

EAORC BULLETIN 1,102 – 28 July 2024

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NOTICES

PUBLICATION ALERTS

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

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

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

EDITORIAL INTERJECTIONS

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

NEWS

FOREIGN AFFAIRS – Revenge of the Patriarchs

Why Autocrats Fear Women.

<https://www.foreignaffairs.com/articles/china/2022-02-08/women-rights-revenge-patriarchs>

NATURE BRIEFING – Most cited cat

Today, I’m congratulating Larry Richardson for becoming the world’s most highly cited cat, his 132 citations easily beating F. D. C. (*Felis Domesticus* Chester) Willard’s 107. Larry’s citations were of course entirely fabricated, by metascientist Reese Richardson and fluid dynamics researcher Nick Wise. The duo wanted to show how shady companies exploit Google Scholar to sell fake metrics. “For a fairer scientific enterprise, we ought to ditch quantitative heuristics like citation count, impact factor and h-index altogether,” Richardson writes.

<https://reese-richardson.blog/2024/07/18/engineering-the-worlds-highest-cited-cat-larry/>

SAPIENS – Five Ways Humans Evolved to be Athletes

An archaeologist explores human athletic paleobiology to explain how our prowess in sport has deep roots in evolution.

<https://www.sapiens.org/biology/human-athletic-paleobiology/>

SCIENCEADVISER – Chimps take turns while chatting—just like us

When we chat, the gap between one partner speaking and the other responding is minuscule. This speedy turn-taking is a key part of human language—and it turns out that chimpanzees do it, too.

Researchers analyzed thousands of gestures recorded from chimpanzees in five communities in East Africa, looking at the precise movements each chimp made when gesturing, the response of other chimps, and the duration of the gestures. They found that the chimps responded to gestures with another gesture in 14% of their interactions—in one case, two chimps even exchanged seven gestures in a row.

This turn-taking was rapid and often overlapping, seemingly flowing like human conversations. It took chimps an average of just 120 milliseconds to respond to another chimp's gesture with their own, well within the 0 to 200 millisecond range common in human interactions.

Some researchers say the observed turn-taking behavior—so crucial for language—implies chimps and humans both acquired it from our last common ancestor. However, the authors themselves are more cautious: It's possible that other highly social species that have to coordinate and cooperate also have this ability. "We don't know if this is something special about chimpanzee communication," says animal communication researcher Gal Badihi, or whether turn-taking was found there first "because we have a bias towards looking at chimpanzees when we're asking evolutionary questions."

<https://www.science.org/content/article/chimps-take-turns-while-chatting-just-humans>

SCIENCEADVISER – There's no special smell to ovulation after all, study finds

Contrary to prior research, men demonstrated no preference for the body odors of ovulating women.

<https://www.science.org/content/article/there-s-no-special-smell-ovulation-after-all-study-finds>

SCIENCE DAILY – Evidence for butchery of giant armadillo-like mammals in Argentina 21,000 years ago

Tool marks could be among oldest known evidence for human occupation in southern South America.

<https://www.sciencedaily.com/releases/2024/07/240717162440.htm>

SCIENCE DAILY – Can consciousness exist in a computer simulation?

A new essay explores which conditions must be met for consciousness to exist. At least one of them can't be found in a computer.

<https://www.sciencedaily.com/releases/2024/07/240719123825.htm>

SCIENCE DAILY – Good timing: Study unravels how our brains track time

It's not how many minutes, but how much fun, says new neuroscience research.

<https://www.sciencedaily.com/releases/2024/07/240718205236.htm>

SCIENCE DAILY – Analyzing internal world models of humans, animals and AI

Researchers have developed a new formal description of internal world models, thereby enabling interdisciplinary research. Internal world models help to make predictions about new situations based on previous experience and to help find one's bearings. The new formalized view helps to compare world models of humans, animals and AI and to eliminate deficits.

<https://www.sciencedaily.com/releases/2024/07/240718124848.htm>

SCIENCE DAILY – Chimpanzees gesture back and forth quickly like in human conversations

When people are having a conversation, they rapidly take turns speaking and sometimes even interrupt. Now, researchers who have collected the largest ever dataset of chimpanzee 'conversations' have found that they communicate back and forth using gestures following the same rapid-fire pattern.

<https://www.sciencedaily.com/releases/2024/07/240722154952.htm>

SCIENCE DAILY – Language affects how quickly we perceive shades of color

People who speak a language that has multiple words for different shades of colour perceive the shades more quickly.

<https://www.sciencedaily.com/releases/2024/07/240724123040.htm>

SCIENCE DAILY – Size doesn't matter for mammals with more complex brains

Mammals that have evolved more developed brains tend to have a smaller size difference between males and females of that species, according to new research.

<https://www.sciencedaily.com/releases/2024/07/240725154746.htm>

SCIENCE.ORG NEWS – Chimps take turns while chatting, just like humans

Findings could shed light on evolution of language.

<https://www.science.org/content/article/chimps-take-turns-while-chatting-just-humans>

PUBLICATIONS

Biolinguistics

PAPERS

CHENCHEN SONG – On Hilbert’s Epsilon Operator in FormSequence

This paper examines Chomsky’s recently proposed and abandoned FormSequence operation and presents a middle-ground implementation of it in a way that conforms to the Strong Minimalist Thesis. Special attention is paid to the role of Hilbert’s epsilon (ϵ) operator in this operation. I argue that while the ϵ -operator can give FormSequence its desired effect, the sequence-choosing mechanism should more adequately be attributed to the cognitive-computational context (mainly the interfaces) instead of Narrow Syntax. In other words, FormSequence is not entirely syntactic in nature but only partly so. I implement its syntactic part as repeated Pair Merge of a coordinator with a number of conjuncts, which yields a partially ordered set as output instead of a sequence. This implementation reconciles FormSequence with the Strong Minimalist Thesis and maintains a purely hierarchical syntactic module of human language. Furthermore, I compare the use of the ϵ -operator in FormSequence and its more established use in formal semantics and eventually promote a domain-general perspective on the fundamental cognitive procedure of sequence formation.

<https://bioling.psychopen.eu/index.php/bioling/article/view/14061>

STEFANIE BODE – Uniformity and Diversity of Language in an Evolutionary Context

The paper explores a view on language that is in line with the Strong Minimalist Thesis and that derives an evolutionary scenario predicting language variation in time and space. A stable and uniform UG making available recursive Merge shaped by laws of nature such as simplicity and efficiency has been integrated by a sudden rewiring of the brain into an existing biological system which is comparable to the concept of the faculty of language in the broad sense. The basic oppositions such as symmetry and asymmetry, internal language/thought and externalization, uniformity and diversity, universality and particular languages are derived as an automatic consequence of the architecture of the grammar as it evolved in the human species in concert with general principles of nature. A stable and simple system can be reconciled with a dynamic complex one.

