

EAORC BULLETIN 1,110 – 22 September 2024

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NOTICES

PUBLICATION ALERTS

If you have had a paper or book published, or you see something which would be of interest to the group, please send me a publication alert so that I can include it in the newsletter. Many thanks to those who have already sent in alerts.

If there is a journal you feel I should be tracking on a regular basis, let me know.

And if you have any other ideas for extending the “EAORC experience”, please contact me.

EDITORIAL INTERJECTIONS

Comments in curly brackets are editorial interjections. The Editor reserves the right to be wrong.

ACADEMIA.EDU – Stone toolmaking energy expenditure differs between novice and expert toolmakers

American Journal of Biological Anthropology, e25026 (2024).

JUSTIN PARGETER, ADELA CEBEIRO & STEPHANIE B. LEVY – Stone toolmaking energy expenditure differs between novice and expert toolmakers

This study investigates the energetic costs associated with Oldowan-style flake production and how skill differences influence these costs.

Nine adult participants, including novice and expert toolmakers, underwent a 2-h experimental session where we measured energy expenditure and flaking outcomes. We measured body mass (kg), percent body fat, and fat-free mass (kg) and used open-circuit indirect calorimetry to quantify energy expenditure. The lithic analysis used standard linear and mass measurements on the resulting cores and flakes. Qualitative observations from the video recordings provide insight into the subject's body positions and hand grips.

Results reveal significant differences in energy expenditure between novice and expert toolmakers, with experts demonstrating lower overall energy expenditure. Additionally, experts produced more flakes, reduced greater core mass per unit of energy expenditure, and exhibited distinct body positions, hand grips, and core/flake morphologies compared with novices.

The study provides novel insights into the bio-cultural impacts of stone toolmaking skill acquisition, suggesting that skilled performance reduces the metabolic costs of stone tool production. These findings contribute to debates surrounding the origins of human cultural capacities and highlight the importance of including energy expenditure measures in knapping experiments. Moreover, the results suggest that the presence or absence of expertise in the Paleolithic would have fundamentally altered selective pressures and the reliability of skill reproduction. This study enhances our understanding of differences in stone toolmaking skill and their implications for human energy allocation strategies during early technological evolution.

https://www.academia.edu/123958332/Stone_toolmaking_energy_expenditure_differs_between_novice_and_expert_toolmakers

ACADEMIA.EDU – Palaeolithic archaeology and the naturalistic turn in the self-image of humankind

In Narrating the Past: Archaeological Epistemology, Explanation and Communication. Proceedings of the 6th annual conference of the Central European Theoretical Archaeology Group, held at the University of Leipzig (Germany) on 12–13 September 2019, Jan Miera (ed.), Archaeolingua Foundation, 129-202 (2023).

RIMTAUTAS DAPSCHAUSKAS – The contribution of palaeolithic archaeology to the naturalistic turn in the self-image of humankind: A subjective essay with the attempt for a balanced reflection

Charles Darwin's two epochal works, “On the Origin of Species” and “The Descent of Man,” published in 1859 and 1871, respectively, started a deep and, as it seems, irrevocable transition in the self-image of humankind: from creation's crowning glory far above the animal world to an evolved biological organism amongst many others in the grand tree of life. Seminal discoveries in primatology and molecular genetics during the second half of the 20th century further undermined the narrative of human exceptionalism. With the steep rise of cognitive neuroscience and evolutionary psychology since the 1990s, even the human mind and consciousness itself have become increasingly naturalised. The main goal of this essay is to provide a synthesis of the separate but ultimately converging scientific developments which led to this naturalistic turn in the self-image of humankind. Special attention is given to palaeolithic archaeology (and its partner disciplines), as crucial archaeological and paleoanthropological discoveries over the last 200 years contributed tremendously to naturalistic

narratives about the origin of our very own species – although their contribution to the naturalistic turn is often overlooked. Today, palaeolithic archaeology shows that *Homo sapiens*' celebrated abilities have deep evolutionary histories. However, our species was not the only human form with "higher" cognitive capacities such as those manifested through sophisticated tool use, control of fire, and even non-utilitarian behaviours such as ornamentation, ritual, and human burial. For almost 300,000 years, other hominins, to some extent with comparable cognitive capabilities, (co-)existed with our species on this planet and sometimes even interbred. In particular, the changing picture of Neanderthals, based on meticulous archaeological research in the last two decades, has contributed to a profound readjustment of our self-image. Finally, my essay also explores the main epistemological fallacies which lie at the bottom of ideological misuses and backlashes accompanying the naturalistic transformation of our self-image. That seems especially prevalent when an evolutionary perspective is taken not only of the human body but also of the human mind. I conclude with a plea for academic freedom. [https://www.academia.edu/104284894/The contribution of palaeolithic archaeology to the naturalistic turn in the self image of humankind A subjective essay with the attempt for a balanced reflection](https://www.academia.edu/104284894/The_contribution_of_palaeolithic_archaeology_to_the_naturalistic_turn_in_the_self_image_of_humankind_A_subjective_essay_with_the_attempt_for_a_balanced_reflection)

NEWS

NATURE BRIEFING – Sleuths criticize 'stealth corrections'

Research-integrity sleuths have flagged more than 130 'stealth corrections' in the scientific literature, where journals have updated papers without flagging that a change has been made. The findings have encouraged at least one publisher, MDPI, to update its policy on publicizing corrections that it deems to be minor. But there is no general agreement among scientists and publishers about how big a change must be to warrant a notice.

<https://retractionwatch.com/2024/09/12/stealth-corrections-when-journals-quietly-fix-papers/>

SCIENCEADVISER – These gibbons cut loose (footloose)

Gibbons, which inhabit the dense rainforests of southern Asia, are known for their freakishly long arms. But make no mistake—when the mood strikes, these goofy-looking apes also put their best foot forward, according to an upcoming Primates study posted online as a preprint.

When scientists analyzed videos of crested gibbons from zoos and other facilities, they saw behavior that looked a bit like something out of a Michael Jackson music video. "The body becomes stiff, and then these robot-dance-like movements commence," zoologist Kai Caspar tells *The New York Times*.

Although dancing is usually considered a human art form, many other animals know how to cut a rug. Numerous birds, for example, engage in ritualized movements as part of their courtship displays. In these cases, the dancing animal is typically a male attempting to attract females, but the gibbons in these videos—which swayed, squatted, and posed with rhythm and style—were all adult females. And, while earlier research found that female gibbons in China dance to compete for male attention, many of the species described in this new study are monogamous.

Female gibbons in zoos also dance in front of humans, usually performing with their back to the viewer and peeking over their shoulders to ensure their audience is still watching. While the gibbon boogie may share some key characteristics with human dance, it doesn't have anything to do with sound or music, and the researchers say it probably emerged independently.

<https://www.biorxiv.org/content/10.1101/2024.08.29.610299v1.full>

SCIENCE DAILY – Vital language sites in brain act like connectors in a social network

When surgeons perform brain surgery on people with brain tumors or epilepsy, they need to remove the tumor or abnormal tissue while preserving parts of the brain that control language and movement. A new study may better inform doctors' decisions about which brain areas to preserve, thereby improving patients' language function after brain surgery. The study expands the understanding of how language is encoded in the brain and identifies key features of critical sites in the cerebral cortex that work together to produce language.

<https://www.sciencedaily.com/releases/2024/09/240916115512.htm>

SCIENCE DAILY – Brain-wide decision-making dynamics discovered

Neuroscientists have revealed how sensory input is transformed into motor action across multiple brain regions in mice. The research shows that decision-making is a global process across the brain that is coordinated by learning. The findings could aid artificial intelligence research by providing insights into how to design more distributed neural networks.

