

EAORC BULLETIN 1,086 – 7 April 2024

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NOTICES

PUBLICATION ALERTS

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

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

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

EDITORIAL INTERJECTIONS

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

ACADEMIA.EDU – Intentionality, pointing, and early symbolic cognition

Human Studies (2024).

CORIJN VAN MAZUIK – Intentionality, pointing, and early symbolic cognition

Concepts such as “symbolism” and “symbolic cognition” often remain unspecified in discussions the symbolic capacities of earlier hominins. In this paper, I use conceptual tools from phenomenology to reflect on the origins of early symbolic cognition. In particular, I discuss the possible early use of pointing gestures around the time of the earliest known stone tool industries. I argue that unlike more basic social acts such as expression, gaze following, and attention-getters, which are used by extant non-human great apes, communicative pointing involves key elements that are characteristic of symbolic cognition. In particular, it involves “third order intentionality” as well as “shared practice horizons”: shared frameworks of understanding which are required for the interpretation of communicative acts whose meaning is not codified indexically or iconically in the signaling behavior. In the final part, I briefly review some indications for the use of pointing gestures around the time of the Lomekwian and Oldowan industries, as a way to sustain cooperation and possibly learning by instruction. It is suggested that pointing is more complex than is standardly acknowledged, and that it may have been an important communicative act for Early Stone Age hominins in transitioning to more fully symbolic speech capacities.

https://www.academia.edu/116705668/Intentionality_pointing_and_early_symbolic_cognition_Human_Studies_2024

NEWS

NATURE BRIEFING – A reason for right- or left-handedness

Left-handed people are almost three times more likely to have rare variants in the genes for tubulins, proteins that build cells’ internal skeletons. Tubulins assemble into long filaments called microtubules, which control the shapes and movements of cells. Microtubules could influence handedness because they form hair-like protrusions in cell membranes that can direct fluid flows in an asymmetric way during embryonic development.

<https://www.nature.com/articles/d41586-024-00977-x>

SCIENCE.ORG NEWS – Rare wooden artifacts showcase the smarts of early Neanderthals

Complex tools from 300,000-year-old deposit at Schöningen in Germany point to a “wood age”

<https://www.science.org/content/article/rare-wooden-artifacts-showcase-smarts-early-neanderthals>

SCIENCE.ORG NEWS – Popular songs are simpler and more repetitive than they used to be

Lyrics to English-language top hits have become less complex and more repetitive, which may make them catchier—and more appealing.

<https://www.science.org/content/article/popular-songs-are-simpler-and-more-repetitive-they-used-be>

SCIENCE.ORG NEWS – Was Lucy the mother of us all? Fifty years on, famed skeleton has rivals

Iconic 3.2-million-year-old fossil is now part of an extended family of human ancestors.

<https://www.science.org/content/article/was-lucy-mother-us-all-fifty-years-discovery-famed-skeleton-rivals>

PUBLICATIONS**American Journal of Biological Anthropology****PAPERS****JOHANNA NICHOLS – Founder effects identify languages of the earliest Americans**

The known languages of the Americas comprise nearly half of the world's language families and a wide range of structural types, a level of diversity that required considerable time to develop. This paper proposes a model of settlement and expansion designed to integrate current linguistic analysis with other prehistoric research on the earliest episodes in the peopling of the Americas. Diagnostic structural features from phonology and morphology are compared across 60 North American languages chosen for coverage of geography and language families and adequacy of description. Frequency comparison and graphic cluster analysis are applied to assess the fit of linguistic types and families with late Pleistocene time windows when entry from Siberia to North America was possible. The linguistic evidence is consistent with two population strata defined by early coastal entries ~24,000 and ~15,000 years ago, then an inland entry stream beginning ~14,000 ff. and mixed coastal/inland ~12,000 ff. The dominant structural properties among the founder languages are still reflected in the modern linguistic populations. The modern linguistic geography is still shaped by the extent of glaciation during the entry windows. Structural profiles imply that two linguistically distinct and internally diverse ancient Siberian linguistic populations provided the founding American populations.

<https://onlinelibrary.wiley.com/doi/full/10.1002/ajpa.24923>

Cell Reports**PAPERS****SHAOHAN JIANG et al – Distinct genetic and environmental origins of hierarchical cognitive abilities in adult humans**

Human cognitive abilities ranging from basic perceptions to complex social behaviors exhibit substantial variation in individual differences. These cognitive functions can be categorized into a two-order hierarchy based on the levels of cognitive processes. Second-order cognition including metacognition and mentalizing monitors and regulates first-order cognitive processes. These two-order hierarchical cognitive functions exhibit distinct abilities. However, it remains unclear whether individual differences in these cognitive abilities have distinct origins. We employ the classical twin paradigm to compare the genetic and environmental contributions to the two-order cognitive abilities in the same tasks from the same population. The results reveal that individual differences in first-order cognitive abilities were primarily influenced by genetic factors. Conversely, the second-order cognitive abilities have a stronger influence from shared environmental factors. These findings suggest that the abilities of metacognition and mentalizing in adults are profoundly shaped by their environmental experiences and less determined by their biological nature.

[https://www.cell.com/cell-reports/fulltext/S2211-1247\(24\)00388-7](https://www.cell.com/cell-reports/fulltext/S2211-1247(24)00388-7)

Current Anthropology**PAPERS****LIAM M. BRADY, JOHN BRADLEY & AMANDA KEARNEY – Always a Trace: Archaeological Absence, Indigenous Presence, and Depictions of “Contact” Experiences in North Australian Rock Art**

In this paper, we explore how we might “see” and interrogate absence and presence in the archaeological record. Our aim is to bring into question the epistemic lens (archaeological), through which absence is made visible, and the epistemic lens (Indigenous knowledge), through which absence is made impossible. To do this, we turn to the contact rock art record from Yanyuwa Country in northern Australia, where, despite four centuries of contact with the “other” (Indonesian trepanger gatherers and Europeans), no motifs depicting introduced subject matter resulting from these encounters have been found. Rather than attributing this absence to taphonomic factors, we argue that it can be understood as an Indigenous presence when juxtaposed with the richly narrated lifeworld of the Yanyuwa. For Yanyuwa, creating rock art is a non-human-centered activity; it is through the actions of Ancestral Beings and spiritual entities that all rock art, potentially including introduced subject matter, is made and taken away according to cultural circumstances such as Yanyuwa health and well-being and changing engagements with country during postcontact times. We conclude by advocating for archaeologists to look outside of or suspend Western-oriented frameworks and reasoning and turn to self-determined Indigenous ontological and epistemological habits around how absence appears and operates.

