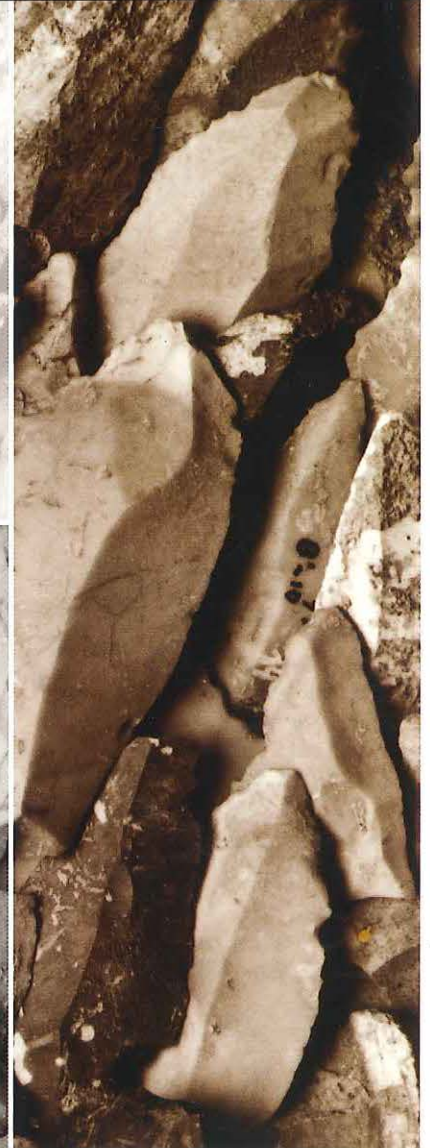
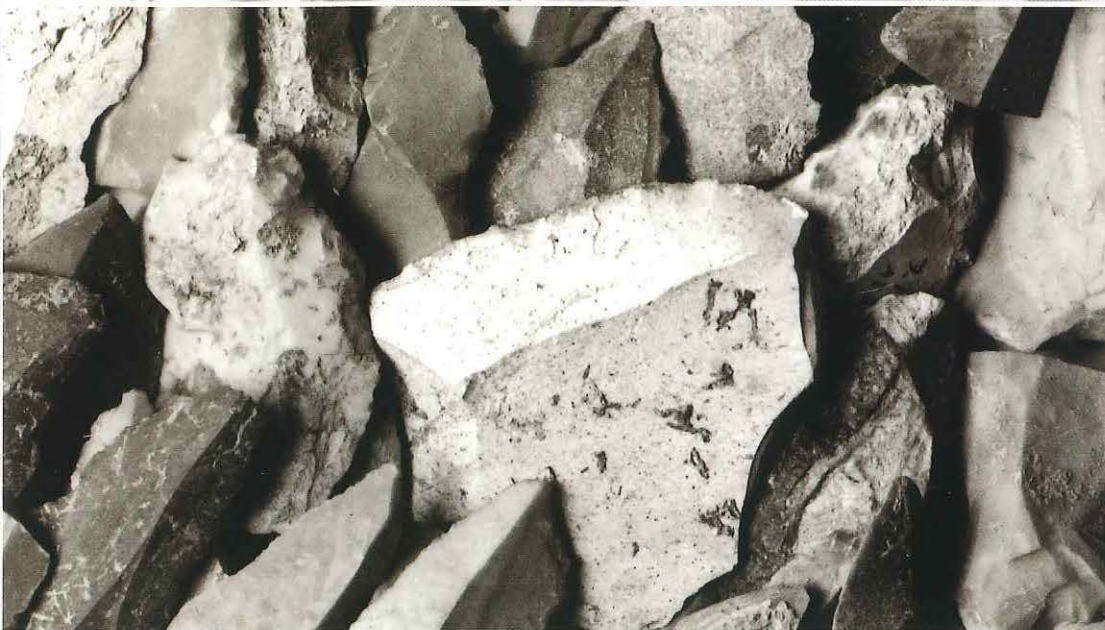


INTERNATIONAL WORKSHOP

Neanderthals and Modern Humans:

*Archaeological Approaches
to Their Learning Behaviors*



NOVEMBER 22-24, 2013

Sanjo Conference Hall & The University Museum
The University of Tokyo, TOKYO / JAPAN

Program and Abstracts
Edited by
Yoshihiro Nishiaki

RNMH



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Replacement of Neanderthals by Modern Humans: Testing Evolutionary Models of Learning
Grant-in-Aid for Scientific Research on Innovative Areas (2010-2014)

Yoshihiro Nishiaki (ed.) 2013

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Published by

RNMH Project A01 Team

The University Museum, The University Tokyo

Hongo 7-3-1, Bunkyo-ku, Tokyo 113-0033, Japan

The project has been supported by a Grant-in-Aid for Scientific Research on Innovative Areas from Japanese Ministry of Education, Science, Culture, and Technology (2010-2014).

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Project Office: Kochi University of Technology, Tokyo Labo./ CIS Tokyo, Tokyo 108-0023, Japan

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URL: <http://www.koutaigeki.org/>

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WORKSHOP PROGRAM

Friday, 22 November—*Sanjo Conference Hall 2F*

Introduction

- 10:30 – 11:00 Introduction
Yoshihiro Nishiaki
- 11:00 – 12:00 Evolution of culture-as-a-0, 1-vector
Laurel Fogarty, Joe Yuichiro Wakano, Marcus W. Feldman, and Kenichi Aoki
- 12:00 – 13:30 ***Lunch Break***

Session 1: Processes of the Replacement of Neanderthals by Modern Humans

- 13:30 – 14:30 Approaching learning behaviors in the replacement of Neanderthals by modern humans: a view from African and Levantine archaeological records
Seiji Kadowaki
- 14:30 – 15:30 Dispersal of modern humans and demise of Neanderthals: a view from spatio-temporal patterns of the European transitional industries
Katsuhiko Sano
- 15:30 – 16:00 ***Coffee Break***
- 16:00 – 17:00 The emergence of modern behaviors in North, Central, and Eastern Asia: issues of the non-European archaeological record
Masaki Naganuma
- 17:30 – 18:30 ***Tour to the Intermediatheque, UMUT, Marunouchi***
- 19:00 – 20:30 ***Welcome Party***

WORKSHOP PROGRAM

Saturday, 23 November–*Sanjo Conference Hall 2F*

Session 2: Cultural Transmission among Neanderthals Societies

- 10:00 – 11:00 The Lower to Middle Palaeolithic transition: from imitation to the origins of tradition
Olaf Jöris
- 11:00 – 12:00 Neandertal lifeways
Wil Roebroeks
- 12:00 – 13:00 ***Lunch Break***
- 13:00 – 14:00 Can we learn about learning in the Levantine Middle Paleolithic?
Mechanisms of culture change, social transmission, and the archaeological record
Erella Hovers
- 14:00 – 15:00 Levallois: potential implications for learning and cultural transmission capacities in Neanderthals and Early Modern Humans
Stephen J. Lycett
- 15:00 – 15:30 ***Coffee Break***

Session 3: Neanderthal Lithic Technology

- 15:30 – 17:00 Levallois knapping (demonstration)
Metin Eren
- 18:00 – ***Dinner***

WORKSHOP PROGRAM

Sunday, 24 November - *Muse Hall of UMUT 7F*

Morning *Tour to the Meiji University Archaeological Museum*

Session 4: Cultural Transmission among Modern Human Societies

13:00 – 14:00 The origins of settlement and society – the Upper Palaeolithic roots of modern human spatial behaviour
Olaf Jöris

14:00 – 15:00 Teaching and skill learning: a case study of the Upper Paleolithic assemblages at the Shirataki sites in Hokkaido, Northern Japan
Jun Takakura

