Lexical selection in spoken production: A web-based study of the effects of semantic context and name agreement in multi-word production

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To communicate effectively, speakers must select word units (i.e. perform lexical selection) and retrieve the corresponding phonological word forms from their mental lexicon based on to-be-expressed concepts (Levelt et al., 1999). Whether lexical selection is a competitive or non-competitive process is a matter of ongoing debate. The present study explored the nature of lexical selection by focusing on the effects of semantic context (homogeneous, heterogeneous) and name agreement (high, low) (e.g. Alario et al., 2004; Belke & Meyer, 2007). Existing models of semantic context effects disagree on whether lexical selection is competitive or not, and they make different predictions about whether the semantic context effect is influenced by the number of activated lemmas during lexical selection. The models with lexical competition (e.g. Howard et al., 2006) predict that the semantic context effect should be stronger for low name agreement pictures than high name agreement pictures, while the models assuming non-competitive lexical selection (e.g. Oppenheim et al., 2010) predict that the semantic context effect should not be influenced by name agreement.

While web-based experiments have been embraced as an alternative to lab-based testing (e.g. Sauter et al., 2020), online experiments can currently not offer the audiovisual synchrony needed to accurately record onset latencies in speech production studies (Bridges et al., 2020). To circumvent poor audiovisual synchrony, we created a web-based modified blocked-cyclic naming paradigm in which reliable dependent variables, such as utterance duration and speech fluency, were measured offline. Forty-one participants[i] named a total of sixteen simultaneously presented pictures that were either four tokens from the same semantic category (homogeneous context), or four tokens from different categories (heterogeneous context) on each trial. Name agreement (high, low) of the pictures was also varied orthogonally. Sample picture grids in each of the four conditions are shown in Figure 1.

Five dependent variables were measured to index naming performance: accuracy, utterance duration, total pause time, total number of chunks (groups of words spoken without intervening pause), and the first chunk length. Bayesian mixed-effect models (BMMs) and Bayes factors (BFs) were used to assess the effects and their corresponding evidence, respectively. Both BMMs and BFs showed robust name agreement effects on all measures except accuracy, with longer utterance durations and longer pause times (Figure 2a), and more response chunks and a shorter first chunk length (Figure 2b) for low name agreement pictures than high name agreement pictures. This replicates the effects observed in lab-based studies (e.g. Alario et al., 2004). BMMs revealed that semantic context effects arose primarily from the second row onwards, showing that participants took longer, paused longer, grouped their responses into more chunks when naming pictures in the homogeneous context than in the heterogeneous context, but BFs showed these effects were relatively weak. BMMs revealed that name agreement and semantic context did not interact on any dependent variables, with BFs showing moderate evidence or better (> 3 for null interactions).

The results suggest two possibilities: One is that lexical selection may be achieved without competition, as proposed by Oppenheim et al. (2010). The other possibility is that lexical selection is a competitive process, but the interaction was too weak to be discovered in the current study. This study therefore expands on existing research on these two aspects of lexical selection (e.g. Alario et al., 2004; Belke & Meyer, 2007). In addition, the present study supports the feasibility of investigating of speech production in a web-based platform by measuring reliable dependent variables (e.g. utterance duration and speech fluency). This takes an important step forward in implementing web-based experiments of spoken production: multi-word naming tasks that tap lexical selection or later stages of production (phonological or phonetic encoding) are good candidates for future work.

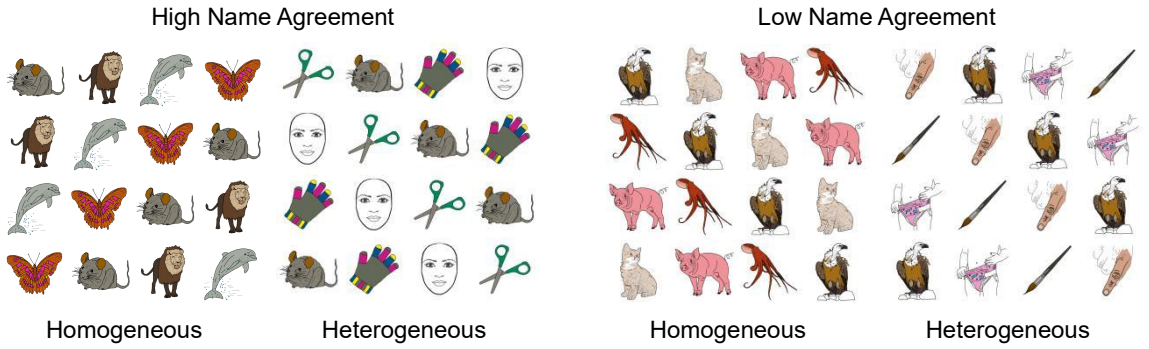

Figure 1. *Sample stimuli per condition*

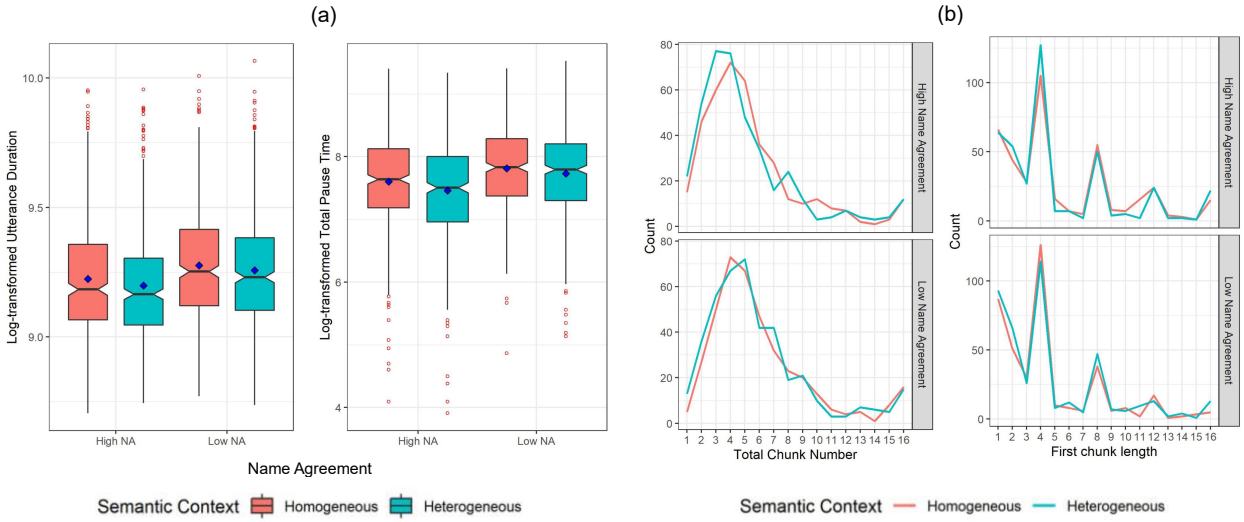

Figure 2. a) *Log-transformed utterance duration (left) and log-transformed total pause time (right) split by name agreement (NA: high, low) and semantic context (homogeneous, heterogeneous). Blue squares represent condition means and red points reflect outliers. b) Total chunk number (left) and the first chunk length (right) split by name agreement (high, low) and semantic context (homogeneous, heterogeneous).*

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[i] The sample size is about twice the sample size used in most lab-based semantic context experiments and seemed appropriate for an exploratory web-based study.