WORDS BONES GENES TOOLS

Tracking Linguistic, Cultural, and Biological Trajectories of the Human Past

Annual Symposium

Biocultural Implications: An Agenda for Integrative Approaches

DFG Center for Advanced Studies

December 3rd— 4th

Hybrid Event: Digital via Zoom and live in Neue Aula

University of Tübingen

EBERHARD KARLS
UNIVERSITÄT
TÜBINGEN

DFG

The DFG Center for Advanced Studies

Inaugurated in 2015, the DFG Center for Advanced Studies "Words, Bones, Genes, Tools: Tracking Linguistic, Cultural and Biological Trajectories of the Human Past" aims to help establish the theoretical foundations for a new cross-disciplinary field of bio-cultural coevolution by pushing the limits of cooperation between traditional disciplines. The center is therefore a forum for interdisciplinary discussion, bringing together scholars from the relevant fields to exchange ideas and develop common research questions and methodological approaches. The University of Tübingen is particularly well positioned to host such a center, with a tradition of excellence in prehistorical and linguistic research. The center is funded by the German Research Foundation (DFG), which currently sponsors 25 Centers of Advanced Studies across Germany.

The University of Tübingen

The University of Tübingen, founded in 1477, looks back on rich academic traditions, yet is home to world-class institutions conducting state-of-the-art research in the Life Sciences, Humanities and Social Sciences. As one of the German government's designated Universities of Excellence, with significant extra funding from the state and federal governments and a rising amount of third-party sponsorship, it has been able to boost top-level research and attract outstanding international researchers. The university comprises some 27.000 students, 450 professors, and more than 5.000 academic staff.

The German Research Foundation

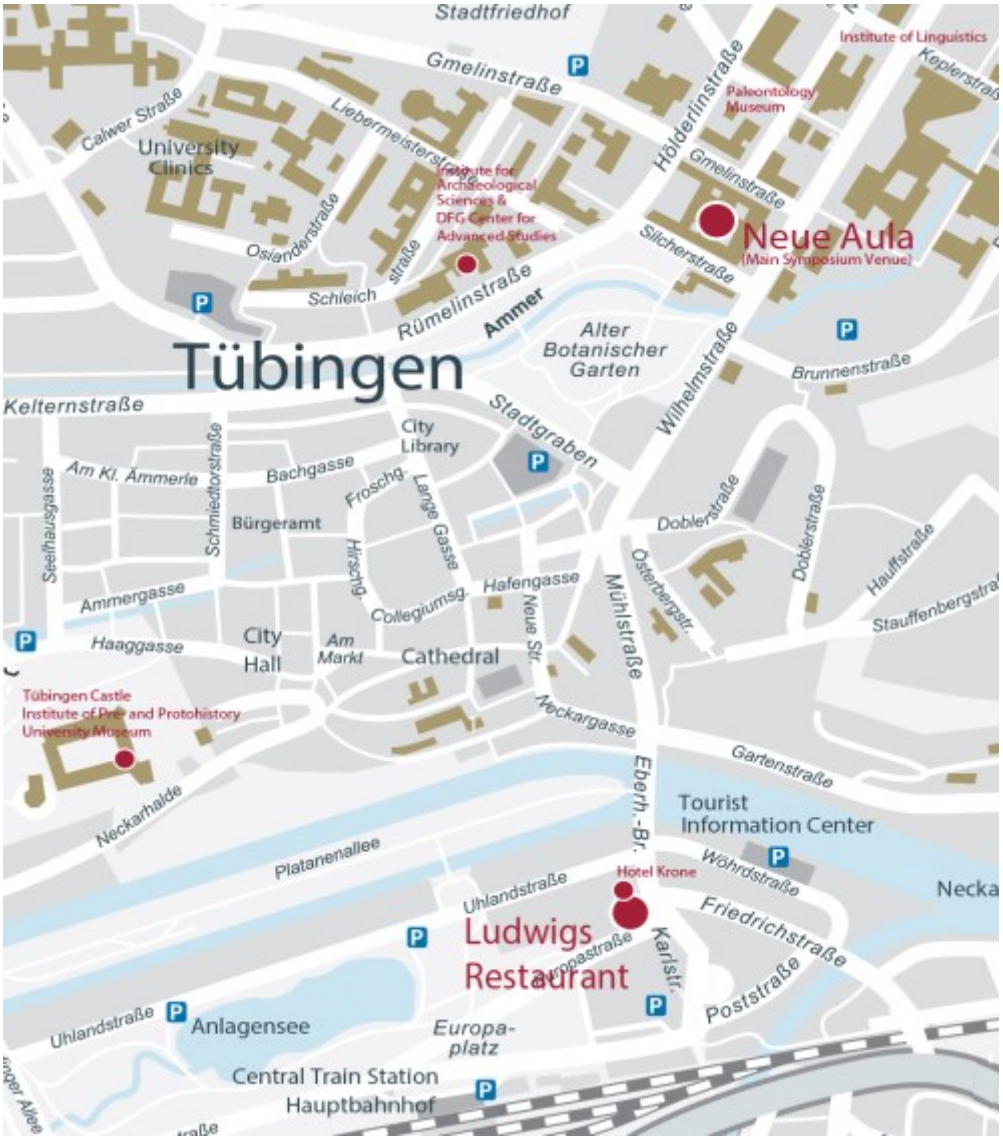
DFG Deutsche Forschungsgemeinschaft

The German Research Foundation (Deutsche Forschungsgemeinschaft or DFG) is the central self-governing research funding organization in Germany. It serves all branches of science and the humanities by funding research projects at universities and other research institutions. The DFG promotes excellence and quality by selecting the best research projects on a competitive basis and actively encourages international research cooperation. It is particularly dedicated to the promotion of young researchers and to gender equality in science and academia. It also advises legislatures and government agencies on scientific matters. The DFG's annual budget of about 2.5 billion euros is underwritten by Germany's federal (67.1%) and state governments (32.7%), as well as the European Union and private donors.

