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Closure Positive Shifts (CPS) as reflecting on-line segmentation of prosodic rhythm-groups in speech

Marks of structural prosody in speech as opposed to lexical marks like “word-stress” are not coded in language but appear universally. These marks associated with rhythm and intonation groups (RGs and IGs) also occur spontaneously in the oral recall of digits or non-sense series, which generally suggests that structural prosodic groupings can be linked to processes of short term memory. In research using ERPs, it has been found that IGs in meaningful utterances as well as in meaningless series evoke a “closure positive shift” (CPS) (Steinhauer 1999, Pannekamp 2005). The present study adopts the view that CPS reflects instead the effects of RGs. Grouping effects on recall are well documented. What is less recognized is that such grouping obeying to similar constraints also appear in speech (Boucher, 2006), suggesting that CPS may capture an online segmentation relating to short-term memory processes.

To illustrate that CPS is specifically evoked by RGs, two experiments were devised where RGs were manipulated independently from IGs. Experiment 1 involved meaningful French sentences, whereas Experiment 2 used meaningless series of syllables. For both types of stimuli, RGs were placed within an IG. The stimuli were elaborated from naturally spoken material using a pacer technique. In this technique, a native speaker utters given contexts while listening to a pacer consisting of pure tone beats bearing the desired rhythm and intonation changes. All 400 target stimuli were constructed (200 meaningless series of syllables, 200 meaningful utterances) with similar RGs and IGs. Additionally, 480 filler stimuli were constructed to vary rhythm, intonation and syntactic content. The two sets of stimuli were presented separately and in random blocks.

Subjects' task consisted of listening to each stimuli and determining if a subsequent prompt was part of a presented utterance or series. Continuous EEG is recorded using 59 scalp electrodes (DC-100Hz, 512 Hz sampling rate). An averaged left-right mastoid reference is applied to all scalp electrodes. After artifact rejection and eye-blink correction, ERPs are averaged with respect to the P-center of the first syllable for both meaningful sentences (experiment 1) and meaningless series (experiment 2). In all, 15 subjects will participate in the test. At present, the results of one subject show that, even within meaningful utterances, CPS is specifically evoked by RGs.

These results bear two implications. First, previous studies showing that CPS is evoked by IGs did not control for RGs. Our present experiment will show that CPS can be specifically evoked by RGs. Second, given that CPS reflects the processing of RGs that are compatible with patterns found in speech and recall, the findings support a perspective of a link between CPS and a process of online segmentation of heard verbal material likely reflecting a notion of focus of attention.

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