<https://www.journals.uchicago.edu/doi/abs/10.1086/729568>

eLife

PAPERS

TRISTAN ROGET et al – A scenario for an evolutionary selection of ageing

Signs of ageing become apparent only late in life, after organismal development is finalized. Ageing, most notably, decreases an individual's fitness. As such, it is most commonly perceived as a non-adaptive force of evolution and considered a by-product of natural selection.

Building upon the evolutionarily conserved age-related Smurf phenotype, we propose a simple mathematical life-history trait model in which an organism is characterized by two core abilities: reproduction and homeostasis.

Through the simulation of this model, we observe 1) the convergence of fertility's end with the onset of senescence, 2) the relative success of ageing populations, as compared to non-ageing populations, and 3) the enhanced evolvability (i.e. the generation of genetic variability) of ageing populations. In addition, we formally demonstrate the mathematical convergence observed in 1).

We thus theorize that mechanisms that link the timing of fertility and ageing have been selected and fixed over evolutionary history, which, in turn, explains why ageing populations are more evolvable and therefore more successful. Broadly speaking, our work suggests that ageing is an adaptive force of evolution.

<https://elifesciences.org/reviewed-preprints/92914>

Frontiers in Psychology

PAPERS

CAEDYN STINSON, IGOR KAGAN & AREZOO POORESMAEILI – The contribution of sensory information asymmetry and bias of attribution to egocentric tendencies in effort comparison tasks

When comparing themselves with others, people often evaluate their own behaviors more favorably. This egocentric tendency is often categorized as a bias of attribution, with favorable self-evaluation resulting from differing explanations of one's own behavior and that of others. However, studies on information availability in social contexts offer an alternative explanation, ascribing egocentric biases to the inherent informational asymmetries between performing an action and merely observing it. Since biases of attribution and availability often co-exist and interact with each other, it is not known whether they are both necessary for the egocentric biases to emerge. In this study, we used a design that allowed us to directly compare the contribution of these two distinct sources of bias to judgements about the difficulty of an effortful task. Participants exhibited no attribution bias as judgements made for themselves did not differ from those made for others. Importantly, however, participants perceived the tasks they actively performed to be harder than the tasks they observed, and this bias was magnified as the overall task difficulty increased. These findings suggest that information asymmetries inherent to the difference between actively performing a task and observing it can drive egocentric biases in effort evaluations on their own and without a contribution from biases of attribution.

<https://www.frontiersin.org/journals/psychology/articles/10.3389/fpsyg.2024.1304372/full>

ULRIKE GRIEBEL & D. KIMBROUGH OLLER – From emotional signals to symbols

The quest for the origins of language is a diverse enterprise, where research from a variety of disciplines brings area-specific ideas and area-specific terminology to bear. This variety often results in misunderstandings and misconceptions about communication in various species. In the present paper, we argue for focus on emotional systems as the primary motivators for social signals in animals in general. This focus can help resolve discrepancies of interpretation among different areas of inquiry and can illuminate distinctions among different social signals as well as their phylogenetic origins in animals and especially in humans. We advocate, following Jaak Panksepp, a view wherein the Seeking System, the endogenous tendency to search and explore, is the most fundamental emotional motivation. The Seeking System forms the basis for flexible, voluntary, and exploratory control of motor systems and makes much of learning possible. The relative lack of vocal learning and expression in nonhuman primates contrasted with extensive vocal learning and expression in humans began, we propose, with the evolution in ancient hominins of a necessary foundation for the many subsequent capabilities required for language. That foundation was, according to the reasoning, naturally selected in the form of neurological connections between the Seeking System and mechanisms of glottal/phonatory control. The new connections allowed ancient hominins to develop flexible, endogenous vocal fitness signals produced at very high rates and including large numbers of discrete syllables, recombinable to form syllable combinations with many prosodic variations. The increasing sociality of hominins supported evolution of massive expansion in the utilization of these flexible vocal forms to allow development of words and sentences.

<https://www.frontiersin.org/journals/psychology/articles/10.3389/fpsyg.2024.1135288/full>

Mind & Language

PAPERS

CONSTANT BONARD – Underdeterminacy without ostension: A blind spot in the prevailing models of communication

Together, the code and inferential models of communication are often thought to range over all cases of communication. However, their prevailing versions seem unable to fully explain what I call underdeterminacy without ostension. The latter is

constituted by communication where stimuli that are not (nor appear to be) produced with communicative or informative intentions nevertheless communicate information underdetermined by the relevant codes. Though the prevailing accounts of communication cannot fully explain how communication works in such cases, I suggest that some version of the inferential model can—if we allow it to extend to non-ostensive, non-intentional behaviors.

<https://onlinelibrary.wiley.com/doi/abs/10.1111/mila.12481>

JAMES LAING – Interpersonal connection

We are social animals that seek to connect with others of our kind. However, this common thought stands in need of elaboration. In this article, I argue for three theses. First, that we pursue certain forms of communicative interaction for their own sake insofar as they are ways of connecting with another. Second, that interpersonal connection is a metaphysically primitive emotional relation which resists reductive analysis in terms of the states of individuals. And finally, that our desire for interpersonal connection has a strong claim to being explanatorily and normatively prior to our desires for mutual-attachment, interpersonal belonging and approbation.

<https://onlinelibrary.wiley.com/doi/full/10.1111/mila.12480>

GABOR BRODY & ROMAN FEIMAN – Polysemy does not exist, at least not in the relevant sense

Based on the existence of polysemy (e.g., lunch can refer to both food and events), it is argued that central tenets of externalist semantics and Fodorian concept atomism, an externalist theory on which words lack semantic structure, are unsound. We evaluate the premise that these arguments rely on—that polysemous words have separate, finer-grained senses. We survey the evidence across psychology and linguistics and argue that it shows that polysemy does not exist, at least not in this “sense”. The upshot is that if polysemy does not exist, it cannot pose a problem for atomism or externalism.

