Important Addresses and Phone Numbers

Locations

**Conference venue**
Senckenberg Biodiversity and Climate Research Centre (BiK-F)
Georg-Voigt-Straße 14-16
60325 Frankfurt am Main

**Icebreaker Party**
Senckenberg Research Institute and Natural History Museum
Senckenberganlage 25
60325 Frankfurt am Main

**Conference Barbecue**
BiK-F garden
Georg-Voigt-Straße 14-16
60325 Frankfurt am Main

Excursion

Hesse State Museum, Darmstadt
Friedensplatz 1
64283 Darmstadt

Contact

Julia Hess and Claudia Groth
Mobile +49 157-55 658 606
expansions2015@roceeh.net
1 Senckenberg Research Institute and Natural History Museum
Senckenber ganlage 25

2 Bik-F (Biodiversity and Climate Research Center)
Georg-Voigt-Straße 14-16
General Program

Sunday 12.07.  18:00 - 20:00  Registration and Icebreaker at Senckenberg Museum

Monday 13.07.  09:00 - 18:00  Opening, Scientific sessions – Expansions of Ecospace

Tuesday 14.07.  09:00 - 18:00  Scientific sessions – Expansions of Cultural Capacities

Wednesday 15.07.  09:00 - 15:00  Excursion to the Hesse State Museum, Darmstadt
                              15:00 - 18:30  Scientific session – Multidisciplinary approaches to expansions
                              19:30  Conference Barbecue

Thursday 16.07.  09:00 - 18:00  Scientific sessions – Quantification and Modelling
                              19:00  Meeting of the Initiative for an INQUA International Focus Group

Friday 17.07.  09:30 - 15:00  Scientific sessions – Expansions of Range, Closing Discussion
Monday, 13.07.2015

09:00  Registration in front of the BiK-F lecture hall

09:30  Friedemann Schrenk
  
  Welcome and general introduction

09:45  Miriam Haidle
  
  Welcome and introduction to the ROCEEH project

EXPANSIONS OF ECOSPACE

10:15  Angela A. Bruch
  
  Introduction to the scientific session

10:25  Hugues-Alexandre Blain, Jordi Agustí, Robert Sala, Bienvenido Martínez-Navarro
  
  Investigating the climatic conditions in the Early Pleistocene of Spain: The case of the hominin site of Barranco León (Granada, Spain)

10:50  Ronan Orain, E. Russo Ermolli, V. Lebreton, Angela A. Bruch, A.-M. Sémah
  
  Ecosystem dynamics and human migrations in central-southern Italy during the Middle Pleistocene: the key influence of local refuge areas.

11:15  Coffee break

11:45  Lutz Christian Maul, Angela A. Bruch, Krister T. Smith, Ran Barkai, Avi Gopher
  
  Palaeoecological implications of the microvertebrates from the Middle Pleistocene Qesem Cave in Israel

12:10  David Horne, Nick Ashton, Simon G. Lewis
  
  Climate on the edge of human dispersal in the European Middle Pleistocene

12:35  J. Saarinen, Jussi T. Eronen, M. Fortelius, H. Seppä, A. M. Lister
  
  Patterns of body mass and diet of large ungulates from Middle and Late Pleistocene of Western Europe and their connections with vegetation openness

13:00  Lunch break

14:00  Geoffrey King, Simon Kuebler, Sally Reynolds, Peter Owenga, Stephen Rucina, Isabelle Winder, Geoff Bailey
  
  Hominin evolution in dynamic environments
14:25 **Geoff Bailey, Dimitris Sakellariou, Garry Momber, Maud Devès, Robyn Inglis, Matthew Meredith-Williams, Abdullah Alsharekh**

*Coastlines as pathways of hominin expansion: A view from the Red Sea*

14:50 **Florian Sauer**

*Geomorphology-based biodiversity modelling. Potential bioresource variation in Late Palaeolithic site catchments*

15:15 **Coffee break**

15:45 **Gerlinde Bigga**

*Plant resources in Schöningen (Northern Germany). Insights into a Middle Pleistocene flora and its usability for Homo heidelbergensis*

16:10 **Britt Starkovich**

*Changes in hominin subsistence strategies in the Middle Paleolithic through Mesolithic of Southern Greece*

16:35 **Emily Lena Jones**

*The ecospaces of Southwest Europe at the Middle-Upper Paleolithic transition: A view from the archaeofaunal record*

17:00 **Discussion**
## Tuesday, 14.07.2015

### EXPANSIONS OF CULTURAL CAPACITIES

<table>
<thead>
<tr>
<th>Time</th>
<th>Speaker(s)</th>
<th>Title</th>
</tr>
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<tbody>
<tr>
<td>09:00</td>
<td>Miriam Haidle</td>
<td>Expansions of hominin performances</td>
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<tr>
<td>09:40</td>
<td>Sarah Wurz</td>
<td>Cultural development in the last ca. 400 ka in South Africa – an overview</td>
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<tr>
<td>10:20</td>
<td>Ron Shimelmitz</td>
<td>The late Lower Paleolithic Acheulo-Yabrudian complex at the crossroads of human evolution</td>
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<tr>
<td>11:00</td>
<td><strong>Coffee break</strong></td>
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<tr>
<td>11:30</td>
<td>Daniel Adler, Keith N. Wilkinson, Simon Blockley, Darren F. Mark, E. Frahm, Beverly A. Schmidt-Magee, Philip J. Glauberman, Yannick Raczynski-Henk, Olaf Jöris, Boris Gasparian</td>
<td>Early Levallois technology and the transition from the Lower to Middle Palaeolithic in the Southern Caucasus</td>
</tr>
<tr>
<td>12:10</td>
<td>Olaf Jöris</td>
<td>The “cultural performances” of the European Palaeolithic 600 – 12 ka, and the evolution of human behaviour and society</td>
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<tr>
<td>12:50</td>
<td><strong>Lunch break</strong></td>
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<tr>
<td>14:00</td>
<td>Tongli Qu, Youping Wang</td>
<td>Developments in cultural behavior in the last ca. 400 ka - material evidence, overview China</td>
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<tr>
<td>14:40</td>
<td>Rimtautas Dapschauskas</td>
<td>The expansion of symbolic and ritual capacities in the Homo lineage from an interdisciplinary perspective</td>
</tr>
<tr>
<td>15:10</td>
<td>Andrew Kandel, Michael Bolus, Nicholas J. Conard, Miriam N. Haidle</td>
<td>The concept of behavioural hyperplasticity</td>
</tr>
<tr>
<td>15:50</td>
<td><strong>Coffee break</strong></td>
<td></td>
</tr>
<tr>
<td>16:20</td>
<td>Duilio Garofoli</td>
<td>The &quot;gannet approach&quot;: Challenging hyper-intellectualism in cognitive archaeology</td>
</tr>
</tbody>
</table>
17:00  Patrick Roberts
   *Using material engagement theory and metaplasticity to explore Late Pleistocene material change and cognitive capacities*

17:40  Discussion
Wednesday, 15.07.2015

**EXCURSION TO THE HESSE STATE MUSEUM, DARMSTADT**

09:00  Departure in front of the main entrance of the Senckenberg Museum

Guided tours to the highlights of the museum (art, culture, natural sciences) and individual time to discover more

**PACKED LUNCH**

14:00  Return to Frankfurt

14:45  Arrival at BiK-F lecture hall

**MULTIDISCIPLINARY APPROACHES TO EXPANSIONS**

15:00  Regine Stolarczyk

_The expansion of behavioral performance: Innovations during the Middle Stone Age of Southern Africa_

15:20  Sebastian Scheiffele

_The complexity of making fire_

15:40  Gregor D. Bader, Manuel Will, Nicholas J. Conard

_Change and continuity in the organization of lithic technology during the later Middle Stone Age of KwaZulu-Natal (South Africa)_

16:00  Tina Lüdecke, Friedemann Schrenk, Heinrich Thiemeyer, Ottmar Kullmer, Jens Fiebig, Ulrike Wacker, Andreas Mulch

_Climate and vegetation patterns in the Malawi Rift during the time of early hominin evolution_

16:20  **COFFEE BREAK**

16:50  Geraldine Quénéhervé, Felix Bachofer, Christine Hertler, Liane Giemsch, Michael Märker

_Detection of soil and landscape patterns related to Stone Age artefact and fossil find locations_

17:10  Felix Bachofer, Geraldine Quénéhervé, Michael Märker, Christine Hertler, Volker Hochschild

_Paleo-environmental research in a semiarid study area in Northern Tanzania - A synopsis_
17:30  Manuel Will, Jay T. Stock
New body size estimates for early Homo and their implications for the first dispersals out of Africa

CONFERENCE BARBECUE

19:30  in the BiK-F garden in front of the BiK-F lecture hall
Thursday, 16.07.2015

QUANTIFICATION AND MODELLING

9:00  Jésus Rodríguez, Ana Mateos Cachorro, Jesus A. Martín-González, Cristina Esteban  
Modelling the distribution of Pleistocene archaeological and palaeontological sites in Europe

9:40  Maria Rita Palombo  
Faunal dynamics during the Early Pleistocene: Hints for detecting causal factors behind the first human dispersal in Southwest Europe

10:20 Rebekka Volmer  
Small but mighty – Competition for food resources among small carnivores and humans in the Southeast Asian Holocene

11:00 COFFEE BREAK

11:15  Ericson Hölzchen, Christine Hertler  
Exploring Out of Africa scenarios by means of agent-based modeling

11:45  Benjamin Duppe, Fabian Lorig, Ericson Hölzchen, Christine Hertler, Michael Märker, Ingo J. Timm  
Modeling the environment for simulation of early human dispersal using cellular automata

12:15  Ingo Timm, Fabian Lorig, Ericson Hölzchen, Christine Hertler  
Scaling agent-based simulation of early human dispersal

12:45  Mathias Gutmann  
Simulation and mimesis

13:15 LUNCH BREAK

14:00  Boris Schröder-Esselbach  
Phenomenological modelling approaches: concepts, applications and limits

14:30  Thomas Müller, Rahel Sollmann  
Learning and environmental factors in long-distance animal movement

15:00  Andreas Bolten, Christian Willmes, Georg Bareth  
Expansion modelling in the SFB 806 framework

