

The footprint of semantic and phonological interference in picture naming in aphasia: Preliminary evidence from ERP

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Traditional models of language production posit two stages (lexical selection and segmental encoding) for producing a word. This assumption has been called into question by a recent (ignition) model (Strijkers et al., 2017), which assumes rapid parallel activation of the whole network of semantic, lexical and phonological features. By manipulating semantic and phonological similarity in a blocked naming paradigm, we investigated control processes that operate on lexical selection and segmental encoding, respectively. Semantic similarity during repeated naming of pictures has led to reliable interference, but the effect of phonological similarity has been less clear. While onset overlap usually induces reliable facilitation (Wang et al., 2018), we have recently shown that overlap in non-onset segments creates reliable interference (Nozari et al., 2016). Because of their sensitivity to the manipulation of similarity, individuals with aphasia are good candidates for studying the effects of similarity manipulations. We present preliminary behavioral and ERP data from an individual with aphasia to test (a) whether both semantic and rhyme similarity lead to reliable interference, and (b) whether the timeline of such interference—and recruitment of control processes for its resolution—is better aligned with the predictions of the two-stage or the ignition model.

The participant SA presented with near-intact semantic comprehension and auditory word-comprehension, 80% accuracy in picture naming (with a predominance of semantic errors). The word-pair task was adapted from Nozari et al. (2016). In a fully-balanced design, 30 pictures were paired into 45 blocks of semantically-related (e.g., pie/cake), rhyme-related (e.g., pie/tie), and unrelated (e.g., pie/hair) items, administered over three sessions with each session containing a mixture of all three block types. Each block contained only one pair. On the first 16 trials of the block (Straight phase), the participant named each picture by its canonical name. On the next 16 trials (Reversed phase), upon viewing each picture, the name of the other picture was produced.

We obtained 1440 responses in total. Since the effect of similarity was comparable in the Straight and Reversed phases, we collapsed the two. Compared to the unrelated condition ($RT=1272\pm 439ms$, $Error=7$), semantic similarity induced significantly slower RTs ($1346\pm 457ms$; $z=-2.40$, $p=0.017$) and numerically more errors (14; $\chi^2=2.39$, $p=0.12$), while rhyme overlap produced significantly slower RTs ($1337\pm 441ms$; $z=-2.54$, $p=0.011$), as well as more errors (19; $\chi^2=5.69$, $p=0.017$). Electrophysiological results revealed a significant effect of semantic similarity as early as 250ms over left central electrodes ($t=-2.4$, $p<0.05$), and a later effect of phonological overlap from 350ms over occipital-parietal electrodes ($t=-3.4$, $p<0.05$).

The results showed clear interference as a result of both semantic and rhyme similarity, adding to the evidence that non-onset phonological overlap increases the need for control in word production. The timeline of phonological interference matched the phonological facilitation reported in Wang et al. (2018), and was visibly later than the effect of semantic interference in both studies. Collectively, these results support a two-stage model of word production with consecutive lexical selection and segmental encoding, each requiring its own control processes.

References:

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