IMPLICATIONS OF TONOGENESIS ON TONE PROCESSING♠

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Tonogenesis and the processing of tone have each engrossed ample attention in literature with proposal of different models and analyses. This paper focuses on the replacement of voicing contrast with tone contrast by following the historical traces, and its relation to the processing of tones in neuroscience. The link between them suggests an intriguing change of hemispheric lateralization for tone and consonant processing in human brain through language evolution.

1. Tonogenesis and Processing of Tone

From the historical-linguistic perspective, it is common to have a tone contrast developed from a voicing contrast. For instance, the reconstructed Proto-Cham makes a distinction between voiced and voiceless stops in initial position whereas such voice contrast is neutralized as voiceless in E. Cham and replaced by a low and non-low tone contrast instead. More than mere difference in F_0, tone in E. Cham demonstrates contrastiveness in meaning, an important indicator for qualifying a language as tonal. Other languages such as Yabem, West Kammu and Utsat also developed low tones on vowels following voiced stops and non-low tones elsewhere like E. Cham. In addition to the preceding voiced consonant, the following voiced consonant in Vietnamese and Old Chinese is also found to induce a low tone. These developments suggest tone arises through exaggeration of a phonetic side effect of voicing in stops, or obstruents generally.

From the neuroscientific perspective, processing of tone and consonant are found to be specialized in the two hemispheres of human brain for efficient processing of diverse information with the complex neural structure. fMRI or

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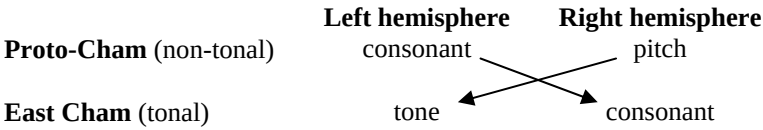
positron emission tomography studies find that the F_0 differences in tone languages like Mandarin Chinese which have lexical tones are preferentially processed in the left hemisphere of native speakers (Whalen & Liberman, 1987; Liberman & Whalen, 2000) because they are phonologically significant while differences in consonants are processed in the right hemisphere. In other words, processing of the more important acoustic cue is left-lateralized.

2. Alternated Hemispheric Lateralization in Human Brain

Studying the interface of the historical-linguistic perspective and neuroscience perspective ensures i) the essentiality of laryngeal contrasts in consonants to the emergence of tone, and ii) an opposite pattern of hemispheric lateralization for tone and consonant contrast. A puzzling representation now appears on a simple graph mapping the consonant and tone contrast in E. Cham with reference to processing.



Graph 1. Changes in hemispheric lateralization.

The above graph models a shift of roles between the left and right hemisphere when Proto-Cham develops from non-tonal to tonal. The left hemisphere which used to process consonant contrast is now responsible for processing tonal contrast whereas the right hemisphere has changed from processing pitch differences to consonant contrast.

In brief, the phonation contrast of consonants leading to emergence of tone could give rise to the proposed alternation in hemispheric lateralization for tone/pitch and consonant processing in human brain during the evolutionary journey. This paper urges further research to take an interdisciplinary approach to examine data across linguistic typology and possibility of the shift in neuroscience.

References

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