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Comment

Title:
Modeling evolution of speech: Comment on " Modeling The Cultural Evolution of Language" by Luc Steels

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Steels' review [1] presents an interesting overview of work on modeling cultural evolution of the core aspects of language: morphology, syntax and semantics. Because of this focus, it misses a large and growing body of work on modeling and experimentally investigating the cultural evolution of *speech*. Speech, being the most physical aspect of language, is more easily modeled than other aspects of language, is directly comparable to animal communication and is perhaps the only aspect of language for which there may be fossil evidence [2]. It therefore has a long tradition of computer modeling of both anatomy and phenomena observed in large corpora of human languages [3]. In addition, speech is a domain where it seems clear that biological evolution [4] and cultural evolution [5,6] interact. Cultural evolution causes systems of signals to expand to fill the available signal space, while biological evolution expands the available signal space.

When taking into account that speech signals are extended in time, it turns out that cultural evolution for distinctiveness may result in combinatorial structure, even though the users of the communication system need not be aware of this structure [7]. However, once this structure is in place, it is advantageous to evolve cognitive adaptations to make use of it. Furthermore, it has been proposed that adaptations for complex combinatorial structure in speech have been exapted for syntax [8]. Thus the study of the evolution of speech may also lead to insights into the evolution of syntax. A recent trend in the study of the evolution of language is to investigate cultural evolution experimentally, often adapting paradigms that were originally developed in computer models [9]. Such efforts are also underway for speech [10] and preliminary results appear to indicate that although cultural evolution can cause emergence of structure in speech, humans do appear to have specialized cognitive adaptations for dealing with this structure.

Thus speech is an aspect of language in which computer modeling, linguistic data, fossil data and experiment can go hand in hand to increase our understanding of cultural and biological evolution of language.

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