{Since when have simplicity and efficiency been laws of nature?}

<https://bioling.psychopen.eu/index.php/bioling/article/view/12823>

Biology Letters

PAPERS

JOHN ROWAN & BERNARD WOOD – Dart and the Taung juvenile: making sense of a century-old record of hominin evolution in Africa

The announcement in 1925 by Raymond Dart of the discovery of the Taung juvenile’s skull in a quarry in sub-Saharan Africa is deservedly a classic publication in the history of palaeoanthropology. Dart’s paper—which designated Taung as the type specimen of the early hominin species *Australopithecus africanus*—provided the first fossil evidence supporting Charles Darwin’s 1871 prediction that Africa was where the human lineage originated. The Taung juvenile’s combination of ape and human characteristics eventually led to a paradigm shift in our understanding of human evolution. This contribution focuses on the milieu in which Dart’s paper appeared (i.e. what was understood in 1925 about human evolution), the fossil evidence as set out by Dart, his interpretation of how a species represented by a fossilized juvenile’s skull fitted within prevailing narratives about human evolution and the significance of the fossil being found in an environment inferred to be very different from that occupied by living apes. We also briefly review subsequent fossil finds that have corroborated the argument Dart made for having discovered evidence of a hitherto unknown close relative of humans, and summarize our current understanding of the earliest stages of human evolution and its environmental context.

<https://royalsocietypublishing.org/doi/full/10.1098/rsbl.2024.0185>

Cell Reports

PAPERS

JIAN DONG et al – A hominoid-specific signaling axis regulating the tempo of synaptic maturation

Human cortical neurons (hCNs) exhibit high dendritic complexity and synaptic density, and the maturation process is greatly protracted. However, the molecular mechanism governing these specific features remains unclear. Here, we report that the hominoid-specific gene *TBC1D3* promotes dendritic arborization and protracts the pace of synaptogenesis. Ablation of *TBC1D3* in induced hCNs causes reduction of dendritic growth and precocious synaptic maturation. Forced expression of *TBC1D3* in the mouse cortex protracts synaptic maturation while increasing dendritic growth. Mechanistically, *TBC1D3* functions via interaction with *MICAL1*, a monooxygenase that mediates oxidation of actin filament. At the early stage of differentiation, the *TBC1D3/MICAL1* interaction in the cytosol promotes dendritic growth via F-actin oxidation and enhanced actin dynamics. At late stages, *TBC1D3* escorts *MICAL1* into the nucleus and downregulates the expression of genes related with synaptic maturation through interaction with the chromatin remodeling factor *ATRX*. Thus, this study delineates the molecular mechanisms underlying human neuron development.

Current Biology

PAPERS

GAL BADIHI et al with KATIE E. SLOCOMBE, KLAUS ZUBERBÜHLER & CATHERINE HOBAITER – Chimpanzee gestural exchanges share temporal structure with human language

Humans regularly engage in efficient communicative conversations, which serve to socially align individuals¹. In conversations, we take fast-paced turns using a human-universal structure of deploying and receiving signals which shows consistent timing across cultures². We report here that chimpanzees also engage in rapid signal-to-signal turn-taking during face-to-face gestural exchanges with a similar average latency between turns to that of human conversation. This correspondence between human and chimpanzee face-to-face communication points to shared underlying rules in communication. These structures could be derived from shared ancestral mechanisms or convergent strategies that enhance coordinated interactions or manage competition for communicative ‘space’.

[https://www.cell.com/current-biology/fulltext/S0960-9822\(24\)00761-9](https://www.cell.com/current-biology/fulltext/S0960-9822(24)00761-9)

NIKOS CHALAS et al – Dissociating prosodic from syntactic delta activity during natural speech comprehension

Decoding human speech requires the brain to segment the incoming acoustic signal into meaningful linguistic units, ranging from syllables and words to phrases. Integrating these linguistic constituents into a coherent percept sets the root of compositional meaning and hence understanding. One important cue for segmentation in natural speech is prosodic cues, such as pauses, but their interplay with higher-level linguistic processing is still unknown. Here, we dissociate the neural tracking of prosodic pauses from the segmentation of multi-word chunks using magnetoencephalography (MEG). We find that manipulating the regularity of pauses disrupts slow speech-brain tracking bilaterally in auditory areas (below 2 Hz) and in turn increases left-lateralized coherence of higher-frequency auditory activity at speech onsets (around 25–45 Hz). Critically, we also find that multi-word chunks—defined as short, coherent bundles of inter-word dependencies—are processed through the rhythmic fluctuations of low-frequency activity (below 2 Hz) bilaterally and independently of prosodic cues. Importantly, low-frequency alignment at chunk onsets increases the accuracy of an encoding model in bilateral auditory and frontal areas while controlling for the effect of acoustics. Our findings provide novel insights into the neural basis of speech perception, demonstrating that both acoustic features (prosodic cues) and abstract linguistic processing at the multi-word timescale are underpinned independently by low-frequency electrophysiological brain activity in the delta frequency range.

[https://www.cell.com/current-biology/fulltext/S0960-9822\(24\)00856-X](https://www.cell.com/current-biology/fulltext/S0960-9822(24)00856-X)

ANTON DVORZHAK, MICHAEL BRECHT & DIETMAR SCHMITZ – Social play behavior is driven by glycine-dependent mechanisms

Social play is pervasive in juvenile mammals, yet it is poorly understood in terms of its underlying brain mechanisms. Specifically, we do not know why young animals are most playful and why most adults cease to social play. Here, we analyze the synaptic mechanisms underlying social play. We found that blocking the rat periaqueductal gray (PAG) interfered with social play. Furthermore, an age-related decrease of neural firing in the PAG is associated with a decrease in synaptic release of glycine. Most importantly, modulation of glycine concentration—apparently acting on the glycinergic binding site of the N-methyl-D-aspartate (NMDA) receptor—not only strongly modulates social play but can also reverse the age-related decline in social play. In conclusion, we demonstrate that social play critically depends on the neurotransmitter glycine within the PAG.

[https://www.cell.com/current-biology/fulltext/S0960-9822\(24\)00857-1](https://www.cell.com/current-biology/fulltext/S0960-9822(24)00857-1)

OBITUARIES

RICHARD WRANGHAM & CHRISTINE WEBB – Frans de Waal (1948–2024)

Frans de Waal revolutionized our understanding of primate society by emphasizing the vital role of cooperative and peaceful behavior within long-term dominance relationships. In his first studies of chimpanzees, conducted at Arnhem Zoo in the 1970s, he discovered that aggressive conflicts are often followed by friendly interactions between opponents, which he termed reconciliations. He showed that reconciliations are part of a wider set of post-conflict management strategies, including consolation (post-conflict affiliation involving a third party) that serve to mitigate the negative effects of aggression — not only for opponents but also for other members of the group. His breakthrough led to extensive comparative work by himself and others on the nature, social dynamics and cognitive foundations of peace-making, and on the social and mental complexities of mammals, especially great apes. His research led him to advocate forcefully for the importance of the social and psychological needs of non-humans, while his studies of apes and monkeys also inspired an interest in the evolution of empathy, morality and justice in humans. In thirteen books, several of which were best-sellers, he described extensive similarities between the rich social, emotional, and cognitive lives of animals and humans. His writing and public talks boldly challenged centuries of anthropocentric thought, captivating audiences around the world with his exceptional ability to translate science to the general public.