<https://onlinelibrary.wiley.com/doi/abs/10.1111/mila.12474>

GUIDO LÖHR & CHRISTIAN MICHEL – Conceptual engineering, predictive processing, and a new implementation problem

According to predictive processing, an increasingly influential paradigm in cognitive science, the function of the brain is to minimize the prediction error of its sensory input. Conceptual engineering is the practice of assessing and changing concepts or word meanings. We contribute to both strands of research by proposing the first cognitive account of conceptual engineering, using the predictive processing framework. Our model reveals a new kind of implementation problem as prediction errors are only minimized if enough agents embrace conceptual changes. This problem can be overcome by emphasizing the importance of social norms and conceptual pluralism.

<https://onlinelibrary.wiley.com/doi/full/10.1111/mila.12471>

SHANNON SPAULDING – Motivating empathy

Critics of empathy argue that empathy is exhausting, easily manipulated, exacerbates rather than relieves conflict, and is too focused on individual experiences. Apparently, empathy not only fails to stop negative acts like sadism, bullying, and terrorism, it motivates and promotes such acts. These scholars argue that empathy will not save us from partisanship and division. In fact, it might make us worse off. I will argue that empathy exhibits bias in the ways critics describe because empathy is motivated. Conceiving of empathy as motivated leads to surprising conclusions about our tools for moral decision-making.

<https://onlinelibrary.wiley.com/doi/abs/10.1111/mila.12469>

LAURA BICKEL – Why the performance of habit requires attention

This article argues that every performance of habit-driven action requires attention. I begin by revisiting the conception of habit-driven actions as reducible to automatically performed responses to stimuli. On this conception, habitual actions are a counterexample to Wayne Wu's action-centered theory of attention. Using the biased competition model of attention, and building on findings from affective cognitive neuroscience, I challenge this position. I claim that the performance of a habitual action requires experiential history to be exerting an influence that is best understood as implicit selection-biasing. It follows from this that habit-driven action is compatible with Wu's theory.

<https://onlinelibrary.wiley.com/doi/full/10.1111/mila.12467>

LUCA INCURVATI & GIORGIO SBARDOLINI – The rejection game

We introduce the rejection game, designed to formalize the interaction between interlocutors in a Stalnakerian conversation: a speaker who asserts something and a listener who may accept or reject. The rejection game is similar to other signalling games known to the literature in economics and biology. We point out similarities and differences, and propose an application in linguistics. We uncover basic conditions under which the Gricean maxim of quality emerges from incentives among the players, providing evidence for a functionalist understanding of the Gricean program.

<https://onlinelibrary.wiley.com/doi/full/10.1111/mila.12460>

KATERYNA SAMOILOVA FRANCO – Pluralism about introspection

If we can and do have some self-knowledge, how do we acquire it? By examining the ways in which we acquire self-knowledge—by introspection—we can try shedding some light onto the nature and the breadth of self-knowledge, as others have tried to do with other forms of knowledge. My aim is to show that introspection involves multiple (that is, at least two) distinct processes, a view I call “pluralism about introspection”. One of the virtues of pluralism is that it explains how we can have such a wide variety of self-knowledge despite our cognitive limitations.

<https://onlinelibrary.wiley.com/doi/abs/10.1111/mila.12483>

Nature**NEWS****Right- or left-handed? Protein in embryo cells might help decide**

Gene that codes for structural protein could determine the dominant side of the human brain.

<https://www.nature.com/articles/d41586-024-00977-x>

ARTICLES**KATE T. SNYDER & NICOLE CREANZA – Birds convey complex signals in simple songs**

The quality of a bird’s song during courtship can influence whether a male is selected as a mate. An innovative approach using machine learning offers a way to analyse the characteristics of birdsong.

<https://www.nature.com/articles/d41586-024-00677-6>

PAPERS**DANYAL ALAM, FAYHA ZIA & TODD F. ROBERTS – The hidden fitness of the male zebra finch courtship song**

Vocal learning in songbirds is thought to have evolved through sexual selection, with female preference driving males to develop large and varied song repertoires. However, many songbird species learn only a single song in their lifetime. How sexual selection drives the evolution of single-song repertoires is not known. Here, by applying dimensionality-reduction techniques to the singing behaviour of zebra finches (*Taeniopygia guttata*), we show that syllable spread in low-dimensional feature space explains how single songs function as honest indicators of fitness. We find that this Gestalt measure of behaviour captures the spectrotemporal distinctiveness of song syllables in zebra finches; that females strongly prefer songs that occupy more latent space; and that matching path lengths in low-dimensional space is difficult for young males. Our findings clarify how simple vocal repertoires may have evolved in songbirds and indicate divergent strategies for how sexual selection can shape vocal learning.

<https://www.nature.com/articles/s41586-024-07207-4>

Nature Communications**PAPERS****DICK SCHIJVEN et al – Exome-wide analysis implicates rare protein-altering variants in human handedness**

Handedness is a manifestation of brain hemispheric specialization. Left-handedness occurs at increased rates in neurodevelopmental disorders. Genome-wide association studies have identified common genetic effects on handedness or brain asymmetry, which mostly involve variants outside protein-coding regions and may affect gene expression. Implicated genes include several that encode tubulins (microtubule components) or microtubule-associated proteins. Here we examine whether left-handedness is also influenced by rare coding variants (frequencies $\leq 1\%$), using exome data from 38,043 left-handed and 313,271 right-handed individuals from the UK Biobank. The beta-tubulin gene TUBB4B shows exome-wide significant association, with a rate of rare coding variants 2.7 times higher in left-handers than right-handers. The TUBB4B variants are mostly heterozygous missense changes, but include two frameshifts found only in left-handers. Other TUBB4B variants have been linked to sensorineural and/or ciliopathic disorders, but not the variants found here. Among genes previously implicated in autism or schizophrenia by exome screening, DSCAM and FOXP1 show evidence for rare coding variant association with left-handedness. The exome-wide heritability of left-handedness due to rare coding variants was 0.91%. This study reveals a role for rare, protein-altering variants in left-handedness, providing further evidence for the involvement of microtubules and disorder-relevant genes.