Locations

Neue Aula, Geschwister Scholl Platz
Main symposium venue

Restaurant Ludwigs – Uhlandstraße 1
Dinner: Friday, December 3rd 19:30



Institute of Archaeological Sciences – Rümelinstraße 23

Institute of Linguistics – Wilhelmstraße 19

Schedule

FRIDAY, 3RD DECEMBER

9:00 Welcome & Introduction to the DFG Center, **Katerina Harvati** and **Gerhard Jäger**

Theoretical considerations in reconstructions of past human behavior, Part I
Session chaired by Katerina Harvati

9:30 **Alexandros Karakostis**, University of Tübingen

Do humans only do what they are good at? Distinguishing habitual behavior from evolutionary adaptation in the fossil record

10:00 **Tracy Kivell**, University of Kent (09:00 AM UK)

Behaviour in our bones: What the skeleton may (and may not) tell us about life in the past

10:30 - 11:00 **Coffee Break**

11:00 **Blandine Brill**, École des Hautes Études en Sciences Sociales (Retired)

A functional framework to understand tool-use and more specifically percussive actions such as stone-knapping - The benefit of a interdisciplinary approach

11:30 **Claudio Tennie,** University of Tübingen

A behavioural biology account of Early Stone Tools

12:00 **Discussion**

12:30—14:00 **Lunch (and coffee)**

14:00 Group photo of people attending in person (in front of “Neue Aula”)

Schedule

FRIDAY, 3RD DECEMBER

14:15—15:00 **Poster Session**

Marisa Köllner / Johannes Wahle, University of Tübingen
Simulating language contact using Approximate Bayesian Computation

Rimtautas Dapschkauskas, University of Heidelberg, Tübingen
Universal human nature: A useful and empirically robust concept for the triangulation of the evolutionary history of human cognition and behavior

Sibylle Wolf, Senckenberg Centre for Human Evolution and Palaeoenvironment at the University of Tübingen
Memes in the Early Upper Palaeolithicof the Swabian Jura? Personal ornaments made from mammoth ivory in the focus

Miriam Noel Haidle, Heidelberg Academy of Sciences and Humanities, The Role of Culture in Early Ex pansions of Humans (ROCEEH)
Modularized behavior – a boost for sociality, learning, and complexity

15:00 **Coffee Break**

Theoretical considerations in reconstructions of past human behavior, Part II
Session chaired by Alexandros Karakostis

15:30 **Dietrich Stout**, Emory College Atlanta (9:30 AM US)
Words and tools: possible relations between language and technology in human evolution

16:00 **Jane Buikstra**, Arizona State University (9:00 AM US)
Activity reconstruction in bioarchaeology and forensic anthropology: A 21st century perspec tive

16:30 **Coffee Break**

17:00 **Ian Wallace,** University of New Mexico (9 AM US)
Experimental evidence that physical activity inhibits osteoarthritis: Implications for inferring activity patterns from osteoarthritis in archeological human skeletons

17:30 **Ammie Kalan,** University of Victoria Canada (8:30 AM CA)
Auditory tool use in nonhuman primates: A potentially overlooked contribution to language evolution?

18:00 **Discussion** Group photo of all people

19:30 **Dinner** at Restaurant Ludwigs (Hotel Krone)

Schedule

SATURDAY, 4TH DECEMBER

Reconstructing the past: Insights from language transmission and computational methods
Session chaired by Gerhard Jäger

9:30 **Nick Enfield**, University of Sydney
Consequences of reflexivity in language

10:00 **Sabine Stoll**, University of Zürich
Language acquisition and the evolution of language: a symbiotic relationship

10:30 **Coffee Break**

11:00 **Natalia Levshina**, MPI Nijmengen
Using corpora for testing hypotheses about language evolution

11:30 **Chundra Cathcart,** University of Zürich
Phylogenetic comparative methods and linguistics: how expressive should we be?

12:00 **Discussion**

12:30 **Lunch (and coffee)**

When words and genes tell different stories: Reconciling interdisciplinary perspectives
Session chaired by Miri Mertner

14:00 **Dan Dediu**, Laboratoire Dynamique Du Langage (DDL) Barcelona
A biocultural perspective is fundamental to understanding language diversity

14:30 **Steven Moran,** University of Neuchatel
Impacts of biology and language contact on the worldwide diversity of speech sounds

15:00 **Coffee Break**

15:30 **Nick Evans,** Australien National University
Faint tracks in an ancient landscape: three puzzles from Sahul

16:00 **Claire Bowern,** Yale University, New Haven, US
Reconciling Australia's linguistic and genetic past(s)

16:30 **Discussion**

17:00 **Closing Ceremony**

Abstracts

Do humans only do what they are good at?
Distinguishing habitual behavior from evolutionary adaptation in the fossil record

Fotios Alexandros Karakostis
University of Tübingen, Germany

Reconstructing habitual physical activity in extinct fossil hominins constitutes a major objective of evolutionary sciences, as it can be used to establish links between biological and cultural lines of evidence, elucidating the factors driving the evolution of human behavior. A plethora of past paleoanthropological studies has focused on this line of research, employing a variety of osteological techniques and markers. Relying on these methods, such studies variably refer to different concepts surrounding physical activity in the past, such as a species' anatomical capacities (i.e., basic ability to perform a movement), biomechanical efficiency for performing a certain task (e.g., dexterity), or habitual activity (i.e., systematic performance of a movement). Even though there is an obvious conceptual distinction among these three characteristics, they are often used interchangeably in the anthropological literature. Consequently, the hypotheses and interpretations of numerous previous studies do not clearly distinguish between habitual lifetime behavior and evolutionary adaptations to greater biomechanical efficiency, effectively assuming that a species' daily behavior is mainly restricted to the tasks for which it is more efficient compared to different species. However, such a simplification grossly underestimates the influence of dynamic ecological as well as cultural factors on hominin subsistence and lifestyle, whose demands are hardly expected to be always consistent with a species' long-term evolutionary history. In this talk, I aim to outline the theoretical weaknesses of this perspective, discuss its consequences for our current understanding of past hominin behavior, and review methods used to investigate habitual activity (rather than biomechanical efficiency) in the past.

Abstracts

Behaviour in our bones:
What the skeleton may (and may not) tell us about life in the past

Tracy Kivell
University of Kent

Tracy L. Kivell [1,2], Christopher J. Dunmore[1], Marine Cazenave[1],
Zewdi J. Tsegai[2], Matthew M. Skinner [1,2]

[1] School of Anthropology and Conservation, University of Kent, Canterbury, UK
[2] Department of Human Evolution, Max Planck Institute for Evolutionary Anthropology, Leipzig, Germany

Bone functional adaptation, or what was traditionally referred to as 'Wolff's Law', is the basic principle that bone, as a living tissue, can modify itself in response to its mechanical environment. This means that the shape of bone, both externally and, particularly, internally – including variation in cortical bone thickness and trabecular (cancellous) structure – can hold information about how different individuals or species may have loaded or used their skeletons during their lifetimes. Recent increased access to high-resolution imaging technology and the development of new analytical tools have allowed for a much broader and fruitful exploration of the functional signals that can be drawn from variation in bone structure across humans, other primates, and fossil hominins, which have, in turn, provided novel reconstructions of behaviour in the past. Here we discuss examples of how analyses of internal bone structure have shed new light on the evolution of hominin locomotion and hand use, but so the many additional factors – most of which remain poorly understood – that can influence bone structure and how we can more accurately reconstruct behaviour in the past.