[https://www.cell.com/current-biology/fulltext/S0960-9822\(24\)00807-8](https://www.cell.com/current-biology/fulltext/S0960-9822(24)00807-8)

eLife

PAPERS

JESSICA E. ROSIEN et al – Food-washing monkeys recognize the law of diminishing returns

Few animal species have the cognitive faculties or prehensile abilities needed to eliminate costly tooth-damaging grit from food surfaces. Some populations of monkeys wash sand from foods when standing water is readily accessible, but this propensity varies within groups for reasons unknown. Spontaneous food-washing emerged recently in a group of long-tailed macaques (*Macaca fascicularis*) inhabiting Koram Island, Thailand, and it motivated us to explore the factors that drive individual variability. We measured the mineral and physical properties of contaminant sands and conducted a field experiment, eliciting 1,282 food-handling bouts by 42 monkeys. Our results verify two long-standing presumptions, that monkeys have a strong aversion to sand and that removing it is intentional. Reinforcing this result, we found that monkeys clean foods beyond the point of diminishing returns, a suboptimal behavior that varies with rank. Dominant monkeys abstain from washing, balancing the long-term benefits of mitigating tooth wear against immediate energetic requirements, an essential predictor of reproductive fitness.

<https://elifesciences.org/reviewed-preprints/98520>

ANDREA I LUPPI et al – A synergistic workspace for human consciousness revealed by Integrated Information Decomposition

How is the information-processing architecture of the human brain organised, and how does its organisation support consciousness? Here, we combine network science and a rigorous information-theoretic notion of synergy to delineate a ‘synergistic global workspace’, comprising gateway regions that gather synergistic information from specialised modules across the human brain. This information is then integrated within the workspace and widely distributed via broadcaster regions. Through functional MRI analysis, we show that gateway regions of the synergistic workspace correspond to the human brain’s default mode network, whereas broadcasters coincide with the executive control network. We find that loss of consciousness due to general anaesthesia or disorders of consciousness corresponds to diminished ability of the synergistic workspace to integrate information, which is restored upon recovery. Thus, loss of consciousness coincides with a breakdown of information integration within the synergistic workspace of the human brain. This work contributes to conceptual and empirical reconciliation between two prominent scientific theories of consciousness, the Global Neuronal Workspace and Integrated Information Theory, while also advancing our understanding of how the human brain supports consciousness through the synergistic integration of information.

<https://elifesciences.org/articles/88173>

Frontiers in Computational Neuroscience

PAPERS

HAIPING HUANG – Eight challenges in developing theory of intelligence

A good theory of mathematical beauty is more practical than any current observation, as new predictions about physical reality can be self-consistently verified. This belief applies to the current status of understanding deep neural networks including large language models and even the biological intelligence. Toy models provide a metaphor of physical reality, allowing mathematically formulating the reality (i.e., the so-called theory), which can be updated as more conjectures are justified or refuted. One does not need to present all details in a model, but rather, more abstract models are constructed, as complex systems such as the brains or deep networks have many sloppy dimensions but much less stiff dimensions that strongly impact macroscopic observables. This type of bottom-up mechanistic modeling is still promising in the modern era of understanding the natural or artificial intelligence. Here, we shed light on eight challenges in developing theory of intelligence following this theoretical paradigm. These challenges are representation learning, generalization, adversarial robustness, continual learning, causal learning, internal model of the brain, next-token prediction, and the mechanics of subjective experience.

<https://www.frontiersin.org/journals/computational-neuroscience/articles/10.3389/fncom.2024.1388166/full>

Frontiers in Ecology and Evolution

COMMENTARIES

TOSHITAKA N. SUZUKI & YUI K. MATSUMOTO – Commentary: No evidence for language syntax in songbird vocalizations

It has been hypothesized that the generative power of language stems from a cognitive capacity called “Merge,” which enables senders to combine two linguistic items (e.g., two words or two phrases) into a sequence and receivers to recognize it as a single unit (Chomsky, 1995, 2001). In an experimental study published in *Nature Communications* (Suzuki and Matsumoto, 2022), we demonstrated that a bird species, the Japanese tit (*Parus minor*), has evolved “core-Merge,” the most fundamental form of Merge that combines two words into a single unit (Fujita, 2009, 2014). In their recent publication in *Frontiers in Psychology*, Beckers et al. (2024) raised concerns about the interpretation of our results. However, after careful consideration, we maintain the conclusion that our results provide evidence for core-Merge.

{Reply to GABRIËL J.L. BECKERS et al with MARTIN B.H. EVERAERT & JOHAN J. BOLHUIS – No evidence for language syntax in songbird vocalizations (*Frontiers in Psychology*, EAORC Bulletin 1,090),

<https://www.frontiersin.org/journals/psychology/articles/10.3389/fpsyg.2024.1393895/full>,

Which was a commentary on TOSHITAKA N. SUZUKI & YUI K. MATSUMOTO – Experimental evidence for core-Merge in the vocal communication system of a wild passerine (*Nature Communications*, EAORC Bulletin 1,060),

<https://www.nature.com/articles/s41467-022-33360-3>

<https://www.frontiersin.org/journals/ecology-and-evolution/articles/10.3389/fevo.2024.1430848/full>

Frontiers in Environmental Archaeology

PAPERS

MARIANA NABAIS, ANNA RUFÀ & MARINA IGREJA – Experimental replication of early human behaviour in bird preparation: a pilot-study focusing on bone surface modification and breakage patterns

The origin of complex behaviour amongst early humans is a subject of heated debate within the scientific community, and the study of small prey remains has become a significant aspect when examining such modern behaviour. Nonetheless, the consumption of small prey by human populations poses analytical difficulties due to the often negligible, or entirely absent, traces on bone surfaces. To address this difficulty, an experimental study focusing on terrestrial avifauna has been prepared, and here we present a preliminary phase of this research. The aim is to distinguish potential modifications on bird bone surfaces and fracture patterns that might facilitate the recognition of human manipulation of avian skeletal remains. Building upon the challenges encountered in the study of archaeological findings recovered from recent excavations in Iberian Middle Palaeolithic sites, the experimental protocol was formulated to encompass the processing of two uncooked and three roasted birds; and the lithic use-wear analysis of the flint flake used in the processing of raw birds. The results showcase distinct patterns of bone surface modifications and breakage between cooked and uncooked birds. Higher numbers of cut marks and manual disarticulation breaks are found on raw animals, whereas roasted animals show no cut marks, local-specific burns and higher bone loss. This pilot-study provides a baseline for future research to further explore the role of avifauna in Neanderthal subsistence and food processing, which may help highlight cultural choices.

<https://www.frontiersin.org/journals/environmental-archaeology/articles/10.3389/fearc.2024.1411853/full>

Frontiers in Human Neuroscience

PAPERS

JACEK ROGALA et al – Local variation in brain temperature explains gender-specificity of working memory performance

Our study utilized advanced techniques like magnetic resonance thermometry, standard working memory n-back tasks, and functional MRI to investigate if gender-based variations in brain temperature correlate with distinct neuronal responses and working memory capabilities.

We observed a significant decrease in average brain temperature in males during working memory tasks, a phenomenon not seen in females. Although changes in female brain temperature were significantly lower than in males, we found an inverse relationship between the absolute temperature change (ATC) and cognitive performance, alongside a correlation with blood oxygen level dependent (BOLD) signal change induced by neural activity. This suggests that in females, ATC is a crucial determinant for the link between cognitive performance and BOLD responses, a linkage not evident in males. However, we also observed additional female specific BOLD responses aligned with comparable task performance to that of males. Our results suggest that females compensate for their brain's heightened temperature sensitivity by activating additional neuronal networks to support working memory. This study not only underscores the complexity of gender differences in cognitive processing but also opens new avenues for understanding how temperature fluctuations influence brain functionality.

