

The London Evolutionary Research Network and the AHRC Centre for the Evolution of Cultural Diversity present a one-day workshop on

## **‘Modern Approaches to Investigating Cultural Evolution’**

November 9<sup>th</sup>, 2007

9.30 – 17.30

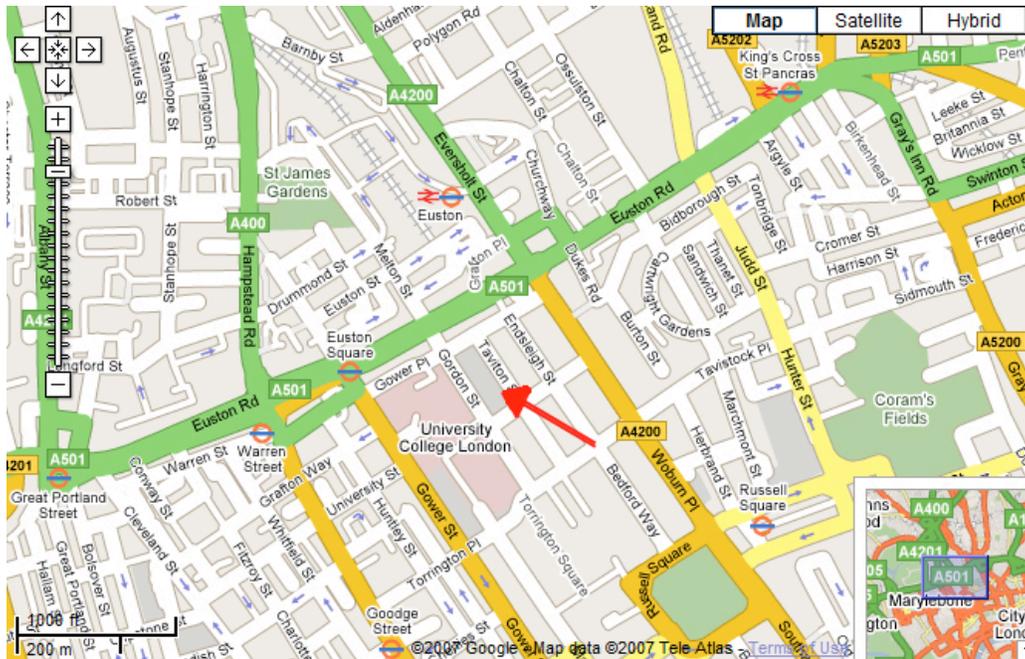
Daryll Forde Seminar Room  
Department of Anthropology  
University College London



- 09:30** **Welcome**
- 09:35** **Anne Kandler**  
*Social Learning, Income Inequality and New Product Diffusion*
- 10:00** **Nicolas Maystre**  
*The Coevolution of Trade and Cultural Diversity: Is the Village Global?*
- 10:25** **Monica Tamariz**  
*Adaptation between forms and meanings: Quantifying the effects of learning on cultural evolution*
- 10:50** **Tea/Coffee/Discussion**
- 11:20** **Hannah Cornish**  
*Language, Learning and Cultural Evolution: An Empirical Approach to Language Emergence*
- 11:45** **Gareth Roberts**  
*Language Change in the Context of the Freerider Problem: An Experimental Approach*
- 12:10** **Hugo Mercier**  
*Mechanisms of epistemic vigilance and their consequences for the spread of information*
- 12:35** **Gordon Ingram**  
*Linguistic displacement and the evolution of cultural norms*
- 13:00** **Lunch**
- 14:00** **Quentin Atkinson**  
*Frequency of word-use predicts rates of lexical evolution throughout Indo-European history*
- 14:25** **Robin Ryder**  
*Modelling and fitting catastrophic rate heterogeneity*
- 14:50** **Michael Dunn**  
*Correlated evolution of structural traits of Austronesian languages*
- 15:15** **Tea/Coffee/Discussion**
- 15:45** **Fiona Jordan**  
*Virtual Archaeology: Using phylogenetic comparative methods to reconstruct ancestral states of cultural traits*
- 16:10** **Erick Robinson**  
*The Identification of Mesolithic Heritage in the Early Neolithic of Northwest Europe*
- 16:35** **Alex Mesoudi**  
*Using the methods of experimental social psychology to study cultural evolution*
- 17:00** **Adam Powell**  
*Demography and the accumulation of culturally inherited skills*
- 17:25** **Close**