Abstracts

A functional framework to understand tool-use and more specifically percussive actions such as stone-knapping; The benefit of an interdisciplinary approach

Blandine Brill

École des Hautes Études en Sciences Sociales (Retired)

Tool-use has been credited with a pivotal role in the acquisition of complex motor skills. Various authors have suggested behavioural similarities between tool-use in early hominins and nut cracking in primates where nut-cracking might be interpreted as a pre-stage of more complex stone flaking. The question of the origin of Plio-Pleistocene percussive technology has recently received a renewed interest, and quite a few publications stress the relevance of comparative cross-species approaches to tool-use for the assessment of early hominin cognition, as well as the necessity of actualistic studies involving connection between disciplines. Our talk will present experiments with humans that directly investigate the links between nut-cracking and stone knapping technique (flaking) in adult, and the development of nut cracking in children, a task that young children explore in quite similar ways as chimpanzees do.

The approach we have adopted in this research is based on the assumption that analyzing tool-use tasks at the functional level presents a privileged entry point for the unravelling of the cognitive and sensori-motor abilities of the actors involved. We consider percussive tasks from the functional demands that have to be satisfied to succeed in solving the task.

Abstracts

A behavioural biology account of Early Stone Tools

Claudio Tennie

University of Tübingen

Early Stone Tools are often seen – sometimes explicitly, but more often implicitly – as the earliest evidence of modern human culture. Advances into the behavioural biology of animal tool use and animal culture of the last decades has however shown that this assumption rests on shaky legs. The reason why scepticism is appropriate here is that many animals – including our closest living relatives, the other great apes – have proven perfectly capable of showing various types of tool use (and even tool making) in the entire absence of cultural access to others showing said behaviour. That is, these behaviours do not depend on cultural transmission of the underlying "know-how" of producing or using these tools; instead, the know-how can and does come about "from scratch" in naive individuals. But without a dependency on cultural transmission of know-how, any comparison of such behaviours to modern human culture is either unwarranted or represents a stretch. And so, we are left with the possibility that the underlying know-how of Early Stone Tools (and with them, Early Stone Tools) could likewise have come about anew in naive hominin individuals. If so, this would mean that these tools, too, may not have depended on cultural transmission of underlying know-how (other types of social learning would have played a role – as they do in ape culture today – but these regulate merely the frequencies of tools, but do not transmit their know-how). Indeed, an analysis of the "variably static" spatio-temporal patterns of the earliest stone tools is best explained by an absence of cultural transmission of know-how.

In addition, wild-representative captive apes (i.e. untrained and unenculturated) do not copy novel know-how from others. This means that the cultural transmission of know-how is a skill that must have evolved on the human lineage.

The question remains when and why this skill evolved. Finally, could it be that the know-how underlying the earliest stone tools is within the reach of non-human great apes? If so, this would be an additional piece of evidence against the view that these tools were dependent on cultural transmission of know-how. We have recently tested for this ability in chimpanzees. In stark contrast to earlier studies using enculturated and trained apes (e.g. tests on Kanzi the bonobo), when we ourselves tested wild-representative chimpanzees, we did not find evidence for the spontaneous ability of these apes to make or use stone tools equivalent to the earliest types in the archaeological record.

Abstracts

Overall then, both the skill to spontaneously produce and use early stone tools and the skill to culturally transmit novel know-how likely evolved on the human lineage after the split from the last common ancestor.

I will argue that the former evolved before the latter, and I will further argue that the latter evolved in large parts culturally. A summary of all these arguments (and more) can be found across two recent publications (1,2).

Tennie, C., Hopper, L. & van Schaik, C.P. (2020). On the origin of cumulative culture: consideration of the role of copying in culture-dependent traits and a reappraisal of the zone of latent solutions hypothesis. In: Chimpanzees in Context: A Comparative Perspective on Chimpanzee Behavior, Cognition, Conservation, and Welfare. Ed.: Ross, S & Hopper, L; University of Chicago Press.

Tennie, C., Bandini, E., van Schaik, C.P. & Hopper, L.M. (2020). The zone of latent solutions and its relevance to understanding ape cultures. *Biology & Philosophy*. 23: 55.

Abstracts

Poster Session:

Simulating language contact using Approximate Bayesian Computation

Marisa Köllner / Johannes Wahle

University of Tübingen

In historical linguistics, the application of phylogenetic methods increases with the availability of machine-readable data. While most adapted methods address the evolution and relationship of languages, less attention has been paid to computationally analyze horizontal transmission and language contact.

Approximate Bayesian Computation (ABC) is a promising approach to model language contact. ABC belongs to the family of computational statistical methods that directly sample from the model and do not require a likelihood. The model uses a language tree as guide tree in order to generate possible contact scenarios (reticulations) among the languages under investigation. The goal of the inference is the estimation of a distribution over reticulations and their density, which can then be evaluated against gold-standard data.

In a first study, we used the data simulation model proposed by Dellert (2019) to reconstruct an artificial language set including information about the languages' evolution, contact scenarios and a gold-standard language tree. The simulated data is used within the ABC framework to model language contact and replicate contact scenarios according to the given data. This allows us to analyze and enhance our summary statistics and evaluating the results, while adjusting the method for linguistic data.

This project aims to open new perspectives on the usage of computational models to analyze language contact and refine the application of Bayesian models to reconstruct language histories including horizontal transmission. The understanding of contact scenarios between (un)related languages provides crucial insights in the relationship between the languages under investigation, which could affect their temporal classification within the classical tree model.

Beaumont, Mark A., Wenyang Zhang, and David J. Balding. "Approximate Bayesian computation in population genetics." *Genetics* 162.4 (2002): 2025-2035.

Beaumont, Mark A. "Approximate bayesian computation." *Annual review of statistics and its application* 6 (2019): 379-403.

Dellert, Johannes. *Information-theoretic causal inference of lexical flow*. Language Science Press, 2019.

Abstracts

Poster Session:

Universal human nature:
A useful and empirically robust concept
for the triangulation of the evolutionary history of human cognition and behavior

Rimtautas Dapschkauskas

Department of Prehistory and Middle Eastern Archaeology, University of Heidelberg, Marstallhof 4, 69117 Heidelberg, Germany; rimdap@icloud.com
Heidelberg Academy of Sciences and Humanities, The Role of Culture in Early Expansions of Humans (ROCEEH), University of Tübingen, Hölderlinstraße 12, 72074 Tübingen, Germany

The concept of a universal human nature as a valid benchmark for the triangulation of lines of evidence into the past has been discredited for many decades. The underlying reason for this can be observed in powerful cultural relativist, constructivist, and postmodernist figures of thought from the 20th century which have long dominated cultural anthropology. It was often argued that one could not infer the past from the behaviour of contemporary people, and certainly not from Westerners, because everything humans think and do is a consequence of idiosyncratic cultural constructions in one form or another.