<https://www.sciencedaily.com/releases/2024/09/240911112023.htm>

SCIENCE DAILY – South African rock art possibly inspired by long-extinct species

A mysterious tusked animal depicted in South African rock art might portray an ancient species preserved as fossils in the same region, according to a new study.

<https://www.sciencedaily.com/releases/2024/09/240918142420.htm>

SCIENCE DAILY – Like humans, artificial minds can 'learn by thinking'

A new review shows that this process of thinking is not exclusive to humans. Artificial intelligence, too, is capable of self-correction and arriving at new conclusions through 'learning by thinking.'

<https://www.sciencedaily.com/releases/2024/09/240918125029.htm>

SCIENCE DAILY – Scientists turn to human skeletons to explore origins of horseback riding

A new, wide-ranging exploration of human remains casts doubt on a long-standing theory in archaeology known as the Kurgan hypothesis -- which, among other claims, suggests that humans first domesticated horses as early as the fourth millennium B.C.

<https://www.sciencedaily.com/releases/2024/09/240920165153.htm>

SCIENCE DAILY – Play it forward: Lasting effects of pretend play in early childhood

As the school year revs up, a renowned child developmental psychologist highlights the robust benefits of pretend play on cognitive, social, and emotional development in children and cautions how 'learning through play' has changed with the demands of contemporary society. Given natural selection's shaping of childhood for the acquisition and refinement of species-adapted social-cognitive skills -- much through pretend play -- he says it's unfortunate that modern culture is ignoring the evolved wisdom of how best to educate young children.

<https://www.sciencedaily.com/releases/2024/09/240919174822.htm>

SCIENCE.ORG NEWS – Female gibbons boogie down, and no one is quite sure why

Videos show the apes engaged in rhythmic, intentional dance moves.

<https://www.science.org/content/article/female-gibbons-boogie-down-and-no-one-quite-sure-why>

THE CONVERSATION – Male elephant society is much richer than previously thought

Female elephants rumble to say 'let's go!' New study in Namibia shows males do too, a sign of unexpected social bonds.

<https://theconversation.com/female-elephants-rumble-to-say-lets-go-new-study-in-namibia-shows-males-do-too-a-sign-of-unexpected-social-bonds-236702>

THE CONVERSATION – Not one, but at least two lineages of late Neanderthals in Europe

Named after the writings of J.R.R. Tolkien, Thorin is the first Neanderthal body to be found in France since 1978. He is forcing us to rethink almost everything we knew about early humanity.

<https://theconversation.com/neanderthal-remains-found-in-france-reveals-there-were-not-one-but-at-least-two-lineages-of-late-neanderthals-in-europe-our-research-shows-238606>

PUBLICATIONS

Current Biology

PAPERS

PERNILLE M. SØRENSEN et al with STEPHANIE L. KING – Communication range predicts dolphin alliance size in a cooperative mating system

It is well known that communication range, often termed active space, varies with habitat structure, and this variation can influence individual vocal behavior across taxa. While theoretical predictions imply that communication distances can drive the evolution of mammalian alliance sizes, empirical tests of this hypothesis are currently lacking. In Shark Bay, Western Australia, unrelated male bottlenose dolphins form multilevel alliances, where males work together in pairs or trios to herd single estrus females. Here, we use empirical measures of male dolphin vocalizations, ambient noise levels, and high-resolution bathymetry data to estimate variation in active space across the study site. We combine this with long-term data on male alliance behavior to determine how active space influences alliance group size and mating success. We show that the active space of vocalizations used by allied males in a reproductive context predicts the number of preferred alliance partners with whom individuals cooperate over the longer term, ultimately contributing significantly to male access to mating opportunities. These results reveal that variation in sensory ecology driven by heterogeneous habitat influences optimal cooperative group size and mating success within a single population of wild animals.

[https://www.cell.com/current-biology/fulltext/S0960-9822\(24\)01147-3](https://www.cell.com/current-biology/fulltext/S0960-9822(24)01147-3)

GIULIA ZAMPIROLO et al – Tracing early pastoralism in Central Europe using sedimentary ancient DNA

Central European forests have been shaped by complex human interactions throughout the Holocene, with significant changes following the introduction of domesticated animals in the Neolithic (~7.5–6.0 ka before present [BP]). However, understanding early pastoral practices and their impact on forests is limited by methods for detecting animal movement across past landscapes. Here, we examine ancient sedimentary DNA (sedaDNA) preserved at the Velký Mamučák rock shelter

in northern Bohemia (Czech Republic), which has been a forested enclave since the early Holocene. We find that domesticated animals, their associated microbiomes, and plants potentially gathered for fodder have clear representation by the Late Neolithic, around 6.0 ka BP, and persist throughout the Bronze Age into recent times. We identify a change in dominant grazing species from sheep to pigs in the Bronze Age (~4.1–3.0 ka BP) and interpret the impact this had in the mid-Holocene retrogressions that still define the structure of Central European forests today. This study highlights the ability of ancient metagenomics to bridge archaeological and paleoecological methods and provide an enhanced perspective on the roots of the “Anthropocene.”

[https://www.cell.com/current-biology/abstract/S0960-9822\(24\)01162-X](https://www.cell.com/current-biology/abstract/S0960-9822(24)01162-X)

eLife

PAPERS

PIERMATTEO MORUCCI et al – Language experience shapes predictive coding of rhythmic sound sequences

Perceptual systems heavily rely on prior knowledge and predictions to make sense of the environment. Predictions can originate from multiple sources of information, including contextual short-term priors, based on isolated temporal situations, and context-independent long-term priors, arising from extended exposure to statistical regularities. While the effects of short-term predictions on auditory perception have been well-documented, how long-term predictions shape early auditory processing is poorly understood. To address this, we recorded magnetoencephalography data from native speakers of two languages with different word orders (Spanish: functor-initial vs Basque: functor-final) listening to simple sequences of binary sounds alternating in duration with occasional omissions. We hypothesized that, together with contextual transition probabilities, the auditory system uses the characteristic prosodic cues (duration) associated with the native language’s word order as an internal model to generate long-term predictions about incoming non-linguistic sounds. Consistent with our hypothesis, we found that the amplitude of the mismatch negativity elicited by sound omissions varied orthogonally depending on the speaker’s linguistic background and was most pronounced in the left auditory cortex. Importantly, listening to binary sounds alternating in pitch instead of duration did not yield group differences, confirming that the above results were driven by the hypothesized long-term ‘duration’ prior. These findings show that experience with a given language can shape a fundamental aspect of human perception – the neural processing of rhythmic sounds – and provides direct evidence for a long-term predictive coding system in the auditory cortex that uses auditory schemes learned over a lifetime to process incoming sound sequences.

<https://elifesciences.org/articles/91636>

VIKTOR KEWENIG, GABRIELLA VIGLIOCCO & JEREMY I SKIPPER – When Abstract Becomes Concrete: Naturalistic Encoding of Concepts in the Brain

Language is acquired and processed in complex and dynamic naturalistic contexts, involving simultaneous processing of connected speech, faces, bodies, objects, etc. How words and their associated concepts are encoded in the brain during real-world processing is still unknown. Here, the representational structure of concrete and abstract concepts was investigated during movie watching to address the extent to which brain responses dynamically change depending on visual context. First, across contexts, concrete and abstract concepts are shown to encode different experience-based information in separable sets of brain regions. However, these differences are reduced when multimodal context is considered. Specifically, the response profile of abstract words becomes more concrete-like when these are processed in visual scenes highly related to their meaning. Conversely, when the visual context is unrelated to a given concrete word, the activation pattern resembles more that of abstract conceptual processing. These results suggest that while concepts generally encode habitual experiences, the underlying neurobiological organisation is not fixed but depends dynamically on available contextual information.

