

Tone and intonation

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Tone and intonation share the common feature of being carried mainly by the fundamental frequency of voice (F0). The ease of obtaining F0 measurements, thanks to the wide availability of software tools and the fact that F0 is largely one-dimensional, have allowed researchers to perform extensive studies on tone and intonation. But ease of observation does not necessarily mean ease of understanding. In fact, the very fact that the same acoustic dimension is involved in both tone and intonation means that their respective contributions to surface F0 contours cannot be easily taken apart [Xu 2004]. Even with regard to intonation alone, there are multiple communicative functions that are co-encoded but hard to disentangle [Hirst 2005]. Furthermore, both tone and intonation are subject to various articulatory mechanisms that all leave indelible marks on the observable surface acoustic patterns [Xu 2005]. Much effort is needed, therefore, to identify the specific communicative functions, their corresponding prosodic properties and the articulatory mechanisms that are behind the surface prosodic patterns. The papers presented in this discussion session all made interesting findings that go toward this goal.

Franich's paper examined the effect of cognitive load on contextual tonal variations. She found that high cognitive load had no effect on carryover assimilatory effect, but increased the amount of anticipatory dissimilation. This is reminiscent of the finding that intrinsic pitch difference between vowels is exaggerated in people who have lost hearing after acquiring speech [Perkell et al. 1992]. Both phenomena suggest that speakers actually make an effort to minimize articulatory effects that increase within-category variance, because the effectiveness of such "normalization" seems to be weaker when they have reduced capacity to monitor the variation due to either loss of hearing or increased cognitive load. My interpretation here, however, is somewhat different from that of Franich's. But such difference could lead to further research on this important issue that so far has attracted little attention.

Teo's paper reports an interesting pattern of tone-intonation interaction. It is found that "in both monosyllabic and disyllabic words, lexical tone is only specified at the left edge of the word, while the right edge of the word is 'free' to take post-lexical intonation tones." The use of a single syllable to carry two consecutive tonal components is especially interesting, but this is not a total stranger to us. It has been observed that an intonational pitch "particle" can be attached to the end of a sentence-final syllable in Mandarin Chinese [Chao 1968, Mueller-Liu 2006, Li et al. 2012] and Cantonese [Wu 2009]. It is also reminiscent of the notion of boundary tone being attached to the end of a phrase accent in the Autosegmental-Metrical (AM) theory of intonation [Pierrehumbert 1980]. Systematic research is nevertheless needed to study the articulatory mechanisms that enable such information coding and how it interacts with the functional need to make use of this mechanism.

The paper by Michalsky examined question intonation in German. It shows evidence of specific F0 patterns that separate questions from statements. He shows that "the phonetic realization generally provides possible cues for interrogativity in German regardless of the speaking style." The finding of the study therefore provides further evidence that functional contrasts like that of question versus statement, or even alternative question versus continuation, are clearly marked by prosodic means. This, to me, suggests the fruitfulness of function-oriented approaches to speech prosody.

Finally, the study by Howell made a direct contrast between function-oriented approaches to intonation and formal-phonology-based approaches as represented by the AM theory. His findings show that it is more

straightforward to describe American English intonation in terms of the acoustic realization of semantic categories of focus than in terms of phonological units such as pitch accents and phrase tones [Pierrehumbert 1980]. He shows clear prosodic distinctions between early, late, broad and double focus, whereas neither theory of focus projection or uniquely syntagmatic models of prominence is able to predict the observed phonetic distinctions. His finding can find further support in our own studies of American English focus intonation [Liu et al. 2013, Liu et al. 2015].

Overall, I hope this session will encourage researchers of tone and intonation to go beyond what is directly obvious in the acoustic manifestation by trying to reveal how communicative meanings are prosodically encoded based on articulatory mechanisms. The session may also inspire more direct comparisons between function-oriented and form-oriented approaches, treating them as competing theories rather than complementing approaches.