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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.

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, and doesn’t object to being called out on it.

NEWS

NATURE BRIEFING – Our brains have four ‘turning points’

Researchers have identified four ‘topological turning points’ — at around 9, 32, 66, and 83 years old — when our brains’ complex network undergoes distinctive age-related changes. For example, at about 9 years old, long, convoluted connections between brain regions seem to become shorter and more efficient — which might support the cognitive and developmental milestones that happen around this time. The findings could help to understand why some mental-health and neurological conditions are more likely to occur at certain ages.

<https://www.newscientist.com/article/2505656-your-brain-undergoes-four-dramatic-periods-of-change-from-age-0-to-90/>

NATURE BRIEFING – Intelligent machines are here — and they are us

Blaise Agüera y Arcas, a leading artificial-intelligence (AI) researcher who works at Google, has gone from pooh-poohing the idea that “a mere next-word predictor could ever truly understand new concepts, write jokes, debug code or do any of the myriad other things that are hallmarks of human intelligence” to believing that it could be — and maybe already is — so. “We must accept that a working ‘simulation’ of intelligence actually is intelligence,” he writes. If we accept that creating intelligent machines was really just a case of making powerful enough computers, then we might have to accept that “biological intelligence and, indeed, life itself might all have emerged from the same process,” he argues. Just as technology such as fire and waterwheels were created from — and helped to create — human society, so AI “is a recent addition to a mutually interdependent superhuman entity we are all already part of,” he writes. “An entity that has long been partly biological, partly technological — and always wholly computational.”

<https://www.nature.com/articles/d41586-025-03857-0>

NATURE BRIEFING – We are all mosaics

Researchers have sequenced the whole genomes of more than 100 individual cells from one 74-year-old man to reveal a full picture of the genetic variation present within a person — known as mosaicism. Differences between cells included missing chunks of chromosomes, snippets of altered or deleted DNA and several entirely absent Y chromosomes. The resulting catalogue will provide a valuable tool for researchers studying the impact of mosaicism on a person's health and on diseases such as cancer, says Soichi Sano, who studies cardiovascular mosaicism.

<https://www.nature.com/articles/d41586-025-03768-0>

NATURE BRIEFING – Walk like a moai, my son

Researchers have long wondered how the moai — the huge stone statues on Rapa Nui, also known as Easter Island — got to where they stand today. Some have suggested an elegantly simple solution: they 'walked'. This potential process — in which people use ropes to shimmy the giant statues along on their base — was first demonstrated in 1986. But the idea has been a hard sell. Critics argue that such movement would damage the statues. Now, archaeologists Carl Lipo and Terry Hunt have used 3D models to lend credence to the walking hypothesis, and have suggested that the movement of moai of all shapes and sizes is what forged many paths on the island.

<https://www.nytimes.com/2025/11/26/science/archaeology-easter-island-rapa-nui.html>

NEWS FROM SCIENCE – Headless bodies hint at why Europe's first farmers vanished

Wave of mass brutality accompanied the collapse of the first pan-European culture.

<https://www.science.org/content/article/headless-bodies-hint-why-europe-s-first-farmers-vanished>

NEWS FROM SCIENCE – A puzzling, 3.4-million-year-old fossil foot belonged to a contemporary of Lucy

Identity of the toe bones and other fossils could shake up the human family tree.

<https://www.science.org/content/article/puzzling-3-4-million-year-old-fossil-foot-belonged-contemporary-famed-lucy>

NEWS FROM SCIENCE – Who built a mysterious ancient city in western China?

DNA recovered from people buried at the site reveals surprises.

<https://www.science.org/content/article/who-built-mysterious-ancient-city-western-china>

THE CONVERSATION – How multilingualism can protect against brain ageing

A study of 86,000 older adults across Europe shows people who speak multiple languages tend to age more slowly than monolinguals.

<https://theconversation.com/how-multilingualism-can-protect-against-brain-ageing-270213>

THE CONVERSATION – The real reason states first emerged thousands of years ago – new research

New findings add weight to the theory that states didn't just spring up from any kind of farming – it had to be grain.

<https://theconversation.com/the-real-reason-states-first-emerged-thousands-of-years-ago-new-research-268539>

PUBLICATIONS

American Journal of Biological Anthropology

PAPERS

GUILLERMO ZORRILLA-REVILLA et al – Morphological Influences and Energetic Walking Flexibility in Determining Preferred vs. Optimal Speeds: An Evolutionary Human Ecology Perspective on Children and Adolescents

Locomotion is fundamental to the survival of our species. The most comfortable walking speed may be the most efficient for allocating conserved energy for other functions. However, whether preferred (PLS) and optimal (OLS) speeds align in children and adolescents remains unclear. This study aimed to determine whether OLS and PLS are similar in children and adolescents and how anthropometry influences both speeds and their differences.

Eleven females and 17 males (8–17 years of age) were anthropometrically characterized. Five treadmill walking pace tests were used to identify the OLS and U-shaped relationship between energy expenditure and speed (χ^2 CoT), indicating walking flexibility. Additionally, PLS was self-selected using the same protocol. Differences between OLS and PLS were calculated (mean difference [MD]).

No significant sex differences in anthropometry and speed-related variables were found. OLS, PLS, and their MD in the pooled sample were 3.05 ± 0.13 , 2.46 ± 0.51 , and 0.60 ± 0.46 , respectively, with significant differences between OLS and PLS ($p < 0.0001$). Femur length (FL), Bi-iliac breadth (BIL), and χ^2 CoT explained variance in OLS, PLS, and MD, respectively, in the forward stepwise regression models.

Unlike adults, OLS and PLS are not interchangeable in children and adolescents. Participants with lower χ^2 CoT (greater flexibility) can select comfortable speeds farther from OLS without energetic penalty. Taller individuals with longer femurs and wider hips might have biomechanical advantages in reaching higher OLS and PLS, but this reduces flexibility. These traits, along with the growth and development pattern of *Homo sapiens*, may reflect evolutionary advantages relevant to interspecies competition.

