

EAORC BULLETIN 1,106 – 25 August 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 – The origin of bone tool technology

In Francesco d'Errico & Lucinda Backwell (eds.), From Tools to Symbols: from Early Hominids to Modern Humans, Wits University Press, 238-275 (2014).

LUCINDA BACKWELL & FRANCESCO D'ERRICO – The origin of bone tool technology and the identification of early hominid cultural traditions

A number of natural processes occurring during the life of an animal or after its death can produce pseudo-tools, mimics of human-made objects. A number of purported bone tools from Lower and Middle Palaeolithic sites have been published without any validating microscopic analysis of the bone surfaces showing possible traces of manufacture and use. This paper discusses the evolutionary significance of bone tool technology and summarises results of research on the use of bone tools by early hominids between one and two million years ago (Mya). It attempts to establish formal criteria for the identification of minimally modified bone tools by characterising the modifications produced by known human and non-human agents, and applying these criteria to the purported bone tool collections from Swartkrans, Sterkfontein and Olduvai Gorge. A number of experiments involving a variety of tasks were conducted in order to increase the range of diagnostic features available. New analytical techniques have been developed for the quantification of microscopic use-wear, and a wide range of taphonomic and morphometric variables have been used to isolate idiosyncratic populations of specimens for which a robust argument can be made for their identification as tools. South and East African early hominid sites dated to between 1,8 Mya and 1 Mya have yielded what appear to be very different types of bone tools. The former are characterised by long bone shaft fragments and horn-cores of medium to large-sized bovids, collected by hominids after weathering, and possibly used in specialised digging activities. Most fragments were used as such, though a few horn-cores were modified by grinding the tips to points on sandstone or compact abrasive sediment. Those from East Africa mainly consist of freshly broken, or more rarely, complete irregular bones from very large mammals, used as such, or modified by flaking. Irregular bones or epiphyses appear to have been used as hammers, while the others were apparently involved in a variety of light- and heavy-duty activities. Based on the bone tool manufacturing techniques recorded in the two regions, there appear to be no significant differences between the cognitive abilities of the hominid users. Evidence of intentional flaking by knapping seen on the Olduvai bone tools, and traces of grinding on those from South Africa, suggests that the makers of the tools had a clear

understanding of the properties of bone, could anticipate the end product, and conceived shaping techniques specific to this raw material in order to achieve optimal efficiency in the tasks for which they were used.

[https://www.academia.edu/7668376/From Tools to Symbols from Early Hominids to Modern Humans edited by Francesco dErrico and Lucinda Backwell 2005 Johannesburg Wits University Press ISBN 1 86814 434 8 hardback 38 94 and US 59 95 ISBN 1 86814 411 9 paperback 26 49 and US 39 95 xxxii 574 pp 140 figs 33 tables](https://www.academia.edu/7668376/From_Tools_to_Symbols_from_Early_Hominids_to_Modern_Humans_edited_by_Francesco_dErrico_and_Lucinda_Backwell_2005_Johannesburg_Wits_University_Press_ISBN_1_86814_434_8_hardback_38_94_and_US_59_95_ISBN_1_86814_411_9_paperback_26_49_and_US_39_95_xxxii_574_pp_140_figs_33_tables)

ACADEMIA.EDU – Semiotics and the Origin of Language in the Lower Palaeolithic

Journal of Archaeological Method and Theory 28, 535-579 (2021).

LAWRENCE BARHAM & DANIEL EVERETT – Semiotics and the Origin of Language in the Lower Palaeolithic

This paper argues that the origins of language can be detected one million years ago, if not earlier, in the archaeological record of *Homo erectus*. This controversial claim is based on a broad theoretical and evidential foundation with language defined as communication based on symbols rather than grammar. Peirce's theory of signs (semiotics) underpins our analysis with its progression of signs (icon, index and symbol) used to identify artefact forms operating at the level of symbols. We draw on generalisations about the multiple social roles of technology in pre-industrial societies and on the contexts tool-use among non-human primates to argue for a deep evolutionary foundation for hominin symbol use. We conclude that symbol-based language is expressed materially in arbitrary social conventions that permeate the technologies of *Homo erectus* and its descendants, and in the extended planning involved in the caching of tools and in the early settlement of island Southeast Asia.

[https://www.academia.edu/95925257/Semiotics and the Origin of Language in the Lower Palaeolithic](https://www.academia.edu/95925257/Semiotics_and_the_Origin_of_Language_in_the_Lower_Palaeolithic)

NEWS

NATURE BRIEFING – There is a black market in fake citations

Researchers went undercover to confirm what many research-integrity sleuths have long suspected: there is a black market for fake citations used to pad scientists' Google Scholar profiles. The investigators paid US\$300 to a firm that sold them 50 citations from studies in 22 journals — 14 of which are indexed in the scholarly database Scopus. "When a manuscript acquires hundreds of citations within days of publication, or when a scientist has an abrupt and large rise in citations, you know something is wrong," says computer scientist Yasir Zaki, who took part in the sting operation.

<https://www.nature.com/articles/d41586-024-01672-7>

SCIAM NEWS – Elephants Call Individuals' Names across the Savanna

Female elephants address one another with individualized rumbles.

<https://www.scientificamerican.com/article/elephants-call-their-relatives-by-name-across-the-savanna/>

SCIAM NEWS – Science Improves When People Realize They Were Wrong

Science means being able to change your mind in light of new evidence.

<https://www.scientificamerican.com/article/science-improves-when-people-realize-they-were-wrong/>

SCIENCEADVISER – A whale of a tool

Many animals use tools to help snag their supper, from rock-wielding sea otters to crocodiles that use sticks as bait to lure nest-building birds. But only a handful of species—including crows, chimpanzees, and orangutans—can make and modify tools the way we humans do. Now, thanks to new research, this elite club may have a new member: the humpback whale. Scientists have known for a while that these strapping cetaceans use their blowholes to release rings of bubbles underwater, creating specialized "bubble-nets" to herd, stun, and catch krill close to the ocean's surface. According to a new study, however, solitary humpbacks in southeast Alaska don't just make nets—they also manipulate them in sophisticated ways. "These whales skillfully blow bubbles in patterns that form nets with internal rings, actively controlling details like the number of rings, the size and depth of the net, and the spacing between bubbles," study author Lars Bejder explains in a statement. This method helps the animals to maximize their food intake, capturing up to seven times more prey in a single dive. These extra calories are invaluable, since these migratory whales must gorge themselves during the summer and fall to prepare for their 3000 mile journey to Hawai'i in the winter.

The researchers had to get creative to study humpbacks in their remote habitat, relying on drones and specialized tracking tags outfitted with suction cups to capture evidence of their unique hunting strategy. According to study author Andy Szabo, the whales' creativity may help them resist the effects of habitat destruction, climate change, and other threats: "It is this behavioral flexibility and ingenuity that I hope will serve these whales well as our oceans continue to change."

<https://royalsocietypublishing.org/doi/10.1098/rsos.240328>

SCIENCE DAILY – AI poses no existential threat to humanity, new study finds

Large Language Models (LLMs) are entirely controllable through human prompts and lack 'emergent abilities'; that is, the means to form their own insights or conclusions. Increasing model size does not lead LLMs to gain emergent reasoning

abilities, meaning they will not develop hazardous abilities and therefore do not pose an existential threat. A new study sheds light on the (until now unexplained) capabilities and shortcomings of LLMs, including the need for carefully engineered prompts to exhibit good performance.

