

## EAORC BULLETIN 1,118 – 17 November 2024

## CONTENTS

<b>NOTICES</b> .....	<b>3</b>
FORMATTED VERSION OF THIS BULLETIN .....	3
PUBLICATION ALERTS .....	3
EDITORIAL INTERJECTIONS .....	3
ACADEMIA.EDU – A Pleistocene Record of Making Symbols .....	3
ERELLA HOVERS & ANNA BELFER-COHEN – A Pleistocene Record of Making Symbols.....	3
ACADEMIA.EDU – Speech, stone tool-making and the evolution of language.....	4
DANA MICHELLE CATALDO, ANDREA BAMBERG MIGLIANO & LUCIO VINICIUS – Speech, stone tool-making and the evolution of language .....	4
ACADEMIA.EDU – Hadar, Ethiopia.....	4
ERELLA HOVERS – Hadar, Ethiopia .....	4
<b>NEWS</b> .....	<b>4</b>
NATURE BRIEFING – Shower time brings out green-eyed elephant .....	4
SCIENCEADVISER – Elephant showering inspires awe—and revenge .....	4
SCIENCEADVISER – Chimps perform better for a crowd, too .....	5
SCIENCEADVISER – Ouch! Pain sounds the same around the world.....	5
SCIENCEADVISER – Ancient youth offers clues to our lengthy childhood .....	5
SCIENCE DAILY – What makes human culture unique?.....	5
SCIENCE DAILY – 'Shallow' sports and 'deep' social hierarchies: Not all pecking orders are created equal .....	6
SCIENCE DAILY – New insights on Denisovans interbreeding with modern day humans .....	6
SCIENCE DAILY – Debunked: Children aren't quicker at picking up new motor skills than adults .....	6
SCIENCEADVISER – Fossil teeth hint at a surprisingly early start to humans' long childhoods .....	6
SCIENCEADVISER – How does a fossil become a superstar? Just ask Lucy.....	6
SCIENCE.ORG NEWS – Why do humans mature so slowly? An ancient youth offers clues .....	6
<b>PUBLICATIONS</b> .....	<b>6</b>
Adaptive Behavior.....	6
<b>PAPERS</b> .....	6
LAMBROS MALAFOURIS – How does thinking relate to tool making? .....	6
KARENLEIGH A. OVERMANN – The material difference in human cognition .....	6
ANNA M. BARONA – The archaeology of the social brain revisited: rethinking mind and material culture from a material engagement perspective .....	7
HANNAH MOSLEY – Primate tool use and the socio-ecology of thinging: how non-humans think through tools .....	7
CHRIS BABER & KLINT JANULIS – Purposeful tool use in early lithic technologies .....	7
JOHN A.J. GOWLETT – Deep structure in the Acheulean adaptation: technology, sociality and aesthetic emergence .....	7
Current Biology .....	8
<b>PAPERS</b> .....	8
LEA URBAN et al – Water-hose tool use and showering behavior by Asian elephants .....	8
AARIT AHUJA et al – Monkeys engage in visual simulation to solve complex problems.....	8
Frontiers for Young Minds.....	8
<b>PAPERS</b> .....	8
MATTHEW MCARTHUR & MARGARET FRIEND – Why Early Chatter Matters: The Role of Language in Shaping Futures .....	8
Frontiers in Psychology .....	8
<b>PAPERS</b> .....	8
SHUTA TOMISATO et al – Speech characteristics that differentiate stuttering and cluttering in Japanese speakers .....	8
LONNEKE JANSSEN, ANNETTE SCHEPER & CONSTANCE VISSERS – Controlling the narrative: the relationship between narrative ability and executive functioning in children with developmental language disorder .....	9
iScience.....	9
<b>PAPERS</b> .....	9
MING LI et al – Language-Specific Representation of Emotion-Concept Knowledge Causally Supports Emotion Inference .....	9
Journal of the Acoustical Society of America .....	9
<b>PAPERS</b> .....	9

MÁIA PONSONNET et al – Vowel signatures in emotional interjections and nonlinguistic vocalizations expressing pain, disgust, and joy across languages.....	9
<b>Mind &amp; Language.....</b>	<b>10</b>
<b>PAPERS.....</b>	<b>10</b>
GUIDO LÖHR – Does the mind care about whether a word is abstract or concrete? Why concreteness is probably not a natural kind .....	10
SARAH A. FISHER – That's not what you said! Semantic constraints on literal speech .....	10
JIANGTIAN LI – Semantic minimalism and the continuous nature of polysemy.....	10
FREDERIK TOLLERUP JUNKER & THOR GRÜNBAUM – Is the wandering mind a planning mind?.....	10
LUCIEN BAUMGARTNER – The pragmatic view on dual character concepts and expressions.....	10
<b>Nature.....</b>	<b>11</b>
<b>NEWS.....</b>	<b>11</b>
How human brains got so big: our cells learned to handle the stress that comes with size.....	11
<b>ARTICLES.....</b>	<b>11</b>
DEBBIE GUATELLI-STEINBERG – Growing up slowed down for an early Homo individual .....	11
<b>PAPERS.....</b>	<b>11</b>
CHRISTOPH P. E. ZOLLIKOFER et al with DAVID LORDKIPANIDZE – Dental evidence for extended growth in early Homo from Dmanisi .....	11
<b>Nature Communications.....</b>	<b>11</b>
<b>PAPERS.....</b>	<b>11</b>
KENICHI YAMAMOTO et al with THE BIOBANK JAPAN PROJECT – Genetic legacy of ancient hunter-gatherer Jomon in Japanese populations .....	11
<b>Nature Humanities &amp; Social Sciences Communications.....</b>	<b>11</b>
<b>PAPERS.....</b>	<b>11</b>
JIANGPING ZHOU – Preferences of interpersonal metaphor of modality in academic disciplines .....	11
MENGYU HE & QIN XIE – Empowering autonomy in language learning: the sustainable impact of data-driven learning on noun collocation acquisition .....	12
<b>Nature Scientific Reports.....</b>	<b>12</b>
<b>PAPERS.....</b>	<b>12</b>
VITTORIA DENTELLA et al – Testing AI on language comprehension tasks reveals insensitivity to underlying meaning .....	12
BROCK FERGUSON, ALEXANDER LATOURRETTE & SANDRA R. WAXMAN – Six-month-old infants use cross-modal synchrony to identify novel communicative signals .....	12
YUSUKE SUZUKI et al – Crossmodal correspondences between visual and speech angularity and tactile jaggedness of response key.....	13
<b>New Scientist.....</b>	<b>13</b>
<b>NEWS.....</b>	<b>13</b>
Marmots could have the solution to a long-running debate in evolution.....	13
Chimps do better at difficult tasks when they have an audience .....	13
<b>ARTICLES.....</b>	<b>13</b>
PENNY SARCHET et al – The origins of writing revealed (Podcast) .....	13
JAMES WOODFORD – Watch elephants use a hose to shower themselves – and prank others.....	13
SUSANA MONSÓ – To truly understand non-human grief, we need to think like the animals .....	13
<b>Philosophical Transactions of the Royal Society A.....</b>	<b>13</b>
<b>PAPERS.....</b>	<b>13</b>
ELISABETH STOCKINGER & MICHAEL MANDLMAYR – Artefact design and societal worldview.....	13
<b>PLoS One.....</b>	<b>14</b>
<b>PAPERS.....</b>	<b>14</b>
RIVKA CHASAN et al – Podocarpaceae and Cupressaceae: A tale of two conifers and ancient adhesives production in South Africa.....	14
TALIA YASHUV & LEORE GROSMAN – 12,000-year-old spindle whorls and the innovation of wheeled rotational technologies .....	14
ANDERS HÖGBERG et al with MARLIZE LOMBARD & PETER GÄRDENFORS – Human socio-technical evolution through the lens of an abstracted-wheel experiment: A critical look at a micro-society laboratory study .....	14
BRIAN VILLMOARE et al – Evolutionary origins of temporal discounting: Modeling how time and uncertainty constrain optimal decision-making strategies across taxa .....	14
BASTIEN MEUNIER et al – A quick response, but not too much: Experienced mangabeys ( <i>Cercocebus torquatus</i> ) lose interest in contact call exchanges that do not respect this “conversational rule” .....	15
OLIVIER SENN et al – Null effect of perceived drum pattern complexity on the experience of groove.....	15
<b>Quarterly Review of Biology.....</b>	<b>15</b>
<b>PAPERS.....</b>	<b>15</b>
ROBERT C. BROOKS – How Might Artificial Intelligence Influence Human Evolution?.....	15
<b>REVIEWS.....</b>	<b>16</b>
ADRIANA A. MALDONADO-CHAPARRO – Modeling Social Behavior .....	16
<b>Royal Society Open Science.....</b>	<b>16</b>
<b>PAPERS.....</b>	<b>16</b>
SIQI DUAN et al – Assessing the measurement invariance of Free Will and Determinism Plus scale across four languages: a registered report .....	16

ADRIAN KEMPF et al – Individual differences in music-induced interpersonal synchronization and self–other integration: the role of creativity and empathy .....	16
MATTHEW N. ZIPPLE et al – Animal emotions and consciousness: a preliminary assessment of researchers’ perceptions and biases and prospects for future progress .....	16
E. TOWNER et al – Increased threat learning after social isolation in human adolescents .....	17
Trends in Cognitive Sciences .....	17
<b>COMMENTARIES</b> .....	17
CHEN SONG – Understanding the qualitative nature of human consciousness .....	17
KRZYSZTOF DOŁĘGA, INÈS MENTEC & AXEL CLEEREMANS – How does the quality space come to be? .....	17
Trends in Ecology and Evolution .....	17
<b>PAPERS</b> .....	17
RUTH FAWTHROP et al – Understanding human-commensalism through an ecological and evolutionary framework .....	17
Trends in Genetics .....	18
<b>PAPERS</b> .....	18
SUSANNAH SELBER-HNATIW & SIRUI ZHOU – The good, the bad, and Neanderthalic immunity .....	18
<b>SUBSCRIBE to the EAORC Bulletin</b> .....	18
<b>UNSUBSCRIBE from the EAORC Bulletin</b> .....	18
<b>PRODUCED BY AND FOR THE EAORC EMAIL GROUP</b> .....	18

## NOTICES

### FORMATTED VERSION OF THIS BULLETIN

A pdf formatted version of this Bulletin is available for download at [martinedwardes.me.uk/eaorc/eaorc\\_bulletins.htm](http://martinedwardes.me.uk/eaorc/eaorc_bulletins.htm).