<https://onlinelibrary.wiley.com/doi/full/10.1002/ajpa.70152>

Animal Behaviour

PAPERS

JOSEFINE BOHR BRASK, MATTHEW SILK & MICHAEL N. WEISS – An introduction to generative network models and their use in animal sociality research

Social networks constitute an important approach in the study of animal social behaviour. So far, the main focus has been on statistical analysis of animal social network structures. However, social networks can also be studied by using generative network models, which are procedures that create simulated network structures. These models play a key role in wider network science, but while they have been used in the animal behaviour field, they have not yet been as well integrated as other approaches. We believe that generative network models have considerable unexploited potential as a tool for understanding animal social systems. Here: (1) we provide a general introduction to generative network models, including a description of questions they are used for investigating in wider network science, an explanation of key model features and an overview of common models; (2) we consider generative network models in relation to the study of animal social behaviour, including a description of questions about animal social systems they can be used to investigate (demonstrated by case studies), an overview of animal behaviour studies that have used generative network modelling, consideration of the relevance of the key model features for animal behaviour studies and guidance on how to choose suitable generative network models for studies of animal social systems. We hope that this can help to further integrate generative network models into the study of animal sociality.

<https://www.sciencedirect.com/science/article/pii/S000334722500291X>

eLife

PAPERS

LEONARDO CERAVALLO et al – Sensitivity of the human temporal voice areas to nonhuman primate vocalizations *Reviewed Preprint v1*

In recent years, research on voice processing in the human brain—particularly the study of temporal voice areas (TVA)—was dedicated almost exclusively to conspecific vocalizations. To characterize commonalities and differences regarding primate vocalization representations in the human brain, the inclusion of closely related nonhuman primates—namely chimpanzees and bonobos—is needed. We hypothesized that neural commonalities would depend on both phylogenetic and acoustic proximities, with chimpanzees ranking closest to *Homo*. Presenting human participants (N=23) with the vocalizations of four primate species (rhesus macaques, chimpanzees, bonobos and humans) and regressing-out relevant acoustic parameters using three distinct analyses, we observed within-TVA, sample-specific, bilateral anterior superior temporal gyrus activity for chimpanzee vocalizations compared to: all other species; nonhuman primates; human vocalizations. Within-TVA activity was also observed for macaque vocalizations. Our results provide evidence for subregions of the TVA that respond principally—but not exclusively—to phylogenetically and acoustically close nonhuman primate vocalizations, namely those of chimpanzees.

<https://elifesciences.org/reviewed-preprints/108795>

MIGUEL BARRETTO GARCÍA et al – Causal evidence for a domain-specific role of left superior frontal sulcus in human perceptual decision making

Reviewed Preprint v2

Humans and animals can flexibly choose their actions based on different information, ranging from objective states of the environment (e.g., apples are bigger than cherries) to subjective preferences (e.g., cherries are tastier than apples). Whether the brain instantiates these different choices by recruiting either specialised or shared neural circuitry remains debated. Specifically, domain-general accounts of prefrontal cortex (PFC) function propose that prefrontal areas flexibly process either perceptual or value-based evidence depending on what is required for the present choice, whereas domain-specific theories posit that PFC sub-areas, such as the left superior frontal sulcus (SFS), selectively integrate evidence relevant for perceptual decisions. Here we comprehensively test the functional role of the left SFS for choices based on perceptual and value-based evidence, by combining fMRI with a behavioural paradigm, computational modelling, and transcranial magnetic stimulation. Confirming predictions by a sequential sampling model, we show that TMS-induced excitability reduction of the left SFS selectively changes the processing of decision-relevant perceptual information and associated neural processes. In contrast, value-based decision making and associated neural processes remain unaffected. This specificity of SFS function is evident at all levels of analysis (behavioural, computational, and neural, including functional connectivity), demonstrating that the left SFS causally contributes to evidence integration for perceptual but not value-based decisions.

Frontiers in Cognition

PAPERS

REBECCA TUKACHINSKY FORSTER et al – How experiencing eudaimonic emotions through music shapes prosocial and altruistic behavior: Introducing a Unified Model of Music-Listening-Induced Eudaimonia (UMMIE)

This paper introduces the Unified Model of Music-Listening Induced Eudaimonia (UMMIE), which offers an integrated novel theoretical framework to explain how music listening promotes prosocial and altruistic outcomes. Drawing on communication and psychology research, UMMIE maintains that elicitation of eudaimonic emotions can be appraised inwards, towards oneself, and thus contribute to the individual's personal growth, wellbeing, and development, or outwards, by connecting to something bigger than oneself, to humanity in general, which could possibly then lead to enhanced prosocial and altruistic attitudes and behaviors. The model specifies musical, situational, and individual variables that serve as moderators and increase the likelihood of experiencing inwards or outwards effects of music listening. In this way, the current article organizes and synthesizes existing literature and offers a novel blueprint for future research.

<https://www.frontiersin.org/journals/cognition/articles/10.3389/fcogn.2025.1705976/full>

Frontiers in Education

PAPERS

HESHAM ALDAMEN et al – Testing Krashen's input hypothesis with AI: a mixed-methods study on reading input and oral proficiency in EFL

This study investigated the impact of AI-generated graded reading materials on the oral proficiency of adult EFL learners in a six-month intervention. Ninety participants generated weekly texts using proficiency-aligned prompts and were assessed through pre- and post-intervention ACTFL Oral Proficiency Interviews, complemented by learner reflective journals. Quantitative results suggested significant proficiency gains across all initial levels, while thematic analysis of journals highlighted perceived benefits in vocabulary development, autonomy, and fluency. Together, these findings provide preliminary evidence consistent with Krashen's Input Hypothesis, while also linking AI-mediated reading to broader frameworks of scaffolding, vocabulary acquisition, and cognitive load management. At the same time, important limitations must be noted. The study relied on a single non-certified rater, lacked a control group, and did not systematically monitor the linguistic properties of AI-generated texts. Attrition was concentrated among Novice High learners, raising concerns about bias in proficiency outcomes. These constraints require cautious interpretation, and the results should be viewed as suggestive rather than definitive. Despite these limitations, the study contributes to current discussions on AI in language education by illustrating how generative tools can provide scalable, proficiency-aligned input. It offers preliminary insights into the potential of AI-mediated reading to support oral proficiency development, while underscoring the need for more rigorous designs in future research.

<https://www.frontiersin.org/journals/education/articles/10.3389/feduc.2025.1614680/full>

Frontiers in Psychology

PAPERS

MARIANNA BOLOGNESI – Beyond concreteness: why word specificity is the missing piece in theories on embodied language comprehension

The concreteness effect has long been associated with embodied theories of language, which propose that concrete words are easier to process than abstract ones because they more directly engage perceptual and motor simulations. However, empirical findings on this effect remain mixed. This paper argues that such variability stems from overlooking a crucial semantic dimension: word specificity. Drawing on evidence from the ERC-funded ABSTRACTION project, I defend (based on classic and more recent empirical studies) that specificity, defined as a word's position within a conceptual hierarchy and corresponding to the inclusiveness of its category, plays a key role in shaping lexical access and conceptual organization, alone and in interaction with concreteness. The relationship between these two dimensions, and its implications for embodied language processing, has so far remained largely unexplored. Integrating specificity into models of embodied semantic representation offers a more nuanced account of how language supports both abstraction and embodiment in cognition.

