EAORC BULLETIN 1,222 – 15 November 2026

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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

BBC – How reading changes the way your brain works

Video.
https://www.youtube.com/watch?v=X1L1Hd3xfrU

NEW SCIENTIST HUMAN STORY – Access to stone as well as water governed where early humans lived

The sands of the Arabian peninsula were once dotted with lakes that teemed with life, but early humans avoided them unless they came with easy access to stone for tool-making.
https://www.newscientist.com/article/2596225-access-to-stone-rather-than-water-governed-where-early-humans-lived/

NEW SCIENTIST HUMAN STORY – Neanderthal skeleton found with horrific injuries

A 75,000-year-old skeleton offers a glimpse into the violent world in which Neanderthals lived, but also offers hints that they cared for one another.
https://www.newscientist.com/article/2593548-neanderthal-skeleton-found-with-horrific-injuries/

NEW SCIENTIST HUMAN STORY – Archaeologists are uncovering the meaning of a unique rock art site

Excavations in the Côa valley in Portugal, the world's largest site of Palaeolithic open-air rock art, are yielding clues about how engravings of animals were seen by prehistoric hunter-gatherers.
https://www.newscientist.com/article/2593633-archaeologists-are-uncovering-the-meaning-of-a-unique-rock-art-site/

NEW SCIENTIST HUMAN STORY – Why are Homo sapiens the only human species left?

Once, we shared our planet with other human species, including Neanderthals and Denisovans. Today, they're gone. So how did Homo sapiens end up as the last humans standing?
https://www.newscientist.com/video/2595194-why-are-homo-sapiens-the-only-human-species-left/

NEW SCIENTIST HUMAN STORY – Humans evolved to be surprisingly fat – why we struggle with dieting

We have an unprecedented choice of food, yet our diets are worse than ever, says palaeoanthropologist Daniel Lieberman. So what can evolution tell us about how to eat better?
https://www.newscientist.com/article/2595250-humans-evolved-to-be-surprisingly-fat-no-wonder-we-struggle-with-diet/

NEW SCIENTIST HUMAN STORY – Your brain's unexpected ability to regenerate and how to harness it

One saga I've been watching from afar, but have never reported on, is the decade-spanning effort to find out whether our brains can produce new neurons in adulthood. Conventional neuroscience says we're pretty much born with all the neurons we'll ever have, but some researchers have found evidence suggesting otherwise. It seems the question is close to being settled, according to a recent feature by Jamie Ducharme. She describes "a slew of new findings", all indicating that new neurons can be formed, in at least one part of the brain. There are still holdouts, but many neuroscientists have accepted the new paradigm. They are now asking themselves what role adult neurogenesis plays in our cognition and mental health.
https://www.newscientist.com/article/2594221-your-brains-unexpected-ability-to-regenerate-and-how-to-harness-it/

NEW SCIENTIST HUMAN STORY – Essential reading

I reviewed 'Minds I've Met', the last book by primatologist Frans de Waal. He died in 2024, leaving the book unfinished, but his wife and three colleagues wrote the rest based on his notes. The result is a hybrid of memoir and science, which sounds clunky but actually makes for an engaging read. Much of de Waal's work was dedicated to demonstrating that animal minds are rich and varied, and that they are not the thoughtless automata sometimes presented by "behaviourist" researchers. He

often made big claims, for instance that chimpanzees engage in social manoeuvres that bear at least some resemblance to human politics, and many of those ideas have proved remarkably durable.
https://www.newscientist.com/article/2594475-primatologist-frans-de-waals-final-book-is-a-rich-mix-of-memoir-and-science/

SCIENCEADVISER – A lens into language: blowing raspberries

Your parents may have blown raspberries at you when you were a baby, or you may have learned to make the silly sound yourself. Chimpanzees make raspberries, too—and the behavior provides a window into how animal language works.
Human words are understood to be arbitrary: their meanings come from how they are commonly used, not from the sound of the words themselves. For example, there's no reason that the sound "cup" needs to signify the vessel you pour water into. By contrast, scientists have thought the vocalizations of wild chimpanzees were biological and fixed, meaning a specific noise should serve the same purpose across populations.
Researchers studied how 91 chimps used the raspberry noise across wild groups in Côte d'Ivoire and sanctuary groups in Sierra Leone. The wild groups almost always made raspberries while grooming, while juveniles in the sanctuary used the noise chaotically in different scenarios. When an adult chimpanzee joined the sanctuary youngsters, the group converged on using raspberries as the adult did. The results suggest that chimpanzee vocalizations aren't innate, but socially learned, much like ours.
"Even aspects of chimpanzee vocal communication that seemed fixed and unlearned may be shaped by learning, suggesting that there is still much to discover about their vocal repertoire," said author Antoine Valet in a statement.
https://www.pnas.org/doi/10.1073/pnas.2606837123

SCIENCEADVISER – She's a killer

Bonobos have a reputation for being our gentlest cousins. But these apes—which are as close to us as chimpanzees—have a ruthless side. And it turns out that in bonobo societies, the females are the ones that go off and hunt. "It really does challenge this idea of the male warrior—that the male hunter is the ancestral model that we should be leaning on," said one primatologist.
https://www.nytimes.com/2026/11/12/science/these-killer-female-apes-challenge-the-man-the-hunter-origin-story.html

