Colour and Discriminability Drive Over-informative Referential Expressions

Speakers are persistently *over-informative* in reference: they provide their listeners with redundant information (Pechmann, 1989). While redundancy seems to violate Grice's (1975) maxim of quantity, some propose that over-informative reference is *rational,* employed when the redundant information facilitates the perceptual processing of the listener (Rubio-Fernandez, 2021). This proposal tracks with two empirical observations: 1.) Speakers over-inform when the referred attributes are perceptually distinctive in a *visual* scene, and 2.) Speakers over-inform using colour attributes, which are held to be inherently perceptually distinctive relative to other attributes such as material constitution (Rubio-Fernandez, 2021; Kursat & Degen, 2021).

This *Perceptual Discriminability* account provides a plausible explanation of reference design as interacting with perceptual factors; however, prior studies have hitherto failed to disentangle whether (H1) the asymmetric use of colour is due to colours' high perceptual discriminability or (H2) colour is unique in reference over-and-above factors of discriminability. While the use of colour in reference declines when colour is made less perceptually discriminable (Viethan et al., 2017), it is unknown whether this reduction in discriminability eliminates speakers' preference for colour use relative to alternative attributes such as material constitution. Thus, it may be the case that perceptual discriminability only partially accounts for colours' asymmetric use.

We addressed this possibility by manipulating the perceptual discriminability of material constitution and colour in a language production experiment (N=72; see Fig. 1). We employed classic psychophysical methods of adaptive perceptual staircases to derive participant-calibrated high- and low- discriminability stimuli for colours and materials. While colour presentations were (necessarily) visual, we used audio for material presentations: the sound of wood or metal. This use of audio is two-fold: first, it allows us to investigate perceptual discriminability as a modality-general property, testing the strongest possible version of the Perceptual Discriminability account. Second, it allows us to overcome the difficulty of visually discriminating material constitution. In the language production experiment, participants were presented with coloured objects that generated an impact sound upon hitting an imaginary surface.

We investigated H1 and H2 using Bayesian logistic regressions with by-participant random intercepts, supporting both hypotheses (Figure 3). Across conditions, participants were more likely to over-inform using colour relative to material (β = 1.41, 95%CI = [1.19 – 1.64]), were more likely to over-inform in the presence of low-discriminability stimuli (β = 0.28, 95%CI = [0.12 – 0.43]), and crucially, were more likely to over-inform when redundancy was necessary to anchor reference in a high-discriminability attribute (β = 1.13, 95%CI = [0.88 – 1.39]). The model including these predictors ($\log_{10}$ Marginal Likelihood = −1191.11) far outperformed a null model's predictions ($\log_{10}$ Marginal Likelihood = −1308.62).

Confirming prior accounts (Rubio-Fernandez, 2021; Kursat & Degen, 2021), our results suggest that perceptual discriminability drives over-informative reference: speakers anchor their reference in easy-to-discriminate attributes across visual colour and auditory material. However, perceptual discriminability alone cannot account for the disproportionate use of colour: over and above such effects, colour is privileged in over-informative reference.
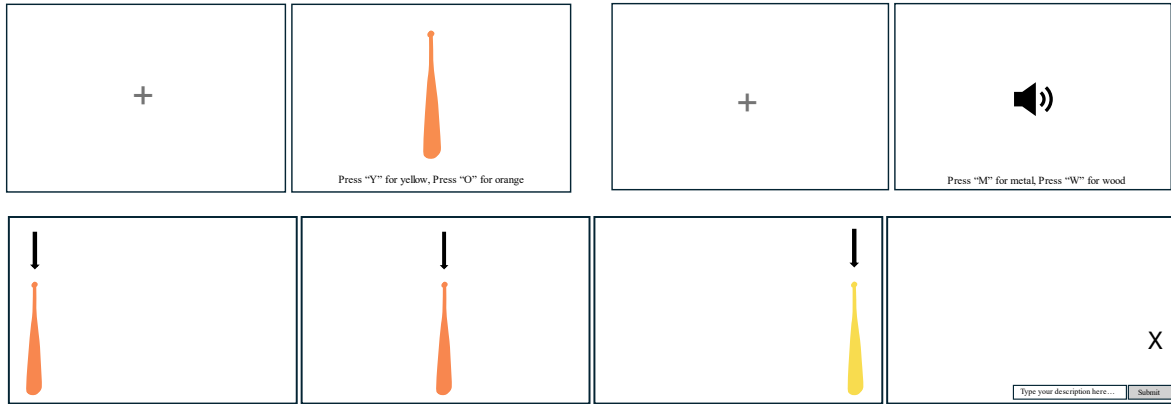
Figure 1. Task figures. The top panels show the psychophysical task, in which speakers are asked to label stimuli that vary in perceptual discriminability. Once stimuli of high- and low-discriminability stimuli are identified for colour and then material, participants move to the language-production experiment (Bottom Panel).