<https://elifesciences.org/reviewed-preprints/91522>

Frontiers in Environmental Archaeology

PAPERS

QUENTIN GOFFETTE et al – Neanderthal exploitation of birds in north-western Europe: Avian remains from Scladina Cave (Belgium)

For a long time, Neanderthals were considered hunters of large mammals, whereas the diversification of the exploited faunal spectrum to include smaller taxa, including birds, was assumed to be specific to anatomically modern humans. In recent decades, archeozoological analyses of faunal remains from layers associated with Middle Paleolithic lithic industries have revealed traces of human manipulation of small taxa, indicating the exploitation of a wider range of animals than previously thought. These new data have challenged the view that Neanderthals did not exploit small animals, thereby narrowing the behavioral gap with anatomically modern humans. Nevertheless, the information currently available comes almost exclusively from southern Europe and the nature of Neanderthal small fauna exploitation in northern Europe remains largely unknown. The present study aims to fill this gap by applying archeozoological methods, including detailed taphonomic and traceological analyses, to 119 bird remains recovered from layers containing Middle Paleolithic industries at Scladina Cave, Belgium. Analyses of proteomics were applied to clarify the taxonomic identity of two morphologically non-diagnostic

elements. Modifications made by non-human predators or scavengers, suggest that mammalian carnivores are responsible for accumulating a considerable portion of the avian assemblage. In total, seven bird bones exhibit anthropogenic marks, and one element presents questionable marks. Various Galliformes taxa and a great cormorant were exploited likely for their meat. The talon of a likely lesser spotted eagle displays intense polishing possibly linked to human manipulation of this element, although this remains hypothetical. On the radius of a Western capercaillie, two deep incisions may indicate bone working, and intense use-wear indicates that the bone has been utilized, potentially on soft organic material. This study provides the first evidence of the exploitation of birds by Neanderthal in Belgium and constitutes the only detailed zooarchaeological analysis of Middle Paleolithic bird material in northwestern Europe. The likely modification and subsequent utilization of a bird bone is only the second example known from Neanderthal occupations in Eurasia. The novel taxa identified as Neanderthal prey highlight the plasticity of Neanderthal ecological behavior, adapting to different landscapes and climates and exploiting a large spectrum of locally available prey.

<https://www.frontiersin.org/journals/environmental-archaeology/articles/10.3389/fearc.2024.1441926/full>

Frontiers in Psychiatry

PAPERS

ASTRID GIESELMANN et al – Perspectives on advance research directives from individuals with mild cognitive impairment and family members: a qualitative interview study

Advance research directives (ARDs) provide a promising way to involve individuals with mild cognitive impairment (MCI) in research decisions before they lose the capacity to consent. At the same time, the views of people with MCI on ARDs are underexplored. This study assesses the perceptions of people with MCI and family members on the benefits and challenges associated with ARDs.

The aim of this study was to investigate the perspectives of individuals with MCI and family members of individuals with MCI on ARDs. We focus specifically on willingness to participate in nontherapeutic research, understanding of ARDs and the ethical considerations involved.

Thirteen open-ended, face-to-face interviews were conducted using a semi-structured format. Seven interviews were conducted with individuals with MCI, and six with family members of individuals with MCI. The narratives were transcribed verbatim and qualitative content analysis was carried out.

Research participation and ARDs were viewed positively, largely based on altruistic motives and the desire to contribute to society. The participants recognized the potential advantages of ARDs in reducing the decision-making burden on family members and maintaining personal autonomy. They also highlighted challenges in comprehending ARDs and navigating the complexities surrounding potential conflicts between current preferences versus preferences described in an ARD.

ARDs were predominantly seen as valuable instruments that enable individuals with MCI to participate in research. This study provides insights into the reasons why affected individuals are interested in drafting ARDs. These insights can guide the development of supportive interventions that are tailored to assist individuals with MCI and their families in navigating ARD processes.

<https://www.frontiersin.org/journals/psychiatry/articles/10.3389/fpsy.2024.1419701/full>

Frontiers in Psychology

PAPERS

SIEM BUSEYNE et al – Peering into the team role kaleidoscope: the interplay of personal characteristics and verbal interactions in collaborative problem solving

The objective of this study is to explore the relationship between personality and peer-rated team role behavior on the one hand and team role behavior and verbal behavior on the other hand. To achieve this, different data types were collected in fifteen professional teams of four members (N = 60) from various private and public organizations in Flanders, Belgium. Participants' personalities were assessed using a workplace-contextualized personality questionnaire based on the Big Five, including domains and facets. Typical team role behavior was assessed by the team members using the Team Role Experience and Orientation peer rating system. Verbal interactions of nine of the teams (n = 36) were recorded in an educational lab setting, where participants performed several collaborative problem-solving tasks as part of a training. To process these audio data, a coding scheme for collaborative problem solving and linguistic inquiry and word count were used. We identified robust links and logical correlation patterns between personality traits and typical team role behaviors, complementing prior research that only focused on self-reported team behavior. For instance, a relatively strong correlation was found between Altruism and the Team builder role. Next, the study reveals that role taking within teams is associated with specific verbal interaction patterns. For example, members identified as Organizers were more engaged in responding to others' ideas and monitoring execution.

<https://www.frontiersin.org/journals/psychology/articles/10.3389/fpsyg.2024.1345892/full>

PASCAL TREMBLAY & SIMONA M. BRAMBATI – A historical perspective on the neurobiology of speech and language: from the 19th century to the present

In this essay, we review 19th century conceptions on the neurobiology of speech and language, including the pioneer work of Franz Gall, Jean-Baptiste Bouillaud, Simon Alexandre Ernest Aubertin, Marc Dax, Paul Broca, and Carl Wernicke. We examine

how these early investigations, anchored in the study of neurological disorders, have broadened their scope via neuropsychological and psycholinguistic theories and models. Then, we discuss how major technological advances have led to an important paradigm shift, through which the study of the brain slowly detached from the study of disease to become the study of individuals of all ages, with or without brain pathology or language disorders. The profusion of neuroimaging studies that were conducted in the past four decades, inquiring into various aspects of language have complemented—and often challenged—classical views on language production. Our understanding of the “motor speech center,” for instance, has been entirely transformed. The notion of cerebral dominance has also been revisited. We end this paper by discussing the challenges and controversies of 21st century neurobiology of speech and language as well as modern views of the neural architecture supporting speech and language functions.

<https://www.frontiersin.org/journals/psychology/articles/10.3389/fpsyg.2024.1420133/full>

Nature Communications

PAPERS

OWEN ALEXANDER HIGGINS et mul – Life history and ancestry of the late Upper Palaeolithic infant from Grotta delle Mura, Italy

Glacial Maximum are not yet fully understood. This study presents a multidisciplinary, high temporal resolution investigation of an Upper Palaeolithic infant from Grotta delle Mura (Apulia, southern Italy) combining palaeogenomics, dental palaeohistology, spatially-resolved geochemical analyses, direct radiocarbon dating, and traditional anthropological studies. The skeletal remains of the infant – Le Mura 1 – were directly dated to 17,320-16,910 cal BP. The results portray a biological history of the infant’s development, early life, health and death (estimated at ~72 weeks). They identify, several phenotypic traits and a potential congenital disease in the infant, the mother’s low mobility during gestation, and a high level of endogamy. Furthermore, the genomic data indicates an early spread of the Villabruna-like components along the Italian peninsula, confirming a population turnover around the time of the Last Glacial Maximum, and highlighting a general reduction in genetic variability from northern to southern Italy. Overall, Le Mura 1 contributes to our better understanding of the early stages of life and the genetic puzzle in the Italian peninsula at the end of the Last Glacial Maximum.