PUBLICATIONS

Biology Letters

PAPERS

MARTIN FIEDER & SUSANNE HUBER – Increasing homozygosity is associated with a less open personality
This study investigates associations between genome-wide homozygosity and human personality traits. Using data from the Wisconsin Longitudinal Study, comprising approximately 7800 genotyped participants, we calculated runs of homozygosity and inbreeding coefficients from genome-wide SNP data. Personality was assessed with the Midlife Development Inventory. Multivariate and univariate linear models, controlling for sex, birth year and population structure, showed that several genome-wide inbreeding coefficients are significantly associated with some of the Big Five traits. Higher homozygosity was linked to lower openness, lower agreeableness and lower conscientiousness, while extraversion showed a non-significant negative trend and neuroticism showed a non-significant positive trend. These personality patterns may reflect tendencies towards caution and diminished sociability. The findings highlight potential interactions among genetic diversity, social behaviour and personality structure, contributing to the understanding of how evolutionary pressures and population structure shape psychological variation in humans.
https://royalsocietypublishing.org/rsbl/article/22/11/20260446/484008/Increasing-homozygosity-is-associated-with-a-less

Cell Genomics

ARTICLES

GABRIEL SANTPERE & XABIER DE MARTIN – Tracing the evolutionary history of human neocortical regulation
Anderson et al. extend comparative brain multi-omics across nine mammals and zebrafish, combining sequence conservation and predicted enhancer-gene relationships with functional assays to examine how regulatory elements with different evolutionary histories contribute to brain function and disease risk.
https://www.cell.com/cell-genomics/fulltext/S2666-979X(26)00262-4

Current Biology

PAPERS

SOFIA M. PEREIRA et al – Social monitoring predicts future rank and mating success in male macaques
In primate societies, much of what matters is revealed by watching others. By attending to the social interactions of group members, individuals may acquire detailed knowledge about prosocial tendencies, alliance networks, and dominance

structure, which can inform strategic decisions such as bond and coalition partner choice. Although allocation of visual attention is a fundamental cognitive process, its immediate and long-term behavioral consequences remain unclear, leaving ethological and neuroscientific research on social attention largely disconnected from work linking sociality to fitness. Bridging these research areas has been challenging in part due to the difficulty of quantifying social attention under natural conditions. Using a novel social scene protocol for recording visual attention to spontaneously unfolding interactions of nearby group members in the wild, we show across 46 adult male macaques that individual differences in visual attention to others' affiliative interactions was associated with male social bond strength later that year. Increased social bond strength, in turn, predicted a male's dominance success in the following year, and ultimately, enhanced male mating success. Post hoc analyses point to interventions in friendly behavior as a plausible behavioral mechanism connecting individual differences in attention with social bonding. In sum, our findings connect two largely siloed bodies of work by providing a chain of evidence linking individual variation in social monitoring to both its effects on the affiliation network and long-term consequences for key correlates of direct fitness.
https://www.cell.com/current-biology/fulltext/S0960-9822(26)01424-7

SPENCER R. LOGGIA et al – The representation of object-concept primitives across the macaque brain
Object concepts are mental representations that provide information beyond immediate sensory input, but where and how the brain encodes them remains unresolved. Here, macaques spent years learning a set of object-concept primitives: two-dimensional stimuli, each defined by a paired association between a unique color and a unique shape. During fMRI, the animals were cued with one feature (shapeless color or colorless shape) and rewarded for subsequently identifying the associated feature. Using a new whole-brain searchlight inspired by convolutional networks, we identified regions that carried information about the unshown feature during cue presentation. Cross-feature decoding was absent in retinotopic cortex but present bilaterally in discrete foci in anterior inferior temporal cortex (aIT), the temporal pole (TP), and frontal cortex (FC). In aIT and TP, the geometry of the neural representation of shapes matched the color-circle geometry of the associated colors, whereas FC supported the best decoding of error trials. Additional passive-viewing experiments showed univariate fMRI response biases to the learned associations in extrastriate visual cortex, which may reflect feedback from regions identified by cross-feature decoding. Together, the results provide a blueprint for how the brain encodes object concepts and suggest how concept representations engage perceptual representations through feedback during vision.
https://www.cell.com/current-biology/fulltext/S0960-9822(26)01412-0

eLife

PAPERS

BENJY BARNETT & STEPHEN M. FLEMING – Distinct neural representations of perceptual and numerical absence in the human brain
The ability to represent absences is fundamental to human perception and cognition. Sensitivity to non-numerical absences depends on inferring a lack of sensory evidence, enabling the recognition of a lack of environmental resources or other objects. In turn, encoding numerical absence as a concept – in the form of the number zero – has enabled a multitude of technological and mathematical advances. Whether perceptual and conceptual absences rely on overlapping or distinct neural representations in the human brain, however, remains unknown. We employed three different tasks together with magnetoencephalography to characterise neural representations of absence evoked within perceptual and numerical domains. Using multivariate decoding and Bayes factor analyses, we replicate previous findings of shared representations of numerical absence across symbolic and non-symbolic formats. In contrast, we show that these representations of numerical absence are distinct from those evoked by non-numerical absences. This result held even after controlling for stimulus-level confounds which generate surface-level similarities between perceptual absences and non-symbolic empty sets. Our results extend a boundary between perception and cognition to the domain of absence and provide insight into the different mechanisms employed by the human brain to both perceive and conceive of absences.
https://elifesciences.org/articles/112088