15:30 COFFEE BREAK
Conference Program

15:45  Carl Georg Heise, Anusch Taraz  
      *Graph theory based methods: Another way to model expansion?*

16:15  Domenico Capolongo  
      *SIGNUM: A numerical landscape evolution model*

16:45  Christopher W Carleton, David Campbell, Mark Collard,  
      *Developing a toolkit for studying human–environment interaction in the archaeological record*

17:15  Discussion

19:00  Meeting of the Initiative for an INQUA International Focus Group  
      “Modelling human presence and environmental dynamics during the Mid-Pleistocene Revolution”
## Friday, 17.07.2015

### EXPANSIONS OF RANGE

<table>
<thead>
<tr>
<th>Time</th>
<th>Speaker</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>09:00</td>
<td>Hanneke Meijer</td>
<td><em>Paleoecological perspectives from fossil bird faunas in Southeast Asia</em></td>
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<tr>
<td>09:30</td>
<td>Susanne Haupt</td>
<td><em>Paleodiet of Homo erectus and Duboisia santeng in Early Pleistocene of Sangiran</em></td>
</tr>
<tr>
<td>10:00</td>
<td>Knut Bretzke</td>
<td><em>New evidence for a late Middle Pleistocene occupation of Southeast Arabia</em></td>
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<tr>
<td>10:30</td>
<td>Trine Kellberg Nielsen</td>
<td><em>What about southern Scandinavia? Discussing the northern range of Neanderthals in the late Middle and early Late Pleistocene</em></td>
</tr>
</tbody>
</table>

**11:00 COFFEE BREAK**

11:15 Hominin dispersals beyond the African continent – Discussion round

**13:00 LUNCH BREAK**

14:00 Closing discussion

15:00 Farewell coffee break

### CLOSING
Abstracts in alphabetical order
Early Levallois Technology and the Transition from the Lower to Middle Palaeolithic in the Southern Caucasus

Adler, Daniel S. 1, Wilkinson, K.N. 2, Blockley, S. 3, Mark, D.F. 4, Frahm, E. 5, Schmidt-Magee, B.A. 1, Glauberman, P.J. 1, Racynski-Henk, Y. 6, Jöris, Olaf 7, Gasparian, Boris 8

1 Department of Anthropology, University of Connecticut, 354 Mansfield Road, Unit 1176, Storrs, CT 06269, USA
2 Department of Archaeology, University of Winchester, Winchester SO22 4NR, UK
3 Department of Geography, Royal Holloway, University of London, Egham, Surrey, TW20 0EX, UK
4 NERC Argon Isotope Facility, Scottish Universities Environmental Research Centre, Scottish Enterprise and Technology Park, Rankine Avenue, East Kilbride, G75 0QF, UK
5 Departments of Anthropology and Earth Sciences, University of Minnesota, 310 Pillsbury Drive SE, Minneapolis, MN 55455, USA
6 Ex-Situ Silex, Vrijheidslaan 646, 2321 DV Leiden, Netherlands
7 MONREPOS Archaeological Research Centre and Museum for Human Behavioural Evolution, Schloss Monrepos, 56567 Neuwied, Germany
8 Institute of Archaeology and Ethnology, National Academy of Sciences of the Republic of Armenia, Charents 15, 0025 Yerevan, Armenia

Presenting author: Daniel S. Adler

The Late Middle Pleistocene (LMP) was a period of profound biological and behavioral change that witnessed the evolution of Homo sapiens in Africa and the Neanderthals in Eurasia, and the transition from the Early Stone Age/Lower Palaeolithic to the Middle Stone Age/Middle Palaeolithic. This latter change can be broadly characterized by the gradual replacement of large cutting tools and bifaces by points, flakes and blades produced through a variety of hierarchical core strategies, among which the Levallois method is most prominent. Within the Southern Caucasus, a pivotal geographic region straddling Africa and Eurasia, virtually nothing is known about the archaeological record of this period (Gasparian, 2010; Gasparian et al. 2014). An important exception is Nor Geghi 1 (NG1), a LMP open-air site located within the Hrazdan valley north of Yerevan, Armenia. Between 2008 and 2009, over 3,000 obsidian artifacts were recovered from a paleosol (Unit 2) that developed on the floodplain of the paleo-Hrazdan. These artifacts document the variable behaviors of NG1’s occupants and chart the local transition from the late Lower Palaeolithic (Mode 2) to the early Middle Palaeolithic (Mode 3) (Adler et al. 2014). Ar40/Ar39 dating of an underlying (Basalt 7, 440 ka) and overlying (Basalt 1, 200ka) lava flow, and sanidine grains from cryptotephra (Unit 1, 308 ka) suggest an age for the Unit 2 assemblage of 335–325 ka (OIS 9e). Recently excavated lithic artifacts from deeper strata extend the chronology of NG1 to OIS 11e, and the pXRF analysis of over 450 artifacts
demonstrate the exploitation of five primary obsidian sources located between 8 and 120 kilometers from NG1. These data indicate that NG1 is among the oldest Eurasian transitional industries with bifacial and Levallois technology recovered from a secure archaeological context, and the oldest stratified site in Armenia. At NG1, the early synchronic use of bifacial and Levallois technology is consistent with the hypothesis that developments in the technological realm of LMP hominins resulted from deep-rooted evolutionary processes based on a common technological ancestry rather than the expansion of a particular species armed with Mode 3 technology.
Paleo-Environmental Research in a Semiarid Study Area in Northern Tanzania - A Synopsis

Bachofer, Felix 1, Quénéhervé, Geraldine 1, Märker, Michael 2, Hertler, Christine 3, Hochschild, Volker 1

1 Institute of Geography, University of Tübingen, Rümelinstr. 19-23, 72070 Tübingen, Germany
2 ROCEEH Research Centre, University of Tübingen, Rümelinstr.19-23, 72070 Tübingen, Germany
3 ROCEEH Research Centre, Senckenberg Research Institute, Senckenberganlage 25, 60325 Frankfurt am Main, Germany

Presenting author: Felix Bachofer

The Lake Manyara area is focus of several paleo-archeological investigations. The Manyara basin is located approximately 70 km east of Olduvai Gorge, where important paleo-anthropological artifacts are traced back to Homo habilis. In the Manyara basin itself, two hominin-bearing sites (0.78 to 0.633 mya) and plenty of vertebrate bones and teeth as well as hand axes from different periods were discovered, especially close to the Makuyuni River. Different methodological approaches with a main emphasis on remote sensing were utilized to contribute to the understanding of the paleo-landscape development. In order to investigate the morphotectonic evolution of the study area, lineaments were detected from Synthetic Aperture Radar satellite scenes. The complex lacustrine development of the Lake Manyara and its paleo-stages were investigated by delineating the extent of paleolake sediments (older than 0.633 mya) with multispectral ASTER data. In addition, lake terraces and shorelines on different levels (up to 80 m above today’s lake level) and an outlet to the neighboring Engaruka basin were detected by analyzing the backscatter intensity of TerraSAR-X data. The distribution of topsoils, identified from multisensoral remote sensing datasets indicates soil formation, as well as erosional and depositional processes. Moreover, the fossils and artifacts were characterized and the distribution probability was determined using a statistical model. The proposed methods contribute to a better understanding of the paleo-environmental interrelations within the study area.
Change and Continuity in the organization of lithic technology during the later Middle Stone Age of KwaZulu-Natal (South Africa)

Bader, Gregor D., Will, Manuel, Conard, Nicholas J.
Department of Early Prehistory and Quaternary Ecology, University of Tübingen, Schloss Hohentübingen, Burgsteige 11, 72070 Tübingen, Germany

Presenting author: Gregor D. Bader

Our knowledge of the time after the Howiesons Poort in southern Africa, a period that dates to marine isotope stage 3 (MIS 3), has increased in recent years. This is the result of detailed analyses conducted at numerous finely stratified sites such as Diepkloof, Sibudu and Klasies River, and also at smaller, less well known sites like Holley Shelter and Umhlatuzana, situated in KwaZulu-Natal Province. What becomes clear from these data is that many innovations appeared during the post Howiesons Poort, after 58 ka BP, especially with regard to lithic technology and raw material acquisition. In contrast to the preceding time periods, these innovations are not limited to a specific technocomplex. Instead they are highly variable at different sites during the same time periods. Here we present a comparative technological study of three MSA sites in KwaZulu-Natal dating to MIS 3, namely Sibudu, Holley Shelter and Umhlatuzana. Although these sites show similar environmental conditions in terms of water and food acquisition, as well as hunting opportunities, the technology varies in many aspects. Raw material acquisition strategies also differ, even though the geological situation of the sites is not too different. Above all, there is still continuity in some aspects of lithic technology. This study addresses the topics of “expansions of hominin performance” as well as “expansion of hominin resource space”. Here we show that transmission of innovations in lithic technology and raw material procurement strategies has not been as similar as one would expect within a relatively small temporal and spatial frame.
Coastlines as Pathways of Hominin Expansion: a View from the Red Sea

Bailey, Geoff ¹, Dimitris Sakellariou ², Garry Momber ³, Maud Devès ¹, Robyn Inglis ⁴, Matthew Meredith-Williams⁵, Abdullah Alsharekh ⁶

¹ Department of Archaeology, University of York, The King’s Manor, York YO1 7EP, UK
² Institute for Oceanography, Hellenic Centre for Marine Research, 46.7km Athens-Sounio Ave., 19013 Anavyssos, Greece
³ Room W1/95, National Oceanography Centre, Empress Dock, Southampton SO14 3ZH, UK
⁴ BioArCh, Biology S-Block, University of York, Wentworth Way, York YO10 5DD, UK
⁵ BioArchaeology, Department of Archaeology, University of York, Wentworth Way, York YO10 5DD, UK
⁶ Department of Archaeology and Museology, King Saud University, P.O. Box 2456, 11451 Riyadh, Kingdom of Saudi Arabia

