



**Us and Them:
Modeling past genetic,
linguistic, and cultural boundaries**



An OMLL Networking Activity

**Auditorium de l'Agora,
Domaine du Haut Carré, Université Bordeaux 1.
Talence, France**

Bordeaux 15–17, May 2008

Organized by Francesco d'Errico and William Banks

This event, as part of the European Science Foundation EUROCORES Programme OMLL, was supported by funds from the EC Sixth Framework Programme under Contract no. ERAS-CT-2003-980409.

Abstract

One of the most prominent challenges facing archaeology, anthropology, and related disciplines, is the need to develop methods with which we can effectively disentangle and interpret the complicated dynamics that exist between natural and human systems. Establishing and employing effective approaches is critical if we are to understand the influence of environmental constraints on social and technical systems, cognition, and communication. This OMLL workshop will bring together archaeologists, linguists, geneticists, palaeoclimatologists, and Geographic Information System specialists in order to discuss the latest investigative methodologies and how they can be applied to investigations of prehistoric cultural geography, linguistics, and genetics, and their relationships with past environmental variability.

Workshop aims

A current challenge facing archaeology, anthropology, ecology, linguistics, genetics, demography, climatology, statistics, and computer modeling is the need to decipher and understand natural and human systems and their reciprocal impacts throughout prehistory, as well as the constants in their dynamic equilibrium.

Identification of the geography and variability of culturally, linguistically and genetically coherent human groups is critical to understanding the complex mechanisms that have shaped the interactions between these realms and the environment. However the idea that the disciplines involved can effectively identify past boundaries in these domains and the factors that have shaped them is increasingly debated. Do they exist, and if so, what creates genetic, linguistic and cultural boundaries? Do we have the means with which to identify them in the past and evaluate their reciprocal influences? Establishing methods to evaluate the rules and driving forces behind these human-environment interactions is critical if we are to assess and understand the influence of environmental constraints on social and technical systems, cognition, and communication.

Brief state of art

The issues that will be the focus of the planned workshop represent a crucial and recurrent concern of all the involved disciplines. Archaeologists have wondered for more than a century about the meaning of the circles they draw on maps to define archaeological 'cultures.' Many archaeologists believe that the distribution of specific elements of material culture such as artifacts types or technological behaviors may identify some sort of 'cultural boundaries' but they do not know whether and to what extent those boundaries accurately represent the distribution of genetically, linguistically and culturally coherent human groups.

This becomes even more apparent when one considers the attitudes of other disciplines concerned with the study of cultural variability. Cultural anthropologists have recurrently questioned the notion of "cultural boundaries," arguing that archaeologists inappropriately posit stable and bounded "islands" of cultural distinctiveness. 'Cultures' would be irreducibly plural, permeable and largely independent from environment with respect to their structural constituents. This culturalist view, however, is contradicted by ethnoarcheologists who have inquired how social boundaries persist despite the constant flow of people and the maintenance of social relations across such boundaries. By using middle-range theoretical principles derived from ethnoarchaeological contexts, archaeologists are developing methods that allow the elucidation of processes behind the formation of social boundaries, even in prehistoric contexts. Of particular interest are the attempts to use stylistic features of selected elements of the material culture to identify and quantify cultural variability from a geographical standpoint. Modeling past cultural boundaries is a multidisciplinary pursuit, integrating environment, subsistence, technology, settlement pattern, cultural landscape, ritual symbolism and historical sources. Heuristic approaches adapted from the biodiversity sciences, such as the one termed eco-cultural niche modeling (ECNM), are now available for reconstructing niches of past human populations and for illuminating the complex mechanisms that regulated the interactions between prehistoric populations and their environments.

Genetic differences between populations mostly arise through random genetic drift when they are separated by factors such as distance, geographical barriers, language or culture, and may or may not be maintained when distinct populations

come into contact. There is disagreement about the importance of each of these factors. A number of approaches have been used to infer spatial genetic boundaries from gene frequency distributions (spatial autocorrelation methods, wombling, computational geometry approach from Monmonier's algorithm, genography, inverse distance-weighted method, trend surface analysis, splines, kriging technique, contour area multifractal model of spatial genetic structure etc.). Results from these studies have shown that rates of gene frequency change across language boundaries, are often obviously and significantly higher than those at random locations, and many linguistic boundaries are known to occur at physical barriers. They have also revealed, however, that the genetic structure of populations over large areas is often determined by gene flow and admixture, rather than by adaptation to varying environmental conditions.

