# EAORC BULLETIN 1,056 – 10 September 2023

## CONTENTS

# NOTICES

## PUBLICATION ALERTS

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

If there is a journal you feel I should be tracking on a regular basis, let me know.
And if you have any other ideas for extending the "EAORC experience", please contact me.

## EDITORIAL INTERJECTIONS

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

## ACADEMIA.EDU – Embodied bounded rationality

**Shaun Gallagher, Riccardo Viale & Vittorio Gallese (eds.). Embodied bounded rationality. Frontiers Media SA. (2023).**
In the last 25 years, a new foundational perspective has emerged in the cognitive sciences under the title of embodied cognition. The core of embodied cognition can be expressed by the general hypothesis that cognitive processes are fundamentally rooted in the morphological traits and sensorimotor and affective systems of the human body. Thinking is based primarily on modal embodied processes rather than amodal ones. These lines of research more or less explicitly recognize the centrality of the embodied variables in economic psychology. This Research Topic aims to demonstrate that the adaptive and ecological dimensions of bounded rationality can be better analyzed by assuming an embodied cognition perspective. Several of the articles in this Research Topic consider how embodied-enactive models of cognition, and the notion of embodied rationality, compare with Herbert Simon's bounded rationality.
https://www.academia.edu/106371838/Embodied_Bounded_Rationality

# NEWS

## GUARDIAN SCIENCE – Archaeologists uncover complete Neolithic cursus on the Isle of Arran

The monument dates to between 4000 and 3000BC and is thought to be the only complete example in Britain.
https://www.theguardian.com/science/2023/sep/04/archaeologists-uncover-complete-neolithic-cursus-on-the-isle-of-arran

## JOHN TEMPLETON FOUNDATION – Are Spiritual Experiences Just In Your Head?

At the core of faith lies the profound realm of spiritual experiences. These encounters have always been the heartbeat of belief, resonating deeply with believers worldwide — and often transcending the confines of corporate worship, touching the very essence of our souls. Recent studies show that a significant 65% of American adults have reported encountering "supernatural phenomena," and an astonishing 49% have described experiencing a "mystical moment" that ignited a profound spiritual awakening. But do these personal experiences necessarily point to something that exists outside ourselves... or are they confined to human minds?
https://www.templeton.org/news/are-spiritual-experiences-just-in-your-head

## SCIENCEADVISER – Ancient human relatives were having a ball trying to perfect the sphere

For decades, archaeologists have been scratching their heads about small stone balls discovered at numerous prehistoric sites around the globe, often alongside other stone tools. Experts currently disagree about how and why these artifacts were made: Some think that they were mere byproducts of other tasks, such as the making of stone hand axes, while others believe they were intentionally designed. But evidence published this week in Royal Society Open Science suggests that the latter theory is correct.
https://www.science.org/content/article/were-these-stone-balls-made-ancient-human-relatives-trying-perfect-sphere

## SCIENCE.ORG NEWS – Human ancestors may have survived a brush with extinction 900,000 years ago

Population of our ancestors shrank to about 1300 breeding adults, modeling study suggests.
https://www.science.org/content/article/human-ancestors-may-have-survived-brush-extinction-900-000-years-ago

## SCIENCE.ORG NEWS – Humans aren't the only fat primate

Contrary to some theories, our species didn't evolve to gain weight more easily than other apes and monkeys, study finds.
https://www.science.org/content/article/humans-aren-t-only-fat-primate

## SCIENCE.ORG NEWS – Were these stone balls made by ancient humans trying to perfect the sphere?

New 3D analysis suggests 1.4-million-year-old objects were intentionally made.
https://www.science.org/content/article/were-these-stone-balls-made-ancient-human-relatives-trying-perfect-sphere

## THE CONVERSATION – Are humans evolution's ultimate destination – or not?

We may have become the most complex living creature in part by accident and replication of error.
{For a given definition of complexity – which isn't given.}
https://theconversationuk.cmail19.com/t/r-l-ttkhdlhk-khhlilahh-yd/

## OTHER NEWS – INDY100 – 148,000-year-old discovery suggests humans wore shoes then

A new analysis of ancient footprints in South Africa suggests that humans may have been wearing hard-soled sandals.
https://www.indy100.com/science-tech/middle-stone-age-footprints-shoes

## OTHER NEWS – PHYS.ORG – The sense of order that distinguishes humans from other animals

Remembering the order of information is central for a person when participating in conversations, planning everyday life, or undergoing an education. A new study, published in the journal PLoS ONE, shows that this ability is probably human unique. Even the closest relatives of humans, such as bonobos, do not learn order in the same way.
https://phys.org/news/2023-09-distinguishes-humans-animals.html

# PUBLICATIONS

## Biolinguistics

### PAPERS

**DIETER G. HILLERT & KOJI FUJITA – Pragmatic Grammar in Genus Homo**

The question of how humans got language is crucial for understanding the uniqueness of the human mind and the cognitive resources and processes shared with nonhuman species. We discuss the origin of symbolic elements in hominins and how a pragmatic grammar emerged from action-based event-structures. In the context of comparative neurobiological findings, we report support for the global workspace hypothesis and social brain hypothesis. In addition, reverse linguistic analysis informs us about the particular role of a pragmatic grammar stage. We assume that this stage was associated with changes to the hominin genotype. Homo erectus may have used a pragmatic grammar which consisted of two or three symbolic elements. Extended syntax and morphology, including hierarchical branching, are not based on genotype changes but may reflect cultural accumulations related to socioecological adaptations. We conclude that the biological capacity for language may have emerged already 1.8 million years ago with the appearance of genus Homo.
https://bioling.psychopen.eu/index.php/bioling/article/view/11911

