EAORC BULLETIN 1,201 – 21 June 2026

CONTENTS

NOTICES

FORMATTED VERSION OF THIS BULLETIN

A pdf formatted version of this Bulletin is available for download at martinedwardes.me.uk/eaorc/eaorc_bulletins.htm.

PUBLICATION ALERTS

If you have had a paper or book published, or you see something which would be of interest to the group, please send me a publication alert so that I can include it in the newsletter. Many thanks to those who have already sent in alerts.
If there is a journal you feel I should be tracking on a regular basis, let me know.
And if you have any other ideas for extending the "EAORC experience", please contact me.

EDITORIAL INTERJECTIONS

Comments in curly brackets are editorial interjections. The Editor reserves the right to be wrong, and doesn't object to being called out on it.

NEWS

NATURE BRIEFING – How the brain builds a sentence

Researchers have tracked the electrical activity of individual brain cells during conversation in real time, capturing how sentences are built before a single word is spoken. By observing these neurons in a brain region called the frontotemporal cortex, scientists have discovered that individual neurons act as specialized linguistic building blocks. "We used to think language was this diffuse, whole-network phenomenon," says neurosurgeon and study co-author Ziv Williams. "But it turns out you have specific neurons that only care if a word is a noun, or only care if a phrase is ending."
https://www.nature.com/articles/d41586-026-01922-w

NATURE BRIEFING – the religion of the stone age made manifest in the ground

"What we're seeing here is the religion of the stone age made manifest in the ground."
The arrangement of a 'prototype' Stonehenge uncovered near the iconic structure aligns with the sunrise and sunset of summer and winter solstices of 5,000 years ago. The finding reinforces the significance of solstice events in the lives of Stone-Age humans, says archaeologist Matt Leivers.
https://www.theguardian.com/uk-news/2026/jun/18/solstice-aligned-monument-archaeology-wiltshire-stonehenge-prototype

NATURE BRIEFING – Goats can follow our dulcet tones

Domestic goats (Capra hircus) can follow the voice of a person to find a reward. A group of goats were each presented with two buckets, one empty and one containing food. When a hidden researcher spoke enthusiastically in the direction of the full bucket, the goats moved toward it 60% of the time — more often than would be expected by chance. Voice-following abilities have previously been found in dogs, but not chimpanzees, which could suggest that the skills arose through domestication.
https://www.theguardian.com/science/2026/jun/17/goats-can-find-food-following-human-voice-study

SCIENCEADVISER – Mesolithic humans took their jobs to the grave

Before agriculture swept the world and forever altered human habitation, our ancestors fueled their lives by hunting, fishing, and gathering food. The structure and culture of these early societies, however, is still poorly known. How did they divide their labor, and how socially important were these roles?
In a new study published in Science Advances, a team of researchers has helped to clarify these questions by analyzing the graves of more than 350 Mesolithic humans excavated from an ancient cemetery in Zvejnieki, Latvia. People were buried with everything from stone tools to amber ornaments, but the researchers were especially interested in the pendants made of mammal teeth sported by roughly one quarter of the individuals.
Previous work indicated that individuals who wore pendants ate more mammals while those who did not consumed diets richer in fish, perhaps pointing to different societal roles. To test that idea, the researchers took CT scans of the ancient humans' bones to search for subtle variations in shape that might indicate lifestyle differences. They found that each male with a pendant developed a right humerus with a circular shape akin to that of a baseball pitcher, suggesting that these individuals hunted down mammals by hurling spears or arrowheads . The other males' arms pointed to lifting and pulling activity, which would fit individuals who spent their lives fishing with nets. Similarly, the arms of females with pendants suggest they were involved in processing hides, while other females may have prepared fish instead.
The findings expand our understanding of social complexity in Mesolithic societies, revealing that occupation may have represented an important aspect of identity in this community. It's another piece of evidence that early human developments had plenty of culture in their own right.
https://www.science.org/doi/10.1126/sciadv.aed3371

SCIENCEADVISER – Do animals perceive time differently from humans?

Science chats with a researcher whose team is using "timescapes" to understand how nonhumans experience the world.

https://www.science.org/content/article/do-animals-perceive-time-differently-humans

PUBLICATIONS

Biology Letters

PAPERS

VICENTE GARCÍA-NAVAS & JOAQUÍN ORTEGO – Song but not colour divergence constrains hybridization in birds

Mating signals, such as songs or plumage ornamentation, are key prezygotic barriers that promote behavioral isolation by ensuring that individuals are able to mate with conspecifics and avoid the costs of hybridization. Previous family-level comparative studies in birds have revealed that song similarity is positively correlated with the incidence of hybridization, whereas genomic research in avian hybrid zones suggests that plumage divergence does not necessarily prevent gene flow. However, no study has jointly evaluated the relative contribution of both signalling modalities to hybridization incidence within a broad macroevolutionary framework. We combined a large-scale dataset on documented hybridization events across bird species with quantitative measures of acoustic and plumage divergence and tested their association using phylogenetically informed comparative models. We found that species-level acoustic divergence showed a strong negative association with the number of hybridization partners after accounting for sympatry. In contrast, male plumage divergence did not predict hybridization incidence, yet female plumage divergence showed a significant negative association. These results indicate that song represents a major reproductive barrier in birds, probably because it is a long-range and evolutionarily labile signal. Moreover, male plumage coloration may play a more limited role in reproductive isolation, potentially because male ornaments may introgress more readily across species boundaries.
https://royalsocietypublishing.org/rsbl/article/22/6/20260237/482153/Song-but-not-colour-divergence-constrains

