Sequential learning and the interaction between biological and linguistic adaptation in language evolution

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It is widely assumed that language in some form or other originated by piggybacking on pre-existing learning mechanism not dedicated to language. Using evolutionary connectionist simulations, we explore the implications of such assumptions by determining the effect of constraints derived from an earlier evolved mechanism for sequential learning on the interaction between biological and linguistic adaptation across generations of language learners. Artificial neural networks were initially allowed to evolve "biologically" to improve their sequential learning abilities, after which language was introduced into the population. We compared the relative contribution of biological and linguistic adaptation by allowing both networks and language to change over time. The simulation results support two main conclusions: First, over generations, a consistent head-ordering emerged due to linguistic adaptation. This is consistent with previous studies suggesting that some apparently arbitrary aspects of linguistic structure may arise from cognitive constraints on sequential learning. Second, when networks were selected to maintain a good level of performance on the sequential learning task, language learnability is significantly improved by linguistic adaptation but not by biological adaptation. Indeed, the pressure toward maintaining a high level of sequential learning performance prevented biological assimilation of linguistic-specific knowledge from occurring.

DOI: 10.1075/is.10.1.02rea
In: Interaction Studies 10:1. 2009. 112 pp. (pp. 5–30)