Presenting author: Geoff Bailey

One of the ideas about early human expansion that has gained ground in the past decade is the idea that coastlines and marine resources have played a significant role in facilitating and accelerating early hominin dispersals, aided in some cases by early developments in seafaring. This idea is especially popular in relation to the spread of anatomically modern humans, and has gained support from a number of disparate sources – palaeogenetic inference, early evidence of marine resources in South African caves, and the early dates for seaborne human entry into New Guinea and Australia. However, the dating and routeways of this postulated dispersal are a matter of controversy, and supporting field evidence, particularly around the Indian Ocean rim extending over 10,000 km from the Horn of Africa to easternmost Java, is largely absent. Moreover, the search for such evidence is made doubly difficult by the fact that sea-levels were substantially lower than present for the periods under discussion, affording very different environmental conditions on the continental shelf from those visible on the present-day coastline. The coastlines and coastal landscapes relevant to this hypothesis, which are likely to harbour the relevant archaeological evidence, are now deeply submerged and will require underwater exploration. In this paper, I will examine critically this idea of coastal dispersal, drawing on recent underwater and on-land field investigations in Southwest Saudi Arabia and the southern Red Sea.
Plant resources in Schöningen (Northern Germany). Insights into a middle Pleistocene flora and its usability for Homo heidelbergensis

Bigga, Gerlinde

Senckenberg Centre for Human Evolution and Palaeoenvironment (HEP), University of Tübingen, Sigwartstr. 10, 72074 Tübingen, Germany

Presenting author: Gerlinde Bigga

Plant macro remains are rare in Palaeolithic deposits. Subfossil material appears in waterlogged sites, such as Schöningen, charred fruits, seeds or tubers are known from Middle and Upper Palaeolithic contexts, e.g. Vanguard and Gorham’s Cave (Gibraltar), Dolni Vestonice (CZ) or Aurensan (FR). But these findings are only small windows into the past and a connection between plant remains and plant use by hominins is hard to prove. Nevertheless, ethnological studies show, that plants play an important role in every hunter-gatherer society. The sediments in Schöningen contain abundant botanical macro-remains, which offer the opportunity to reconstruct the local vegetation and work out the usefulness for human purposes. The taxa list from the “Horse Butchery Site” (Schöningen 13II-4) includes a broad spectrum of usable species, which provides food, raw material, medicine and firewood. A range of edible and medicinal plants were available from spring to autumn. From the late summer up to early spring the lake shore vegetation revealed a hidden energy source in the form of underground storage organs (USOs). Wood was available all year round for different purposes.

Besides the natural deposited remains, the wooden spears and other tools are an exceptional evidence for plant use: as raw material. The artifacts also show, that the hominins of Schöningen had the cognitive abilities and technical skills to gather different plant parts and process them for different purposes. Considering a strategy that is close to optimal foraging, vegetable food must have been a significant part of the diet. Starch rich USOs, nutritious fruits, nuts and sugar-containing phloem are good sources of energy, vitamins and minerals and were rarely left unexploited. Meat of big herbivores alone could not satis.
Investigating the climatic conditions in the Early Pleistocene of Spain: The case of the hominid site of Barranco León (Granada, Spain)

Blain, Hugues-Alexandre 1, Agusti, Jordi 1, Sala, Robert 2, Martínez-Navarro, Bienvenido 3

1 IPHES, Institut Català de Paleoecologia Humana i Evolució Social, c/ Marcel.lí Domingo s/n (Edifici W3), Campus Sescelades, 43007 Tarragona, Spain
2 Department of History and Art History, Campus Catalunya, Universitat Rovira i Virgili, Av. Catalunya 35, 43002 Tarragona, Spain
3 ICREA, Institut Català de Paleoecologia Humana i Evolució Social. Universitat Rovira i Virgili, 43007 Tarragona, Spain

Presenting author: Hugues-Alexandre Blain

Because most amphibians are water dependent and most reptiles are temperature dependent, the climatic and/or environmental parameters in their immediate environment mark their distribution. Accordingly, they can contribute to an understanding of microhabitats and microclimates within a larger landscape, such as the Guadix-Baza Basin in south-eastern Spain. The Early Pleistocene archaeo-paleontological site of Barranco León has yielded a diversified accumulation of herpetofauna that comprises at least 20 taxa of amphibians, chelonians, lizards and snakes. With the exception of the bufonid Bufo sp. (viridis group) and the anguid lizard Dopasia, these two assemblages do not specifically differ from the extant herpetofauna of the Iberian Peninsula, making them suitable for use in paleoclimatic and paleoenvironmental reconstructions without the ecological uncertainties of extinct taxa. By their current ecology, such fauna suggest that the terrestrial landscape was composed of open environments (mainly dry meadows, rocky-stony areas and Mediterranean scrubland), although there were some wet wooded areas. Water-linked amphibians and reptiles suggest the existence of a sunny permanent aquatic environment with banks made up of a movable ground. The application of the Mutual Climatic Range method provides quantitative data indicating that during the hominin presence at Barranco León mean annual temperature and mean annual precipitation were higher than they are now on the south-eastern Iberian Peninsula. The contrast between summer and winter temperatures was less pronounced, mainly due to warmer conditions during winter. Rainfall distribution indicates a considerable increase in precipitation in every season but summer, which was drier and consistent with the Mediterranean climate pattern. These results are compared with those for large mammals, small mammals and pollen analyses, yielding a scenario for the paleoclimatic and paleoenvironmental conditions that were in place at the time of the first hominin occurrence in Western Europe.
New evidence for a late Middle Pleistocene occupation of southeast Arabia

Bretzke, Knut

Department of Early Prehistory and Quaternary Ecology, University of Tübingen, Schloss Hohentübingen, Burgsteige 11, 72070 Tübingen, Germany

Presenting author: Knut Bretzke

The Arabian Peninsula plays an important role in models of hominin expansion out of Africa and the colonization of western Asia. While large field projects during the last decade significantly increased the archaeological record for the Late Pleistocene, evidence for hominin occupation of the Arabian Peninsula during the Middle Pleistocene remain scattered. The scarcity of Middle Pleistocene finds from southeast Arabia is particularly serious because this region often plays an important role in expansion models. In this paper I report on the discovery of the new Paleolithic site Suhailah from the central region of the Emirate of Sharjah, UAE. At Suhaila we found lithic artifacts on the surface that show typo-technological characteristics linking these finds with the Late Acheulean. Given the characteristics of the lithic assemblages and the chronology of the Paleolithic sequence from Jebel Faya, about 30 km to the south, I hypothesize that the finds from Suhailah represent a late Middle Pleistocene occupation. After introducing the site and providing an overview of the lithic assemblage, I will discuss potential implications of this discovery with regard to hominin expansions into arid regions.
High-performance agent-based modeling of large-scale population dynamics

Callegari, Simone ¹, Weissmann, J.D. ¹, Tkachenko, N. ², Lake, G. ², Zollikofer, Ch.P.E. ¹

¹ Anthropological Institute and Museum, University of Zurich, Rämistrasse 71, 8006 Zürich, Switzerland
² Institute for Computational Science, University of Zurich, Winterthurerstrasse 190, 8057 Zurich, Switzerland

Presenting author: Simone Callegari

Quantitative tests of hypotheses regarding the late Pleistocene population dynamics of genus Homo are complex: models of large-scale human dispersals have to be compared with worldwide spatio-temporal patterns of genetic and phenetic distance and variation, as well as archaeological findings. Stochasticity, population sizes, and climatic and environmental variability, all affect the emergent dynamics of the system. Here we present an agent-based framework for large-scale population modelling that is able to handle millions of agents and timesteps in a geographically and ecologically structured environment, and is therefore able to capture phenomena spanning from the individual to the global scale. We show results from simulations of the out-of-Africa dispersal of Homo sapiens using a basic model, in which each agent can be thought of as a simplified, single hominin. Instead of dealing with genetic patterns at the level of demes, such high resolution allows to reconstruct the genetic history of the population by directly tracing the ancestries of simulated individuals. Finally, we discuss how large-scale parameters of population demography and diffusion can affect spatiotemporal patterns and genetic signatures of the dispersal process.
SIGNUM: A numerical landscape evolution model

Capolongo, Domenico

Dipartimento di scienze della Terra e Geoambientali, University of Bari Aldo Moro, Piazza Umberto I, 70121 Bari, Italy

Presenting author: Domenico Capolongo

SIGNUM (Simple Integrated Geomorphological Numerical Model) is a TIN-based landscape evolution model: it is capable of simulating sediment transport at different space and time scales. It is a multi-process numerical model written in the Matlab® high level programming environment, providing a simple and integrated numerical framework for the simulation of some important processes that shape real landscapes. Particularly, at the present development stage, SIGNUM is capable of simulating geomorphological processes (in 2.5 D) such as hillslope diffusion, fluvial incision, tectonic uplift or changes in base-level and climate effects in terms of precipitation and sea level change.
Developing a toolkit for studying human–environment interaction in the archaeological record

Carleton, W. Christopher ¹, Campbell, David ², Collard, Mark ¹

¹ Department of Archaeology, Simon Fraser University, 8888 University Drive, Burnaby, B.C. V5A 1S6, Canada
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Presenting author: Christopher W. Carleton

Interaction with the environment has been central to human evolution. It has impacted our geographic expansion and shaped our technology, economy, social organization, and health. Thus, understanding human–environment interaction is a critical task for archaeologists. The archaeological record has two characteristics that make it important for enhancing that understanding. Firstly, it offers a long-term view of human history, which is crucial because short-term effects can be substantially different from long-term ones. Secondly, it contains a diverse sample of societies and environmental conditions, facilitating comparative analyses that can capture a range of interactions and their effects. However, archaeological research into human–environment interaction has been hamstrung by inadequate analytical methods. Drawing on two recently completed case studies, we will illustrate exactly how inadequate methods can lead to false conclusions and then suggest two new methods that perform much better. In the first case study, we demonstrate how inadequate methods led to a well-known hypothesis that cyclical drought caused several major social upheavals in Classic Maya history. The hypothesis was based on a frequency-based time series analysis of a drought proxy record from the Classic Maya region. Using a better approach, we found no evidence for cyclical droughts that could have affected the Classic Maya, undercutting the cyclical drought hypothesis. In the second case study, we modified a statistical technique to assess the impact of environmental changes on Classic Maya conflict levels. Our findings indicate that temperature increase led to enormous increases in Classic Maya conflict levels. Together, the two case studies offer several insights that will be critical for developing a toolkit for assessing human–environment interaction in the archaeological record.
Abstracts