<https://www.nature.com/articles/s41467-024-46277-w>

Nature Communications Psychology**PAPERS****JOHN F. MAGNOTTI et al – Repeatedly experiencing the McGurk effect induces long-lasting changes in auditory speech perception**

In the McGurk effect, presentation of incongruent auditory and visual speech evokes a fusion percept different than either component modality. We show that repeatedly experiencing the McGurk effect for 14 days induces a change in auditory-only speech perception: the auditory component of the McGurk stimulus begins to evoke the fusion percept, even when presented on its own without accompanying visual speech. This perceptual change, termed fusion-induced recalibration

(FIR), was talker-specific and syllable-specific and persisted for a year or more in some participants without any additional McGurk exposure. Participants who did not experience the McGurk effect did not experience FIR, showing that recalibration was driven by multisensory prediction error. A causal inference model of speech perception incorporating multisensory cue conflict accurately predicted individual differences in FIR. Just as the McGurk effect demonstrates that visual speech can alter the perception of auditory speech, FIR shows that these alterations can persist for months or years. The ability to induce seemingly permanent changes in auditory speech perception will be useful for studying plasticity in brain networks for language and may provide new strategies for improving language learning.

<https://www.nature.com/articles/s44271-024-00073-w>

Nature Molecular Psychiatry

PAPERS

DAN C. LI et al – Social experience in adolescence shapes prefrontal cortex structure and function in adulthood

During adolescence, the prefrontal cortex (PFC) undergoes dramatic reorganization. PFC development is profoundly influenced by the social environment, disruptions to which may prime the emergence of psychopathology across the lifespan. We investigated the neurobehavioral consequences of isolation experienced in adolescence in mice, and in particular, the long-term consequences that were detectable even despite normalization of the social milieu. Isolation produced biases toward habit-like behavior at the expense of flexible goal seeking, plus anhedonic-like reward deficits. Behavioral phenomena were accompanied by neuronal dendritic spine over-abundance and hyper-excitability in the ventromedial PFC (vmPFC), which was necessary for the expression of isolation-induced habits and sufficient to trigger behavioral inflexibility in socially reared controls. Isolation activated cytoskeletal regulatory pathways otherwise suppressed during adolescence, such that repression of constituent elements prevented long-term isolation-induced neurosequelae. Altogether, our findings unveil an adolescent critical period and multi-model mechanism by which social experiences facilitate prefrontal cortical maturation.

<https://www.nature.com/articles/s41380-024-02540-6>

Nature Reviews Neuroscience

ARTICLES

JAKE ROGERS – Natural primate neurobiology

Many of the natural behaviours of primates that sustain their dynamic social relationships are not captured in artificial laboratory tasks. Testard et al. addressed this issue by assessing neural activity in unrestrained socially interacting rhesus macaques, identifying cortical signatures of several key natural and co-operative behaviours.

<https://www.nature.com/articles/s41583-024-00816-y>

Original Paper, EAORC Bulletin 1,083: CAMILLE TESTARD et al – Neural signatures of natural behaviour in socializing macaques

<https://www.nature.com/articles/s41586-024-07178-6>

Nature Reviews Psychology

PAPERS

JESSICA F. CANTLON & STEVEN T. PIANTADOSI – Uniquely human intelligence arose from expanded information capacity

Most theories of how human cognition is unique propose specific representational capacities or biases, often thought to arise through evolutionary change. In this Perspective, we argue that the evidence that supports these domain-specific theories is confounded by general information-processing differences. We argue that human uniqueness arises through genetic quantitative increases in the global capacity to process information and share it among systems such as memory, attention and learning. This change explains regularities across numerous subdomains of cognition, behavioural comparisons between species and phenomena in child development. This strict evolutionary continuity theory of human intelligence is consistent with comparative evidence about neural evolution and computational constraints of memory on the ability to represent rules, patterns and abstract generalizations. We show how these differences in the degree of information processing capacity yield differences in kind for human cognition relative to other animals.

<https://www.nature.com/articles/s44159-024-00283-3>

Nature Scientific Reports

PAPERS

PETER M. YAWORSKY, EMIL S. NIELSEN & TRINE K. NIELSEN – The Neanderthal niche space of Western Eurasia 145 ka to 30 ka ago

Neanderthals occupied Western Eurasia between 350 ka and 40 ka ago, during the climatically volatile Pleistocene. A key issue is to what extent Neanderthal populations expanded into areas of Western Eurasia and what conditions facilitated such range expansions. The range extent of Neanderthals is generally based on the distribution of Neanderthal material, but the

land-altering nature of glacial periods has erased much of the already sparse material evidence of Neanderthals, particularly in the northern latitudes. To overcome this obstacle species distribution models can estimate past distributions of Neanderthals, however, most implementations are generally constrained spatially and temporally and may be artificially truncating the Neanderthal niche space. Using dated contexts from Neanderthal sites from across Western Eurasia, millennial-scale paleoclimate reconstructions, and a spatiotemporal species distribution model, we infer the fundamental climatic niche space of Neanderthals and estimate the extent of Neanderthal occupation. We find that (a.) despite the long timeframe, Neanderthals occupy a relatively narrow fundamental climatic niche space, (b.) the estimated projected potential Neanderthal niche space suggests a larger geographic range than the material record suggests, and (c.) that there was a general decline in the size of the projected potential Neanderthal niche from 145 ka ago onward, possibly contributing to their extinction.

<https://www.nature.com/articles/s41598-024-57490-4>

ROCIO BOTTA, GERARDO BLANCO & CHRISTIAN E. SCHAEERER – Discipline and punishment in panoptical public goods games

In Public Goods Games (PGG), the temptation to free-ride on others' contributions poses a significant threat to the sustainability of cooperative societies. Therefore, societies strive to mitigate this through incentive systems, employing rewards and punishments to foster cooperative behavior. Thus, peer punishment, in which cooperators sanction defectors, as well as pool punishment, where a centralized punishment institution executes the punishment, is deeply analyzed in previous works. Although the literature indicates that these methods may enhance cooperation on social dilemmas under particular contexts, there are still open questions, for instance, the structural connection between graduated punishment and the monitoring of public goods games. Our investigation proposes a compulsory PGG framework under Panoptical surveillance. Inspired by Foucault's theories on disciplinary mechanisms and biopower, we present a novel mathematical model that scrutinizes the balance between the severity and scope of punishment to catalyze cooperative behavior. By integrating perspectives from evolutionary game theory and Foucault's theories of power and discipline, this research uncovers the theoretical foundations of mathematical frameworks involved in punishment and discipline structures. We show that well-calibrated punishment and discipline schemes, leveraging the panoptical effect for universal oversight, can effectively mitigate the free-rider dilemma, fostering enhanced cooperation. This interdisciplinary approach not only elucidates the dynamics of cooperation in societal constructs but also underscores the importance of integrating diverse methodologies to address the complexities of fostering cooperative evolution.