Jalingo Journal of Linguistics and Literary Studies

PAPERS

PATRICIA NWAMAKA CHIEKEZIE et al – Minimalism and Language Functions in the Language Classroom: An Overview of Chomsky's Position and Its Pedagogical Implications
This paper examines the relationship between Chomsky's Minimalist Program and language functions in the language classroom. The study is motivated by a persistent theoretical and pedagogical question: how can a formal theory concerned primarily with the structure and computation of language be related to classroom practices in which learners use language for communicative, interpersonal, cognitive and social purposes? The paper adopts a qualitative, library-based conceptual research design. Scholarly works published mainly from 2000 to 2026 were purposively selected and thematically synthesized, while foundational works were retained where necessary to establish the historical development of the concepts under investigation. The analysis is organized around three related perspectives: Minimalist syntax, particularly competence, syntactic computation and Merge; functional approaches to language, particularly Hallidayan systemic

functional linguistics; and contemporary research on classroom discourse and language pedagogy. The review finds that Minimalism and functional approaches address different analytical dimensions of language. Minimalism provides an account of the computational and structural resources through which linguistic expressions are constructed, whereas functional approaches explain how speakers deploy those resources to accomplish communicative purposes in context. The analysis further demonstrates that the seven functions considered in the paper: informative, instrumental, regulatory, interactional, personal, heuristic and imaginative, cannot be mapped mechanically onto individual syntactic structures. Rather, a single structure can realise different functions depending on context, and a single function can be realised through different grammatical forms. The paper therefore argues for a complementary, rather than conflated, relationship between formal and functional perspectives. In classroom practice, grammatical instruction can be strengthened when teachers connect form with meaning, communicative purpose and context. The paper recommends that language teaching should integrate structural awareness with opportunities for authentic functional language use, while teacher education should equip teachers to distinguish grammatical form from communicative function and to recognise the multifunctionality of classroom discourse.
https://oer.tsuniversity.edu.ng/index.php/jajolls/article/view/2609

Nature

ARTICLES

DYANI LEWIS – Retractions of old papers are on the rise: when should bad science be culled?
Decades-old papers are increasingly being pulled from the literature, bringing a host of challenges.
https://www.nature.com/articles/d41586-026-03624-9

Nature Communications

PAPERS

JORDAN LEI et al – Environmental stochasticity reduces human planning effort
The world is stochastic, making planning difficult. Despite the ubiquity of stochasticity in real-world environments, it remains an open question how people effectively balance the cognitive costs of planning against its potential benefits when faced with stochasticity. To study this, we designed a planning task where participants face one of three forms of stochasticity commonly encountered in the real world: reliability, volatility, and controllability. We find a robust pattern across all three manipulations: as stochasticity increases, people reduce their planning effort as measured by first-choice response times. To understand the processes underlying this effect, we developed several computational cognitive models to account for participants' choices. We find that rather than calculating expected values optimally, people choose a simpler strategy, acting as if the world were deterministic, a phenomenon known as determinizing. Consistent with our response time findings, we find that people reduce their effort by decreasing their sensitivity to values with increasing stochasticity, a signature of policy compression. Our work highlights the often overlooked role of stochasticity in human planning and its impact on planning strategy and effort. Moreover, it reveals the limitations of studying stochasticity solely through single-shot decisions.
https://www.nature.com/articles/s41467-026-78023-9

Nature Humanities & Social Sciences Communications

PAPERS

CHRIS CLARKSON et al – 65,000 years of ochre processing and use at Madjedbebe, northern Australia
We're sharing this article early to provide faster access to peer-reviewed, accepted research. It is citable and carries a permanent DOI. This version is subject to further edits and will be replaced automatically by the final Version of Record. All legal disclaimers apply.
The emergence and dispersal of symbolic behaviour is central to understanding the global expansion of Homo sapiens. Although ochre use has deep roots in Africa, evidence for intensive pigment technologies accompanying early modern human dispersals is rare elsewhere. Here we report an extensive assemblage of ground ochre from Madjedbebe, northern Australia, spanning initial settlement of Sahul (~65 ka) to the recent past (<100 years). Six cultural phases (Phases 2–7) preserve 5941 ochre pieces weighing more than 46 kg, demonstrating sustained acquisition and processing from first occupation. Early inhabitants selected vibrant ochres, employed multiple powder-extraction techniques and apparently combined ochre with mica to produce reflective pigments. Hand stencils dated to at least 67.8 ka in Sulawesi provide complementary evidence for pigment-based symbolic expression along the dispersal corridor into Sahul. Together, these records suggest that the first Australians carried well-developed pigment traditions as part of a broader symbolic repertoire accompanying Homo sapiens across Island Southeast Asia.
https://www.nature.com/articles/s41599-026-09364-5

Nature Reviews Neuroscience

PAPERS

MENG-YUN WANG et al – The many facets of human brain asymmetry

Asymmetry on the left–right axis is an organizing principle of the human brain that is important for diverse cognitive and behavioural functions. Advances in neuroimage analysis, genomics and large-scale data collection in the past decade have transformed our understanding of the biological foundations and multivariate nature of brain asymmetry. In this Review, we synthesize evidence across scales — from functional and macro-anatomical asymmetries and their inter-relations to microstructural, cellular and molecular levels. We examine inter-individual variation and atypical forms of brain asymmetry, which reveal that diverse aspects of asymmetry can vary largely independently across individuals rather than constituting a single trait. In this context, we discuss the developmental origins, lifespan trajectories and genetic architecture of hemispheric differences. We also summarize the relevance of brain asymmetry for neurological and psychiatric disorders and evolutionary changes of brain asymmetry that occurred in humans. Through this synthesis, we illustrate how contrasting the left and right hemispheres provides an informative window into the multi-level brain organization that supports cognition and behaviour.

https://www.nature.com/articles/s41583-026-01099-1

Neuron

PAPERS

CICELY F. DAY, ALEX A. POLLEN & MADELINE A. LANCASTER – Neural organoid models of human brain evolution

The human brain has structural and functional differences to our closest living relatives, the other great apes. It is thought that these differences give rise to many of the traits we associate with being human, such as our prodigious capacity to learn and be creative. However, the molecular mechanisms that underpin these differences are mostly unknown. In this review, we describe how neural organoids, an in vitro model of brain development, enable questions of human brain evolution to be functionally investigated in evolutionarily relevant developmental contexts. We discuss new insights at the genetic, cellular, and developmental scales and highlight current challenges in organoid generation, in long-term culture, and in establishing multimodal phenotypic measurements. We anticipate expanding the application of organoid models across Mammalia to help us better define species- and lineage-specific traits and improve our understanding of how complex traits emerge and evolve across developmental and evolutionary timescales.

