LingPhil Summer School 2020

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Course C: **Language evolution in the laboratory**

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Investigating language evolution is hard. Languages evolve over historical timescales in response to complex dynamics and interactions of many factors pertaining to biology, cognition, culture, social interaction, technology and the environment. Furthermore, language does not fossilize and we are left with only very indirect evidence of the earlier stages of language. Language evolution is also a big theoretical battleground. Scholars largely disagree about the mechanisms that shape language. While primatology, archeology and studies of newly evolving sign languages can give us some hints, it is very difficult to investigate and make claims about the causal mechanisms driving the evolution of language.

Through the last two decades a new research program has emerged that uses laboratory experiments and simulations to inform discussions of language evolution. These experimental approaches aim to investigate the factors and underlying processes that shape the development of communication systems. In the laboratory, researchers can experimentally simulate simple environments where participants have to evolve communicative systems from scratch in order to solve a collaborative task. This approach allows the researcher to systematically control and investigate different factors and how they interact to form functional communication systems, and, ultimately inform discussions of the processes underlying language evolution. In this workshop we will look into the different types of experimental paradigms that have been used and try them out in class, and we will discuss how to design other experimental investigations of language evolution.

**Session 1: How to bootstrap a communication system.**

Language has famously been argued to be fundamentally arbitrary (Saussure, 1916). However, a central question in language evolution concerns the so-called “symbol grounding problem” (Harnad 1990): In order to collectively establish and conventionalize (arbitrary) meanings of new signs we depend on expressions, definitions or negotiations of those meanings in some other modality or language. We discuss solutions to this circularity problem reviewing experimental evidence that new signs are initially grounded in motivated iconic or indexical mappings to the referents. While iconicity could seem an important factor in bootstrapping a new communications system there also seems to be processes that might push communication system away from iconicity and towards more arbitrary signs. Among these are pressures for optimization of communication.

Recommended readings:

* Garrod, S., Fay, N., Lee, J., Oberlander, J., & MacLeod, T. (2007). Foundations of representation: where might graphical symbol systems come from? *Cognitive Science, 31*(6), 961-987
* Harnad, S. (1990). The symbol grounding problem. *Physica D: Nonlinear Phenomena*, *42*(1-3), 335-346
* Fay, N., Ellison, M., & Garrod, S. (2014). Iconicity: From sign to system in human communication and language. *Pragmatics & Cognition*, *22*(2), 244-263
* Fay, N., Arbib, M., & Garrod, S. (2013). How to bootstrap a human communication system. *Cognitive science*, *37*(7), 1356-1367

**Session 2: On the role of cultural transmission**

While session one is mainly concerned with the role of social interaction (sometimes referred to as “horizontal transmission”), in session two we will review a additional factors that have been suggested to impact the emergence and structure of sign systems. Specifically, we will look into the role of transmission and learning (“vertical transmission”), and the way our cognitive systems with their biases, expectations and limited memory capacities give shape to sign system through instruction and learning over multiple generations.

Recommended readings:

* Kirby, S., Cornish, H., & Smith, K. (2008). Cumulative cultural evolution in the laboratory: An experimental approach to the origins of structure in human language. Proceedings of the National Academy of Sciences, 105(31), 10681-10686
* Tamariz M & Kirby S (2015) Culture: Copying, compression and conventionality. Cognitive Science 39, 171-183

**Session 3: Social dynamics, communities and networks**

In this class we explore how different structures of cultural transmission might impact the structure of resulting communication systems. It has been consistently observed how signs that are transmitted in a ‘community design’ differ from signs evolved by ‘isolated pairs’ or iterated learning. Agent-based simulations also show how the architecture of cultural networks might impact processes of conventionalization.

Recommended readings:

* Mesoudi, A., & Whiten, A. (2008). The multiple roles of cultural transmission experiments in understanding human cultural evolution. Philosophical Transactions of the Royal Society B: Biological Sciences, 363(1509), 3489-3501.
* Fay, N., Garrod, S., & Roberts, L. (2008). The fitness and functionality of culturally evolved communication systems. *Philosophical Transactions of the Royal Society of London B: Biological Sciences*, *363*(1509), 3553-3561.
* Barrat, A., Baronchelli, A., Dall’Asta, L., & Loreto, V. (2007). Agreement dynamics on interaction networks with diverse topologies. *Chaos: An Interdisciplinary Journal of Nonlinear Science*, *17*(2), 026111.

**Session 4: The emergence of grammar**

What are the conditions under which communication behaviors evolve to become “a system”? We will look at the adaptive pressures that might give rise to proto-grammatical phenomena such as stable word order and properties of systematicity and combinatoriality.

Recommended readings:

* Christensen, P., Fusaroli, R., & Tylén, K. (2016). Environmental constraints shaping constituent order in emerging communication systems: Structural iconicity, interactive alignment and conventionalization. *Cognition*, *146*, 67-80
* Nölle, J., Staib, M., Fusaroli, R., & Tylén, K. (2018). The emergence of systematicity: how environmental and communicative factors shape a novel communication system. *Cognition*, *181*, 93-104.

**Session 5: Language as shaped by the environment**

One of the most fundamental aspects of human language is linguistic diversity (Evans & Levinson 2009). But where does linguistic diversity come from? We will review the Linguistic Niche Hypothesis, that is, the suggestion that the physical and social environment might have an impact on the propagation of linguistic structure, and look at how recent experimental approaches might inform these discussions.

Recommended readings:

* Evans, N., & Levinson, S. C. (2009). The myth of language universals: Language diversity and its importance for cognitive science. *Behavioral and brain sciences*, *32*(5), 429-448.
* Nölle, J., Fusaroli, R., Mills, G. J., & Tylén, K. (2020). Language as shaped by the environment: linguistic construal in a collaborative spatial task. *Palgrave Communications*, *6*(1), 1-10.