<https://www.nature.com/articles/s41467-024-51150-x>

Nature Communications Psychology

NEWS

TROBY KA-YAN LUI – Cognitive neuroscience: the brain’s symphony in hearing speech and music

New research shows that the brain employs similar anatomical regions but specific neural oscillatory patterns during speech and music perception.

<https://www.nature.com/articles/s44271-024-00136-y>

Nature Ecology & Evolution

ARTICLES

PETER MITCHELL – Population continuity and change in Africa’s far south

Ancient human genomic data from Oakhurst Rockshelter in South Africa push back the earliest reported ancient DNA from the subcontinent to the start of the Holocene, revealing surprising genetic continuity and raising questions about the nature of regional cultural change.

<https://www.nature.com/articles/s41559-024-02537-y>

PAPERS

JOSCHA GRETZINGER et al with JOHANNES KRAUSE – 9,000 years of genetic continuity in southernmost Africa demonstrated at Oakhurst rockshelter

Southern Africa has one of the longest records of fossil hominins and harbours the largest human genetic diversity in the world. Yet, despite its relevance for human origins and spread around the globe, the formation and processes of its gene pool in the past are still largely unknown. Here, we present a time transect of genome-wide sequences from nine individuals recovered from a single site in South Africa, Oakhurst Rockshelter. Spanning the whole Holocene, the ancient DNA of these individuals allows us to reconstruct the demographic trajectories of the indigenous San population and their ancestors during the last 10,000 years. We show that, in contrast to most regions around the world, the population history of southernmost Africa was not characterized by several waves of migration, replacement and admixture but by long-lasting genetic continuity from the early Holocene to the end of the Later Stone Age. Although the advent of pastoralism and farming substantially transformed the gene pool in most parts of southern Africa after 1,300 bp, we demonstrate using allele-frequency and identity-by-descent segment-based methods that the †Khomani San and Karretjiemense from South Africa still show direct signs of relatedness to the Oakhurst hunter-gatherers, a pattern obscured by recent, extensive non-Southern African admixture. Yet, some southern San in South Africa still preserve this ancient, Pleistocene-derived genetic signature, extending the period of genetic continuity until today.

<https://www.nature.com/articles/s41559-024-02532-3>

Nature Human Behaviour

PAPERS

JASON W. BURTON et al – How large language models can reshape collective intelligence

Collective intelligence underpins the success of groups, organizations, markets and societies. Through distributed cognition and coordination, collectives can achieve outcomes that exceed the capabilities of individuals—even experts—resulting in improved accuracy and novel capabilities. Often, collective intelligence is supported by information technology, such as online prediction markets that elicit the ‘wisdom of crowds’, online forums that structure collective deliberation or digital platforms that crowdsource knowledge from the public. Large language models, however, are transforming how information is aggregated, accessed and transmitted online. Here we focus on the unique opportunities and challenges this transformation poses for collective intelligence. We bring together interdisciplinary perspectives from industry and academia to identify potential benefits, risks, policy-relevant considerations and open research questions, culminating in a call for a closer examination of how large language models affect humans’ ability to collectively tackle complex problems.

<https://www.nature.com/articles/s41562-024-01959-9>

Nature Humanities & Social Sciences Communications

PAPERS

BUN-SUN KIM & HONGJOON JO – Why can’t artificial language contain the truth? A focus on Foucault’s and Heidegger’s discussions

This article seeks to argue that although AI language has developed to the level where it can answer human questions, AI language cannot yet contain the truth. In the AI era, humans who speak their minds will no longer express their thoughts directly in words and will depend more on AI’s artificial language. However, it is only a question for now whether AI will be able to substitute for human speech and whether such a fact will contribute to the expansion of human thinking and the state of being. Accordingly, in this paper, we try to identify the limitations of artificial intelligence language by precisely clarifying the meaning of human language and discourse. Foucault and Heidegger’s discussion of discourse deals with issues of language, subject, existence, and authentic discourse. We use their discussions as a tool to illuminate our own perspectives. Therefore, we will re-analyze the language produced in the AI environment in relation to the issue of truth.

<https://www.nature.com/articles/s41599-024-03648-4>

Nature Neuroscience

PAPERS

BARBARA PEYSAKHOVICH et al – Primate superior colliculus is causally engaged in abstract higher-order cognition

The superior colliculus is an evolutionarily conserved midbrain region that is thought to mediate spatial orienting, including saccadic eye movements and covert spatial attention. Here, we reveal a role for the superior colliculus in higher-order cognition, independent of its role in spatial orienting. We trained rhesus macaques to perform an abstract visual categorization task that involved neither instructed eye movements nor differences in covert attention. We compared neural activity in the superior colliculus and the posterior parietal cortex, a region previously shown to causally contribute to abstract category decisions. The superior colliculus exhibits robust encoding of learned visual categories, which is stronger than in the posterior parietal cortex and arises at a similar latency in the two areas. Moreover, inactivation of the superior colliculus markedly impaired animals’ category decisions. These results demonstrate that the primate superior colliculus mediates abstract, higher-order cognitive processes that have traditionally been attributed to the neocortex.

<https://www.nature.com/articles/s41593-024-01744-x>

Nature Scientific Reports

PAPERS

EWELINA WNUK & JAN WODOWSKI – Culture shapes how we describe facial expressions

From Darwin through Wittgenstein to contemporary scientific investigations, it has been argued humans tend to view facial expressions through a mentalistic lens. According to this view, when looking at someone’s expressive face, we see emotion and are unable to describe the face in behavioral terms, i.e., name the details of facial movements. At the same time, however, a growing body of work shows cultures in fact differ in the degree of importance they attribute to mental states and willingness to discuss them. Is this variation reflected in the linguistic coding of facial expressions? To explore this, we conducted two facial expression naming tasks targeting mental states and facial movements with speakers of Maniq (Austroasiatic, Thailand) and Polish (Indo-European, Poland), representing highly diverse linguistic and cultural settings. We found that, while Polish speakers conformed with the predicted orientation towards mental states, this did not hold for Maniq speakers. The Maniq were instead oriented towards behavioral aspects of faces, naming them more frequently, more precisely, and with higher consensus, compared to the Polish. These differences are carved into the Maniq and Polish lexicons, suggesting diverse cultures exhibit differential specialization in verbalizing expressive faces.