What means do we have to disentangle these contrasting factors and build integrated and reliable explanations for these fluctuating boundaries? Can the varied panoply of methods created by geneticists be adapted to other disciplines and used effectively?

These are the questions that we would like to address and possibly answer during this meeting.

PROGRAM

Thursday, May 15 – Haut Carré, Bordeaux 1 Campus

- 9:30 – Introductions and Opening Remarks (Jacques Jaubert and Francesco d'Errico)
- 9:45 – **Claudio Castellano**: Models of cultural dissemination: the approach of statistical physics.
- 10:15 – **William Fletcher**: Climatic changes during the last 60,000 years in Europe.
- 10:45 – Break
- 11:00 – **Masa Kageyama**: Modeling the climate and vegetation of the last glacial period: results from a high resolution general circulation model.
- 11:30 – **Raphaëlle Chaix**: The influence of social organization on genetic variability.
- 12:00 – Lunch
- 14:00 – **Jean-Pierre Bocquet-Appel**: Some past works of boundary detections in demography and archaeology.
- 14:30 – **Roger Blench**: Agriculture and phyllic dispersals: re-evaluating the evidence.
- 15:00 – Break
- 15:15 – **Evelyn Heyer**: Phylogeographic and linguistic variability of Central Asia.
- 15:45 – **Jean-Marie Hombert** and **Gerard Lenclud**: What is a Linguistically Modern Man?
- 16:15 – Discussion
- 19:30 – Conference Dinner

Friday, May 16 - Haut Carré, Bordeaux 1 Campus

- 9: 30 – **Anne Delagnes**: Tackling Culture in the lithic prehistoric record: a challenging issue.
- 10:00 – **Francesco d'Errico** et al.: Expectations of the impact of climatic variability of OIS 3-2 on human demography and cultural diversity in Europe.

10:30 – **William Banks et al.**: Possible relationships between cultural boundaries and large mammal ecological niches during the LGM

11:00 – Break

11:15 – **Bruno Maureille**: New reflections on Neanderthal burials and their chronological and geographical repartitions.

11:45 – **Joao Zilhão**: New Data on the Ebro Frontier: Origins and Significance of an Archaeographic Pattern.

12:15 – Lunch

14:00 – **Anne-Marie Tillier**: Fluctuating boundaries, identities and taxonomic affiliations: the case of "Neanderthals" and "Modern humans" in the Near East

14:30 – **Matthew Grove**: Data-driven spatial analytic methods for prehistoric land use reconstruction.

15:00 – **Stephen Lycett**: Planting trees in a forest of 'culture': the importance and prospects of phylogenetic methods in understanding cultural phenomena.

15:30 – Break

15:45 – **Love Erikson**: Modeling cultural, linguistic, and genetic boundaries in prehistoric Amazonia

16:15 – **Salikoko Mufwene**: From inter-idiolectal variation through linguistic diversity to language boundaries

Saturday, May 17 – Salle de réunion, 3rd floor, IPGQ, Building B18

9:30 – **Franz Manni**: Dialect, surname and genetic boundaries. Are they related? Do they mean anything? Are they robust?: Methodological insights.

10:00 – **Graeme Ackland**: Modeling cultural hitchhiking.

10:30 – **Ron Pinhasi**: Assessing spatio-temporal relationships between cultural and biological boundaries in Neolithic Europe.

10:45 – Break

11:15 – **Stephan Naji**: title forthcoming

12:15 – Lunch

14:00 – Jean-Marie Hombert: Discussant

14:30-15:30 – Discussion and Research Perspectives

ABSTRACTS

Graeme Ackland (University of Edinburgh)

Modeling Cultural Hitchhiking.

Computer simulation can be used to make a rigorous test of whether various explanations of history are credible. Historically, the invention of any advantageous technology has facilitated the spread of the culture which invented it. Here, we adopt model of Neolithic farming population growth based on food production on a heterogeneous landscape with multiple populations: the original farmers' culture spreads until the technology is adopted by others, forming a sharp or diffuse boundary depending on the cultural marker. Such simple models form a "null hypothesis", and while they capture general trends, more powerful deductions can be made from their failures.