Colour Uniquely Demarcates Reference (Material Does Not)
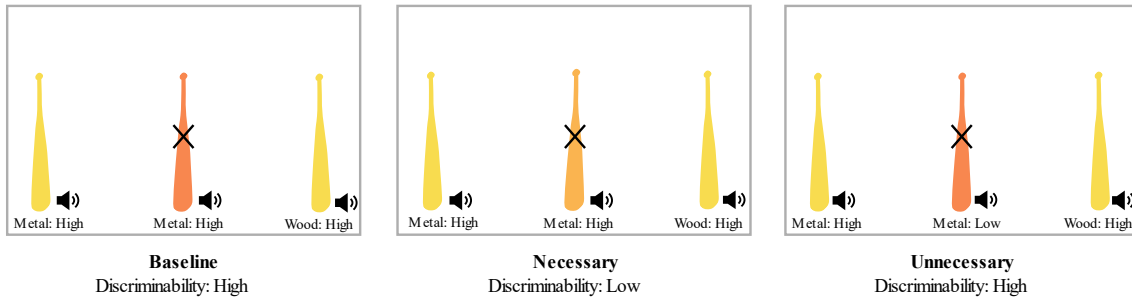
Figure 2. Illustration of experimental conditions, using colour-sufficient trials as an example case.
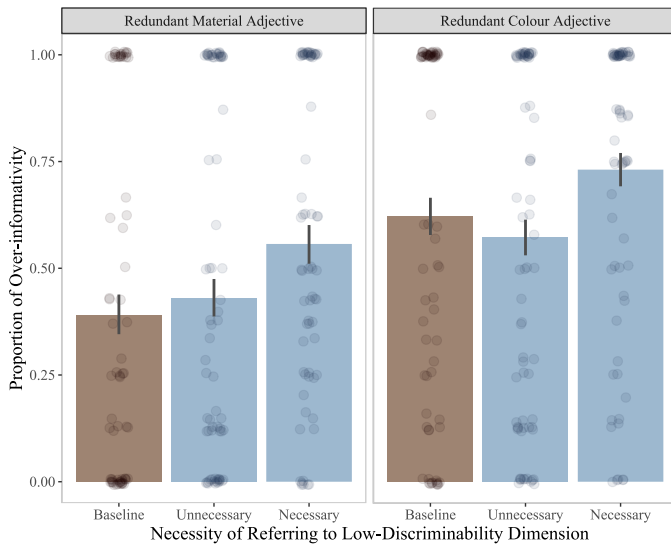
Figure 3. "Baseline" refers to high-discriminability trials. Mean proportion of over-informativity when object property discriminability is high (Base), when the property discriminability is low and not necessary to isolate the referent (Unnecessary), and when the property discriminability is low and necessary to establish reference (Necessary). Lines represent 95% bootstrapped CIs. Points represent participant means.

References

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