<https://www.frontiersin.org/journals/human-neuroscience/articles/10.3389/fnhum.2024.1398034/full>

Frontiers in Language Sciences

PAPERS

TIMOTHY J. HERRON et al – Is Broca's area critical for speech and language? Evidence from lesion-symptom mapping in chronic aphasia

The specific role that Broca's area plays in speech and language has been hotly debated in the literature. Some research has pointed to a specific role in particular aspects of speech production, while other findings have suggested additional roles in aspects of language comprehension. In the current study, we had the opportunity to take a broad approach by analyzing lesion and behavioral data from a large cohort of left hemisphere stroke patients. In this brief report, our objective was to identify which speech-language measures show a significant association with Broca's area, specifically pars opercularis and pars triangularis.

Lesion site and neuropsychological data from 173 chronic left hemisphere stroke patients were analyzed in the current study. Univariate lesion-symptom mapping (LSM) with rigorous correction was used to identify brain regions associated with

individual test performance on a large battery of speech and language tasks. Multivariate LSM analyses were conducted in subsequent runs to confirm findings.

The LSM results identified many predictable left hemisphere gray and white matter regions significantly associated with the speech-language data, but Broca's area was not implicated in performance on any speech or language measure. Regions adjacent to Broca's area, however, in left central opercular, precentral, and insular cortices were associated with speech production and motor speech performance.

The current study failed to identify a single speech or language measure in our comprehensive test battery that was dependent on Broca's area. This finding could not be attributed to a lack of power, as Broca's area had among the highest power values and substantial lesion coverage. Interrogation of data at the individual patient level revealed the likely source of this null finding: Patients with lesions involving Broca's area varied widely in their speech-language performance, with profiles ranging from non-aphasic to Broca's to global aphasia. Given previous studies in acute stroke patients and healthy participants implicating Broca's area in speech-language, the current findings suggest that Broca's area plays a more supplementary than critical role and can be compensated by surrounding brain regions in chronic stroke.

<https://www.frontiersin.org/journals/language-sciences/articles/10.3389/flang.2024.1398616/full>

Heliyon

PAPERS

TRUC LE THANH – Heartfelt ventures: The power of empathy in driving social entrepreneurial

Although the notion of social entrepreneurship is not new to us today, it has not yet gained widespread acceptance and development in Vietnam. Although there are numerous study publications on the relationship between empathy and social entrepreneurial intentions, this problem has yet to be studied much in the context of Vietnam's, particularly among youth. The goal of this study is to see if young empathy is linked to their desire to start a social enterprise. Reliability analysis using PLS-SEM software and a binary regression model will be used to examine data obtained from 339 university students in Vietnam. According to the findings, as well as the theory of planned behavior and the theory of action phases, (1) empathy does not directly affect social business intention, but rather indirectly through two mechanisms, social worth and social entrepreneurial self-efficacy, and (2) individuals who are confident in their own abilities have more social entrepreneurship intentions. We provide recommendations based on these findings to inspire young people to pursue social entrepreneurship, contribute to the development of a sustainable economy, and contribute positive values to society.

[https://www.cell.com/heliyon/fulltext/S2405-8440\(24\)11150-4](https://www.cell.com/heliyon/fulltext/S2405-8440(24)11150-4)

iScience

PAPERS

TAMAR I. REGEV et al with EVELINA FEDORENKO – Preserved functional organization of auditory cortex in two individuals missing one temporal lobe from infancy

Human cortical responses to natural sounds, measured with fMRI, can be approximated as the weighted sum of a small number of canonical response patterns (components), each having interpretable functional and anatomical properties. Here, we asked whether this organization is preserved in cases where only one temporal lobe is available due to early brain damage by investigating a unique family: one sibling born without a left temporal lobe, another without a right temporal lobe, and a third anatomically neurotypical. We analyzed fMRI responses to diverse natural sounds within the intact hemispheres of these individuals and compared them to 12 neurotypical participants. All siblings manifested typical-like auditory responses in their intact hemispheres. These results suggest that the development of the auditory cortex in each hemisphere does not depend on the existence of the other hemisphere, highlighting the redundancy and equipotentiality of the bilateral auditory system.

[https://www.cell.com/iscience/fulltext/S2589-0042\(24\)01773-5](https://www.cell.com/iscience/fulltext/S2589-0042(24)01773-5)

Language and Cognition

PAPERS

THERESA MATZINGER et al with PRZEMYSŁAW ŻYWICZYŃSKI & SŁAWOMIR WACEWICZ – Inherent linguistic preference outcompetes incidental alignment in cooperative partner choice

An important quality to assess in others is their cooperativeness. We hypothesized that people use linguistic markers in their partners' speech as a proxy of their cooperativeness in other tasks: specifically, we predicted that participants would prefer syntactically similar conversation partners as cooperation partners in a monetary game. We found that, indeed, participants preferably selected syntactically similar conversation partners as cooperation partners, but only when the participants could communicate using their naturally preferred constructions. In contrast, when participants were forced to communicate using dispreferred constructions, they rather cooperated with those partners that matched their natural preference than with those that matched their overt linguistic use. This pattern of results was likely driven by participants valuing representational alignment (i.e., being aligned on both linguistic features and their mental representations) more than incidental behavioral alignment (i.e., superficial convergence on similar linguistic features during interaction). This is because representational alignment is a potential indicator of group membership and may be associated with in-group benefits such as reputation,

reciprocity and normative behavior. Those benefits may outweigh the benefits of simple behavioral alignment, which could be a potential indicator of others' willingness to cooperate. This has important implications for communication in intercultural settings where members of diverse linguistic groups negotiate cooperative actions.

<https://www.cambridge.org/core/journals/language-and-cognition/article/inherent-linguistic-preference-outcompetes-incident-alignment-in-cooperative-partner-choice/5308285B5D188854B398B1A60A2CB872>

Nature

ARTICLES

The ape Y chromosome evolves extremely rapidly, but the X chromosome is conserved

The ape sex chromosomes have now been fully sequenced. Rapid evolution has led to extreme differences in the Y chromosome between species, whereas the X chromosome experienced much less dynamic changes. The palindromic structure of the Y chromosome has preserved genes relevant to fertility, hidden in the repetitive DNA.