Cell Reports

PAPERS

JOSHUA B. TAN et al – Compositional recombination is facilitated by a distributed cortico-cerebellar network

Human cognition depends on the ability to flexibly recombine existing knowledge in new ways. Although this capacity for compositionality has traditionally been attributed to cortical networks, its broader neural basis remains unclear. We combine dimensionality reduction of task-based fMRI with recurrent neural network modeling to dissociate two processes underlying compositional cognition: specialized components; and the more general process of recombination. Across 87 participants performing a well-established compositional task, domain-specific cortical and anterior cerebellar regions support component processes, whereas a low-dimensional, highly integrated cortico-cerebellar network engages recombination processes consistently across diverse contexts. Recurrent neural networks trained to perform multiple cognitive tasks present similar functional signatures to the fMRI data, suggesting that low-dimensional recombination is a general solution for flexible compositional cognition. Our findings revise existing models of compositional cognition, highlighting interactions between component and recombination processes with cortico-cerebellar interactions serving as a mechanism for flexible, integrative task generalization.
https://www.cell.com/cell-reports/fulltext/S2211-1247(26)00650-9

eLife

PAPERS

RUMENG TANG et al – Betrayal is worse than loss during cooperation

Cooperative behavior is a cornerstone of human interaction. Although both “betrayal aversion” (the affective cost of being betrayed) and “loss aversion” (the financial detriment incurred from betrayal) are established determinants of cooperative behavior, their relative potency remains undetermined. Here, we investigated these effects by integrating computational modeling and event-related potential (ERP) techniques. In two tasks involving risk and cooperation, participants decided whether to take financial risks or to cooperate under possible betrayal. Our results showed that betrayal aversion had a stronger effect on reducing cooperation compared to loss aversion. Furthermore, ERP data demonstrated sequential processing: betrayal was encoded early in decision-making, reflected by increased P3 with weaker betrayal aversion, whereas loss aversion manifested later, marked by increased LPP. By dissociating the contributions of betrayal and loss, our finding provides novel insights into the cognitive and neural mechanisms underlying cooperative behavior.
https://elifesciences.org/reviewed-preprints/111043

JONAS SIMOENS et al – Two time scales of adaptation in human learning rates

Different situations may require radically different information updating speeds (i.e., learning rates). Some demand fast learning rates, while others benefit from using slower ones. To adjust learning rates, decision makers could rely on either global, meta-learned differences between environments, or faster but transient adaptations to locally experienced prediction errors. Here, we introduce a new paradigm that allows researchers to measure and empirically disentangle both forms of adaptations. Participants performed short blocks of trials of a continuous estimation task – fishing for crabs – on six different islands that required different optimal (initial) learning rates. Across two experiments, participants showed fast adaptations

in learning rate within a block. Critically, participants also learned global environment-specific learning rates over the time course of the experiment, as evidenced by computational modelling and by the learning rates calculated on the very first trial when revisiting an environment (i.e., unconfounded by transient adaptations). Using representational similarity analyses of fMRI data, we found that differences in voxel pattern responses in the central orbitofrontal cortex correlated with differences in these global environment-specific learning rates. Our findings show that humans adapt learning rates at both slow and fast time scales, and that the central orbitofrontal cortex may support meta-learning by representing environment-specific task-relevant features such as learning rates.
https://elifesciences.org/reviewed-preprints/108223

ALEXIA ROUX-SIBILON et al – The view tolerance of human identity recognition depends on horizontal face information
Our ability to recognize objects and people across dramatic changes in physical appearance is a central yet unresolved question in vision science. In particular, the visual information that supports the human ability to recognize face identity across views is not fully specified. Past research suggests horizontally oriented face information plays a key role. To test this hypothesis, we investigated how humans use the visual information physically available across different orientation ranges of the face stimulus to recognize identity in a view-tolerant manner.
Human observers performed an old/new identity recognition task with face stimuli presented under different viewpoints, achieved by rotating the faces in yaw (from left to right profile) and filtered to preserve contrast in selective orientation ranges. We found that human recognition performance remained tuned to the horizontal range of face information irrespective of yaw.
We used a model observer approach to define the information physically available in the stimulus for matching face identity within each viewpoint (view-selective model observer) or across different viewpoints (view-tolerant model observer). The view-selective model indicated that face identity is carried by orientation ranges shifting from horizontal in frontal views to vertical in profile views. In contrast, the view-tolerant model showed that the horizontal range provides the most stable identity cues across views. The horizontally-tuned orientation profile of human recognition performance was predicted by the high diagnosticity of horizontal information in frontal views and the stability of the horizontal identity cues across views. The informativeness and stability of the identity cues carried by horizontal face information are confirmed by additional model observer evidence that this range best predicts the average summary of full-spectrum face appearances across views. Our findings indicate that the invariant representation of a face, gradually learned through repeated exposure to its natural appearance statistics, relies primarily on horizontal facial information. By identifying the spatial information supporting view-tolerant face recognition in humans, the present work yields concrete, data-driven constraints for the refinement of theoretical and computational models of visual recognition.
https://elifesciences.org/reviewed-preprints/108495

