12. **16:20 Jon William Carr** (University of Glasgow 4th year)
Language Evolution on Stella Fructa: The Effects of Novel Variables on an Iterated Learning Model of Linguistic Evolution by Cultural Transmission
Topic: Evolutionary Linguistics

It is suggested that human language arose as a function of three adaptive processes: evolution by natural selection, individual learning, and cultural evolution (Kirby and Hurford 2002). In this paradigm, biological evolution is intrinsically difficult to explore due to the ephemeral nature of language; however, the interface between learning and cultural evolution has recently been tested in a variety of mathematical, computational, and experimental models. These models demonstrate that systematic linguistic structure can arise in the transmission of language across multiple language users. Kirby, Cornish, and Smith (2008) introduced an experimental method for studying the cumulative effect on language of this cultural transmission. Their iterated learning model represented the first experiment on human participants to suggest that the cultural transmission of language leads cumulatively to the appearance of linguistic design without any explicit designer.

The present paper presents the results from a repeat of this experiment, which was conducted with a number of novel variables. Therefore, not only is the experimental method verified, but the resilience of the approach is tested too. The notable variables introduced in this version of the experiment are (a) an auditory modality, (b) a modified meaning-space, and (c) a modified signal-space. Despite these novel variables, learnability increases over the course of the experiment in a way that is strikingly similar to the results observed by Kirby et al. (2008). The emergence of compositional structure, however, is less forthcoming. This presents a problem: if the languages evolve to become easier to learn, yet a strong degree of compositionality does not emerge, then there must exist at least one other mechanism by which the languages optimize their successful transmission. The results suggest that this mechanism might lie in a different type of adaptation of the signal-space (i.e. the sounds and syllable structures employed by the languages). Over the course of the experiment, the languages tended to become more focused on a smaller set of syllable patterns, and this adaptation appears to make them easier to learn. Furthermore, as the signal-space becomes increasingly more focused, the probability of a chance alignment between signal and meaning becomes increasingly more likely to occur. It is therefore hypothesized that, in allowing the languages to evolve for perhaps five or ten more generations, a degree of compositional structure comparable with Kirby et al. (2008) might eventually emerge.

References:
Kirby S, Hurford JR (2002) The emergence of linguistic structure: An overview of the iterated learning model. In Cangelosi A, Parisi D (eds) Simulating the Evolution of Language (London: Springer Verlag): 121—148
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: 10681—10686