<https://www.frontiersin.org/journals/psychology/articles/10.3389/fpsyg.2025.1718655/full>

Human Nature

CORRECTIONS

AXEL G. EKSTRÖM et al with PETER GÄRDENFORS – Correction: Correlates of Vocal Tract Evolution in Late Pliocene and Pleistocene Hominins

The Original Article was published on 01 March 2025 [EAORC BULLETIN 1143]

Correction to: Human Nature (2025) 36:22–69

<https://doi.org/10.1007/s12110-025-09487-9>

In this article the figure captions for Figs. 1 and 2 were inadvertently switched.

<https://link.springer.com/article/10.1007/s12110-025-09501-0>

iScience

PAPERS

CHIARA DE GREGORIO & ADRIANO R. LAMEIRA – Twice times two: Dual mechanism for double rhythmic meter in orangutans and the evolution of human song

Rhythmic pulse, the division of a beat into subordinate patterns, is the backbone of music. Across the world's musical traditions, the division of the primary beat into two equal parts – “double meter” – represents a prototypical pulse, also found in singing nonhuman primates. The last great ape common ancestor was, however, a non-singing species. How rhythmic pulse evolved in human song and music is, thus, enigmatic. Here, we analyse wild male orangutan long calls, which are structurally isochronous (i.e., with a steady 1:1 rhythm). Males divided the primary rhythm into 1:2 and 2:1 subordinate patterns and did so by two distinct mechanisms: tempo changes as used by other primates and voiced in-exhale alternations as still used today by some human song traditions. Findings confirm double-meter in a non-singing great ape and suggest the two-phase cycle of the phonatory-respiratory system may have been leveraged for the evolution of human song and music.

[https://www.cell.com/iscience/fulltext/S2589-0042\(25\)02534-9](https://www.cell.com/iscience/fulltext/S2589-0042(25)02534-9)

Nature

ARTICLES

BLAISE AGÜERA Y ARCAS – What is the future of intelligence? The answer could lie in the story of its evolution

The advent of artificial intelligence might be just the latest stage in a guiding biological process that has produced ever more complex, mutually dependent organisms over the history of life.

<https://www.nature.com/articles/d41586-025-03857-0>

FRED SPOOR – Mystery owner of African hominin foot identified

Fossils newly discovered in Ethiopia indicate that previously unidentified foot bones belong to the ancient human relative *Australopithecus deyiremeda*.

<https://www.nature.com/articles/d41586-025-03451-4>

PAPERS

YOHANNES HAILE-SELASSIE et al – New finds shed light on diet and locomotion in *Australopithecus deyiremeda*

The naming of *Australopithecus deyiremeda* from Woranso-Mille (less than 3.59 to more than 3.33 million years) indicated the presence of a species contemporaneous with *Australopithecus afarensis* in the Ethiopian Afar Rift. A partial foot (BRT-VP-2/73) and several isolated teeth from two Burtele (BRT) localities, however, were not identified to the species level. Recently recovered dentognathic specimens clarify not only the taxonomic affinity of the BRT hominin specimens but also shed light on the diet and locomotion of *A. deyiremeda*. Here we present a comparative description of these specimens and show that they are attributable to *A. deyiremeda*. We also find it parsimonious to attribute the BRT foot to this species based on the absence of other hominin species at BRT. The new material demonstrates that overall, *A. deyiremeda* was dentally and postcranially more primitive than *A. afarensis*, particularly in aspects of canine and premolar morphology, and in its retention of pedal grasping traits. Furthermore, the low and less variable distributions of its dental enamel $\delta^{13}\text{C}$ values are similar to those from *Ardipithecus ramidus* and *Australopithecus anamensis*, indicating a reliance on C3 foods. This suggests that *A. deyiremeda* had a dietary strategy similar to the earlier *A. ramidus* and *A. anamensis*. The BRT foot and its assignment to *A. deyiremeda* provides conclusive evidence that arboreality was a significant component of the positional behaviour of this australopith, further corroborating that some degree of arboreality persisted among Pliocene hominins.

<https://www.nature.com/articles/s41586-025-09714-4>

Nature Communications

PAPERS

SIWEI LI et al – Flexible Use of Limited Resources for Sequence Working Memory in Macaque Prefrontal Cortex

Our brain is remarkably limited in how many items it can hold simultaneously, but it can also represent unbounded novel items through generalization. How the brain rationally uses limited resources in working memory (WM) remains unexplored. We investigated mechanisms of WM resource allocation using calcium imaging and electrophysiological recording in the prefrontal cortex of monkeys performing sequence WM (SWM) tasks. We found that changes in the neural representation of SWM, including geometry, generalizable and separate rank subspaces, reflected WM load. SWM resources, represented by neurons' signal strength and spatial tuning projected onto each rank subspace, were shared flexibly between ranks. Crucially, the prefrontal cortex dynamically utilized shared tuning neurons to ensure generalization, while engaging disjoint and spatially shifted neurons to minimize interference, thus achieving a trade-off between behavioral and neural costs within capacity. The allocated resources can predict monkeys' behavior. Thus, the geometry of compositionality underlies the flexible use of limited resources in SWM.

Nature Communications Psychology

PAPERS

NAOMI NERO et al – Adults with more severe psychopathy in the community show increased social discounting

Psychopathy is a personality construct characterized by boldness, disinhibition, insensitivity to others' suffering or distress, and persistent engagement in behaviors that harm others. These combined features suggest that highly psychopathic people may place much less subjective weight on others' outcomes relative to their own. We therefore assessed social discounting, which indexes how the subjective value of others' outcomes declines as a function of social distance, in a demographically diverse community sample of very-high psychopathy adults (above the 95th percentile of TriPM scorers; $n = 288$), as well as a sample of demographically similar controls ($n = 427$), who also reported antisocial and criminal behavior. Results show robust increases in social discounting as psychopathy increases ($p < 0.001$), and that reduced subjective valuation of others' outcomes partially mediates the group differences in antisocial behavior ($p = 0.018$). These insights emphasize the importance of understanding how psychopathic traits manifest in the community and underscore how diminished valuation of others' outcomes represents an important mechanism driving maladaptive behaviors.