<https://www.nature.com/articles/s41598-024-57842-0>

YIPU WEI, YINGJIA WAN & MICHAEL K. TANENHAUS – Spontaneous perspective-taking in real-time language comprehension: evidence from eye-movements and grain of coordination

Linguistic communication requires interlocutors to consider differences in each other's knowledge (perspective-taking). However, perspective-taking might either be spontaneous or strategic. We monitored listeners' eye movements in a referential communication task. A virtual speaker gave temporally ambiguous instructions with scalar adjectives ("big" in "big cubic block"). Scalar adjectives assume a contrasting object (a small cubic block). We manipulated whether the contrasting object (a small triangle) for a competitor object (a big triangle) was in common ground (visible to both speaker and listener) or was occluded so it was in the listener's privileged ground, in which case perspective-taking would allow earlier reference-resolution. We used a complex visual context with multiple objects, making strategic perspective-taking unlikely when all objects are in the listener's referential domain. A turn-taking, puzzle-solving task manipulated whether participants could anticipate a more restricted referential domain. Pieces were either confined to a small area (requiring fine-grained coordination) or distributed across spatially distinct regions (requiring only coarse-grained coordination). Results strongly supported spontaneous perspective-taking: Although comprehension was less time-locked in the coarse-grained condition, participants in both conditions used perspective information to identify the target referent earlier when the competitor contrast was in privileged ground, even when participants believed instructions were computer-generated.

<https://www.nature.com/articles/s41598-024-58699-z>

JACQUELINE NONWEILER et al – Emotional self-knowledge profiles and relationships with mental health indicators support value in 'knowing thyself'

"Know thyself" may be indicated by a balanced high pairing of two emotional self-knowledge indicators: attention to emotions and emotional clarity. Closely associated but often evaluated separately, emotional clarity is consistently, inversely associated with psychopathology, while evidence regarding attention to emotions is less consistent. Variables of high/low emotional clarity and attention to emotions yielded four emotional self-knowledge profiles which were analyzed for associations with mental health indicators (depression and anxiety symptoms, self-esteem, self-schema, resiliency, transcendence) in $n = 264$ adolescents. Here we report regression models which show that compared with neither, both high (attention + clarity) show higher positive self-schema ($B = 2.83$, $p = 0.004$), more resiliency ($B = 2.76$, $p = 0.015$) and higher transcendence ($B = 82.4$, $p < 0.001$), while high attention only is associated with lower self-esteem ($B = -3.38$, $p < 0.001$) and more symptoms ($B = 5.82$, $p < 0.001$ for depression; $B = 9.37$, $p < 0.001$ for anxiety). High attention only is associated with most severe impairment all indicators excepting transcendence. Profiles including high clarity suggest protective effects, and

'implicit' versus 'explicit' emotional awareness are discussed. Balanced vs. imbalanced emotional self-awareness profiles dissimilarly affect mental health, which have implications for treatment and policy.

<https://www.nature.com/articles/s41598-024-57282-w>

Neuron

PAPERS

GEORGE A. MASHOUR – Anesthesia and the neurobiology of consciousness

In the 19th century, the discovery of general anesthesia revolutionized medical care. In the 21st century, anesthetics have become indispensable tools to study consciousness. Here, I review key aspects of the relationship between anesthesia and the neurobiology of consciousness, including interfaces of sleep and anesthetic mechanisms, anesthesia and primary sensory processing, the effects of anesthetics on large-scale functional brain networks, and mechanisms of arousal from anesthesia. I discuss the implications of the data derived from the anesthetized state for the science of consciousness and then conclude with outstanding questions, reflections, and future directions.

[https://www.cell.com/neuron/abstract/S0896-6273\(24\)00156-9](https://www.cell.com/neuron/abstract/S0896-6273(24)00156-9)

New Scientist

NEWS

Birds make an 'after you' gesture to prompt their mate to enter nest

Japanese tits sometimes flutter their wings in an apparent gesture of encouraging their mate to enter their shared nest first.

<https://www.newscientist.com/article/2423980-birds-make-an-after-you-gesture-to-prompt-their-mate-to-enter-nest/>

Ancient people carved mysterious symbols near dinosaur footprints

A unique site in Brazil features rock carvings closely associated with dinosaur tracks, suggesting prehistoric people saw the footprints as meaningful.

<https://www.newscientist.com/article/2424152-ancient-people-carved-mysterious-symbols-near-dinosaur-footprints/>

PLoS One

PAPERS

DANIEL FLETCHER, ROBERT HOUGHTON & ALEXA SPENCE – Approaching future rewards or waiting for them to arrive: Spatial representations of time and intertemporal choice

Our mental representation of the passage of time is structured by concepts of spatial motion, including an ego-moving perspective in which the self is perceived as approaching future events and a time-moving perspective in which future events are perceived as approaching the self. While previous research has found that processing spatial information in one's environment can preferentially activate either an ego-moving or time-moving temporal perspective, potential downstream impacts on everyday decision-making have received less empirical attention. Based on the idea people may feel closer to positive events they see themselves as actively approaching rather than passively waiting for, in this pre-registered study we tested the hypothesis that spatial primes corresponding to an ego-moving (vs. time-moving) perspective would attenuate temporal discounting by making future rewards feel more proximal. 599 participants were randomly assigned to one of three spatial prime conditions (ego-moving, time-moving, control) resembling map-based tasks people may engage with on digital devices, before completing measures of temporal perspective, perceived wait time, perceived control over time, and temporal discounting. Partly consistent with previous research, the results indicated that the time-moving prime successfully activated the intended temporal perspective—though the ego-moving prime did not. Contrary to our primary hypotheses, the spatial primes had no effect on either perceived wait time or temporal discounting. Processing spatial information in a map-based task therefore appears to influence how people conceptualise the passage of time, but there was no evidence for downstream effects on intertemporal preferences. Additionally, exploratory analysis indicated that greater perceived control over time was associated with lower temporal discounting, mediated by a reduction in perceived wait time, suggesting a possible area for future research into individual differences and interventions in intertemporal decision-making.