https://www.cell.com/neuron/fulltext/S0896-6273(26)00816-0

New Scientist

ARTICLES

BALAND JALAL – What terrifying sleep paralysis demons reveal about the mind-body connection

After waking with the feeling of a shadowy presence pressing on his chest, neuroscientist Baland Jalal went on to study sleep paralysis. He explains what this frightening condition might reveal about consciousness.

https://www.newscientist.com/article/2596521-what-terrifying-sleep-paralysis-demons-reveal-about-the-mind-body-connection/

CHRISTA LESTÉ-LASSERRE – Prehistoric Britons may have made giant stone axes to show off

Unusually large handaxes weighing up to 3 kilograms have puzzled archaeologists because they are so unwieldy, but their function may have been purely symbolic.

https://www.newscientist.com/article/2597990-prehistoric-britons-may-have-made-giant-stone-axes-to-show-off/

Philosophical Psychology

PAPERS

KEITH ALLEN & PHILIP QUINLAN – Do colours exist in the dark? A study of folk beliefs

Do colours exist in the dark? This is an instance of a broader question about whether sensible qualities, like colours, sounds, felt temperatures and pains, can exist unperceived. Whether sensible qualities exist unperceived is a long-standing philosophical issue that is central to discussions about their nature and existence. The claim that colours cannot exist in the dark, and more broadly that sensible qualities cannot exist unperceived, is often used to motive broadly subjectivist theories, such as the 'secondary quality' or dispositionalist view of sensible qualities. Intuitive judgments about various real and imagined cases play an important role in these discussions.

The current paper reports the results of two experiments that investigate judgments about a range of cases discussed in the philosophical literature. In the case of colour, the majority of participants judged that colours exist unperceived across a wide range of scenarios, and there was only limited evidence of any differences in judgments about apparently 'relational' colours, such as the colours of rainbows, mirrors, and illumination-dependent colours. This suggests that the folk regard colours as non-relational properties. Judgments about sounds varied depending on scenario type: while the majority thought that a tree that falls in a forest with no-one there to hear it makes a sound, judgments differed about whether there is a sound in a

vacuum. Judgments about pain also varied depending on scenario type, particularly in the hypothetical case in which all humans have developed congenital insensitivity to pain so that no-one ever feels pain. Even then, however, it was nevertheless notable that at least half of the participants judged that pains exist when they are not experienced.
https://pure.york.ac.uk/portal/en/publications/do-colours-exist-in-the-dark-a-study-of-folk-beliefs/

Philosophical Transactions of the Royal Society B

PAPERS

TONY J. PRESCOTT et al with AGNIESZKA WYKOWSKA – From being to identity: analysis and synthesis of the self

The experience of being, or having, a self—contained by our bodies and able to act in the world—comes naturally to us as humans, along with a feeling of being the same self from day to day and of seeing others as also being selves. But what is the self, and how is it constituted? In this theme issue, we explore these questions through contemporary analytic approaches, in philosophy, psychology and neuroscience, that seek to understand the human self through conceptual and empirical investigations. Alongside this, we also explore synthetic approaches that attempt to construct a sense of self, or some part thereof, in artefacts such as robots. Our overall aim is to deepen the understanding of self as a foundational aspect of the human condition and explore both theoretical and practical implications of the emerging science of the self. In this introduction, we review the scope and content of the theme issue and argue that these complementary research strands can be seen as converging towards a 'systems' view that sees the self as an emergent property of an embodied, dynamical and informational system that continuously distinguishes, regulates and models itself through processes that sustain and explain its own existence.
https://royalsocietypublishing.org/rstb/article/381/1962/20250152/484152/From-being-to-identity-analysis-and-synthesis-of

LEON LI, SEBASTIAN GRUENEISEN & MICHAEL TOMASELLO – Evolutionary foundations of social identity

Social identity theory provides a rich description of how humans relate to various kinds of social groups, but no substantive account of why human psychology evolved to be so group-minded in the first place. We propose that the evolutionarily original form of social identity was one's moral identity as a cooperative group member. For ancient humans, survival depended on being an assimilated member of a cultural group, which, in turn, competed against other groups. In this context, humans evolved skills and motivations for engaging in the collective agency of a cultural group, especially the self-reflective capacity to adopt a social identity (i.e. to construe oneself as a member of a 'we') and the concomitant self-regulatory motivation to maintain a positive social identity (i.e. to strive for 'I', the individual, to meet the standards that 'we' uphold). In this evolutionary proposal, behavioural effects of group identity, inferences of common knowledge and moral emotions are all manifestations of the function of social identity as a self-regulatory system for maintaining one's good standing as a cooperative group member.
https://royalsocietypublishing.org/rstb/article/381/1962/20250157/483962/Evolutionary-foundations-of-social

QIAOYUE REN, ANDREEA M. GUI-BORDEIANU & OLAF BLANKE – Body in memory: the role of bodily self-consciousness in episodic memory and autonoetic consciousness

Episodic memory (EM) enables the conscious recollection of personally experienced events, including contextual features such as visual, auditory and emotional details. However, the role of bodily signals has been largely neglected in EM, although the observer's body provides a rich bodily context during the encoding, storage and recall of events, and has recently been associated with a bodily form of self-consciousness (bodily self-consciousness; BSC). Here, we introduce key concepts and findings on BSC and then summarize recent experimental paradigms, as well as behavioural and neural evidence, on how BSC impacts EM. This includes autonoetic consciousness, a core EM feature that emphasizes the conscious re-experiencing of past events. Current evidence suggests that modulations of BSC impact later memory, including objective EM performance and subjective autonoetic recollection (and other forms of memory such as working memory). These BSC–EM effects are supported by brain mechanisms in the posterior parietal cortex (particularly the temporoparietal junction and precuneus), motor cortex (premotor cortex and supplementary motor area) and prefrontal cortex that are coupled with the hippocampal complex, mediating BSC effects in EM. Linking subjective bodily experience during encoding and retrieval to the subjective re-experiencing of past events, we highlight open questions for future research on self and memory.
https://royalsocietypublishing.org/rstb/article/381/1962/20250167/483964/Body-in-memory-the-role-of-bodily-self

VICTORIA SOUTHGATE – How does the developing mind construct a self?