The workshop will be held in the Daryll Forde Seminar Room which is on the second floor of the UCL Department of Anthropology building. The full address is:

Department of Anthropology  
University College London  
14 Taviston Street  
London  
WC1H 0BW



The building is locked for security reasons so please use the intercom on the railings to the left of the door (you may be asked to sign-in). The elevators and stairs are to the left of the foyer and I'll put up posters directing you to the seminar room.

**09:30 Welcome**

**09:35 *Social Learning, Income Inequality and New Product Diffusion***

Anne Kandler & James Steele  
*AHRC Centre for the Evolution of Cultural Diversity, London*  
a.kandler@ucl.ac.uk

The typical cumulative adoption curve for a new durable good, whose price declines over time, is sigmoid in shape. This pattern can be approximated equally well by a biased transmission model, or by a model based on consumer heterogeneity in price thresholds for adoption. We expound the two alternative approaches, and propose a combined model in which the formation of a preference to adopt is shaped by social learning, but the timing of adoption is constrained by affordability. We note that evolutionary approaches to innovation diffusion in contemporary market economies need to take account of economic inequalities, in addition to basic mechanisms of human social learning.

**10:00 *The Coevolution of Trade and Cultural Diversity: Is the Village Global?***

Nicolas Maystre  
*Department of Political Economics, University of Geneva*  
Nicolas.Maystre@ecopo.unige.ch

This paper studies empirically the joint evolution of international trade and cultural diversity. Following the genetical and physical anthropology literature and based on the individual survey we develop an index of cultural diversity that can be split up into a between- and within-country component. Contrary to the existing literature, our index is time-varying which enables to neutralize many endogeneity concerns. First we found that both components of cultural diversity have decreased during the last two decades. We interpret this result as evidence for cultural convergence and for cultural erosion at the world level. In a second stage we look at the impact of cultural diversity on international trade. We found that an increase in cultural diversity between two given countries reduces their bilateral trade. We also found that an increase in cultural diversity within a given country translates into an increase of its total exports. In a third stage we study the causal impact of international trade on cultural diversity between countries. Using an instrumental variable approach and including time and country-pair fixed effects, we found that bilateral trade reduces the between-country component of cultural diversity. The effect is sizeable as a one standard deviation increase in bilateral trade openness translates into a 18.2% decrease in the between component of cultural diversity.

**10:25 *Adaptation between forms and meanings: Quantifying the effects of learning on cultural evolution***

Monica Tamariz & Andrew Smith  
*Language Evolution and Computation Research Unit, School of Philosophy, Psychology and Language Sciences, University of Edinburgh*  
monica@ling.ed.ac.uk

The structure of cultural forms is the combined effect of a number of selection pressures. We focus on two crucial pressures, namely individual learning, which filters out skills and behaviours that are difficult to learn, and the structure of the meanings that the forms have to convey. We use a novel method involving information theoretical tools and cross-situational learning to quantify the degree of systematicity between the structure of forms and the structure of meanings. An Artificial Language Learning experimental paradigm permits us to measure changes in systematicity during learning. Analyses of the structure of learning input and output languages reveal the nature and relative strength of several learning biases. This, in turn, allows us to link causal cognitive processes to the structure of language resulting from cumulative change over generations of learners. We discuss applications of this method to other cultural domains.