<https://www.sciencedaily.com/releases/2024/08/240812165443.htm>

SCIENCE DAILY – How 'winner and loser effects' impact social rank in animals -- and humans

A new article provides a narrative review of the relevant similarities and distinctions between nonhumans and humans to assess the causes and consequences of winner and loser effects in humans.

<https://www.sciencedaily.com/releases/2024/08/240819130756.htm>

SCIENCE DAILY – In subdivided communities cooperative norms evolve more easily

Researchers simulated social norms with a supercomputer. Their findings contribute to a deeper understanding of the evolution of social norms and their role in fostering cooperative behavior.

<https://www.sciencedaily.com/releases/2024/08/240814124504.htm>

SCIENCE DAILY – Larger teams in academic research worsen career prospects, study finds

Researchers reveal that individuals who finish their PhD in situations where the average team in their field is larger have worse academic career options.

<https://www.sciencedaily.com/releases/2024/08/240814124427.htm>

SCIENCE DAILY – Fossil hotspots in Africa obscure a more complete picture of human evolution

A new study shows how the mismatch between where fossils are preserved and where humans likely lived may influence our understanding of early human evolution.

<https://www.sciencedaily.com/releases/2024/08/240820124505.htm>

SCIENCE DAILY – More academic freedom leads to more innovation

The innovative strength of a society depends on the level of academic freedom. An international team has now demonstrated this relationship. The researchers analyzed patent applications and patent citations in a sample from around 160 countries over the 1900–2015 period in relation to indicators used in the Academic Freedom Index. In view of the global decline in academic freedom over the past 10 years, the researchers predict a loss in innovative output.

<https://www.sciencedaily.com/releases/2024/08/240821124350.htm>

SCIENCE DAILY – Humpbacks are among animals who manufacture and wield tools

Researchers suggest a new designation of the humpback whales they study: tool wielders. Researchers have known that humpback whales create "bubble-nets" to hunt, but they have learned that the animals don't just create the bubble-nets; they manipulate this unique tool in a variety of ways to maximize their food intake in Alaskan feeding grounds.

<https://www.sciencedaily.com/releases/2024/08/240820221814.htm>

SCIENCE.ORG NEWS – Larger teams worsen academic career prospects

As teams grow, new Ph.D. graduates are less likely to land tenure-track jobs and more likely to leave science—especially women and international researchers.

<https://www.science.org/content/article/larger-teams-worsen-academic-career-prospects>

THE CONVERSATION – Babies and animals can't tell us if they have consciousness

Dogs and infants may not be able to tell us what they're thinking, but we are developing the tools that will help us find out.

<https://theconversation.com/babies-and-animals-cant-tell-us-if-they-have-consciousness-but-philosophers-and-scientists-are-starting-to-find-answers-235138>

THE CONVERSATION – What the unique shape of the human heart tells us about our evolution

New research reveals that the human heart has evolved distinct structural and functional traits that set it apart from our closest great ape relatives.

<https://theconversation.com/what-the-unique-shape-of-the-human-heart-tells-us-about-our-evolution-235463>

PUBLICATIONS

American Journal of Biological Anthropology

PAPERS

DEAN FALK & ASSAF MAROM – The DNH 7 endocast of *Paranthropus robustus* from Drimolen, South Africa: Reconsidering the functional significance of an enlarged occipital-marginal (O/M) sinus system in robust australopithecines

This paper presents a detailed analysis of the endocast of one of the most complete *Paranthropus robustus* crania known, DNH 7, from the Drimolen site (South Africa), and compares it with the morphology of other australopithecine endocasts. We focus on endocranial volume, the impressions of cortical sulci, cranial sutures, and the pattern of cranial venous sinuses on the endocast. A noteworthy observation is the estimated endocranial capacity of 403 cm³, which is small for an adult *Paranthropus*. Fragmentary sulci identified in the frontal and temporal lobes of DNH 7 exhibit similarities with patterns observed in chimpanzees and gracile australopithecines. We observe the presence of a large remnant of an occipital-marginal sinus on DNH 7 and provide an updated table of 13 *Paranthropus* endocasts that are scorable for this trait, which reinforces the hypothesis that an enlarged occipital-marginal (O/M) sinus system was fixed across the three species of *Paranthropus*. In light of this, the possible functional significance of the occipital-marginal sinus system is reevaluated considering the ontogenetic development of cranial venous blood flow in human children. This leads us to hypothesize that the ontogenetic development of cranial blood flow in *Paranthropus* and *Australopithecus africanus* infants were different and to suggest that Taung 1 was the only *A. africanus* specimen known to have exhibited an enlarged O/M sinus system because it was an immature individual.

<https://onlinelibrary.wiley.com/doi/full/10.1002/ajpa.25010>

RAFAEL OMAR SÁNCHEZ-VIDAL et al – Acoustic recognition of predators by mantled howler monkeys (*Alouatta palliata*): A playback experiment with naïve and experienced subjects

When the production of antipredator behaviors is costly, prey is expected to stop displaying such behaviors and lose the ability to recognize extirpated predators. However, the loss or maintenance of predator recognition abilities is conditional on the eco-evolutionary context of prey. Here, we examined the behavioral responses of naïve and experienced mantled howler monkeys (*Alouatta palliata*) to simulated acoustic cues from natural predators.

We studied experienced individuals in the Uxpanapa Valley and naïve individuals in Los Tuxtlas (Veracruz, México). Jaguars (*Panthera onca*) and harpy eagles (*Harpia harpyja*), the main predators of howler monkeys, are extant in the Uxpanapa Valley but have been extirpated in Los Tuxtlas for approximately 70 and 45 years, respectively. We exposed six naïve and six experienced groups to playbacks of acoustic stimuli from the two predators and a non-predator control species (plain chachalacas, *Ortalis vetula*), and recorded the latency, frequency, and duration of antipredation behaviors (n = 127 trials). In contrast with experienced mantled howler monkeys, naïve subjects did not respond to trials from harpy eagles. However, response patterns were generally similar between naïve and experienced individuals when exposed to jaguar stimuli. Our findings suggest that naïve mantled howler monkeys do not recognize harpy eagle calls, but they respond to jaguar calls in a manner consistent with experienced individuals. These results illustrate how different mechanisms for the recognition of extirpated predators operate within a single species according to evolutionary and ecological experience.

<https://onlinelibrary.wiley.com/doi/abs/10.1002/ajpa.25013>

Current Biology

ARTICLES

JASON D. YEATMAN – Primate brain: A unique connection between dorsal and ventral visual cortex

In humans and other primates, vision is subserved by at least two parallel processing streams that are interconnected through a pathway known as the vertical occipital fasciculus. New research reveals that this white matter pathway may be a unique feature of the primate brain.

[https://www.cell.com/current-biology/abstract/S0960-9822\(24\)00849-2](https://www.cell.com/current-biology/abstract/S0960-9822(24)00849-2)

JONATHAN D. CRYSTAL – Comparative cognition: Free-living birds remember things past

New research suggests that free-living blue and great tits remember foraging, including food type, location, and time since eating, even when event details were not known to be relevant for a subsequent assessment of memory, implicating the use of episodic memory in natural behavior.