Our capacity to think about ourselves is a developmental achievement that, when it emerges, profoundly changes cognition. Currently, there are few, if any mechanistic accounts of where a concept of self could come from, and empirical investigation within contemporary developmental science is surprisingly absent. Drawing on a wealth of data from cognitive neuroscience and developmental psychology, I propose a new mechanistic account of the ontogeny of our reflective self-awareness anchored in infants' interoceptive signals. This is a social cognitive account in which infants' expectations about others' attention are deeply entwined with the modulating effect that others' attention has on infants' awareness of their interoceptive state, together providing the impetus for infants to generate a conceptual representation of self de novo.

https://royalsocietypublishing.org/rstb/article/381/1962/20250158/483968/How-does-the-developing-mind-construct-a-self-How

KAI VOGELEY, MARK WÜNSCHE & MATHIS JORDING – The social self: integration of multimodal communication signals in dyadic interactions

Humans are in continuous exchange with other persons, thereby integrating the individual self and the social self. This requires the production of different verbal and nonverbal signals at the subpersonal level (individual self) and, at the same time, their coordination with various perceived signals at the interpersonal level (social self). Many of our communicative signals are conveyed substantially nonverbally—that is automatically, intuitively and effortlessly, requiring dynamic coordination over time ('chronemics'). Whereas successful communication is usually perceived as pleasant and satisfying, communication can also be experienced as disrupted if chronemics do not unfold properly. With respect to the particularly informative example of autism spectrum disorder, we propose the concept of 'double invisibility'. Non-autistic persons intuitively produce and expect a rich, multimodal stream of communication signals without being aware of it (first invisibility). By contrast, autistic persons produce and expect nonverbal cues either to a significantly lesser extent or not at all without being aware of it (second invisibility). This mismatch leads to misunderstandings and disturbed communication. The coordination within the dyad that is continuously constructed through real-time communication is crucial to understand the full complexity of multimodal interactions and their disturbances.
https://royalsocietypublishing.org/rstb/article/381/1962/20250164/483969/The-social-self-integration-of-multimodal

JASON K. DAY & DAN ZAHAVI – Psychedelic ego-dissolution: a philosophical and qualitative critique

Ego-dissolution is a phenomenon of central interest across interdisciplinary research on psychedelics. In this paper, we present a philosophical and qualitative critique of the claim that ego-dissolution can result in conscious states with no phenomenal sense of self, i.e., states that completely lack any form of self-consciousness. We first turn to recent publications by Chris Letheby and Raphaël Millière, for whom trip reports of experiences induced by 5-MeO-DMT (5-methoxy-N,N-dimethyltryptamine) present clear evidence for the existence of totally selfless experiential states. Their claim is undermined, we argue, by the fact that they operate with overinflated notions of 'self' and 'self-consciousness,' meaning that more minimal forms are available and arguably still present in 5-MeO-DMT experiences. We then perform a qualitative thematic analysis of 411 5-MeO-DMT trip reports. Pointing to the ambiguous language of the trip reports, the self-admitted inadequacy of the descriptions and the affective dimension of the reported experiences, we argue that claims concerning total selflessness are unwarranted and instead offer an alternative interpretation: extreme ego-dissolution during 5-MeO-DMT experiences involves a radically minimal form of self-consciousness, one in which the identity of the subject is experienced as unfamiliar and underdetermined.
https://royalsocietypublishing.org/rstb/article/381/1962/20250154/483972/Psychedelic-ego-dissolution-a-philosophical-and

MARYA SCHECHTMAN – Defending the narrative self

The idea that the self is narrative in form is widely expressed in both academic study and everyday speech. It has also been widely disparaged. Criticism from philosophers has been especially vociferous, arguing not only that narrative views do not represent the best conception of self, but that they are misleading and potentially dangerous. In this paper, I develop and defend an account of the narrative self that addresses these challenges. I begin by exploring the charges made against narrative views in more detail, uncovering three distinct but interrelated objections. Using lessons from constructivist theories of episodic memory and narrative accounts of the self in developmental psychology (especially that of Robyn Fivush), I describe a view according to which a particular form of self-narration constitutes us as mature human selves by conferring a range of cognitive, behavioural and experiential capacities that enable sophisticated forms of social engagement. On this view, the self is not constituted by a self-narrative so much as we constitute ourselves as human selves by becoming self-narrators who construct our narratives within the constraints of a social–cultural framework. I show how this account addresses each of the three objections outlined at the beginning.
https://royalsocietypublishing.org/rstb/article/381/1962/20250155/483973/Defending-the-narrative-selfDefending-the

ODYSSE M. DAVIS, LYNETTE J. TIPPETT & DONNA ROSE ADDIS – Towards a comprehensive understanding of the processes underlying phenomenological continuity

