Healthy and aphasic participants entrain to metrical regularities in speech and song

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Melodic Intonation Therapy, a speech therapy based on exaggerated intonation and regular rhythm, has been shown to facilitate speech recovery in non-fluent aphasic patients. We hypothesize that the benefit of MIT rests on entrainment: a general tendency to synchronize movements with temporal regularities present in external stimuli. We test whether temporal regularity is sufficient to elicit entrainment, and thus speech improvement, in aphasics. We manipulated the temporal regularity and the melodic intonation of speech and song. Syntactically matched French and English 13-syllable sentences, controlled for word frequency, were used as stimuli. Content and function words were placed to induce a trochaic stress pattern. These sentences were recorded in 3 conditions by a bilingual speaker/singer: natural speech (spoken with the natural prosody of each language), regular speech (every other syllable aligned with a metronome click, leading to a trochaic metrical pattern) and regular song (sung on a simple melody, every other note aligned with a metronome click, leading to a trochaic metrical pattern). In the first experiment (tapping task), twenty-four healthy Francophone participants and 24 healthy Anglophone participants tapped along with the beat they perceived in these utterances. Both Francophone and Anglophone participants tapped more regularly (with smaller coefficient of variation, CV, of the taps) to regular speech and song than to natural speech in both languages. Their tapping consistency did not differ between regular speech and song, although the sung utterances were acoustically more regular (smaller CV of inter-vocalic intervals) than were the regularly spoken utterances. Thus, the melodic contour of the song did not benefit listeners’ tapping beyond the temporal regularities. In the second experiment (speech/singing task), non-fluent French aphasics attempted to synchronize (shadow) their speech and singing with a subset of the French stimuli from Experiment 1, which were presented at a slower rate designed to match the aphasics’ normal speech rate. We tested whether aphasics’ speech would improve more with regular speech and song than with natural speech, and whether the melodic intonation of song would add any additional benefit compared to the regular speech. Two variables evaluated aphasics’ performance: correct phonemes per utterance and metrical feet filled per utterance (production of syllables in time with the stimulus, irrespective of the phonetic accuracy). Preliminary results suggest that the least fluent aphasics exhibited significant improvement synchronizing with the regularly spoken and the sung utterances, compared to the naturally spoken utterances. There was no difference in performance between regular speech and song, indicating that melodic contour did not influence their shadowing. In sum, both healthy listeners and aphasic participants demonstrated similar entrainment to spoken and sung sentences that presented temporally regular patterns, as evidenced in their sensitivity to metrical stress. These findings suggest that beneficial influences of MIT and other choral speech therapies may be attributable to rhythmic regularity, rather than melody.