15:00 – 15:30 ***Coffee Break***

15:30 – 16:30 Learning of sanukite knapping at the Upper Palaeolithic site of Suichoen (Japan)
Shoji Takahashi

Session 5: Toward Understanding Prehistoric Learning Behavior

16:30 – 17:30 The influence of stone raw material differences on expert learning: handaxe production with flint, basalt, and obsidian
Metin Eren, Christopher I. Roos, Noreen von Cramon-Taubadel, and Stephen J. Lycett

17:30 – Discussion
Yoshihiro Nishiaki

18:30 – ***Sayonara Party***

WORKSHOP PROGRAM

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Metin Eren, Christopher I. Roos, Noreen von Cramon-Taubadel, and Stephen J. Lycett

17:30 – Discussion
Yoshihiro Nishiaki

18:30 – *Sayonara Party*

ABSTRACTS

Introduction

Introduction

Yoshihiro Nishiaki

The University Museum, The University of Tokyo

The “Replacement of Neanderthals by Modern Humans” project aims to clarify the processes and the backgrounds behind the fate of the Neanderthals and the success of modern humans. As a step to facilitating discussion, the project employs a working hypothesis that differences in learning abilities (strategies) played a decisive factor in the replacement. This hypothesis is based on the assumption that because the replacement is likely to have been related to differences in the cultural adaptability between these two groups of populations, the driving force for the development of culture and technology, that is, ways of learning, must also have differed. The hypothesis has been tested in an interdisciplinary framework combining contributions from the humanities, geosciences, engineering, and biological sciences, including neuro-cognitive science.

A specialist team is dealing with the archaeological data on the past cultures and learning behaviors within this framework. The learning behaviors cannot be determined by learning ability alone, being affected by numerous other factors, too, such as cultural tradition, population size, life history, and birth rate. As such, identification of differences of learning behaviors in the archaeological records does not necessarily demonstrate differences in learning ability between the populations under study. Nevertheless, this research provides a fundamental part of the basis on which the hypothesis is tested. Furthermore, investigation of learning behaviors has its own value. Because any human culture is a result of learning, the study of learning behaviors is essential to understanding different patterns of cultural evolution and their consequences. In addition, research on learning behavior, which reflects a number of other important facets of social and biological backgrounds, provides a useful window through which past human culture can be viewed in its entirety. The present workshop is an attempt to bring archaeological data or pertinent issues together to develop a discussion on how the current field data can be used to understand the learning behaviors of the Neanderthals and modern humans.

Evolution of culture-as-a-0, 1-vector

Laurel Fogarty¹, Joe Yuichiro Wakano², Marcus W. Feldman¹, and Kenichi Aoki³

1 - Department of Biology, Stanford University

2 - School of Interdisciplinary Mathematical Sciences, Meiji University

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Meiji University

An increasing number of empirical studies on cultural evolution are formulated, explicitly or implicitly, in terms of a 0, 1-vector to represent the cultural state of a society. In this representation, each element of this vector corresponds to one cultural trait, with 1 denoting presence and 0 denoting absence of this cultural trait. By comparing the 0, 1-vectors of different contemporary societies or of the same society at different times, these studies have produced estimates of the cultural evolutionary rate, and moreover have revealed instances in which two or more cultural traits change interdependently (e.g. Rogers and Ehrlich, 2008; Rogers et al., 2009; Brown and Feldman, 2009; Jordan and Shennan, 2009; Jordan and O'Neill, 2010).

We describe models for the evolution of culture-as-a-0, 1-vector, representing a large number of non-interacting cultural traits, and conduct Monte Carlo/agent based simulations to address two theoretical questions. First, we ask how alternative modes of social transmission (random oblique, direct bias, indirect bias, one-to-many), innovation rate, population size, and number of acquaintances determine the cultural evolutionary rate. Second, we introduce a slight modification to these models to ask how the efficiency of social learning, together with these same factors, determines the number of cultural traits in the population and the average number of cultural traits per individual at equilibrium. In connection with the second question, we also investigate the rate of approach to equilibrium, after for example a change in population size. By comparing the answers to these two questions, we identify possible correlations between cultural evolutionary rate and number of cultural traits at equilibrium.

The first question was previously addressed by Aoki et al. (2011) who proposed an analytical model of cultural evolution based on the Moran model for social learning and the infinite sites model for innovations. One interesting prediction of this work was that one-to-many transmission does not cause an acceleration of cultural evolution (relative to random oblique transmission). The simulations to be reported here provide a check on these results.

The second question was previously addressed by Strimling et al. (2009) for random oblique

transmission and by Lehmann et al. (2011) for other modes of social transmission. Both studies adopted the Moran model for social learning but not the infinite sites model for innovations, entailing the unrealistic assumption that innovations are produced only by newborns. Here, we investigate the consequences of permitting all older individuals to innovate.

Finally, we note that there is a complementary approach to modeling the evolution of culture in terms of a continuous trait, which can be interpreted as an abstract representation of cultural complexity (Henrich, 2004; Powell et al., 2009; Mesoudi, 2011; Kobayashi and Aoki, 2012).

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ABSTRACTS

Session 1

***Processes of the Replacement of Neanderthals by
Modern Humans***

Approaching learning behaviors in the replacement of Neanderthals by modern humans: a view from African and Levantine archaeological records

Seiji Kadowaki

Nagoya University Museum, Nagoya University

Prehistoric learning behavior and culture change

This study is part of an archaeological project aiming to examine prehistoric learning behavior in an effort to discuss if this aspect of human behavior had any influence in the replacement or assimilation of Neanderthals by modern humans (Akazawa, 2012; Nishiaki, 2012). And, if this complex anthropological and behavioural process did contribute to Neanderthal transformations, in what form did it take? In this study, I regard learning behavior as the way people receive, modify, and pass on information about various human activities and the natural world (somewhat similar to the concept of cultural transmission). Learning behavior varies under biological conditions (e.g., cognitive abilities, growth pattern, and longevity) as well as sociocultural ones (e.g., demography, social interaction, and social norms), both of which are further influenced by climatic and environmental conditions. Thus, a concept of learning behavior can serve as a middle-range theoretical framework, in which biological, sociocultural, and environmental factors are effectively linked with each other towards an integrative explanation of human biological and cultural evolution.

This study examines patterns of Palaeolithic cultural shifts that are primarily represented by changes in lithic technology (see Kadowaki, in press for a preliminary study of the Middle and Upper Palaeolithic industries in the Levant). This is one of the many possible archaeological approaches to prehistoric learning behavior by early *Homo sapiens* and Neanderthals. The study of Palaeolithic cultural change is based on the general assumption that stone tools, or more precisely, technological behaviors/choices in the production and use of stone tools, are products of cultural learning. More specifically, I expect that patterns in the continuity or changes in lithic industries were more or less influenced by social communications, in which certain technological behaviors/choices in lithic production were socially shared. In other words, they would be disseminated through social learning by members who could also practice individual learning and/or exploratory individual learning that could lead to changes in lithic technological behaviors.

Consistent with this research question, we have constructed a database, named Neander DB,

that organizes archaeological and chronological records from sites in Africa and Eurasia in the time range of ca. 300-20 kya. Although a main body of data comprises lithics, their stratigraphic sequences, and radiometric dates, we also collected data of other artifacts, such as bone tools and ornamental objects, as well as human fossils. Using this database, we are examining chronological and geographic distributions of Palaeolithic cultural variability in the time periods and geographic areas, where *Homo sapiens* presumably emerged and dispersed with replacement or assimilation of preceding populations, including Neanderthals. This paper focuses on the African and west Asian records, while those of other areas are presented in other two papers (Sano and Naganuma, this volume).