William E. Banks, Francesco d'Errico, A. Townsend Peterson*, Masa Kageyama, Guillaume Colombeu** (PACEA-CNRS, University of Bordeaux 1, *University of Kansas, **LSCE-CNRS, Gif-sur-Yvette)

Possible relationships between cultural boundaries and large mammal ecological niches during the LGM

Biocomputational architectures have been extensively used in the biological sciences for over a decade with excellent results. With this study, we apply one such tool, the Genetic Algorithm for Rule-Set Prediction, to reconstruct the ecological niches and geographic ranges of reindeer and red deer during the Last Glacial Maximum. These predictive models are compared to human ranges and niche reconstructions for the same period obtained with the same methodology. Our results indicate that ecological niche models based on a wide range of archaeological data (material culture, faunal, radiometric, etc.) allow one to explore the environmental factors that most influenced human and large mammal distributions and adaptations.

Roger Blench (Linguist and Private Consultant)

Agriculture and phyllic dispersals: re-evaluating the evidence

Associated principally with archaeology are a number of highly questionable claims concerning the antiquity of language families and the motivation for their expansion. A proposal that has been extended to the language phyla of the world and that has been influential far out of proportion to its evidential base is the idea that phyllic (and thus demic) expansions are driven by agriculture. This has a long history within Indo-European, but its extension, notably to Austronesian, has most recently been associated with the work of Peter Bellwood. While such explanations might be seriously entertained in a small number of specific cases, the case for attributing such hypotheses, their more global explanatory power is questionable. In particular, the actual linguistic evidence adduced is often slight at best. The paper looks at methodological problems associated with this argument, tabulates the evidence (or lack of it) for major world phyla, and re-evaluates Austronesian, which has been held up as an exemplar for this model. It proposes that Austronesian was not an agricultural expansion, despite the well-attested reconstructions of crop names and that the engines of phyllic expansion were very diverse. A model of the expansion of Nilo-Saharan driven by the exploitation of

aquatic resources, linking palaeoclimatology, archaeology, linguistics and palaeozoogeography, is proposed as a methodological example.

Jean-Pierre Bocquet-Appel (UPR 2147-CNRS)

Some Past Works of boundary detections in Demography and Archaeology,

Population or cultural frontiers can be fixed or mobile. Typically the former can be that of a tribal area or linguistic group(s), geographically stable, while the latter may be reflected in biological or cultural diffusion processes (invasion or colonization). Some of the techniques that make it possible to identify these fixed or mobile frontiers, from georeferenced markers, are briefly described along with a discussion of their strengths and weaknesses in archaeological and paleoanthropological contexts (e.g., spatial archaeological densities, simple and generalized wombling, kriging and isochrones).

Claudio Castellano (University of Rome)

Models of cultural dissemination: the approach of statistical physics

Statistical physics traditionally aims at understanding how simple interactions of a large number of elementary constituents (particles, spins) give rise to macroscopic collective phenomena. Applications of this approach to fields where complex behavior emerges out of the social interaction of a large number of individuals have started to appear in the last years. This process is stimulated by the formal similarity between some models for social sciences and for physics. I will present examples of this interdisciplinary line of research, with particular reference to models for cultural dissemination.

Raphaëlle Chaix (Muséum National d'Histoire Naturelle – CNRS)

The influence of social organization on genetic variability

To evaluate the impact of different social organisations on the genetic evolution of human populations, we compare the genetic diversity of patrilineal pastoral populations and cognatic farmers in Central Asia.

Anne Delagnes (PACEA-CNRS, University of Bordeaux 1)

Tackling Culture in the lithic prehistoric record: a challenging issue

Tackling the influence of cultural trends on the prehistoric lithic record has been a challenging and recurring issue for successive generations of prehistorians. It has resulted in diverse and often extreme positions ranging from the paradigm of large-scale cultural diffusionism to the complete negation of cultural content devoted to tool-making and knapping practices. Is an intermediate position tenable and on which arguments? This issue is addressed via a diachronic overview of the Old World Pleistocene lithic record.

Francesco d'Errico, Maria-Fernanda Sanchez-Goñi, Marian Vanhaeren

(PACEA-CNRS, University of Bordeaux 1; EPOC-CNRS, Ecole Pratique d'Hautes Etudes; ArScAn-CNRS, University of Paris 10-Nanterre)

Expectations of the impact of climatic variability of OIS 3-2 on human demography and cultural diversity in Europe

Building on present day cultural and ethnolinguistic diversity, we explore how millennial-scale climatic variability that affected Europe between 60–10k cal BP may have influenced vegetation and mammal communities as well as cultural diversity. We will test these expectations with a case study of grave goods recovered from Gravettian burials.