With regard to ethnographic comparisons, researchers have frequently emphasized that recent hunter-gatherers do not represent authentic time capsules from the Stone Age. Therefore, ethnographic data about traditional societies should not be used to answer scientific questions in the palaeosciences. These warnings point to some inherent problems regarding the identification of cognitive and cultural universals by means of ethnographic comparisons, statistical data, and experiments from the present; however, they are also marked by a heavy anti-evolutionist undertone.

My paper aims to point out that this fundamental rejection of the concept of a universal human nature does not stand up to critical scrutiny when confronted with empiricism and logic. Despite all the problems with the details (which admittedly exist), I would argue that it is possible to identify human universals, both at the level of the individual and the social group by using *nomological networks of cumulative evidence*. Such networks are built by cumulative evidence stemming from widely different sources, methodologies and disciplines – unified under the umbrella of evolutionary theory.

Abstracts

Together with evidence from primatology and the palaeosciences, the identified human universals of feeling, thinking, and behaviour provide important anchor points from which to triangulate the evolutionary histories of the central features of *Homo sapiens* as an ultrasocial and cultural species.

Such features include cumulative culture, social norms, group identity, social networks, status hierarchies, prestige, ritual, religion, art, music, symbolic communication, language, tribalism, warfare, and so forth. Thus it seems timely to rehabilitate an updated version of the concept of a universal human nature for theoretical considerations in reconstructions of past human behaviour and cognition.

Abstracts

Poster Session:

Modularized behavior – a boost for sociality, learning, and complexity

Miriam Noël Haidle

Heidelberg Academy of Sciences and Humanities, The Role of Culture in Early Expansions of Humans (ROCEEH), University of Tübingen, Hölderlinstraße 12, 72074 Tübingen, Germany

The systematic reconstruction of tool behavior in animals and early humans with cognigrams has drawn attention to a form of behavioral organization that has a major impact on human biocultural evolution: modularization.

Modular performances are composed of discrete functional units (modules) which can be combined to larger complexes. Modularity broadens the options of acting and thinking from linear to hierarchical forms, with a decoupling of basic needs and their immediate satisfaction allowing derived needs and intermediate targets. Through partitioning larger problem-solution concepts to smaller units, complexity in each of the units decreases. Through recombination, however, the overall complexity can increase, and new applications arise. The increase of modularity in human evolution facilitates learning as well as innovation processes and fosters integration of several agents in solving larger problems. The combination of modules enables more complex performances such as manufacturing processes requiring multiple tools and the production and use of composite and complementary technology. With modularity the spatial association of tasks can decrease, and longer temporal interruptions of problem-solution processes become possible.

By 2.3 million years ago (or probably even earlier), evidence of modular behavior can be presumed in early flaked stone tool technology based on the use of secondary tools (tools to manufacture tools to reach a goal) with procurement of raw material and basic tools and the manufacture and use of other tools as potential modules.

Abstracts

Poster Session:

Memes in the Early Upper Palaeolithicof the Swabian Jura? Personal ornaments made from mammoth ivory in the focus

Sibylle Wolf

Senckenberg Centre for Human Evolution and Palaeoenvironment at the University of Tübingen

Within the UNESCO World Heritage cave sites of the Swabian Jura (southwestern Germany) abundant mammoth ivory remains were excavated that date to the beginning of the Early Upper Palaeolithic, the Aurignacian. The extensive research of these caves started in the 1930s of the 20thcentury. Among other artefacts forms, the excavators unearthed whole tusks, debris, splinters, figurative artworks, flutes and personal ornaments which were carved from mammoth ivory. Especially the personal ornaments are of interest, because these items were excavated within all sites.

The whole archaeological inventories of the recent excavations within the Swabian cave sites give testimony of the creative mind of our ancestors. Particularlythe double perforated beads are present in the Ach and in the Lone Valley sites. Personal ornaments do not necessarily have a functional use. These artefacts are regarded as cultural expressions used by the respective carrier of the beads. The double perforated bead occurs over a time span of at least eight millennia. This form was transmitted within generations of Palaeolithic people.

Even if the meaning of these ornaments changed over time, the transfer of a very special form, restricted to the Swabian Jura, shows that this special bead can be denoted as a meme. These memes accrued to traditions that existed over multiple generations.

Wolf, Sibylle in press. Memes in the Early Upper Palaeolithicof the Swabian Jura? Personal ornaments made from mammoth ivory in the focus. In: Keiko Kitagawa, Valentina Tumolo, Marta Díaz-Zorita Bonilla (eds.), Proceedings of the International Workshop Beyond Subsistence. Human-Nature Interactions. SFB 1070 Resource Cultures, October 16-18, 2019, Tübingen, Germany.SFB Series. Tübingen: University Press

Abstracts

Words and tools: possible relations between language and technology in human evolution

Dietrich Stout
Emory College Atlanta, US

Possible evolutionary links between tool making and language have been a subject of speculation for nearly 150 years, but compelling empirical tests have remained elusive. Long considered intractable, the study of language evolution itself has experienced a renaissance since 1990s, fueled by emerging perspectives on language as an adaptation sharing important cognitive foundations with other behaviors. Together with theoretical progress in neuroscience and the emergence of functional neuroimaging methods, this has led to renewed interest in empirical research on the coevolution of language and technology. Contemporary research emphasizes two, non-exclusive possibilities.

First, language and tool making may draw upon shared capacities for hierarchically structured sequential behavior such that neurocognitive adaptations for technological behavior might have been initially exapted and then secondarily adapted for communication. This is supported by neuroimaging evidence of functional overlap of basic sequencing and chunk-based learning mechanisms across behavioral domains.

Second, the demands of socially reproducing increasingly complex Paleolithic technologies may have provided selective s and developmental contexts favoring the emergence of enhanced communication, for example in teaching. This is supported by experiments on stone tool making skill acquisition under different learning conditions. These two possibilities are unified by the concept of an evolving human technological niche dependent on the discovery, collaborative production, and social reproduction of technological behaviors, knowledge, and equipment.

Abstracts

Activity reconstruction in bioarchaeology and forensic anthropology: A 21st century perspective

Jane E. Buikstra
Arizona State University

Forensic anthropology and bioarchaeology have recently converged to focus on life histories of individuals, as embodied in skeletonized human remains. These osteological records reflect both isolated events and repetitive activities across the human life-course. In forensic anthropology, documented traumatic events and occupational stressors are interrogated against osteological observations in identifying or excluding known persons from the range of possibilities for medico-legally significant finds. Interpretations of the past, also grounded in skeletal observations, must be contextualized and rigorously evaluated in terms of complex archaeological and historical records. For such bio-archaeological reconstructions, interpretative creativity has frequently superseded scientific rigor during the 20th and 21st centuries.

