ABSTRACT
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Laryngeal Function During Speech
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For the past nine years we have been studying the effects of pitch-shifted voice feedback on voice F_0 control on sustained vowels. Recently, we have begun using these techniques to study F_0 control during speech. In this presentation, I will compare data from two studies; one on Mandarin speech and one on English speech.

Mandarin is a tonal language in which voice F_0 is used linguistically, that is, to distinguish linguistic units, which are otherwise phonologically identical. Precise control of F_0 is thus important to carry meaning in Mandarin speech as well as in other tonal languages. We tested six speakers of Mandarin as they produced three different bitonal phrases using the syllables /ma ma/ . Subjects received upward and downward pitch shifts or no shifts (control trials) during their productions. Measures of response magnitude and latency from the test average waves were compared with control average waves. Results showed that response magnitudes were larger than previous studies on sustained vowels. Results also showed an increase in response magnitude when an upward pitch-shift was presented prior to a planned decrease in the F_0 trajectory. Response latencies were shorter when a decreasing pitch-shift was presented prior to a drop in the F0 trajectory. These results indicate that there is task-dependent modulation of voice F_0 during Mandarin speech. Moreover, the changes in response magnitude and latency suggest that online use of voice pitch feedback is used to help produce the tonal sequences accurately.

In the study on English speech, we tested 21 subjects as they repeated the phrase “you know Nina” in each of two conditions. In one condition, stress was placed on the “you” and in other on “Nina”. Subjects received upward and downward pitch shifts or no shifts (control trials) during their productions. Results showed that there was no difference in the magnitude of the peak of the inflection compared to previously published data on responses to pitch-shifted feedback during sustained vowels. We also found that the response latency was shorter when the pitch shift was presented during a stressed syllable. We interpret the findings to indicate that placing stress on a syllable can facilitate mechanisms of the pitch-shift reflex. We found that the peak time of the response in three of the conditions was delayed relative to the control average wave. However, in one condition, when the pitch shift stimulus was upward during a stressed syllable, the Peak Time of the test average wave was slightly advanced relative to the control average wave. We interpret this finding to mean that when an upward pitch shift is presented during the rising phase of the F_0 trajectory for a stressed syllable, no corrective response is necessary. However, in other conditions corrective responses can result not only in a change in voice F_0, but also a delay in timing of the corrective response.

Comparison of the two studies revealed that response magnitudes are larger in Mandarin than English. This may indicate that auditory feedback is relied upon to a greater extent for control of Mandarin tones than it is in English, where F_0 is used suprasegmentally. In both languages latency was reduced in some cases, suggesting that speech can facilitate mechanisms of the pitch-shift response and reduce the onset latency. The changes in Peak Time observed with English suggests that changes in voice F_0 feedback can disrupt timing of production of accented syllables. This is the first report of which we are aware in which perturbation of pitch feedback leads to changes in timing of suprasegmental features of speech production.