
Gestures and prosody in aphasia: A temporal synchronisation analysis

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Gestures are normally well-timed with speech (McNeill 1992). However, in aphasia, specific prosodic and gestural patterns may be observed. Ferré's (2021) work reveals significantly prolonged pre-stroke hold phases, indicating patients' attempts at speech-gesture synchronisation. This study's method evaluates speech-gesture synchronisation accuracy and detects potential impairments.

We analysed video recordings from 6 participants (2 non-fluent aphasia, 2 fluent aphasia, 2 controls) retelling *The Pear Film* by W. Chafe. Audio was segmented (using PRAAT software) into phonetic words (stressed vowels marked) and EDUs (pitch accents annotated). Video was annotated in ELAN for manual and cephalic gestures, identifying stroke apexes at trajectory/speed changes (Türk & Calhoun 2023). Gesture-word pairs were considered synchronised if: 1) apex aligns with stressed vowel; 2) stroke covers most of word; 3) stroke hits stressed vowel; or 4) stroke precedes word on hesitation pause (no other gesture on word). For each pair, apex-to-vowel onset distance (ms) was measured (positive when apex preceded vowel).

Median signed apex-vowel intervals showed delayed gestures across groups: -112 ms (non-fluent), -47 ms (fluent), -71 ms (controls), with significant non-fluent vs fluent ($p < 0.001$, 95% CI = [-31.0, 31.0]) and non-fluent vs control difference ($p = 0.013$, 95% CI [-28.0, 27.5], based on 10000 bootstrap replicates, Bonferroni-corrected). Absolute median distances were similar: 131 ms, 121 ms, 108.5 ms respectively, all n.s. Distance distributions showed higher kurtosis in non-fluent (4.55) vs fluent speakers (0.19, $p < 0.001$, 95% CI [-3.06, 3.07], based on 10000 bootstrap replicates, Bonferroni-corrected), indicating tighter clustering around the mean in non-fluent speakers compared to more uniformly distributed values in fluent speakers. Kurtosis value for the control group is 0.95, but the comparison with both clinical groups was insignificant.

The synchronisation of hand gestures and speech is impaired in patients with non-fluent aphasia. However, both clinical groups exhibit distinct synchronisation patterns, which differ from those of the control group.

References: • Ferré, G. (2021). Gesture, prosody and verbal content in non-fluent aphasic speech. *Multimodal Communication*, 10(1), 73–91. • McNeill, D. (1992). *Hand and mind: What gestures reveal about thought*. Chicago: University of Chicago Press. • Türk, O. & S. Calhoun (2023). Multimodal cues to intonational categories: Gesture apex coordination with tonal events. *Laboratory Phonology*, 14(1).