<https://www.nature.com/articles/s44271-025-00353-z>

DARIUS LEWEN et al – Continuous dynamics of cooperation and competition in social decision-making

Real-life social interactions often unfold continuously and involve dynamic cooperation and competition, yet most studies rely on discrete games that do not capture the adaptive and graded nature of continuous sensorimotor decisions. To address this gap, we developed the Cooperation-Competition Foraging game—an ecologically grounded paradigm in which pairs of participants (dyads) navigate a continuous shared space under face-to-face visibility, deciding in real-time to collect rewarded targets either individually or jointly. Dyads ($n = 58$, 116 participants) spontaneously converged on distinct stable strategies along the cooperation-competition spectrum, forming three groups: cooperative, intermediate, and competitive. Despite the behavioral complexity, our computational model, which incorporated travel path minimization, sensorimotor communication, and recent choice history, predicted dyadic decisions with 87% accuracy, and linked prediction certainty with ensuing dynamics of spatiotemporal coordination. Further modeling revealed how sensorimotor factors, such as movement speed and skill, shape distinct strategies and payoffs. Crucially, we quantify the cost of cooperation, demonstrating that in many dyads prosocial tendencies outweigh the individual benefits of exploiting skill advantages. Our versatile framework provides a predictive, mechanistic account of how social and embodied drivers promote the emergence of dynamic cooperation and competition, and offers rigorous metrics for investigating the neural basis of naturalistic social interactions, and for linking personality traits to distinct strategies.

<https://www.nature.com/articles/s44271-025-00348-w>

VANESSA MITSCHKE et al – Laughter regulation in solitary and social contexts varies across emotion regulation strategies

We are providing an unedited version of this manuscript to give early access to its findings. Before final publication, the manuscript will undergo further editing. Please note there may be errors present which affect the content, and all legal disclaimers apply.

Regulating amusement is crucial in social contexts where expressing amusement may be inappropriate or disruptive. Yet little research has directly compared the effectiveness of different strategies for laughter regulation. Across three experiments, we examined how distraction, cognitive reappraisal, and expressive suppression affect laughter-related facial expressions and amusement ratings during exposure to jokes. Laughter regulation was operationalized by means of facial electromyography (fEMG) and subjective ratings of funniness as proxies for the expression and experience of amusement. In Experiments 1 and 2 ($n = 40$ each), distraction and expressive suppression most strongly reduced facial activity, whereas reappraisal produced smaller but consistent effects. However, only reappraisal reliably decreased funniness ratings, suggesting selective effects on the cognitive evaluation of humor. Experiment 3 ($n = 41$) introduced social laughter feedback and revealed that the presence of another's laughter impaired expression control and increased funniness ratings, indicating that social cues shape both emotional expression and experience. Together, these findings show how distinct emotion-regulation strategies modulate amusement and laughter expressions in response to humorous stimuli and highlight the contextual sensitivity of laughter regulation in socially dynamic settings.

<https://www.nature.com/articles/s44271-025-00368-6>

Nature Ecology & Evolution

PAPERS

STUART A. WEST et al – Behavioural ecology in the twenty-first century

Behavioural ecology research has explained traits from foraging and cooperation to mating strategies and sex allocation. However, the size and interdisciplinary nature of this research can obscure the broader contributions that behavioural ecology has made and the major tasks for the future. We first assess the contributions of behavioural ecology to fundamental

science, for both understanding nature and the scientific method. Second, we explore the application of behavioural ecology research to global challenges, from pests and pathogens to conservation and mitigating human impact. In all cases, progress has relied on a hypothesis-driven approach that combines mathematical modelling with empirical testing and the strategic choice of simplifying assumptions.

<https://www.nature.com/articles/s41559-025-02912-3>

Nature Human Behaviour

PAPERS

CHRISTOPHER OPIE & QUENTIN D. ATKINSON – State formation across cultures and the role of grain, intensive agriculture, taxation and writing

The invention of agriculture is widely thought to have spurred the emergence of large-scale human societies. It has since been argued that only intensive agriculture can provide enough surplus for emerging states. Others have proposed it was the taxation potential of cereal grains that enabled the formation of states, making writing a critical development for recording those taxes. Here we test these hypotheses by mapping trait data from 868 cultures worldwide onto a language tree representing the relationships between cultures globally. Bayesian phylogenetic analyses indicate that intensive agriculture was as likely the result of state formation as its cause. By contrast, grain cultivation most likely preceded state formation. Grain cultivation also predicted the subsequent emergence of taxation. Writing, although not lost once states were formed, more likely emerged in tax-raising societies, consistent with the proposal that it was adopted to record those taxes. Although consistent with theory, a causal interpretation of the associations we identify is limited by the assumptions of our phylogenetic model, and several of the results are less reliable owing to the small sample size of some of the cross-cultural data we use.

<https://www.nature.com/articles/s41562-025-02365-5>

RICHARD FUTRELL & MICHAEL HAHN – Linguistic structure from a bottleneck on sequential information processing

Human language has a distinct systematic structure, where utterances break into individually meaningful words that are combined to form phrases. Here we show that natural-language-like systematicity arises in codes that are constrained by a statistical measure of complexity called predictive information, also known as excess entropy. Predictive information is the mutual information between the past and future of a stochastic process. In simulations, we find that codes that minimize predictive information break messages into groups of approximately independent features that are expressed systematically and locally, corresponding to words and phrases. Next, drawing on cross-linguistic text corpora, we find that actual human languages are structured in a way that yields low predictive information compared with baselines at the levels of phonology, morphology, syntax and lexical semantics. Our results establish a link between the statistical and algebraic structure of language and reinforce the idea that these structures are shaped by communication under general cognitive constraints.

<https://www.nature.com/articles/s41562-025-02336-w>

ELLIOT HOWARD-SPINK et al with CAREL VAN SCHAİK & ANDREW WHITEN – Culture is critical in driving orangutan diet development past individual potentials

Humans accumulate extensive repertoires of culturally transmitted information, reaching breadths exceeding any individual's innovation capacity (culturally dependent repertoires). It is unclear whether other animals require social learning to acquire adult-like breadths of information in the wild, including by key developmental milestones, or whether animals are capable of constructing their knowledge repertoires primarily through independent exploration. We investigated whether social learning mediates orangutans' diet-repertoire development, by translating an extensive dataset describing wild orangutans' behaviour into an empirically validated agent-based model. In this model, diets reliably developed to adult-like breadths only when simulated immatures benefited from multiple forms of social learning. Moreover, social learning was required for diets to reach adult-like breadths by the age immatures become independent from their mothers. This implies that orangutan diets constitute culturally dependent repertoires, with social learning enhancing the rate and outcomes of diet development past individual potentials. We discuss prospective avenues for researching the building of cultural repertoires in hominids and other species.