<https://www.nature.com/articles/s41598-024-72432-w>

NICHOLAS RICCARDI, XUAN YANG & RUTVIK H. DESAI – The Two Word Test as a semantic benchmark for large language models

Large language models (LLMs) have shown remarkable abilities recently, including passing advanced professional exams and demanding benchmark tests. This performance has led many to suggest that they are close to achieving humanlike or “true” understanding of language, and even artificial general intelligence (AGI). Here, we provide a new open-source benchmark, the Two Word Test (TWT), that can assess semantic abilities of LLMs using two-word phrases in a task that can be performed relatively easily by humans without advanced training. Combining multiple words into a single concept is a fundamental linguistic and conceptual operation routinely performed by people. The test requires meaningfulness judgments of 1768 noun-noun combinations that have been rated as meaningful (e.g., baby boy) or as having low meaningfulness (e.g., goat sky) by human raters. This novel test differs from existing benchmarks that rely on logical reasoning, inference, puzzle-solving, or domain expertise. We provide versions of the task that probe meaningfulness ratings on a 0–4 scale as well as binary judgments. With both versions, we conducted a series of experiments using the TWT on GPT-4, GPT-3.5, Claude-3-Opus, and Gemini-1-Pro-001. Results demonstrated that, compared to humans, all models performed relatively poorly at rating meaningfulness of these phrases. GPT-3.5-turbo, Gemini-1.0-Pro-001 and GPT-4-turbo were also unable to make binary discriminations between sensible and nonsense phrases, with these models consistently judging nonsensical phrases as making sense. Claude-3-Opus made a substantial improvement in binary discrimination of combinatorial phrases but was still significantly worse than human performance. The TWT can be used to understand and assess the limitations of current LLMs, and potentially improve them. The test also reminds us that caution is warranted in attributing “true” or human-level understanding to LLMs based only on tests that are challenging for humans.

<https://www.nature.com/articles/s41598-024-72528-3>

HITOSHI YAMAMOTO & AKIRA GOTO – Behavioural strategies in simultaneous and alternating prisoner’s dilemma games with/without voluntary participation

The Prisoner’s Dilemma is one of the most classic formats for exploring the principle of direct reciprocity. Although numerous theoretical and experimental studies have been conducted, little attention has been paid to the divergence between theoretical predictions and actual human behaviour. In addition, there are two additional essential challenges of experimental research. First, most experimental approaches have focused on games in which two players decide their actions simultaneously, but little is known about alternating games. Another is that there are few experiments on voluntary participation. Here, we conducted experiments on simultaneous games, alternating games, and games with and without voluntary participation for a total of four game patterns and examined the deviation from theoretical predictions for each. The results showed that, contrary to theoretical predictions, humans chose cooperation even after being exploited. We also observed that, with or without voluntary participation, people tended to take the same action they had taken in the previous round. Our results indicate that to understand the mechanisms of human behaviour, we need to integrate findings from behavioural science, psychology, and game theory.

<https://www.nature.com/articles/s41598-024-73353-4>

New Scientist**NEWS****Evidence grows for dramatic brain remodelling during pregnancy**

A woman’s brain was scanned throughout her pregnancy, adding to the growing body of evidence that dramatic remodelling takes place in preparation for motherhood.

<https://www.newscientist.com/article/2447785-evidence-grows-for-dramatic-brain-remodelling-during-pregnancy/>

ARTICLES**ALEX WILKINS – The AI expert who says artificial general intelligence is nonsense**

Artificial intelligence has more in common with ants than humans, says Neil Lawrence. Only by taking a more nuanced view of intelligence can we see how machines will truly transform society.

<https://www.newscientist.com/article/mg26335091-000-the-ai-expert-who-says-artificial-general-intelligence-is-nonsense/>

ALISON GEORGE – Genome of Neanderthal fossil reveals lost tribe cut off for millennia

Analysis of DNA from a Neanderthal fossil found in a French cave indicates that it belonged to a group that was isolated for more than 50,000 years.

<https://www.newscientist.com/article/2447513-genome-of-neanderthal-fossil-reveals-lost-tribe-cut-off-for-millennia/>

PeerJ

PAPERS

DRISHTI SHARMA & ABHISHEK SRIVASTAVA – Detecting rumors in social media using emotion based deep learning approach

Social media, an undeniable facet of the modern era, has become a primary pathway for disseminating information. Unverified and potentially harmful rumors can have detrimental effects on both society and individuals. Owing to the plethora of content generated, it is essential to assess its alignment with factual accuracy and determine its veracity. Previous research has explored various approaches, including feature engineering and deep learning techniques, that leverage propagation theory to identify rumors. In our study, we place significant importance on examining the emotional and sentimental aspects of tweets using deep learning approaches to improve our ability to detect rumors. Leveraging the findings from the previous analysis, we propose a Sentiment and EMotion driven TransformEr Classifier method (SEMTEC). Unlike the existing studies, our method leverages the extraction of emotion and sentiment tags alongside the assimilation of the content-based information from the textual modality, i.e., the main tweet. This meticulous semantic analysis allows us to measure the user's emotional state, leading to an impressive accuracy rate of 92% for rumor detection on the "PHEME" dataset. The validation is carried out on a novel dataset named "Twitter24". Furthermore, SEMTEC exceeds standard methods accuracy by around 2% on "Twitter24" dataset.

<https://peerj.com/articles/cs-2202/>

Philosophical Transactions of the Royal Society A

PAPERS

BRIAN MINTZ & FENG FU – How norms shape the evolution of prosocial behaviour—compassion, universalizability, reciprocity and equity: a C.U.R.E for social dilemmas

How cooperation evolves and persists widely remains an open problem for improving humanity across domains ranging from climate change to pandemic response. To shed light on how behavioural norms can resolve social dilemmas around cooperation, we present a formal mathematical model of individuals' decision making under general social norms, encompassing a variety of concerns and motivations an individual may have beyond simply maximizing their own payoff. Using the canonical Prisoner's dilemma, we compare four norms: compassion, universalizability, reciprocity and equity, to determine which, if any, social forces can facilitate the evolution of cooperation. We analyse our model through a variety of limiting cases, including weak selection, low mutation and large population sizes. This is complemented by computer simulations of population dynamics via a Fisher process, which confirm our theoretical results. We find that the first two norms lead to the emergence of cooperation in a wide range of games, but the latter two cannot. Owing to our framework's generality, it can be used to investigate many other norms, and how norms themselves evolve. Our work complements recent work on fair-minded learning dynamics and provides a useful bottom-up perspective into understanding the impact of top-down social norms on collective cooperative intelligence.

<https://royalsocietypublishing.org/doi/10.1098/rspa.2024.0092>

Philosophical Transactions of the Royal Society B

PAPERS

ANDREW J. LATHAM, KRISTIE MILLER & RASMUS PEDERSEN – Mental time travel in animals: the 'when' of mental time travel

While many aspects of cognition have been shown to be shared between humans and non-human animals, there remains controversy regarding whether the capacity to mentally time travel is a uniquely human one. In this paper, we argue that there are four ways of representing when some event happened: four kinds of temporal representation. Distinguishing these four kinds of temporal representation has five benefits. First, it puts us in a position to determine the particular benefits these distinct temporal representations afford an organism. Second, it provides the conceptual resources to foster a discussion about which of these representations is necessary for an organism to count as having the capacity to mentally time travel. Third, it enables us to distinguish stricter from more liberal views of mental time travel that differ regarding which kind(s) of temporal representation is taken to be necessary for mental time travel. Fourth, it allows us to determine the benefits of taking a stricter or more liberal view of mental time travel. Finally, it ensures that disagreement about whether some species can mentally time travel is not merely the product of unrecognized disagreement about which temporal representation is necessary for mental time travel. We argue for a more liberal view, on the grounds that it allows us to view mental time travel as an evolutionarily continuous phenomenon and to recognize that differences in the ways that organisms mentally time travel might reflect different temporal representations, or combinations thereof, that they employ. Our ultimate aim, however, is to create a conceptual framework for further discussion regarding what sorts of temporal representations are required for mental time travel.