This presentation will critically evaluate the various lines of evidence used to interpret specific classes of activities, grounded in interpretative challenges currently being faced by the Phaleron Bioarchaeological Project, centered on the ancient Greek site of Phaleron (750-380 BCE). Perimortem blunt force trauma has been attributed by the site archaeologists to many men interred in mass graves, for example. This is a confirmation challenge for those specialized in skeletal biology. Similarly, it is postulated that occupational specializations differ across groups in different burial contexts. Lines of skeletal evidence typically used to support such interpretations include degenerative joint disease, bone x-sectional diameter, entheseal pathology, and enthesis morphology.

In this presentation, I will briefly introduce the Phaleron project and then critically evaluate the present state of scientific knowledge about the identification of peri-mortem blunt force trauma and bony changes linked to repetitive activities. Special emphasis will be placed upon the degree to which analyses conform to scientific principles.

Abstracts

Experimental evidence that physical activity inhibits osteoarthritis: Implications for inferring activity patterns from osteoarthritis in archeological human skeletons

Ian J.Wallace

Department of Anthropology, University of New Mexico

Osteoarthritis (OA) is a common joint disease whose causes are not fully understood, but a longstanding hypothesis is that OA stems primarily from the cumulative effects of joint mechanical loading throughout life. Based on this “wear and tear” hypothesis, anthropologists have assumed that the presence of OA in archeological human skeletons can be interpreted as evidence of a highly physically active lifestyle.

In this study, I used guinea pigs to experimentally test the hypothesis that higher levels of routine physical activity result in greater OA degeneration. Guinea pigs are a useful model for OA research because they spontaneously develop the disease in a manner similar to humans. One group of growing animals was housed for 22 weeks in a large room that promoted voluntary physical activity (4.8 km of movement per day, on average), while animals in another group were housed in small cages that restricted their mobility (n=15/group).

After the experiment, histological and micro-computed tomographic analyses were conducted focusing on the knees. Rather than causing greater OA degeneration, elevated levels of routine physical activity resulted in significantly less knee cartilage deterioration, less synovial inflammation, smaller osteophytes, and maintenance of greater epiphyseal trabecular bone quantity.

These results are inconsistent with the hypothesis that high levels of routine physical activity drive the pathogenesis of OA and call into question typical interpretations of OA in studies of archeological human skeletons

Abstracts

Auditory tool use in nonhuman primates: A potentially overlooked contribution to language evolution?

Ammie K. Kalan

Department of Anthropology, University of Victoria, BC, Canada

While multiple species of nonhuman primates use tools in the wild, only chimpanzees, and select species of capuchins and macaques, regularly use stone tools. These species have therefore been of great interest for comparative evolutionary models of hominin stone tool technology.

However, there is one facet of nonhuman primates' tool use behaviour that has not yet been given the attention it perhaps rightly deserves, and that is its auditory component. Scholars argue whether human language originated from a gestural or vocal origin, and although many would agree that a multimodal origin is perhaps most parsimonious, we still have little empirical data to support multimodal theories.

In this talk, I explore the potential for an alternative multimodal hypothesis for language evolution: auditory tool use in nonhuman primates. We know hand-eye coordination is integral to precise movements for effective tool use, and variation in handedness may facilitate hemispheric lateralization in the brain.

Here, I review reports of handedness in wild chimpanzee stone tool use, one of our closest living relatives, and provide multiple pathways in which auditory sounds may enhance visual-motor coordination, especially whilst using stone tools, and speculate about the potential for these pathways to have been co-opted during the evolution of language.

Abstracts

Consequences of reflexivity in language

Nick Enfield, Jack Sidell

University of Sydney

A unique feature of language is its *reflexivity* (Hockett 1966, Taylor 2000, Duncker 2019). Language is the only animal communication system that can be used to communicate about itself. Here we argue that this property of language had at least three revolutionary consequences for our species.

First, reflexivity provides the elements needed for reputation management, a foundational function in human society. A piece of gossip such as *Kim lied to me* is possible thanks to three elements that depend at some level on reflexivity: (1) personal names, (2) grammatical displacement (tense-marking), and (3) quoted speech. Arguably, all social accountability is grounded in these elements.

Second, reflexivity provides the elements needed for the coherence of higher-level 'texts' including conversations and narratives, both of deep importance to human affairs, both for in-the-moment social coordination, cooperation, and persuasion, and for functions of speech oriented to cumulative cultural conventions and social norms across generations. These elements include (i) repair, turn-taking, and sequence organization in interaction, (ii) reference-tracking systems in texts, (iii) narrative structure.

Third, quoted speech enables the separation of the 'animator' of a signal and its 'author' and 'principal'—meaning that one person's message can reach another person without the two people needing to be in each other's presence; the seemingly simple possibility of quoting another's speech is arguably the original information revolution in our species, having the effect of compressing space and time in social networks (by enabling a message to reach a recipient who is away from the sender); we speculate that every information revolution since (including writing, printing, mass media, and the Internet) has been an quantitative scaling of this basic qualitative advance.

This supports some speculations about the origins of reflexivity in language, and its relation to the roots of human sociality and language. The idea that metalanguage is foundational to language raises an apparent paradox concerning the origins of language. If metalanguage is a prerequisite for language, how could metalanguage have evolved first? (Taylor 2000)

Abstracts

We think that a solution to the riddle can be found in the universal organization of *repair* (Schegloff et al 1977, Enfield et al 2013, Dingemanse 2013, 2105 et. al), and in particular in the discoveries that (1) *huh?* is a word and, (2), it is found in every known language (Dingemanse et al 2013). We speculate that *huh?* is 'as close as you can get to the core of the human faculty for language' (Enfield 2017:207).

Could *Huh?* have been the first word? We find it conceivable that at a stage when early humans were able to draw attention to elements of a gesture-response sequence, a structural slot could have opened in which an addressed individual produces an interjection of puzzlement where her behavioural response was expected to have occurred. The interjection is metacommunicative in so far as it is 'about' the communicative action just made by another agent. This is the wedge that introduces 'metalanguage' into a not-yet-linguistic system. It is communication about communication. Then imagine that this response promotes the redoing of the gesture. In turn, the link between the interjection of puzzlement and the re-doing of the not-yet-understood gesture becomes ritualized and so may be used again to bring about the same end—a repetition of the previous communicative move—either by this proto-human or by another who happened to witness the events unfold.

We can imagine here a shift from learning via ontogenetic ritualization to imitation, i.e., conventional transmission, the beating heart of language and culture.

The account also raises implications for the shared infrastructure for language and its role in communication in language contact situations.