The sense that ourself is continuous over time is a ubiquitous human experience. Although episodic autobiographical memory (AM) makes some contribution to one's subjective sense of self-continuity—also known as I-self continuity or phenomenological continuity—there is growing evidence that individuals with memory disorders report intact phenomenological continuity. These observations suggest that additional processes must also contribute to phenomenological continuity. This systematic search and critical review aimed to identify candidate bodily and psychological processes underlying phenomenological continuity, with a focus on processes beyond AM. A systematic search of three databases (PsycINFO, PubMed and Web of Science) yielded 153 publications that provided evidence of several processes contributing to phenomenological continuity: interoception, embodiment, temporality, a stable life trajectory and nostalgia. Alongside episodic AM, these processes provide multiple sources of constancy integrated across differing timescales. In addition, we identified several processes that indirectly influence the saliency and expression of phenomenological

continuity, such as ageing, socio-cultural factors and narrative processes. These findings extend existing models of self-continuity, providing a more comprehensive overview of the processes that, along with memory, underpin phenomenological continuity.
https://royalsocietypublishing.org/rstb/article/381/1962/20250162/483975/Towards-a-comprehensive-understanding-of-the

MATEUSZ WOŹNIAK et al with AGNIESZKA WYKOWSKA – Two minds, one body: neural correlates of processing of We-information during shared control over a humanoid robot

When speaking about the self, we typically think about 'I' or 'Me'. However, our relations with other people are also a critically important aspect of our self, forming our 'We'. In the current study, we investigated processing of information about the We during joint control over a single body. While naturally such a case occurs among the conjoint twins, we reconstructed such a situation by allowing two people to share control over a single humanoid robot. Using EEG, we investigated which neurocognitive processes are affected by providing We-information, i.e. information that conveys knowledge about properties at the group-level, while being uninformative about the individuals. We found that processing of We-information engages a cascade of processes, as indexed by various event-related potentials (ERPs), involving perception (P1, N1 and P2p), action selection (N2), working memory (P3b) and response preparation (contingent negative variation, CNV). We-information also modulates perception and processing of the subsequent information about the robot's target position, as indicated by modulation of similar ERPs (P1, N2 and P3b). Moreover, we found that We-information can affect dynamic allocation of covert attention towards the side of the partner controlling the other side of the robot. Overall, our results show that processing of information about the We can have a widespread influence on cognition, similarly to processing information about the self.
https://royalsocietypublishing.org/rstb/article/381/1962/20250163/483976/Two-minds-one-body-neural-correlates-of-processing

MARTIN V. BUTZ, VERENA V. HAFNER & PABLO LANILLOS – Building a robotic self

I wake up in the morning, I see my hand and I know it is me. This seemingly simple skill lies at the foundation of our agentive selves. We assume that the development of the self, in both biological and synthetic agents, is grounded in sensorimotor embodiment and inductive learning biases, as well as in the principle of predictive coding. Here, we explore the core inductive biases and process components for building a robotic minimal self. We propose that the formation of a hierarchical, generative model of the self is driven by active inference processes that interactively infer both an endogenous contextual frame and behaviour within this frame. Accordingly, experimental implementations in humanoid robots show how body ownership and agency can develop as foundational computational components. This work on building a robotic minimal self outlines future research directions in mechanistic modelling of the development of an artificial self. To probe the depth of this development, we sketch out embodied Turing tests that challenge complex problem-solving skills, as well as social intelligence and theory of mind. We suggest that uncertainty resolution and the social domain may be promising avenues for further research in the near future.
https://royalsocietypublishing.org/rstb/article/381/1962/20250166/483977/Building-a-robotic-selfBuilding-a-robotic-self

PAUL F.M.J. VERSCHURE – The six capacities of responsible autonomy: naturalizing free will in biological and artificial systems

The rapid integration of agentic AI is intensifying disputes about artificial autonomy, widening an agency schism between normative frameworks that presuppose agency and a scientific ontology that denies it. This paper proposes a revisionary naturalization: free will designates the control interface that embodied agents evolved to navigate social worlds pervaded by hidden intentional states, not a metaphysical ornament. The antinomy between determinism and libertarian freedom is dissolved by analysing free will from the perspective of control mechanisms. Diagnosing the philosophical record and systems neuroscience, I specify six capacities that naturalize free will as Responsible Autonomy: Active Decoupling, Endogenous Drive, Leeway, Normative Self-Governance, Diachronic Integrity and Experiential Ownership. These are proposed as control constraints on any responsible agent, and hence as design constraints for model construction and as a checklist for evaluating responsible agency in biological and artificial systems. A companion paper maps each capacity to the Distributed Adaptive Control theory of volition and agency, its neurobiological substrates and the Evaluation Suite for Responsible Autonomy (ESRA) test, supplying, in Carnap's terms, the precision and predictive power that complete the explication.
https://royalsocietypublishing.org/rstb/article/381/1962/20260001/484145/The-six-capacities-of-responsible-autonomy

ERIC GILSON, EMMA C. TEELING & GEORGE A. GARINIS – Ageing and development: two processes, one history

Development and ageing are usually studied by different communities, with different organisms, tools and vocabularies. Yet the 20 contributions assembled in this theme issue converge on a simple proposition: ageing trajectories are shaped by the way organisms are built. Molecular clocks place the onset of ageing at the end of gastrulation; growth restriction, epigenetic stabilization and the repression of telomerase install, during development, the conditions under which damage will later be tolerated or amplified; and the early environment leaves durable marks on somatic integrity in wild populations. At the same time, the issue shows that development does not determine ageing as an inexorable fate. Organs age as a mosaic, damage

initiated in one organ propagates to others through inflammatory and metabolic communication, and some trajectories can be redirected late in life by targeting transmission rather than damage. From these studies, it emerges that ageing is modular and communicative, determining different windows for intervention.
https://royalsocietypublishing.org/rstb/article/381/1963/20250322/484180/Ageing-and-development-two-processes-one

PLoS One

PAPERS

LAURENT DAVIN et al – Modelling symbols among the first-sedentary communities: Emergence of clay figurines in Epipaleolithic Southwest Asia