ISHAN KALBURGE et al – Human decision-makers terminate evidence accumulation using flexible decision rules
Decisions based on evidence accumulated over time require rules governing when to end the accumulation process and commit to a choice. These rules control inherent trade-offs between decision speed and accuracy, which require careful balance to maximize quantities that depend on both like reward rate. We previously showed that, to maximize reward rate, normative decision rules adapt to changing task conditions (Barendregt et al., 2022). Here we used a novel task to examine whether and how people use adaptive rules for individual decisions under a variety of conditions, including changes in decision outcomes across trials and changes in evidence quality both across and within trials. We found that the participants tended to use rules that adjusted, at least partially, to predictable changes in task conditions to improve reward rate, consistent with a rationally bounded implementation of normative principles. These findings help inform our understanding of the extent and limits of flexible decision formation in the brain.
https://elifesciences.org/reviewed-preprints/111082

Evolutionary Human Sciences

PAPERS

PÉTER PONGRÁCZ & PETRA DOBOS – Attention and improvement: social learning reveals two behavioural dimensions behind dog-human interactions
Accepted Manuscripts are early, peer-reviewed versions that have not yet been copyedited, typeset, or formally published and may not meet all accessibility standards. A fully formatted accessible version will follow.
Humans selected hundreds of dog breeds, which show different levels of dependence on human-provided cues. While robust grouping factors, such as genetic relatedness-based ancestry, and function-based cooperativeness, denote useful frameworks to analyse behavioural differences in dogs, they may lack fine enough resolution for a more detail-oriented understanding of human-oriented behaviours. Here, we focused on behaviour-based analysis of the characteristic reliance of dog breeds on human behaviour. We utilized N=187 adult purebred dogs' performance in a social learning task. Dogs observed a human demonstrator performing a detour around a transparent obstacle. With Principal Component Analysis, we established two behavioural dimensions: detour latency improvement and watching the demonstrator. Then, with K-means cluster analysis, we found six categories, based on different combinations of lower/higher values of the two dimensions. The clusters showed significant differences in both behavioural dimensions, highlighting attention combined with improvement

types among purebred working dogs. Some extremes showed excellent improvement with only minimal attention to the human demonstrator, while others watched the human without improving their performance. We conclude that by finer analysis, it is possible to set up a dependence-based framework for the understanding of behavioural differences among dogs that go beyond functional breed-selection and ancestry.
https://www.cambridge.org/core/journals/evolutionary-human-sciences/article/attention-and-improvement-social-learning-reveals-two-behavioural-dimensions-behind-doghuman-interactions/87315AE2398C1C11F932ACEE612A98F1

Frontiers in Artificial Intelligence

PAPERS

RASMUS BLANCK & BILL NOBLE – Logic, inference, understanding: cross-domain generalization for generative language models

Neural systems for Natural Language Inference (NLI) have seen impressive performance over the last ten years, but their ability to generalize beyond their training data has repeatedly been questioned. The NLI task has long been considered as a proxy for the wider problem of Natural Language Understanding (NLU), implicitly motivated by relying on an inferentialist conception of semantics. This paper draws on insights from work in formal logic and semantics to introduce distinctions between different notions of generalizations (in-domain vs. cross-domain, and linguistic vs. inferential) in an attempt to disentangle the problem of generalization. We leverage the theoretical contributions in experiments addressing the inferential generalization power of autoregressive NLI models.
https://www.frontiersin.org/journals/artificial-intelligence/articles/10.3389/frai.2026.1800372/full

Frontiers in Endocrinology

PAPERS

MICHAELA REIMANN-AYIKÖZ et al – From womb to words: the sex-specific interplay of fetal sex hormones and maternal mood on infant language development

Language development is influenced by biological and environmental factors, including infant hormonal status and maternal mental health. Previous research on the role of infant sex hormones in language development focused on estradiol and testosterone, yet first evidence indicates that dehydroepiandrosterone (DHEA), the dominant fetal steroid hormone, may be a more sensitive biomarker for language development by shaping the organization of the developing brain. Concerning infants' language-learning environment, maternal well-being is a key factor, with maternal depressed mood postpartum, even at subclinical levels, negatively affecting language development, as depressed mothers engage less with their children and use less infant-directed speech. The present study examined the interplay of fetal DHEA levels and maternal mood at eight weeks postpartum on receptive language abilities at 12 months in boys and girls. Fetal DHEA levels were extracted from hair samples collected two weeks after birth (n = 58; 28 girls), allowing fetal hormone milieu quantification in the third trimester. Maternal mood in the subclinical depression range was assessed using the Edinburgh Postnatal Depression Scale. Children's receptive language abilities were assessed using the German version of the Bayley Scales of Infant and Toddler Development. Stepwise multiple linear regression analysis revealed fetal DHEA to predict language development in boys, with the effect depending on maternal mood. Only when mothers experienced better mood postpartum were higher DHEA levels related to lower language ability. By contrast, in girls, only maternal mood significantly contributed to language ability, with better mood relating to higher language outcome. Our findings suggest that the effect of infant sex hormones on language development follows sex-specific patterns and appears to be modulated by the learning environment. Moreover, our results emphasize the importance of mental support during the early stages of language development.
https://www.frontiersin.org/journals/endocrinology/articles/10.3389/fendo.2026.1817292/full

Frontiers in Human Neuroscience

PAPERS

ANNA ILONA ROBERTS & SAM G.B. ROBERTS – Food culture as a mechanism of social bonding and social identity in primates

