LETTER

Are articulatory commands automatically and involuntarily activated during speech perception?

A recent PNAS article by Yuen et al. (1) presented evidence for articulation-specific effects of auditory speech on subsequent production of spoken syllables (Expt 1). This was interpreted as evidence that motor routines are "automatically" and "involuntarily" activated by heard speech, and the authors concluded their paradigm provides "a behavioral diagnostic for the activation of articulatory information in speech perception." Electropalatography is an appealing approach to investigating the nature of motor involvement in speech perception. The authors demonstrated that an incongruent alveolar /t/ sound led to a greater proportion of alveolar tongue contact in the initial phase of subsequent production of /s/ and /k/ sounds, relative to a congruent condition. However, the claim that hearing speech evokes *automatic* motor activation is undermined by the inclusion of an overt phoneme monitoring task on the auditory speech. In Experiment 1, participants heard a distractor syllable, then received a written cue to produce a rhyming target aloud, after which they were visually prompted to indicate whether or not a specific phoneme had occurred in the original distractor. Phoneme monitoring requires segmentation of heard speech into its constituent elements, and it has long been argued that such tasks engage neural systems beyond those associated with normal speech comprehension (2, 3). For example, illiterate individuals can understand speech but cannot perform simple phoneme segmentation (4). Consistent with this perspective, a recent study showed that repetitive transcranial magnetic stimulation (TMS) applied to premotor cortex has a detrimental effect on performance of a task requiring phoneme segmentation, but has no effect on tasks that relied on simpler acoustic processing (e.g., identification of isolated phonemes) (5).

Yuen et al. (1) defend the use of a phoneme monitoring task in their study, arguing that any articulatory encoding of the auditory distractors would be "disadvantageous to performance" of the speech output task, and that their participants should therefore have been "highly motivated" to adopt alternative strategies. Unfortunately, they provide no evidence that participants did not engage articulatory processes to perform the perceptual task.

Given the existing literature showing involvement of premotor cortex during phoneme segmentation (2, 3, 5), it is difficult to identify whether the observed effects in the Yuen et al. (1) study are due to automatic processing or the task demands of phoneme monitoring. The articulatory specificity in Experiment 1 would still arise from phoneme segmentation, because the activated motor representations would reflect the phonetic properties of the segmented speech. Furthermore, these task effects are not ruled out by Experiment 2 (a voicing incongruency would not affect alveolar tongue contact in phoneme segmentation), nor by Experiment 3 (because the written distractors greatly reduce the demand for phoneme segmentation). We have previously argued that motor cortex may be involved in language processing in a variety of ways and that unambiguous evidence supporting an obligatory role for motor representations in the perception of normal speech remains hard to find (3). This debate is unlikely to move forward when active tasks like phoneme monitoring are commonly used to measure basic speech perception (2, 3).

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