[https://www.cell.com/current-biology/abstract/S0960-9822\(24\)00930-8](https://www.cell.com/current-biology/abstract/S0960-9822(24)00930-8)

PAPERS

LIUBA PAPEO et al – Abstract thematic roles in infants' representation of social events

Infants' thoughts are classically characterized as iconic, perceptual-like representations. Less clear is whether preverbal infants also possess a propositional language of thought, where mental symbols are combined according to syntactic rules, very much like words in sentences. Because it is rich, productive, and abstract, a language of thought would provide a key to

explaining impressive achievements in early infancy, from logical inference to representation of false beliefs. A propositional language—including a language of thought ψ —implies thematic roles that, in a sentence, indicate the relation between noun and verb phrases, defining who acts on whom; i.e., who is the agent and who is the patient. Agent and patient roles are abstract in that they generally apply to different situations: whether A kicks, helps, or kisses B, A is the agent and B is the patient. Do preverbal infants represent abstract agent and patient roles? We presented 7-month-olds ($n = 143$) with sequences of scenes where the posture or relative positioning of two individuals indicated that, across different interactions, A acted on B. Results from habituation (experiment 1) and pupillometry paradigms (experiments 2 and 3) demonstrated that infants showed surprise when roles eventually switched (B acted on A). Thus, while encoding social interactions, infants fill in an abstract relational structure that marks the roles of agent and patient and that can be accessed via different event scenes and properties of the event participants (body postures or positioning). This mental process implies a combinatorial capacity that lays the foundations for productivity and compositionality in language and cognition.

[https://www.cell.com/current-biology/abstract/S0960-9822\(24\)01020-0](https://www.cell.com/current-biology/abstract/S0960-9822(24)01020-0)

VEITH WEILNHAMMER, YUKI MURAI & DAVID WHITNEY – Dynamic predictive templates in perception

Hallucinations are vivid and transient experiences of objects, such as images or sounds, that occur in the absence of a corresponding stimulus. To understand the neurocomputational mechanisms of hallucinations, cognitive neuroscience has focused on experiments that induce false alarms (FAs) in healthy participants, psychosis-prone individuals, and patients diagnosed with schizophrenia. FAs occur when participants make decisions about difficult-to-detect stimuli and indicate the presence of a signal that was, in fact, not presented. Since FAs are, at heart, reports, they must meet two criteria to serve as an experimental proxy for hallucinations: first, FAs should reflect perceptual states that are characterized by specific contents (criterion 1). Second, FAs should occur on a timescale compatible with the temporal dynamics of hallucinations (criterion 2). In this work, we combined a classification image approach with hidden Markov models to show that FAs can match the perceptual and temporal characteristics of hallucinations. We asked healthy human participants to discriminate visual stimuli from noise and found that FAs were more likely to occur during an internal mode of sensory processing, a minute-long state of the brain during which perception is strongly biased toward previous experiences (serial dependency). Our results suggest that hallucinations are driven by dynamic predictive templates that transform noise into transient, coherent, and meaningful perceptual experiences.

[https://www.cell.com/current-biology/fulltext/S0960-9822\(24\)01026-1](https://www.cell.com/current-biology/fulltext/S0960-9822(24)01026-1)

ELLEN BIALYSTOK – Bilingualism modifies cognition through adaptation, not transfer

The standard explanation for bilingual effects on cognition is that an aspect of language processing transfers to nonverbal cognitive performance, leading to improvements in executive functioning. However, much evidence is incompatible with that view, and transfer across those domains seems unlikely. The present argument is that bilingual experience modifies cognition through an adaptation to the underlying attention system, making attention more efficient. ‘Transfer’ focuses on the overlap of specific processes, so task similarity predicts outcomes. By contrast, ‘adaptation’ focuses on recruitment of the modified resource, so the degree of attention required predicts outcome. In this view, bilinguals require less attentional effort than monolinguals for similar levels of performance, and outperform monolinguals on tasks with high attention demands regardless of task similarity.

[https://www.cell.com/trends/cognitive-sciences/abstract/S1364-6613\(24\)00199-2](https://www.cell.com/trends/cognitive-sciences/abstract/S1364-6613(24)00199-2)

eLife

PAPERS

ISAÏH SCHWAB-MOHAMED et al – Bridging verbal coordination and neural dynamics

Our use of language, which is profoundly social in nature, essentially takes place in interactive contexts and is shaped by precise coordination dynamics that interlocutors must observe. Thus language interaction is high demanding on fast adjustment of speech production. Here, we developed a real-time coupled-oscillators virtual partner that allows - by changing the coupling strength parameters - to modulate the ability to synchronise speech with a speaker. Then, we recorded the intracranial brain activity of 16 patients with drug-resistant epilepsy while they performed a verbal coordination task with the virtual partner (VP). More precisely, patients had to repeat short sentences synchronously with the VP. This synchronous speech task is efficient to highlight both the dorsal and ventral language pathways. Importantly, combining time-resolved verbal coordination and neural activity shows more spatially differentiated patterns and different types of neural sensitivity along the dorsal pathway. More precisely, high-frequency activity in secondary auditory regions is highly sensitive to verbal coordinative dynamics, while primary regions are not. Finally, the high-frequency activity of the IFG BA44 seems to specifically index the online coordinative adjustments that are continuously required to compensate deviation from synchronisation. These findings illustrate the possibility and value of using a fully dynamic, adaptive and interactive language task to gather deeper understanding of the subtending neural dynamics involved in speech perception, production as well as their interaction.

<https://elifesciences.org/reviewed-preprints/99547>

Frontiers in Human Neuroscience

PAPERS

ANANTAJIT SUBRAHMANYA et al – Pitch corrections occur in natural speech and are abnormal in patients with Alzheimer's disease

Past studies have explored formant centering, a corrective behavior of convergence over the duration of an utterance toward the formants of a putative target vowel. In this study, we establish the existence of a similar centering phenomenon for pitch in healthy elderly controls and examine how such corrective behavior is altered in Alzheimer's Disease (AD). We found the pitch centering response in healthy elderly was similar when correcting pitch errors below and above the target (median) pitch. In contrast, patients with AD showed an asymmetry with a larger correction for the pitch errors below the target phonation than above the target phonation. These findings indicate that pitch centering is a robust compensation behavior in human speech. Our findings also explore the potential impacts on pitch centering from neurodegenerative processes impacting speech in AD.

<https://www.frontiersin.org/journals/human-neuroscience/articles/10.3389/fnhum.2024.1424920/full>

Heliyon

PAPERS

VANDITA GROVER & HEMA BANATI – An Attention Approach to Emoji Focused Sarcasm Detection

Emojis play a nuanced role in digital communication and have a potential to convey sarcastic intent as they often offer non-explicit and sometimes ambiguous cues. This ambiguity has a potential to fuel hate-speech, trolling, or cyber-bullying under the guise of sarcasm. There have been numerous studies that employ modalities like audio, images, videos, emojis or a combination of modalities to detect sarcasm in online text. There is limited research that focuses solely on the impact of emojis in discerning sarcasm. Therefore, in this work we use popular attention networks to capture if sarcasm classification can be improved when emojis are present in text. We experiment with LSTM, Bi-LSTM, and attention networks and compare the results with the fine-tuned benchmark DeepMoji model. Our experiments demonstrate that the emojis can help improve sarcasm classification. These models outperform the benchmark DeepMoji model on two different test datasets on Matthew's correlation coefficient and Area under the curve metrics. Our proposed models surpass DeepMoji by an increase in 0.22 and 0.25 when compared for MCC and an increase in 13.3% and 14.76% for the ROC-AUC metric.