<https://royalsocietypublishing.org/doi/full/10.1098/rstb.2023.0398>

GLADYS AYSON & CRISTINA ATANCE – Children’s mental time travel into the future: a functional perspective

Children’s episodic future-thinking is typically assessed using experimental tasks that measure whether children select an item with future utility. Although these tasks—inspired by Tulving’s seminal ‘spoon test’ (Tulving E. 2005 *Episodic memory and autonoesis: uniquely human? In The missing link in cognition: origins of self-reflective consciousness* [eds HS Terrace, J Metcalfe], pp. 3–56. Oxford, UK: Oxford University Press. [doi:10.1093/acprof:oso/9780195161564.001.0001])—are passed around age 4, they tell us little about the functional significance of children’s episodic future-thinking in their day-to-day lives. We highlight how a naturalistic approach can shed light on this issue, and present a small study where we recruited mothers to report on their children’s (N = 12, 3- and 4-year-olds and 6- and 7-year-olds) future-thinking over a 7-day period. We used a thematic analysis to understand why children express future thoughts and derived the following themes: (1) expressing future desires and/or intentions, (2) future-oriented information-seeking, (3) connecting present actions with future outcomes, and (4) predicting future mental/physiological states. We compare these themes with recent accounts of the functional significance of future-thinking in adults and conclude that children largely express their future-thinking verbally to request information or support from their parent—likely because they do not yet possess enough control/autonomy to independently act for their own future. Our findings both complement and extend an experimental approach and further elucidate the functional significance of mental time travel in children.

<https://royalsocietypublishing.org/doi/full/10.1098/rstb.2023.0399>

CHRISTINE COUGHLIN et al – Of popsicles and crackers: when spatio-temporal memory is not integrated into children’s decision-making

Prior research has used innovative paradigms to show that some non-human animal species demonstrate behavioural choices (i.e. foraging for a food item at a specific location, and at a time that guarantees it has not yet decayed), reflecting episodic-like or ‘WWW’ memory (memory for ‘what’ happened, ‘where’ and ‘when’). These results raised the question of whether similar approaches could be used to examine memory in young children in order to reduce verbal demands. The present research examines the extent to which children’s WWW memory aligns with memory-based choices in 3- to 5-year-olds (n = 95; study 1) and in 7- to 11-year-olds and adults (n = 168; study 2). Results indicate that preschoolers’ struggle with choice-based tasks probably reflects difficulty integrating their WWW memory with an understanding that certain items decay over time. Moreover, a convergence between verbal recall measures and choice-based measures is observable in 7-year-olds and beyond, reflecting a stronger integration of memory signals, understanding of state transformation, and decision-making.

<https://royalsocietypublishing.org/doi/abs/10.1098/rstb.2023.0400>

MATHIAS OSVATH & MIKAEL JOHANSSON – A short natural history of mental time travels: a journey still travelled?

Tulving’s introduction of episodic memory and the metaphor of mental time travel has immensely enriched our understanding of human cognition. However, his focus on human psychology, with limited consideration of evolutionary perspectives, led to the entrenched notion that mental time travel is uniquely human. We contend that adopting a phylogenetic perspective offers a deeper insight into cognition, revealing it as a continuous evolutionary process. Adherence to the uniqueness of pre-defined psychological concepts obstructs a more complete understanding. We offer a concise natural history to elucidate how events that occurred hundreds of millions of years ago have been pivotal for our ability to mentally time travel. We discuss how the human brain, utilizing parts with ancient origins in a networked manner, enables mental time travel. This underscores that episodic memories and mental time travel are not isolated mental constructs but integral to our perception and representation of the world. We conclude by examining recent evidence of neuroanatomical correlates found only in great apes, which show great variability, indicating the ongoing evolution of mental time travel in humans.

<https://royalsocietypublishing.org/doi/full/10.1098/rstb.2023.0402>

SUSAN D. HEALY et al – The function of episodic memory in animals

The best-known example of episodic memory in animals came from food-storing birds. One of the beauties of the food-storing system was that inherent in the behaviour were the elements that (at the time) made up episodic memory: what, where and when. While there were then already plenty of data on animals’ ability to put together what and where, the addition of the time element in animals’ memory and its testing was one that was both new and experimentally challenging. It has, however, led to an increasing variety of examples showing that animals can put together all three informational components. If episodic memories can be described as those memories that make any one of us who we are, why should non-human animals have such memories? Here, we argue that episodic memories play a significant functional role in the lives of real animals, in particular, enabling them to make decisions about how they might or should act in their future. We support our argument with data from a range of examples, focussing on data from the field.

<https://royalsocietypublishing.org/doi/full/10.1098/rstb.2023.0403>

GEMA MARTIN-ORDAS – The constructive nature of memories in insects: bumblebees as a case study

The view that human memory is constructive implies that recollections are not necessarily an accurate reproduction of past events. An approach to study this constructive nature of memory is by examining memory errors. In this regard, conjunction

errors—i.e. incorrect recollection of new stimuli integrated by components from two previously studied stimuli—have attracted important attention in human memory research. Do animals other than humans make conjunction errors? To investigate this issue, a choice task in which training was not involved was used. Bees experienced two to-be-remembered stimuli. At the test, they were presented with four stimuli: one of the original items (i.e. old), an item made by combining two features of the original items (i.e. conjunction), an item containing a previously presented feature and a new one (i.e. feature), and an item integrated solely by new features (i.e. new). Bumblebees remembered the old items. Importantly, when making memory errors, bumblebees selected conjunction and feature lures more often than new items. These results indicate that bumblebees, like humans, spontaneously make memory conjunction errors and suggest that invertebrates' memories might also be constructive in nature. I suggest that focusing on memory errors is a solid avenue to investigate episodic (like) memory in animals.

<https://royalsocietypublishing.org/doi/full/10.1098/rstb.2023.0405>

DONNA ROSE ADDIS & KARL K. SZPUNAR – Beyond the episodic–semantic continuum: the multidimensional model of mental representations

Tulving's concept of mental time travel (MTT), and the related distinction of episodic and semantic memory, have been highly influential contributions to memory research, resulting in a wealth of findings and a deeper understanding of the neurocognitive correlates of memory and future thinking. Many models have conceptualized episodic and semantic representations as existing on a continuum that can help to account for various hybrid forms. Nevertheless, in most theories, MTT remains distinctly associated with episodic representations. In this article, we review existing models of memory and future thinking, and critically evaluate whether episodic representations are distinct from other types of explicit representations, including whether MTT as a neurocognitive capacity is uniquely episodic. We conclude by proposing a new framework, the Multidimensional Model of Mental Representations (MMMMR), which can parsimoniously account for the range of past, present and future representations the human mind is capable of creating.

<https://royalsocietypublishing.org/doi/full/10.1098/rstb.2023.0408>

FELIPE DE BRIGARD – Episodic memory without autothetic consciousness

Ever since Tulving's influential 1985 article 'Memory and consciousness', it has become traditional to think of autothetic consciousness as necessary for episodic memory. This paper questions this claim. Specifically, it argues that the construct of autothetic consciousness lacks validity and that, even if it was valid, it would still not be necessary for episodic memory. The paper ends with a proposal to go back to a functional/computational characterization of episodic memory in which its characteristic phenomenology is a contingent feature of the retrieval process and, as a result, open to empirical scrutiny. The proposal also dovetails with recent taxonomies of memory that are independent of conscious awareness and suggests strategies to evaluate within- and between-individual variability in the conscious experience of episodic memories in human and non-human agents.