Cultural changes from the Middle to Upper Palaeolithic period

Figure 1 is a schematic table showing chronological and geographical distributions of lithic industries from Africa and the Levant for the time range of ca. 300-20 kyr. This long temporal range was initially studied in an attempt to compare patterns of cultural change between early *Homo sapiens* and Neanderthals (for which data from Europe was also used), rather than focusing on the timing of the replacement of Neanderthals by modern humans. For this purpose, we focused on the occurrences of records often interpreted as “modern human behavior” or “behavioral modernity”. However, I am not certain whether currently available archaeological records, given their fragmentary nature and small sample size, allow archaeologists to make reliable generalization of cultural characteristics or patterns of cultural change by modern humans in comparison with Neanderthals. This is because records interpreted as “precocious behavioral modernity” during the Middle Palaeolithic and Middle Stone Age appear to have occurred only intermittently rather than continuously (or accumulatively) towards the beginning of the Upper Palaeolithic or Later Stone Age.

I do not deny the possibility that the cases of “precocious behavioral modernity” could represent examples of behavioral differences, including learning behavior, between *Homo sapiens* and archaic hominins. However, in order to examine the question of whether the replacement or assimilation of archaic hominins by *Homo sapiens* resulted from their behavioral differences, including learning behavior, we still need to clarify how they actually behaved when *Homo sapiens* dispersed widely into Eurasia given the potential variability of human behavior under various sociocultural, environmental, and biological conditions. Therefore, we are currently focusing on the archaeological records that are temporally and spatially immediate to this anthropological process, that is, the transition from the Middle to Upper Palaeolithic period in

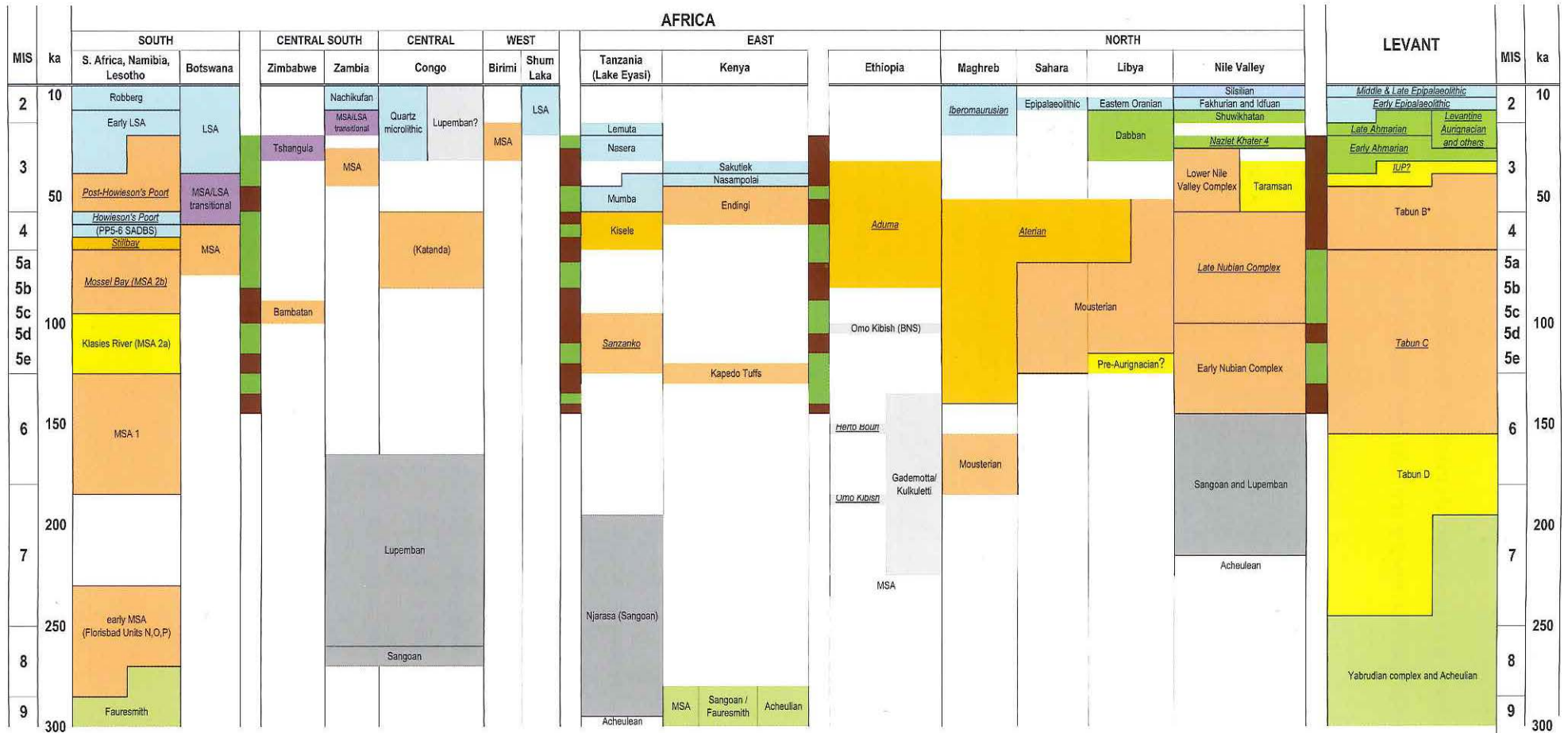
Eurasia.

An analytical focus on the transition from the Middle to Upper Palaeolithic period poses difficulty in pursuing our research question regarding behavioral differences between *Homo sapiens* and Neanderthals. This is because much remains to be clarified between archaeological remains and hominin taxa at the finer chronological and geographical scales. One such case in the Levant, is the maker of the Emiran or Initial Upper Palaeolithic industry. Immediately preceding this industry, there are examples of Neanderthal fossils (e.g., from Dederiyeh, Amud, Kebara) recovered in association with the Tabun B-type industry, while the Early Ahmarian, following the Emiran, is mostly likely associated with *Homo sapiens*. In addition, even for the late Middle Palaeolithic (ca. 75-45 kyr), we cannot assume that all behavioral records in west Asia represent Neanderthals considering the presence of early *Homo sapiens* at Qafzeh and Skhul preceding this period.

Therefore, within the limit of current evidence, comparing patterns of cultural change between *Homo sapiens* and Neanderthals requires the estimation of human taxa from behavioral residues. However, I do not attempt this. Instead, I am examining archaeological records in two ways that should serve for more reliable discussion of learning behavior. The first is to make a detailed assessment of current archaeological records on temporal and spatial cultural variability at the transition from the Middle to Upper Palaeolithic in the Levant. The second is to organize data on social conditions surrounding the cultural patterns at this time period. At present, I have worked on the former task, the results of which are presented in this paper. I will then present my scope and preliminary results of the second approach.

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Characteristics of lithic technology

- Flake production including discoidal/Levallois methods with large bifacial tools
- Flake production including discoidal/Levallois methods with rare bifacial tools (points and handaxes)
- Flake, point, and occasionally blade production including discoidal/Levallois methods
- Handaxes, flake production from discoidal/Levallois cores, and blade production
- Blade production by Levallois, Levallois-based methods and/or laminar system
- Production of blades with small butts from prismatic cores

Industry name = Associated with anatomically modern humans

Industry name* = Associated with Neanderthals

Wet terrestrial conditions

Dry terrestrial conditions

After Blome et al. 2012

Fig. 1. Schematic table showing chronological and geographical distributions of lithic industries from Africa and the Levant for the time range of ca. 300-20 kyr.

Dispersal of modern humans and demise of Neanderthals: a view from spatio-temporal patterns of the European transitional industries

Katsuhiko Sano

The University Museum, The University of Tokyo

Recent studies suggest that the distributions of the Bachokirian (the Balkans) and the Bohunician (Eastern and Central Europe) industries deriving from the Levantine Levallois-leptolithic technocomplex (Initial Upper Palaeolithic) represent the earliest occupation of Europe by modern humans (Svoboda, 2004). The chronometric dating and the geographic distribution of the Levallois-leptolithic technocomplex indicate that modern humans equipped themselves with this archaeological entity colonized Eastern and Central Europe through the Balkans between c. 48 and 45 ka cal BP (Fig. 1).