[https://www.cell.com/heliyon/fulltext/S2405-8440\(24\)12429-2](https://www.cell.com/heliyon/fulltext/S2405-8440(24)12429-2)

Interface: Journal of the Royal Society

PAPERS

JONATHAN S. REEVES et al with TOMOS PROFFITT – Searching for the earliest archaeological record: insights from chimpanzee material landscapes

The origin of tool use is a central question in human evolutionary studies. Plio-Pleistocene core and flake technologies represent the earliest evidence of tool use in the human lineage. Some suggest this form of tool use is probably pre-dated by a phase of percussive tool use. However, there is currently no evidence for such a record. The archaeological signature of solely percussive behaviours is not as well understood as that associated with cores and flakes. The durable nature of primate percussive stone tools and their by-products provide an opportunity to investigate what such a record looks like. Here, we present a landscape-scale study of the chimpanzee (*Pan troglodytes verus*) material culture from the Djouroutou Chimpanzee Project, Taï Forest, Cote d'Ivoire. This study explores the interplay between behavioural and environmental factors in shaping the stone record of nut cracking. Through a survey of nut-cracking sites, the available nut species, and raw materials, we show how resource availability influences the resulting material signature of nut cracking. These results also reveal the diversity of material signatures associated with a purely percussive material record. We gain insight into the range of signatures that may be associated with a pre-core and flake archaeological record, providing new expectations for an earlier record of tool use.

<https://royalsocietypublishing.org/doi/10.1098/rsif.2024.0101>

iScience

PAPERS

ROKSANA MARKIEWICZ, KATRIEN SEGAERT & ALI MAZAHERI – Brain-to-brain coupling forecasts future joint action outcomes

In this study, we investigated whether brain-to-brain coupling patterns could predict performance in a time-estimation task which requires two players to cooperate. The participant pairs, were tasked with synchronising button presses after converging on a shared representation of 'short', 'medium', and 'long' time intervals while utilizing feedback to adjust responses. We employed EEG-hyperscanning and focused on post-feedback brain activity. We found that negative feedback led to increased frontal mid-line theta activity across individuals. Moreover, a correlation in post-feedback theta power between players forecasted failed joint action, while an anti-correlation forecasted success. These findings suggest that temporally coupled feedback related brain activity between two individuals serves as an indicator of redundancy in adjustment of a common goal representation. Additionally, the anti-correlation of this activity reflects cognitive strategic

mechanisms that ensure optimal joint action outcomes. Rather than a paired overcompensation, successful cooperation requires flexible strategic agility from both partners.

[https://www.cell.com/iscience/fulltext/S2589-0042\(24\)02027-3](https://www.cell.com/iscience/fulltext/S2589-0042(24)02027-3)

Nature Communications

PAPERS

GWENNA BRETON et al – BaTwa populations from Zambia retain ancestry of past hunter-gatherer groups

Sub-equatorial Africa is today inhabited predominantly by Bantu-speaking groups of Western African descent who brought agriculture to the Luangwa valley in eastern Zambia ~2000 years ago. Before their arrival the area was inhabited by hunter-gatherers, who in many cases were subsequently replaced, displaced or assimilated. In Zambia, we know little about the genetic affinities of these hunter-gatherers. We examine ancestry of two isolated communities in Zambia, known as BaTwa and possible descendants of recent hunter-gatherers. We genotype over two million genome-wide SNPs from two BaTwa populations (total of 80 individuals) and from three comparative farming populations to: (i) determine if the BaTwa carry genetic links to past hunter-gatherer-groups, and (ii) characterise the genetic affinities of past Zambian hunter-gatherer-groups. The BaTwa populations do harbour a hunter-gatherer-like genetic ancestry and Western African ancestry. The hunter-gatherer component is a unique local signature, intermediate between current-day Khoe-San ancestry from southern Africa and central African rainforest hunter-gatherer ancestry.

<https://www.nature.com/articles/s41467-024-50733-y>

Nature Ecology & Evolution

ARTICLES

W. ANDREW BARR – Spatial bias in the fossil record affects understanding of human evolution

Using modern mammals as analogues, we investigate how spatial bias in the early human fossil record probably influences understanding of human evolution. Our results suggest that the environmental and fossil records from palaeoanthropological hotspots are probably missing aspects of environmental and anatomical variation.

<https://www.nature.com/articles/s41559-024-02524-3>

PAPERS

W. ANDREW BARR & BERNARD WOOD – Spatial sampling bias influences our understanding of early hominin evolution in eastern Africa

The eastern branch of the Eastern African Rift System (EARS) is the source of a large proportion of the early hominin fossil record, but it covers a tiny fraction (ca. 1%) of the continent. Here we investigate how this mismatch between where fossils are preserved and where hominins probably lived may influence our ability to understand early hominin evolution, using extant mammals as analogues. We show that the eastern branch of the EARS is not an environmentally representative sample of the full species range for nearly all extant rift-dwelling mammals. Likewise, when we investigate published morphometric datasets for extant cercopithecine primates, evidence from the eastern branch alone fails to capture major portions of continental-scale cercopithecine cranial morphospace. We suggest that extant rift-dwelling species should be used as analogues to place confidence intervals on hominin habitat reconstructions. Furthermore, given the north–south orientation of the eastern branch of the EARS, morphoclines that are not aligned along this major north–south axis are likely to be poorly sampled by sites in the eastern branch. There is a pressing need for research on the geography of early hominin morphoclines to estimate how morphologically representative the hominin fossil sample from the eastern branch may be.

<https://www.nature.com/articles/s41559-024-02522-5>

Nature Human Behaviour

ARTICLES

ELSPETH HAYES – Twelve thousand years of ritual practice

It is rare to formally identify ethnographically known rituals in the archaeological record that are more than a few hundred years old. David et al. report two buried miniature fireplaces from Cloggs Cave, southeastern Australia, that match the structure and contents of ethnographically known Australian Aboriginal rituals, which signals 500 generations of cultural tradition.

<https://www.nature.com/articles/s41562-024-01916-6>

PAPERS

DREW H. BAILEY et al – Causal inference on human behaviour

Making causal inferences regarding human behaviour is difficult given the complex interplay between countless contributors to behaviour, including factors in the external world and our internal states. We provide a non-technical conceptual overview of challenges and opportunities for causal inference on human behaviour. The challenges include our ambiguous causal language and thinking, statistical under- or over-control, effect heterogeneity, interference, timescales of effects and complex treatments. We explain how methods optimized for addressing one of these challenges frequently exacerbate other

problems. We thus argue that clearly specified research questions are key to improving causal inference from data. We suggest a triangulation approach that compares causal estimates from (quasi-)experimental research with causal estimates generated from observational data and theoretical assumptions. This approach allows a systematic investigation of theoretical and methodological factors that might lead estimates to converge or diverge across studies.

<https://www.nature.com/articles/s41562-024-01939-z>

BRUNO DAVID et al with GUNAIKURNAI LAND AND WATERS ABORIGINAL CORPORATION – Archaeological evidence of an ethnographically documented Australian Aboriginal ritual dated to the last ice age

In societies without writing, ethnographically known rituals have rarely been tracked back archaeologically more than a few hundred years. At the invitation of GunaiKurnai Aboriginal Elders, we undertook archaeological excavations at Cloggs Cave in the foothills of the Australian Alps. In GunaiKurnai Country, caves were not used as residential places during the early colonial period (mid-nineteenth century CE), but as secluded retreats for the performance of rituals by Aboriginal medicine men and women known as ‘mulla-mullung’, as documented by ethnographers. Here we report the discovery of buried 11,000- and 12,000-year-old miniature fireplaces with protruding trimmed wooden artefacts made of Casuarina wood smeared with animal or human fat, matching the configuration and contents of GunaiKurnai ritual installations described in nineteenth-century ethnography. These findings represent 500 generations of cultural transmission of an ethnographically documented ritual practice that dates back to the end of the last ice age and that contains Australia’s oldest known wooden artefacts.