The expansion of symbolic and ritual capacities in the Homo lineage from an interdisciplinary perspective

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Presenting author: Rimtautas Dapschauskas

Based on the analyses of tool behaviour in cognitive terms it has been shown recently that an expansion of cultural capacities occurred through the Middle Stone Age in Sub-Saharan Africa (Lombard/Haidle 2012). In this talk I will argue that a rather similar observation can be made regarding the capacities of symbolic communication through ritual behaviour in the late Homo lineage. With a combination of theories from evolutionary biology, cognitive science and cultural anthropology applied to the constantly growing archaeological record it can be shown that an expansion of cognitive capacities to communicate symbolically through collective rituals probably occurred within that time span too. I present three types of archaeological evidence which may represent early symbolic-ritual behaviour in the Palaeolithic record, namely ochre, burials as well as their predecessors, and personal ornaments. Thus, ritual behaviour is not restricted to Homo sapiens alone, but can also be connected with Neanderthals. There may be some sporadic evidence for ritual behaviour in Homo heidelbergensis as well, such as mortuary activity and pigment use. For that reason it is likely that ritual behaviour is a part of human nature with a deep evolutionary history, which is confirmed by some new observations in Primatology as well, let alone the massive ethnographic record of rituals which occur in almost all known human cultures on the planet.
“Modeling the Environment for Simulation of Early Human Dispersal using Cellular Automata”

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According to the Out-Of-Africa-Hypothesis the geographic origin of hominins is located in Africa. Even though the existence of waves of early human dispersal is scientifically recognized, there is no evidence on the real cause and route of migration. Different environmental and biological factors and a concurrence of these factors are discussed as a cause, yet, there is no consensus. Hence, a suitable technique for analyzing and evaluating the plausibility of certain factors influencing dispersal processes is needed.

By executing models of real world systems using computer simulation, artificial scenarios can be generated and examined individually. However, a variety of specialized domain models, e.g., climate, predator, and flora, are required for an adequate simulation of dispersal processes. Thus, these models have to be integrated into a holistic simulation model for covering the relevant aspects. At the same time, it needs to be taken account of the complexity of the simulation models, as increasing complexity results in decreasing performance of the simulation experiments. Furthermore, multiple runs under various conditions have to be performed for gaining information out of the simulation experiments.

Therefore, we present an approach for discretizing the environment into cells representing the spatial dimension and computing a potential field-like valuation of each cell as an integration and aggregation of the different environmental influences. Hominin’s behavior and movement can then be simplified in such a way, that the hominins are searching for the highest potential within their neighborhood. As a result of this approach, the computation of the hominins decision process is facilitated as it only depends on the potential of its environment.
Patterns of body mass and diet of large ungulates from Middle and Late Pleistocene of Western Europe and their connections with vegetation openness

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Presenting author: Jussi T. Eronen

Ungulate ecomorphology reflects environmental conditions as well as competition and facilitation by other species. The diets of ungulates vary following differences in vegetation, and their body size is affected by a complex set of ecological and physiological variables. Here we analyse Middle and Late Pleistocene British and German ungulate palaeocommunities in order to test whether there are significant correlations of diet and body size of the ungulates with vegetation openness. We use mesowear analysis for dietary analyses and regression equations for estimating body mass from dental and skeletal measures. The results show a correlation between ungulate mesowear and non-arboreal pollen percentages of the localities, but there are marked species-specific differences. Body sizes of deer (Cervidae) and rhinoceroses (Rhinocerotidae) with small group sizes are on average larger in open environments, whereas aurochs (Bos primigenius) and steppe bison (Bison priscus) do not show clear connection of body size with environmental conditions and the wild horse (Equus ferus) has on average smaller mean size in open environments, probably because of large group sizes and resource limitations. It is evident that the correlation of body size and vegetation openness is not as straightforward as that of diet and vegetation. This is likely to reflect the varying effects of population density, ecological adaptations and environmental conditions on body size in different species.
The "gannet approach": Challenging hyper-intellectualism in cognitive archaeology

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Gannets (genus Morus) are seabirds able to dive from great heights and hit the water surface at ca 100 km/h, catching fishes deeper than other seabirds can reach. In consequence, these birds have to close their wings at the right moment before the impact with water. However, gannets do not streamline by internally representing speed, acceleration, relative height, or time-to-contact. Rather, they focus on the variation of the properties of water surface while diving, closing the wings when water affords "penetrability". Such embodied/situated strategies stand at the crux of the radical embodiment agenda, which attempts to limit the general tendency to over-emphasize internal computations and representations in cognitive explanations. This problem is particularly acute in cognitive archaeology, where abstractions, detailed mental plans and internal computations are often intuitively used to explain the production of Paleolithic artifacts. Adopting the gannet example as a model, I will argue that such mentalistic processes cannot be assumed as default explanations in this domain. To make the argument, I will discuss the example of simple wooden spears ascribed to Homo heidelbergensis in Europe, arguing that, in contrast to some initial assumptions, the invention and transmission of the spears do not require abstractions and a priori mental plans. On the contrary, material engagement with artifacts stands as a necessary condition to bring these abstractions to the fore within the long term. Importantly, arguments from phenomenology show that highly sophisticated mentalistic processes, though in principle possible, are not even primary in modern humans. Thus, attempts to consider these "modern standards" as a central feature of extinct populations’ minds appear to be incoherent. A minimalistic epistemology is proposed here, which aims to assess how far we can explain human cognitive evolution without tapping into supposedly "modern" abilities, avoiding to depict "hyper-intellectual" versions of past humanity.
Simulation and Mimesis

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Presenting author: Mathias Gutmann

Insofar as palaeoanthropology is assumed to belong to the group of historical sciences it seems to aim at adequate representations of the past. One key feature of these representations is to give an impression of “how it actually happened”, as Ranke puts it (“Wie es eigentlich gewesen (ist)”). And indeed, without at least some partial correspondence between the representation and the real process, natural history narratives would be some idle tale telling.

However, this claim is easier admitted than answered, because from an epistemological point of view, different models, theories or reconstructions may be derived from one and the same data set. And these will differ in respect of their logical structure, their claims of validity and their explanatory power. Consequently, the most challenging problem is to identify “the correct” correspondences, which might provide at least some clues for the evaluation of the adequacy of the respective narrative. The situation becomes even worse, as with the introduction of simulation techniques (e.g. in terms of multi agent modelling) the relation between the representation of the natural process and the process itself becomes increasingly indirect.

This paper argues that this process is a necessary effect of the concept of simulation itself, the tools that are applied and the knowledge bases, which are integrated. By providing a reconstruction of the epistemic structure of simulation and the resulting natural history narratives, a scenario-based solution for the problem of correspondence is developed. Following this argumentative strategy, simulation should be understood as an intrinsically mimetic procedure, which avoids some of the shortcomings of representationalist approaches. One important result of this solution is the consequence that simulation seems to be rather more a “way of world making”, than the generation of a simulacrum, which is assumed to reproduce the natural process itself.
The expansion of hominin performances

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Presenting author: Miriam N. Haidle

A major element in the process of “becoming human” is the expansion of the variety and flexibility of human performances and their physical, mental, and behavioral aspects. Cultural performances are a subset of human performances. Hominin performances have three developmental dimensions: evolutionary-biological, historical-social and ontogenetic-individual. These three dimensions are multifactorial and interact with one another and their specific resource space. While cultural performances represent the actual sets of cultural attributes expressed by an organism or a group, cultural capacities represent the potential range of cultural performances in different subgroups at a given time. The cultural capacity, e.g., of Homo heidelbergensis cannot be directly observed, but must be deduced from the sum of quasi-contemporaneous performances seen in the record of material culture preserved at different archaeological sites associated with H. heidelbergensis.

The role of culture is not static, as cultural capacities change in the process of becoming human. The abilities needed to advance cultural performance are well documented in the animal world and include the use of social information, long term learning in a social milieu, and the development of traditions that span across generations. The conditions needed to achieve even the most basic cultural capacity, namely groups of a single species having different patterns of tradition among them, are met by just a few species including chimpanzees and orangutans. Our model for the evolution and expansion of cultural capacities (EECC) (Haidle et al. 2015) use the expansion of the problem-solution distance to explain advances in behavior associated with tool use; the EECC model proposes four higher levels of cultural capacity which developed over the course of human evolution. Based on currently known assemblages of finds, the beginnings of each expansion date to about:

- Modular: 3.3-2.6 Ma
- Composite: 0.5-0.2 Ma
- Complementary: ~70 ka
- Notional: 40-100 ka

Different cultural capacities can express themselves through many different cultural performances. Just because a group acquires a specific cultural capacity does not mean that they will implement all of the associated performances applicable within a specific ecospace. In fact, the potential for cultural differentiation results from this. The increasing transformation of
cultural capacities and their transfer to solve different problems unfolds in a gradual process that can even be retrograde. Cultural performances and capacities are not juxtaposed against nature or environment. They are rather part of the natural development. Over the course of humanity cultural performances and capacities represent an ever increasing component of the environment (in this case, artifacts) and influence the development of the environment and the specific resource space.
Paleodiet of Homo erectus and Duboisia santeng in Early Pleistocene of Sangiran

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The Sangiran dome is one of the richest hominid localities outside of Africa (Indriati 2004). It covers a large time span from Early to Middle Pleistocene. The hominid fossil bearing layers at Sangiran are the upper part of the Sangiran formation, Grenzbank and the Bapang formation (Watanabe & Kadar 1985). *Duboisia santeng*, a boselaphine antelope from the Koenigswald collection, co-occurs with the hominids and is restricted to these layers. That makes them the ideal candidates for paleoecological studies at the time of *Homo erectus*. This study focuses on the paleodiet of *Homo erectus* (S7-37) and *Duboisia* individuals from Sangiran.

We took serial samples from each molar and analyzed the carbon isotope signal. In this way we can detect seasonal changes in the diet from the beginning to the end of the molar crown formation. In the case of *Duboisia* we suppose a crown formation time of c. 3 years based on a study on African bovids (Macho & Williamson 2002). The *Homo erectus* M1 took c. 2.5 years to crown completion, which starts shortly before the birth of this individual (Dean et al. 2001). Therefore, we can identify the breastfeeding and weaning phase of *Homo erectus* in our data.