Food culture is one of the identifying features of social life of any human being every day. The shared habits, rituals and beliefs around producing, procuring and consuming a wide variety of food types, textures and flavours shape how we feel and behave towards others. Food culture defines who we are, our identity and everyday values, and shapes social relationships. This helps us live in complex societies, where we form connections not only with family, but also with society at large and even far-away countries. However, food-related behaviours rarely leave traces in the fossil record, making the evolutionary origins of food culture difficult to reconstruct. Studies of non-human primates help clarify its evolution in the human lineage. Yet research on primate culture has focused largely on social learning and tool use, with relatively little attention given to the cultural dimensions of feeding behaviour. Here we propose that food culture may function as a mechanism of social bonding and social identity in primates, as it does in human groups. Drawing on the Social Brain Hypothesis, we suggest that shared dietary traditions—socially transmitted food preferences—may maintain cohesion in socially complex systems characterised by large groups, fission–fusion dynamics, and tolerant intergroup encounters. Behavioural similarity arising from shared food preferences may facilitate social bonding in complex social systems, providing

an additional mechanism when tracking individual relationships becomes cognitively demanding. In humans, cultural behaviours such as food preferences are used to identify others as having the same identity or a different identity. This sense of social identity then affects how we treat others, with members displaying same cultural characteristics favoured over members where these characteristics are absent. This paper proposes that food culture may play a comparable role in primate social systems. We develop a conceptual framework to examine whether dietary traditions are present among primates, contribute to social complexity, influence tactical ranging decisions, and extend beyond feeding preferences to include traditions in vocalisations during feeding. This framework provides testable predictions for understanding how food culture may act as a socio-cognitive mechanism underpinning social bonding and the evolution of human food practices.
https://www.frontiersin.org/journals/human-neuroscience/articles/10.3389/fnhum.2026.1788917/full

Frontiers in Neural Circuits

PAPERS

XINCHENG ZHAO et al – Developmental trajectories of vocal behaviors in common marmosets as a reference framework for neurobehavioral studies

Nonhuman primates are essential model animals for understanding brain development and neurodevelopmental disorders. The common marmoset is becoming a key primate species due to its ease of handling and reproductive efficiency, along with increasing research resources, such as an MRI brain atlas of developing marmosets. The present study aims to further support the use of marmosets by providing a detailed description of the developmental trajectories of vocal behaviors with an automated system to detect and analyze vocalizations. We collected 64,736 vocalizations, classified them into 11 vocal types, and observed significant changes in their vocal behaviors from neonates to 12 weeks of age. Several call types, including Trill, Phee, and Cry, peaked around the sixth week before gradually declining. By contrast, calls such as immature Phee, and Twitter were most frequent at birth but decreased steadily, nearly disappearing by 6–8 weeks. In addition, we provide a platform for automatically detecting these vocalizations using artificial neural networks trained on a dataset applicable across various research contexts. Overall, this study not only describes the developmental trajectories of vocal behaviors in a fixed controlled context across developmental stages, but also serves as a reference framework for analyzing marmoset models of developmental disorders.
https://www.frontiersin.org/journals/neural-circuits/articles/10.3389/fncir.2026.1821810/full

Frontiers in Psychology

PAPERS

FANG YI, ZHI ZHANG & YILIN REN – Bridging self-control and prosocial behavior in early adolescents: a simulation-based node-perturbation analysis

Prosocial behaviors during early adolescence are closely related to self-control; however, they are not completely accounted for through variable-centered methods, as person-centered variations in these behaviors may co-exist independently. The present study used a person-centered, network-informed approach to explore self-control profiles latent within persons, the corresponding networks of prosocial behavior, along with responses to node perturbation.

A cross-sectional sample of 1,417 early adolescents (M = 13.57 years, SD = 1.10) was recruited from junior middle schools in Guangxi, China. Using self-reported multidimensional self-control and prosocial behavior, we conducted latent profile analysis (LPA), Ising network estimation, Gaussian Graphical Model estimation, and simulation-based node-perturbation analysis (Network Intervention Response Analysis; NIRA) to identify profile-specific association patterns and candidate node-level leverage points.

LPA identified four self-control subgroups: Lowest, Low-to-Moderate, Moderate-to-High, and Highest. Overall prosocial behavior tended to be higher in profiles with higher self-control, although item-level patterns were not uniformly monotonic. The Low-to-Moderate self-control subgroup showed the densest pattern of associations among prosocial nodes, a pattern that may reflect stronger behavioral coupling but should not be interpreted as necessarily adaptive. Hypothetical node perturbations suggested profile-specific sensitivities: lower self-control profiles were more responsive to emotionally reactive and request-based helping nodes (e.g., PB24: Compliant helping), whereas higher self-control profiles were more responsive to non-reciprocal and principle-oriented helping nodes (e.g., PB25: Pure altruism). These patterns indicate different association structures rather than moral superiority or confirmed intervention effects.

The present research offers person-first, network-informed evidence that self-control profiles correspond to both the extent of, and structure behind, prosocial behaviors during early adolescence. The node-perturbation results should be interpreted as hypothesis-generating evidence for potential targets requiring longitudinal and experimental validation. These findings suggest that school-based programs in the future should incorporate cautious, profile-sensitive measures instead of claims that simulating specific targets is a better method than universal target methods.
https://www.frontiersin.org/journals/psychology/articles/10.3389/fpsyg.2026.1774626/full

iScience

PAPERS

FARZAD ROSTAMI et al – Frontal brain injury alters human risky choices in self and other contexts

Frontal lobe integrity is crucial for risky decision-making. We investigated how frontal lesions affect computational mechanisms underlying risk when decisions impact oneself versus others. Twenty patients with frontal damage and 20 matched controls accepted or rejected mixed-outcome gambles for themselves or an anonymous other. Patients accepted more disadvantageous gambles than controls in the self condition and showed greater caution for another person; controls showed no self-other difference. Formal model comparison favored a four-parameter Prospect Theory model. Relative to controls, patients showed near-linear probability weighting, reduced loss aversion, and steeper utility curvature; counterfactual analysis identified reduced loss aversion as the principal driver of increased acceptance of disadvantageous gambles. Parameter differences were consistent across conditions; the behavioral dissociation was not reflected computationally. Lesion overlap revealed heterogeneous frontal damage with common ventral and medial prefrontal involvement. These findings provide a mechanistic account of how frontal damage produces dissociable decision patterns across social contexts.