<https://www.nature.com/articles/d41586-024-02404-7>

PAPERS

KATERYNA D. MAKOVA et mul – The complete sequence and comparative analysis of ape sex chromosomes

Apes possess two sex chromosomes—the male-specific Y chromosome and the X chromosome, which is present in both males and females. The Y chromosome is crucial for male reproduction, with deletions being linked to infertility¹. The X chromosome is vital for reproduction and cognition². Variation in mating patterns and brain function among apes suggests corresponding differences in their sex chromosomes. However, owing to their repetitive nature and incomplete reference assemblies, ape sex chromosomes have been challenging to study. Here, using the methodology developed for the telomere-to-telomere (T2T) human genome, we produced gapless assemblies of the X and Y chromosomes for five great apes (bonobo (*Pan paniscus*), chimpanzee (*Pan troglodytes*), western lowland gorilla (*Gorilla gorilla gorilla*), Bornean orangutan (*Pongo pygmaeus*) and Sumatran orangutan (*Pongo abelii*)) and a lesser ape (the siamang gibbon (*Symphalangus syndactylus*)), and untangled the intricacies of their evolution. Compared with the X chromosomes, the ape Y chromosomes vary greatly in size and have low alignability and high levels of structural rearrangements—owing to the accumulation of lineage-specific ampliconic regions, palindromes, transposable elements and satellites. Many Y chromosome genes expand in multi-copy families and some evolve under purifying selection. Thus, the Y chromosome exhibits dynamic evolution, whereas the X chromosome is more stable. Mapping short-read sequencing data to these assemblies revealed diversity and selection patterns on sex chromosomes of more than 100 individual great apes. These reference assemblies are expected to inform human evolution and conservation genetics of non-human apes, all of which are endangered species.

<https://www.nature.com/articles/s41586-024-07473-2>

Nature Genetics

PAPERS

NOLAN KAMITAKI et al – A sequence of SVA retrotransposon insertions in ASIP shaped human pigmentation

Retrotransposons comprise about 45% of the human genome¹, but their contributions to human trait variation and evolution are only beginning to be explored^{2,3}. Here, we find that a sequence of SVA retrotransposon insertions in an early intron of the ASIP (agouti signaling protein) gene has probably shaped human pigmentation several times. In the UK Biobank ($n = 169,641$), a recent 3.3-kb SVA insertion polymorphism associated strongly with lighter skin pigmentation (0.22 [0.21–0.23] s.d.; $P = 2.8 \times 10^{-351}$) and increased skin cancer risk (odds ratio = 1.23 [1.18–1.27]; $P = 1.3 \times 10^{-28}$), appearing to underlie one of the strongest common genetic influences on these phenotypes within European populations^{4,5,6}. ASIP expression in skin displayed the same association pattern, with the SVA insertion allele exhibiting 2.2-fold (1.9–2.6) increased expression. This effect had an unusual apparent mechanism: an earlier, nonpolymorphic, human-specific SVA retrotransposon 3.9 kb upstream appeared to have caused ASIP hypofunction by nonproductive splicing, which the new (polymorphic) SVA insertion largely eliminated. Extended haplotype homozygosity indicated that the insertion allele has risen to allele frequencies up to 11% in European populations over the past several thousand years. These results indicate that a sequence of retrotransposon insertions contributed to a species-wide increase, then a local decrease, of human pigmentation.

<https://www.nature.com/articles/s41588-024-01841-4>

Nature Human Behaviour

ARTICLES

CECILIA PADILLA-IGLESIAS & ANDREA B. MIGLIANO – Musical instruments, tools, language and genetic data reveal ancient hunter-gatherer networks

Central Africa is home to the greatest number of hunter-gatherers remaining in the world, but the origins of their culture remain unclear. We compiled a dataset of Central African hunter-gatherer musical instruments, subsistence tools, specialized vocabulary and genome-wide single-nucleotide polymorphism data, which revealed ancient networks of cultural and linguistic exchange that spanned thousands of kilometres.

<https://www.nature.com/articles/s41562-024-01893-w>

JO CUTLER & PATRICIA LOCKWOOD – How brain damage affects our willingness to help others

Damage to a specific part of the brain in the frontal cortex reveals its necessity in effortful actions that help other people. These findings could have implications for understanding and treating disorders of social behaviour.

<https://www.nature.com/articles/s41562-024-01900-0>

PAPERS

STACI MEREDITH WEISS et al with MARK H. JOHNSON – Trajectories of brain and behaviour development in the womb, at birth and through infancy

Birth is often seen as the starting point for studying effects of the environment on human development, with much research focused on the capacities of young infants. However, recent imaging advances have revealed that the complex behaviours of the fetus and the uterine environment exert influence. Birth is now viewed as a punctuate event along a developmental pathway of increasing autonomy of the child from their mother. Here we highlight (1) increasing physiological autonomy and perceptual sensitivity in the fetus, (2) physiological and neurochemical processes associated with birth that influence future behaviour, (3) the recalibration of motor and sensory systems in the newborn to adapt to the world outside the womb and (4) the effect of the prenatal environment on later infant behaviours and brain function. Taken together, these lines of evidence move us beyond nature–nurture issues to a developmental human lifespan view beginning within the womb.

<https://www.nature.com/articles/s41562-024-01896-7>

CECILIA PADILLA-IGLESIAS et al – Deep history of cultural and linguistic evolution among Central African hunter-gatherers

Human evolutionary history in Central Africa reflects a deep history of population connectivity. However, Central African hunter-gatherers (CAHGs) currently speak languages acquired from their neighbouring farmers. Hence it remains unclear which aspects of CAHG cultural diversity results from long-term evolution preceding agriculture and which reflect borrowing from farmers. On the basis of musical instruments, foraging tools, specialized vocabulary and genome-wide data from ten CAHG populations, we reveal evidence of large-scale cultural interconnectivity among CAHGs before and after the Bantu expansion. We also show that the distribution of hunter-gatherer musical instruments correlates with the oldest genomic segments in our sample predating farming. Music-related words are widely shared between western and eastern groups and likely precede the borrowing of Bantu languages. In contrast, subsistence tools are less frequently exchanged and may result from adaptation to local ecologies. We conclude that CAHG material culture and specialized lexicon reflect a long evolutionary history in Central Africa.

<https://www.nature.com/articles/s41562-024-01891-y>

JAMES W. A. STRACHAN et al with MICHAEL S. A. GRAZIANO – Testing theory of mind in large language models and humans

At the core of what defines us as humans is the concept of theory of mind: the ability to track other people's mental states. The recent development of large language models (LLMs) such as ChatGPT has led to intense debate about the possibility that these models exhibit behaviour that is indistinguishable from human behaviour in theory of mind tasks. Here we compare human and LLM performance on a comprehensive battery of measurements that aim to measure different theory of mind abilities, from understanding false beliefs to interpreting indirect requests and recognizing irony and faux pas. We tested two families of LLMs (GPT and LLaMA2) repeatedly against these measures and compared their performance with those from a sample of 1,907 human participants. Across the battery of theory of mind tests, we found that GPT-4 models performed at, or even sometimes above, human levels at identifying indirect requests, false beliefs and misdirection, but struggled with detecting faux pas. Faux pas, however, was the only test where LLaMA2 outperformed humans. Follow-up manipulations of the belief likelihood revealed that the superiority of LLaMA2 was illusory, possibly reflecting a bias towards attributing ignorance. By contrast, the poor performance of GPT originated from a hyperconservative approach towards committing to conclusions rather than from a genuine failure of inference. These findings not only demonstrate that LLMs exhibit behaviour that is consistent with the outputs of mentalistic inference in humans but also highlight the importance of systematic testing to ensure a non-superficial comparison between human and artificial intelligences.

