How we regulate speech rate: phonetic evidence for a 'gain strategy' in speech planning

Joe Rodd[1][2], Hans Rutger Bosker[1][3], Mirjam Ernestus[2][1], Louis ten Bosch[2], Antje S. Meyer[1]

[1] Max Planck Institute for Psycholinguistics, Nijmegen, the Netherlands
[2] Centre for Language Studies, Radboud University, Nijmegen, the Netherlands
[3] Donders Institute for Brain, Cognition and Behaviour, Radboud University, The Netherlands

`joe.rodd@mpi.nl`

Speech can be produced at different rates. The ability to produce faster or slower speech may be thought to result from executive control (EC) processes enlisted to modulate lexical selection and phonological encoding stages of speech planning. However, the EC strategies adopted to achieve accelerated or decelerated speech and their phonetic consequences remain unknown. This study compared two different cognitive accounts: (1) EC in the form of adjusted input activation levels to the planning network (the *gain strategy*) predicts that rate modulation is achieved by adjusting gesture duration, whilst overlap between gestures remains constant. Conversely, (2) EC in the form of adjusted selection thresholds within each planning stage (the *threshold strategy*) predicts modulated overlap and stable gesture durations across rates.

In our picture naming experiment, twelve participants were recorded (in Dutch) naming pre-familiarised (C)CV.CVC words arranged on a 'clock face' at three speaking rates (132wpm, 93wpm, 66wpm) indicated by a cursor. We measured acoustically evident gestural overlap by identifying above-average MFCC instability falling between the MAUS-aligned vowel and consonant centres. From this metric and manually corrected word onsets and offsets, we derived three dependent measures: gestural overlap duration, first syllable duration, and second syllable duration.

Mixed-effects models showed no difference in gestural overlap duration across the rate conditions. Relative to the middle rate, syllable gestures were shorter in the fast condition, and longer in the slow condition (particularly in the second, unstressed syllables). These results support an account where the *gain strategy* is the dominant mechanism of rate control, with a subordinate role for the *threshold strategy*.