ABSTRACT

Language comprises a central component of what the co-founder of modern evolutionary theory, Alfred Russell Wallace, called “man’s intellectual and moral nature” – the human capacities for creative imagination, language and symbolism generally, a complex that is sometimes simply called “the human capacity.” This complex seems to have crystallized fairly recently among a small group in East Africa of whom we are all descendants, distinguishing contemporary humans sharply from all other animals, with enormous consequences for the whole of the biological world, as well as for the study of computational cognition. How can we explain this evolutionary leap? On the one hand, common descent has been important in the evolution of the brain, such that avian and mammalian brains may be largely homologous, particularly in the case of brain regions involved in auditory perception, vocalization and auditory memory. On the other hand, there has been convergent evolution of the capacity for auditory-vocal learning, and possibly for structuring of external vocalizations, such that apes lack the abilities that are shared between songbirds and humans. Language’s recent evolutionary origin suggests that the computational machinery underlying syntax arose via the introduction of a single, simple, combinatorial operation. Further, the relation of a simple combinatorial syntax to the sensory-motor and thought systems reveals language to be asymmetric in design: while it precisely matches the representations required for inner mental thought, acting as the “glue” that binds together other internal cognitive and sensory modalities, at the same time it poses computational difficulties for externalization, that is, parsing and speech or signed production. Despite this mismatch, language syntax leads directly to the rich cognitive array that marks us as a symbolic species, including mathematics, music, and much more.

About the Keynote Speaker

Robert C. Berwick is professor of computational linguistics. Professor Berwick and his research group investigate computational models of language acquisition, language processing, and language change, within the context of machine learning, modern grammatical theory, and mathematical models of dynamical systems. In the area of machine learning and language, the lab uses the minimum description length (MDL) proposal, updated to incorporate Vapnik’s notion of both structural and empirical risk minimization, to induce models from naturalistic parent-child language examples such as the CHILDES corpus. They use this to test explicit hypotheses about the nature and rate of child language development within the context of current linguistic theories, and across multiple languages such as English, Dutch, French, and German.

By parameterizing Chomsky's current linguistic theory into a set of approximately two-dozen modules, the lab has implemented a Prolog system that can be rapidly switched among several dozen languages simply by substituting a new lexicon or dictionary. This computer model can be used to predict and test current linguistic theories with respect to their psycholinguistic fidelity and their logical adequacy. Further, this same model can be viewed as a formal account of both language change over time and language acquisition.