### 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 – A Pleistocene Record of Making Symbols

*In Thomas Wynn, Karenleigh A. Overmann & Frederick L. Coolidge (eds.), The Oxford Handbook of Cognitive Archaeology ch20, 485-504 (2022).*

#### ERELLA HOVERS & ANNA BELFER-COHEN – A Pleistocene Record of Making Symbols

Symbol making involves active agency, as it is, by definition, intentional and aims to deliver messages, worldviews, and social contents to designated audiences. As archaeology can specify only elements of behavior that are expressed as material objects, it must focus on material objects and their contexts. Accordingly, this chapter does not aim to elucidate the symbolic content of objects. Whether the role of objects is perceived as a clear dichotomy between utilitarian and symbolic or as a “mixed bag,” in the practice of prehistoric archaeology it is the context of artifacts that is often enlisted to provide telltale signs about their role in the behavioral system. Employing archaeological tools (material culture, chronology, and context), the chapter addresses (1) the epistemology of understanding prehistoric symbols by reviewing criteria that are prevalent in the research to assess whether an object may have acted as a symbolic manifestation and (2) the diachronic shift from a cognitive capacity to comprehend and make symbolic objects to a broader, evolved, symbolic behavioral system. Its review of the Pleistocene symbolic record of the Levant suggests that the trajectories of change parallel patterns (though not necessarily the same chronology) observed in neighboring regions. The analysis suggests that rather than changes in the neurological infrastructure per se, the coevolution of symbolic behavior and social complexity is driven by changes in social cognition as a major adaptive tool in hominin cultural evolution.

[https://www.academia.edu/95835031/Hovers\\_E\\_and\\_Belfer\\_Cohen\\_A\\_2023\\_A\\_Pleistocene\\_Record\\_of\\_Making\\_Symbols\\_in\\_Wynn\\_T\\_Overmann\\_K\\_A\\_Coolidge\\_F\\_L\\_Eds\\_The\\_Oxford\\_Handbook\\_of\\_Cognitive\\_Archaeology\\_Oxford\\_University\\_Press\\_pp\\_485\\_504\\_https\\_doi\\_org\\_10\\_1093\\_oxfordhb\\_9780192895950\\_013\\_23](https://www.academia.edu/95835031/Hovers_E_and_Belfer_Cohen_A_2023_A_Pleistocene_Record_of_Making_Symbols_in_Wynn_T_Overmann_K_A_Coolidge_F_L_Eds_The_Oxford_Handbook_of_Cognitive_Archaeology_Oxford_University_Press_pp_485_504_https_doi_org_10_1093_oxfordhb_9780192895950_013_23)

**ACADEMIA.EDU – Speech, stone tool-making and the evolution of language***PLoS ONE 13:1, e0191071 (2018).***DANA MICHELLE CATALDO, ANDREA BAMBERG MIGLIANO & LUCIO VINICIUS – Speech, stone tool-making and the evolution of language**

The ‘technological hypothesis’ proposes that gestural language evolved in early hominins to enable the cultural transmission of stone tool-making skills, with speech appearing later in response to the complex lithic industries of more recent hominins. However, no flintknapping study has assessed the efficiency of speech alone (unassisted by gesture) as a tool-making transmission aid. Here we show that subjects instructed by speech alone underperform in stone tool-making experiments in comparison to subjects instructed through either gesture alone or ‘full language’ (gesture plus speech), and also report lower satisfaction with their received instruction. The results provide evidence that gesture was likely to be selected over speech as a teaching aid in the earliest hominin tool-makers; that speech could not have replaced gesturing as a tool-making teaching aid in later hominins, possibly explaining the functional retention of gesturing in the full language of modern humans; and that speech may have evolved for reasons unrelated to tool-making. We conclude that speech is unlikely to have evolved as tool-making teaching aid superior to gesture, as claimed by the technological hypothesis, and therefore alternative views should be considered. For example, gestural language may have evolved to enable tool-making in earlier hominins, while speech may have later emerged as a response to increased trade and more complex inter- and intra-group interactions in Middle Pleistocene ancestors of Neanderthals and *Homo sapiens*; or gesture and speech may have evolved in parallel rather than in sequence.

[https://www.academia.edu/108250395/Speech\\_stone\\_tool\\_making\\_and\\_the\\_evolution\\_of\\_language](https://www.academia.edu/108250395/Speech_stone_tool_making_and_the_evolution_of_language)

**ACADEMIA.EDU – Hadar, Ethiopia**

*In A. Beyin et al (eds.), Handbook of Pleistocene Archaeology of Africa: Hominin Behavior, Geography, and Chronology. Springer, 373-385 (2023).*

**ERELLA HOVERS – Hadar, Ethiopia**

in northeastern Ethiopia. While best known for its Pliocene (3.45–2.9 Ma) hominin fossils and fauna, stone artifact-bearing sites have been documented in Hadar since the 1970s. A majority of artifacts were found as eroded surface finds. Few “Middle Acheulean” and Oldowan finds were reported as in situ occurrences (Corvinus, 1975: Fig. 1; Corvinus & Roche, 1980; Roche & Tiercelin, 1980), some of which (Harris, 1983) were later incorporated in the Gona project and explored under its auspices. Additional sites in the HRP were discovered and systematically excavated between 1994 and 2011 by members of the HRP, and have been under study since. A.L. 666 (11.0912° N, 40.3312° E), and A.L. 894 (11.0915° N, 40.3310° E) are two localities in the Makaamitalu drainage (Fig. 1), where artifacts were first found as eroded surface finds as well as in situ, following systemic excavations. An additional locality with in situ artifacts identified as A.L. 1101 (11.0750° N, 40.3249° E) was found in the Burahin Dora headwaters. Isolated Acheulean bifaces were collected from the surface in the Koborto Gaba area, in the upper reaches of the Unda Hadar drainage (Fig. 1). All the currently known archaeological localities in the Hadar research area are found in sediments of the previously designated upper Kada Hadar (KH) member of the Hadar Formation. This member is now subsumed into the pan-Afar depression Busidima Formation (BF).

[https://www.academia.edu/105728753/Hovers\\_E\\_2023\\_Hadar\\_Ethiopia\\_in\\_Beyin\\_A\\_Wright\\_D\\_K\\_Wilkins\\_J\\_Olszewski\\_D\\_I\\_Eds\\_Handbook\\_of\\_Pleistocene\\_Archaeology\\_of\\_Africa\\_Hominin\\_Behavior\\_Geography\\_and\\_Chronology\\_Springer\\_pp\\_373\\_385\\_https\\_doi\\_org\\_10\\_1007\\_978\\_3\\_031\\_20290\\_2\\_22](https://www.academia.edu/105728753/Hovers_E_2023_Hadar_Ethiopia_in_Beyin_A_Wright_D_K_Wilkins_J_Olszewski_D_I_Eds_Handbook_of_Pleistocene_Archaeology_of_Africa_Hominin_Behavior_Geography_and_Chronology_Springer_pp_373_385_https_doi_org_10_1007_978_3_031_20290_2_22)

**NEWS****NATURE BRIEFING – Shower time brings out green-eyed elephant**

Two Asian elephants (*Elephas maximus*) have been recorded engaged in behaviours never before observed in the large mammals. One, named Mary, has learned to use a hose as a showerhead, bypassing the need to spray water over her body from her trunk. This sophisticated use of a tool implies a complex understanding of water trajectory. Younger elephant Anchali deliberately attempts to thwart Mary’s efforts by creating a kink in the hose to stem the flow. Researchers suspect that Anchali might be jealous, or attempting revenge for Mary’s occasional aggression towards her.

[https://www.cell.com/current-biology/fulltext/S0960-9822\(24\)01371-X](https://www.cell.com/current-biology/fulltext/S0960-9822(24)01371-X)

**SCIENCEADVISER – Elephant showering inspires awe—and revenge**

When scientists spotted an elderly pachyderm named Mary using a hose to shower herself off at the Berlin Zoo, they were impressed with her tool-using prowess. Elephants are already famous for their smarts, but Mary’s dexterity with the hose—changing her grip to spray different parts of her body, an apparent understanding of water ballistics, and other skills—suggested an even more sophisticated insight than researchers had imagined. That wasn’t the end of the story, however. It turns out that one of Mary’s comrades wasn’t as impressed. A much younger pachyderm named Anchali, seemingly in response to all of the attention Mary was getting, figured out how to shut the hose off—kinking it and stepping on it—a type of sabotage rarely seen among animals.

The observations further cement elephants as complex thinkers, says Lucy Bates, a behavioral ecologist who was not involved in the study. She says both behaviors suggest insight instead of simple trial-and-error. But that's a difficult thing to prove without more observations, she says. "Obviously we don't know if [Anchali's] original intention was to stop Mary's shower, but the fact she persevered and got better at doing this is quite compelling."