The emergence of clay technologies and their use in symbolic practices marks a momentous techno-symbolic innovation for human societies. While in North Africa, Europe and East Asia, this innovation was sporadically attested during the Upper Palaeolithic, in Southwest Asia, it has been commonly believed to emerge in full much later, as one of the innovations associated with Neolithic agricultural societies. Here, shifting back the 'revolution of symbols', we report evidence of the earliest clay figurative tradition in Southwest Asia with the discovery of 154 figurative artefacts from three Natufian (15,000–11,650 years cal. BP) sites in the Southern Levant (Israel). Through a combined multidisciplinary approach, we demonstrate that children and adults manufactured these objects to produce new symbols with new figurative techniques and practices used as their primary media of figurative expression. Our study provides important original insights regarding the demographics of craft production and the development of symbolic practices at the beginning of sedentism that influenced the Neolithic transition in Southwest Asia.
https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0360388

EDUARDO VIJANDE-VILA et al – The last builders of megaliths in the South of the Iberian peninsula? The Bronze Age necropolis of Trafalgar (Barbate, Cádiz, Spain)

The archaeological excavations undertaken at the Trafalgar tombolo during 2021–2022 led to the identification of a Bronze Age megalithic necropolis. This paper presents an interdisciplinary study, considering chronological, structural, bioarchaeological, and archaeometrical evidence of two megalithic tombs. The main aim of this work is to date both tombs through the use of Bayesian statistical models that confirms the use of the necropolis during the first quarter of the 2nd millennium BC. Another goal is to define the period of use of these structures and the burial practices adopted by this community. Although the 2nd millennium BC is characterized by the reuse of megalithic tombs from earlier periods, the significance of the Trafalgar necropolis also lais in the possibility to have been built ex novo during the first quarter of the 2nd millennium BC. This would make it one of the latest megalithic necropolises of the Iberian peninsula. The use of high value objects such as gold, silver, and ivory, as grave goods and the necropolis' location in an outstanding geographical landmark, Cape Trafalgar, suggests that the sea played a key role for these communities both economically (trade routes) and ideologically (as a funerary landscape). Finally, in addition to helping us with the architectural analysis of the two tombs, the use of new technologies (3D scanner and photogrammetry) allowed us to generate digital models for the transfer of knowledge purpose, since the site is challenging in terms of public value and recognition.
https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0359220

KHALED ABDO et al – Wild cereal harvesting ca. 14,000 years ago at Jeftelik (Western Syria)

The harvesting of wild cereals with sickle blades during the Late Epipalaeolithic Natufian period (ca. 14.6–11.5 ka cal BP) is widely documented; however, the scale and methods of sickle harvesting remain poorly understood. This study examines plant-harvesting activities through the functional analysis of glossed lithic tools from the Early Natufian site of Jeftelik (Western Syria), dated to ca. 14,000 years ago. Twelve sickle blades recovered from secure Natufian contexts were analysed using confocal microscopy and three-dimensional surface texture analysis. Their surface textures were compared with an experimental reference collection, including tools used to harvest wild cereals in natural stands on the one hand and tools used to cut other siliceous plants, such as reeds and grasses, on the other. The results indicate that most glossed tools were used for harvesting wild cereals, although the processing of other siliceous plants was also identified. Tool-level analysis shows that five implements were primarily used for harvesting wild cereals, one mainly for cutting reeds or grasses, and six display mixed plant-processing signals. Estimates of use intensity suggest generally moderate-to-long harvesting episodes of wild cereals: two tools exhibit intermediate use, between 10 and 20 hours, whereas three tools show evidence of more prolonged use, for more than 20 hours. Glossed sickle blades represent only a small proportion of the lithic assemblage at Jeftelik (ca. 1%). These results indicate that, although wild cereals were harvested at Jeftelik sometimes with relatively high use intensity—sickle harvesting was not a frequently performed activity. Two interpretations can be proposed: either wild cereals were not intensively exploited, or, more likely, they were an important resource, but methods other than sickle harvesting were also employed. Wild cereal harvesting likely formed part of a broader and flexible exploitation system, in which cereals were collected using multiple techniques, including reaping with sickles during periods when intensified resource acquisition was required.
https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0350364

PNAS

PAPERS

ANTOINE VALET et al with CATHERINE CROCKFORD – A signal convention in natural chimpanzee communication

Human language relies on conventional signals that are arbitrary, stable, and socially transmitted. Whether other animals exhibit meaning-based communicative conventions is virtually unknown. Using a quasi-experimental design, we investigated this in chimpanzee unvoiced calls (UCs), such as acoustic raspberries, known to show usage variation. We collected audio and contextual data in 91 chimpanzees (0 to 55 y), across eight wild and captive groups that differed in the presence or absence of adult role models. Communities with role models emitted UCs in one dominant context, which remained stable over years and from first utterances in development (1 to 2 y old). In contrast, groups without role models displayed highly variable, unstable UC usage across contexts and years. This contextual variation could not be explained by age or by a shared emotional valence, and individuals could use different UC forms within the same context, suggesting a decoupling between the signal form and usage. Together, these findings provide evidence that chimpanzee UCs meet key criteria for a signal convention: arbitrary signal–usage mappings, social transmission, and stability within communities. These findings demonstrate that conventionalized communication is not a uniquely human feature but can also emerge through social learning mechanisms in other animals' natural communication.

