of America (PLSA)* 4(33). 1–13. <https://doi.org/10.3765/plsa.v4i1.4511>.
- Scontras, Gregory, Galia Bar-Sever, Zeinab Kachakeche, Cesar Manuel Rosales Jr. & Suttera Samonte. 2020. Incremental semantic restriction and subjectivity-based adjective ordering. In *Proceedings of Sinn und Bedeutung 24*.
- Scontras, Gregory, Judith Degen & Noah D. Goodman. 2017. Subjectivity predicts adjective ordering preferences. *Open Mind: Discoveries in Cognitive Science* 1(1). 53–65. https://doi.org/10.1162/OPMI_a_00005.
- Scontras, Gregory, Judith Degen & Noah D. Goodman. 2019. On the grammatical source of adjective ordering preferences. *Semantics and Pragmatics* 12(7). <https://doi.org/10.3765/sp.12.7>.
- Scontras, Gregory & Andreea Cristina Nicolae. 2014. Saturating syntax: Linkers and modification in Tagalog. *Lingua* 149. 17–33. <https://doi.org/10.1016/j.lingua.2014.05.005>.
- Simonič, Mihael. 2018. *Functional explanation of adjective ordering preferences using probabilistic programming*. University of Tübingen MA thesis.
- Sproat, Richard & Chilin Shih. 1991. The cross-linguistic distribution of adjective ordering restrictions. In Carol Georgopoulos & Roberta Ishihara (eds.), *Interdisciplinary approaches to language: Essays in honor of S.-Y. Kuroda*. 565–593. Dordrecht: Kluwer Academic Publishers.
- Tucker, Gordon. 1998. *The lexicogrammar of adjectives: A systemic functional approach to lexis*. London: Cassell Academic.