<https://www.nature.com/articles/s41562-024-01882-z>

MAURICIO GONZÁLEZ-FORERO – Evolutionary–developmental (evo-devo) dynamics of hominin brain size

Brain size tripled in the human lineage over four million years, but why this occurred remains uncertain. Here, to study what caused this brain expansion, I mathematically model the evolutionary and developmental (evo-devo) dynamics of hominin brain size. The model recovers (1) the evolution of brain and body sizes of seven hominin species starting from brain and body sizes of the australopithecine scale, (2) the evolution of the hominin brain–body allometry and (3) major patterns of human development and evolution. I show that the brain expansion recovered is not caused by direct selection for brain size but by its genetic correlation with developmentally late preovulatory ovarian follicles. This correlation is generated over development if individuals experience a challenging ecology and seemingly cumulative culture, among other conditions.

These findings show that the evolution of exceptionally adaptive traits may not be primarily caused by selection for them but by developmental constraints that divert selection.

<https://www.nature.com/articles/s41562-024-01887-8>

BAHAAEDDIN ATTAALLAH et al – The role of the human hippocampus in decision-making under uncertainty

The role of the hippocampus in decision-making is beginning to be more understood. Because of its prospective and inferential functions, we hypothesized that it might be required specifically when decisions involve the evaluation of uncertain values. A group of individuals with autoimmune limbic encephalitis—a condition known to focally affect the hippocampus—were tested on how they evaluate reward against uncertainty compared to reward against another key attribute: physical effort. Across four experiments requiring participants to make trade-offs between reward, uncertainty and effort, patients with acute limbic encephalitis demonstrated blunted sensitivity to reward and effort whenever uncertainty was considered, despite demonstrating intact uncertainty sensitivity. By contrast, the valuation of these two attributes (reward and effort) was intact on uncertainty-free tasks. Reduced sensitivity to changes in reward under uncertainty correlated with the severity of hippocampal damage. Together, these findings provide evidence for a context-sensitive role of the hippocampus in value-based decision-making, apparent specifically under conditions of uncertainty.

<https://www.nature.com/articles/s41562-024-01855-2>

Nature Scientific Reports

PAPERS

AXEL G. EKSTRÖM et al with ADRIANO R. LAMEIRA – Chimpanzee utterances refute purported missing links for novel vocalizations and syllabic speech

Nonhuman great apes have been claimed to be unable to learn human words due to a lack of the necessary neural circuitry. We recovered original footage of two enculturated chimpanzees uttering the word “mama” and subjected recordings to phonetic analysis. Our analyses demonstrate that chimpanzees are capable of syllabic production, achieving consonant-to-vowel phonetic contrasts via the simultaneous recruitment and coupling of voice, jaw and lips. In an online experiment, human listeners naive to the recordings’ origins reliably perceived chimpanzee utterances as syllabic utterances, primarily as “ma-ma”, among foil syllables. Our findings demonstrate that in the absence of direct data-driven examination, great ape vocal production capacities have been underestimated. Chimpanzees possess the neural building blocks necessary for speech.

<https://www.nature.com/articles/s41598-024-67005-w>

CARLY A. BOBAK et al – Defining a core breath profile for healthy, non-human primates

Non-human primates remain the most useful and reliable pre-clinical model for many human diseases. Primate breath profiles have previously distinguished healthy animals from diseased, including non-human primates. Breath collection is relatively non-invasive, so this motivated us to define a healthy baseline breath profile that could be used in studies evaluating disease, therapies, and vaccines in non-human primates. A pilot study, which enrolled 30 healthy macaques, was conducted. Macaque breath molecules were sampled into a Tedlar bag, concentrated onto a thermal desorption tube, then desorbed and analyzed by comprehensive two-dimensional gas chromatography-time of flight mass spectrometry. These breath samples contained 2,017 features, of which 113 molecules were present in all breath samples. The core breathprint was dominated by aliphatic hydrocarbons, aromatic compounds, and carbonyl compounds. The data were internally validated with additional breath samples from a subset of 19 of these non-human primates. A critical core consisting of 23 highly abundant and invariant molecules was identified as a pragmatic breathprint set, useful for future validation studies in healthy primates.

<https://www.nature.com/articles/s41598-024-64910-y>

YONATAN SAHLE et al – MIS 3 innovative behavior and highland occupation during a stable wet episode in the Lake Tana paleoclimate record, Ethiopia

Securely dated archaeological sites from key regions and periods are critical for understanding early modern human adaptive responses to past environmental change. Here, we report new radiocarbon dates of > 42,000 cal years BP for an intensive human occupation of Gorgora rockshelter in the Ethiopian Highlands. We also document the development of innovative technologies and symbolic behaviors starting around this time. The evidenced occupation and behavioral patterns coincide with the onset and persistence of a stable wet phase in the geographically proximate high-resolution core record of Lake Tana. Range expansion into montane habitats and the subsequent development of innovative technologies and behaviors are consistent with population dispersal waves within Africa and beyond during wetter phases ~ 60–40 thousand years ago (ka).

<https://www.nature.com/articles/s41598-024-67743-x>

JACKIE DESPRIÉE et al with MARIE-HÉLÈNE MONCEL – Earliest evidence of human occupations and technological complexity above the 45th North parallel in Western Europe. The site of Lunery-Rosieres la-Terre-des-Sablons (France, 1.1 Ma)

The site of Lunery-Rosieres la-Terre-des-Sablons (Lunery, Cher, France) comprises early evidence of human occupation in mid-latitudes in Western Europe. It demonstrates hominin presence in the Loire River Basin during the Early Pleistocene at the transition between an interglacial stage and the beginning of the following glacial stage. Three archaeological levels sandwiched and associated with two diamicton levels deposited on the downcutting river floor indicate repeated temporary occupations. Lithic material yields evidence of simple and more complex core technologies on local Jurassic siliceous rocks and Oligocene millstone. Hominins availed of natural stone morphologies to produce flakes with limited preparation. Some cores show centripetal management and a partially prepared striking platform. The mean ESR age of 1175 ka ± 98 ka obtained on fluvial sediments overlying the archaeological levels could correspond to the transition between marine isotopic stages (MIS) 37 and 36, during the normal Cobb Mountain subchron, and in particular at the beginning of MIS 36. The Lunery site shows that hominins were capable of adapting to early glacial environmental conditions and adopting appropriate strategies for settling in mid-latitude zones. These areas cannot be considered as inhospitable at that time as Lunery lies at some distance from the forming ice cap.

<https://www.nature.com/articles/s41598-024-66980-4>

XIN GE et al – Impact of discrepant accumulations strategy on collective cooperation in multilayer networks

Understanding large-scale cooperation among related individuals has been one of the largest challenges. Since humans are in multiple social networks, the theoretical framework of multilayer networks is perfectly suited for studying this fascinating aspect of our biology. To that effect, we here study the cooperation in evolutionary game on interdependent networks. Importantly, a part of players are set to adopt Discrepant Accumulations Strategy. Players employing this mechanism not only use their payoffs in the multilayer network as the basis for the updating process as in previous experiments, but also take into account the similarities and differences in strategies across different layers. Monte Carlo simulations demonstrate that considering the similarities and differences in strategies across layers when calculating fitness can significantly enhance the cooperation level in the system. By examining the behavior of different pairing modes within cooperators and defectors, the equilibrium state can be attributed to the evolution of correlated pairing modes between interdependent networks. Our results provide a theoretical analysis of the group cooperation induced by the Discrepant Accumulations Strategy. And we also discuss potential implications of these findings for future human experiments concerning the cooperation on multilayer networks.