Slightly after this modern human dispersal, backed point industries emerged in the Italian Peninsula (Uluzzian) and in the Franco-Cantabrian region (Chatelperronian) at c. 45 ka cal BP. The microtomographic analysis of deciduous molars recovered at the Uluzzian levels of Grotta del Cavallo (Benazzi et al., 2011) and the re-evaluation of Uluzzian laminar and flake technology (De Stefani et al., 2012; Moroni et al., in press) demonstrate that the Uluzzian is a cultural entity remade by *Homo sapiens*.

While the association of the Chatelperronian assemblages with Neanderthal fossils at Grotte du Renne and St. Césaire was challenged (Bar-Yosef and Bordes, 2010; Higham et al., 2010), the new AMS-dating of well-preserved bone fragments shows inconsistent results with the admixture hypothesis (Hublin et al., 2012). In addition, the technological studies on Chatelperronian laminar production provide contradict evolutionary trajectories, such as MTA-B - Chatelperronian linkage (Roussel, 2013) vs Chatelperronian - Proto-Aurignacian linkage (Bordes and Teyssandier, 2011). Although further plausible evidences are required to reveal the makers of the Chatelperronian, it might be difficult to completely exclude Neanderthals from the Chatelperronian makers according to the current archaeological records.

Yet, the rapid expansion of the Proto-Aurignacian in the Mediterranean region (Fig. 2) where Neanderthals have preferably occupied would have made an enormous impact on the process of the demise of Neanderthals.

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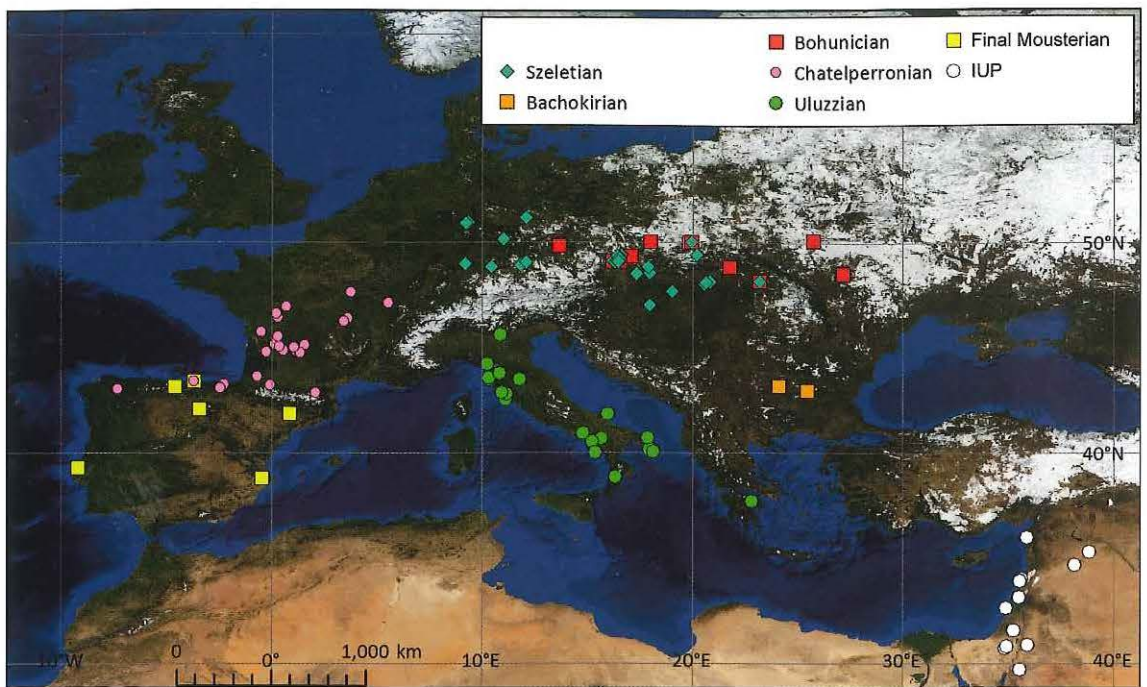


Fig. 1. Distribution of the transitional industries in Europe.

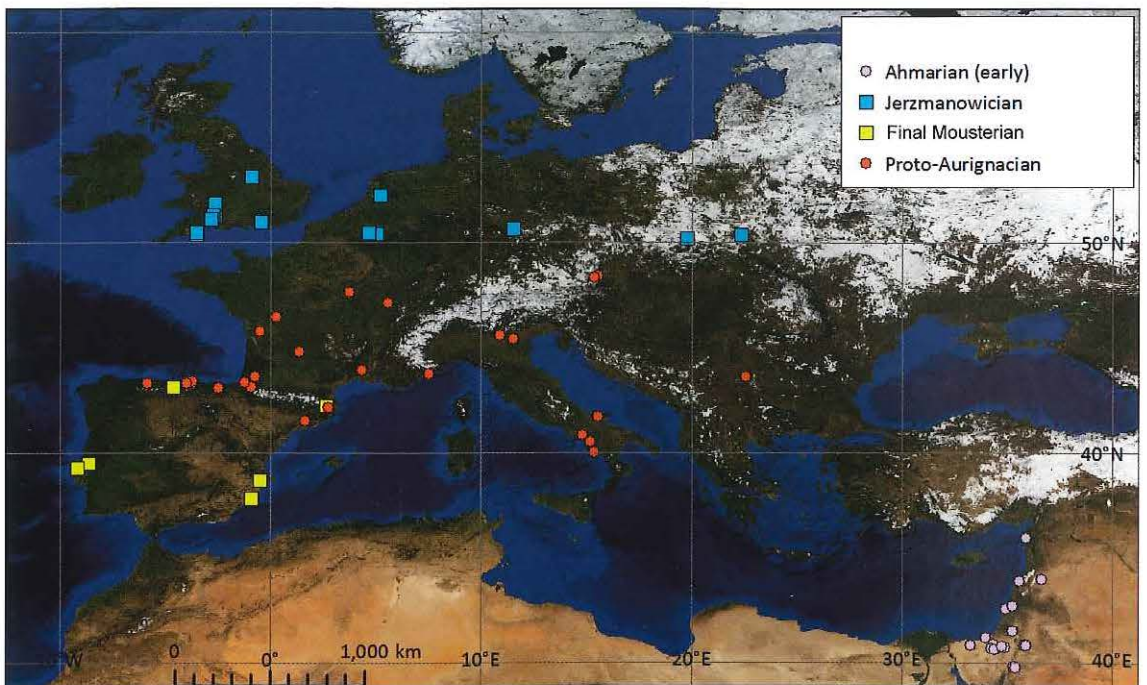


Fig. 2. Distribution of Proto-Aurignacian and Final Neanderthal sites.

The emergence of modern behaviors in North, Central, and Eastern Asia: issues of the non-European archaeological record

Masaki Naganuma

Center for Ainu and Indigenous Studies, Hokkaido University

This presentation reviews the archaeological records relevant to understanding the emergence of modern behaviors in North, Central, and Eastern Asia, an area known as the eastern boundary for the distribution of Neanderthals (Okladnikov and the Chagrskaya caves in the Altai Mountains).

In North Asia, several local variants of lithic assemblages with Levallois elements as well as non-Levallois pebble-flake tool variants (Mode I) are identified as the Middle Palaeolithic or at least “Pre Upper Palaeolithic”. In both cases, there is a possibility that sites are at least older than 50 ka (not calibrated). Later at around 40-30 ka, the Levallois-based blade industry spread broadly across Siberia, Mongolia and Northwest China (North Asian Early Upper Palaeolithic [EUP]). These assemblages occasionally include non-utilitarian artifacts such as beads, pendants, ocher, and figurine-like carving materials. In spite of the lack of human fossils, these artifacts appear to suggest behavioral modernity.

