Variability in duration of verbal tics that are temporally adjacent to speech

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Parameters describing skilled goal-driven behavior vary flexibly in relation with changing, contextualized goals [1-2]. For example, systematic token-to-token variability in spoken word production is well documented in the linguistics literature and is linked to prosodic grouping and phrasing, speech rate, prominence, style and other factors, all of which are linked to a talker's intended linguistic messages and broader behavioral goals. Verbal tics—the unwanted, often word-like vocalizations that are produced by individuals living with Tourette syndrome—do not correspond to communicative intentions to speak. Instead, they are automatic responses to a preceding urge to produce that tic specific tic [3]. What patterns of token-to-token variability can we expect from urge-based verbal tics? In this study, the duration of tic words occurring at three "faux" prosodic positions was examined in order to test the hypothesis that tics are not grouped into prosodic phrases, despite their close temporal proximity to words. Duration did not vary significantly as a function of its location relative to speech structure. In so far as durational effects like slowing at a boundary can be conceived of as indices of phrasal edges, then tic words lacking this effect show that they were not "prosodified".

Word duration shrinks and stretches in response to, among other things, the location of that word within a phrase because the articulatory gestures instantiating word production are slowed at prosodic boundaries [4]. Token-to-token rigidity in word duration disserves communicative and linguistic goals and is not observed outside of neurological insult [e.g., 5]. In constrast, token-to-token rigidity in tic duration would not necessarily impede exitinction of the urge to tic, which is the preceding stimulus to which a tic responds. In fact, clinicians consistently allude to the apparent "stereotypy" of tics [e.g., 6]. However, studies of ticcing have largely been limited by the conceptualization of tics as dimensionless point processes; the low token-to-token variability speculated by clinicians has not been experimentally verified.

Tic word duration was examined in three adults living with Tourette syndrome since early childhood (two female, one male); all are speakers of British English and are from the greater London area. A corpus of acoustic recordings of co-speech ticcing provided tokens for analysis. Recordings of passage readings, picture description and other speech tasks were obtained for each participant. These were segmented at the word level. Only each participant's most-frequent tics were considered for analysis: *biscuit*, *cocktails* and *banana*.

For each participant, the subset of SP tics was identified as follows. First, the median duration of the participant's most-frequent tic was obtained. Only tics separated from words (on either or both sides) by intervals *shorter* than this median duration were measured. Three kinds of speech-proximal tics exist: those flanked by acoustic silence on the left and a word on the right, those flanked by words on both sides, and those flanked by a word on the left and acoustic silence on the right. These three kinds of tics represent three faux-prosodic conditions: phrase-initial, phrase-medial and phrase-final.

In speech, words that occur together are grouped together. Adjacency of tics and words with no intervening silences could be taken as evidence that the tic has been grouped into the prosodic phrase. Such tics, here called *speech-proximal* (SP), are expected to vary in duration like words in analogous prosodic positions would: phrase-

medial ones being shorter than phrase-initial and phrase-final ones. I predicted that tics would not show durational effects related to the presence of prosodic boundaries. As expected, this study found that tic words produced by each participant were highly stable in terms of duration regardless of the linguistic units and events happening around them.

Participants also read sentences containing their most-frequent tic word (i.e., *biscuit, cocktails* and *banana*) used as an actual word in order to quantify the magnitude of systematic variability that words in different prosodic positions are expected to display. Four sentence frames were designed per participant/tic, two placing the tic word in a phrase-medial/unaccented position and two placing it phrase-finally. Sentence frame pairs were matched for length in syllables (28 vs. 12). A total of forty repetitions of tic words used as words in a sentence were obtained for each participant, twenty in phrase-medial and twenty in phrase-final positions. As expected, word duration varies as a function of prosodic position for all participants, in contrast to tic duration. Preliminary within-category (phrase-medial vs phrase-final) duration results suggest that tic duration is more rigid (i.e., has a lower index of variability) than duration of identical words in each different prosodic context. Results are discussed in light of (a) interactions between goal-directed motor systems and vegetative, urge-based functions using the same effectors and (b) the temporal organization of vocalization across domains. Role of "automatization" in goal-directed vocal behavior is also discussed.

References

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