Abstracts

Language acquisition and the evolution of language: a symbiotic relationship

Sabine Stoll

Department of Comparative Language Science,Center for the Interdisciplinary Study of Language Evolution (ISLE) University of Zürich

To understand how language evolved, we need to understand how languages are transmitted. For languages to be transmitted they not only have to be learnable but they also have to be learned by the next generation. Humans are the only species with a communication system that varies extremely across communities, changes constantly and has to be completely learned from scratch. From sounds to constructions everything needs to be learned in the first years of an infant's life.

To be able to learn any of the thousands of complex systems of human languages a combination of socio-cognitive and pattern-detection skills is needed which allow the infant to adapt, learn, generalise, creatively use and then later on even to contribute in changing these systems. In this talk I focus on how the combination of these abilities contributes to language development. Children use these abilities to implicitly extract information from their surrounding environment.

To contribute to our understanding of how the surrounding language provides opportunities for learning and generalisation, I will present an approach that enables us to search for universal structures in the input. The approach relies on a dataset of typologically diverse languages which simulates variation in the languages of the world. I will suggest a number of structural features of child-directed speech which presumably help the learner in building up their grammar and lexicon. I show that these patterns are on the one hand common to human communication but on the other hand they are specifically adapted to the growing linguistic and cognitive competence of the developing child

Abstracts

Using corpora for testing hypotheses about language evolution

Natalie Levshina

Max Planck Institute for Psycholinguistics, Nijmegen

Understanding language evolution requires investigating how different linguistic and extralinguistic variables shape language structure. In order to test causal hypotheses of this kind, we need data about the past states of languages, which is very often missing. A popular alternative is artificial miniature language learning and communication (e.g. Kirby et al 2008; Culbertson et al. 2020; Raviv et al. 2019), which aims to reproduce language evolution in the lab. This approach has its advantages and limitations.

In this presentation I want to discuss another method, which infers causal relationships between different linguistic variables based on synchronic corpora of different languages. The recent advances in multilingual corpus creation and annotation, such as the Universal Dependencies project (Zeman et al. 2020), make this approach increasingly attractive. I will demonstrate how this can be done for different linguistic cues that help to identify the grammatical roles of Subject and Object. The cues involve case marking, word order and distributional semantics of Subject and Object. Using large web-based corpora from more than 30 languages annotated with the Universal Dependencies, I will present correlational analyses of these cues, and compare the results with causal networks based on the Fast Causal Inference algorithm (cf. Dellert 2019). The results of the causal analyses corroborate previous findings from historical linguistics and artificial language learning, which means that this method can be added to the evolutionary linguist's toolkit.

Culbertson, J., Schouwstra, M. & Kirby, S. 2020. From the world to word order: Deriving biases in noun phrase order from statistical properties of the world. *Language* 96(3): 696-717. doi: 10.1353/lan.2020.0045.

Dellert, J. 2019. *Information-Theoretic Causal Inference of Lexical Flow*. Berlin: Language Science Press.

Kirby, S., Cornish, H. & Smith, K. 2008. *Proceedings of the National Academy of Sciences*. 105(31): 10681-10686.

Raviv, L., Meyer, A., & Lev-Ari, S. 2019. Larger communities create more systematic languages. *Proceedings of the Royal Society B: Biological Science* 286(1907). doi: 10.1098/rspb.2019.1262.

Zeman, D., Nivre, J., Abrams, M. et al. 2020. Universal Dependencies 2.6. LINDAT/CLARIAH-CZ digital library at the Institute of Formal and Applied Linguistics (ÚFAL), Faculty of Mathematics and Physics, Charles University. URL http://hdl.handle.net/11234/1-3226.

Abstracts

Phylogenetic comparative methods and linguistics:

How expressive should we be?

Chundra Cathcart

University of Zürich

In 21st century historical linguistics, phylogenetic comparative methods (PCMs) are agreed to play an important role in furthering our understanding of the dynamics of linguistic change. At the same time, a number of tensions between traditional historical linguistics and PCMs can be clearly identified. For instance, traditional models of linguistic change tend to be strongly based on formal comparison of homologous elements, while PCMs often focus on the presence or absence of more abstract structural categories (with an increasing number of exceptions, e.g., Dunn et al 2017, Blasi et al 2019).

Additionally, while traditional models explicitly account for language contact, standard PCMs do so only indirectly. Another issue is that the stochastic models of evolution employed by PCMs (e.g., continuous-time Markov processes, Brownian motion, Ornstein-Uhlenbeck processes) do not always dovetail with qualitative views of the ways in which language change takes place. In particular, the most restrictive of these models involve the assumption of constant transition rates across lineages within a language family, but entirely different rates across language families (Dunn et al 2011; see Jäger & Wahle 2021 for discussion). This issue has been addressed in biology by means of models which explicitly model heterotachy, or lineage-level rate variation.

I begin with a broad overview of biological models designed to relax the assumption of constant evolutionary rates within families for both continuous as well as discrete models of character evolution (Tuffley & Steele 1998, Heath et al 2011; O'Meara et al 2006, Lemey et al 2010). I then provide a short survey of these and related models' use in linguistic applications. I compare the flexibility and expressiveness of these models to the state of the art in non-phylogenetic models such as hierarchical regression models, which account very well for group-level idiosyncrasies in data (Gelman and Hill 2007), and propose some means of potentially incorporating a comparable degree of flexibility into PCMs.

I discuss the extent to which different orthogonal pressures in language change (e.g., speed of change versus propensity towards a particular state) can be independently represented in PCMs by means of alternative parameterizations of evolutionary rates.

Abstracts

I present a number of simulation studies designed to address the question of whether standard biological models of heterotachy are capable of capturing relatively complex scenarios of change, as well as the degree to which standard models are misspecified for the purposes of dealing with certain linguistic phenomena.

I conclude by discussing some technical ramifications of these findings: as PCMs become more flexible, the inference algorithms required to fit the models grow in complexity. I will sketch out some methodological desiderata for future work in the field, and discuss some under-exploited tools for efficient inference in PCMs (e.g., Irvahn & Minin 2014).

Blasi, DE et al. 2019. Human sound systems are shaped by post-Neolithic changes in bite configuration. Science 363(6432):eaav3218.

Dunn, M et al. 2011. Evolved structure of language shows lineage-specific trends in word-order universals. Nature 473.79–82.

Dunn, M et al. 2017. Dative sickness: A phylogenetic analysis of argument structure evolution in Germanic. Language 93.e1–e22.

Gelman, A and Hill, J 2007. Data analysis using regression and multilevel/hierarchical models. Cambridge: Cambridge UP.

Heath, T et al. 2011. A Dirichlet Process Prior for estimating lineage-specific substitution rates. Molecular Biology and Evolution 29, 939–55.