[https://www.cell.com/current-biology/fulltext/S0960-9822\(24\)01371-X](https://www.cell.com/current-biology/fulltext/S0960-9822(24)01371-X)

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### SCIENCEADVISER – Chimps perform better for a crowd, too

It can be great to have an audience: People tend to perform better on tricky tasks when they're being watched, a phenomenon psychologists often attribute to our very social nature and the need to maintain good reputations. Now researchers have found that chimpanzees also do better at hard mental tasks when there are more people watching them, suggesting this 'audience effect' evolved in our shared primate ancestors.

Having an audience wasn't always great for the apes—just like it isn't for us. When asked to select five numbers in order, a simple task for these well-trained animals, the presence of human spectators proved distracting. But as researchers upped the difficulty—first by skipping numbers but still expecting the chimps to put them in smallest-to-largest order, then by hiding the numbers after the first selected so the chimp had to memorize where the numbers were—the apes performed better when more people watched them work.

"It was very surprising to find that chimpanzees are affected in their task performance by audience members, and by human audience members nonetheless!" study co-author Christen Lin said in a statement.

[https://www.cell.com/iscience/fulltext/S2589-0042\(24\)02416-7](https://www.cell.com/iscience/fulltext/S2589-0042(24)02416-7)

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### SCIENCEADVISER – Ouch! Pain sounds the same around the world

When I stub my toe on the coffee table, I might let out a yelp, say "Ouch!", or fire off a few words not suitable for publication in a family-friendly newsletter. But while I'm cursing my clumsiness, I can at least take solace in the fact that this experience is pretty much universal. Although there are an estimated 7000 languages spoken worldwide, new research suggests the noises people make when they're in pain sound pretty much the same around the globe.

Humans across cultures tend to vocalize in response to emotions. Some of these noises, known as expressive interjections, have linguistic elements (words like "Oops!" "Wow!" or "Yikes!"), while others don't follow any linguistic structure at all (screams, cries, and bouts of laughter). When scientists analyzed nonlinguistic expressions of pain, joy, and disgust from 131 different languages, they found that each of the three emotions yielded distinct vowel sounds. They also discovered that pain interjections typically feature similar open "a" vowels and wide falling diphthongs (like the "ou/ow" sound in "Ouch"). They didn't find similar consistent vowel patterns for joy and disgust interjections, which surprised them.

The findings suggest that the sounds humans naturally make when they're in pain may have influenced the development of the words we use to describe the sensation. Since other primates also produce nonlinguistic vocalizations, studying them could potentially shed light on the origin of speech in humans. As lead study author Maïa Ponsonnet explains in a press release, "Looking at these commonalities across species can help us understand where humans diverged and how."

<https://pubs.aip.org/asa/jasa/article/156/5/3118/3319867/Vowel-signatures-in-emotional-interjections-and>

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### SCIENCEADVISER – Ancient youth offers clues to our lengthy childhood

Ask any parent of a teen: Humans take a long time to grow up. In fact, we take about twice as long as chimpanzees to reach adulthood. Anthropologists theorize our long childhood evolved so we could build bigger brains or learn cognitive or social skills. Now, a study of an ancient youth's teeth suggests a slow pattern of growth appeared at least 1.8 million years ago, half a million years earlier than thought.

Researchers used state-of-the-art X-ray imaging to count growth lines in the molars of a member of our genus, Homo, who lived 1.77 million years ago and died at about 11.4 years old in what today is Dmanisi, Georgia. The researchers created a virtual video of how teeth grew in this ancient youth's mouth, as they reported Wednesday in *Nature*. For the youngster's first 5 years, its molars developed slowly, and it kept its baby teeth longer. Then from age 6 to 11, its teeth developed more quickly. Overall, the youth matured faster than a modern human, but the early slowdown in growth is the oldest example of such a pattern. The authors suggest tool use, meat eating, and changes in social structure allowed the children of early Homo to depend on adults longer.

"One of the main questions in paleoanthropology is to understand when this pattern of slow development evolves," says bioarchaeologist Alessia Nava, who was not involved in the work. "Now, we have an important hint."

<https://www.science.org/content/article/why-do-humans-mature-so-slowly-ancient-youth-offers-clues>

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### SCIENCE DAILY – What makes human culture unique?

Why is human culture -- the shared body of knowledge passed down across generations -- so much more powerful than animal cultures?

<https://www.sciencedaily.com/releases/2024/11/241107115259.htm>

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### SCIENCE DAILY – 'Shallow' sports and 'deep' social hierarchies: Not all pecking orders are created equal

Researchers have added a new dimension to the mathematics used to predict the outcomes of all manner of competitions, including sports, games and social hierarchies in both humans and animals.

<https://www.sciencedaily.com/releases/2024/11/241106142608.htm>

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### SCIENCE DAILY – New insights on Denisovans interbreeding with modern day humans

Scientists believe individuals of the most recently discovered 'hominin' group (the Denisovans) that interbred with modern day humans passed on some of their genes via multiple, distinct interbreeding events that helped shape early human history. Scientists outline evidence suggesting that several Denisovan populations, who likely had an extensive geographical range from Siberia to Southeast Asia and from Oceania to South America, were adapted to distinct environments. They further outline a number of genes of Denisovan origin that gave modern day humans advantages in their different environments.

<https://www.sciencedaily.com/releases/2024/11/241108113302.htm>

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### SCIENCE DAILY – Debunked: Children aren't quicker at picking up new motor skills than adults

Contrary to popular belief, children aren't better at learning new skills than adults. Indeed, young adults seem to learn faster than kids -- but also tend to forget more quickly. Here, better sleep seems to advantage children.

<https://www.sciencedaily.com/releases/2024/11/241112123436.htm>

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### SCIENCE NEWS – Fossil teeth hint at a surprisingly early start to humans' long childhoods

X-ray imaging reveals signs of slow dental development in a youth from an early Homo species.

<https://www.sciencenews.org/article/fossil-teeth-tooth-human-childhood>

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### SCIENCE NEWS – How does a fossil become a superstar? Just ask Lucy

Discovered 50 years ago, the skeleton ushered in a new way of thinking about human evolution.

<https://www.sciencenews.org/article/fossil-lucy-superstar-evolution-science>

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### SCIENCE.ORG NEWS – Why do humans mature so slowly? An ancient youth offers clues

Small-brained member of Homo that lived 1.8 million years ago may signal a step toward long, drawn-out childhoods.

<https://www.science.org/content/article/why-do-humans-mature-so-slowly-ancient-youth-offers-clues>

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## PUBLICATIONS

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### Adaptive Behavior

*April 2021: Special Issue on 4E cognition in the Lower Palaeolithic*

#### PAPERS

#### LAMBROS MALAFOURIS – How does thinking relate to tool making?

How the boundaries of the mind should be drawn with respect to action and the material world is a core research question that cognitive archaeology shares with contemporary cognitive sciences. The study of hominin technical thinking, as in the case of stone tool making, is a good way to bring that question to the fore. This article argues that archaeologists who study lithic artefacts and their transformations over the course of human evolution are uniquely well positioned to contribute to the ongoing debate about the marks of the mental. Adopting the material engagement approach, I propose to replace the internalist vision of mentality, that is, the vision of a brain-bound mind that is using the body to execute and externalise preconceived mental plan through the stone, with an ecological-enactive vision of participatory mentality where bodily acts and materials act together to generate rather than merely execute thought processes. I argue that the latter participatory view changes the geography of the cognitive and offers a better description for the continuity of mind and matter that we see in the lithic record.

<https://journals.sagepub.com/doi/full/10.1177/1059712320950539>

#### KARENLEIGH A. OVERMANN – The material difference in human cognition

Humans leverage material forms for unique cognitive purposes: We recruit and incorporate them into our cognitive system, exploit them to accumulate and distribute cognitive effort, and use them to recreate phenotypic change in new individuals and generations. These purposes are exemplified by writing, a relatively recent tool that has become highly adept at eliciting specific psychological and behavioral responses in its users, capability it achieved by changing in ways that facilitated, accumulated, and distributed incremental behavioral and psychological change between individuals and generations. Writing is described here as a self-organizing system whose design features reflect points of maximal usefulness that emerged under sustained collective use of the tool. Such self-organization may hold insights applicable to human cognitive evolution and tool use more generally. Accordingly, this article examines the emergence of the ability to leverage material forms for cognitive

purposes, using the tool-using behaviors and lithic technologies of ancestral species and contemporary non-human primates as proxies for matters like collective use, generational sustainment, and the non-teleological emergence of design features.

<https://journals.sagepub.com/doi/full/10.1177/1059712320930738>

### **ANNA M. BARONA – The archaeology of the social brain revisited: rethinking mind and material culture from a material engagement perspective**

The social brain hypothesis (SBH) has played a prominent role in interpreting the relationship between human social, cognitive and technological evolution in archaeology and beyond. This article examines how the SBH has been applied to the Palaeolithic material record, and puts forward a critique of the approach. Informed by Material Engagement Theory (MET) and its understanding of material agency, it is argued that the SBH has an inherently cognitivist understanding of mind and matter at its core. This Cartesian basis has not been fully resolved by archaeological attempts to integrate the SBH with relational models of cognition. At the heart of the issue has been a lack of meaningful consideration of the cognitive agency of things and the evolutionary efficacy of material engagement. This article proposes MET as a useful starting point for rethinking future approaches to human social cognitive becoming in a way that appreciates the co-constitution of brains, bodies and worlds. It also suggests how MET may bridge archaeological and 4E approaches to reconsider concepts such as the ‘mental template’ and Theory of Mind.