<https://www.nature.com/articles/s41562-025-02350-y>

Nature Neuroscience

PAPERS

CHRISTIAN WAIBLINGER, APRIL R. REEDY & GARRETT B. STANLEY – An adaptive and flexible role for primary sensory cortex

Classical views of sensory perception describe a hierarchical organization, extending from the sensory periphery to static representations in the primary sensory cortex, with downstream regions supporting decision-making and action. There is growing evidence that suggests a more flexible role of primary sensory cortex, with behaviorally relevant functions distributed across multiple levels of the early sensory pathway that can change in response to context. In this Perspective, we first examine primary sensory cortex beyond sensory representations through the lens of sufficiency to predict behavior. We

then consider the necessity of primary sensory cortex in sensory-driven behaviors, explored through a range of inactivation and lesioning studies. Finally, we provide evidence that points to an adaptive and flexible role for primary sensory cortex, where function is shaped by experience and context. This adaptive nature demands a more holistic investigative approach that challenges sensory pathways with adaptive behaviors in response to changing environments, behavioral contexts and injury.

<https://www.nature.com/articles/s41593-025-02124-9>

Nature npj Acoustics

PAPERS

YONGHONG YAN, FEI CHEN & JUNFENG LI – An overview of the impacts of vowels and consonants in speech understanding and their applications

As a primary mode of human interaction, speech consists of two fundamental sound categories, i.e., vowels and consonants. This overview paper begins by providing an overview of the relative contributions of vowels and consonants to speech understanding. Their significance in speech understanding varies depending on the type of stimulus, the language, and the hearing abilities of the listener. With outcomes of these perceptual studies, a number of applications have been developed, including speech recognition, speech enhancement, auditory prosthetic devices, language acquisition, and speech privacy protection. By processing vowels and consonants, these speech technologies and applications have a significant impact on everyday life. Finally, the future research challenges in this field are outlined.

<https://www.nature.com/articles/s44384-025-00032-7>

Nature Scientific Reports

PAPERS

WILLIAM D. HOPKINS, SOPHIA FRANGOU & RUIYANG GE – Brain age gap is associated with cognitive abilities in captive chimpanzees

Brain age gap refers to the difference between chronological and brain age based on computational models derived from various neuroimaging phenotypes. Studies in humans have reported that brain age gap is a biological measure that is sensitive to the effects of genetic, environmental and health-related variables on the pace of aging. Here, for the first time, we tested whether estimates of brain age gap could be derived from neuroimaging data obtained in chimpanzees and whether they were associated with different cognitive and motor phenotypes. Archived measures of cortical thickness and surface area were obtained from 34 brain regions in a sample of 215 chimpanzees from the National Chimpanzee Brain Resource. Brain age gap values were computed and tested for their association with individual variation in cognition and motor function. The mean absolute average age gap was ~ 6 years in chimpanzees, a value that overlaps with reports in human subjects. Chimpanzees with “older” brain ages performed more poorly on a measure of cognition compared to individuals with “younger” brains, after controlling for the sex and rearing effects. Like in humans, brain age gap can be used as a valid biomarker of brain aging in chimpanzees and is sensitive to individual differences in cognition.

<https://www.nature.com/articles/s41598-025-26062-5>

JOSÉ BRAGA, Z. ALEMSEGED & E. GILISSEN – Complex and diverse patterns of neurocranial development in Australopithecus, Paranthropus and Homo

Even though poorly understood, early ontogeny may have influenced the distinct morphologies and behaviors of Homo sapiens, fossil hominins and extant African apes. Leveraging an extensive high-resolution computed tomography dataset, we investigated previously unexplored relationships between facial, basicranial and endocranial development during early ontogeny in African apes, H. sapiens, Australopithecus afarensis and Paranthropus robustus. We found that a delay in endocranial growth in Pan paniscus infants does not necessarily indicate a uniform trend toward delayed development, suggesting more complexity in developmental processes than previously thought. A. afarensis exhibited protracted endocranial growth compared to P. robustus, a contrast even greater than that between P. paniscus and Pan troglodytes, suggesting that endocranial development in A. afarensis more closely resembles that of H. sapiens than P. robustus. Unlike the shared delayed development of H. sapiens and Homo erectus, A. afarensis and P. robustus show contrasting developmental patterns. We therefore propose that early ontogeny in Australopithecus and Paranthropus was variable, showing no consistent pattern of developmental delay or acceleration across species. Our finding also enhances our ability to identify neonatal cranial remains in the fossil record, providing new opportunities for expanding much needed sample size and advance paleobiological studies.

<https://www.nature.com/articles/s41598-025-25584-2>

JULIANE KAMINSKI et al – What makes a dog a label-learner: Individual cognitive differences underlying label-learning abilities in domestic dogs (Canis familiaris)

Only a few dogs in the world are label-learners, with the ability to process and retain a vast number of object referents. Here we present data from a battery of cognitive tests that could explain why they outperform their conspecifics. In a citizen science approach, we instructed dog owners across five different countries, on how to administer a series of eight cognitive

tests to their dogs. The group of label-learner dogs (N = 11) was then compared to control dogs (N = 11) that did not have that label learning ability. Our experiment demonstrates, for the first time, that the label-learner dogs' ability might be based on measurable individual differences in three specific cognitive domains: their interest in novel objects, their targeted interest in objects and their inhibitory skills. Future research, replicating the results on a larger sample, can explore if the label-learner dogs' outstanding cognitive skills are already present at the puppy stage or develop over time.

<https://www.nature.com/articles/s41598-025-25646-5>

AROA CASADO et al – Inferences about fossil hominin locomotion through 3D morphometric analysis of wrist ligament insertion sites

Understanding the evolution of wrist anatomy in fossil hominins is essential for reconstructing their locomotor behavior and manipulative capabilities. Traditionally, most studies have focused on bone morphology, overlooking the informative potential of soft tissue attachment sites. In this study, we introduce a novel approach based on the three-dimensional geometric morphometric analysis of ligament insertion sites on the distal radial epiphysis. We analyzed a comparative sample including fossil hominins—*Australopithecus afarensis*, *Australopithecus anamensis*, *Australopithecus sediba*, *Paranthropus robustus*, *Homo neanderthalensis*, and archaic *Homo sapiens*—as well as extant hominoids: *Homo sapiens*, *Pan troglodytes*, *Gorilla gorilla* and *Pongo pygmaeus*. The results show marked interspecies differences in the size, orientation, and position of specific ligament insertions, reflecting divergent functional adaptations. Notably, the morphology of these insertions aligns with known behavioral and locomotor patterns described for these species, highlighting the reliability of ligament morphology as a proxy for inferring habitual activity in extinct taxa. This research expands the methodological toolkit available for paleoanthropology and emphasizes the relevance of soft-tissue-related structures in understanding hominin evolution beyond bone morphology alone.