Irvahn, J and Minin VN. 2014. Phylogenetic Stochastic Mapping Without Matrix Exponentiation. Journal of Computational Biology 21:676–90.

Jäger, G and Wahle J. 2021. Phylogenetic typology. https://arxiv.org/pdf/2103.10198.pdf

Lemey, P et al. 2010. Phylogeography takes a relaxed random walk in continuous space and time. Mol. Biol. Evol. 27:1877–1885

O'Meara BC et al. 2006. Testing for different rates of continuous trait evolution using likelihood. Evolution 60:922–33.

Tuffley, C and Steel, M. 1998. Modeling the covarion hypothesis of nucleotide substitution. Mathematical biosciences 147(1), 63–91.

Abstracts

A biocultural perspective is fundamental to understanding language diversity

Dan Dediu [1, 2]

[1] Department of Catalan Philology and General Linguistics, University of Barcelona, Barcelona, Spain
[2] Catalan Institute for Advanced Studies and Research (ICREA), Barcelona, Spain

It is always important to remember what we are talking about when we talk about linguistic diversity: there are about 7,000 languages (Hammarström et al., 2018) (and not 10, nor 10 million; (Dediu et al., 2013)) that vary in almost every dimension one decides to study, and in ways that are almost always surprising, even to seasoned language scientists (Evans & Levinson, 2009).

Everybody agrees that this diversity is in large part due to the vagaries of language change – fundamentally a form of cultural evolution (Richerson & Christiansen, 2013) – but there is sometimes a tendency to negate or neglect the influence of non-linguistic forces or factors on the way languages change (Dediu et al., 2017; Everett et al., 2016).

However, language is an entity intrinsically "living" at the intersection of the physical environment, our biology and cognition, society and culture, and I review here (very briefly) several lines of evidence supporting each of these kinds of forces and processes (or "forcing factors").

In particular, I will focus on the relevance of our biology on nudging the way language changes (Dediu et al., 2017), ranging from the effect of our genes on linguistic tone (Dediu, 2021; Wong et al., 2020), to the influence of the precise shape of some of our articulators on the sounds various languages might or might not use (Blasi et al., 2019; Dediu & Moisik, 2019), and to the prospect of being able to make informed inferences about the speech of long-gone humans from their osteological and fossil traces (Dediu et al., 2021).

Ultimately, the take-home message is, I think, that only by combining multiple strands of evidence emerging from multiple scientific disciplines and using multiple methodologies, do we stand a chance of understanding our language – its nature, origins, evolution and diversity – and to be able to make informed predictions about what ever.

Abstracts

Blasi, D. E., Moran, S., Moisik, S. R., Widmer, P., Dediu, D., & Bickel, B. (2019). Human sound systems are shaped by post-Neolithic changes in bite configuration. *Science*, *363*(6432), eaav3218. https://doi.org/10.1126/science.aav3218

Dediu, D. (2021). Tone and genes: New cross-linguistic data and methods support the weak negative effect of the "derived" allele of ASPM on tone, but not of Microcephalin. *PLOS ONE*, *16*(6), e0253546. https://doi.org/10.1371/journal.pone.0253546

Dediu, D., Cysouw, M., Levinson, S.C., Baronchelli, A., Christiansen, M.H., Croft, W., Evans, N., Garrod, S., Gray, R., Kandler, A., & Lieven, E. (2013). Cultural evolution of language. In Richerson, P.J. & Christiansen, M.H. (Eds.), *Cultural evolution: Society, technology, language, and religion* (Vol. 12, pp. 303–332). MIT Press.

Dediu, D., Janssen, R., & Moisik, S. R. (2017). Language is not isolated from its wider environment: Vocal tract influences on the evolution of speech and language. *Language and Communication*, *54*, 9–20. https://doi.org/doi:10.1016/j.langcom.2016.10.002

Dediu, D., & Moisik, S. R. (2019). Pushes and pulls from below: Anatomical variation, articulation and sound change. *Glossa: A Journal of General Linguistics*, *4*(1), 7. https://doi.org/10.5334/gjgl.646

Dediu, D., Moisik, S. R., Baetsen, W. A., Bosman, A. M., & Waters-Rist, A. L. (2021). The vocal tract as a time machine: Inferences about past speech and language from the anatomy of the speech organs. *Phil. Trans. R. Soc. B*, *376*, 20200192. https://doi.org/10.1098/rstb.2020.0192

Evans, N., & Levinson, S. C. (2009). The myth of language universals: Language diversity and its importance for cognitive science. *Behavioral and Brain Sciences*, *32*(5), 429–448. https://doi.org/10.1017/S0140525X0999094X

Everett, C., Blasi, D. E., & Roberts, S. G. (2016). Language evolution and climate: The case of desiccation and tone. *Journal of Language Evolution*, *1*(1), 33–46. https://doi.org/10.1093/jole/lzv004

Hammarström, H., Bank, S., Forkel, R., & Haspelmath, M. (2018). *Glottolog 3.2*. Max Planck Institute for the Science of Human History. http://glottolog.org

Richerson, P. J., & Christiansen, M. (Eds.). (2013). *Cultural evolution: Society, technology, language, and religion* (Vol. 12). MIT Press.

Wong, P. C. M., Kang, X., Wong, K. H. Y., So, H.-C., Choy, K. W., & Geng, X. (2020). ASPM-lexical tone association in speakers of a tone language: Direct evidence for the genetic-biasing hypothesis of language evolution. *Science Advances*, *6*(22), eaba5090. https://doi.org/10.1126/sciadv.aba5090

Abstracts

Impacts of biology and language contact on the worldwide diversity of speech sounds

Steven Moran

University of Neuchátel

Regarding the biocultural implications on the evolution of language, a key question is: what are the biological versus the cultural processes that play a role in the diversification of languages? In this talk, I will discuss recent findings regarding the evolution of the phonological system and the diversification of speech sounds from the biological, biocultural, and cultural perspectives.

Regarding our biology, the key ingredients of speech emerged before *Homo sapiens* and the basic building blocks of speech sounds can arguably be identified through comparative analysis of great apes vocalizations. Here we find evolutionary continuity with certain paralinguistic functions and consonant and vowel-like sounds, which are widely found in the world's languages today. This gives us a basis to identify biologically old speech sounds versus ones that are more recent biocultural innovations.

As for the biocultural impacts on the phonological repertoires of modern humans, recent re-search shows that post-neolithic changes to our bite configuration (due to technological advances in food production) has led to the emergence of a new class of speech sounds, the so-called labiodentals. This finding suggests that the vast diversity of speech sounds in the world's languages seen today is not only contingent on our biology, but culturally induced changes to our morphology.

This observation goes against the commonly accepted notion that the range of speech sounds that we observe today has been fixed since the emergence of *Homo sapiens*.