<https://royalsocietypublishing.org/doi/abs/10.1098/rstb.2023.0410>

JONATHAN REDSHAW – The recursive grammar of mental time travel

One apparent feature of mental time travel is the ability to recursively embed temporal perspectives across different times: humans can remember how we anticipated the future and anticipate how we will remember the past. This recursive structure of mental time travel might be formalized in terms of a 'grammar' that is reflective of but more general than linguistic notions of absolute and relative tense. Here, I provide a foundation for this grammatical framework, emphasizing a bounded (rather than unbounded) recursive function that supports mental time travel to a limited temporal depth and to actual and possible scenarios. Anticipated counterfactual thinking, for instance, entails three levels of mental time travel to a possible scenario ('in the future, I will reflect on how my past self could have taken a different future action') and is centrally implicated in complex human decision-making. This perspective calls for further research into the mechanisms, ontogeny, functions and phylogeny of recursive mental time travel, and revives the question of links with other recursive forms of thinking such as theory of mind.

<https://royalsocietypublishing.org/doi/full/10.1098/rstb.2023.0412>

AMNON DAFNI-MEROM et al – Travelling beyond time: shared brain system for self-projection in the temporal, political and moral domains

Mental time travel (MTT), a cornerstone of human cognition, enables individuals to mentally project themselves into their past or future. It was shown that this self-projection may extend beyond the temporal domain to the spatial and social domains. What about higher cognitive domains? Twenty-eight participants underwent functional magnetic resonance imaging (fMRI) while self-projecting to different political, moral and temporal perspectives. For each domain, participants were asked to judge their relationship to various people (politicians, moral figures, personal acquaintances) from their actual or projected self-location. Findings showed slower, less accurate responses during self-projection across all domains. fMRI analysis revealed self-projection elicited brain activity at the precuneus, medial and dorsolateral prefrontal cortex, temporoparietal junction and anterior insula, bilaterally and right lateral temporal cortex. Notably, 23.5% of active voxels responded to all three domains and 27% to two domains, suggesting a shared brain system for self-projection. For ordinality

judgement (self-reference), 52.5% of active voxels corresponded to the temporal domain specifically. Self-projection activity overlapped mostly with the frontoparietal control network, followed by the default mode network, while self-reference showed a reversed pattern, demonstrating MTT's implication in spontaneous brain activity. MTT may thus be regarded as a 'mental-experiential travel', with self-projection as a domain-general construct and self-reference related mostly to time.

<https://royalsocietypublishing.org/doi/full/10.1098/rstb.2023.0414>

TONY J. PRESCOTT & PETER F. DOMINEY – Synthesizing the temporal self: robotic models of episodic and autobiographical memory

Episodic memories are experienced as belonging to a self that persists in time. We review evidence concerning the nature of human episodic memory and of the sense of self and how these emerge during development, proposing that the younger child experiences a persistent self that supports a subjective experience of remembering. We then explore recent research in cognitive architectures for robotics that has investigated the possibility of forms of synthetic episodic and autobiographical memory. We show that recent advances in generative modeling can support an understanding of the emergence of self and of episodic memory, and that cognitive architectures which include a language capacity are showing progress towards the construction of a narrative self with autobiographical memory capabilities for robots. We conclude by considering the prospects for a more complete model of mental time travel in robotics and the implications of this modeling work for understanding human episodic memory and the self in time.

<https://royalsocietypublishing.org/doi/full/10.1098/rstb.2023.0415>

HUNTER GENTRY & CAMERON BUCKNER – Transitional gradation and the distinction between episodic and semantic memory

In this article, we explore various arguments against the traditional distinction between episodic and semantic memory based on the metaphysical phenomenon of transitional gradation. Transitional gradation occurs when two candidate kinds A and B grade into one another along a continuum according to their characteristic properties. We review two kinds of arguments—from the gradual semanticization of episodic memories as they are consolidated, and from the composition of episodic memories during storage and recall from semantic memories—that predict the proliferation of such transitional forms. We further explain why the distinction cannot be saved from the challenges of transitional gradation by appealing to distinct underlying memory structures and applying our perspective to the impasse over research into 'episodic-like' memory in non-human animals. On the whole, we recommend replacing the distinction with a dynamic life cycle of memory in which a variety of transitional forms will proliferate, and illustrate the utility of this perspective by tying together recent trends in animal episodic memory research and recommending productive future directions.

<https://royalsocietypublishing.org/doi/10.1098/rstb.2023.0407>

JAMES R. DAVIES & NICOLA S. CLAYTON – Is episodic-like memory like episodic memory?

Episodic memory involves the conscious recollection of personally experienced events and when absent, results in profound losses to the typical human conscious experience. Over the last 2.5 decades, the debate surrounding whether episodic memory is unique to humans has seen a lot of controversy and accordingly has received significant research attention. Various behavioural paradigms have been developed to test episodic-like memory; a term designed to reflect the behavioural characteristics of episodic memory in the absence of evidence for consciously experienced recall. In this review, we first outline the most influential paradigms that have been developed to assess episodic-like memory across a variety of non-human taxa (including mammals, birds and cephalopods), namely the what–where–when memory, incidental encoding and unexpected question, and source memory paradigms. Then, we examine whether various key features of human episodic memory are conceptually represented in episodic-like memory across phylogenetically and neurologically diverse taxa, identifying similarities, differences and gaps in the literature. We conclude that the evidence is mixed, and as episodic memory encompasses a variety of cognitive structures and processes, research on episodic-like memory in non-humans should follow this multifaceted approach and assess evidence across various behavioural paradigms that each target different aspects of human episodic memory.

<https://royalsocietypublishing.org/doi/10.1098/rstb.2023.0397>

ELI COLLARO et al – Measuring episodic memory and mental time travel: crossing the species gap

Mental time travel is the projection of the mind into the past or future, and relates to experiential aspects of episodic memory, and episodic future thinking. Framing episodic memory and future thinking in this way causes a challenge when studying memory in animals, where demonstration of this mental projection is prevented by the absence of language. However, there is good evidence that non-human animals pass tests of episodic memory that are based on behavioural criteria, meaning a better understanding needs to be had of the relationship between episodic memory and mental time travel. We argue that mental time travel and episodic memory are not synonymous, and that mental time travel is neither a requirement of, nor an irrelevance to, episodic memory. Mental time travel can allow improved behavioural choices based on episodic memory, and work in all species (including humans) should include careful consideration of the behavioural outputs being measured.

<https://royalsocietypublishing.org/doi/10.1098/rstb.2023.0406>

COREY J. A. BRADSHAW et al – Small populations of Palaeolithic humans in Cyprus hunted endemic megafauna to extinction

The hypothesized main drivers of megafauna extinctions in the late Quaternary have wavered between over-exploitation by humans and environmental change, with recent investigations demonstrating more nuanced synergies between these drivers depending on taxon, spatial scale, and region. However, most studies still rely on comparing archaeologically based chronologies of timing of initial human arrival into naïve ecosystems and palaeontologically inferred dates of megafauna extinctions. Conclusions arising from comparing chronologies also depend on the reliability of dated evidence, dating uncertainties, and correcting for the low probability of preservation (Signor–Lipps effect). While some models have been developed to test the susceptibility of megafauna to theoretical offtake rates, none has explicitly linked human energetic needs, prey choice, and hunting efficiency to examine the plausibility of human-driven extinctions. Using the island of Cyprus in the terminal Pleistocene as an ideal test case because of its late human settlement (~14.2–13.2 ka), small area (~11 000 km²), and low megafauna diversity (2 species), we developed stochastic models of megafauna population dynamics, with offtake dictated by human energetic requirements, prey choice, and hunting-efficiency functions to test whether the human population at the end of the Pleistocene could have caused the extinction of dwarf hippopotamus (*Phanourios minor*) and dwarf elephants (*Palaeoloxodon cypriotes*). Our models reveal not only that the estimated human population sizes ($n = 3000\text{--}7000$) in Late Pleistocene Cyprus could have easily driven both species to extinction within < 1000 years, the model predictions match the observed, Signor–Lipps-corrected chronological sequence of megafauna extinctions inferred from the palaeontological record (*P. minor* at ~12–11.1 ka, followed by *P. cypriotes* at ~10.3–9.1 ka).

