**Compensation for Altered Feedback in Vowels and Glides**

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This study compares the behavior of vowels and glides in an altered feedback paradigm to investigate a hypothesized difference in prioritization of acoustic versus other (e.g. somatosensory) feedback. It finds that compensatory responses for /i/ and /j/ differ under the influence of altered feedback, with vowels compensating more than glides only when the vowels were shorter than the applied alteration.

Altered feedback paradigms (AFPs) are studies in which the participant hears a real-time playback of their voice which is, unknown to them, altered in some fashion. This alteration elicits some degree of compensation, in which participants change their production so that the feedback they receive better resembles the target. Acoustic alteration may be temporal, by stretching or compressing some portion of the signal, or spectral, for instance by altering formants. AFPs have been previously applied to glides (Ogane & Honda 2014) with temporal alteration and to vowels (e.g. Houde 2011) with formant alteration. Glides have not previously been examined under formant alteration. Formant alteration was chosen for this study because /i/ and /j/ have similar formants (whereas they have very different durations), allowing the same alteration to be applied to both with similar effects, so that any compensatory differences can be attributed to vowel/glide status rather than differences in experimental design.

The hypothesis is that vowels prioritize acoustics more than glides, which instead prioritize other feedback. This predicts that speakers would show more compensation in vowels than glides for the purely acoustic alteration. This was true for some participants, but the reverse was true for others, dependent on their vowel durations.

**Methods.** 20 native English speakers were initially given auditory models of /biə/ ‹bia› and /bjə/ ‹bya› and were subsequently cued orthographically throughout the experiment. Feedback alteration was achieved with Audapter, a software package for real-time manipulation of acoustic parameters of speech. Maximum alteration was an increase of F2 by 250Hz and a decrease of F1 by 120Hz, effectively making the input sound more high and more front. Alteration tapered off within each word as shown in Figure 1a, to avoid altering the formants of the final vowel in addition to the target vowel/glide. Each word was repeated in a block 400 times, with block order randomized, and alteration varied over the course of a block as shown in Figure 1b, where 1 represents maximum alteration.

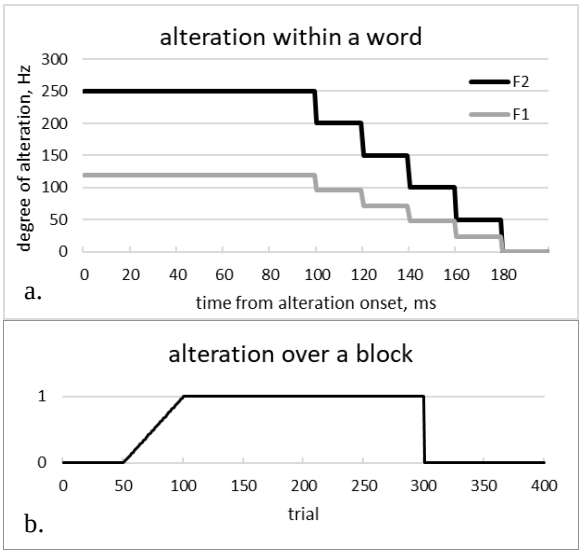


Figure 1. Alteration over (a) words and (b) blocks.

**Results.** Participants were divided. Some produced longer /i/ vowels than modeled, exceeding the 100ms duration of alteration; the alteration then produced something sounding like a diphthong rather than simply a higher, fronter monophthong, which may have made it harder for participants to compensate or may have reduced the impetus to compensate, as these participants generally showed less compensation for the vowel than the glide. In contrast, those participants who produced shorter /i/ vowels and thus experienced the intended alteration tended to compensate more for the vowel than the glide, as predicted and as shown in Figure 2b.

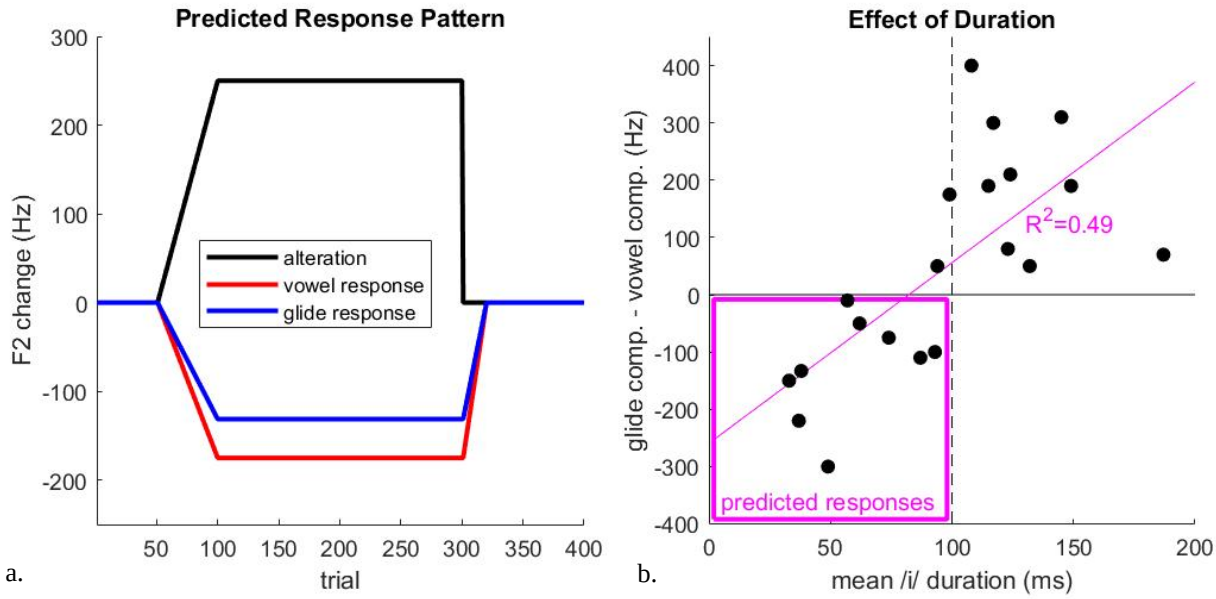


Figure 2. (a) Predicted response pattern. Note that no prediction was made as to the exact degree of compensation, only that vowels would show significantly more compensation relative to glides. (b) Participant responses. The y-axis shows the difference in compensation for glides and vowels in F2, negative meaning that vowels showed more compensation, positive that glides did. The x-axis shows mean /i/ duration. The dotted line at 100ms marks the duration of the applied alteration.