<https://www.nature.com/articles/s41598-025-26487-y>

SHUMPEI SOGAWA et al with REDOUAN BSHARY – Rapid self-recognition ability in the cleaner fish

Whether animals are self-aware has important implications for our approaches to both animal cognition and animal welfare. A landmark moment in animal cognition research was when great apes passed the mark-test and demonstrated mirror self-recognition (MSR). Animals that pass the mark-test are capable of visually self-recognising and considered to be self-aware. Other taxa, including a fish, the cleaner wrasse (cleaner fish: *Labroides dimidiatus*) have also now passed the mark-test, forcing a rethink of the mental and neurological requirements for MSR. Previous research has largely focused on which species can pass the mark-test, rather than the processes underlying MSR. Here, we marked mirror-naïve cleaner fish with an ecologically relevant mark resembling an ectoparasite and then undertook detailed behavioural observations after exposure to a mirror. We found that cleaner fish achieve MSR rapidly, implying self-awareness prior to mirror exposure. By observing the exact timing of MSR in individuals, we could also report previously undocumented differences in pre- and post-MSR behaviours, including post-MSR exploratory behaviour of the mirror's reflective properties. We find remarkable parallels between the processing of MSR in humans and cleaner fish, suggesting that some aspects of self-awareness are conserved across animal taxa.

<https://www.nature.com/articles/s41598-025-25837-0>

REUVEN YESHURUN et al – Archaic humans in the Middle Palaeolithic Levant conducted planned and selective intercepts of aurochs, but not mass hunting

While archaeologically challenging, determining whether hominins practised mass hunting before ca. 50,000 years ago is crucial for demonstrating intergroup communication and cooperation. The premise is that killing and processing several herd animals in a single event implicates planning, food sharing, and aggregation at a scale greater than most other Palaeolithic activities. Here, we focus on Unit III in the deep Middle Palaeolithic deposits of the Nesher Ramla karst depression (~120,000 years ago) in Israel, an early contact area of archaic and modern humans. Numerous aurochs (*Bos primigenius*) remains were found in this thin, temporally constrained stratigraphic unit, featuring signs of human butchery and consumption. An aurochs tibia displayed an embedded flint chip enveloped by bone remodelling, consisting unique evidence of recapture. We apply ageing, sexing, tooth wear and isotopic techniques to test the hypothesis that this assemblage represents mass hunting events but conclude that the evidence agrees better with multiple isolated, planned, and selective hunting and processing episodes. Thus, our results lend support to the commonly accepted view that Middle Palaeolithic archaic humans lived in small, dispersed, and disconnected groups, which might have been a disadvantage when faced with the sympatric modern humans.

<https://www.nature.com/articles/s41598-025-26274-9>

New Scientist

NEWS

Ancient humans took two routes to Australia 60,000 years ago

Scientists have long tried to uncover the perilous journey humans took to reach the ancient land mass that now makes up Australia. Now, a genetic study has edged us closer to understanding how and when they achieved this.

<https://www.newscientist.com/article/2506312-ancient-humans-took-two-routes-to-australia-60000-years-ago/>

Neanderthals' hefty noses weren't well adapted to cold climates

Neanderthals were thought to have structures inside their noses that helped them deal with the cold, but analysis of an exceptionally preserved specimen contradicts that.

<https://www.newscientist.com/article/2504597-neanderthals-hefty-noses-werent-well-adapted-to-cold-climates/>

Ancient figurine may show sexual encounter between woman and goose

A 12,000-year-old clay sculpture found in Israel depicts a goose on the back of a woman, and archaeologists suggest it may be a depiction of an animistic mythological scene.

<https://www.newscientist.com/article/2504582-ancient-figurine-may-show-sexual-encounter-between-woman-and-geese/>

Vast Bronze Age city discovered in the plains of Kazakhstan

A major settlement in Central Asia called Semiyarka dating back to 1600 BC had houses, a big central building and even an industrial zone for producing copper and bronze.

<https://www.newscientist.com/article/2504671-vast-bronze-age-city-discovered-in-the-plains-of-kazakhstan/>

Kissing may have evolved in an ape ancestor 21 million years ago

Rather than being a recent cultural development, kissing may have been practised by other early humans like Neanderthals and our ape ancestors.

<https://www.newscientist.com/article/2504932-kissing-may-have-evolved-in-an-ape-ancestor-21-million-years-ago/>

ARTICLES**ROWAN HOOPER & PENNY SARCHET – The origin and evolution of music [Podcast]**

In this week's episode, we welcome musician and podcaster Steve Pretty, who plays music on a conch shell, recreating the acoustics of prehistoric cave gatherings. Steve explains the evocative nature of music, the different functions that it has in society and how it allows us to tap into different emotional states.

<https://www.youtube.com/watch?v=zKY3Cxt5KbU&list=PLuz7RUvtFdHK7nRGZAL3v50QsFau4HLzG&index=2>

Philosophical Transactions of the Royal Society A**PAPERS****ARKADY PLOTNITSKY – Ambiguity and free will: the topology of decision in quantum and quantum-like sciences**

This article considers the relationships between quantum theory (QT) and quantum-like theories (QLTs), theories using mathematical models based on the formalism of QT, from a reverse perspective, that of QLTs. The article argues that QT is no longer a theory of the behaviour, in particular motion, of physical objects, as was the case in classical physics and relativity. Instead, QT is a form of decision theory, involving a special 'topology' of decisions, using the term topology in part metaphorically, but only in part, because it applies in its proper mathematical sense to the formalism of QT. Part of this topology is the concept of free will, reconsidered through the concept of decision. This character of QT is grounded in a particular type of interpretations of QT, 'reality without realism' (RWR) interpretations. To address the affinities and differences between QT and QLTs, the article introduces two new principles: 'the unambiguity principle', equally applicable in QT and QLTs, or in mathematics and science in general, and 'the free will principle', only applicable in QLTs and not in QT. The article also reflects on the limits of quantum-like sciences (QLSs) and mathematical-experimental science in general in dealing with human thinking and decision making.