We therefore analyze the diet of the individuals in different ways. First of all we analyze the chronological sequence of each specimen and features of the diet at every time step. This analysis provides information on individual food supply in successive periods. Moreover, we compare *Duboisia* individuals with each other. In this part of the study we collect data on the paleodiet of *Duboisia santeng* and therefore about the sequence of paleoenvironments at Sangiran. Finally, several of the Duboisia specimens included in this study originate from the same stratigraphic layer as the *Homo erectus* tooth. Comparing the signals retrieved from both of the species provides information on the diet of *Homo erectus* in different stages of his life.
Graph theory based methods: Another way to model Expansion?

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Presenting author: Carl Georg Heise

Graphs are mathematical structures that can be used to describe networks that appear in nature, society and engineering. Typical examples of such networks are communication or transportation systems and social or biological networks. The corresponding graphs consist of a set of nodes, representing for example individual computers, locations, human beings or chemical substances, and two such nodes are joined by an edge if they are connected by physical or wireless links, by a road, a personal relation or a chemical reaction, respectively.

Over the last two decades, various parameters and properties of these systems have been empirically analyzed, such as their diameter, their connectivity and robustness, their degree distribution and their clusters. Somewhat surprisingly, strong similarities have been observed despite the fact that the networks arise in rather different fields. This has prompted the development of stochastic graph models in order to understand and predict the behaviour and evolution of these systems. In this talk, we survey such graph theoretic models. Our emphasis will be on investigating those parameters and properties that can be used to explain expansion and spreading processes that occur in the networks.
Exploring Out of Africa scenarios by means of agent-based modeling

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Presenting author: Ericson Hölzchen

According to the Out of Africa theory the genus Homo originated in Africa and dispersed from there all over Eurasia. As we can assume from fossil evidence, such a dispersal event must have happened at least two times. There is evidence of an early dispersal of hominin species such as Homo erectus/ergaster around 2 million years ago and a dispersal of modern humans around at least 130 thousand years ago. Yet, we do not know the triggers of such unprecedented dispersals. There are, however, various hypotheses including changes in the environment, demography, resource distribution and availability, competition for resources as well as biological and cognitive evolution. So far, there is no procedure to test and compare these hypotheses.

We want to explore the capabilities of agent-based modeling (ABM) to explore Out of Africa hypotheses. An agent-based model consists of agents which are the acting entities, an environment and rules of action and interaction defining the behavior of the agents. We found that the most common Out of Africa hypotheses can be summarized in four scenarios. Subsequently, we want to test these scenarios on specific research questions concerning the early hominin dispersals out of the African continent. First results of our reconstruction and a preliminary version of the model will be introduced in frame of this presentation.
Climate on the edge of human dispersal in the European Middle Pleistocene

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Presenting author: David J. Horne

Pleistocene palaeoclimatic reconstructions based on fossils from sites containing archaeological evidence of human occupation can answer key questions about the climatic context of early human dispersal in Europe. Biological proxies such as ostracods, beetles and pollen are widely used to estimate palaeoclimatic parameters via Indicator Species, Mutual Climatic Range (MCR), Modern Analogue Technique (MAT) and Transfer Function approaches. Any single proxy method will yield a result, often a plausible one, but there is a need for more rigorous, multi-proxy comparative testing to validate such methods. The Multi-Proxy Consensus (MPC) approach not only tests two or more proxies against each other in order to validate (or not) their results, but also (subject to validation) enables a more precise palaeoclimate determination to be obtained from, e.g., the range of mutual agreement between two or more overlapping palaeotemperature ranges. Reconstructed palaeotemperatures can be mapped in a GIS to find areas with analogous modern climates and estimate the climate type according to the Köppen classification scheme. Application of this approach to British interglacials, using new as well as previously published quantitative palaeotemperature reconstructions, facilitates a more detailed and critical consideration of the climatic settings of early human expansions into northern Europe. We present results ranging from the oldest known British human occupation site, Happisburgh 3 (MIS 21–25), through Pakefield (MIS17 or 19) and Boxgrove (MIS13), to sites assigned to MIS11, MIS9 and MIS7 interglacials. Human colonization of these sites by dispersal from more southerly populations had to contend with colder and longer winters, requiring greater dependence on meat for food because plant resources were only available in the warmer months. Adaptive strategies likely involved the use of shelters and animal hides to keep warm, and eventually also fire (at least by MIS11), rather than seasonal migrations or physiological adaptations.
The rich archaeofaunal record of Southwest Europe has long been a productive source of information about changing environments. In this presentation, I use the archaeozoological record from 60 – 30 kya southwestern France and Iberia to identify macro-bioclimatic regions. Nestedness, cluster (unweighted pair-group method using arithmetic averages [UPGMA]), and non-metric multidimensional scaling (NMDS) analyses suggest that as climate changed, the macro-bioclimatic regions in Southwest Europe did as well, with barriers and corridors developing and disappearing through time. These changes in ecospaces would have shaped the decisions made by Neanderthals and anatomically modern humans alike in terms of where to settle, what to eat, and where to hunt.

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Presenting author: Olaf Jöris

Early hominin presence in Europe can be traced back almost two million years, beginning with the Dmanisi hominin fossils found in the Georgian Transcaucasus, which are well-dated to c. 1.8 million years ago, at the base of an archaic Eurasian branch. Until about 600,000 years ago the European Palaeolithic archaeological record appears to be highly discontinuous. Even more punctuated is the European fossil hominin record until the mid-Middle Pleistocene, i.e. until ~250,000 years ago.

As a result, it is heavily debated in how many waves of geographical expansions hominins dispersed over Europe, whether these dispersals occurred in distinct phases, or whether hominin dispersal into Europe is better understood as a process of continuous dispersion over longer periods of time. In addition to these questions it is debated whether the European archaeological record is best understood as reflecting populations that dispersed over the continent, or as due to the spread of ideas between groups or populations. The decision between models is – to a large degree – most often due to the individual researcher’s interpretation of the cognitive capacities and cultural performances that are deduced from the archaeological record.

The present paper will discuss the overarching chronological trends and trajectories archived in the European Palaeolithic record between roughly between 600,000 and 12,000 years ago. In addition to an outline of the general trends, the paper intends to contribute to an improved understanding of the variability of cultural performances in time and space. It will highlight the evolution of human behaviour over this period and finally contrast the Upper Palaeolithic societies with the archaeological record of the preceding Lower and Middle Palaeolithic.
THE CONCEPT OF BEHAVIORAL HYPERPLASTICITY AS A FRAMEWORK FOR EXAMINING EXPANSIONS OF CULTURAL CHANGE DURING THE MIDDLE STONE AGE OF SOUTHERN AFRICA

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Presenting author: Andrew W. Kandel

The Middle Stone Age (MSA) of southern Africa represents a key period in cultural evolution during which modern humans expanded and adopted a series of transformative innovations over time. The artifacts associated with these expansions have been recognized as expressions of “cultural modernity” or “cognitive complexity” and represent a package of attributes that researchers generally interpret as examples of modern behavior. But do these varied cultural performances really indicate an important breakthrough that conferred evolutionary advantages upon the makers of MSA assemblages? Based on our integrative macro-scale assessment of behavioral trends during the MSA, we see an extension in the range of cultural performances, but no evidence for unilinear progress. We observe an increase in the cultural capacity, that is, the framework of biological, historical-social and individual factors that allowed humans to make selective use of a wide spectrum of possible behaviors. We interpret this selectivity as a positive adaptive feature and postulate that as human evolution progressed, flexibility itself became the key evolutionary adaptation. We suggest that this “behavioral hyperplasticity” conferred a decisive advantage on modern humans. Diverse and flexible forms of individual behavior would directly benefit groups to cope with unknown circumstances, whether caused by fluctuating climatic conditions, changing ecosystems, shifting group allegiances or illnesses. Behavioral hyperplasticity differs from simple behavioral plasticity in the shift from mainly individually expressed cultural performances to performances involving the flexible behavior of many individuals on a group level. Enlarged social networks, enhanced communication and intergroup cooperation would have fostered behavioral hyperplasticity and thereby mitigated uncertainty. These factors associated with enhanced cognitive abilities provide an evolutionary advantage that can be passed on to subsequent generations. Thus behavioral hyperplasticity represents a mechanism driving cultural change during the MSA and helps to explain the process by which modern humans expanded across the globe and outcompeted multiple forms of archaic hominins.
What about southern Scandinavia? – Discussing the northern range of Neanderthals in the late Middle- and early Late Pleistocene

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Presenting author: Trine Kellberg Nielsen

Advances in archaeology have shown that understanding the dispersal patterns and range of Neanderthals is central to understanding their behavioural-, adaptive- and cultural capacities. This development has recently been accompanied with a shift in research focus from the highly investigated core occupation area (i.e. France), to an increase in investigations of what is occasionally referred to as ‘peripheral occupations’ (Krause et al., 2007; Prüfer et al., 2014; Roebroeks et al., 2011; Slimak et al., 2011; White and Pettitt, 2011). The topic presented here, situates itself within this debate of the Neanderthal ‘peripheral’ range, by discussing the possibility of a Neanderthal presence in southern Scandinavia. The notion of pre-modern humans in Scandinavia is highly controversial and has long been regarded implausible, most often with reference to the lacking fossil- and archaeological record and climatic constraints assumed for the region (but see discussions in Holm and Larsson, 1995; Larsson, 2000). Evidence from the North European Plain (Roebroeks and Speleers, 2002) and Schleswig-Holstein (Hartz et al., 2012) suggest that Neanderthals were indeed present within the relative catchment area, but whether these sites represents the actual ‘northern boundary’ or are the result of taphonomic bias needs to be established. The aim of the project presented here, is to question our preconceived, and highly biased, notions of the possibility of early dispersals into southern Scandinavia by evaluating 1) the climatic and ecological signal, 2) the palaeogeographical history and 3) the historical research-agenda of the region and its possible impact on the Pleistocene archaeological record. The temporal focus will be placed on the late Middle Pleistocene and early Late Pleistocene (Eemian to early Weichselian) because of the empirical corpus available for this period.
Hominin evolution in dynamic environments

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Hominins evolved in the Savannah of Africa as the climate became drier and it is assumed that these were smooth or flat plains. In fact sites occur in areas of complex topography resulting from tectonic movement which would have been active at the time. This correlation is assumed to be a taphonomic effect associated with burial by sediment followed by exhumation. We contest this view and argue that these areas, with frequent sudden and severe changes in gradient, and a wide variety of landforms (rocky outcrops, cliffs, gorges, ridges etc), offered security (plenty of look-out points, shelter, protection from most predators) and could therefore have been attractive for hominins. They could also have acted as a powerful stimulus to improving locomotor skills for moving around the landscape by climbing, balancing, scrambling and moving rapidly over broken ground. These would have facilitated the emergence of bipedalism. Additionally, this type of broken, disrupted terrain offers greater chances of trapping prey species in cul-de-sacs or on very broken ground, and would thus have been additionally attractive to early hominins. We illustrate this with examples from the Eastern Mediterranean, East Africa and South Africa. For many of these, we can specifically exclude a taphonomic explanation.