In terms of cultural factors on the diversification of speech sounds, recent quantitative approaches using phonological inventory databases shows that the distribution of speech sounds has substantially changed in the last few hundred to few thousand years. Here we find that mass borrowing events in recent times have led languages to become more homogeneous in terms of their speech sounds, with correspondingly reduced areal-specific profiles.

This observation also suggests that the *Uniformitarian Hypothesis* -- that cross-linguistic distributions of linguistic properties have always been more or less the same -- cannot be held uncritically in terms of the composition of phonological inventories.

The ultimate goal of my research agenda is to determine which speech sounds are due to biological adaptations and which ones are due to biocultural and cultural pressures and diffusion. The results should lead to a natural timeline of when different speech sounds were co -opted for spoken language

Abstracts

Faint tracks in an ancient landscape: three puzzles from Sahul

Nick Evans
Australian National University

Interdisciplinary work on the human past of any region does not always produce consilient models, in the way it famously has in such textbook cases as the Austronesian settlement of the Pacific. Sometimes it results in uncomfortable enigmas: any one field is able to formulate a reasonably coherent hypothesis about the deep human past, but when they are put together cracks arise in these comfortable formulations, and ongoing research aggravates rather than conciliates the discrepancies. One such case regards the human past of Sahul – the ancient continent uniting Australia and New Guinea, settled from around 60,000 bp, and only split into two in the last 10,000 years of human habitation.

This talk I summarise the three most serious puzzles that arise as we attempt to understand the past of Sahul. These are:

(a) *differential linguistic diversity in New Guinea and Australia*. Why are there something like eighty maximal clades in New Guinea but – at least on some views – just one in Australia? And why is the level of typological diversity (aka linguistic disparity) in New Guinea so much greater than in Australia? Have there been different numbers of immigrant pulses on the two halves of Sahul? Are the populations more genetically diverse? Are there different dynamics driving linguistic diversification, and disparification, faster in New Guinea than in Australia?

(b) *the age problem for proto-Australian*. Though there is not yet full consensus that all Australian languages are related, the evidence is growing, and this includes detailed paradigmatic reconstructions and many highly specific lexical items – perhaps at levels of similarity comparable to Afroasiatic languages. But how should we date this 'proto-Australian'? The conventional assumption among linguists is that 10 millennia or so forms the outer range for reconstructable historical signal. Yet archaeological evidence points to clear settlement from 60,000 years ago, without significant new waves of immigration, or major discontinuities at continental level.

c) *the Pama-Nyungan enigma.* Of the twenty-five or so primary linguistic groupings found within Australia, one ('Pama-Nyungan') covers seven-eighths of the continent, while the

remainder are all squashed into the northwestern eighth. The linguistic evidence thus points to a major recent expansion of one branch, but this hypothesis raises many still-unanswered questions, even if unsubstantiated claims abound. When (mid-Holocene)? How (ceremonial/ religious motivation? Stone point technologies? Post-epidemic recolonisation?) From where (southwestern Gulf of Carpentaria)? Which non-Pama-Nyungan groups are its closest relatives (Gunwinyguan, Tangkic?)

What is clear, however sketchy our answers to these questions, is that we are dealing with a linguistic expansion which cannot be related to agriculture-based 'demic diffusion' à la Bellwood-Renfrew.

Although I will take my own field, linguistics, as the point of departure, I will critically evaluate how the models it produces square up against facts known from other fields concerned with the deep human past – archaeology, genetics, palaeoecology and comparative ethnography.

My talk will not provide neat answers, but will aim to provoke the next round of research by reminding us where assumptions need reexamination, what the next round of information-gathering and model-building needs to target, and what sorts of procedures are needed to integrate the models supplied by different fields in a convincing way.

Abstracts

Reconciling Australia's linguistic and genetic past(s)

Claire Bowern

Yale University

Bouckaert, Bowern, and Atkinson (2018) date the beginning of the expansion of the Pama-Nyungan family throughout Australia to a period between 4 and 7kya. In contrast, two recent gene trees (Malaspinas et al 2016, Tobler et al 2017) provide evidence that Australian population dispersions are ancient, dating to more than 30kya. Malaspinas et al's tree is convergent in many respects with the linguistic tree of Bouckaert, Bowern, and Atkinson (2018), despite the difference in dates, while Tobler et al's tree is not. Tobler et al is based on mitochondrial DNA (inherited through the female line) while Malaspinas et al's is based on full genome coverage.

This leads to a contradiction: if the regional genetic variation depicted in the gene trees is old and the spread of Pama-Nyungan is recent, then Pama-Nyungan must have been spread by cultural diffusion rather than by migration into uninhabited territory. Such a scenario would explain the lack of congruence between Tobler et al's gene tree and the language tree, as well as the 7-fold differences in dating of dispersal. However, in that case, why is the Malaspinas et al tree such a close fit to the observed language tree? Moreover, how do we reconcile the claims of regional stability in the gene trees with the evidence from climatic variation and gaps in the archaeological record, both of which suggest regional dynamics and settlement fluctuations?

In this talk, I suggest several ways in which we might reconcile the gene and language trees, involving the diagnosis of migration versus contact-induced diffusion.

First, the gene trees are rather low resolution geographically, with small numbers of individuals contributing and large gaps across the country. Several phylogeographic genetic analyses provide information only at the level of the 'state', a grouping that is not only highly anachronistic but also useless considering that Wati groups (a single subgroup within Pama-Nyungan) span three states. The language tree, in contrast, has high-density coverage from across the family of language locations at the time of European settlement.

Secondly, the timing of the breakup of several major Pama-Nyungan subgroups tracks breaks in the archaeological record, as noted by Bouckaert, Bowern, and Atkinson (2018). This provides evidence for migration rather than diffusion. However, in areas where there is no such tracking (especially where the archaeological evidence suggests continued occupation), diffusion is more likely.

Thirdly, examining the linguistic and geographical neighbors allows us to distinguish likely migrations (where strong tree-like signal follows topographic features) from other events. Finally, I suggest an approach that would let us detect substrate signal through vocabulary replacement. These methods allow us further insight into the dynamic history of Aboriginal Australia.

Bouckaert, Remco R., Claire Bowern, and Quentin D. Atkinson. "The origin and expansion of Pama-Nyungan languages across Australia." *Nature Ecology & Evolution* (2018): 741-749

Malaspinas, Anna-Sapfo, et al. "A genomic history of Aboriginal Australia." *Nature* 538.7624 (2016): 207-214.

Tobler, Ray, et al. "Aboriginal mitogenomes reveal 50,000 years of regionalism in Australia." *Nature* 544.7649 (2017): 180-184.

Notes

Notes

Notes

.

Notes

Notes

Notes

Notes

Notes

Notes

Notes

.