<https://royalsocietypublishing.org/doi/10.1098/rsta.2024.0379>

Philosophical Transactions of the Royal Society B**PAPERS****BAS VAN BOEKHOLT, ALEXANDRA B. BOSSHARD AND SIMONE PIKA – Sequence organization of mother–infant interactions in chimpanzees (*Pan troglodytes schweinfurthii*) in the wild**

Sequence organization is a fundamental feature of human communication, shaping our interactions. This organization underlies interactions with and without language, appears early in human development and is even hypothesized to precede language itself. However, remarkably little is known about the evolutionary origins of the sequence organization of interactions. Here, we investigated the sequence organization of mother–infant interactions in one of our closest living relatives, the chimpanzee (*Pan troglodytes*). We focused our study on two components of sequence organization: (i) adjacency pairs around turn transitions and (ii) flexibility on an interactional scale. In total, 361 communicative interactions containing 3647 signals and actions in 17 mother–infant dyads living in the Ngogo population, Uganda, were collected and analysed. The results showed that on a two-turn scale, a large proportion (42%) of turn transitions are non-randomly combined into potential adjacency pairs. Regarding flexibility, a conditional transition network revealed eight highly distinguished clusters of flexibly used units. With this consilience of methods, we show that, like humans, interactions of

chimpanzees are sequentially organized, strengthening the hypothesis that sequence organization is indeed a fundamental feature of communication pre-dating the evolution of language.

<https://royalsocietypublishing.org/doi/10.1098/rspb.2025.2271>

Physics of Life Reviews

PAPERS

MICHAEL J. WALKER – “Homo informatio”

A phylogenetic split ~7.5 Ma (million years ago) separated paninan ancestors that were unlike today's chimpanzees, from homininan ancestors that were unlike *Homo sapiens* today; neither had evolved into their modern physical and behavioural forms. Those paninans gave rise to the mainly frugivorous woodland-dwelling chimpanzees (*Pan troglodytes*), whose multifemale-multimale troops have social hierarchies where prominent parts are played by promiscuous males whose female offspring have little choice after menarche but to seek sexual partners in other troops, hostility between troops notwithstanding, whilst male promiscuity is incompatible with paternal interest in their offspring, interest being provided mainly by mothers or female alloparents. Contrary to widespread conjecture that the social arrangements of *Pan* were those of primaeval homininans, it is proposed here that ~4 Ma the nature of the mosaic landscapes (of grasslands and stands of trees) that were the habitat of australopithecine homininans, had 4 consequences that impinged on homininan evolution, differentiating it from that of woodland-dwelling paninans: (1) The diversity of whatever was available to eat was not the same in adjoining habitats of homininan social units, each of which may have been constrained by whatever mostly could be foraged, scavenged, eaten, or carried away, within perhaps a 2-hour walk; (2) Whatever was forageable, scavengeable, and edible within that distance likely was limited at any period of the year, so social units were increasingly omnivorous and necessarily small; (3) Smallness demanded cognitive ingenuity and transmissibility of existential information acquired by active inference generated by self-evidencing through enacted neuroethological behavioural responses, in line with the free energy principle, thanks to the cognitive broadening of homininan “zones of bounded surprisal” (ZBS) with respect to paninans' ZBS, both within each homininan “small-world” social unit and between nearby homininan units spreading out, in space and time, as budding very small-world information networks; (4) The existential continuity of small homininan social units depended on cooperation and sporadic collaboration between social units with mixed-sex philopatry (perhaps present ~4 Ma among *Australopithecus anamensis*), behaviour which, together with (a) the generation of information within each unit that is enhanced by the intimate proximity to toddlers and children of older females and males in small mixed-sex social units, and (b) mixed-sex dispersal of sexually-active partners establishing mixed-sex social units at newly-formed localities nearby, was behaviour that maintained not only heterozygosity, but also, crucial cognitive awareness of kinship links favouring transmissibility of information and cooperation and collaboration (rather than hostility) between neighbouring social units, and was behaviour that represented evolutionary cognitive and social divergence from paninans. The vulnerability of small fragile social units implies there were hundreds of false dawns between ~4 Ma and ~40,000 BCE when even *Homo neanderthalensis* had vanished, leaving only our prehistoric *Homo sapiens* ancestors bearing “Homo informatio's” highly-evolved hierarchically mechanistic mind with its unequalled wide cognitive “zone of bounded surprisal” (ZBS) grounded in active inference in accord with the free energy principle.

<https://www.sciencedirect.com/science/article/pii/S1571064525001502>

PLoS Biology

PAPERS

DENISE MOEREL et al – Collaborative rule learning promotes Interbrain information alignment

Social interactions shape our perception of the world, influencing how we interpret incoming information. Alignment between interacting individuals' sensory and cognitive processes is key to successful cooperation and communication, but the neural processes underlying this alignment remain unknown. Here, we leveraged Representational Similarity Analysis (RSA) on electroencephalography (EEG) hyperscanning data to investigate information alignment in 24 pairs of participants who performed a categorization task together based on agreed-upon rules. Significant interbrain information alignment emerged within 45 ms of stimulus presentation and persisted for hundreds of milliseconds. Early alignment (45–180 ms) occurred in both real and randomly matched pseudo-pairs, reflecting shared sensory responses. Importantly, alignment after 200 ms strengthened with practice and was unique to real pairs, driven by shared representations associated with, and extending beyond, the categorization rules they formed. Together, these findings highlight distinct processes underpinning interbrain information alignment during social interactions, that can be effectively captured and disentangled with Interbrain RSA.

<https://journals.plos.org/plosbiology/article?id=10.1371/journal.pbio.3003479>

Science

ARTICLES

ASIF A. GHAZANFAR & GAVIN STEIN – Groove to the music: What can tapping macaques reveal about the evolution of musicality?

More than a hundred years ago, Charles Darwin's ideas about the evolution of music were pitted against those of the sociologist Herbert Spencer. Darwin believed that the ability to make music evolved as a trait with adaptive value across different animal groups before the advent of contemporary humans, whereas Spencer believed that only humans can make true music. Adaptive explanations for the evolution of human music still abound. In the absence of compelling fossil or archaeological evidence of music making, however, 21st-century researchers rely as much on conjecture as they did in Darwin and Spencer's time. On page 940 of this issue, Rajendran et al. report that macaque monkeys have the capacity to tap to a musical beat. Might such research on the capacities of nonhuman animals compensate for archaeological and conceptual gaps and help to overcome the impasse of the Darwin and Spencer debate?