**10:50 Tea/Coffee/Discussion**

**11:20 *Language, Learning and Cultural Evolution: An Empirical Approach to Language Emergence***

Hannah Cornish

*Language Evolution and Computation Research Unit, School of Philosophy, Psychology and Language Sciences, University of Edinburgh*

[hannah@ling.ed.ac.uk](mailto:hannah@ling.ed.ac.uk)

Language Evolution and Computation Research Unit, University of Edinburgh

Computational models of language evolution have demonstrated that universal structural properties of linguistic systems, such as compositionality, can emerge as a result of languages themselves adapting to become better transmitted culturally. This provides an alternative to the idea that such universal properties are innately encoded, arising solely via the processes of biological evolution. The research discussed here explores this idea empirically and non-computationally for the first time in human populations, detailing the emergence and cultural transmission of artificial languages in the laboratory. Subjects learn a subset of an initially unstructured 'alien' language and are then tested. Their output is given as training input to the next generation of subjects, and the process iterates. It will be shown that even when subjects are exposed to only half the language, we still see gradual cumulative cultural adaptation towards an intergenerationally stable system, and that by changing the constraints on transmission in other ways, different types of structure, including compositionality, emerge.

**11:45 *Language Change in the Context of the Freerider Problem: An Experimental Approach***

Gareth Roberts

*Language Evolution and Computation Research Unit, School of Philosophy, Psychology and Language Sciences, University of Edinburgh*

[gareth@ling.ed.ac.uk](mailto:gareth@ling.ed.ac.uk)

Change and variation are inevitable in a culturally transmitted system like language. However, they are not dysfunctional. There is reason to think that human beings have evolved to exploit the variation that exists in language and are highly attuned to even quite subtle phonetic cues. This allows the almost immediate identification of outsiders, who may exploit the cooperative

behaviour of community members. The avoidance of such 'freeriders' is vital to the establishment and maintenance of social networks based on cooperative exchange. Although the role this plays in the development of linguistic diversity has been explored to some extent in sociolinguistic studies and computational simulations, there has been very little experimental work on this question. Here, I present an artificial-language experiment that I hope will go some way towards filling this gap.

**12:10 *Mechanisms of epistemic vigilance and their consequences for the spread of information***

Hugo Mercier  
*Institut Jean Nicod, Paris*  
hugo.mercier@gmail.com

Human culture relies enormously on communication. The maintenance of (mostly) honest communication, however, poses well known evolutionary problems. To solve these problems humans rely on a set of cognitive mechanisms, dubbed epistemic vigilance, specialized in filtering communicated information. Differential trust, selective memory, source monitoring and argument evaluation are such mechanisms. Considerations of costs preclude these mechanisms from filtering out all the information that can have a negative impact on us. Some maladaptive information may thus spread through a population. I will explain how a wide range of psychological studies (from persuasion and attitude change to the psychology of reasoning or consumer psychology) can be used to understand the mechanisms of epistemic vigilance – and their failures – and show how such an understanding can then be used to predict the differential spread of some type of information.

**12:35 *Linguistic displacement and the evolution of cultural norms***

Gordon Ingram  
*Institute of Cognition and Culture, Queen's University, Belfast*  
gingram02@qub.ac.uk

Language is essential for cultural evolution as we know it to take place. The linguistic property known as *displacement* – the representation of a situation in the world to someone who has not witnessed that situation – means that cultural activities can be transmitted not only through imitative learning, but also through verbal descriptions of how to perform them. Linguistic displacement has also enabled the spread of social information about absent third parties – gossip. This means that humans can club together to punish cheaters and bullies. Without this capacity, cultural systems of norms and values could not have evolved. These theoretical issues are illustrated by a behavioural ecological study of pre-school children's reporting of peers' behaviour. Young children's reporting of behaviour shows several properties that aid the effective punishment of norm violators: such reports are overwhelmingly truthful, are biased towards antisocial behaviour, and often focus on determining the limits of cultural norms.