<https://journals.sagepub.com/doi/full/10.1177/1059712320941945>

### **HANNAH MOSLEY – Primate tool use and the socio-ecology of thinging: how non-humans think through tools**

While ecological psychology and embodied approaches to cognition have gained traction within the literature on non-human primate tool use, a fear of making assumptions on behalf of animal minds means that their application has been conservative, often retaining the methodological individualism of the cognitivist approach. As a result, primate models for technical and cognitive evolution, rooted in the teleological functionalism of the Neo-Darwinist approach, reduce tool use to the unit of the individual, conflating technology with technique and physical cognition with problem-solving computations of energetic efficiency. This article attempts, through the application of material engagement theory, to explore non-human primate technology as a non-individualistic phenomenon in which technique is co-constructed through the ontogenetic development of skill within a dynamic system of structured action affordances and material interactions which constitute an emergent, species-specific mode of technical cognition.

<https://journals.sagepub.com/doi/full/10.1177/1059712320943623>

### **CHRIS BABER & KLINT JANULIS – Purposeful tool use in early lithic technologies**

Tool use can be considered in terms of purposeful behaviour. This emphasis on ‘purpose’ hides a host of assumptions about the nature of cognition and its relationship with physical activity. In particular, a notion of ‘purpose’ might assume that this is teleological which, in turn, requires a model of a desired end state of an action that can be projected onto the environment. Such a model is fundamental to traditional descriptions of cognition and a version of this can be found in the ‘template’ theory of stone-tool production (i.e. where the maker of the tool has a model in mind and attempts to reproduce this model in stone). Against this cognitive perspective, a number of approaches have been proposed that share their roots in the work of Gibson (i.e. ecological psychology) or Bernstein (i.e. dynamic systems). From these perspectives, ‘purpose’ is not a matter of a projection but opportunity; put simply, an action is performed until it need not be performed further. Trivial though this might sound, it has implications for how we define purpose and how this might apply to our understanding of tool use. We argue from a dynamic systems perspective and demonstrate the use of tools to crack bones for marrow extraction.

<https://journals.sagepub.com/doi/full/10.1177/1059712320941543>

### **JOHN A.J. GOWLETT – Deep structure in the Acheulean adaptation: technology, sociality and aesthetic emergence**

This article considers the adaptive setting and probable origins of human aesthetic capabilities, using evidence of the Acheulean tradition in the last million years, and highlighting the importance of the preceding and enveloping social and technological contexts. Acheulean bifaces, made from about 1.75 to 0.1 Ma, often with an appearance of symmetry, give windows on crucial interlocking aspects of human intellectual evolution. These have been seen as the domains of technology, sociality and aesthetics, following Leroi-Gourhan, or in near-equivalence the ‘technological’, ‘sociological’ and ‘ideological/philosophical’ of L.A. White. These domains can be analysed to have a reality, in the sense that social worlds of the apes far antedate technology, which in turn is generally taken to be far older than a sense of aesthetic appreciation. The bifaces are helpful in illustrating early developments because they can be made only through bringing together a set of concepts linking form, function and technology of manufacture, in a recurring ‘deep structure’. As there are at least 6 to 12 necessary concepts, perhaps significantly more, the artefacts are essentially multivariable or multivariate. They thus impose high cognitive requirements in manufacture, pressing towards effective sequencing of steps so that not too many variables will be involved simultaneously. Support of such a knowledge base has social requirements of shared or collective intention. Biomechanical and functional necessities also exert pressures on concepts: rules maintained by all these requirements entail a notion of ‘appropriateness’ or ‘rightness’ that may have been a prime factor in driving evolution of a sense of aesthetics and even the shaping of moral feelings. As the rules are variably expressed through time and space in the Acheulean, some of

the best information comes from seeing how far particular variables are 'locked' in relationships which recur to give the impression of deep structure.

<https://journals.sagepub.com/doi/full/10.1177/1059712320965713>

## Current Biology

### PAPERS

#### **LEA URBAN et al – Water-hose tool use and showering behavior by Asian elephants**

Since Jane Goodall's famous observations of stick tool use by chimpanzees, animal tool use has been observed in numerous species, including many primates, dolphins, and birds. Some animals, such as New Caledonian crows, even craft tools. Elephants frequently use tools and also modify them. We studied water-hose tool use in Asian zoo elephants. Flexibility, extension, and water flow make hoses exceptionally complex tools. Individual elephants differed markedly in their water-hose handling. Female elephant Mary displayed sophisticated hose-showering behaviors. She showed lateralized hose handling, systematically showered her body, and coordinated the trunk-held water hose with limb behaviors. Mary usually grasped the hose behind the tip, using it as a stiff shower head. To reach her back, however, she grasped the hose further from the tip and swung it on her back, using hose flexibility and ballistics. Aggressive interactions between Mary and the younger female elephant, Anchali, ensued around Mary's showering time. At some point, Anchali started pulling the water hose toward herself, lifting and kinking it, then regrasping and compressing the kink. This kink-and-clamp behavior disrupted water flow and was repeated in several sessions as a strict sequence of maneuvers. The efficacy of water flow disruption increased over time. In control experiments with multiple hoses, it was not clear whether Anchali specifically targeted Mary's showering hose. We also observed Anchali pressing down on the water hose, performing an on-hose trunk stand, which also disrupted water flow. We conclude that elephants show sophisticated hose tool use and manipulation.

[https://www.cell.com/current-biology/fulltext/S0960-9822\(24\)01371-X](https://www.cell.com/current-biology/fulltext/S0960-9822(24)01371-X)

#### **AARIT AHUJA et al – Monkeys engage in visual simulation to solve complex problems**

Visual simulation—i.e., using internal reconstructions of the world to experience potential future versions of events that are not currently happening—is among the most sophisticated capacities of the human mind. But is this ability in fact uniquely human? To answer this question, we tested monkeys on a series of experiments involving the “Planko” game, which we have previously used to evoke visual simulation in human participants. We found that monkeys were able to successfully play the game using a simulation strategy, predicting the trajectory of a ball through a field of planks while demonstrating a level of accuracy and behavioral signatures comparable with those of humans. Computational analyses further revealed that the monkeys' strategy while playing Planko aligned with a recurrent neural network (RNN) that approached the task using a spontaneously learned simulation strategy. Finally, we carried out awake functional magnetic resonance imaging while monkeys played Planko. We found activity in motion-sensitive regions of the monkey brain during hypothesized simulation periods, even without any perceived visual motion cues. This neural result closely mirrors previous findings from human research, suggesting a shared mechanism of visual simulation across species. Taken together, these findings challenge traditional views of animal cognition, proposing that nonhuman primates possess a complex cognitive landscape, capable of invoking imaginative and predictive mental experiences to solve complex everyday problems.

[https://www.cell.com/current-biology/abstract/S0960-9822\(24\)01380-0](https://www.cell.com/current-biology/abstract/S0960-9822(24)01380-0)

## Frontiers for Young Minds

### PAPERS

#### **MATTHEW MCARTHUR & MARGARET FRIEND – Why Early Chatter Matters: The Role of Language in Shaping Futures**

The words we learn early in life are building blocks for our brains, helping them grow and helping us understand the world better. As we learn new words and the concepts behind them, we support the foundation on which our future learning, relationships, and achievements are built. A rich early vocabulary opens the door to understanding complex ideas, solving problems, and expressing thoughts and emotions more clearly. Early language can even support distant future outcomes such as academic success in high school and employment as an adult. This article will discuss why early chatter is so powerful, how it supports future learning, and what factors are the most important contributors to developing vocabulary in the first few years of life.

<https://kids.frontiersin.org/articles/10.3389/frym.2024.1426649>

## Frontiers in Psychology

### PAPERS

#### **SHUTA TOMISATO et al – Speech characteristics that differentiate stuttering and cluttering in Japanese speakers**

Cluttering is a speech disorder distinct from stuttering. Despite this distinction, there is no established method to clearly differentiate the two disorders. This study aimed to use objective criteria to differentiate cluttering from stuttering in Japanese speakers.

Participants were 32 consecutive native-Japanese speakers who visited the Keio University Hospital between July 2020 and January 2023 with a chief complaint of speech disfluency. One physician and two speech-language-hearing therapists



concluded on a stuttering or cluttering diagnosis of the 32 patients based on recordings of the Kitsuo kensa-ho test. The frequencies of stuttering-like disfluencies (SDF) and normal disfluencies (NDF) were calculated from the Kitsuo kensa-ho, and the ratio of disfluencies (RDF) was calculated as the ratio of SDF to NDF. Differences between the cluttering and stuttering groups in the RDF and the mean articulatory rate (MAR) for oral reading and a monologue task were tested using the Mann–Whitney U test. ROC curves were used to determine the sensitivity and specificity that well-distinguished subjects with cluttering from those with stuttering; the experts' diagnosis was the gold standard.

Of the 32 participants, 12 (38%) were diagnosed with cluttering and 20 (62%) with stuttering. The cluttering and stuttering groups were comparable in demographic characteristics. The RDF on monologue task had the highest sensitivity in diagnosing cluttering, and the MAR on monologue task had the highest specificity. Adopting provisional criteria of a monologue RDF greater than 1.2 and a monologue MAR greater than 7.5 produced a sensitivity of 0.92 and a specificity of 0.95.

We conclude that combining monologue RDF and monologue MAR well-distinguished cluttering from stuttering. This method provides new objective diagnostic criteria, which can aid clinicians, therapists, and basic researchers.