Central (Inner) Asia is a region that links Western (Levant and Zagros Mountains) and North Asia. The lithic assemblages here, including Levallois products (cores, points, blades and flakes), are identified at many locations in the western foot of the Tian-shan, but their absolute dates are almost unspecified. The Obi-Rakhmat cave (Uzbekistan) and several other assemblages represent a Levallois-based blade industry similar to that in the North Asian EUP or the West Asian Emiran industry. The later UP assemblages are characterized by carinated, prismatic, and narrow-faced cores for blade manufacture, bladelets, end-scrapers on blades, and so on. Their estimated ages are in the range of 34-23 ka (C14). Some of the finds are similar to those in Western Asia (Aurignacian, Baradostian), but neither non-utilitarian artifacts nor human fossils are included in them. The modern behaviors are inconspicuous, and only lithic assemblages suggest a close relationship with *Homo sapiens* cultures of Western Asia.

Neanderthal fossil remains are absent in Eastern Asia. There are, however, several certain fossils of modern humans and many archaeological sites dated to MIS3 in this region. Fossils of “archaic sapiens” (Zaoqizhiren), possibly evolved from earlier local hominin lineages (*Homo erectus*, etc.), have been uncovered in many parts of China. The Levallois-based blade industries

appeared about 30 ka in the Northwestern region (Shuidonggou, near Inner Mongolia), and suggest modern human dispersal from Siberia. However, this distribution is small and limited. In contrast, the core-flake and quartz industry would have continued from the Lower Pleistocene era to just before the emergence of the micro-blade industry (20 ka) in North China. Some of these blades were accompanied by *Homo sapiens* fossils and body decorations, which were dated to 30-27 ka (Zhoukoudian Upper cave). In terms of the invention of new tools and activities, pitfall hunting and polished stone tools, as well the beginning of sea travel to access obsidian resources, are also considered unique modern behaviors (in the Japanese islands circa 40-30 ka).

ABSTRACTS

Session 2

Cultural Transmission among Neanderthal Societies

The Lower to Middle Palaeolithic transition: from imitation to the origins of tradition

Olaf Jöris

MONREPOS Archaeological Research Centre and Museum for Human Behavioural Evolution,
Schloss Monrepos

Since the beginning of research of “fossil man” it has long been debated whether the spread of Palaeolithic populations is mirrored by the spread of different material cultures. This does not only concern the possible link between Anatomical Modern Humans and the roots of our modern human behaviours, but also the relationship between archaic hominins and different lithic manufacturing traditions.

In Western Eurasia and much of Africa the transition from the Lower to the Middle Palaeolithic ~400–200 ka appears as a remote period of behavioural changes, as is reflected, for example, in dietary adaptations as well as in lithic technology. Simultaneous to the decrease in Acheulian bifaces this period witnesses a radiation of flaking strategies focussed on the production of tools made on blanks of largely predictable dimensions and shapes (flakes, points, and blades). In contrast, Lower Palaeolithic flaking concepts were characterized by relatively short reduction sequences only (e.g. discoid, polyhedral, large flakes from ‘giant cores’, “Clactonian” flake production). At the Lower-Middle Palaeolithic transition entirely new concepts of blank production arose that facilitated the reduction of hierarchical and/or more volumetric cores (Levallois, laminar) that permitted the removal of a larger series of blanks.

Within different geographical regions late Middle Pleistocene assemblages often comprise different forms (‘types’) of Acheulian bifaces associated with cores and flakes that derive from some of the flaking strategies mentioned above, as for example the combination of handaxes with laminar and Quina-like flaking in the Acheulo-Yabrudian Cultural Complex of the Near East or in combination with Levallois flaking concepts as is documented over much of Western Europe. However, other European sites from this period document the early presence of Levallois technology, lacking any (Acheulian) bifacial tools, and, moreover, a range of further non-Acheulian sites that are characterized by a limited amount of primary production with tools that were often retouched from natural lithic breaks. While Levallois reduction concepts in Europe may have developed *in situ* out of the preceding regional Acheulian substrate, other methods of flaking (e.g. Quina, laminar) add entirely new concepts of blank production to the operational chains underlying Acheulian bifaces. Furthermore, some Middle Pleistocene assemblages display knapping strategies that appear unique to a specific site.

This geographical, temporal and technological cultural mosaic documents the complexity of behavioural changes underlying the Lower to Middle Palaeolithic transition in Western Eurasia. This

hampers a straightforward interpretation of the evidence at stake. A view from Central European late Middle Palaeolithic assemblages characterized by bifacially backed knives (=Keilmesser) may, however, shed light on the modes of learning, which – when applicable backwards in time – may help understanding the mechanisms underlying the patterns of regional cultural differentiation around the Lower to Middle Palaeolithic transition.

Late Middle Palaeolithic *Keilmesser*-production appears extremely standardized, aiming at long artefact use-lives. At Buhlen (Central Germany) evidence for handedness and the production of ad-hoc scrapers that ‘mimic’ the more elaborate *Keilmesser* can be interpreted as evidence for less experienced or infant individuals imitating the tool manufacture of an elder. Such modes of social learning are argued to ultimately lead to the development of traditions, as can be concluded from a comparative analyses of the main trajectories underlying the production of these bifacially backed knives including a series of *Keilmesser*-sites, showing that identical tools were produced largely independent of the initial raw material morphology.

Further discussion will focus on whether the regional cultural differentiation and ‘traditions’ documented for the Late Middle Palaeolithic can also be identified even earlier during the late Middle Pleistocene, specifically the Lower-Middle Palaeolithic transition. It will be argued that imitation of blank production schemes may have resulted in modes of learning that triggered the development of regional traditions that become increasingly visible from around ~400–200 onwards. However, the overall trend towards the successive replacement of Acheulian bifaces by unifacial scraper forms of varying morphology may be indicative for the inter-regional exchange or transmission of ideas between the different groups or demes. It could be argued that the latter type of transferral of information would demand the (at least temporal, but not necessarily permanent) existence of more extensive social networks.

Neandertal lifeways

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Neanderthals are by far the best-studied extinct hominins, with a rich fossil record sampling hundreds of individuals, roughly dating from between 400,000 and 40,000 years ago (Hublin, 2009; Stringer, 2012). They were large-bodied, with an average body mass larger than in most recent human populations, including Palaeolithic modern Europeans. Their distinct fossil remains have been retrieved from Spain in the west to the Altai area in central Asia in the east and from below the waters of the North Sea in the north to a series of caves in Israel in the south.

Judging from the current distribution of their fossils, Neandertals were spread over a large area, of up to 10 million square kilometres, larger than Australia. Within that area and over the long period of their existence the cultural and biological adaptations of Neandertal populations must have varied significantly. Some regions may have seen a more or less continuous presence of groups of Neandertals, whereas in others, such as in the northern margins of their range, discontinuity characterised their occupation in the long-term.

Reviewing the adaptations of populations which were distributed over such vast area and over such a long a period of time is a major enterprise, and far beyond the scope of my presentation. Furthermore, the Neandertal fossil and archaeological record is strongly biased in favour of Neandertals from Western Europe, an area only about one-fifth the size of their estimated range, but containing roughly three-quarters of all the sites with Neandertal remains.