We then present a detailed landscape reconstruction of Olorgesailie, a key site in the East African Rift with a long history of use between ~1.2 and ~0.5 Ma and abundant evidence of large-mammal butchery. We show how it was strategically located to exploit the complex landscape for ambush hunting. We suggest this as the earliest known example of strategic landscape use. We introduce new methods in support of this hypothesis, using tools developed to study earthquake faults, and the mapping of trace nutrients in soils critical to the health of large mammals. These techniques allow us to identify the limited routes of movement and grazing areas available to large mammals in the Olorgesailie region during the Lower to Middle Pleistocene and show the strategic location of the site as a base for their exploitation. These features explain the importance of Olorgesailie as a preferred location of repeated hominin
activity that maintained its attractions despite multiple changes in climate and local environmental conditions.
Climate and vegetation patterns in the Malawi Rift during the time of early hominin evolution

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Presenting author: Tina Lüdecke

The development of East African savannas is crucial for the origin, evolution and migration of early hominins. These ecosystems range from closed woodland to open grassland savanna and vary widely in fraction of woody cover. We contrast δ13C values from pedogenic carbonate with data from fossil enamel of different suid, bovid, and equid species. We complement the former by Δ47 thermometry data as a proxy for soil temperature. Our data from the Chiwondo Beds (Northern Malawi) represent a southern hemisphere record in the EARS, a region particularly interesting for reconstructing vegetation patterns and correlating these across the ITCZ with data on the evolution and migration of early hominids and the proposed boundary shift between different savannas.

The studied sediments contain fossils attributed to Homo rudolfensis and Paranthropus boisei. These Uraha and Malema hominin localities are situated between the well-known hominin bearing sites of today’s Somali-Masai savanna in the Eastern Rift and the Highveld Grassland in southern Africa and fill an important geographical gap for hominin research.

Consistent δ13C values around -9 ‰ from pedogenic carbonate and suidae enamel spanning the last 4.3 Ma indicate a C3-dominated closed environment in the Karonga Basin. Only regional patches of C4-grasslands are indicated by specialized grazers with more positive δ13C values around -1 ‰. The overall fraction of woody cover of 60-70 % near the lake reflects more canopy in the Malawi Rift than in the Eastern Rift throughout time. The discrepancy between the two savanna types increases since the Late Pliocene, when the Somali-Masai ecosystem started to show clear evidence for an open, C4-dominated landscape. Thus the evolution of ecosystems in East Africa follows different patterns of change. The appearance of C4-grasses is considered as a driver of evolutionary faunal shifts, but despite the difference of ecosystem evolution in the north, similar hominins occurred in both landscapes, pointing to distinct habitat flexibility, and may also indicate nutritional versatility.
Palaeoecological implications of the microvertebrates from the Middle Pleistocene Qesem Cave in Israel

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Presenting author: Lutz Christian Maul

The Middle Pleistocene Qesem Cave in Israel is a uniquely well preserved archaeological site, rich in lithic and faunal finds, and well dated by radiometric, archaeological and biostratigraphic methods. It greatly improves our knowledge of human cultural evolution and adaptation as well as microvertebrate evolution in the Levant during the cultural period of the Acheulo-Yabrudian complex (late Middle Pleistocene). The site gains particular importance by its geographic location on a major Pleistocene migration corridor for humans and animals at the nexus of Africa, Europe and Asia lends it particular importance.

Microvertebrates are generally well suited for drawing inferences on past environmental conditions because they are closely bound to the areas in which they lived. We discuss the palaeoecological implications of two microvertebrate concentrations in Qesem Cave. The ecological preferences of the nearest living relatives of the microvertebrate taxa recorded in Concentrations 1 (squares L–N/13–15) and 2 (squares G–H/16–17) at Qesem Cave allow us to infer a mosaic palaeoenvironment of open landscapes, shrubland, Mediterranean Forest, rocky areas and riverbanks. Additionally, we infer palaeoclimate from the bioclimatic distribution of extant species using the Coexistence Approach. These data suggest cooler and slightly drier winters and somewhat lower seasonality than at present around Qesem Cave; the differences are more pronounced for the time covered by Concentration 2 than Concentration 1.
Paleoenvironmental perspectives from fossil bird assemblages from Insular Southeast Asia

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Presenting author: Hanneke Meijer

In contrast to Africa, where a wealth of information regarding the evolution of early hominins and their environments has become available over the past decades, our knowledge of the ecological and climatic conditions under which hominins and their associated vertebrate faunas dispersed, and thrived across Insular Southeast Asia (ISEA) lags behind. Fossil bird assemblages are an excellent source of palaeoenvironmental information. This is especially true for island archipelagos, which lack many terrestrial animal groups, and thus birds often form the largest faunal group in terms of species richness and diversity. Unfortunately, the presence of avian remains in fossil vertebrate collections from ISEA has been largely ignored, and interpretations of terrestrial faunal evolution, palaeoenvironmental change and extinction in ISEA have thus far been based on the mammalian fossil record. However, recent excavations, as well as reinvestigations of existing collections, during the last decades have significantly increased the abundance as well as the diversity of the avian fossil record for this region. With at least 63 species in 54 genera and 27 families, the avian fossil record for ISEA covers the Eocene through the Holocene, with the majority of bird fossils Pleistocene in age. Although this only constitutes a fraction of the modern avian diversity, patterns are starting to emerge that demonstrate the potential of employing the avian fossil record for palaeoenvironmental analysis. During my talk, I will give an overview of the fossil bird record for ISEA and the emerging patterns, and I will demonstrate how fossil bird assemblages can be utilized for palaeoenvironmental reconstructions.
Learning and environmental factors in long-distance animal movement

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Presenting author: Thomas Müller

Animal movement receives widespread attention within ecology and behaviour. However, much research is restricted within isolated sub-disciplines focusing on single phenomena, such as navigation (e.g. homing behaviour), search strategies (e.g. Levy flights) or theoretical considerations of optimal population dispersion (e.g. ideal free distribution). This talk focuses on integrating individual-level behaviour and population-level spatial distributions with respect to spatio-temporal resource dynamics. For example, how do landscape dynamics affect animal movement and lead to population patterns such as range residency or migration? How can individual- or social learning affect long-distance animal movements? I will present case studies ranging from nomadic long-distance movements of ungulates in the steppes of Mongolia to human assisted learning of migration in cranes to highlight the role of learning and environmental factors in explaining long-distance movement behaviours in animals.
Ecosystem dynamics and human migrations in central-southern Italy during the Middle Pleistocene: the key influence of local refuge areas.

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Presenting author: Ronan Orain

With its important concentration of prehistoric sites dated from ca. 670 ka to 300 ka, central-southern Italy plays a major role in the knowledge of Lower Paleolithic technical and subsistence behaviors. Namely, the site of Notarchirico delivered the oldest bifacial tools known in Eurasia (ca. 670-660 ka, MIS 16), whereas the oldest Levallois tools in Europe were uncovered in Guado San Nicola (ca. 395-380 ka, MIS 11-10). The archaeological assemblages attest to the active and selective predation strategies hominins developed to benefit from the broad regional diversity of ecosystems available during the Middle Pleistocene. The persistence of such diversity, even during the glacial phases, could have been a key factor for hominins to sustain in central and southern Italy all along the Middle Pleistocene.

The palaeoenvironmental dynamics, which occurred in the region during the Middle Pleistocene, is documented by pollen data from five intramontane basins of the central and southern Apennines (Sessano, Boiano, Acerno, Vallo di Diano and Mercure). These sequences depict local singularities and regional vegetation trends between MIS 16 and MIS 9, documenting the history of the ecosystems hominins exploited. For example, Acerno and Mercure record important representation of the Mediterranean forest, whereas Vallo di Diano records strong rates of Zelkova and Boiano, the late occurrence of Carya. Both the Vallo di Diano and Boiano basins appear to have represented ecological refuges for exigent taxa and ecosystems. Compositional Data Analysis and climate quantifications through the Coexistence Approach method have been applied to decipher palaeoenvironments and palaeoclimats singularities, which led to the establishment of these refuges. Annual and seasonal disparities in edaphic moisture and/or atmospheric humidity have been assumed to control the distribution of the ecosystems in central-southern Italy under the long-termed aridification trend of the Middle Pleistocene.
Faunal Dynamics during the Early Pleistocene: hints for detecting causal factors behind the first human dispersal in SW Europe

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Presenting author: Maria-Rita Palombo

Despite the growing amount of data and the increasing interest in establishing the baseline factors that may have promoted the earliest dispersals of hominins towards Western Europe, we are still far from deciphering the complex relationships between climate changes and vegetation, fauna, and human evolutionary dynamics. A number of questions as to the causal mechanisms promoting human diffusion and permanent settlement in focal areas still remain open to discussion. Analysing the dynamics of the large mammal fauna from the SW European regions during the Early Pleistocene is of crucial importance to infer to what extent, if any, climate changes might have promoted dispersals, diffusion and at least temporary settlements of archaic human populations in SW Europe before and during the global transition in Earth’s climatic system known as the Mid-Pleistocene Revolution (MPR).

This research deals with dispersal events, shifts in biodiversity and turnovers of large mammals. It compares trends among three focal territories, i.e. the Iberian Peninsula, France and Italy, with the aim of providing a fresh perspective on the debate as to whether climate and ecosystem changes may have affected dispersals of hominin populations.

