

The Effects of Motor Priming on Categorical Perception  
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Scientists have different theories on how interconnected the mechanisms of speech perception and production are. The motor theory of speech perception proposes that the mental representations of speech sounds has more to do with the articulatory gestures than it does with acoustic sounds (Liberman et. al., 1952, Liberman & Mattingly 1985, ). The now-widely-known McGurk effect illustrates that, at least to some extent, we do use articulatory cues during perception (McGurk & MacDonald 1976). Motor theories have seen a revival in the new era of neuroimaging, and with the discovery of mirror neurons. Pulvermüller et. al. (2006) found in an fMRI study that brain areas active during speech perception were similar to those during (imagined or actual) speech production. D'Ausilio et. al (2009) conducted a TMS study that had similar findings. However, the question of whether the motor systems of production play a mediating role in speech perception is still open and contested.

Marc Sato and colleagues recently conducted a study (Sato et. al., 2011) investigating this question. Subjects were conditioned through motor priming before performing a forced-choice decision task between /pa/ and /ta/ stimuli. Subjects performed either lip or tongue movement repetitively to prime them towards bilabial (/pa/) or alveolar (/ta/) sounds. The study measured reaction time and accuracy and found no significant effects of motor movement. The authors conclude that motor systems only play a role at higher level processes of categorization/decision processes. Yet this study does not compare motor priming to acoustic priming. We conducted one that does.

Our experiment uses two different types of priming to compare the acoustic and motor aspects of speech perception. Subjects were asked to indicate whether they heard [ta] or [da] by pushing a button. Twenty-one sound files were made using a voice synthesizer so that they varied in voice onset time from 0ms to 100ms (in 5ms increments). Before listening to these stimuli, subjects underwent one of two types of priming. Subjects assigned to the auditory priming group listened to 100 words that began with [t] before performing the identification task, while subjects in the motor priming group were asked to silently pronounce the same list of words (so they didn't also hear them and create a confound). Thirty eight adult native speakers of English participated in the study. One hundred fifty eight subjects participated in a previous study (using the same design) provided a baseline threshold value with which to compare our primed subjects (Durvasula & Hestvik 2012).

Our experiment provides evidence in favor of the motor theory of speech perception. Preliminary analysis indicates that the motor priming group has a significantly higher rate of categorizing threshold VOT values as [ta] than the unprimed control group. In contrast, the auditory priming group does not vary significantly from the control group. It seems that the mental representation of phonemes may be more closely linked to the gestural score responsible for forming them than to the acoustic output they produce.

## References

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Figure 1. Percentage of Choosing [ta] as a function of Voice Onset Time