**13:00 Lunch**

**14:00 *Frequency of word-use predicts rates of lexical evolution throughout Indo-European history***

Quentin D. Atkinson<sup>1</sup>, Andrew Meade<sup>2</sup> and Mark Pagel<sup>2</sup>

1. *Institute of Social and Cultural Anthropology, University of Oxford*

2. *School of Biological Sciences, University of Reading*

quentin.atkinson@anthro.ox.ac.uk

Among Indo-European languages, some meanings, such as 'tail', evolve rapidly whilst others, like the number 'two', evolve much more slowly. No general mechanism has been advanced to explain the striking variation in rates of lexical replacement among meanings. Here we combine corpus data on word-use with estimates of rates of evolution across 200 meaning categories and show that the way meanings are used in regular speech predicts rates of lexical replacement over the 6,000-10,000 year history of Indo-European. We propose a model of lexical replacement, derived from population genetics and models of cultural evolution, that can account for up to 50% of the observed variance in rates of meaning evolution. Our findings are consistent with social models of word change that emphasise the role of selection, and suggest that owing to the ways that humans use language, some words will evolve slowly and others rapidly across all languages.

**14:25 *Modeling and fitting catastrophic rate heterogeneity***

Robin Ryder

*Department of Statistics, University of Oxford*

ryder@stats.ox.ac.uk

While historical linguists for the most part favour a root age for Indo-European at about 6000 years before the present, quantitative methods using phylogenetic analyses lead to a root age between 8000 and 9500 BP (Gray and Atkinson, 2003). Several model misspecifications have been suggested which could explain the discrepancy; rate heterogeneity is clearly important. The treatment given by Gray and Atkinson and their collaborators (including ourselves) goes some way to measuring rate heterogeneity. However, there are weaknesses in both model veracity and statistical methodology. We describe and fit a model of 'catastrophic' rate heterogeneity. The modelled evolution is a birth-death process of language traits with point-like catastrophic events, involving multiple births and deaths, superposed on a process of otherwise constant rate. At catastrophes many language traits change at the same time. This greatly enlarges the class of rate models under consideration, since the data may provide evidence of many small catastrophes, or a few large ones, or any mixture. The model has several extra parameters, which are estimated from data, simultaneously with phylogeny. Preliminary results obtained by fitting this model to the Indo-European datasets of Ringe et al. (2002) and Dyen et al. (1992) suggest a number of new interpretations.

**14:50 *Correlated evolution of structural traits of Austronesian languages***

Michael Dunn<sup>1</sup> and Simon Greenhill<sup>2</sup>

1. *MPI Psycholinguistics, Nijmegen, Netherlands*

2. *Department of Psychology, University of Auckland*

Michael.Dunn@mpi.nl

The study of language change has long been hampered by difficulties in distinguishing the causes of cross-linguistic correlations between typological features. Correlations may be motivated by functional linkage of traits, or may be the result of the historical accident of common ancestry (Galton's problem). A sizable literature has developed in linguistics concerning the ordering of grammatical constituents, and a number of dependencies and constraints have been proposed (e.g. Greenberg's word order universals). The statistical validity of these claims is often unclear, especially since linguists have hitherto relied for their generalizations on identifying genealogically independent samples. Following the approach used by Holden and Mace (2003, 2005), Pagel and Meade (2005) a solution to this problem is demonstrated using Bayesian character state reconstruction (BayesTraits, Pagel and Meade 2006). Pairwise tests for correlated evolution of typological traits are carried out within a language family (here, the Austronesian family) to build a network map of typological dependencies.

**15:15 Tea/Coffee/Discussion**

**15:45 *Virtual Archaeology: Using phylogenetic comparative methods to reconstruct ancestral states of cultural traits***

Fiona Jordan & Thomas Currie  
*Department of Anthropology, University College London*  
*f.jordan@ucl.ac.uk*

Many aspects of human social behaviour leave little trace in the archaeological record. With phylogenetic models of population history, we are able to use data from the ethnographic present and extrapolate backwards in time to reconstruct ancestral states of social behaviours. Kinship-related cultural traits are of especial interest to anthropologists as they relate to how people distribute their resources and to sex-specific patterns of dispersal. We show how Bayesian comparative methods can be used to infer the kinship systems of ancestral Austronesian-speaking societies in the Pacific up to 6000 years ago. We also present simulation studies that test how robust such inferences are to increasing levels of horizontal transmission of cultural traits between populations.