<https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0301781>

ELEANOR STANSBURY et al – How children generalize novel nouns: An eye-tracking analysis of their generalization strategies

Recent research has shown that comparisons of multiple learning stimuli which are associated with the same novel noun favor taxonomic generalization of this noun. These findings contrast with single-stimulus learning in which children follow so-called lexical biases. However, little is known about the underlying search strategies. The present experiment provides an eye-tracking analysis of search strategies during novel word learning in a comparison design. We manipulated both the conceptual distance between the two learning items, i.e., children saw examples which were associated with a noun (e.g., the two learning items were either two bracelets in a "close" comparison condition or a bracelet and a watch in a "far" comparison condition), and the conceptual distance between the learning items and the taxonomically related items in the generalization options (e.g., the taxonomic generalization answer; a pendant, a near generalization item; versus a bow tie, a

distant generalization item). We tested 5-, 6- and 8-year-old children's taxonomic (versus perceptual and thematic) generalization of novel names for objects. The search patterns showed that participants first focused on the learning items and then compared them with each of the possible choices. They also spent less time comparing the various options with one another; this search profile remained stable across age groups. Data also revealed that early comparisons, (i.e., reflecting alignment strategies) predicted generalization performance. We discuss four search strategies as well as the effect of age and conceptual distance on these strategies.

<https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0296841>

HANTAO WANG, YUSUF ALI & LUDO MAX – Perceptual formant discrimination during speech movement planning

Evoked potential studies have shown that speech planning modulates auditory cortical responses. The phenomenon's functional relevance is unknown. We tested whether, during this time window of cortical auditory modulation, there is an effect on speakers' perceptual sensitivity for vowel formant discrimination. Participants made same/different judgments for pairs of stimuli consisting of a pre-recorded, self-produced vowel and a formant-shifted version of the same production. Stimuli were presented prior to a "go" signal for speaking, prior to passive listening, and during silent reading. The formant discrimination stimulus /uh/ was tested with a congruent productions list (words with /uh/) and an incongruent productions list (words without /uh/). Logistic curves were fitted to participants' responses, and the just-noticeable difference (JND) served as a measure of discrimination sensitivity. We found a statistically significant effect of condition (worst discrimination before speaking) without congruency effect. Post-hoc pairwise comparisons revealed that JND was significantly greater before speaking than during silent reading. Thus, formant discrimination sensitivity was reduced during speech planning regardless of the congruence between discrimination stimulus and predicted acoustic consequences of the planned speech movements. This finding may inform ongoing efforts to determine the functional relevance of the previously reported modulation of auditory processing during speech planning.

<https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0301514>

ELIJAH GALVAN & ALAN SANFEY – Reciprocity in ambiguous situations: Default psychological strategies underlying ambiguity resolution in moral decision-making

When deciding whether to reciprocate trust, people are typically strongly influenced by how much trust their interaction partner has originally shown them. If a partner has placed a lot of trust in you, there is a strong motivation to reciprocate, and indeed this factor often outweighs pro-self considerations to maximize one's own financial payout. However, one important unanswered question in this regard is what people decide to do when this prior information is ambiguous; that is, when they do not know for sure exactly how trusting their partner has been. How then do people decide to reciprocate? This study utilizes a novel version of the Trust Game to directly address this question. Here, we develop, and validate, a computational model-based approach to quantify and categorize how participants assessed the trustworthiness of an unfamiliar partner when making reciprocity decisions. We find that participants spontaneously use their prior experience about the trustiness of game partners in general to inform their reciprocity decisions, even when they had the opportunity to strategically assume that their new, unfamiliar, partners were untrusting, and hence could have justified lower reciprocation rates.

<https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0300886>

TABEA J. KOCH et al – Differences in birch tar composition are explained by adhesive function in the central European Iron Age

Birch bark tar is the most widely documented adhesive in prehistoric Europe. More recent periods attest to a diversification in terms of the materials used as adhesives and their application. Some studies have shown that conifer resins and beeswax were added to produce compound adhesives. For the Iron Age, no comparative large-scale studies have been conducted to provide a wider perspective on adhesive technologies. To address this issue, we identify adhesive substances from the Iron Age in north-eastern France. We applied organic residue analysis to 65 samples from 16 archaeological sites. This included residues adhering to ceramics, from vessel surface coatings, repaired ceramics, vessel contents, and adhesive lumps. Our findings show that, even during the Iron Age in north-eastern France, birch bark tar is one of the best-preserved adhesive substances, used for at least 400 years. To a lesser extent, Pinaceae resin and beeswax were also identified. Through statistical analyses, we show that molecular composition differs in samples, correlating with adhesive function. This has implications for our understanding of birch bark tar production, processing and mode of use during the Iron Age in France and beyond.

<https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0301103>

WENJUN WU, HUAN XIAO & DENGKE YU – Individual quality, insecure organizational attachment, and formalistic task completion: Social cognitive perspective

Formalistic tasks are widely utilized in modern companies due to their ability to increase productivity and contribute to the achievement of corporate goals at a lower cost. However, these tasks are often met with resistance from individuals because they do not provide direct short-term rewards for their efforts. Drawing on social cognitive theory, this study examined the influence of individual quality and organizational attachment on the completion of formalistic tasks. To address

this, the study conducted a questionnaire survey to collect data from 602 Chinese respondents and built a structural equation model for data analysis. Through empirical research, the study confirmed the positive role of individual quality, including knowledge and personality, in the completion of formalistic tasks. Furthermore, the study proved that avoidant attachment could significantly weaken the effect of some components of individual quality on formalistic task completion. This paper is the first to reveal the influence of individual and environmental factors on individuals' completion of formalistic tasks, progressing from bottom to top. The implications of these results are discussed.