Results obtained indicate that shortly before the beginning of the MPR, climatic perturbations (which became more pronounced with the onset of the intensification and lengthening of the glacial intervals during the MPR) led to environmental fragmentation and instability in a more arid, open environmental context, which in turn may have facilitated the dispersal into SW Europe of hominin groups from about 1.5 Ma BP. The increased habitat heterogeneity and changes in the structure of large mammal palaeocommunities, and the resulting enlarged prey spectrum, may have produced environmental contexts where flexible, opportunistic and omnivorous “predators”, such as hominins, would have had access to a broader spectrum of resources, thereby avoiding/reducing the competition with more specialized species.
"Developments in cultural behavior in the last ca. 400 ka - material evidence, overview China"

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Presenting author: Tongli Qu

The paper will present the archaeological records from ca. 400 Ka to ca. 10 Ka in China to illustrate the development of cultural behavior. However, the up-to-date archaeological material before Late Pleistocene is very limited in number due to various possible causes. Based on our current study, the significant cultural change took place during the Late Pleistocene in terms of lithic and non-lithic technology, subsistence, potential ritual behavior and human occupations. The processes of the diachronic development are identified, as well as the regional variability. The case of China points to the culturally distinctive trajectory to the development of modern populations.
Detection of Soil and Landscape Patterns related to Stone Age Artefact and Fossil Find Locations

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Presenting author: Geraldine Quénéhervé

Eastern Africa is one of the geographic focus areas of the ROCCEH project. The East African Rift System is seen as a migration corridor linking Southern Africa and possible ways “out of Africa” for early humans. In this work, we concentrated on the detection of soil and landscape patterns related to localities of stone artefacts of early humans (two hominin-bearing sites from 0.78–0.633 Ma) as well as paleontological findings within the landscape around the town Makuyuni in northern Tanzania. These remains are concentrated along the paleo-lake Manyara shorelines, nowadays located within the erosion channel networks of the Makuyuni River, draining into Lake Manyara.

To derive landscape patterns, geomorphometric analyses based on digital elevation models are carried out. We derive primary and secondary terrain parameters (such as Slope, Aspect, Topographic Wetness Index, Altitude above Stream Channel, etc.) as well as landform element characteristics (Topographic Position Index). We identified nine target pedo-lithological classes with sophisticated stochastic approaches, based on spectral, physical and topographical properties of the surface material. Soil profiles in the field have been analysed in the lab to receive the respective calibration data.

The main objective of the study is to determine if these results of soil and landscape patterns are linked to the locations of the remains of early humans and bones of the faunal assemblages. We analysed the spatial patterns of the derived parameter distributions with advanced statistical modelling. Stochastic gradient boosting methods combines information of a spatial distribution as well as point data. To address the presence-only data of the find locations, we also included Maximum Entropy statistics. The results provide a probability distribution of find locations that are linked to present day soil and landscape processes.
Using Material Engagement Theory and Metaplasticity to explore Late Pleistocene material change and cognitive capacities

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Presenting author: Patrick Roberts

Material evidence from the Late Pleistocene archaeological record is often framed within narratives of the progression and nature of early human, and hominin, cognitive capacities and ‘behavioural modernity’. In recent years, however, both the concept of ‘behavioural modernity’ and its passive treatment of material culture have become highly criticised. Yet, there has remained some confusion as to where to turn in its absence. Lambros Malafouris outlined the theoretical frameworks of Material Engagement Theory and Metaplasticity as a means to understand the active role of material culture in the constitution of the human mind. However, despite Malafouris’ application of these theoretical frameworks to a series of case studies previously associated with human cognitive ‘modernity’ (including tool manufacture, early body ornamentation, and ritual art), the Late Pleistocene archaeological community has done little to engage with this work. In this paper I outline and then apply MET and Metaplasticity to two case studies often considered pertinent to the development of human cognition in the Late Pleistocene – namely, long-distance resource sourcing and/or exchange and the development of composite technologies. In doing so, I hope to demonstrate that these theoretical bases facilitate a more productive relationship between archaeology and neuroscience in the exploration of the constant interplay between early human minds and the ever-changing material world.
Modelling the distribution of Pleistocene archaeological and palaeontological sites in Europe.

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Presenting author: Jesus Rodríguez

Our ability to model the distribution and dispersion of ancient organisms, including humans, depends on the nature and quality of the raw data available. All the information we have about the distribution of an extinct organism depends on the distribution of archaeological-palaeontological sites. Here we analyze and model the distribution of palaeontological and archaeological sites in Europe along the Pleistocene. Our aim is to evaluate how the distribution of sites may influence our perception of the distribution of ancient organisms. We selected the Pleistocene sites recorded in the NQMDB (Neogene-Quaternary Mammals Database) located to the north of the parallel 36°N and between longitude -10.00 and 30.00. A total of 1379 fossil assemblages from 798 localities were analyzed. As it is widely known, the temporal distribution of sites is not homogeneous. Our sample includes 200 Early Pleistocene assemblages, 223 Middle Pleistocene assemblages and 956 Late Pleistocene assemblages. Thus, we divided the sample in several time periods and evaluated whether the spatial distribution of sites was different among them.
Geomorphology-Based Biodiversity Modelling. Potential Bioresource Variation in Late Palaeolithic Site Catchments

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Presenting author: Florian Sauer

Reconstruction of biogenetic resources in prehistory often faces limitations resulting from the availability of proxy-data. These data also represent more or less local information and make it difficult to model the change of biogeography throughout the landscape. In the case of the Bavarian Late Palaeolithic this situation is very expressed. Only a small number of pollen-samples give insight into late Pleistocene vegetation and data on faunal composition is absent. This situation is contrasted by a great number of surface collections that can be assigned to the Federmesser-Groups. In this presentation, a new approach towards organic resource modelling will be demonstrated. It is based on the profound influence of geomorphology on factors relevant for plant growth. Different geomorphic units (landforms) will yield different environmental conditions supporting the propagation of specific plant communities. These variations in environmental conditions will be used to give insight into the potential diversity of biogenetic resources in the catchments of the different Late Palaeolithic sites. As a part of the PhD Project “Late Palaeolithic Landuse Patterns in Bavaria” at the Friedrich-Alexander University Erlangen-Nürnberg, which includes settlement and raw material procurement pattern analysis as well as the study of site-specific tool utilization, the approach presented here could provide valuable information on bioeconomic possibilities in the study area and the sites’ catchments.
The complexity of making fire

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Prestenting author: Sebastian Scheiffele

While Palaeolithic evidence on the control and technical application of fire is increasing, the organizational elements for its maintenance and production have not been examined in a systematic way. Here, a comparative analysis of maintenance and production of fire with different tool kits will be presented. The studies are based on ethnographic literature and experiments. The reconstructed processes are coded in cognigrams and effective chains, showing the different attention foci (raw materials, tools), actions, and effects of foci on other foci. Maintaining a burning fire on a spot can be regarded as a simple process. However, the maintenance of fire out of a piece of ember requires already the ability to cope with the concept of composite tools. The production of fire, no matter by which method, can be mastered only with the competence to create and use complementary tool sets. It can be shown that the control of fire is not a simple question of absence/presence, but represents sequences of development in knowledge and skill, conceptual understanding, and cognition.
Innovative expressions before the supposed rise of the Still Bay - Evidence from Sibudu Cave, KwaZulu-Natal, South Africa

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Presenting author: Viola C. Schmid

Over the past decades, researchers have put strong emphasize on the investigation of the Still Bay and Howiesons Poort, as these two techno-complexes are considered to be particularly innovative. The Still Bay features besides its most diagnostic characteristic, the bifacial technology, objects of symbolic expression, creation of compound adhesives and production of bone implements. On the contrary, the phase of the MSA encompassing the Early Late Pleistocene pre-dating the Still Bay is regarded as monotonous and conventional. This sub-stage is described as a period of stasis concerning technological innovations and it is still poorly documented, as only a few sites have been re-investigated. However, new evidence from the site of Sibudu Cave contradicts the common view about the Still Bay and pre-Still Bay. The rock shelter about 40 km north of Durban and 15 km inland of the Indian Ocean contains a long sequence of the MSA, among others Still Bay and layers labeled as pre-Still Bay. These deposits revealed results that indicate innovations before the appearance of the Still Bay, including bone technology, construction of beddings and bifacial technology. Thus, Sibudu provides an optimal framework to study the distinct technological features of this basal assemblage as well as to draw comparisons to the Still Bay. The analysis, using the chaîne opératoire approach, includes the lithics from the excavations of University Tübingen since 2011. Here, we give a detailed description of an assemblage pre-dating the Still Bay. Furthermore, we explore the questions, if these strata yield elements that already announce innovations assigned to the Still Bay and which technological trends highlight this phase of the MSA. Finally, we contribute to a clarification of the technological variability during the time period of the Early Late Pleistocene. This study addresses the topics of “expansions of hominin performance” as well as “expansions of range”.
Phenomenological modelling approaches: concepts, applications and limits

Schröder-Esselbach, Boris

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Presenting author: Boris Schröder-Esselbach

This talk introduces to basic concepts of phenomenological, statistical modelling. The talk will present selected applications of advanced statistical and machine learning methods exploring range expansion of species considering the analysis of distribution patterns and dispersal processes. Additionally, I will present methodological advancements dealing with obstacles of statistical modelling such as multicollinearity, non-stationarity, or spatial autocorrelation. Moreover, procedures to validate the models are presented. Finally, I will discuss limits and constraints concerning the approaches and related data.
The late Lower Paleolithic Acheulo-Yabrudian complex at the crossroads of human evolution

Shimelmitz, Ron

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Presenting author: Ron Shimelmitz

