The Sensory-Motor Interfaces in Language and Music Compared

Tecumseh Fitch
University of St Andrews

In a multi-component approach to language evolution, different subsystems of the language faculty are treated as semi-independent, from both biological and evolutionary viewpoints. Such an approach invites us to consider potential overlaps between language and other computational systems in the human brain. An obvious comparison is between phonology (at the sensory-motor interface) and music. I will suggest that some crucial computational aspects of phonology and syntax result from serialization constraints intrinsic to producing and/or parsing a signal, and that insights into these constraints can be gained from consideration of music. I propose two fundamental constraints that apply in both domains:

1) dimensionality reduction - high-dimensional representations need to be "squeezed out" into a low-dimensional (even one-dimensional) output stream; and

2) recoverability - despite the inevitable loss of information associated with 1), the higher-dimensional structure corresponding to the signal should be recoverable, which entails common constraints on both the encoding and decoding processes.

I suggest that several shared aspects of musical phrase structure and phonology and phrasal syntax result from these constraints. In particular, phenomena of phrase-final lengthening and declination can both be readily interpreted as phrase boundary markers to aid in chunking and thus (non)deterministic parsing, while phenomena of metrical stress and rhythmic stress result from a deeper constraint on the recoverable serialization of non-terminals in hierarchical structures.

Despite manifest differences in these two domains (e.g. the presence of propositional semantics in language, or discretization of time and pitch in music), this computational analysis suggests that there is ample room for interchange between biolinguistics and biomusicology, and that some key aspects of language and music are common responses to the same underlying computational problem. I end by suggesting some experiments to test these ideas.