<https://www.nature.com/articles/s41562-024-01912-w>

Nature Scientific Reports

PAPERS

CORENTIN PUFFAY et al – Classifying coherent versus nonsense speech perception from EEG using linguistic speech features

When a person listens to natural speech, the relation between features of the speech signal and the corresponding evoked electroencephalogram (EEG) is indicative of neural processing of the speech signal. Using linguistic representations of speech, we investigate the differences in neural processing between speech in a native and foreign language that is not understood. We conducted experiments using three stimuli: a comprehensible language, an incomprehensible language, and randomly shuffled words from a comprehensible language, while recording the EEG signal of native Dutch-speaking participants. We modeled the neural tracking of linguistic features of the speech signals using a deep-learning model in a match-mismatch task that relates EEG signals to speech, while accounting for lexical segmentation features reflecting acoustic processing. The deep learning model effectively classifies coherent versus nonsense languages. We also observed significant differences in tracking patterns between comprehensible and incomprehensible speech stimuli within the same language. It demonstrates the potential of deep learning frameworks in measuring speech understanding objectively.

<https://www.nature.com/articles/s41598-024-69568-0>

SIBYLLA LEON GUERRERO, LAURA MESITE & GIGI LUK – Distinct functional connectivity patterns during naturalistic learning by adolescent first versus second language speakers

Spoken lessons (lectures) are commonly used in schools as a medium for conveying educational content. In adolescence, experience-expectant maturation of language and cognitive systems supports learning; however, little is known about whether or how learners' language experiences interact with this integration process during learning. We examined functional connectivity using fMRI in 38 Spanish–English bilingual (L1-Spanish) and English monolingual (L1-English) adolescents during a naturalistic science video lesson in English. Seed analyses including the left inferior frontal gyrus (pars opercularis) and posterior middle temporal gyrus showed that L1-Spanish adolescents, when learning in their second language (L2), displayed widespread bilateral functional connectivity throughout the cortex while L1-English adolescents displayed mostly left-lateralized connectivity with core language regions over the course of the science lesson. Furthermore, we identified functional seed connectivity associated with better learning outcomes for adolescents with diverse language backgrounds. Importantly, functional connectivity patterns in L1-Spanish adolescents while learning in English also correlate with their Spanish cloze reading. Findings suggest that functional networks associated with higher-order language processing and cognitive control are differentially engaged for L1 vs. L2 speakers while learning new information through spoken language.

<https://www.nature.com/articles/s41598-024-69575-1>

PAULA MATEO-LOMBA et al – First identification of a Neanderthal bone spear point through an interdisciplinary analysis at Abric Romaní (NE Iberian Peninsula)

Osseous industry has been observed at an increasing number of Neanderthal sites. Bone fragments were used for practical purposes, and a range of bone shaping techniques were employed. The variability of bone tools observed in different assemblages reflects considerable functional diversity. However, no bone spear points have been reported from these contexts. A comprehensive analysis of a bone spear point from the Middle Palaeolithic site of Abric Romaní (Barcelona, Spain) is presented. Through an interdisciplinary, multi-technique, and multi-scale approach combining technology,

taphonomy, and functional analysis, compelling evidence for manufacture, use, and hafting was uncovered. The specimen exhibits clear signs of intentional knapping. The presence of microscopic linear impact marks, an impact fracture at the tip and potential internal stress fractures indicate its use as a spear. Furthermore, the observed wear pattern and a morphological adjustment of the trabecular tissue support the hafting hypothesis. Abric Romaní contributes to our understanding of Neanderthal hunting behaviour and the significance of composite bone tools in their technological repertoire 50,000 years ago. This discovery highlights the flexibility and adaptability of Neanderthal technology, providing evidence of bone technology that is sometimes obscured in the archaeological record and offering valuable insights into their hunting strategies during the Middle Palaeolithic.

<https://www.nature.com/articles/s41598-024-67817-w>

JAN PETŘÍK et al – Technology and provenience of the oldest pottery in the northern Pannonian Basin indicates its affiliation to hunter-gatherers

Consensus holds that pottery technology came to Central Europe from the Northern Balkans with independent pottery traditions existing concurrently in Eastern Europe. An unusual grass-tempered pottery dating back to around 5800 cal BC found in lake sediments at Santovka, Slovakia, predated the earliest known Neolithic pottery in the region (~ 5500 cal BC), suggesting unexplored narratives of pottery introduction. Analyses of the pottery's technology, origin, and grass temper shedding light on ceramic traditions' spread can unveil mobility patterns and community lifestyles. Our findings indicate a non-local provenance, low temperature firing, Festuca sp. grass temper and unique rectangular or cylindrical vessel shapes which align with Eastern European hunter-gatherer practices. Moreover, the pottery style and technology have no analogies in the contemporary Danubian pottery traditions and have more similarities to those of the Eastern traditions. The pottery's raw materials likely originated from distant areas, indicating extensive territorial access for its creators. Our findings imply late Mesolithic hunter-gatherers as the probable artisans and with implications for the site's significance in the late Mesolithic landscape.

<https://www.nature.com/articles/s41598-024-69208-7>

ANNIKA LÜBBERT et al – Predicting social experience from dyadic interaction dynamics: the BallGame, a novel paradigm to study social engagement

Theories of embodied cognition suggest that a shared environment and ongoing sensorimotor interaction are central for interpersonal learning and engagement. To investigate the embodied, distributed and hence dynamically unfolding nature of social cognitive capacities, we present a novel laboratory-based coordination task: the BallGame. Our paradigm requires continuous sensing and acting between two players who jointly steer a virtual ball around obstacles towards as many targets as possible. By analysing highly resolved measures of movement coordination and gaming behaviour, game-concurrent experience ratings, semi-structured interviews, and personality questionnaires, we reveal contributions from different levels of observation on social experience. In particular, successful coordination (number of targets collected) and intermittent periods of high versus low movement coordination (variability of relation) emerged as prominent predictors of social experience. Importantly, having the same (but incomplete) view on the game environment strengthened interpersonal coordination, whereas complementary views enhanced engagement and tended to generate more complex interactive behaviour. Overall, we find evidence for a critical balance between similarity and synchrony on the one hand, and variability and difference on the other, for successful engagement in social interactions. Finally, following participant reports, we highlight how interpersonal experience emerges from specific histories of coordination that are closely related to the interaction context in both space and time.

<https://www.nature.com/articles/s41598-024-69678-9>

Neuron

PAPERS

JINGWEN CHEN et al – Flexible control of sequence working memory in the macaque frontal cortex

To memorize a sequence, one must serially bind each item to its rank order. How the brain controls a given input to bind its associated order in sequence working memory (SWM) remains unexplored. Here, we investigated the neural representations underlying SWM control using electrophysiological recordings in the frontal cortex of macaque monkeys performing forward and backward SWM tasks. Separate and generalizable low-dimensional subspaces for sensory and memory information were found within the same frontal circuitry, and SWM control was reflected in these neural subspaces' organized dynamics. Each item at each rank was sequentially entered into a common sensory subspace and, depending on forward or backward task requirement, flexibly and timely sent into rank-selective SWM subspaces. Neural activity in these SWM subspaces faithfully predicted the recalled item and order information in single error trials. Thus, compositional neural population codes with well-orchestrated dynamics in frontal cortex support the flexible control of SWM.