Love Eriksen (Lund University)

Modeling cultural, linguistic, and genetic boundaries in prehistoric Amazonia

The aim of this project is to investigate how Geographical Information System (GIS) mapping of materialized aspects of human culture in prehistoric Amazonia can increase our understanding of the distribution of past genetic, linguistic, and cultural boundaries in that geographical area. The main objective of the project is to build a GIS database for correlating geography, linguistics, material culture (e.g., ceramic styles, rock art styles, horticultural systems, etc.), trade routes, and political projects over time, in order to gain further understanding of the forces behind the extraordinary linguistic diversity in Amazonia. This database will then be used to explore possible correlations with historical linguistics (including distribution of key loanwords), other historical information (e.g., on trade), ethnography (e.g., material culture, mythological themes, etc.), biogeography (particularly soil and vegetation), and genetics. The aim is to explore various hypotheses about connections between linguistic families and specific archaeological features (e.g., ceramic styles, agricultural systems), and between these phenomena and specific ecological zones. It is hoped that the conclusions will add to our knowledge about the past genetic, linguistic, and cultural boundaries in prehistoric Amazonia, and that our ability to define such boundaries and to explore their content and construction will increase.

William Fletcher (EPOC-CNRS and Ecole Pratique d'Hautes Etudes)

Climatic changes during the last 60,000 years in Europe.

I will provide a review of the types of data used by palaeoclimatologists to reconstruct the climatic variability of Marine Isotope Stages 4–1, describe the impacts of this variability on the European continent and neighboring marine systems, and illustrate their effects on vegetation.

Matt Grove (Royal Holloway, University of London)

Data-driven spatial analytic methods for prehistoric land use reconstruction

The study of prehistoric land use in archaeology has a considerable history, but has until recently lacked the sound quantitative basis necessary to allow the comparison of mobility patterns across the broad temporal and geographic extent of the Palaeolithic. This paper builds a data-driven methodology for the reconstruction of land use based on the locations of archaeological sites and the materials they contain. The advocated procedures avoid many of the arbitrary assumptions associated with the standard spatial analytic techniques of ecology and geography, and provide a probabilistic approach to simulating mobility. Such approaches can profitably be applied to archaeological landscapes for the purposes of regional or temporal comparison.

Evelyne Heyer (Muséum National d'Histoire Naturelle – CNRS)
Phylogeographic and linguistic variability of Central Asia.

We will present genetic data on Central Asia focusing on two aspects: the peopling of the area and the genetic differences between populations belonging to the two main language families: Turco-Mongol and Indo-Iranian.

Jean-Marie Hombert and Gerard Lenclud
What is a Linguistically Modern Man?

It is generally accepted that the total set of Modern Human characteristics did not appear abruptly. As a result of a mosaic process the appearance of Culturally Modern Man did not coincide chronologically with Anatomically Modern Man in the evolution of our species. In fact, because different traits of each of these two categories (Anatomically Modern vs. Culturally Modern) emerged at different places and at different times, our evolution can be considered as constituting a double-mosaic pattern.

In this paper we propose to investigate the concept of “Linguistically Modern Man” and show how it should be integrated in this double mosaic process of evolution. We will look successively: 1) at the origin of our communication system from non-human primates (insisting on the role of communicative gestures); 2) at the possibility of emergence of our communication system at different places and at different times (polygenesis vs. monogenesis); and 3) at the various proposals concerning the emergence of Proto-languages and the subsequent role of recursivity. We will suggest that the capacity to produce articulated speech was probably in place long before “full language capacity” and allowed a first significant step in our ability to transmit information to our conspecifics. Finally, we will attempt to establish a link between linguistic capabilities and traces of human behaviour as witnessed by archaeological findings.

Masa Kageyama (LSCE-CNRS, Gif-sur-Yvette)
Modeling the climate and vegetation of the last glacial period: results from a high resolution general circulation model

Numerous climate reconstructions have shown that the climate of the last glacial period was highly unstable. In this talk, I will show how we have modeled three different glacial climate/vegetation states using the high resolution general circulation model LMDZ.3.3 coupled to the ORCHIDEE dynamical vegetation model.