https://www.cell.com/iscience/fulltext/S2589-0042(26)01802-X

Journal of the Royal Society Interface

PAPERS

HAOMIN WANG, ZHENYU SHI & SHA SONG – Strength asymmetry and replacement bias shape the evolution of cooperation in finite populations

Heterogeneity is common in real populations, but many classic evolutionary game models assume identical individuals. Here, we study how two simple forms of heterogeneity affect the evolution of cooperation in a finite population. We construct a model of evolution in a finite population with two heterogeneous subpopulations, referred to as weak and strong subpopulations. The heterogeneity is reflected in two aspects: strength asymmetry—the probability that a weak individual defeats a strong one, and replacement bias, which renders one subpopulation more likely to be updated than the other. Under weak selection, we employ the expected fixation probability framework to derive an explicit threshold for the benefit–cost ratio that determines when cooperation is favoured. We find three main results. First, when replacement is symmetric, increasing the proportion of weak individuals can enhance cooperation, with the strongest effect at an intermediate size imbalance. Second, when only replacement bias varies, the cooperation threshold increases with the bias, but the reason differs on either side of the symmetric point. Finally, when strong individuals are more likely to be updated, there is a clear 'sweet spot', where stronger strength asymmetry and stronger replacement bias jointly and monotonically promote cooperation.

https://royalsocietypublishing.org/rsif/article/23/239/20260074/482136/Strength-asymmetry-and-replacement-bias-shape-the

Mind & Language

PAPERS

NIMA MUSSAVIFARD & GERGELY CSIBRA – Inferential communication: The primacy of external representations

We argue that intentionalist accounts of ostensive-inferential communication fail to adequately explain the role of external representations in human communication. We propose that the contents of a specific form of representational communication, symbolic depictions via spatio-temporal arrangements of objects, can be inferred without attributing mental states. We analyze the cognitive capacities that underpin the production and interpretation of depictions and emphasize their potential role in transmitting generic knowledge. We then propose an evolutionary scenario in which depictive demonstrations of tool use and instrumental actions fostered diverse types of inferential communication as well as the emergence of metarepresentational capacities.

https://onlinelibrary.wiley.com/doi/full/10.1111/mila.70039

Nature

NEWS

How the brain builds sentences, neuron by neuron

Neural maps reveal the specialized cells that produce speech.

https://www.nature.com/articles/d41586-026-01922-w

PAPERS

DARREL R. DEO et mul – A mosaic of whole-body representations on the human precentral gyrus

Understanding how the body is represented in the motor cortex is key to understanding how the brain controls movement. Although the motor cortex has been mapped in animal models at a fine scale, characterization in humans remains primarily limited to low-resolution recording and stimulation techniques. Here we created a comprehensive map of the human motor

cortex at single-neuron resolution, spanning microelectrode array recordings from 20 arrays across 8 individuals with paralysis from spinal cord injury, amyotrophic lateral sclerosis or brainstem stroke, all enrolled in brain–computer interface clinical trials. These arrays broadly sample the crown of the precentral gyrus (PCG; thought to be composed largely of the premotor cortex (Brodmann area 6)). We found that body parts were highly intermixed, such that the entire body was represented in all sampled locations of the PCG, although the relative strength of body parts was roughly consistent with the motor homunculus. We also found two speech-preferential areas with a broadly tuned, orofacial-dominant area in between them. Throughout the PCG, movement representations of the four limbs were interlinked, with homologous movements of different limbs (for example, toe curl and hand close) having correlated representations. These data provide evidence consistent with an intermixed, interrelated and behaviour-centred organization of the motor cortex. The resulting map also provides important targeting information for brain–computer interfaces that seek to restore motor function.
https://www.nature.com/articles/s41586-026-10653-x

JING CAI et al – Mapping the neuronal building blocks of human language with language models
Humans can convey new and highly diverse information through language. This ability to form and combine words into elaborate phrases and sentences enables us to express inexhaustible meanings and is fundamental to human cognition. However, understanding the microscopic cellular building blocks and cortical landscape that precisely underlie human language has remained a challenge. Here we used wide-scale single-neuronal recordings combined with natural language processing models to identify fine-grained linguistic representations across the human frontotemporal cortex during language production. We find that, whereas certain neurons represented the detailed grammatical relationships between words or their parts of speech, others tracked the sentences' higher-order syntactic structure, their phrase transitions and sequence. Collectively, these neurons reliably captured the words' syntactic and semantic properties but also dynamically incorporated their specific sentence contexts, therefore enabling them to encode information combinatorially and at highly granular levels of detail. We show how these cell populations were locally organized and how their microscale representations differed from that of their wider field potential patterns. We also show how these neurons were distributed broadly across the frontotemporal cortex, but how their ability to encode linguistic information was left-lateralized and varied between cortical regions. Together, these findings identify some of the most basic cellular building blocks by which linguistic information is encoded in humans and begin to define the cortical landscape of language at a combined micro (cellular), meso (local population) and macro (regional) scale.
https://www.nature.com/articles/s41586-026-10691-5