[https://www.cell.com/neuron/abstract/S0896-6273\(24\)00569-5](https://www.cell.com/neuron/abstract/S0896-6273(24)00569-5)

PeerJ

PAPERS**CAITLIN E. O'CONNELL-RODWELL et al – The use of vocal coordination in male African elephant group departures: evidence of active leadership and consensus**

Group-living animals engage in coordinated vocalizations to depart from a location as a group, and often, to come to a consensus about the direction of movement. Here, we document for the first time, the use of coordinated vocalizations, the “let’s go” rumble, in wild male African elephant group departures from a waterhole. We recorded vocalizations and collected behavioral data as known individuals engaged in these vocal bouts during June-July field seasons in 2005, 2007, 2011, and 2017 at Mushara waterhole within Etosha National Park, Namibia. During departure events, we documented which individuals were involved in the calls, the signature structure of each individual’s calls, as well as the ordering of callers, the social status of the callers, and those who initiated departure. The “let’s go” rumble was previously described in tight-knit family groups to keep the family together during coordinated departures. Male elephants are described as living in loose social groups, making this finding particularly striking. We found that this vocal coordination occurs in groups of closely associated, highly bonded individuals and rarely occurs between looser associates. The three individuals most likely to initiate the “let’s go” rumble bouts were all highly socially integrated, and one of these individuals was also the most dominant overall. This finding suggests that more socially integrated individuals might be more likely to initiate, or lead, a close group of associates in the context of leaving the waterhole, just as a high-ranking female would do in a family group. The fact that many individuals were involved in the vocal bouts, and that departure periods could be shorter, longer, or the same amount of time as pre-departure periods, all suggest that there is consensus with regard to the act of leaving, even though the event was triggered by a lead individual.

<https://peerj.com/articles/17767/>

Philosophical Transactions of the Royal Society B**PAPERS****BRYONY PAYNE & CAROLINE CATMUR – Embodiment in the enfacement illusion is mediated by self–other overlap**

The enfacement illusion is a facial version of the rubber hand illusion, in which participants experience tactile stimulation of their own faces synchronously with the observation of the same stimulation applied to another’s face. In previous studies, participants have reported experiencing an illusory embodiment of the other’s face following synchronous compared to asynchronous stimulation. In a series of three experiments, we addressed the following three questions: (i) how does similarity between the self and the other, operationalized here as being of the same or different gender to the other, impact the experience of embodiment in the enfacement illusion; (ii) does the experience of embodiment result from alterations to the self-concept; and (iii) is susceptibility to the experience of embodiment associated with interoceptive processing, i.e. perception of the internal state of the body? Results indicate that embodiment is facilitated by the similarity between the self and the other and is mediated by the incorporation of the other into the self-concept, but sensitivity to one’s own internal states does not impact upon embodiment within the enfacement illusion.

<https://royalsocietypublishing.org/doi/abs/10.1098/rstb.2023.0146>

YUANYUAN LI, CHANG SU & YAFENG PAN – Spontaneous movement synchrony as an exogenous source for interbrain synchronization in cooperative learning

Learning through cooperation with conspecifics—‘cooperative learning’—is critical to cultural evolution and survival. Recent progress has established that interbrain synchronization (IBS) between individuals predicts success in cooperative learning. However, the likely sources of IBS during learning interactions remain poorly understood. To address this dearth of knowledge, we tested whether movement synchrony serves as an exogenous factor that drives IBS, taking an embodiment perspective. We formed dyads of individuals with varying levels of prior knowledge (high–high (HH), high–low (HL), low–low (LL) dyads) and instructed them to collaboratively analyse an ancient Chinese poem. During the task, we simultaneously recorded their brain activity using functional near-infrared spectroscopy and filmed the entire experiment to parse interpersonal movement synchrony using the computer-vision motion energy analysis. Interestingly, the homogeneous groups (HH and/or LL) exhibited stronger movement synchrony and IBS compared with the heterogeneous group. Importantly, mediation analysis revealed that spontaneous and synchronized body movements between individuals contribute to IBS, hence facilitating learning. This study therefore fills a critical gap in our understanding of how interpersonal transmission of information between individual brains, associated with behavioural entrainment, shapes social learning.

<https://royalsocietypublishing.org/doi/abs/10.1098/rstb.2023.0155>

HÉLÈNE GRANDCHAMP DES RAUX et al – The role of action concepts in physical reasoning: insights from late childhood

A fundamental component of human cognition is the ability to intuitively reason about behaviours of objects and systems in the physical world without resorting to explicit scientific knowledge. This skill was traditionally considered a symbolic process. However, in the last decades, there has been a shift towards ideas of embodiment, suggesting that accessing physical knowledge and predicting physical outcomes is grounded in bodily interactions with the environment. Infants and

children, who learn mainly through their embodied experiences, serve as a model to probe the link between reasoning and physical concepts. Here, we tested school-aged children (5- to 15-year-olds) in online reasoning games that involve different physical action concepts such as supporting, launching and clearing. We assessed changes in children's performance and strategies over development and their relationships with the different action concepts. Children reasoned more accurately in problems that involved supporting actions compared to launching or clearing actions. Moreover, when children failed, they were more strategic in subsequent attempts when problems involved support rather than launching or clearing. Children improved with age, but improvements differed across action concepts. Our findings suggest that accessing physical knowledge and predicting physical events are affected by action concepts, and those effects change over development.

<https://royalsocietypublishing.org/doi/abs/10.1098/rstb.2023.0154>

GUY DOVE – Symbol ungrounding: what the successes (and failures) of large language models reveal about human cognition

Large language models can handle sophisticated natural language processing tasks. This raises the question of how their understanding of semantic meaning compares to that of human beings. Supporters of embodied cognition often point out that because these models are trained solely on text, their representations of semantic content are not grounded in sensorimotor experience. This paper contends that human cognition exhibits capabilities that fit with both the embodied and artificial intelligence approaches. Evidence suggests that semantic memory is partially grounded in sensorimotor systems and dependent on language-specific learning. From this perspective, large language models demonstrate the richness of language as a source of semantic information. They show how our experience with language might scaffold and extend our capacity to make sense of the world. In the context of an embodied mind, language provides access to a valuable form of ungrounded cognition.

<https://royalsocietypublishing.org/doi/abs/10.1098/rstb.2023.0149>

DOROTHY M. FRAGASZY, DAMIAN G. KELTY-STEPHEN & MADHUR MANGALAM – How bipedalism shapes humans' actions with hand tools

The task for an embodied cognitive understanding of humans' actions with tools is to elucidate how the human body, as a whole, supports the perception of affordances and dexterous action with objects in relation to other objects. Here, we focus on the relationship between humans' actions with handheld tools and bipedal posture. Posture plays a pivotal role in shaping animals' perception and action dynamics. While humans stand and locomote bipedally, other primates predominantly employ quadrupedal postures and locomotion, relying on both hands and feet to support the body. Drawing upon evidence from evolutionary biology, developmental psychology and performance studies, we elucidate the influence of bipedalism on our actions with objects and on our proficiency in using tools. We use the metaphor of cascades to capture the dynamic, nonlinear transformations in morphology and behaviour associated with posture and the use of tools across evolutionary and developmental timescales. Recent work illustrates the promise of multifractal cascade analysis to reveal nonlinear, cross-scale interactions across the entire body in real-time, supporting the perception of affordances for actions with tools. Cascade analysis enriches our comprehension of real-time performance and facilitates exploration of the relationships among whole-body coordination, individual development, and evolutionary processes.