<https://www.frontiersin.org/journals/psychology/articles/10.3389/fpsyg.2024.1408929/full>

### **LONNEKE JANSSEN, ANNETTE SCHEPER & CONSTANCE VISSERS – Controlling the narrative: the relationship between narrative ability and executive functioning in children with developmental language disorder**

Children with developmental language disorder (DLD) experience problems in language comprehension and/or production. In particular, storytelling or narrative ability is often impaired, as this type of discourse involves all domains of language. These problems may lead to a lower quality of social interaction and mental health. Moreover, problems in oral narrative ability during early development have a negative effect on later literacy. However, telling a story involves more than language alone. Executive functioning is thought to play an important part in stimulating narrative ability, as linguistic utterances need to be planned in a temporal and causal order, and switching is needed between multiple characters and events in the story. Research has shown that children with DLD experience problems with executive functioning, independent of their language ability. Thus, the difficulties in storytelling may be caused by both impaired language and executive functioning, as both domains follow hierarchical developmental paths during the early childhood years. In this review, we discuss three components of narrative ability (comprehension, production of macrostructure and production of microstructure) and how they may be interconnected to the three core components of executive functioning (working memory, switching and inhibition) and attention. This review shows that updating and monitoring information in working memory plays an important part in all three components of narrative ability, across multiple studies. This result may give direction in the development of narrative assessment and intervention, and urge further research to disentangle the interplay between language and executive control in DLD.

<https://www.frontiersin.org/journals/psychology/articles/10.3389/fpsyg.2024.1489997/full>

## iScience

### PAPERS

#### **MING LI et al – Language-Specific Representation of Emotion-Concept Knowledge Causally Supports Emotion Inference**

Humans no doubt use language to communicate about their emotional experiences, but does language in turn help humans understand emotions, or is language just a vehicle of communication? This study used a form of artificial intelligence (AI) known as large language models (LLMs) to assess whether language-based representations of emotion causally contribute to the AI's ability to generate inferences about the emotional meaning of novel situations. Fourteen attributes of human emotion concept representation were found to be represented by the LLM's distinct artificial neuron populations. By manipulating these attribute-related neurons, we in turn demonstrated the role of emotion concept knowledge in generative emotion inference. The attribute-specific performance deterioration was related to the importance of different attributes in human mental space. Our findings provide a proof-in-concept that even a LLM can learn about emotions in the absence of sensory-motor representations and highlight the contribution of language-derived emotion-concept knowledge for emotion inference.

[https://www.cell.com/iscience/fulltext/S2589-0042\(24\)02626-9](https://www.cell.com/iscience/fulltext/S2589-0042(24)02626-9)

## Journal of the Acoustical Society of America

### PAPERS

#### **MAÏA PONSONNET et al – Vowel signatures in emotional interjections and nonlinguistic vocalizations expressing pain, disgust, and joy across languages**

In this comparative cross-linguistic study we test whether expressive interjections (words like ouch or yay) share similar vowel signatures across the world's languages, and whether these can be traced back to nonlinguistic vocalizations (like screams and cries) expressing the same emotions of pain, disgust, and joy. We analyze vowels in interjections from dictionaries of 131 languages (over 600 tokens) and compare these with nearly 500 vowels based on formant frequency measures from voice recordings of volitional nonlinguistic vocalizations. We show that across the globe, pain interjections feature a-like vowels and wide falling diphthongs (“ai” as in Ayyy! “aw” as in Ouch!), whereas disgust and joy interjections do

not show robust vowel regularities that extend geographically. In nonlinguistic vocalizations, all emotions yield distinct vowel signatures: pain prompts open vowels such as [a], disgust schwa-like central vowels, and joy front vowels such as [i]. Our results show that pain is the only affective experience tested with a clear, robust vowel signature that is preserved between nonlinguistic vocalizations and interjections across languages. These results offer empirical evidence for iconicity in some expressive interjections. We consider potential mechanisms and origins, from evolutionary pressures and sound symbolism to colexification, proposing testable hypotheses for future research.

<https://pubs.aip.org/asa/jasa/article/156/5/3118/3319867/Vowel-signatures-in-emotional-interjections-and>

## Mind & Language

### PAPERS

#### **GUIDO LÖHR – Does the mind care about whether a word is abstract or concrete? Why concreteness is probably not a natural kind**

Many psychologists currently assume that there is a psychologically real distinction to be made between concepts that are abstract and concepts that are concrete. It is for example largely agreed that concepts and words are more easily processed if they are concrete. Moreover, it is assumed that this is because these words and concepts are concrete. It is thought that interesting generalizations can be made about certain concepts because they are concrete. I argue that we have surprisingly little reason to believe that the abstract-concrete distinction is psychologically real.

<https://onlinelibrary.wiley.com/doi/full/10.1111/mila.12473>

#### **SARAH A. FISHER – That's not what you said! Semantic constraints on literal speech**

According to some philosophers, a sentence's semantics can fail to constitute a complete propositional content, imposing mere constraints on such a content. Recently, Daniel Harris has begun developing a formal constraint semantics. He claims that the semantic values of sentences constrain what speakers can literally say with them—and what hearers can know about what was said. However, that claim is undermined by his conception of semantics as the study of a psychological module. I argue instead that semantic constraints should be understood as properties of public languages.

<https://onlinelibrary.wiley.com/doi/full/10.1111/mila.12508>

#### **JIANGTIAN LI – Semantic minimalism and the continuous nature of polysemy**

Polysemy has recently emerged as a popular topic in philosophy of language. While much existing research focuses on the relatedness among senses, this article introduces a novel perspective that emphasizes the continuity of sense individuation, sense regularity, and sense productivity. This new perspective has only recently gained traction, largely due to advancements in computational linguistics. It also poses a serious challenge to semantic minimalism, so I present three arguments against minimalism from the continuous perspective that touch on the minimal concept, the distinction from homonymy, and the quasi-rule-like nature of polysemy. Last, I provide an account of polysemy that incorporates this continuous perspective.

<https://onlinelibrary.wiley.com/doi/full/10.1111/mila.12509>

#### **FREDERIK TOLLERUP JUNKER & THOR GRÜNBAUM – Is the wandering mind a planning mind?**

Recent studies on mind-wandering reveal its potential role in goal exploration and planning future actions. How to understand these explorative functions and their impact on planning remains unclear. Given certain conceptions of intentions and beliefs, the explorative functions of mind-wandering could lead to regular reconsideration of one's intentions. However, this would be in tension with the stability of intentions central to rational planning agency. We analyze the potential issue of excessive reconsideration caused by mind-wandering. Our response resolves this tension, presenting a model that aligns the roles of mind-wandering in planning with empirical evidence and the sustained stability of intentions.

<https://onlinelibrary.wiley.com/doi/full/10.1111/mila.12503>

#### **LUCIEN BAUMGARTNER – The pragmatic view on dual character concepts and expressions**

This article introduces a new pragmatic framework for dual character concepts and their expressions, offering an alternative to the received lexical-semantic view. On the prevalent lexical-semantic view, expressions such as “philosopher” or “scientist” are construed as lexical polysemes, comprising both a descriptive and a normative dimension. Thereby, this view prioritizes established norms, neglecting normative expressions emerging in specific contexts. In contrast, the pragmatic view integrates pragmatic modulation as a central element in explaining context-dependent dual character concepts and expressions. This not only accounts for a wider range of phenomena but also addresses several theoretical shortcomings of the lexical view.

<https://onlinelibrary.wiley.com/doi/full/10.1111/mila.12505>

## Nature

### NEWS

#### **How human brains got so big: our cells learned to handle the stress that comes with size**

Understanding how human neurons cope with the energy demands of a large, active brain could open up new avenues for treating neurological disorders.

<https://www.nature.com/articles/d41586-024-03716-4>

### ARTICLES

#### **DEBBIE GUATELLI-STEINBERG – Growing up slowed down for an early Homo individual**

Human children pair fast growth of a large brain with slow body growth. Ancient Homo fossil teeth reveal that hominin dental growth rates began to slow before there was a major increase in brain size compared with apes.

<https://www.nature.com/articles/d41586-024-03547-3>

### PAPERS

#### **CHRISTOPH P. E. ZOLLIKOFER et al with DAVID LORDKIPANIDZE – Dental evidence for extended growth in early Homo from Dmanisi**

Human life history is characterized by an extended period of immaturity during which there is a disjunction between cerebral and somatic growth rates<sup>1</sup>. This mode of ontogeny is thought to be essential for the acquisition of advanced cognitive capabilities in a socially complex environment while the brain is still growing<sup>2</sup>. Key information about when and how this pattern evolved can be gleaned from the teeth of fossil hominins because dental development informs about the pace of life history<sup>3,4,5</sup>. Here we show that the first evolutionary steps towards an extended growth phase occurred in the genus Homo at least 1.77 million years ago, before any substantial increase in brain size. We used synchrotron phase-contrast tomography<sup>6</sup> to track the microstructural development of the dentition of a subadult early Homo individual from Dmanisi, Georgia. The individual died at the age of  $11.4 \pm 0.6$  years, shortly before reaching dental maturity. Tooth growth rates were high, similar to rates in living great apes. However, the Dmanisi individual showed a human-like delayed formation of the posterior relative to the anterior dentition, and a late growth spurt of the dentition as a whole. The unique combination of great-ape-like and human-like features of dental ontogeny suggests that early Homo had evolved an extended growth phase before a general slow-down in life history, possibly related to biocultural reproduction<sup>7</sup> rather than brain growth.

<https://www.nature.com/articles/s41586-024-08205-2>

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## Nature Communications

### PAPERS

#### **KENICHI YAMAMOTO et al with THE BIOBANK JAPAN PROJECT – Genetic legacy of ancient hunter-gatherer Jomon in Japanese populations**

The tripartite ancestral structure is a recently proposed model for the genetic origin of modern Japanese, comprising indigenous Jomon hunter-gatherers and two additional continental ancestors from Northeast Asia and East Asia. To investigate the impact of the tripartite structure on genetic and phenotypic variation today, we conducted biobank-scale analyses by merging Biobank Japan (BBJ;  $n = 171,287$ ) with ancient Japanese and Eurasian genomes ( $n = 22$ ). We demonstrate the applicability of the tripartite model to Japanese populations throughout the archipelago, with an extremely strong correlation between Jomon ancestry and genomic variation among individuals. We also find that the genetic legacy of Jomon ancestry underlies an elevated body mass index (BMI). Genome-wide association analysis with rigorous adjustments for geographical and ancestral substructures identifies 132 variants that are informative for predicting individual Jomon ancestry. This prediction model is validated using independent Japanese cohorts (Nagahama cohort,  $n = 2993$ ; the second cohort of BBJ,  $n = 72,695$ ). We further confirm the phenotypic association between Jomon ancestry and BMI using East Asian individuals from UK Biobank ( $n = 2286$ ). Our extensive analysis of ancient and modern genomes, involving over 250,000 participants, provides valuable insights into the genetic legacy of ancient hunter-gatherers in contemporary populations.