<https://www.nature.com/articles/s41598-024-67871-4>

New Scientist
NEWS
Butchered bones hint humans were in South America 21,000 years ago

Prehistoric mammal bones found at a construction site in Argentina appear to have been cut with stone tools, suggesting that humans lived in the region much earlier than previously thought.

<https://www.newscientist.com/article/2440063-butchered-bones-hint-humans-were-in-south-america-21000-years-ago/>

Chimps respond to each other at a pace similar to human conversation

Humans and chimpanzees both take part in rapid social exchanges, suggesting some foundational principles of language may have evolved earlier than previously thought.

<https://www.newscientist.com/article/2440299-chimps-respond-to-each-other-at-a-pace-similar-to-human-conversation/>

PeerJ
PAPERS
CAITLIN E. O'CONNELL-RODWELL et al – The use of vocal coordination in male African elephant group departures: evidence of active leadership and consensus

Group-living animals engage in coordinated vocalizations to depart from a location as a group, and often, to come to a consensus about the direction of movement. Here, we document for the first time, the use of coordinated vocalizations, the “let’s go” rumble, in wild male African elephant group departures from a waterhole. We recorded vocalizations and collected behavioral data as known individuals engaged in these vocal bouts during June-July field seasons in 2005, 2007, 2011, and 2017 at Mushara waterhole within Etosha National Park, Namibia. During departure events, we documented which individuals were involved in the calls, the signature structure of each individual’s calls, as well as the ordering of callers, the social status of the callers, and those who initiated departure. The “let’s go” rumble was previously described in tight-knit family groups to keep the family together during coordinated departures. Male elephants are described as living in loose social groups, making this finding particularly striking. We found that this vocal coordination occurs in groups of closely associated, highly bonded individuals and rarely occurs between looser associates. The three individuals most likely to initiate the “let’s go” rumble bouts were all highly socially integrated, and one of these individuals was also the most dominant

overall. This finding suggests that more socially integrated individuals might be more likely to initiate, or lead, a close group of associates in the context of leaving the waterhole, just as a high-ranking female would do in a family group. The fact that many individuals were involved in the vocal bouts, and that departure periods could be shorter, longer, or the same amount of time as pre-departure periods, all suggest that there is consensus with regard to the act of leaving, even though the event was triggered by a lead individual.

<https://peerj.com/articles/17767/>

Philosophical Transactions of the Royal Society B

PAPERS

JUDITH L. BRONSTEIN & HARI SRIDHAR – Connecting and Integrating cooperation within and between species

There has long been a fundamental divide in the study of cooperation: researchers focus either on cooperation within species, including but not limited to sociality, or else on cooperation between species, commonly termed mutualism. Here, we explore the ecologically and evolutionarily significant ways in which within- and between-species cooperation interact. We highlight two primary cross-linkages. First, cooperation of one type can change the context in which cooperation of the other type functions, and thus potentially its outcome. We delineate three possibilities: (i) within-species cooperation modulates benefits for a heterospecific partner; (ii) between-species cooperation affects the dynamics of within-species cooperation; and (iii) both processes take place interactively. The second type of cross-linkage emerges when resources or services that cooperation makes available are obtainable either from members of the same species or from different species. This brings cooperation at the two levels into direct interaction, to some extent obscuring the distinction between them. We expand on these intersections between within- and between-species cooperation in a diversity of taxa and interaction types. These interactions have the potential to weave together social networks and trophic dynamics, contributing to the structure and functioning of ecological communities in ways that are just beginning to be explored.

<https://royalsocietypublishing.org/doi/abs/10.1098/rstb.2023.0203>

ANASTASIA MADSEN & SHERMIN DE SILVA – Societies with fission–fusion dynamics as complex adaptive systems: the importance of scale

In this article, we argue that social systems with fission–fusion (FF) dynamics are best characterized within a complex adaptive systems (CAS) framework. We discuss how different endogenous and exogenous factors drive scale-dependent network properties across temporal, spatial and social domains. Importantly, this view treats the dynamics themselves as objects of study, rather than variously defined notions of static ‘social groups’ that have hitherto dominated thinking in behavioural ecology. CAS approaches allow us to interrogate FF dynamics in taxa that do not conform to more traditional conceptualizations of sociality and encourage us to pose new types of questions regarding the sources of stability and change in social systems, distinguishing regular variations from those that would lead to system-level reorganization.

<https://royalsocietypublishing.org/doi/full/10.1098/rstb.2023.0175>

MINA OGINO & DAMIEN R. FARINE – Collective intelligence facilitates emergent resource partitioning through frequency-dependent learning

Deciding where to forage must not only account for variations in habitat quality but also where others might forage. Recent studies have suggested that when individuals remember recent foraging outcomes, negative frequency-dependent learning can allow them to avoid resources exploited by others (indirect competition). This process can drive the emergence of consistent differences in resource use (resource partitioning) at the population level. However, indirect cues of competition can be difficult for individuals to sense. Here, we propose that information pooling through collective decision-making—i.e. collective intelligence—can allow populations of group-living animals to more effectively partition resources relative to populations of solitary animals. We test this hypothesis by simulating (i) individuals preferring to forage where they were recently successful and (ii) cohesive groups that choose one resource using a majority rule. While solitary animals can partially avoid indirect competition through negative frequency-dependent learning, resource partitioning is more likely to emerge in populations of group-living animals. Populations of larger groups also better partition resources than populations of smaller groups, especially in environments with more choices. Our results give insight into the value of long- versus short-term memory, home range sizes and the evolution of specialization, optimal group sizes and territoriality.

<https://royalsocietypublishing.org/doi/full/10.1098/rstb.2023.0177>

STUART KININMONTH, DIANA LÓPEZ FERRANDO & MIKEL BECERRO – Neighbourhood benthic configuration reveals hidden co-occurrence social diversity

Ecological interactions among benthic communities are crucial for shaping marine ecosystems. Understanding these interactions is essential for predicting how ecosystems will respond to environmental changes, invasive species, and conservation management. However, determining the prevalence of species interactions at the community scale is challenging. To overcome this challenge, we employ tools from social network analysis, specifically exponential random graph modelling (ERGM). Our approach explores the relationships among animal and plant organisms within their neighbourhoods. Inspired by companion planting in agriculture, we use spatiotemporal co-occurrence as a measure of mixed species interaction. In other words, the variety of community interactions based on co-occurrence defines what we call ‘co-

occurrence social diversity'. Our objective is to use ERGM to quantify the proportion of interactions at both the simple paired level and the more complex triangle level, enabling us to measure and compare co-occurrence social diversity. Applying our approach to the Spanish coastal zone across eight sites, five depths, and sunlit/shaded aspects, we discover that 80% of sessile communities, consisting of over a hundred species, exhibit co-occurrence social diversity, with 5% of species consistently forming associations with other species. These organism-level interactions probably have a significant impact on the overall character of the site.