**16:10 *The Identification of Mesolithic Heritage in the Early Neolithic of Northwest Europe***

Erick Robinson  
*Research School of Archaeology and Archaeological Science, University of Sheffield*  
*e.n.robinson@sheffield.ac.uk*

For the past three decades researchers have constructed various hypotheses to explain the presence of trapezes in the lithic toolkits of the northwest European *Linearbandkeramik* ('LBK', or *Rubané*) culture. While most hypotheses agree to the clear later Mesolithic affinities of the trapezes, they differ when it comes to their meaning. At the moment the hypotheses are polarized on opposite ends of the modelling spectrum: the first suggests the trapezes indicate the uptake of the LBK cultural 'package' by indigenous hunter-fisher-gatherers, while the other suggests the contact and subsequent acculturation of these indigenous groups by LBK colonists. This presentation centres on recent research that aims to test the significance of these armatures as

types, and most importantly, to determine whether they possess homologous or analogous similarity. This research begins from the foundations of inquiry into archaeological culture, which is essential to questions concerning the neolithisation processes of northwest Europe. On face, this archaeological problem seems to be an appropriate fit for evolutionary approaches, however, the research contexts—such as find situations and chronological resolution—make the dataset a difficult fit for fine-grained phylogenetic methods. The primary aim of this presentation is to introduce the dataset and research objectives in order to generate constructive feedback from the workshop participants concerning the potentials for using contemporary evolutionary methods to investigate the problem of identifying Mesolithic heritage in the Early Neolithic of northwest Europe.

### **16:35 *Using the methods of experimental social psychology to study cultural evolution***

Alex Mesoudi

*Department of Social and Developmental Psychology, University of Cambridge*  
am786@cam.ac.uk

Laboratory experiments have played a key role in furthering knowledge of biological evolution, from uncovering the details of genetic inheritance to simulating long-term patterns of biological macroevolution. The same is true for cultural evolution. Laboratory experiments that draw on the methods of social psychology can reveal details of cultural transmission biases and simulate long-term patterns of cultural macroevolution. To illustrate the latter, I will present details of a study that I recently conducted with the evolutionary archaeologist Michael O'Brien, in which we experimentally simulated the cultural transmission of prehistoric Great Basin projectile points. Participants designed their own "virtual projectile points", and tested these designs in a "virtual hunting environment". Different phases of the experiment simulated either isolated individual learning or indirectly-biased cultural transmission. The data generated during these experimental phases matched up with data from actual prehistoric points found in California and Nevada respectively, suggesting the operation of these forms of learning in prehistoric Great Basin environments.

### **17:00 *Demography and the accumulation of culturally inherited skills***

Adam Powell<sup>1</sup>, Stephen Shennan<sup>2</sup>, and Mark Thomas<sup>1</sup>

1. *Centre for Genetic Anthropology, University College London*

2. *Institute of Archaeology, University College London*

adam.powell@ucl.ac.uk

The Upper Palaeolithic Transition occurred around 40-50k years BP in Europe and Western Asia, but somewhat later in North Africa and East Asia, and is associated with a significant increase in human cultural and technological complexity. However, many of its features appear much earlier in the African Middle Stone Age. Many explanations for this cultural shift have been proposed, including biological / cognitive change, innovations in social structure, fluctuations in environmental / socio-economic circumstances and the effects of demography on the transmission of skills. Previous work by Henrich and Boyd (2002) on the inheritance of continuous cultural representations has shown that in a model of directly biased oblique transmission, where the learning mechanism is incomplete and inaccurate, population size is a crucial parameter in determining the accumulation (or loss) of cultural skills. We have extended this analytical model by using semi-realistic stochastic simulations that reflect plausible human demographic conditions during the Pleistocene. Our simulation model consists of a large number of spatially separated sub-populations connected by migratory activity, which is determined by local sub-population group density. Within each sub-population a naïve offspring generation undergoes a process of enculturation, through both vertical (parental) and directly biased oblique transmission, before

replacing the adult generation. We show that (1) the level of cultural skill that can be maintained in sub-populations is related to the density of those sub-populations, and (2) geographic heterogeneity in local sub-population density leads to stable spatial structuring of skill accumulation.

**17:25 Wine reception**