<https://royalsocietypublishing.org/doi/abs/10.1098/rstb.2023.0152>

LAURA DESIRÉE DI PAOLO et al with ANDY CLARK – Active inference goes to school: the importance of active learning in the age of large language models

Human learning essentially involves embodied interactions with the material world. But our worlds now include increasing numbers of powerful and (apparently) disembodied generative artificial intelligence (AI). In what follows we ask how best to understand these new (somewhat 'alien', because of their disembodied nature) resources and how to incorporate them in our educational practices. We focus on methodologies that encourage exploration and embodied interactions with 'prepared' material environments, such as the carefully organized settings of Montessori education. Using the active inference framework, we approach our questions by thinking about human learning as epistemic foraging and prediction error minimization. We end by arguing that generative AI should figure naturally as new elements in prepared learning environments by facilitating sequences of precise prediction error enabling trajectories of self-correction. In these ways, we anticipate new synergies between (apparently) disembodied and (essentially) embodied forms of intelligence.

<https://royalsocietypublishing.org/doi/10.1098/rstb.2023.0148>

PLoS One

PAPERS

ABIGAIL ANDERSON et al – The Myth of Man the Hunter: Women's contribution to the hunt across ethnographic contexts

The sexual division of labor among human foraging populations has typically been recognized as involving males as hunters and females as gatherers. Recent archeological research has questioned this paradigm with evidence that females hunted (and went to war) throughout the Homo sapiens lineage, though many of these authors assert the pattern of women hunting may only have occurred in the past. The current project gleans data from across the ethnographic literature to investigate

the prevalence of women hunting in foraging societies in more recent times. Evidence from the past one hundred years supports archaeological finds from the Holocene that women from a broad range of cultures intentionally hunt for subsistence. These results aim to shift the male-hunter female-gatherer paradigm to account for the significant role females have in hunting, thus dramatically shifting stereotypes of labor, as well as mobility.

<https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0287101>

JAMES BROOKS et al with ZANNA CLAY – Increased alertness and moderate ingroup cohesion in bonobos' response to outgroup cues

In a number of species, including humans, perceived outgroup threat can promote ingroup cohesion. However, the distribution and selection history of this association across species with varied intergroup relations remains unclear. Using a sample of 8 captive groups (N = 43 individuals), we here tested whether bonobos, like chimpanzees, show more affiliative ingroup behaviour following perception of outgroup cues (unfamiliar male long-distance vocalisations). We used comparable methods to our previous study of captive chimpanzees, and found that, although weaker, there was an association for more frequent social grooming in response to the outgroup condition than the control condition, alongside more alert posture and increased self-directed behaviour. This provides preliminary evidence for an ancestral origin to the proximate association between outgroup cues and ingroup cohesion, at least prior to the Pan-Homo split, and suggests the presence of intergroup competition in our last common ancestor.

<https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0307975>

R. SCOTT BYRAM, KENT G. LIGHTFOOT & JUN UENO SUNSERI – Clovis points and foreshafts under braced weapon compression: Modeling Pleistocene megafauna encounters with a lithic pike

Historical and ethnographic sources depict use of portable braced shaft weapons, or pikes, in megafauna hunting and defense during Late Holocene millennia in North and South America, Africa, Eurasia and Southeast Asia. Given the predominance of megafauna in Late Pleistocene North America during the centuries when Clovis points appeared and spread across much of the continent (13,050–12,650 cal BP), braced weapons may have been used in hunting of megaherbivores and defense against megacarnivores. Drawing from historical examples of pike use against lions, jaguars, boars, grizzlies, carabao and warhorses we consider the possibility of a fluted lithic pike. Associated osseous rods have been problematic as Clovis foreshafts due to the bevel angle and the apparent weakness of the splint haft when great strength is needed for deep penetration in megafauna hunting. However our review of Late Holocene pike use in megafauna encounters indicates the sharp tip becomes less important after hide or armor has been pierced because compression is sustained. Thus, foreshaft collapse after hide entry may not limit but rather increase the efficacy of the braced weapon. We conduct preliminary static experiments to model a fluted pike that adjusts during compression such that haft collapse and point detachment (when point jams on impact with bone) preserve the fluted biface, beveled rod and wooden mainshaft tip. In addition to Clovis point attributes and association with osseous rods, potential archaeological correlates of Clovis pike use include the high frequency of Clovis point isolates and concentrations of complete points with unbutchered mammoth remains at sites such as Naco in Arizona.

<https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0307996>

CORRECTIONS

ABIGAIL ANDERSON et al – Correction: The Myth of Man the Hunter: Women's contribution to the hunt across ethnographic contexts

PLOS ONE 19(8): e0309543.

<https://doi.org/10.1371/journal.pone.0309543>

PNAS

PAPERS

MICHAEL L. WONG et al – On the roles of function and selection in evolving systems

Physical laws—such as the laws of motion, gravity, electromagnetism, and thermodynamics—codify the general behavior of varied macroscopic natural systems across space and time. We propose that an additional, hitherto-unarticulated law is required to characterize familiar macroscopic phenomena of our complex, evolving universe. An important feature of the classical laws of physics is the conceptual equivalence of specific characteristics shared by an extensive, seemingly diverse body of natural phenomena. Identifying potential equivalencies among disparate phenomena—for example, falling apples and orbiting moons or hot objects and compressed springs—has been instrumental in advancing the scientific understanding of our world through the articulation of laws of nature. A pervasive wonder of the natural world is the evolution of varied systems, including stars, minerals, atmospheres, and life. These evolving systems appear to be conceptually equivalent in that they display three notable attributes: 1) They form from numerous components that have the potential to adopt combinatorially vast numbers of different configurations; 2) processes exist that generate numerous different configurations; and 3) configurations are preferentially selected based on function. We identify universal concepts of selection—static persistence, dynamic persistence, and novelty generation—that underpin function and drive systems to evolve through the exchange of information between the environment and the system. Accordingly, we propose a “law of increasing functional

information”: The functional information of a system will increase (i.e., the system will evolve) if many different configurations of the system undergo selection for one or more functions.

<https://www.pnas.org/doi/10.1073/pnas.2310223120>

COMMENTARIES

MEREDITH ROOT-BERNSTEIN – Evolution is not driven by and toward increasing information and complexity

Wong et al. present a general theory of evolution that assumes that evolution is progress, via selection for increasing complexity. The authors’ undisguised anthropocentrism leads them to believe that humans are more complex, successful, and indicative of the general trends of evolution than any other example. Indisputably, the diversification of life includes major trends of cumulative integration and additive niche creation. However, there is no evidence that biotic evolution is progressive or globally directional or that relative simplicity is disadvantaged. “Simple” species such as bacteria are among the most “successful” (long-lasting lineages, largest share of biomass). “Complex” (multicellular, large, evolutionarily derived) species emerge and then regularly disappear in mass extinction events. There are many examples of ecosystems that do not maximize productivity, diversity, or other potential measures of complexity (temperate forests), as well as natural processes such as retrogressive succession that lead to reductions in all such measures.

<https://www.pnas.org/doi/full/10.1073/pnas.2318689121>

MICHAEL L. WONG et al – Reply to Root-Bernstein: Increasing complexity allows for the pervasiveness of low-complexity entities and is not anthropocentric

Root-Bernstein argues that our usage of the terminology “selection for” is not consistent with the picture of selection in evolutionary biology. We contend that this is a matter of semantics, for we agree that biological selection operates via diffuse, nonuniform survival/reproduction, and we do not invoke the requirement for “some agent” that drives nature toward a particular goal. Information is no more an agent of evolution than mass is an agent of gravity or entropy is an agent of the second law of thermodynamics; these are simply measurable parameters about the world that are useful for describing its regularities.

