## Untangling frequency and word type effects on lexical decision processes

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Many studies have reported that word frequency influences language processing. For example, the lexical decision (LD) - deciding whether a character string is a word or not - becomes faster and more accurate when word frequency is increased. Yet, our understanding of the precise way continuous changes in frequency impact the different cognitive processes involved in reaching LDs remains limited. To address this, we conducted an EEG LD study in which we manipulated the continuous frequency of Dutch words *and* non-words (pseudo words and random character strings) and observed the impact on the duration of LD processing stages using a recent machine-learning technique.

To obtain frequency scores compatible with words and non-words we relied on Google result counts. The trial-level duration estimates of LD processing stages were recovered from EEG using a combination of Hidden semi-Markov models and multivariate pattern recognition (Anderson et al., 2016, *Psychol. Rev.*). These duration estimates for each processing stage were then analyzed using generalized additive mixed models. We included (potentially nonlinear) effects of frequency and word type as predictors.

Confirming previous research, we found evidence for six processing stages. For the first three processing stages (0-70, 70-150, 150-240 ms) stage duration increased for more frequent stimuli. However, already in these earliest stages the effect of frequency differed slightly yet reliably between word types. For the last three processing stages we observed more complex effects of frequency and word type. In contrast to most earlier findings, this suggests that frequency has an effect on virtually every process involved in LD, including the earliest ones likely related to visual processing and orthographic encoding.