

Pragmatic inferences are modulated by informativity across cultures

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Listeners routinely make sophisticated pragmatic inferences during real-time comprehension. For instance, when they hear “Hand me the big...,” they anticipate the referent to be one of a pair that differ in size (e.g., big cup and small cup; [1]). This inference is thought to reflect the listener’s expectation that speakers aim to be optimally informative--saying enough to deliver an unambiguous message, but no more than necessary [2]. However, contra this Gricean explanation, English listeners appear not to anticipate a contrast when they hear a color modifier (e.g., “Hand me the blue...” [3,4]; cf. [5]). Here, **we study pragmatic (contrastive) inference in the Tsimane’**, an indigenous people of the Bolivian lowlands, in order to 1) probe whether informativity expectations are fundamental to language processing or an adaptation specific to industrialized cultures, and 2) test the pragmatic inference account by analyzing modifier interpretation in a language that differs from English in the use of size and color modifiers.

English speakers use size modifiers informatively (they include them when a bare noun would be ambiguous and they usually omit them when they are not required for disambiguation) but, they use color modifiers redundantly (e.g., “Show me the blue shirt” even if there is no other shirt; [6,7]). Use of size modifiers is not well-documented in Tsimane’ (relevant production data are forthcoming) but they are known to use color modifiers at a much lower rate than English speakers, perhaps because they are less likely to refer to objects that differ exclusively in color than people in industrialized cultures [8]. Thus, we predict that the presence of both size and color modifiers should be informative in Tsimane’ and both should elicit contrastive inferences.

Methods: Eye-gaze data were collected from 60 Tsimane’ participants (data collection ongoing for English-speaking controls) in a visual world paradigm experiment modeled on [1]. In 120 trials, participants observed a 4-picture display (Fig. 1) and followed auditory instructions in Tsimane’ (recorded by a translator), such as “Show me the blue cup.” We manipulated contrast (presence vs. absence of a size- or color-contrasted pair in the display) and modification type: size (big, small), color word properties (“low-entropy” colors are used consistently and reliably by Tsimane’ speakers and “high-entropy” colors are used inconsistently; [8]) and target properties (color modifiers preceded either natural or artificial [industrialized] objects). *Results:* Looks to the Target in a 1.4s (mean duration of modifier + noun) time-window starting 200ms after modifier onset (see Fig. 2) were analysed with autoregressive logistic mixed-effects models. We observe a size contrast effect (Target looks more likely in Contrast than No Contrast condition; odds ratio [OR]: 1.16) and color contrast effects (high-entropy natural OR: 1.06, high-entropy artificial OR: 1.04, low-entropy artificial OR: 1.04). Only the low-entropy natural color contrast effect (OR: 0.97) was significantly reduced relative to size, though inspection of the timecourse suggests that target items in that category were unintentionally more predictable, which may have reduced the need for inference or the ability to detect it.

Discussion: First, Tsimane’ speakers made anticipatory looks consistent with contrastive inference while listening to size-modified references, pointing to a universal expectation that speakers typically choose their utterances to be optimally informative. Second, the contrast effect was not significantly smaller for color modifiers relative to size, except in the case of low-entropy color modifiers followed by natural objects. The latter corresponds to the color modification situation most likely to elicit redundancy expectations in Tsimane’, which may account for the lack of inference (but see above for alternative explanation). Control data with English speakers (forthcoming) are needed in order to make strong comparative claims, but the current data suggest that listeners’ inferences may be tuned to the informativity of modifier use particular to their linguistic and cultural experience.

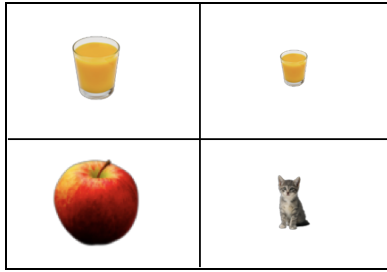


Figure 1. Example display corresponding to “Show me the big cup.” (Contrast condition - Size modification). Top left: Target. Top right: Target pair (replaced with a small distractor image in No Contrast condition). Bottom left: Competitor. Bottom right: Distractor.

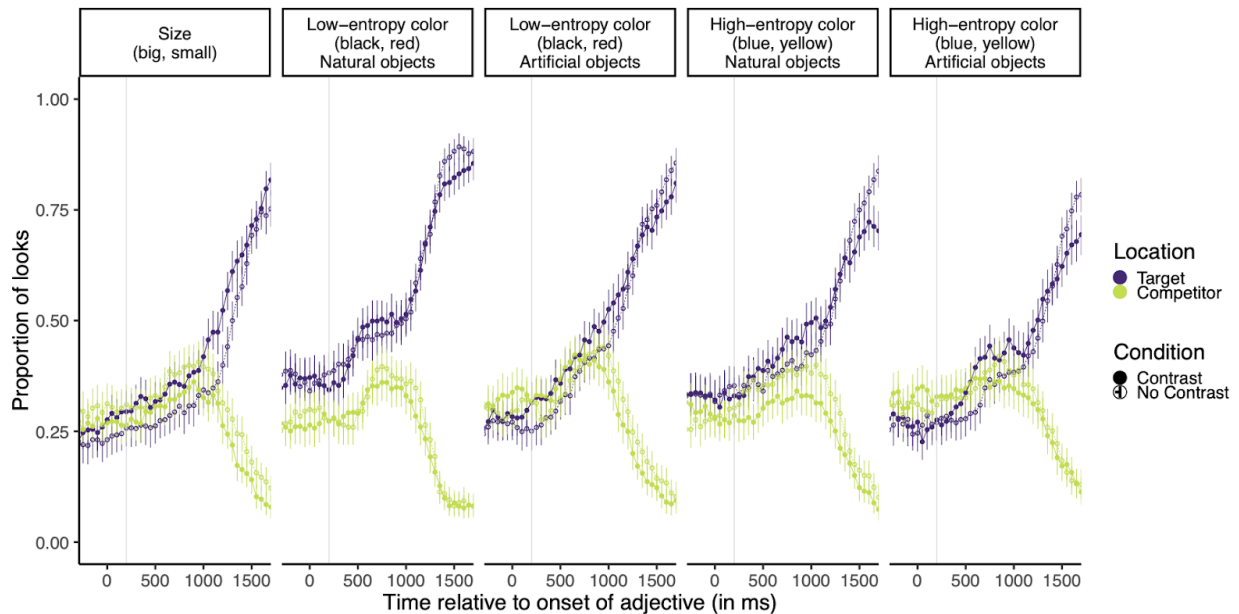


Figure 2. Average timecourse of looks to Target and Competitor images by Condition, separately for each modifier category. Grey lines indicate beginning of analysis window (200ms after modifier onset). Error bars are bootstrapped 95% CIs.

References: [1] Sedivy et al., 1999. *Cognition*. [2] Grice, 1975. *Logic and Conversation*. [3] Sedivy, 2003. *Journal of Psycholinguistic Research*; [4] Sedivy, 2005. *Approaches to studying world-situated language use*; [5] Aparicio et al., 2016. *Proceedings of SALT*; [6] Brown-Schmidt & Konopka, 2011. *Information*; [7] Rubio-Fernández, 2016. *Frontiers in Psychology*. [8] Gibson et al. 2017; *Proceedings of the National Academy of Sciences*.