HOW SPEECH RATE NORMALIZATION AFFECTS LEXICAL ACCESS

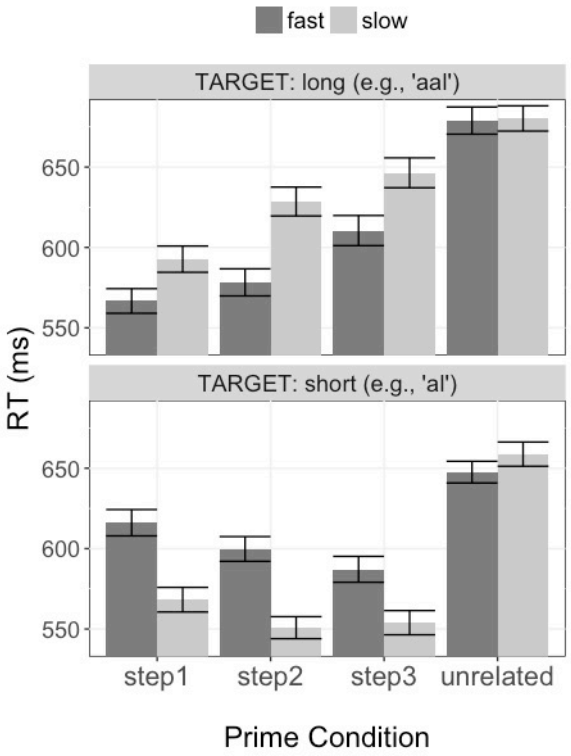
Merel Maslowski (Max Planck Institute for Psycholinguistics), Antje S. Meyer (Max Planck Institute for Psycholinguistics), & Hans Rutger Bosker (Max Planck Institute for Psycholinguistics)
merel.maslowski@mpi.nl

Speech can be produced at different speech rates, with considerable variation between talkers, within talkers, and even within utterances. Listeners have been suggested to cope with this temporal variation by normalizing segmental durations for surrounding speech rates. This has, for instance, been demonstrated in categorization experiments in which participants are presented with ambiguous speech sounds (e.g., between short /ɑ/ and long /a:/ in Dutch) embedded in fast or slow precursor sentences. A fast speech rate typically biases target perception towards the long vowel and a slow speech rate to the short vowel.

This rate normalization process has been argued to involve low-level automatic perceptual processing, since effects arise immediately upon hearing the target vowel, are insensitive to talker voice changes between precursors and targets, and can even be induced by non-speech precursors (e.g., tones). However, rate normalization has been studied exclusively with a two-alternative forced choice (2AFC) paradigm, where participants' attention is directed to the vowel contrast. If rate-dependent speech perception involves early general auditory mechanisms, rate normalization should also influence linguistic processing when no overt categorization response is required. We investigated this hypothesis using a cross-modal repetition priming paradigm. This also allowed us to assess how normalization affects lexical access processes.

Experiment 1 (*N* = 12 native speakers of Dutch) established rate normalization in a 2AFC task. Three-step spectral continua (1: /a:/-like; 3: /ɑ/-like) were created for 75 minimal target pairs (e.g., *al* /ɑl/ "already" - *aal* /a:l/ "eel"), and embedded in a rate-manipulated fixed precursor sentence (using PSOLA). As expected, categorization data revealed effects of the spectral continua and of the precursor, with fast precursors biasing perception towards /a:/.

Experiment 2 (*N* = 80) involved cross-modal repetition priming with a lexical decision task, using the sentences from Experiment 1 as auditory primes (plus control primes with unrelated words without the /ɑ–a:/ contrast). Targets were always the short or the long member of the /ɑ–a:/ minimal pairs, presented orthographically immediately after prime offset (plus an equal number of non-words with /ɑ/ or /a:/). The response times in each condition are illustrated on the right. Linear Mixed Models showed a significant interaction between Target Word (top panel: long; bottom panel: short) and Prime Condition (Spectral Step + unrelated controls), indicating shorter RTs for 'long' targets with more /a:/-like primes (and vice versa). Importantly, we also found an interaction between Target Word and Precursor Rate (dark grey: fast; light grey: slow). This interaction revealed shorter RTs for 'long' targets with fast primes, but longer RTs for the same targets with slow primes (and vice versa for 'short' targets).



These findings show that speech rate effects are induced even when no explicit attention is drawn to the temporally ambiguous word. This outcome is compatible with the view that rate normalization involves low-level perceptual processing, in turn affecting higher-level linguistic processes such as lexical access.