<https://www.nature.com/articles/s41467-024-54052-0>

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## Nature Humanities & Social Sciences Communications

### PAPERS

#### **JIANGPING ZHOU – Preferences of interpersonal metaphor of modality in academic disciplines**

Drawing on diachronic and synchronic collexeme analyses, this paper investigated preferences of interpersonal metaphor of modality, which is realized by explicit subjective orientation, explicit objective orientation and implicit objective orientation, in academic disciplines of Corpus of Contemporary American English or COCA. The findings demonstrate that explicit subjective orientation is generally avoided by academic writers in later phases of COCA and more rarely used in natural sciences than in social and human sciences. Explicit objective orientation that denotes low modal value of probability, i.e., possible, and median value of obligation, i.e., important and necessary, is insensitive to both three phases and academic disciplines in COCA. Implicit objective orientation, inclusive of significantly attracted possibility and importance, employs probability and obligation that denote median value of probability and high value of obligation respectively to mask the

subjective judgments of scholars regarding the proposition under scrutiny. This research is significant in shedding light on the use of interpersonal metaphor of modality in academic writings across disciplines.

<https://www.nature.com/articles/s41599-024-04084-0>

### **MENGYU HE & QIN XIE – Empowering autonomy in language learning: the sustainable impact of data-driven learning on noun collocation acquisition**

This study explores the effectiveness of Data-Driven Learning (DDL) in teaching noun collocations to pre-tertiary learners in Hubei Province, China, using the online corpus tool 'Corpusmate'. Acknowledging the importance and challenge of mastering collocations in learning a foreign language, this study focuses on the effects of DDL on pre-tertiary learners, an area less examined previously due to the complexities associated with using corpus tools. Conducted over two months, the research employed pre-tests, post-tests, and delayed post-tests to measure learners' comprehension and retention of noun collocations. Additionally, a questionnaire was distributed to gather feedback on learners' experiences with the DDL approach and 'Corpusmate'. Results indicated that the experimental group, which received DDL training, showed significant improvements in test scores compared to the control group, which used traditional resources. The experimental group's scores remained high in the delayed post-test, suggesting that the DDL approach facilitated long-term retention of collocational knowledge, although a notable proportion of learners expressed neutral or negative perceptions of the DDL activities. These results highlight the need for further investigation into the attitudes of the participants. Overall, most participants provided positive feedback on the use of 'Corpusmate' in learning noun collocations. These results advocate for the incorporation of corpus consultation into language teaching practices. The study underscores that with appropriate training and tools like 'Corpusmate', the DDL approach can potentially aid in the sustained learning of complex language elements, such as collocations, even for younger learners.

<https://www.nature.com/articles/s41599-024-04038-6>

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## Nature Scientific Reports

### PAPERS

### **VITTORIA DENTELLA et al – Testing AI on language comprehension tasks reveals insensitivity to underlying meaning**

Large Language Models (LLMs) are recruited in applications that span from clinical assistance and legal support to question answering and education. Their success in specialized tasks has led to the claim that they possess human-like linguistic capabilities related to compositional understanding and reasoning. Yet, reverse-engineering is bound by Moravec's Paradox, according to which easy skills are hard. We systematically assess 7 state-of-the-art models on a novel benchmark. Models answered a series of comprehension questions, each prompted multiple times in two settings, permitting one-word or open-length replies. Each question targets a short text featuring high-frequency linguistic constructions. To establish a baseline for achieving human-like performance, we tested 400 humans on the same prompts. Based on a dataset of  $n = 26,680$  datapoints, we discovered that LLMs perform at chance accuracy and waver considerably in their answers. Quantitatively, the tested models are outperformed by humans, and qualitatively their answers showcase distinctly non-human errors in language understanding. We interpret this evidence as suggesting that, despite their usefulness in various tasks, current AI models fall short of understanding language in a way that matches humans, and we argue that this may be due to their lack of a compositional operator for regulating grammatical and semantic information.

<https://www.nature.com/articles/s41598-024-79531-8>

### **BROCK FERGUSON, ALEXANDER LATOURETTE & SANDRA R. WAXMAN – Six-month-old infants use cross-modal synchrony to identify novel communicative signals**

Humans adopt non-linguistic signals, from smoke signals to Morse code, to communicate. This communicative flexibility emerges early: embedding novel sine-wave tones in a social, communicative exchange permits 6-month-olds to imbue them with communicative status, and to use them in subsequent learning. Here, to specify the mechanism(s) that undergird this capacity, we introduced infants to a novel signal—sine-wave tone sequences—in brief videotaped vignettes with non-human agents, systematically manipulating the socio-communicative cues in each vignette. Next, we asked whether infants interpreted new tone sequences as communicative in a fundamental cognitive task: object categorization. Infants successfully interpreted tones as communicative if they were produced in dialogues with one agent speaking (Study 1) or both agents producing tones (Study 2), or in monologues involving only a single agent (Study 3). What was essential was cross-modal temporal synchrony between an agent's movements and the tones: when this synchrony was disrupted (Study 4), infants failed in the subsequent task. This synchrony, we propose, licensed an inference that the tones, generated by an agent, were candidate communicative signals. Infants' early capacity to use synchrony to identify new communicative signals and recruit them in subsequent learning has implications for theory and for interventions to support infants facing communicative challenges.

<https://www.nature.com/articles/s41598-024-78801-9>

**YUSUKE SUZUKI et al – Crossmodal correspondences between visual and speech angularity and tactile jaggedness of response key**

Several studies reported various crossmodal correspondences related to tactile features. These previous studies have investigated tactile-related correspondences through explicit matching or subjective evaluation tasks, which required participants to recognize relationships between tactile and other sensory features or rate tactile materials on scales with adjective labels related to visual or auditory features. However, these tasks are prone to occur the experimenter-expectancy effects and arbitrary categorization of tactile materials by the labels, making it difficult to assess implicit and non-arbitrary aspects of crossmodal correspondences. To address this, we used a speeded classification task to examine whether the angularity/roundedness of visual and auditory stimuli correspond to tactile jaggedness/fluffiness. Participants distinguished between angularity or roundedness (Experiment 1: visual shapes; Experiment 2: speech sounds) by pressing right- or left-positioned response keys with task-irrelevant jaggedness or fluffiness without prior instruction on which key represented jaggedness/fluffiness. Results showed faster keypresses for jagged/fluffy responses to angular/rounded stimuli, suggesting an implicit correspondence between these sensory features except for the experimenter-expectancy effects and the influence of the labels. Unlike previous studies that examined the correspondence with simple tactile features (e.g., weight, size), our findings suggest that even complex tactile-quality features, such as jaggedness/fluffiness, implicitly correspond to visual and auditory angularity/roundedness.

<https://www.nature.com/articles/s41598-024-79400-4>

**New Scientist****NEWS****Marmots could have the solution to a long-running debate in evolution**

When it comes to the survival of animals living in the wild, the characteristics of the group can matter as much as the traits of the individual, according to a study in marmots.

<https://www.newscientist.com/article/2454693-marmots-could-have-the-solution-to-a-long-running-debate-in-evolution/>

**Chimps do better at difficult tasks when they have an audience**

An analysis of thousands of cognitive tests carried out by chimpanzees finds that the number of spectators influenced their performance in different ways depending on the difficulty of the task.

<https://www.newscientist.com/article/2455504-chimps-do-better-at-difficult-tasks-when-they-have-an-audience/>

**ARTICLES****PENNY SARCHET et al – The origins of writing revealed (Podcast)**

The roots of the world's oldest known writing system are being uncovered. Cuneiform was invented around 3200 BC in ancient Mesopotamia, but before it came a much simpler form of writing called proto-cuneiform. Researchers are now shedding light on how writing began along with the cultural factors that spurred on its invention.

<https://www.newscientist.com/podcasts/>

**JAMES WOODFORD – Watch elephants use a hose to shower themselves – and prank others**

Asian elephants at Berlin Zoo show impressive skill when using a hose as a tool, and even appear to sabotage each other by stopping the flow of water.

<https://www.newscientist.com/article/2455485-watch-elephants-use-a-hose-to-shower-themselves-and-prank-others/>

**SUSANA MONSÓ – To truly understand non-human grief, we need to think like the animals**

Evidence that animals mourn the death of loved ones is growing, but we should be wary of letting our biases cloud this topic.

<https://www.newscientist.com/article/mg26435172-100-to-truly-understand-non-human-grief-we-need-to-think-like-the-animals/>

**Philosophical Transactions of the Royal Society A****PAPERS****ELISABETH STOCKINGER & MICHAEL MANDLMAYR – Artefact design and societal worldview**

Technological artefacts are created in accordance with the values and worldviews of their designers. In operation, they act as a medium, facilitating and constraining human interaction with, and perception of, the world. When used on a large scale, they may lastingly affect societal ethos. If institutional structures of domination allocate the resources necessary for artefact design and development to some population groups over others, the direction and extent of such an effect may lead to increased disparity and inequity. While the direct influence of technology on opinion is well-studied, the evaluation of non-epistemic values, assumptions and presuppositions is a hurdle in the way of a deeper understanding of the large-scale effects of asymmetries in worldviews embodied by artefacts. Here, we show that artefacts have a strong potential to bias societal worldviews when they are distributed unevenly across the value spectrum. They can affect the clustering behaviour of agents with regard to worldview, both aiding and hindering intra- and inter-cluster diversity, depending on their distribution and

frequency. Our findings underline the distributional sensitivity of worldview dynamics to institutional structures of domination. We highlight the importance of procedural interventions such as participatory design, which explicitly acknowledges existing asymmetries and redistributes power accordingly.