{The word “semantics” seems to be used dismissively here, which I think is unfair. There is a problem describing evolution as a mechanism “selecting for”, when evolution is actually a constant adjustment of the capacities of a species after the event, to cope in a changing environment. But that’s probably just me.}

<https://www.pnas.org/doi/full/10.1073/pnas.2406598121>

Proceedings of the Royal Society B

PAPERS

CHRISTINE R. DAHLIN et al – Widespread cultural change in declining populations of Amazon parrots

Species worldwide are experiencing anthropogenic environmental change, and the long-term impacts on animal cultural traditions such as vocal dialects are often unknown. Our prior studies of the yellow-naped amazon (*Amazona auropalliata*) revealed stable vocal dialects over an 11-year period (1994–2005), with modest shifts in geographic boundaries and acoustic structure of contact calls. Here, we examined whether yellow-naped amazons maintained stable dialects over the subsequent 11-year time span from 2005 to 2016, culminating in 22 years of study. Over this same period, this species suffered a dramatic decrease in population size that prompted two successive uplists in IUCN status, from vulnerable to critically endangered. In this most recent 11-year time span, we found evidence of geographic shifts in call types, manifesting in more bilingual sites and introgression across the formerly distinct North–South acoustic boundary. We also found greater evidence of acoustic drift, in the form of new emerging call types and greater acoustic variation overall. These results suggest cultural traditions such as dialects may change in response to demographic and environmental conditions, with broad implications for threatened species.

<https://royalsocietypublishing.org/doi/10.1098/rspb.2024.0659>

MANUEL SAPAGE et al – Mate-choice copying accelerates species range expansion

Mate-choice copying is a type of social learning in which females can change their mate preference after observing the choice of others. This behaviour can potentially affect population evolution and ecology, namely through increased dispersal and reduced local adaptation. Here, we simulated the effects of mate-choice copying in populations expanding across an environmental gradient to understand whether it can accelerate or retard the expansion process. Two mate-choice copying strategies were used: (i) when females target a single individual and (ii) when females target similar individuals. We also simulated cases where the male trait singled out by females with mate choice maps perfectly onto his genotype or is influenced by genotype-by-environment interactions. These rules have different effects on the results. When a trait is determined by genotype alone, populations where copier females target all similar males expand faster and the number of potential copiers increased. However, when preference is determined by genotype-by-environment interactions, populations where copier females target a single male had higher dispersal and also expand faster, but the potential number of copiers decreases. The results show that mate-choice copying can accelerate the expansion process, although its adaptiveness depends on the information animals use in different contexts.

<https://royalsocietypublishing.org/doi/10.1098/rspb.2024.1201>

Royal Society Open Science

PAPERS

A. SZABO et al – Solitary humpback whales manufacture bubble-nets as tools to increase prey intake

Several animal species use tools for foraging; however, very few manufacture and/or modify those tools. Humpback whales, which manufacture bubble-net tools while foraging, are among these rare species. Using animal-borne tag and unoccupied aerial system technologies, we examine bubble-nets manufactured by solitary humpback whales (*Megaptera novaeangliae*) in Southeast Alaska while feeding on krill. We demonstrate that the nets consist of internally tangential rings and suggest that whales actively control the number of rings in a net, net size and depth and the horizontal spacing between neighbouring bubbles. We argue that whales regulate these net structural elements to increase per-lunge prey intake by, on average, sevenfold. We measured breath rate and swimming and lunge kinematics to show that the resulting increase in prey density does not increase energetic expenditure. Our results provide a novel insight into how bubble-net tools manufactured by solitary foraging humpback whales act to increase foraging efficiency.

<https://royalsocietypublishing.org/doi/10.1098/rsos.240328>

Science Advances

PAPERS

JOSÉ ANTONIO LOZANO RODRÍGUEZ et al – Early science and colossal stone engineering in Menga, a Neolithic dolmen (Antequera, Spain)

Megaliths represent the earliest form of monumental stone architecture. The earliest megalithic chambers in Europe appeared in France in the fifth millennium BCE. Menga is the oldest of the great dolmens in Iberia (approximately 3800 to 3600 BCE). Menga's capstone #5 weighing 150 tons is the largest stone ever moved in Iberia as part of the megalithic phenomenon and one of the largest in Europe. The research presented here proposes a completely innovative interpretation of how this colossal monument was built. It comprises a geoarchaeological analysis encompassing three major components: (i) the angles of the planes of each stone, (ii) the stratigraphic polarity of each structural element, and (iii) the depth of the foundations. Our results show that Menga is a unique example of creative genius and early science among Neolithic societies. It was designed as a completely original engineering project, for which we know of no precedents in Iberia.

<https://www.science.org/doi/10.1126/sciadv.adp1295>

Trends in Cognitive Sciences

PAPERS

ELLEN BIALYSTOK – Bilingualism modifies cognition through adaptation, not transfer

The standard explanation for bilingual effects on cognition is that an aspect of language processing transfers to nonverbal cognitive performance, leading to improvements in executive functioning. However, much evidence is incompatible with that view, and transfer across those domains seems unlikely. The present argument is that bilingual experience modifies cognition through an adaptation to the underlying attention system, making attention more efficient. 'Transfer' focuses on the overlap of specific processes, so task similarity predicts outcomes. By contrast, 'adaptation' focuses on recruitment of the modified resource, so the degree of attention required predicts outcome. In this view, bilinguals require less attentional effort than monolinguals for similar levels of performance, and outperform monolinguals on tasks with high attention demands regardless of task similarity.

[https://www.cell.com/trends/cognitive-sciences/abstract/S1364-6613\(24\)00199-2](https://www.cell.com/trends/cognitive-sciences/abstract/S1364-6613(24)00199-2)

COMMENTARIES

SIMON A.B. BROWN, ELIZABETH S. PAUL & JONATHAN BIRCH – To test the boundaries of consciousness, study animals

How can we validate tests for consciousness beyond healthy adult humans? Bayne and colleagues propose the 'iterative natural kind strategy' (INKS). INKS begins by taking seriously all tests with at least some face validity rather than restricting our attention to a small subset of tests that antecedently pass stringent requirements of validation. We then look for clustering among our tests (and mechanisms explaining such patterns), using these findings to refine our battery of tests. Subsequently, we apply the same process to the new battery.

[https://www.cell.com/trends/cognitive-sciences/abstract/S1364-6613\(24\)00161-X](https://www.cell.com/trends/cognitive-sciences/abstract/S1364-6613(24)00161-X)

TIM BAYNE et al with ANIL SETH, MARCELLO MASSIMINI & AXEL CLEEREMANS – Animals and the iterative natural kind strategy

What entities are conscious and how could we ever know? We recently provided a framework for developing validated tests for consciousness ('C-tests'): the Iterative Natural Kind Strategy (INKS). Brown and colleagues raise some important questions for the INKS approach, although we are not sure how different their answers to those questions are from our own.

[https://www.cell.com/trends/cognitive-sciences/abstract/S1364-6613\(24\)00196-7](https://www.cell.com/trends/cognitive-sciences/abstract/S1364-6613(24)00196-7)

Original article: EAORC Bulletin 1,083

TIM BAYNE et al with ANIL K. SETH, MARCELLO MASSIMINI & AXEL CLEEREMANS – Tests for consciousness in humans and beyond

[https://www.cell.com/trends/cognitive-sciences/fulltext/S1364-6613\(24\)00010-X](https://www.cell.com/trends/cognitive-sciences/fulltext/S1364-6613(24)00010-X)

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