https://www.pnas.org/doi/10.1073/pnas.2606837123

Proceedings of the Royal Society A

PAPERS

JIACHAO GUO et al – Evolution of cooperation with asymmetric social learning

In the evolution of collective cooperation, individuals update their strategies through social learning—imitating the strategies of successful peers with higher pay-offs. The tendency to imitate successful peers is governed by pay-off sensitivity, which captures how likely an individual is to imitate the strategy of a peer based on the difference in their pay-offs. Previous studies have typically assumed that pay-off sensitivity is identical across individuals, regardless of their current strategies. Here, we challenge this assumption and investigate the effects of asymmetric pay-off sensitivity between cooperators and defectors on the evolution of cooperation in structured populations represented by networks. We find that when cooperators exhibit higher pay-off sensitivity than defectors, cooperation is significantly promoted in heterogeneous networks, including synthetic, empirical and temporal networks. By contrast, this asymmetry has negligible effects in homogeneous networks. Mechanistically, we demonstrate that higher pay-off sensitivity among cooperators reduces the probability that hub cooperators will imitate low-pay-off peripheral defectors, thereby stabilizing cooperative clusters. Our research reveals that asymmetric social learning can profoundly shape the evolution of cooperation, paving the way for a deeper understanding of state-dependent updating mechanisms in structured populations.

https://royalsocietypublishing.org/rspa/article/482/2349/20260548/484107/Evolution-of-cooperation-with-asymmetric-social

Review of Philosophy and Psychology

PAPERS

MICHAŁ WYRWA – Reconstructing Folk Attribution of Consciousness: From Behavior-oriented Intentional Stance to Mind-oriented Conscious Stance

The paper delves into an often-neglected aspect of folk psychology: the folk attribution of consciousness. While the existing view suggests that laypeople attribute conscious mental states by recognizing their phenomenality, the paper argues that this claim lacks empirical support. Instead, I propose shifting the focus to the link between consciousness and having a mind, advocating for a broader understanding of mindreading. This approach distinguishes between behavior-oriented and mind-oriented mindreading, corresponding to the intentional and newly introduced 'conscious stance', respectively. While attributing mental states to explain behavior does not necessarily imply attributing minds, adopting the conscious stance does, as it allows us to explain and predict activities within agents' minds. This novel perspective challenges the conventional understanding of folk attribution of consciousness and opens up new avenues for exploration in folk psychology and consciousness studies.

https://link.springer.com/article/10.1007/s13164-026-00854-8

Royal Society Open Science

ARTICLES

MARINA DUBOVA & QIAWEN E. LIU – Everyone knows what science is…until you ask

What is science? Scientists often assume that we share a general understanding of what science is, yet this assumption has rarely been empirically assessed. We examined scientists' and members of the public's agreement with a range of common conceptualizations of science, including science as a search for truth, a mirror of nature, a free marketplace of competing ideas and others. We found substantial heterogeneity in responses to these conceptualizations, with scientists disagreeing with each other more than the public does. We also found systematic differences in how the public and scientists understand

science. Members of the public tended to endorse an idealized view of science, portraying it as a reliable machine for discovering objective truths through well-defined procedures. Scientists, in contrast, were more reserved in their endorsements, often emphasizing the limitations of the scientific method, contingency of scientific results and the roles of improvisation and creativity in scientific practice. This suggests that shared understanding of science cannot be taken for granted. Differences in how we understand science have implications for science practice, education and communication.
https://royalsocietypublishing.org/rsos/article/13/11/260933/484137/Everyone-knows-what-science-is-until-you

Science

PAPERS

CHRIS CLARKSON et al with MICHAEL D. PETRAGLIA – Poisoned hunting weapons, megafauna, and plant use at a 125,000-year-old Arabian paleolakeshore

After the African origin of Homo sapiens, multiple dispersals radiated into Asia, yet the Saharo-Arabian archaeological record remains sparse. In this study, we report on 'Uruq Aljelibah, a Middle Paleolithic site dated to ~125,000 years ago (marine isotope stage 5e) and located on the shore of Mundafan paleolake, Saudi Arabia. Levallois assemblages, refits, and megafaunal associations indicate in situ tool production and carcass processing. Stone tool residues, use-wear, and biomarkers reveal animal and plant processing, including palms, tubers, trees, and shrubs. Several points exhibit impact damage and poison residues (from Acokanthera schimperi), indicating use as hafted weapon tips within composite hunting systems. Megafaunal remains include hippopotamus, buffalo, gazelle, ostrich, and camel, illuminating hominin use of freshwater and grassland ecosystems.
https://www.science.org/doi/10.1126/science.aef9342

Science Advances

PAPERS

ALEXANDROS TSOUPAS et al – Tracing Neanderthal ancestry patterns through successive population expansions in Europe

During their expansion from Africa, modern humans interbred with Neanderthals, resulting in introgression of Neanderthal DNA into their genomes. This process contributed to a Southeast-to-Northwest gradient of Neanderthal ancestry across Europe. We investigate the population dynamics underlying the emergence and persistence of this gradient through two successive human range expansions. We developed a three-population, layered, spatially explicit simulation framework to track the spatiotemporal evolution of Neanderthal ancestry under a model of interactions among Neanderthals, pre-Neolithic hunter-gatherers, and Neolithic farmers. Our results indicate that the ancestry cline emerged from the interplay between the direction of the initial hunter-gatherer expansion, the northern limit of the Neanderthal range, and strong reproductive isolation, without requiring natural selection. The similar direction of the subsequent Neolithic expansion explains the cline's persistence and Neanderthal ancestry differences between hunter-gatherers and farmers. These findings demonstrate how spatiotemporal patterns in ancient DNA provide insights into past population dynamics.
https://www.science.org/doi/10.1126/sciadv.aeg6161

Trends in Cognitive Sciences

ARTICLES

ROMY FROEMER – The best-laid plans are not worth it

Planning is essential for achieving long-term goals but is fraught with challenges in an uncertain world. In a timely study, Lei et al. ***{see Nature Communications above}*** show that uncertainty diminished people's willingness to plan and that people reduced planning effort by treating uncertain choices as deterministic and planning less carefully.
https://www.cell.com/trends/cognitive-sciences/fulltext/S1364-6613(26)00260-3

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