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

## PLoS One

### PAPERS

#### **RIVKA CHASAN et al – Podocarpaceae and Cupressaceae: A tale of two conifers and ancient adhesives production in South Africa**

Research on ancient adhesives from the South African Stone Age is expanding, driven by excellent preservation conditions of adhesives and the potential to address diverse archaeological questions. These adhesives are primarily characterized through microscopic and chemical analysis. Despite geographic variability, a consistently identified component is Podocarpus resin or tar. We challenge these identifications, considering another Podocarpaceae genus, Afrocarpus, and the Cupressaceae genus Widdringtonia. Gas Chromatography-Mass Spectrometry was employed to analyze molecular signatures of modern wood, tar, resin, and seed cones from these genera. The results form an extensive reference database and reveal challenges in distinguishing these genera based on the diterpenoid signature. While Podocarpus is frequently cited, we advocate for a broader classification as Podocarpaceae when phenolic diterpenoids are found in high abundances and pimaranes and abietanes in lower abundances, and Widdringtonia when the opposite is true. The study differentiates materials used in adhesive production, including leaves and wood, highlighting the significance of  $\alpha,\omega$ -dicarboxylic acids, hydroxy acids, n-alkanes, and alcohols. Tars produced from leaves are characterized by odd-numbered n-alkanes, while tars produced from twigs and branches are characterized by long-chain  $\alpha,\omega$ -dicarboxylic acids, hydroxy acids, and alcohols. Because the differences between these adhesives in terms of raw material procurement and production are great, a more nuanced and cautious approach that acknowledges the challenges in differentiating tree species on a molecular level and considers archaeological and environmental context is required.

<https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0306402>

#### **TALIA YASHUV & LEORE GROSAN – 12,000-year-old spindle whorls and the innovation of wheeled rotational technologies**

‘The wheel and axle’ revolutionized human technological history by transforming linear to rotary motion and causing parts of devices to move. While its ancient origins are commonly associated with the appearance of carts during the Bronze Age, we focus on much earlier wheel-shaped find—an exceptional assemblage of over a hundred perforated pebbles from the 12,000-year-old Natufian village of Nahal Ein-Gev II, Israel. We analyze the assemblage using 3D methodologies, incorporating novel study applications to both the pebbles and their perforations and explore the functional implications. We conclude that these items could have served as spindle whorls to spin fibres. In a cumulative evolutionary trend, they manifest early phases of the development of rotational technologies by laying the mechanical principle of the wheel and axle. All in all, it reflects on the technological innovations that played an important part in the Neolithization processes of the Southern Levant.

<https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0312007>

#### **ANDERS HÖGBERG et al with MARLIZE LOMBARD & PETER GÄRDENFORS – Human socio-technical evolution through the lens of an abstracted-wheel experiment: A critical look at a micro-society laboratory study**

Micro-society experimental setups are increasingly used to infer aspects of human behavioural evolution. A key part of human society today is our dependence on, and use of, technology—whether simple (such as a knife) or complex (such as the technology that underpins AI). Previously, two groups of researchers used an abstracted-wheel experiment to explore the evolution of human technical behaviour, reaching fundamentally different outcomes. Whereas one group saw their results as indicating social learning only (void of causal understanding), the other inferred non-social technical reasoning as part of human technical behaviour. Here we report on the third generation of the micro-society abstracted-wheel experiment. We argue that causal reasoning is inseparable from both social learning and technical reasoning, and that these traits probably co-evolved into the current human socio-technical niche. Based on our outcomes, we present a critical assessment of what this experiment may (or may not) reveal about the evolution of human technical behaviour. We show that the abstracted-wheel experiment reflects behavioural output only, instead of testing for cognition. It is therefore limited in its ability to inform on aspects of human cognitive evolution, but it can provide useful insights into the interrelatedness of social learning, technical reasoning, and causal reasoning. Such a co-evolutionary insight has the potential to inform on aspects of human socio-technical evolution throughout the Pleistocene.

<https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0310503>

#### **BRIAN VILMOARE et al – Evolutionary origins of temporal discounting: Modeling how time and uncertainty constrain optimal decision-making strategies across taxa**

The propensity of humans and non-human animals to discount future returns for short-term benefits is well established. This contrasts with the ability of organisms to unfold complex developmental sequences over months or years efficiently. Research has focused on various descriptive and predictive parameters of ‘temporal discounting’ in behavior, and

researchers have proposed models to explain temporal preference in terms of fitness-maximizing outcomes. Still, the underlying ultimate cause of this phenomenon has not been deeply explored across taxa. Here, we propose an ultimate (i.e., evolutionary) causal explanation for the selection of temporal discounting largely conserved across taxa. We propose that preference for a short-term reward (e.g., heightened impulsivity) often is less than optimal and likely is the product of constraints imposed on natural selection with respect to predicting events in a temporal framework in the context of future uncertainty. Using a simple Newtonian model for time across a fitness landscape in which movement by organisms is only possible in one direction, we examine several factors that influence the ability of an organism to choose a distant reward over a more temporally proximate reward: including the temporal distance of the far reward, the relative value of the distant reward, and the effect of uncertainty about the value and presence of the distant reward. Our results indicate that an organism may choose a more distant reward, but only if it is not too far into the future and has a substantially higher-value fitness payoff relative to the short-term reward. Notably, any uncertainty about the distant reward made it extremely unlikely for an organism to choose the delayed reward strategy compared to choosing a closer reward, even if the distant reward had a much higher payoff because events that are uncertain are only partially visible to natural selection pressures. The results help explain why natural selection is constrained to promote more optimal behavioral strategies and why it has difficulty selecting a distant reward over a lower-value short-term reward. The degree of uncertainty is an especially salient ecological variable in promoting and preferencing short-term behavioral strategies across taxa. These results further help illustrate why, from an ultimate causal perspective, human and non-human taxa have difficulty making more optimal long-term decisions.

<https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0310658>

### **BASTIEN MEUNIER et al – A quick response, but not too much: Experienced mangabeys (*Cercocebus torquatus*) lose interest in contact call exchanges that do not respect this “conversational rule”**

Several non-human primate species engage in vocal exchanges of contact calls, throughout the day in peaceful contexts. These vocal exchanges have been compared to human conversations because vocalizations are uttered in turn-taking: a temporal pattern where interlocutors minimize silences and avoid overlaps. But observing such a pattern in the spontaneous production of a species, as is the case with red-capped mangabeys (*Cercocebus torquatus*), is not enough to make it a rule. Another prerequisite is that the pattern is expected by the animal. Here, we conducted a playback experiment using the violation-of-expectation paradigm to test whether captive red-capped mangabeys react differently to usual vs unusual interactive temporal patterns. We played back vocal exchanges with usual minimized response time (0.5 sec), with unusual longer response time (1.5 sec) and with unusual call overlap to 12 adult captive male mangabeys. For each individual, we measured the occurrences and durations of head orientation toward the loudspeaker after the stimuli. The interest of individuals varied according to the vocal exchange temporal pattern in interaction with their age. Indeed, the older (and thus more socially experienced) an individual was, the less interested he became after an unusual vocal exchange, i.e. a vocal exchange with call overlap or with a delayed response time. These findings suggest that experience shapes attention towards more socially relevant situations, and thus that turn-taking can be qualified as a social rule.

<https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0310857>

### **OLIVIER SENN et al – Null effect of perceived drum pattern complexity on the experience of groove**

There is a broad consensus in groove research that the experience of groove, understood as a pleasurable urge to move in response to music, is to some extent related to the complexity of the rhythm. Specifically, music with medium rhythmic complexity has been found to motivate greater urge to move compared to low or high complexity music (inverted-U hypothesis). Studies that confirmed the inverted-U hypothesis usually based their measure of complexity on the rhythmic phenomenon of syncopation, where rhythms with more and/or stronger syncopation are considered to be more complex than less syncopated rhythms. However, syncopation is not the same as complexity and represents only one rhythmic device that makes music complex. This study attempts the verification of the inverted-U hypothesis independently from syncopation. It uses a new stimulus set of forty idiomatic popular music drum patterns whose perceptual complexity was measured experimentally in a previous study. The current study reports the results of a listening experiment with  $n = 179$  participants, in which the inverted-U hypothesis was not confirmed. Complexity did not have any significant effect on listeners' urge to move ( $p = 834$ ). Results are discussed in the context of the psychological model of musical groove, which offers a nuance to this null result: simple drum patterns motivate listeners to dance because they convey metric clarity; complex patterns invite dancing because they are interesting. Yet, overall, the urge to move does not seem to depend on complexity, at least in the case of idiomatic drum patterns that are typically encountered in the Western popular music repertoire.