<https://royalsocietypublishing.org/doi/10.1098/rspb.2024.0967>

PLoS One**PAPERS****DAVID S. YIN & XIAOXIN YIN – Scaffolding learning: From specific to generic with large language models**

Large language models such as ChatGPT have been shown to excel in solving complex math problems. However, they cannot solve basic arithmetic problems such as $758 \times 639 = 484,362$. This makes us ponder if LLMs have been trained to solve math and science problems in the right way. When a student learns math at school, she or he starts with arithmetic, then moves to word problems, polynomials, and calculus. Each skill she or he acquires will be used in the next stage to solve more advanced problems. In this paper we propose Scaffolding Learning for LLMs, which imitates how a student learns a subject in a step-by-step manner. For example, we first train an LLM to perform highly specific operations such as multiplication and division, and then apply such “skills” in a more generic task such as solving word problems. This is related to Curriculum Training, which trains a model on tasks following a specific order, such as training on easy tasks first and then gradually increases the difficulty. Our proposed approach goes from specific tasks to generic ones, which can be considered as a special case of Curriculum Training. Our empirical studies show that when an LLM has “mastered” a specific skill, only a small amount of training is required to teach it to apply the skill to a more generic application.

<https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0310409>

HOLLY E. JENKINS et al – Assessing processing-based measures of implicit statistical learning: Three serial reaction time experiments do not reveal artificial grammar learning

Implicit statistical learning, whereby predictable relationships between stimuli are detected without conscious awareness, is important for language acquisition. However, while this process is putatively implicit, it is often assessed using measures that require explicit reflection and conscious decision making. Here, we conducted three experiments combining an artificial grammar learning paradigm with a serial reaction time (SRT-AGL) task, to measure statistical learning of adjacent and nonadjacent dependencies implicitly, without conscious decision making. Participants viewed an array of six visual stimuli and were presented with a sequence of three auditory (nonsense words, Expt. 1; names of familiar objects, Expt. 2) or visual (abstract shapes, Expt. 3) cues and were asked to click on the corresponding visual stimulus as quickly as possible. In each experiment, the final stimulus in the sequence was predictable based on items earlier in the sequence. Faster responses to this predictable final stimulus compared to unpredictable stimuli would provide evidence of implicit statistical learning, without requiring explicit decision making or conscious reflection. Despite previous positive results (Christiansen et al. 2009 and Misyak et al. 2010) we saw little evidence of implicit statistical learning in any of the experiments, suggesting that in this case, these SRT-AGL tasks were not an effective measure [of] implicit statistical learning.

<https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0308653>

CECILIA BARROSO-MEDINA et al – Design and development of a sensorized hammerstone for accurate force measurement in stone knapping experiments

The process of making stone tools, specifically knapping, is a hominin behaviour that typically involves using the upper limb to manipulate a stone hammer and apply concentrated percussive force to another stone, causing fracture and detachment of stone chips with sharp edges. To understand the emergence and subsequent evolution of tool-related behaviours in hominins, the connections between the mechanics of stone knapping, including the delivery of percussive forces, and biomechanics and hominin anatomy, especially in the upper limb, are required. However, there is an absence of direct

experimental means to measure the actual forces generated and applied to produce flakes during knapping. Our study introduces a novel solution to this problem in the form of an ergonomic hand-held synthetic hammerstone that can record the percussive forces that occur during knapping experiments. This hammerstone is composed of a deformable pneumatic 3D-printed chamber encased within a 3D-printed grip and a stone-milled striker. During knapping, hammer impact causes the pneumatic chamber to deform, which leads to a change in pressure that is measured by a sensor. Comparisons of recorded pressure data against corresponding force values measured using a force plate show that the synthetic hammer quantifies percussion forces with relatively high accuracy. The performance of this hammerstone was further validated by conducting anvil-supported knapping experiments on glass that resulted in a root mean square error of under 6%, while recording forces up to 730 N with successful flake detachments. These validation results indicate that accuracy was not sensitive to variations up to 15° from the vertical in the hammer striking angle. Our approach allows future studies to directly examine the role of percussive force during the stone knapping process and its relationship with both anatomical and technological changes during human evolution.

<https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0310520>

JULIEN BENOIT – A possible later stone age painting of a dicynodont (Synapsida) from the South African Karoo

The Horned Serpent panel at La Belle France (Free State Province, South Africa) was painted by the San at least two hundred years ago. It pictures, among many other elements, a tusked animal with a head that resembles that of a dicynodont, the fossils of which are abundant and conspicuous in the Karoo Basin. This picture also seemingly relates to a local San myth about large animals that once roamed southern Africa and are now extinct. This suggests the existence of a San geomyth about dicynodonts. Here, the La Belle France site has been visited, the existence of the painted tusked animal is confirmed, and the presence of tetrapod fossils in its immediate vicinity is supported. Altogether, they suggest a case of indigenous palaeontology. The painting is dated between 1821 and 1835, or older, making it at least ten years older than the formal scientific description of the first dicynodont, *Dicynodon lacerticeps*, in 1845. The painting of a dicynodont by the San would also suggest that they integrated (at least some) fossils into their belief system.

<https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0309908>

Science

ARTICLES

INBAL BEN-AMI BARTAL – The complex affective and cognitive capacities of rats

For several decades, although studies of rat physiology and behavior have abounded, research on rat emotions has been limited in scope to fear, anxiety, and pain. Converging evidence for the capacity of many species to share others' affective states has emerged, sparking interest in the empathic capacities of rats. Recent research has demonstrated that rats are a highly cooperative species and are motivated by others' distress to prosocial actions, such as opening a door or pulling a chain to release trapped conspecifics. Studies of rat affect, cognition, and neural function provide compelling evidence that rats have some capacity to represent others' needs, to instrumentally act to improve their well-being, and are thus capable of forms of targeted helping. Rats' complex abilities raise the importance of integrating new measures of rat well-being into scientific research.

<https://www.science.org/doi/10.1126/science.adq6217>

Trends in Cognitive Sciences

PAPERS

TANIA LOMBROZO – Learning by thinking in natural and artificial minds

Canonical cases of learning involve novel observations external to the mind, but learning can also occur through mental processes such as explaining to oneself, mental simulation, analogical comparison, and reasoning. Recent advances in artificial intelligence (AI) reveal that such learning is not restricted to human minds: artificial minds can also self-correct and arrive at new conclusions by engaging in processes of 'learning by thinking' (LbT). How can elements already in the mind generate new knowledge? This article aims to resolve this paradox, and in so doing highlights an important feature of natural and artificial minds – to navigate uncertain environments with variable goals, minds with limited resources must construct knowledge representations 'on demand'. LbT supports this construction.

[https://www.cell.com/trends/cognitive-sciences/fulltext/S1364-6613\(24\)00191-8](https://www.cell.com/trends/cognitive-sciences/fulltext/S1364-6613(24)00191-8)

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