Incremental contrasts: Why spotting a blue triangle is different in English than in Spanish

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In referential communication, adjectives are normally used to preempt an ambiguity between entities of the same kind. For example, you may refer to 'the blue triangle' to distinguish it from a red triangle. As a listener, this pragmatic expectation would allow you to anticipate the word 'triangle' when you hear 'the blue…' in a situation with a blue triangle, a blue square and a red triangle. However, Sedivy (2003, 2005) observed that people do not derive a contrastive inference in processing color adjectives, and tend to produce color adjectives in contexts where they are not necessary. Sedivy interpreted these results as evidence that color adjectives – unlike material and relative adjectives – tend to be used and interpreted *non-contrastively*.

In this study, we investigated an alternative interpretation of this pattern of results: color contrast may be established across categories, rather than within categories when color adjectives appear in prenominal position (Rubio-Fernandez, 2016). That is, color contrast is established *incrementally*. Thus, in Display A, English speakers may mention color to establish a contrast between the blue triangle and all the other figures. Likewise, in Display C, processing the adjective 'blue' would allow the listener to narrow down the referential domain, establishing a contrast between blue and non-blue figures, rather than between the two triangles.

We predicted that redundant color adjectives (i.e. those that do not discriminate between entities of the same kind) would be used more often in English than in Spanish because prenominal modification is contrastive to the entire set, whereas postnominal modification is contrastive to the subset narrowed down by the head noun. We tested this hypothesis with native speakers of English and Spanish (N=22 per group). The results supported our account: English speakers produced significantly more redundant color adjectives than Spanish speakers did (z=2.054, p=0.04), replicating the results of Rubio-Fernandez (2016) [see Figure 1].

We also predicted that the first word of a modified noun phrase will guide visual search in reference resolution. We tested this hypothesis in a visual-world eye-tracking experiment with native speakers of English and Spanish (N=25 per group). If color contrast is established incrementally, in displays with a SHAPE competitor, English speakers should identify the target referent by its color and not suffer interference from the SHAPE competitor when processing the noun. Conversely, in displays with a COLOR competitor, Spanish speakers should show an earlier preference for the target referent because shape would be discriminatory. On the other hand, competitor interference should result in lower total looking time (dwell time) to the target within the critical region (ADJ+N in English and N+ADJ in Spanish; +200ms corrected).

We used mixed effect linear regression models with maximally converging random effect structures to predict dwell times for the target within the critical region. As predicted, English dwell times for the target were longer in the SHAPE condition than in the COLOR condition (β=89, t=3.32, p<0.05), where the color competitor created a temporary ambiguity in the instructions. In Spanish, dwell times for the target were longer in the COLOR condition than in the SHAPE condition (β=158, t=7.15, p<0.05), because in the latter the noun was ambiguous between two shapes [see Figures 2 and 3]. We further investigated whether the same Spanish speakers would reverse their strategy if tested in English immediately after, and search by color, rather than shape, in line with an incrementality account. As predicted, dwell times for the target were longer in the SHAPE than in the COLOR conditions (β=97, t=5.09, p<0.05) [see Figure 4].

Conclusion: Previous studies (e.g., Sedivy, 2003, 2005; Grodner & Sedivy, 2011) have treated the contrastive interpretation of adjectives as a pragmatic inference, not acknowledging that such inferences can only be derived with prenominal adjectives (since postnominal adjectives already apply to the relevant set). Our results support the view that color contrast is established incrementally, which affects both the production and processing of color adjectives. That both these processes are grounded in *incremental visual processing* is an important insight that has been overlooked by pragmatic models of referential communication.

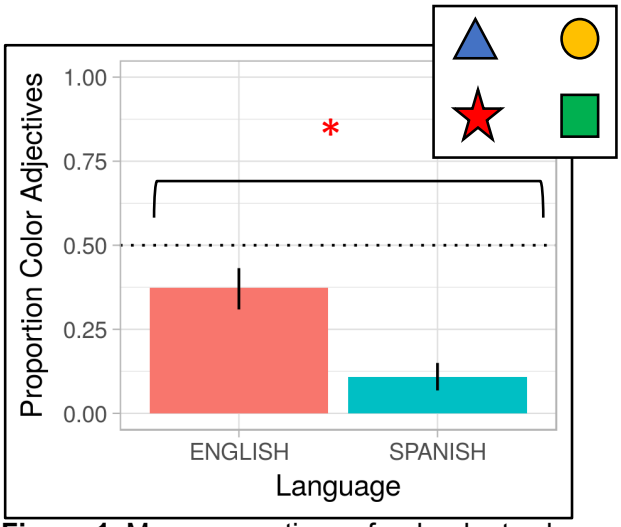

Figure 1: Mean proportions of redundant color adjectives produced in English and Spanish when referring to a target in A-Displays.