<https://royalsocietypublishing.org/doi/10.1098/rstb.2023.0174>

PLoS One

PAPERS

GEORGIA-ANN CARTER, FRANK KELLER & PAUL HOFFMAN – Flexibility in conceptual combinations: A neural network model of gradable adjective modification

Our ability to combine simple constituents into more complex conceptual combinations is a fundamental aspect of cognition. Gradable adjectives (e.g., 'tall' and 'light') are a critical example of this process, as their meanings vary depending on the noun with which they are combined. For example, a dark diamond is less dark than dark charcoal. Here, we investigate how a neural network encodes the flexible nature of gradable adjectives in adjective–noun pairs, using the perceptual feature of brightness as a test case. We trained a neural network to predict human brightness ratings for unmodified nouns and adjective–noun pairs and assessed its ability to generalize to untrained combinations (e.g., 'light paint' vs. 'dark paint'). We also explored how this information is encoded. We found that flexible learning of gradable adjectives was possible, with neural networks first making predictions based on the adjective alone, and then modulating these with information from the noun later in learning. We also found that model outputs mimicked the kind of non-additive feature modulation present in human data. Our results have implications for understanding how semantic composition occurs and generate testable predictions for future work.

<https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0307775>

Royal Society Open Science

PAPERS

XIANWEI MENG et al – Gender stereotypes regarding power and niceness in Japanese children

Belief in gendered social power imbalance (i.e. males are more powerful than females) leads to undesirable gender disparities, but little is known about the developmental origins of this belief, especially in Eastern cultures. We investigated the development onset of this belief by focusing on 4–7-year-old Japanese children while considering another belief (females are nicer than males) for comparison. In the dyadic context tasks, children saw pairs of animated characters depicting powerful–powerless or kind–unkind postures and judged the characters' gender (boy or girl). Results suggested both 'nice = female' and 'powerful = female' gender stereotypes in children. In the collective context tasks, children were presented with stories in occupational contexts, including multiple unspecified people and verbal cues, describing more explicitly the powerful and nice traits of the protagonists. The results replicated the 'nice = female' gender stereotype. Moreover, early 'powerful = male' gender stereotypes were seen in 6-year-old boys but not among girls in general. These findings demonstrate that Japanese children's beliefs regarding gender differences in power vary depending on the context in which male–female interactions are presented. Additionally, the study reveals that signs of the 'powerful = male' social power gender stereotype emerge around the age of 6.

<https://royalsocietypublishing.org/doi/10.1098/rsos.230863>

JONAS DOUMEN, KATRIEN BEULS & PAUL VAN EECKE – Modelling constructivist language acquisition through syntactico-semantic pattern finding

The constructivist acquisition of language by children has been elaborately documented by researchers in psycholinguistics and cognitive science. However, despite the centrality of human-like communication in the field of artificial intelligence, no faithful computational operationalizations of the mechanisms through which children learn language exist to date. In this article, we fill part of this void by introducing a mechanistic model of the constructivist acquisition of language through syntactico-semantic pattern finding. Concretely, we present a methodology for learning grammars based on similarities and differences in the form and meaning of linguistic observations alone. The resulting grammars consist of form-meaning mappings of variable extent and degree of abstraction, called constructions, which facilitate both language comprehension and production. Applying our methodology to the CLEVR benchmark dataset, we provide a proof of concept that demonstrates the online, incremental, data-efficient, transparent and effective learning of item-based construction grammars from utterance–meaning pairs.

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AXELLE DELAUNAY et al with MARIE J. E. CHARPENTIER – An early-life challenge: becoming an older sibling in wild mandrills

In monotocous mammals, most individuals experience the birth of a younger sibling. This period may induce losses in maternal care and can be physiologically, energetically and emotionally challenging for the older sibling, yet has rarely been studied in wild primates. We used behavioural data collected from a natural population of mandrills to investigate changes in maternal care and mother–juvenile relationship throughout the transition to siblinghood (TTS), by comparing juveniles who recently experienced the birth of a younger sibling, to juveniles who did not. We found that the TTS was associated with an abrupt cessation of the weaning process for the juvenile, and to a decrease in maternal affiliation. Juveniles' reactions were sex-specific, as males associated less with their mother, while females tended to groom their mother more often after the birth of their sibling. Despite the substantial loss of maternal care, juveniles did not show an increase in conflict or anxiety-related behaviours. This study contributes to explain why short interbirth intervals often pose a risk to juveniles' survival in monotocous primates. Our results contrast existing studies and further highlight the importance of examining the TTS in species and populations with various life histories and ecologies.

<https://royalsocietypublishing.org/doi/10.1098/rsos.240597>

Science Advances**PAPERS****TORSTEN HAUFFE, JUAN L. CANTALAPIEDRA & DANIELE SILVESTRO – Trait-mediated speciation and human-driven extinctions in proboscideans revealed by unsupervised Bayesian neural networks**

Species life-history traits, paleoenvironment, and biotic interactions likely influence speciation and extinction rates, affecting species richness over time. Birth-death models inferring the impact of these factors typically assume monotonic relationships between single predictors and rates, limiting our ability to assess more complex effects and their relative importance and interaction. We introduce a Bayesian birth-death model using unsupervised neural networks to explore multifactorial and nonlinear effects on speciation and extinction rates using fossil data. It infers lineage- and time-specific rates and disentangles predictor effects and importance through explainable artificial intelligence techniques. Analysis of the proboscidean fossil record revealed speciation rates shaped by dietary flexibility and biogeographic events. The emergence of modern humans escalated extinction rates, causing recent diversity decline, while regional climate had a lesser impact. Our model paves the way for an improved understanding of the intricate dynamics shaping clade diversification.

<https://www.science.org/doi/10.1126/sciadv.adl2643>

Trends in Cognitive Sciences**PAPERS****TANYA L. PROCYSHYN, JULIETTE DUPERTUYS & JENNIFER A. BARTZ – Neuroimaging and behavioral evidence of sex-specific effects of oxytocin on human sociality**

Although the social role of oxytocin came to light due to sex-specific interactions such as mother–offspring bonding, current understanding of sex differences in the effects of oxytocin on human sociality is limited because of the predominance of all-male samples. With the increasing inclusion of females in intranasal oxytocin research, it is now possible to explore such patterns. Neuroimaging studies reveal relatively consistent sex-differential effects of oxytocin on the activation of brain regions associated with processing social stimuli – particularly the amygdala. Findings from behavioral research are varied but suggest that oxytocin more often facilitates social cognition and positive social interactions in males, with context-dependent effects in each sex. We discuss potential biological and psychological mechanisms underlying the reported sex differences, and conclude with considerations for future research and clinical applications of oxytocin.

[https://www.cell.com/trends/cognitive-sciences/fulltext/S1364-6613\(24\)00170-0](https://www.cell.com/trends/cognitive-sciences/fulltext/S1364-6613(24)00170-0)

HENRIK OLSSON & MIRTA GALESIC – Analogies for modeling belief dynamics

Belief dynamics has an important role in shaping our responses to natural and societal phenomena, ranging from climate change and pandemics to immigration and conflicts. Researchers often base their models of belief dynamics on analogies to other systems and processes, such as epidemics or ferromagnetism. Similar to other analogies, analogies for belief dynamics can help scientists notice and study properties of belief systems that they would not have noticed otherwise (conceptual mileage). However, forgetting the origins of an analogy may lead to some less appropriate inferences about belief dynamics (conceptual baggage). Here, we review various analogies for modeling belief dynamics, discuss their mileage and baggage, and offer recommendations for using analogies in model development.

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