Nature Human Behaviour

PAPERS

THOMAS BROCHHAGEN et al – The interaction of meaning similarity and confusability explains regularity in form–meaning mappings at and below the word level
Languages exhibit striking regularities in how meanings are mapped to word forms, yet analogous patterns at the subword level remain under-explored. This study presents a large-scale cross-linguistic analysis of regularity at and below the word level, drawing on data from over 1,900 languages. Here we find that while the co-expression of meanings at both levels is highly systematic, the meanings recurrently involved in the two levels differ. Nevertheless, regularity at and below the word level is explained by the same underlying principle: a tension between pressure for lexical compression and lexical differentiation. The former favours reusing forms for similar meanings to ease learning and processing. The latter favours the use of distinct forms to prevent ambiguity. These findings offer a unified account of lexical organization across the world's languages, with subword-level form reuse emerging as a principled compromise when full word-level reuse risks miscommunication.
https://www.nature.com/articles/s41562-026-02488-3

Nature Scientific Reports

PAPERS

LEO SOKOLOVIČ, JURAJ KUKOLJA & MARKUS HOFMANN – A neurocognitive interactive activation model of semantic priming in lexical decisions
This study introduces the sequential read-out model (SROM) to investigate the strategic and decision-making contributions to the semantic priming effect in a lexical-decision task (LDT). We use behavioral and fMRI data from two experiments (n = 32 and 31), which factorially manipulated the association strength, semantic similarity, and stimulus-onset-asynchrony. Using a leaky competing accumulator layer for lexical decisions, the SROM successfully accounted for behavioral data and showed that switching from short to long stimulus-onset-asynchrony changed the decision-making mode from competitive to independent race regime. We then used the individually estimated SROM parameters to predict the interindividual differences in BOLD responses to targets. We found that lexical-orthographic evidence modulated BOLD amplitudes in the left lingual gyrus, suggesting that it maintains lexico-orthographic evidence in working memory, which is then used for lexical decisions. The decision threshold, inhibition parameters and top-down semantic excitation predicted activation differences in the left inferior frontal gyrus, suggesting it regulates the decision process. Decision noise and top-down semantic excitation

were associated with the left angular gyrus, supporting its involvement in evidence accumulation. Overall, the SROM provided mechanistic interpretations of brain activations in the regions involved in the semantically primed LDT, while accounting for associative semantic and strategic factors.
https://www.nature.com/articles/s41598-026-58866-4

JUDIT MOKOS et al – Cost-free charity facilitates dishonesty in a dice-rolling experiment
We are providing an unedited version of this manuscript to give early access to its findings. Before final publication, the manuscript will undergo further editing. Please note there may be errors present which affect the content, and all legal disclaimers apply.
Exploring the motivations behind collaboratively dishonest behaviour, is often done using dice-rolling experiments, where coordinated cheating increases participant pairs' earnings. Here we present a preregistered dice-rolling experiment that investigates how participants' dishonest (cheating) behaviour is influenced (i) by the dishonest (cheating) behaviour of their experimental partners and (ii) by by-product altruism (or cost-free charity) that is a direct consequence of a monetary reward in this experiment. We studied a 2 × 2 factorial design of the dice-rolling game, with the presence or absence of (i) a cheating partner and (ii) by-product altruism. Following the game, participants filled out the Moral Foundations Questionnaire and the Social Dominance Orientation questionnaire. We found that without the opportunity of cost-free charity, cheating was not detectable, independent of the cheating behaviour of the partner. However, the opportunity of donating to a chosen charitable foundation (cost-free charity) significantly increased the level of cheating. We found that the relationship between the degree of dishonesty and the measured psychological traits is complex and, in some cases, contradictory. Our results do, however, confirm that participants with a stronger moral integrity were less likely to cheat. Our results showed that the level of collaborative cheating to obtain a monetary benefit is significantly increased by participants' perception of acting in a socially beneficial way as a by-product of their unethical behaviour.
https://www.nature.com/articles/s41598-026-56788-9

New Scientist

ARTICLES

MICHAEL MARSHALL – What really happened when ancient humans migrated out of Africa
The out-of-Africa migration, in which ancient humans went on to inhabit every other continent except Antarctica, may not have been one moment in time, but a long and slow process. Columnist Michael Marshall examines how archaeologists are rethinking this critical part of our history
https://www.newscientist.com/article/2529312-what-really-happened-when-ancient-humans-migrated-out-of-africa/

PeerJ

PAPERS

GINA MONTALTO et al – "Whoooo said that?": responses of captive owls (Strigiformes) to the voices of familiar caregivers
Group-living is hypothesized to select for individual recognition, but territorial and cooperatively breeding species would also benefit from this ability, even with regard to heterospecifics. Some social species differentiate familiar human caregiver voices from the voices of unfamiliar humans but few non-domesticated, non-group-living species have been tested. We presented 21 captive owls (strigiformes) representing seven species with playbacks of unfamiliar and familiar human voices. We predicted that subjects would respond (i.e., head turns, peering, vocalizations and postural changes) differently to familiar compared to unfamiliar voices but that this response would depend on the nature of the relationship between the owls and their caregivers. The owls were slower to respond and increasingly likely to exhibit fearful postures across playback trials within sessions. However, owls were more likely but slower to respond to the voices of familiar caregivers the longer they had worked with them for. They were also faster to respond to the voices of those that performed aspects of their husbandry and those that rated their relationships with the owls more positively. Lastly, they were less likely to show fear when they heard the voices of their trainers compared to those of other familiar individuals and when the relationship was rated as more positive compared to less positive. These results suggest that owls in managed care are capable of recognizing individual caregiver voices, and even that they may encode aspects of their relationship along with the sound of the caregiver's voice.
https://peerj.com/articles/21421/