<https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0301256>

ALEJANDRO SIERRA et al – Shepherding the past: High-resolution data on Neolithic Southern Iberian livestock management at Cueva de El Toro (Antequera, Málaga)

The feeding strategies of the first domesticated herds had to manage the risks arising from the novelty of livestock practices in territories often distant from the animals' primary habitats. The Iberian Peninsula is characterised by a great diversity of environments, which undoubtedly influenced these dynamics. At the beginning of the Neolithic period these led the possibility to combine diverse livestock farming practices based on different animal feeding habits. This variability is also consistent with the rhythms of adoption of domesticated animals, being later on the northern area. In order to address this issue, this work focuses on the dietary regimes of early sheep herds from southern Iberia, an area for which information is currently scarce. This study utilises high-resolution radiocarbon dating and stable isotope data on teeth to investigate sheep husbandry management strategies in Cueva de El Toro (Antequera, Málaga). The radiocarbon dates on the analysed remains evidenced they were deposited at the site over a short period, supporting the recurrent use of the cave. The sequential analysis of oxygen and carbon isotopes in tooth enamel reveals distinct livestock management strategies, reproduction patterns, feeding habits, and mobility during this short period. This variability demonstrates that livestock management practices in the western Mediterranean are more diverse than previously considered. Furthermore, these findings support the hypothesis that early Neolithic communities in the southern Iberian Peninsula were able to adopt different feeding strategies within the same herd, depending on their ecological and productive needs.

<https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0299786>

PNAS

PAPERS

ALAN J. S. BEAVAN, MARIA ROSA DOMINGO-SANANES, & JAMES O. MCINERNEY – Contingency, repeatability, and predictability in the evolution of a prokaryotic pangenome

Pangenomes exhibit remarkable variability in many prokaryotic species, much of which is maintained through the processes of horizontal gene transfer and gene loss. Repeated acquisitions of near-identical homologs can easily be observed across pangenomes, leading to the question of whether these parallel events potentiate similar evolutionary trajectories, or whether the remarkably different genetic backgrounds of the recipients mean that postacquisition evolutionary trajectories end up being quite different. In this study, we present a machine learning method that predicts the presence or absence of genes in the *Escherichia coli* pangenome based on complex patterns of the presence or absence of other accessory genes within a genome. Our analysis leverages the repeated transfer of genes through the *E. coli* pangenome to observe patterns of repeated evolution following similar events. We find that the presence or absence of a substantial set of genes is highly predictable from other genes alone, indicating that selection potentiates and maintains gene–gene co-occurrence and avoidance relationships deterministically over long-term bacterial evolution and is robust to differences in host evolutionary history. We propose that at least part of the pangenome can be understood as a set of genes with relationships that govern their likely cohabitants, analogous to an ecosystem's set of interacting organisms. Our findings indicate that intragenomic gene fitness effects may be key drivers of prokaryotic evolution, influencing the repeated emergence of complex gene–gene relationships across the pangenome.

<https://www.pnas.org/doi/10.1073/pnas.2304934120>

Proceedings of the Royal Society B

PAPERS

MASON YOUNGBLOOD – Language-like efficiency and structure in house finch song

Communication needs to be complex enough to be functional while minimizing learning and production costs. Recent work suggests that the vocalizations and gestures of some songbirds, cetaceans and great apes may conform to linguistic laws that reflect this trade-off between efficiency and complexity. In studies of non-human communication, though, clustering signals into types cannot be done a priori, and decisions about the appropriate grain of analysis may affect statistical signals in the data. The aim of this study was to assess the evidence for language-like efficiency and structure in house finch (*Haemorrhous mexicanus*) song across three levels of granularity in syllable clustering. The results show strong evidence for Zipf's rank–frequency law, Zipf's law of abbreviation and Menzerath's law. Additional analyses show that house finch songs have small-world structure, thought to reflect systematic structure in syntax, and the mutual information decay of sequences is consistent with a combination of Markovian and hierarchical processes. These statistical patterns are robust across three

levels of granularity in syllable clustering, pointing to a limited form of scale invariance. In sum, it appears that house finch song has been shaped by pressure for efficiency, possibly to offset the costs of female preferences for complexity.

<https://royalsocietypublishing.org/doi/10.1098/rspb.2024.0250>

Royal Society Open Science

PAPERS

MATTHEW WARBURTON et al – Getting stuck in a rut as an emergent feature of a dynamic decision-making system

Human sensorimotor decision making has a tendency to get ‘stuck in a rut’, being biased towards selecting a previously implemented action structure (hysteresis). Existing explanations propose this is the consequence of an agent efficiently modifying an existing plan, rather than creating a new plan from scratch. Instead, we propose that hysteresis is an emergent property of a system learning from the consequences of its actions. To examine this, 152 participants moved a cursor to a target on a tablet device while avoiding an obstacle. Hysteresis was observed when the obstacle moved sequentially across the screen between trials, whereby the participant continued moving around the same side of the obstacle despite it now requiring a larger movement than the alternative. Two further experiments (n = 20) showed an attenuation when time and resource constraints were eased. We created a simple computational model capturing probabilistic estimate updating that showed the same patterns of results. This provides, to our knowledge, the first computational demonstration of how sensorimotor decision making can get ‘stuck in a rut’ through the updating of the probability estimates associated with actions.

<https://royalsocietypublishing.org/doi/abs/10.1098/rsos.231550>

SONIA KLEINDORFER et al – Aggressiveness predicts dominance rank in greylag geese: mirror tests and agonistic interactions

Individual differences in aggressiveness, if consistent across time and contexts, may contribute to the long-term maintenance of social hierarchies in complex animal societies. Although agonistic interactions have previously been used to calculate individuals’ positions within a dominance hierarchy, to date the repeatability of agonistic behaviour has not been tested when calculating social rank. Here, we examined the consistency and social relevance of aggressiveness as a personality trait in a free-flying population of greylag geese (*Anser anser*). For each individual, we quantified (i) aggressiveness using a standardized mirror stimulation test and (ii) dominance ranking based on the number of agonistic interactions won and lost in a feeding context. We found that individual differences in aggressiveness were significantly repeatable and that individuals’ aggressiveness predicted their dominance rank position. The flock showed a robust and intermediately steep dominance hierarchy. Social rank was higher in paired birds, males and older birds, and most agonistic interactions occurred between individuals with moderate rank differences. We suggest that selection favours aggressiveness as a personality trait associated with resource acquisition and social rank, whereby a dominance hierarchy may increase the benefits of group living and reduce costs over conflict within dyads.

<https://royalsocietypublishing.org/doi/abs/10.1098/rsos.231686>

Science

ARTICLES

ANDREW CURRY – Rare wooden artifacts show the smarts of early Neanderthals

Complex tools from 300,000-year-old deposit at Schöningen in Germany point to a “wood age”.