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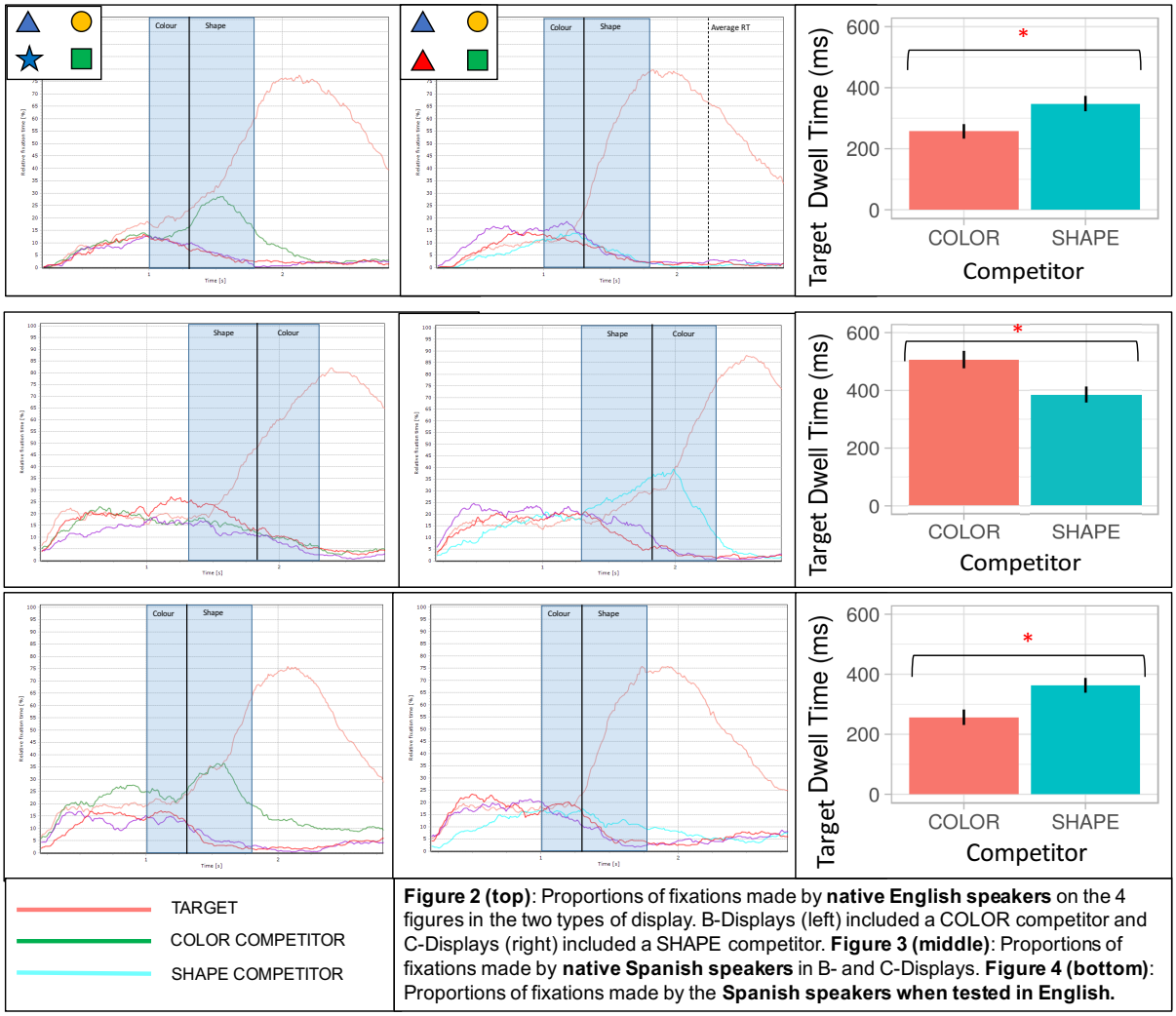

Figure 2 (top): Proportions of fixations made by **native English speakers** on the 4 figures in the two types of display. B-Displays (left) included a COLOR competitor and C-Displays (right) included a SHAPE competitor. **Figure 3 (middle)**: Proportions of fixations made by **native Spanish speakers** in B- and C-Displays. **Figure 4 (bottom)**: Proportions of fixations made by the **Spanish speakers when tested in English.**