<https://www.science.org/doi/10.1126/science.aec8640>

PAPERS

VANI G. RAJENDRAN et al – Monkeys have rhythm

Synchronizing movements to music is a hallmark of human culture, but its evolutionary and neurobiological origins remain unknown. This ability requires (i) extracting a steady rhythmic pulse, or beat, out of continuous sounds; (ii) projecting this pattern forward in time; and (iii) timing motor commands to anticipate future beats. Here, we demonstrate that macaques can synchronize to a subjective beat in real music and even spontaneously do so over alternative strategies. This contradicts the influential "vocal-learning hypothesis" that musical beat synchronization is privileged to species with complex learned vocalizations. We propose an alternative view of musical beat perception and synchronization as a continuum onto which different species can be mapped based on their capacity to coordinate the general abilities listed above through association with reward.

<https://www.science.org/doi/10.1126/science.adp5220>

Science Advances

ARTICLES

DAVID S. WHITLEY – Unlocking the secrets of ancient Texas cave paintings

Recent research decodes the most visible, least accessible remnants of prehistoric hunter-gatherer lives using iconographic analysis, data collection, and an innovative dating technique.

<https://www.science.org/doi/10.1126/sciadv.aed6883>

PAPERS

KAREN L. STEELMAN, CAROLYN E. BOYD & J. PHIL DERING – Mapping the chronology of an ancient cosmovision: 4000 years of continuity in Pecos River style mural painting and symbolism

Forager societies in southwest Texas and northern Mexico painted polychromatic Pecos River style murals in limestone rock shelters containing well-preserved archaeological assemblages. To establish the temporal context of the murals, we obtained 57 direct radiocarbon dates and 25 indirect oxalate dates for pictographs across 12 sites using plasma oxidation and accelerator mass spectrometry. Bayesian modeling estimates that Pecos River style began between 5760 and 5385 calibrated years before the present (cal B.P.) and probably ended in 1370 to 1035 cal B.P. Painting spanned a duration of 4095 to 4780 years (68.3%). Stratigraphic and iconographic analyses revealed that eight of the murals were created as compositions adhering to a set of rules and an established iconographic vocabulary. Results suggest consistent messaging throughout a period marked by changes in material culture, land use, and climate. We propose that Pecos River style paintings, embedded in a cultural keystone landscape, faithfully transmitted a sophisticated metaphysics that later informed the beliefs and symbolic expression of Mesoamerican agriculturalists.

<https://www.science.org/doi/10.1126/sciadv.adx7205>

WESTON C. MCCOOL et al – Climate stability and low population pressure predict peaceful interactions over 10,000 years of Central Andean history

As anthropogenic climate change threatens to destabilize global societies and ecosystems, anticipating likely human responses becomes ever more urgent. A key global initiative is the promotion of peaceful relations. Nonetheless, studies that systematically evaluate factors that promote peace are limited, and research focuses on recent centuries when climate conditions were stable. Here, we couple evolutionary ecology theory with machine learning models to investigate the relative effects of climatological, demographic, and socio-political conditions on the persistence of peace over the 10,000-year Central Andean Holocene sequence. We find that stable climate conditions and low population density have a strong influence on peace, even when average climate conditions are not ideal for farming. Given that climate projection models predict increasing climate volatility in coming decades, our results suggest that future climate instability may weaken peaceful interactions, particularly among subsistence populations in marginal environments.

<https://www.science.org/doi/10.1126/sciadv.adt9007>

The Innovation

PAPERS

AOQI CHEN et al – Misinformation Beyond Fact-Checking: Definitional Integration and the Dual-Path Evolution Model

Recently, misinformation has garnered wider attention. However, the ambiguous definition of misinformation hinders deeper and more integrated research across various fields concerning misinformation. Therefore, departing from fact-checking methods, we identify two receiver-based misinformation dimensions: public engagement level and gist misunderstanding. Furthermore, we integrate existing conceptualizations of misinformation to propose an evolutionary model that delineates two key pathways of misinformation development: (1) information distortion processes, and (2) intra-group dissemination dynamics. This work is anticipated to (1) systematize the currently fragmented conceptualizations of misinformation through its dual-dimensional integration, (2) establish novel diagnostic metrics for disinformation identification in applied domains such as health communication and public opinion governance, while (3) providing theoretical foundations for platform content moderation and media literacy education by elucidating misinformation's source-level evolutionary mechanisms. Ultimately, contributing to more robust scientific frameworks and societal-level prevention systems.

[https://www.cell.com/the-innovation/fulltext/S2666-6758\(25\)00394-7](https://www.cell.com/the-innovation/fulltext/S2666-6758(25)00394-7)

Trends in Cognitive Sciences

PAPERS

MICHAEL PLEYER et al with MARCUS PERLMAN & GARY LUPYAN – The ‘design features’ of language revisited

Language is often regarded as a defining trait of our species, but what are its core properties? In 1960, Hockett published ‘The origin of speech’ enumerating 13 design features presumed to be common to all languages, and which, taken together, separate language from other communication systems. Here, we review which features still hold true in light of new evidence from cognitive science, linguistics, animal cognition, and anthropology, and demonstrate how a revised understanding of language highlights three core aspects: that language is inherently multimodal and semiotically diverse; that it functions as a tool for semantic, pragmatic, and social inference, as well as facilitating categorization; and that the processes of interaction and transmission give rise to central design features of language.

[https://www.cell.com/trends/cognitive-sciences/fulltext/S1364-6613\(25\)00279-7](https://www.cell.com/trends/cognitive-sciences/fulltext/S1364-6613(25)00279-7)

Trends in Ecology and Evolution

PAPERS

JUAN GEFAELL & TOBIAS ULLER – From rivals to partners: adversarial collaboration in ecology and evolution

Since their inception, ecology and evolutionary biology have been filled with controversies. While controversies are generally beneficial, they can sometimes hinder meaningful communication and, ultimately, decelerate scientific advancement. A clear example is when scientific rivals enter a point-scoring mode in which proving the opponent wrong sidelines objective assessments. To counter this, we introduce to the ecology and evolutionary biology audiences the adversarial collaboration approach, where opponents cooperatively address their disagreements to advance their field. We describe the logic of adversarial collaboration, examine a series of potential challenges to its successful adoption in these disciplines, and show how they can be overcome. Adversarial collaboration is an invitation to align controversies with the scientific ethos of collectively seeking empirical truths.

[https://www.cell.com/trends/ecology-evolution/fulltext/S0169-5347\(25\)00319-2](https://www.cell.com/trends/ecology-evolution/fulltext/S0169-5347(25)00319-2)

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