During the last two decades it became increasingly clear that technological features commonly attributed to the Middle Paleolithic and Middle Stone Age in Eurasia and Africa actually emerged earlier, already in the late Lower Paleolithic and Early Stone Age. Among these technological features are the regular use of predetermined technologies, the exploitation of a highly variable toolkit and the emergence of habitual fire. Despite the presence of several lines of similarities, a high variability characterizes the various regions. While tracing the expansion of innovations and/or population movements throughout the Old World at this timeframe could greatly benefit from a cross regional comparative study, many benefits are also to be found in the exploration of spatially limited regional sequences. The Acheulo-Yabrudian complex of the Levant is a case in point. It is assigned to the late Lower Paleolithic (ca. 415 to 250 ka) and has been known for almost a century. Yet, its crucial role in the puzzle of human evolution has only recently received attention, due to novel results from two important cave sites: Tabun and Qesem. Tabun Cave, in particular, with its exceptionally long stratigraphic sequence, encompassing half a million years, can serve as an excellent focal point to examine transformations in human evolution. Particularly interesting are the intricacies of the Acheulo-Yabrudian’s emergence out of the preceding Lower Paleolithic industry—the Acheulean—and its subsequent evolvement into the Middle Paleolithic industry. By examining these and other changes using a long range perspective, searching lines of continuities and interruptions we are able not only to see the possible expansion of new ideas and/or populations, but also to understand how 'old' and 'new' ideas merged.
Changes in Hominin Subsistence Strategies in the Middle Paleolithic through Mesolithic of Southern Greece

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Presenting author: Britt Starkovich

A central problem in understanding changes in subsistence practices in the Late Pleistocene is distinguishing between environmental and human factors. Many parts of the Mediterranean Basin experienced changes in hominin prey choice during the Paleolithic, and it is important to understand if these shifts are related to environmental change, increased hunting pressures from human population growth, more efficient hunting technologies, or a combination of factors. In this presentation, I attempt to distinguish between these different factors using zooarchaeological data from the Late Pleistocene sites of Klissoura and Kephalari caves in southern Greece. Changes in subsistence patterns from the Middle to Upper Paleolithic at Klissoura indicate that some shifts track local climatic change, while others do not. Specifically, increases in ungulate species diversity correlates with wetter periods, and greater abundances of certain dry-tolerant small game animals (e.g., great bustard) likely correspond with dry periods. Overall, the baseline diversity of ungulates is low at Klissoura, which reflects its position in an ecologically homogeneous dry gorge. Other large-scale diachronic shifts, such as the increased importance of lower-return small animals (e.g., hares and partridges), occur over the occupation of the site irrespective of environmental conditions, which indicates intensified human hunting efforts. Nearby Kephalari Cave complements the Aurignacian and Gravettoid occupations of the Klissoura Upper Paleolithic, and also contains a robust Late Glacial component. Ungulate species diversity is comparatively higher at Kephalari in all phases, due to its position in a heterogeneous ecotone at the edge of mountains, valleys, and the coastal plain. There is also greater reliance on low-return small animals (including fish) at Kephalari than at Klissoura. These examples highlight the importance of the relationship between human cultural and demographic factors, changing environments, and different local ecology, in understanding human prey choice.
The expansion of behavioral performance: Innovations during the Middle Stone Age of Southern Africa

Stolarczyk, Regine

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Presenting author: Regine Stolarczyk

A ROCEEH (The Role of Culture in Early Expansion of Humans) associated ongoing DFG (German Research Foundation) project currently aims to develop a systematic approach to analyse artefact spectrums in regard to the capacity for innovation. The focus lies on differences in the MSA techno-complexes of Southern Africa. The developed approach includes the quantitative and qualitative characterisation of object behaviour under consideration of typological aspects, technological attributes, like material, form, or function, as well as the complexity. The goal is, to identify innovations in different aspects of object behaviour. To this end, quantitative and comparative analyses are performed and two qualitative methods, cognigrams and effective chains, developed by Haidle (Haidle 2012; Lombard & Haidle 2012), are being applied to code tool use schematically. During the MSA of Southern Africa various innovations (tool types, technological aspects, and mental elements) occur. In the future, the work on innovations during the MSA can also be used to get insights into the expansion of humans. Innovations are one part of the behavioural aspects of hominin performances. Studying the emergence and spread of new elements in the material culture can not only help to understand the expansion of new ideas, but also to get insights into the expansion of the range of humans. Initial analyses suggest that at least some innovations during the South African MSA, like bone artefacts, do not lead to an expansion of the new idea. After their first appearance, bone tools appear and disappear, then, thousands of years later, reappear in a variety of forms from a variety of innovative or traditional production techniques. Even if an innovation does not lead to a widespread expansion of that particular idea, the Southern African archaeological record shows clearly that the people were quite innovative and had complex mental abilities. Furthermore, the new elements seem to have led to an enhancement of behavioural possibilities and resulted in various cultural expressions.
Scaling Agent-based Simulation of Early Human Dispersal

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Presenting author: Ingo J. Timm

In the last years, Agent-Based Modeling (ABM) has been established as an innovative approach for a dynamic analysis of early human dispersal. In ABM, the actors of the system are modeled explicitly and in simulation the computation of actors’ behavior determines the overall system’s dynamic. The specification of agents has to detail out the level of autonomous decision making, reactive behavior, and capability for social deliberation. A common approach in ABM is to use simple agent architectures, i.e., agent designs, where the decision behavior is dominated by simple functions allowing for reactive behavior with swarm like interaction behavior in groups of agents. These kind of agent models are appropriate to reproduce simple animal behavior, e.g., ants, birds, or fish. However, in more complex mammals the decision function of the “entities” gets more complex, such that simple “if-then”-decision rules are no longer reasonable. In agent technology, deliberative agent architectures have been developed, which provide means for intention-based reasoning and social deliberation. Those models seem to be more appropriate to model primates or hominins.

However, by extending simulation based on deliberative agent architectures the computational complexity increases dramatically. Furthermore, early human dispersal is highly depending on various parameters and influences, which have to be taken into account. For systematic exploration of scenarios, this could result in a combinatorial explosion for potential simulation experiments. The huge number of potentially resulting experiments combined with the high computational complexity represents a key challenge for applying ABM and simulation to research on early human dispersal.

In early human dispersal, further challenges arise from the spatial scale (Africa as a whole), size of population (every hominin in Africa), and temporal dimension (up to one million years).

In the talk, we will discuss scalability of ABM and simulation for research on early human dispersal.
Small but mighty – Competition for food resources among small carnivores and humans in the Southeast Asian Holocene.

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Presenting author: Rebekka Volmer

Competition between early Homo sapiens and his surrounding fauna is crucial for understanding his migration patterns and expansion processes. Studies on competition between hominins and predators often neglect small carnivores. However, small carnivores must have also acted as competitors for food resources of humans, especially on aquatic resources.

Interspecific competition for prey is the basic factor determining the structure of carnivore guilds. To understand and observe changes in carnivore guild structure the degree of competition between the guild members has to be measured. Therefore, a model is developed to quantify the effects of interspecific competition among carnivorous and omnivorous taxa. The model is based on body mass, prey mass spectrum and relative abundance of individual guild members. Competition moreover depends on limitations to resource access. Therefore, prey biomass availability is also included. Based on these data the effects among individual members of a carnivore guild can be assessed.

This model is applied to the fossil carnivore guilds of sites in Sumatra, Indonesia and Palawan, Philippines. Therefore well documented and comprehensive fossil samples are required to reconstruct the data for the model. The fossils collected by Dubois from Sibrambang Cave are used to reconstruct the body mass, relative abundance and prey mass spectrum of the carnivore guild members of Sumatra. For Palawan samples from Ille Cave in Palawan from the Archaeological Studies Program will be used. The structure of the carnivore guilds is assessed by the model. Guild structures from Palawan and Sumatra will be compared and effects on humans by competition will be discussed.
New body size estimates for early Homo and their implications for the first dispersals out of Africa

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Presenting author: Manuel Will

The estimation of body size among the earliest members of the genus Homo (2.4-1.5 Myr) is central to interpretations of their biology. It is widely accepted that Homo ergaster possessed increased body size compared with Homo habilis and Homo rudolfensis, and that this change in physique might have facilitated the dispersal of Homo out of Africa. The study of taxonomic differences in body size, however, is problematic. Postcranial remains are rarely associated with craniodental fossils, and taxonomic attributions frequently rest upon the size of skeletal elements. Previous body size estimates have been based upon well-preserved specimens with a more reliable species assessment. Since these samples are small (n<5) and disparate in space and time, little is known about geographical and chronological variation in body size within early Homo. We investigate temporal and spatial variation in body size among early Homo between 2.4-1.5 Myr using a ‘taxon-free’ approach, considering evidence for size variation of isolated and fragmentary postcranial remains (n=39) from eastern and southern Africa as well as Dmanisi. To render the size of disparate fossil elements comparable, we derived new regression equations for common parameters of body size from a globally representative sample of hunter-gatherers and applied them to postcranial measurements from the fossils. The results demonstrate that pronounced body size increases within Africa take place only after hominin populations were established at Dmanisi, suggesting that migrations into Eurasia were not contingent on larger body sizes. The primary evidence for these marked changes in physique among early Homo is based upon material from Koobi Fora after 1.7 Myr, indicating regional size variation in Africa after the earliest dispersals to Eurasia. The evolution of larger bodies and longer legs can thus no longer be assumed to be the main driving factor behind the earliest expansions of our genus to Eurasia.
Cultural development in the last ca. 400 ka in South Africa – an overview

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Cultural and biological evolution of humans followed separate trajectories over the past 400 000 years with physiological adaptations marked by a complete loss of archaic traits only around 30 000 years ago. Archaeologically, there is no evidence for development of cumulative culture until the late Holocene. Key behavioural milestones for this period are the development of composite weaponry, replacing lithic core shaping technologies with prepared core and volumetric reduction methods, pyrotechnology and artistic material culture. The development of composite tools and spatially intricate lithic reduction methods for flakes imply that the capacity for complex cultural expression was already in place early on, but that there was not sufficient contact between groups to stimulate cumulative culture until much later. Cultural variability is best known for the intervals between MIS 5e to MIS 4, and MIS 2 to 1, as they are associated with larger numbers of sites with adequate chronometric control combined with in depth study. It is thus perhaps no accident that it is for these phases that pulses of increased innovation and complexity have been recorded. For the better researched periods geographic and temporal patterning, and potential expansion patterns, can also be observed. These boundaries in time and space emerged due to aggregate behavioural patterns of populations with sufficiently large social networks to transmit ideas on how to do and make things. The modeling of expansion patterns of humans require integration of archaeological, ecological and climatic variability, but also factoring in the role that research intensity and bias in the scale of variability reported play.
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