PLoS Biology

PAPERS

BENJAMIN PARRELL et al – Audiomotor prediction errors drive speech adaptation even in the absence of overt movement
This is an uncorrected proof.
Observed outcomes of our movements sometimes differ from our expectations. These sensory prediction errors recalibrate the brain's internal models for motor control, reflected in alterations to subsequent movements that counteract these errors

(motor adaptation). While leading theories suggest that all forms of motor adaptation are driven by learning from sensory prediction errors, dominant models of speech adaptation argue that adaptation results from integrating time-advanced copies of corrective feedback commands into feedforward motor programs. Here, we tested these competing theories of speech adaptation by inducing planned, but not executed, speech. Human speakers were prompted to speak a word and, on a subset of trials, were rapidly cued to withhold the prompted speech. On standard trials, speakers were exposed to real-time playback of their own speech with an auditory perturbation of the first formant to induce single-trial speech adaptation. Speakers experienced a similar sensory error on movement cancellation trials, hearing a perturbation applied to a recording of their speech from a previous trial at the time they would have spoken. Speakers adapted to auditory prediction errors in both contexts, altering the spectral content of spoken vowels to counteract formant perturbations even when no actual produced speech coincided with the perturbed feedback. Such adaptation was not observed when participants passively listened to perturbed feedback without the intention to speak, ruling out observational learning as the cause of adaptation in movement cancellation trials. These results suggest that prediction errors, rather than corrective motor commands, drive audiomotor adaptation in speech, building on recent findings in reaching.
https://journals.plos.org/plosbiology/article?id=10.1371/journal.pbio.3003862

PLoS One

PAPERS

SEBASTIJAN VESELIC et al – Children and adults differ in how primary and secondary incentives modulate valuation, effort, and cognitive control

Rewards have a profound impact on human motivation, cognition, affect, and behaviour. The study of reward processing and incentive effects therefore occupies a central place in psychology and cognitive neuroscience. One common assumption when comparing groups or individuals is that different reward types are valued similarly. Here we examined this assumption in a sample of 51 adults and 39 children (7–12 years) using both primary and secondary rewards. Across three tasks – subjective valuation, willingness to exert cognitive effort, and reward-related modulation of cognitive control – adults showed stronger effects of secondary relative to primary reinforcers, whereas children showed comparatively similar responses across reward types. While we interpret our findings as consistent with age-group differences in the value assigned to secondary reinforcers, larger longitudinal studies using more closely matched incentives will be required to determine how such differences emerge across development. More broadly, our work highlights the importance of carefully considering incentive value when comparing different groups on reward-related processes.
https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0351143

PNAS

PAPERS

KASPER OTTEN – The co-occurrence of ingroup and outgroup prosociality across 121 societies

In an increasingly interconnected world, prosociality across group boundaries becomes ever more important. Yet, a common premise in the behavioral and social sciences is that people are prosocial mainly toward their ingroup and not outgroups. So far, evidence for this premise comes mostly from studies in which people must choose between ingroup and outgroup prosociality, thereby precluding positive associations between the two types of prosociality. We study situations in which people make separate decisions regarding the ingroup and outgroup, allowing us to examine how ingroup and outgroup prosociality are related. Across six large-scale and cross-societal datasets spanning 743,402 individuals in 121 societies, we find a robust positive relationship between ingroup and outgroup prosociality. This relationship holds across societies, different group categorizations, and a diverse range of prosociality measures, including prisoner's dilemmas, public good dilemmas, dictator games, and survey items on trust and tolerance. Although people are slightly more prosocial toward their ingroup than the outgroup, those who are prosocial toward the ingroup also tend to be prosocial toward the outgroup. The results offer an optimistic message for prosociality across group boundaries. When people are not made to choose between the ingroup and outgroup, they are generally prosocial toward both.
https://www.pnas.org/doi/10.1073/pnas.2517013123

COMMENTARIES

QINYU XIAO & HIROTAKA IMADA – The co-occurrence of ingroup and outgroup prosociality requires cross-group partner choice

Otten reported a robust individual-level positive association between ingroup and outgroup prosociality across six cross-cultural datasets, including diverse self-report and behavioral measures. Hence, prosociality appears to generalize beyond group boundaries when people are not made to choose between ingroups and outgroups. Based on this finding, Otten suggests that a promising strategy to "establish prosociality across group boundaries" is to restructure the interdependence of cross-group interactions so that it is less negative on the group level (i.e., benefiting one group does not necessarily harm another), or less perceived as such.

We note a qualification regarding the effectiveness of this strategy for promoting cross-group prosocial behaviors. Specifically, the relevance of less negative interdependence presupposes intergroup exposure and contact, and Otten's

prescription may be effective only if people are generally willing to interact with outgroups. A substantial body of evidence, however, indicates that this is unlikely to be the case in practice.
https://www.pnas.org/doi/full/10.1073/pnas.2606967123

KASPER OTTEN – Reply to Xiao and Imada: Prosociality across group boundaries is possible without partner choice
When benefitting one's ingroup comes at the cost of an outgroup, these groups are said to be negatively interdependent. In such situations, ingroup prosociality can go together with outgroup hostility (1). In the absence of negative interdependence, I showed that ingroup prosociality tends to go together with outgroup prosociality instead of hostility (2). Across six cross-societal datasets where people make independent decisions regarding ingroups and outgroups, those who are prosocial toward ingroups also tend to be prosocial toward outgroups, albeit at somewhat lower levels. Xiao and Imada (3) acknowledge this co-occurrence of ingroup and outgroup prosociality, but suggest that it may not manifest in practice because people avoid interactions with outgroups. They therefore argue that this co-occurrence requires cross-group partner choice. I appreciate this insightful comment and recognize the importance of cross-group partner choice. However, I do not think it is required for the co-occurrence of ingroup and outgroup prosociality, for two related reasons.
https://www.pnas.org/doi/full/10.1073/pnas.2613719123