In general terms, we do have a rich picture of many aspects of the life of these Neandertal populations, as a result of detailed archaeological research, combined with the result of genetic studies and other bio-molecular approaches, including isotope studies. Neandertals were often thin on the ground, subject to local extinctions (Hublin and Roebroeks, 2009), and living in a wide range of environments, from full interglacial to cold steppic ones. Unlike earlier hominins, the faunal evidence clearly indicates that they hunted and butchered a variety of medium-sized and large mammals (Gaudzinski-Windheuser and Niven, 2009), in a wide range of topographical settings. Their hunting weapons included wooden spears, with some spears probably hafted with stone points (Villa and Lenoir, 2009). Their isotope signals suggest that the largest part of their dietary protein was obtained from meat, reflecting a rather narrow diet, but there exists abundant evidence that their diet was broader, and included aquatic resources, plants and small fast games such as birds and rabbits (Blasco et al., 2011; Blasco and Fernández Peris, 2009, 2012). Some of the gathered plants were cooked (Henry et al., 2011), one of the ways in which Neandertals used fire; judging from the abundant

evidence for fire usage at Neandertal sites and the rarity of fire proxies at earlier ones, Neandertals may have been the first fire producers, and fire certainly was an integral part of the Neandertal technological repertoire (Roebroeks and Villa, 2011).

In my presentation I will briefly discuss some cultural adaptations which seem to have been developed by/or are definitely associated with Neandertal populations, including their use of fire, and which to some degree may be informative about the core theme of the conference, Neandertal learning behaviours.

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Can we learn about learning in the Levantine Middle Paleolithic? Mechanisms of culture change, social transmission, and the archaeological record

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From the broad-scale, low-resolution cultural evolutionary perspective, the Eurasian Middle Paleolithic (MP) record has been perceived as a period of cultural stasis over some 200,000 years, without cumulative changes that culminated in cultural evolution. This has been attractively conceptualized by the concept of “rugged fitness landscapes” (Boyd and Richerson, 1996; Dobzhansky, 1951), whereby significant, costly fitness-enhancing changes only occurred when the adaptive landscape were disrupted dramatically. However, such a broad perspective tells us little about the dynamics that created and preserved the putative stasis.

The presence of two hominin populations in the Levantine Middle Paleolithic (MP), which bear many similarities in their material cultural remains, renders the this time period in the particular region one of the most interesting case studies for looking at the processes of accumulation, loss and retention of cultural diversity among late Middle-early Upper Pleistocene hominin populations. It has been posited that Levantine MP material culture variability, while environment-related (e.g., patterns of raw material use, tool functions), does not respond directly to climatic shifts. Nor is variability clearly dichotomized according to the two hominin species present in the Levantine MP are questionable both theoretically and empirically (Hovers, 2009; Hovers and Belfer-Cohen, 2013 [in press]). An alternative hypothesis for explaining the variability in material culture records invokes micro-evolutionary mechanisms of cultural transmission (e.g., Bettinger, Boyd, and Richerson, 2009). Loss and retention of cultural diversity may be due to demographic properties (group size) or to demographic events (local extinctions, demic diffusion), all of which affect the amount and the rate of cultural diversity loss/retention. Other prominent agents of changes in, and accumulation of cultural diversity, are intrinsic factors of social transmission of information (e.g., random drift or various forms of socially-mediated [‘biased’] cultural transmission by individuals), which can lead to group-scale changes.

Understanding the Levantine MP stasis from this micro-evolutionary perspective is limited by the incompatibility of the evolutionary time scales of the MP record compared to the generational time-scale of decision-making and social transmission processes, as well as by the

incipient stages of relevant formal modeling. Still, considering the possibility of parsing the incongruity between cultural stasis and demic changes in the Levant during this time span is a useful exercise that may help draw the focus of discussion to the processes and how they may be addressed from archaeology.

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Levallois: potential implications for learning and cultural transmission capacities in Neanderthals and Early Modern Humans

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The study of stone artifacts represents – whether we like it or not – our primary opportunity to study the behavior of extinct hominin populations (Lycett, 2013). Levallois reduction was practiced by both Neanderthals (*Homo neanderthalensis*) and early Anatomically Modern Humans (*Homo sapiens*). The production of such technologies might, therefore, provide insight into shared learning and social transmission capacities in these species. Recent experimental work (Eren and Lycett, 2012) has provided evidence that Levallois reduction supplied flakes that have predictable benefits from a functional perspective. Moreover, recent experimental tests (Lycett and Eren, 2013a) of previously proposed mathematical models (Brantingham and Kuhn, 2001) have provided further evidence that Levallois reduction has economic benefits in terms of minimization of raw material wastage while attempting to produce flakes that maximize cutting edge. Hence, from an evolutionary optimization perspective, Levallois reduction may logically have been motivated by “coinciding optima” relating to flake utility and economic factors (Lycett and Eren, 2013b).

Recent 3D geometric morphometric analyses of archaeological Levallois cores (Lycett and von Cramon-Taubadel, 2013) have, meanwhile, demonstrated that preferential (lineal) Levallois cores have a specific geometry even across wide geographic regions. Specifically, the margin shape of such cores is relatively constrained across regions, especially compared with core outline shape (Fig. 1). These analyses suggest that from the perspective of prehistoric knappers, the relationship between the margin of the core its relationship to the topological/geometric properties of the core’s surface were relatively important. In other words, in order to produce “Levallois flakes” from classic Levallois cores, the knapper needed to impose and maintain a specific, and relatively constrained, set of geometric properties (Fig. 2).

Given these findings, it may be important to ask whether learning a specific “Levallois” geometry involved social transmission mechanisms (such as active instruction or “teaching”) beyond those used by populations producing Acheulean handaxes (e.g. emulation and/or imitation). Importantly, recent mathematical models (Fogarty et al., 2011) have indicated that teaching is specifically more likely to emerge when novices cannot easily learn the information

required to perform the task themselves, and the instructor can increase their inclusive fitness benefits by engaging in teaching (i.e. the learned task provides specific fitness benefits to kin). Although independent tests of this hypothesis are required, given the combined findings noted above, Levallois reduction potentially represents a behavior requiring relatively sophisticated means of social learning (i.e. active instruction) in all populations that produced it.

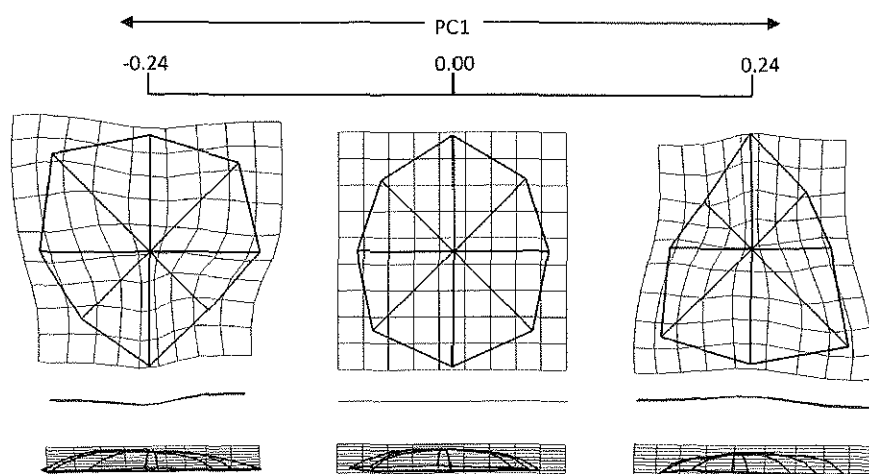


Fig. 1. Results of 3D geometric morphometric analyses of core surface and outline morphology of Levallois cores from Africa, the Near East, the Indian subcontinent, and Europe ($n = 152$ cores). The analyses show that the margin of these cores, and in particular their topological relationship to the surface of such cores, is highly constrained relative to the outline form of these cores.