Stephen Lycett (University of Liverpool)
Planting trees in a forest of 'culture': the importance and prospects of phylogenetic methods in understanding cultural phenomena.

Visible cultural patterns (either ethnographic or archaeological) are the product of an historical process involving social transmission and descent with modification of behavioural variants through time. Phylogenetic methods can play an important role in studying such phenomena. In this presentation, it is shown how phylogenetic methods can shed light on whether patterns of behavioural variation seen in living wild chimpanzee populations are the product of social or genetic mechanisms, at a proximate level. Such analyses have important implications for

studying the possibility of 'culture' and cultural variation in extinct hominins. Thereafter, a specific case study using Palaeolithic stone tool assemblages is described, which shows how phylogenetic methods can be further used to assess whether putative instances of cultural proximity in the archaeological record are the product of genuine continuity or of cultural convergence.

Franz Manni (Muséum National d'Histoire Naturelle – CNRS)

Dialect, surname and genetic boundaries. Are they related? Do they mean anything? Are they robust?: Methodological insights.

One of the recurring chimæras of population geneticists has been to interpret archaeological findings and linguistic classifications in the light of the genetic relatedness of human populations. After a first step based on hierarchical classifications, some geneticists started to be interested in geography, in order to exactly map the differences.

I will present some of the results I have obtained so far concerning the possible relation between cultural markers (inferred from dialect variability) and genetic markers, being surnames at the interface. To explain the patterns, I have developed methods to test their robustness and to minimize the effect of geographic distance over the genetic and linguistic distances that were measured, thus assuming an underlying diffusionist model.

Bruno Maureille (PACEA-CNRS, University of Bordeaux 1)

New reflections on Neanderthal burials and their chronological and geographical repartitions.

The object of this presentation is not to return to the age old debate of the existence of voluntary Neanderthal burials, since the topic has been exhausted, even if there are real differences between Mousterian graves of early anatomically Modern Humans and those of Neanderthals as well as between UP graves and those of Neandertals. I wish to present a revision of the attribution of technocomplex (debitage and/or production technique) affiliation to Neanderthal burials. And, even though direct, absolute dates of Neanderthal fossils from burials are extremely rare, the chronological distribution of these graves could be the consequence of variability in the density of the Neanderthal settlement.

Salikoko Mufwene (University of Chicago)

From inter-idiolectal variation through linguistic diversity to language boundaries

No language has ever evolved wholesale as the invention of one single speaker or group of speakers designing one and copied by others. The phylogenetic evolution of language has been a protracted emergence process, involving a series of exaptations facilitated by various transformations in the anatomical and mental structures of hominins under changing physical and social ecological pressures. Every modern language appears to have evolved gradually and piecemeal, through cooperative interactions of speakers alternatively innovating forms and structures and copying from each other, avoiding reinventing the wheel. While imperfect replication has fostered variation, mutual accommodations have facilitated the emergence of communal norms and the reduction of intra-group variation. On the other hand, isolation of groups has fostered inter-group diversity,

with the boundaries imposed by a wide range of ecological factors having to do with population structure.

Stephan Naji (UPR 2147-CNRS)
Title Forthcoming

Pinhasi, R (University College Cork)
Assessing spatio-temporal relationships between cultural and biological boundaries in Neolithic Europe

A major challenge in the study of prehistory is the reconstruction of non-tangible social, cultural biological aspects which characterised past societies. In line with the aims of this workshop, this paper will address the spatio-temporal relationships between the morphology of European Neolithic populations and material culture attributes. It will examine the extent to which archaeological 'cultures' that are defined on the basis of pottery and other material attributes share a common biological (and hence genetic) profile. It will also address the extent to which there is a correlation between geographic and biological (craniometric) distance matrices in the context of changes in population structure and stochastic models.

Anne-Marie Tillier (PACEA-CNRS, University Bordeaux 1)
Fluctuating boundaries, identities and taxonomic affiliations: the case of "Neanderthals" and "Modern humans" in the Near East

João Zilhão
New Data on the Ebro Frontier: Origins and Significance of an Archaeographic Pattern

New results from ongoing field work will be presented concerning the exact timing of the replacement of Mousterian Neanderthals by Aurignacian moderns and the immediate environmental context of the process in two regions of Iberia, Murcia (Spain) and central Portugal.

List of Speakers

(OMLL affiliates in blue; External experts in black)

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