CORRECTIONS

FRANCES FORREST et al – Correction for Forrest et al., Early evidence for a stable and flexible foraging niche in the evolution of Homo
[EAORC BULLETIN 1,195]
Correction for "Early evidence for a stable and flexible foraging niche in the evolution of Homo," by Frances Forrest et al, published May 4, 2026 (Proc. Natl. Acad. Sci. U.S.A. 123, e2537631123).
The authors note that Fig. 1 appeared incorrectly. Per the authors, "in Fig. 1, the numbered labels corresponding to FLK Zinj and Peninj were incorrect. The published figure labels these localities as 6 and 8, respectively, but they should be labeled 7 and 9." Additionally, the map in Fig. 1 should use "Oldupai Gorge" instead of "Olduvai Gorge" for consistency with the terminology used throughout the article. The article has been corrected.
https://www.pnas.org/doi/full/10.1073/pnas.2617803123

Royal Society Open Science

PAPERS

ROZHIN MOHAMMADIKIAN et al – Identifying preferred routes of sharing information on social networks
The spread of information has become faster and wider than ever with the advent of social network platforms. The question raised in this study is whether information dissemination in social networks is random or follows a discernible structure. Our results from real-world hashtag data suggest that the spread of hashtags is not random and follows specific patterns. This study proposes two preferential models to explore how news spreads on social media. Specifically, we examine global and local preferential selection models and demonstrate that information dissemination aligns with these patterns. According to these two models, information flows are distributed through specific paths on networks. This suggests that new information tends to propagate along the same paths as previous news, with the specific pathways varying depending on the type of content. Finally, an examination of the propagation of political hashtags on Twitter confirms the existence of these paths that also emerge from the two preferential models.
https://royalsocietypublishing.org/rsos/article/13/6/251274/482152/Identifying-preferred-routes-of-sharing

Trends in Cognitive Sciences

PAPERS

ISHAN SINGHAL, JONATHAN BIRCH & ANIL K. SETH – Timescapes of non-human experience
How can we investigate non-human experiences scientifically? Given substantial differences in sensory abilities and the private nature of consciousness, this remains an open question. In this review, we propose a way to gain empirical traction on one key feature of experience: its temporal structure, or 'timescape'. Perceptual contents follow systematic temporal principles—synchronisation, revision, and persistence—and are sampled across attentional windows and vary in stability. These principles can be explored through temporal illusions and experimental paradigms. We conceptualise an animal's timescape in terms of five key windows, all of which are experimentally testable, and analyse evidence across animal species to highlight varying timescapes. Together, these ideas lay the foundations for a research programme comparing the temporal Umwelts of non-human animals.
https://www.cell.com/trends/cognitive-sciences/fulltext/S1364-6613(26)00108-7

JENNIFER M. RODD – Building word meanings from memories and predictions
Successful communication requires that members of a language community share a common store of knowledge about words and their meanings. Yet, words show remarkable flexibility, adapting to different situations and extending their meanings in novel and creative ways. The FUSE (Flexible Use of Semantic and Episodic knowledge) model offers a unified

account of stability and flexibility in word meaning. Word meanings are constructed dynamically by integrating relatively stable, stored lexical-semantic knowledge with context-specific semantic predictions and idiosyncratic semantic associations that are retrieved from episodic memory. When words are ambiguous or used in unfamiliar or creative ways, contextual predictions and episodic memories become especially important, compensating for the limitations of stored lexical knowledge.
https://www.cell.com/trends/cognitive-sciences/fulltext/S1364-6613(26)00109-9

Trends Open

PAPERS

ADRIANO R. LAMEIRA – Reclaiming origins, reframing evolution: Language origin is distinct from language evolution
Through language, humans conceive and convey infinitely possible messages, yet the emergence of language's generative power remains controversial. Computational/mechanistic and functional/ecological schools dispute whether natural selection can explain language evolution, in part because they address different Tinbergen questions and in part because both reconstruct evolution retrospectively in the image of modern humans. This review re-evaluates the debate and separates pre-origin from post-origin phases to show that evolutionary causes lie in the former, not the latter, and thus are irrecoverable retrospectively. Language evolution must be understood as a hominid phenomenon; however, distinguishing the two phases yields a multidimensional framework for mapping the evolutionary likelihood of generativity across ecologies and biologies to determine whether language could also lie in the solution space of other species.
https://www.cell.com/trends-open/fulltext/S3117-3470(26)00007-6

SUBSCRIBE to the EAORC Bulletin

If you would like to subscribe to this free weekly newsletter, please contact martin.edwardes@btopenworld.com.

UNSUBSCRIBE from the EAORC Bulletin

Send an email to martin.edwardes@btopenworld.com with the subject "EAORC unsubscribe".

PRODUCED BY AND FOR THE EAORC EMAIL GROUP

EAORC is a fee-free academic internet news service and has no commercial sponsorship or other commercial interests.
EAORC website information is at http://martinedwardes.me.uk/eaorc/
If you have received this bulletin, and are unhappy about receiving it, please contact martin.edwardes@btopenworld.com.