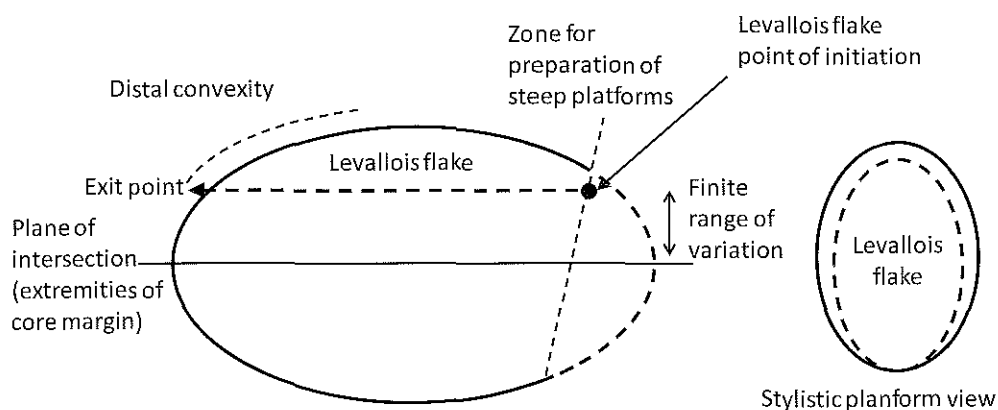


Fig. 2. Schematic representation of the geometric relationships between the Levallois core margin and other diagnostic features of "classic" Levallois cores.

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ABSTRACTS

Session 3

Neanderthal Lithic Technology

Levallois knapping

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(demonstration)

ABSTRACTS

Session 4

***Cultural Transmission
among Modern Human Societies***

The origins of settlement and society : the Upper Palaeolithic roots of modern human spatial behaviour

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Modern Human behaviour is organised at distinct spatial levels. Humans create “spatial systems” to organise their relations, interactions and transactions. Such systems are inherent to all our actions. This spatiality shapes the organisation from the small scale of households, the most elemental socio-economic units, to any type of settlement, including modern Mega-cities. The different modes of spatial organisation are directly linked to super-ordinate land use patterns that derive from our distinctively human spatial behaviour.

Palaeolithic Archaeology can document spatial signatures left from past activities at the highest resolution, allowing archaeologists to identify different expressions of spatial behaviour. These can include traces of ephemeral activities or patterns resulting from a more permanent structuring of space over a certain period of time. Whilst the spatial signatures left by Lower and Middle Palaeolithic archaic hominins are interpreted as due to ephemeral activities, it is not before the beginning of the European Upper Palaeolithic that modern human spatial behaviour is varied with a plethora of spatial expressions beyond ephemerality alone. This new form of structuring of sites and territories is interpreted as a modern human invention reflecting novel conventions in spatial organisation. Until today our lives are governed by this spatiality. Nevertheless, the consequences of this “revolution of spatial behaviour” have yet not been fully explored.

The origins and evolutionary advantages of this latter type of behaviour remain, however, entirely unknown. Here, we seek to investigate these origins during a period, when early Modern Human populations were about to establish all over Europe in the early Upper Palaeolithic. Using a diachronic approach we will investigate whether this spatial behaviour co-evolved in parallel with or facilitated new forms of social organisation and cultural performance, ultimately asking for the roots of our human ‘behavioural setup’.

Teaching and skill learning: a case study of the Upper Paleolithic assemblages at the Shirataki sites in Hokkaido, Northern Japan

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The understanding of lithic skill acquisition and transmission process among prehistoric knappers has become the frequent subject of the lithic technological research over the past decade or two. However, the problem of extracting information on skill from the archaeological lithic materials remains unsolved. In approaching the skill learning process involved in stone tool production, the potential of the lithic refitting is evident in the significant advances that the results of such have brought to archaeological research. I have also attempted to reveal past human behavior with regard to the skill transmission process, based on the analysis of abundant lithic refitted sets from the Upper Paleolithic assemblages at the Shirataki sites, Northern Japan, in terms of the *chaîne opératoire* approach. The conclusion obtained from the analysis demonstrates that observation and imitation, as well as some kind of instruction, played significant roles in the skill learning process among the Upper Paleolithic knappers (Takakura, in press). In particular, some of the refitted sets found from the Kamishirataki 2 site, which can be interpreted as “academic cores”, show that an expert knapper conducted a pedagogical demonstration through the reduction of cores.

This stands in contrast to ethnographically based claims that this kind of formalized training/learning process is rare among “small scale societies”, and in particular forager societies (e.g., Gaskins and Paradise, 2010). The analyses conducted at the Magdalenian sites in the Paris Basin (e.g., Bodu et al., 1990) have suggested that such process was not a restrictive phenomenon which might have been only seen in the Upper Paleolithic site of Hokkaido, Northern Japan. Thus, we should reconsider a role of some kind of “teaching” involving instruction in the skill transmission process for the highly developed craft production in prehistoric contexts.

This paper presents a case study to explore the lithic skill acquisition and transmission process executed by the blade knappers in the Upper Paleolithic of Northern Japan. Drawing on new analyses of the refitted sets obtained from the Shirataki sites, I seek to re-examine the roles of “teaching” in the lithic skill learning process, taking into account the contexts that were related to the blade reduction sequences.

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Learning sanukite knapping at the Upper Paleolithic site of Suichoan (Japan)

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Located in Habikino City, Osaka, the Suichoan site represents a knapping locus from the Upper Paleolithic. In 1992, 21,261 stone artifacts were excavated *in situ*, having been found in 40 concentrations. We have refitted 44% of the pieces (82% by weight) close to the original shapes of 150 cobbles. Analyses of spatial relations of the refitted pieces indicate that three or more men knapped continuously to form five series of units consisting of a couple of concentrations and that they sometimes made more than 100 backed points at the end of a series. The sole material used for knapping was sanukite, which was repetitively collected when needed from colluvial deposits about 5 kilometers from the site. Knappers only adopted the Setouchi method: first, they divided a cobble into several slabs (stage I), then detached so-called wing-shaped flakes or transversal blades from a slab to make backed points (stage II). The simplicity of using one material and one method enables us to consider the differences in knapping results as primarily steps in a learning process.

In some cases, disassembling a refitted ensemble and evaluating the reduction process make it possible to rate the knapper's skill. However, we only recognize 23 of 128 cobbles in stage I and 33 of 495 slabs in stage II as showing highly advanced skills, while 8 cobbles and 10 slabs indicate especially low abilities. Moreover, we have identified *le poste de débitage* (the knapping post or place) of every cobble or slab based on the distribution of its veritable wastes, such as incidental flakes. Since cobbles or slabs at the same post would be regarded as one knapper's blanks for a short-term activity, we can evaluate not only refitted ensembles with explicit marks of skill but also the rest of all the ensembles in order to analyze the learning. In regard to all the ensembles, we record quality and quantity of products including absent ones, rate the knappers' skills out of 5 points, and classify the finished states of cores. The skills and working contents are then compared by post to establish every knapper's step of learning. Additionally, owing to the peculiar knapping method, it is important and unique to be able to identify relationships between knappers by tracing the transferences of slabs.

Characteristics of the learning by modern humans at Suichoan are as follows: 1) Judging from their respective intervals and orientations of individuals' bodies, the attitude of an expert toward learners is essentially *laissez-faire*, either in ordinary tool making or preparations of a journey.

2) Rare relationships between learners indicate an expert's control over the whole activity. 3) Teaching is suggested by a few slabs that were transferred from an expert one time to each learner in a unit and by the post where the expert struck cobbles that were difficult to divide. One cobble (37-001) tells us that learning to knap occasionally followed a specific process: setting a task, criticizing the result, and correcting errors by means of expert demonstration. 4) The more a learner's skill advanced, the more intensely an expert invested in him. It is inferred that the progress of an advanced learner was given priority. 5) An expert gradually left a larger part of the work to the most advanced learner, possibly in preparation of passing on the technique to the group. 6) Even though the work amount of a learner exceeded an expert's on occasion, the former remained under the latter's control. Learning required a very long time and learners should continue obeying an expert even after having reached a certain skill level, perhaps until their independence from the group.