<https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0311877>

## Quarterly Review of Biology

### PAPERS

#### **ROBERT C. BROOKS – How Might Artificial Intelligence Influence Human Evolution?**

As artificial intelligence (AI) becomes more common and sophisticated, its effects on human lives and societies are attracting considerable attention. The question of how these new technologies might affect human evolution remains far less often

asked, and most attempts focus on dramatic but perhaps unlikely events, including possibilities of human annihilation, assimilation, or enslavement. This article considers instead the inevitable but incremental evolutionary consequences of AI's everyday use and human-AI interactions. I consider some possible forms of human-AI interaction, and the evolutionary implications of such interactions via natural selection, including forms of selection that resemble the inadvertent and deliberate selection that occur during domestication. The direction and rate of evolution can be hard to predict even for organisms kept under controlled conditions. Far more so the complexities of predicting selection and resulting evolution of humans in a fast-moving AI-rich world. Nonetheless, I extract several predictions, including the acceleration of recent trends toward smaller brains, selection on attention spans, personality types, and mood-disorder susceptibilities. Further, changes in intimacy-building and mating competition due to AI applications that act as friends and intimates are likely already affecting mating success and may influence the evolution of social behavior.

<https://www.journals.uchicago.edu/doi/abs/10.1086/733290>

## REVIEWS

### **ADRIANA A. MALDONADO-CHAPARRO – Modeling Social Behavior**

Review of 'Modeling Social Behavior: Mathematical and Agent-Based Models of Social Dynamics and Cultural Evolution' by Paul E. Smaldino. Princeton University Press (2023).

<https://www.journals.uchicago.edu/doi/abs/10.1086/733297>

## Royal Society Open Science

### PAPERS

#### **SIQI DUAN et al – Assessing the measurement invariance of Free Will and Determinism Plus scale across four languages: a registered report**

Free will is assumed to be the core of an individual's self-concept. Belief in free will has been studied extensively and was found to be correlated with many behavioural and psychological outcomes. Although developed and validated in the West, the Free will and Determinism Plus (FAD-Plus) scale has been translated, used, and interpreted as a measurement of free will beliefs in multiple cultures. However, the cross-cultural measurement invariance of FAD-Plus has not been examined. Given the cultural differences in understanding the concept of 'free will', items of FAD-Plus may have different interpretations in different cultures, which may compromise its cross-cultural measurement invariance. To provide empirical evidence for the lack of cross-cultural measurement invariance, we collected data in China and analyzed these data together with open datasets of FAD-Plus in three other languages: Japanese, French and English. We only found partial measurement invariance between the Chinese and English datasets, as well as the Japanese and English datasets. These results provided the first assessment of cross-cultural measure invariance of FAD-Plus. We discussed the potential implications of the current study for future studies in the field.

<https://royalsocietypublishing.org/doi/10.1098/rsos.220876>

#### **ADRIAN KEMPF et al – Individual differences in music-induced interpersonal synchronization and self–other integration: the role of creativity and empathy**

It has been demonstrated that moving together in synchrony to music makes us feel connected. Yet, little is known about the individual differences that shape the relationship between interpersonal synchronization to music and social bonding. The present research tests the hypothesis that this association is influenced by differences in empathy and creativity—two highly relevant factors in many musical activities. We implemented a synchronization task featuring a virtual drummer and measured self–other integration (SOI), a core component of social bonding. We employed a dual-measurement paradigm, incorporating both an explicit assessment (Inclusion of Other in the Self scale) and an implicit assessment (joint-Simon effect) of SOI. Surprisingly, our analysis did not reveal explicit and implicit measurements correlating, nor were they similarly affected by interpersonal synchronization. This raises questions about the assessment of SOI in interpersonal synchronization experiments. Furthermore, we observed no moderating role of empathy or creativity in the association between interpersonal synchronization and SOI. Nevertheless, we found creativity to correlate with SOI. In light of this finding, we recommend placing greater emphasis on creativity as a decisive factor in the study of musical interaction.

<https://royalsocietypublishing.org/doi/10.1098/rsos.240654>

#### **MATTHEW N. ZIPPLE et al – Animal emotions and consciousness: a preliminary assessment of researchers' perceptions and biases and prospects for future progress**

Scientists and philosophers have long struggled with the question of whether non-human animals experience emotions or consciousness. Yet, it is unclear where the scientific consensus on these topics lies today. To address this gap, we administered a survey of professional animal behaviour researchers to assess perceptions regarding (i) the taxonomic distribution of emotions and consciousness in non-human animals, (ii) respondents' confidence in this assessment, and (iii) attitudes towards pitfalls and potential for progress when addressing these questions. Respondents (n = 100) ascribe emotionality and consciousness to a broad swath of the animal taxonomy, including non-human primates, other mammals, birds and cephalopods. Respondents' attribution of these phenomena was strongly associated with their confidence in their assessments ( $R^2 > 0.9$ ), with respondents assuming an absence of emotions and consciousness when they were unsure. We



also identify an emergent consensus of the components involved in a functional definition of emotions. Researchers are optimistic that tools either currently exist or will exist in the future to rigorously address these questions (>85%) and that animal behaviour, as a field, should do more to encourage research works on emotions (>70%). We discuss implications for publication bias and future work in this area as well as ethical considerations regarding animal care and use.

<https://royalsocietypublishing.org/doi/10.1098/rsos.241255>

### **E. TOWNER et al – Increased threat learning after social isolation in human adolescents**

In animal models, social isolation impacts threat responding and threat learning, especially during development. This study examined the effects of acute social isolation on threat learning in human adolescents using an experimental, within-participant design. Participants aged 16–19 years underwent a session of complete isolation and a separate session of isolation with virtual social interactions, counterbalanced between participants, as well as a baseline session. At baseline and following each isolation session, participants reported their psychological state and completed a threat learning task in which self-report ratings and physiological responses to learned threat and safety cues were measured. Threat learning increased after both isolation sessions in two ways. First, participants found the learned threat cue more anxiety-inducing and unpleasant after isolation compared with baseline. Second, during threat extinction, electrodermal activity was partially elevated after isolation compared with baseline. Further, the results suggested that isolation influenced threat learning through state loneliness. Threat learning is central to threat-related disorders including anxiety, phobias, obsessive-compulsive disorder (OCD) and post-traumatic stress disorder (PTSD), and our findings suggest that isolation and loneliness in adolescence might increase vulnerability to the emergence of these disorders through increased threat learning.

<https://royalsocietypublishing.org/doi/10.1098/rsos.240101>

## Trends in Cognitive Sciences

### COMMENTARIES

#### **CHEN SONG – Understanding the qualitative nature of human consciousness**

Understanding what conscious experiences feel like from a first-person perspective, known as the hard problem of consciousness, remains one of the most intriguing yet elusive topics in science and philosophy. In their timely article in *TICS*, Fleming and Shea propose the quality space approach as a promising path forward. They suggest that the qualitative nature of consciousness can be studied by correlating the subjective similarity between stimulus-evoked conscious experiences with the similarity in neural activity patterns. While I support their endeavor, I wish to highlight two foundational challenges: first, how to infer the qualitative nature of consciousness from subjective similarity, and second, how to link the qualitative nature of consciousness to the nature of neural activity. These challenges represent key directions for future research, with new developments offering potential breakthroughs.

[Original paper: *EAORC Bulletin 1,101.*]

[https://www.cell.com/trends/cognitive-sciences/abstract/S1364-6613\(24\)00265-1](https://www.cell.com/trends/cognitive-sciences/abstract/S1364-6613(24)00265-1)

#### **KRZYSZTOF DOŁĘGA, INÈS MENTEC & AXEL CLEEREMANS – How does the quality space come to be?**

In their recent opinion article, Fleming and Shea explore how different theories of consciousness fare in accounting for the structure of our phenomenology. Under the quality space hypothesis, each experience corresponds to a point in a multidimensional space instantiated over the activity of processing units (i.e., natural or artificial neurons). This way of thinking about representation is familiar to connectionists [2] and it is indeed radically different from the hypothesis that mental representation always involves symbolic propositions. As Fleming and Shea delineate, one of the main consequences of such a conception of representation is that, in a sense, all representations are related in virtue of being instantiated over the same processing units in a distributed manner: Each representation is subtended by many units and each unit is involved in multiple representations. The quality space perspective suggests that what it means for me to see red is constituted by the functional similarity relationships that exist between the representations of red, blue, green, and so on.

[https://www.cell.com/trends/cognitive-sciences/abstract/S1364-6613\(24\)00267-5](https://www.cell.com/trends/cognitive-sciences/abstract/S1364-6613(24)00267-5)

## Trends in Ecology and Evolution

### PAPERS

#### **RUTH FAWTHROP et al – Understanding human-commensalism through an ecological and evolutionary framework**

Human-commensalism has been intuitively characterised as an interspecific interaction whereby non-human individuals benefit from tight associations with anthropogenic environments. However, a clear definition of human-commensalism, rooted within an ecological and evolutionary framework, has yet to be proposed. Here, we define human-commensalism as a population-level dependence on anthropogenic resources, associated with genetic differentiation from the ancestral, non-commensal form. Such a definition helps us to understand the origins of human-commensalism and the pace and form of adaptation to anthropogenic niches, and may enable the prediction of future evolution in an increasingly human-modified world. Our discussion encourages greater consideration of the spatial and temporal complexity in anthropogenic niches, promoting a nuanced consideration of human-commensal populations when formulating research questions.

[https://www.cell.com/trends/ecology-evolution/fulltext/S0169-5347\(24\)00257-X](https://www.cell.com/trends/ecology-evolution/fulltext/S0169-5347(24)00257-X)

## Trends in Genetics

### PAPERS

#### **SUSANNAH SELBER-HNATIW & SIRUI ZHOU – The good, the bad, and Neanderthalic immunity**

Introgression with archaic hominins and subsequent natural selection has shaped the immune system of modern humans. Recently, Sun et al. investigated the immunity advantages of a Neanderthalic variant in the membrane-bound immunoglobulin G1 (IGHG1) gene, activating pathogen-specific antibody production toward modern threats yet conversely increasing the risk of autoimmune diseases.

[https://www.cell.com/trends/genetics/abstract/S0168-9525\(24\)00261-0](https://www.cell.com/trends/genetics/abstract/S0168-9525(24)00261-0)

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