<https://www.science.org/content/article/rare-wooden-artifacts-showcase-smarts-early-neanderthals>

ANN GIBBONS – Lucy’s world

Fifty years after her discovery, the 3.2-million-year-old fossil still reigns as mother of us all. But she now has rivals.

<https://www.science.org/content/article/was-lucy-mother-us-all-fifty-years-discovery-famed-skeleton-rivals>

Science Advances

PAPERS

WANQIU DING et al – Adaptive functions of structural variants in human brain development

Quantifying the structural variants (SVs) in nonhuman primates could provide a niche to clarify the genetic backgrounds underlying human-specific traits, but such resource is largely lacking. Here, we report an accurate SV map in a population of 562 rhesus macaques, verified by in-house benchmarks of eight macaque genomes with long-read sequencing and another one with genome assembly. This map indicates stronger selective constraints on inversions at regulatory regions, suggesting a strategy for prioritizing them with the most important functions. Accordingly, we identified 75 human-specific inversions and prioritized them. The top-ranked inversions have substantially shaped the human transcriptome, through their dual effects of reconfiguring the ancestral genomic architecture and introducing regional mutation hotspots at the inverted regions. As a proof of concept, we linked APCDD1, located on one of these inversions and down-regulated specifically in humans, to neuronal maturation and cognitive ability. We thus highlight inversions in shaping the human uniqueness in brain development.

Trends in Cognitive Sciences

PAPERS

WAYNE WU – We know what attention is!

Attention is one of the most thoroughly investigated psychological phenomena, yet skepticism about attention is widespread: we do not know what it is, it is too many things, there is no such thing. The deficiencies highlighted are not about experimental work but the adequacy of the scientific theory of attention. Combining common scientific claims about attention into a single theory leads to internal inconsistency. This paper demonstrates that a specific functional conception of attention is incorporated into the tasks used in standard experimental paradigms. In accepting these paradigms as valid probes of attention, we commit to this common conception. The conception unifies work at multiple levels of analysis into a coherent scientific explanation of attention. Thus, we all know what attention is.

[https://www.cell.com/trends/cognitive-sciences/abstract/S1364-6613\(23\)00286-3](https://www.cell.com/trends/cognitive-sciences/abstract/S1364-6613(23)00286-3)

ANDREA I. LUPPI et al – Information decomposition and the informational architecture of the brain

To explain how the brain orchestrates information-processing for cognition, we must understand information itself. Importantly, information is not a monolithic entity. Information decomposition techniques provide a way to split information into its constituent elements: unique, redundant, and synergistic information. We review how disentangling synergistic and redundant interactions is redefining our understanding of integrative brain function and its neural organisation. To explain how the brain navigates the trade-offs between redundancy and synergy, we review converging evidence integrating the structural, molecular, and functional underpinnings of synergy and redundancy; their roles in cognition and computation; and how they might arise over evolution and development. Overall, disentangling synergistic and redundant information provides a guiding principle for understanding the informational architecture of the brain and cognition.

[https://www.cell.com/trends/cognitive-sciences/fulltext/S1364-6613\(23\)00284-X](https://www.cell.com/trends/cognitive-sciences/fulltext/S1364-6613(23)00284-X)

STEPHAN LEWANDOWSKY et al – When liars are considered honest

This article introduces a theoretical model of truth and honesty from a psychological perspective. We examine its application in political discourse and discuss empirical findings distinguishing between conceptions of honesty and their influence on public perception, misinformation dissemination, and the integrity of democracy.

[https://www.cell.com/trends/cognitive-sciences/fulltext/S1364-6613\(24\)00058-5](https://www.cell.com/trends/cognitive-sciences/fulltext/S1364-6613(24)00058-5)

Trends in Ecology and Evolution

PAPERS

JOANNA M. WOLFE – Pangenomes at the limits of evolution

Evolutionary pathways can be random or deterministic. In a recent article, Beavan et al. investigate this balance by applying machine learning models to microbial pangenomes. The presence of almost one-third of genes can be reliably inferred, indicating a surprising amount of predictable evolution.

[https://www.cell.com/trends/ecology-evolution/abstract/S0169-5347\(24\)00081-8](https://www.cell.com/trends/ecology-evolution/abstract/S0169-5347(24)00081-8)

Trends in Neurosciences

PAPERS

NICHOLAS B. TURK-BROWNE & RICHARD N. ASLIN – Infant neuroscience: how to measure brain activity in the youngest minds

The functional properties of the infant brain are poorly understood. Recent advances in cognitive neuroscience are opening new avenues for measuring brain activity in human infants. These include novel uses of existing technologies such as electroencephalography (EEG) and magnetoencephalography (MEG), the availability of newer technologies including functional near-infrared spectroscopy (fNIRS) and optically pumped magnetometry (OPM), and innovative applications of functional magnetic resonance imaging (fMRI) in awake infants during cognitive tasks. In this review article we catalog these available non-invasive methods, discuss the challenges and opportunities encountered when applying them to human infants, and highlight the potential they may ultimately hold for advancing our understanding of the youngest minds.

[https://www.cell.com/trends/neurosciences/abstract/S0166-2236\(24\)00019-5](https://www.cell.com/trends/neurosciences/abstract/S0166-2236(24)00019-5)

BENJAMIN M. BASILE, SPENCER J. WATERS & ELISABETH A. MURRAY – What does preferential viewing tell us about the neurobiology of recognition memory?

The two tests most widely used in nonhuman primates to assess the neurobiology of recognition memory produce conflicting results. Preferential viewing tests (e.g., visual paired comparison) produce robust impairments following hippocampal lesions, whereas matching tests (e.g., delayed nonmatching-to-sample) often show complete sparing. Here, we review the data, the proposed explanations for this discrepancy, and then critically evaluate those explanations. The most likely explanation is that preferential viewing tests are not a process-pure assessment of recognition memory, but also test

elements of novelty-seeking, habituation, and motivation. These confounds likely explain the conflicting results. Thus, we propose that memory researchers should prefer explicit matching tests and readers interested in the neural substrates of recognition memory should give explicit matching tests greater interpretive weight.

[https://www.cell.com/trends/neurosciences/fulltext/S0166-2236\(24\)00040-7](https://www.cell.com/trends/neurosciences/fulltext/S0166-2236(24)00040-7)

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