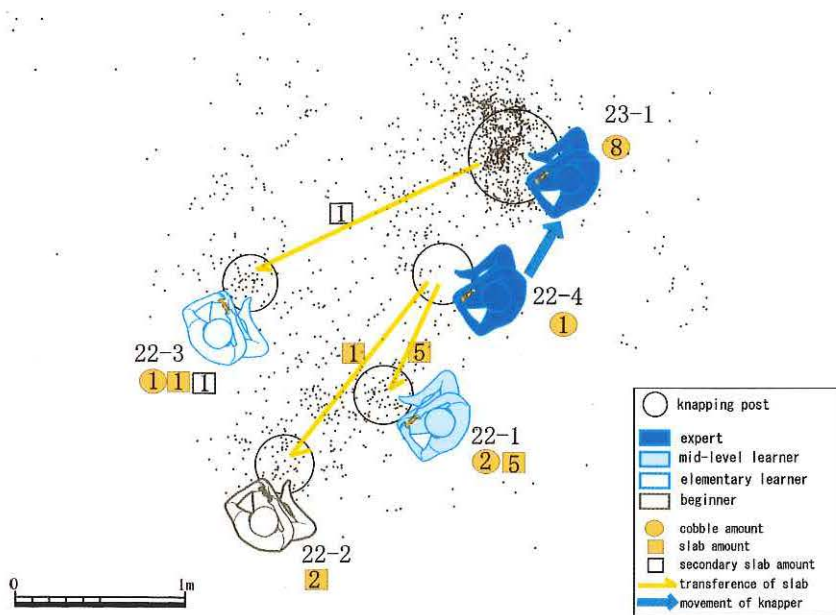


Fig. 1. Learning in series 2-2 at Suichoan. Note the knappers' intervals and body orientations. No relationship between the learners suggests the expert's control over the whole process.

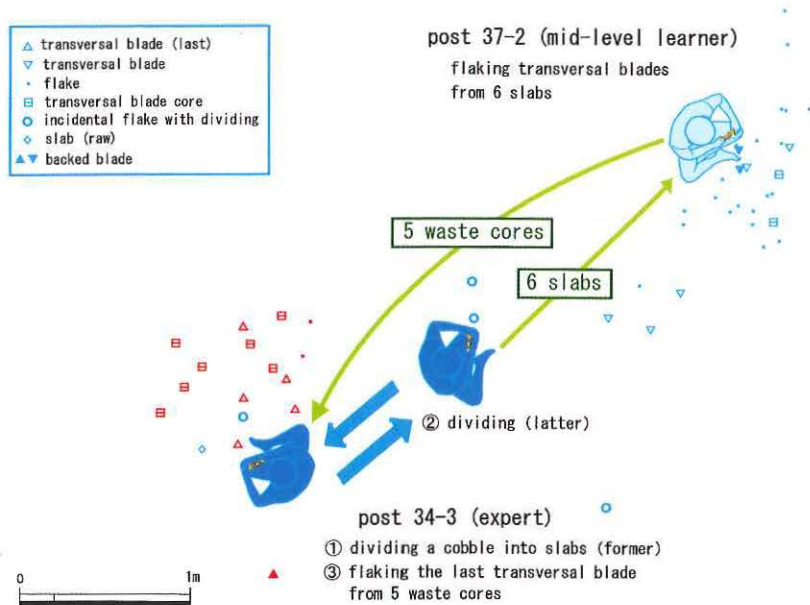


Fig. 2. Teaching indicated by Cobble 37-001, in series 4-2 at Suichoen. An expert offered six slabs to a mid-level learner, who knapped them and returned five waste cores. Finally, the expert demonstrated how to detach the last blade from all waste cores at his own knapping post.

ABSTRACTS

Session 5

***Toward Understanding
Prehistoric Learning Behavior***

The influence of stone raw material differences on expert learning: handaxe production with flint, basalt, and obsidian

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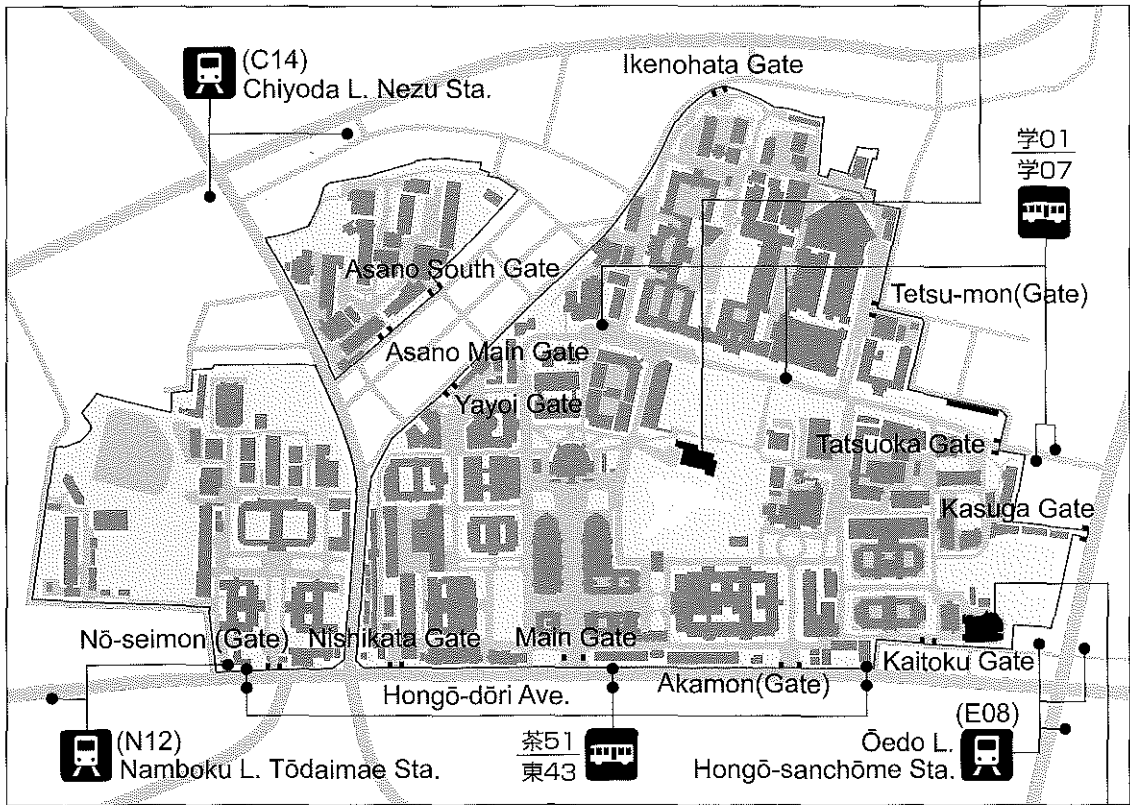
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Lithic raw material differences are widely assumed to be a determining factor of flaked stone tool morphology, but this assumption remains largely untested. Two different sets of toolstone properties are thought to influence lithic artefact form. The first set is internal, i.e. the mechanical flaking properties. The second set is external, namely the form (size, shape, surface regularity, and presence of cortex) of the initial nodule, block, or blank from which the flakes are struck. We conducted a controlled replication experiment to determine whether an expert knapper's increasing ability to replicate a model handaxe was influenced by raw materials of significantly different internal and external properties: flint, basalt, and obsidian. Our results show that raw material does not influence a knapper's ability to learn a particular handaxe shape, and thus the assumed primacy of raw material differences as the predominant explanatory factor in stone tool morphology is unwarranted.

■ Map of Hongo Campus, The University of Tokyo

Sanjo Conference Hall



Muse Hall of UMUT 7F
(University Museum, University of Tokyo)