Entropy management in English and German noun phrases

Dorothée B. Hoppe (Univ. of Groningen), Edward Gibson (MIT), Jacolien van Rij (Univ. of Groningen), Petra Hendriks (Univ. of Groningen), Michael Ramscar (Univ. of Tübingen)
d.b.hoppe@rug.nl

German and English noun phrases make an interesting 'minimal pair' when it comes to their management of information (in the form of entropy) in the signal: while both languages position adjectives prenominally and both use articles, only German nouns are gendered. This makes German articles (which agree with noun gender) more informative about upcoming nouns than English articles. Furthermore, corpus data shows a higher proportion of prenominal adjectives in English than in German, supporting recent suggestions that English prenominal adjectives contribute more to reducing noun entropy in signals than German prenominal adjectives (Dye et al., 2015, 2018). To examine whether this difference reflects speakers' sensitivity to the information articles and adjectives convey about upcoming nouns in production, we tested German and English speakers' propensity to produce prenominal color adjectives in an online reference production task (as in Rubio-Fernández et al., 2020; Wu & Gibson, 2021).

Participants were asked to describe a colored target shape presented with three competitor shapes by completing the sentence "Please click on ...". Each stimulus contained four different shapes in four different colors. Crucially, as shape nouns in German can have different genders, German articles can convey information about a shape noun coming up in a signal in contexts in which several shapes are present. To test whether speakers' sensitivity to the information that articles and adjectives provide about nouns causes them to use prenominal adjectives differently in the two languages, we created two kinds of stimuli: either the gender of the German target shape noun differed from the gender of the competitor nouns (*German informative condition*, Fig. 3a) or all four shape nouns had the same gender in German (*German uninformative condition*, Fig. 3b). As a third condition we tested English speakers (where articles are always uninformative; *English uninformative condition*). We predicted that Germans would produce the same number of prenominal color adjectives as English speakers when German articles were uninformative, but that their color adjective use would decrease when articles were informative.

In Study 1, participants (n = 300) frequently dropped the article. Crucially, while they were always ungrammatical, article omissions were systematic regarding article informativity in the three conditions: English speakers produced the least articles, followed by Germans in the uninformative condition and Germans in the informative condition, which produced most articles (Fig. 1a). Furthermore, missing articles impaired the production of prenominal adjectives in German while English speakers were not affected by article omissions (Fig. 1b & c). In Study 2, participants were explicitly asked to produce grammatical sentences (n = 900). This manipulation successfully caused them to produce noun phrases with articles which confirmed our main hypothesis: English speakers produced significantly more prenominal adjectives than German speakers in the informative condition; however, crucially, when German articles were uninformative, Germans produced as many prenominal adjectives as English speakers (Fig. 2).

The results of both studies suggest that speakers are sensitive to the information articles and adjectives provide about upcoming nouns. In Study 1, articles were produced according to how informative they were about the following noun; additionally, German articles appeared to be not only informative about nouns but also about adjectives, since adjective production in German was impaired without articles. In Study 2, Germans behaved like English speakers in contexts in which articles were uninformative, producing more prenominal adjectives, whereas when German gendered articles conveyed information about nouns, the rate at which they produced adjectives declined. These results suggest that rather than playing only a semantic role, an idea based on the traditional assumption of adjectives being 'content' words, prenominal adjectives seem to play more a grammatical role, quite similar to articles, traditional 'function' words.
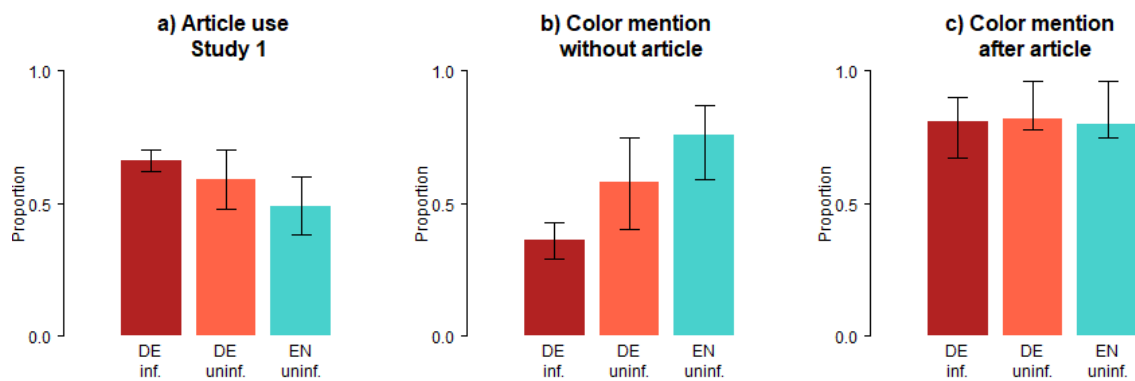
Figure 1: Model estimates (CI ±1.96 SE) for Study 1 (n = 300) of a) the overall proportion of articles produced by condition (article informative in German, article uninformative in German, English), b) the proportion of prenominal color adjectives produced without articles and c) with articles.
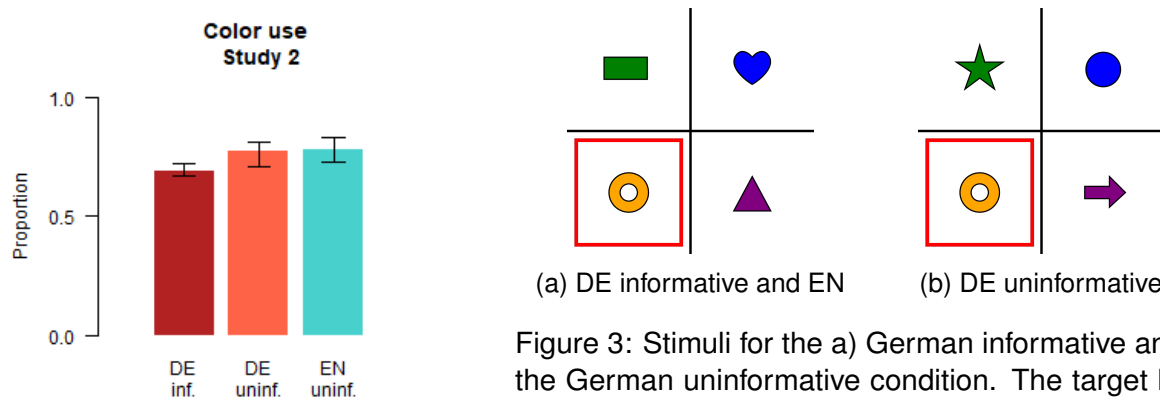

Figure 2: Model estimates (CI ±1.96 SE) of the proportion of prenominal color adjectives produced in Study 2 (n = 900, only noun phrases with articles).

(a) DE informative and EN   (b) DE uninformative

Figure 3: Stimuli for the a) German informative and b) the German uninformative condition. The target here is masculine (*der* Ring) in German. In a) competitors are all neuter (*das* Rechteck, *das* Herz, *das* Dreieck), which makes the target article informative, while in b) they are all masculine (*der* Stern, *der* Kreis, *der* Pfeil), which makes the target article uninformative. As English articles are uninformative in both contexts, we tested English speakers only in one context, namely a).

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