## eLife

### PAPERS

**ALAN V. RINCON et al – Higher social tolerance is associated with more complex facial behavior in macaques**

The social complexity hypothesis for communicative complexity posits that animal societies with more complex social systems require more complex communication systems. We tested the social complexity hypothesis on three macaque species that vary in their degree of social tolerance and complexity. We coded facial behavior in >3000 social interactions across three social contexts (aggressive, submissive, affiliative) in 389 animals, using the Facial Action Coding System for macaques (MaqFACS). We quantified communicative complexity using three measures of uncertainty: entropy, specificity, and prediction error. We found that the relative entropy of facial behavior was higher for the more tolerant crested macaques as compared to the less tolerant Barbary and rhesus macaques across all social contexts, indicating that crested macaques more frequently use a higher diversity of facial behavior. The context specificity of facial behavior was higher in rhesus as compared to Barbary and crested macaques, demonstrating that Barbary and crested macaques used facial behavior more flexibly across different social contexts. Finally, a random forest classifier predicted social context from facial behavior with highest accuracy for rhesus and lowest for crested, indicating there is higher uncertainty and complexity in the facial behavior of crested macaques. Overall, our results support the social complexity hypothesis.
https://elifesciences.org/reviewed-preprints/87008

**ZILU LIANG et al – Social navigation: distance and grid-like codes support navigation of abstract social space in human brain**

People form impressions about others during daily social encounters and infer personality traits from others' behaviors. Such trait inference is thought to rely on two universal dimensions, i.e., competence and warmth. These two dimensions can be used to construct a 'social cognitive map' organizing massive information obtained from social encounters efficiently. Originated from spatial cognition, the neural codes supporting representation and navigation of spatial cognitive map has been widely studied. Recent studies suggest similar neural mechanism subserves the map-like architecture in social cognition as well. Here we investigated how spatial codes operate beyond physical environment and support the representation and navigation of social cognitive map. We designed a social value space defined by two dimensions of competence and warmth. Behaviorally, participants were able to navigate to a learned location from random starting locations in this abstract social space. At neural level, we identified representation of distance in precuneus, fusiform gyrus and middle occipital gyrus. We also found grid-like representation patterns in medial prefrontal cortex and entorhinal cortex. Moreover, the intensity of grid-like response scaled with performance of navigating in social space and social avoidance trait scores. Our findings suggest a neurocognitive mechanism by which social information can be organized into a structured representation namely cognitive map and its relevance to social well-being.
https://elifesciences.org/reviewed-preprints/89025

**AMÉLIE BEAUDET & EDWIN DE JAGER – Broca's area, variation and taxic diversity in early Homo from Koobi Fora (Kenya)**
Because brain tissues rarely fossilize, pinpointing when and how modern human cerebral traits emerged in the hominin lineage is particularly challenging. The fragmentary nature of the fossil material, coupled with the difficulty of characterizing such a complex organ, have been the source of long-standing debates. Prominent among them is the uncertainties around the derived or primitive state of the brain organization in the earliest representatives of the genus Homo, more particularly in key areas such as the Broca's area. By revisiting a particularly well-preserved fossil endocast from the Turkana basin (Kenya) attributed to early Homo, here we confirm that humans in Africa had a primitive organization of the Broca's area ca. 1.9 million years ago. Additionally, our description of KNM-ER 3732 adds further information about the variation pattern of the inferior frontal gyrus in fossil hominins, with implications for early Homo taxic diversity (i.e., one or two Homo species at Koobi Fora) and the nature of the mechanisms involved in the emergence of derived cerebral traits.
https://elifesciences.org/reviewed-preprints/89054

**NIMAY KULKARNI & BRADLEY C. LEGA – Episodic boundaries affect neural features of representational drift in humans**
A core feature of episodic memory is representational drift, the gradual change in aggregate oscillatory features that supports temporal association of memory items. However, models of drift overlook the role of episodic boundaries, which indicate a shift from prior to current context states. Our study focuses on the impact of task boundaries on representational drift in the parietal and temporal lobes in 99 subjects during a free recall task. Using intracranial EEG recordings, we show boundary representations reset gamma band drift in the medial parietal lobe, selectively enhancing the recall of early list (primacy) items. Conversely, the lateral temporal cortex shows increased drift for recalled items but lacked sensitivity to task boundaries. Our results suggest regional sensitivity to varied contextual features: the lateral temporal cortex uses drift to differentiate items, while the medial parietal lobe uses drift-resets to associate items with the current context. We propose drift represents relational information tailored to a region's sensitivity to unique contextual elements. Our findings offer a mechanism to integrate models of temporal association by drift with event segmentation by episodic boundaries.
https://elifesciences.org/reviewed-preprints/90576

## Frontiers in Language Sciences

### PAPERS

**MARIT LOBBEN et al – Tracking semantic relatedness: numeral classifiers guide gaze to visual world objects**
Directing visual attention toward items mentioned within utterances can optimize understanding the unfolding spoken language and preparing appropriate behaviors. In several languages, numeral classifiers specify semantic classes of nouns but can also function as reference trackers. Whereas all classifier types function to single out objects for reference in the real world and may assist attentional guidance, we propose that only sortal classifiers efficiently guide visual attention by being inherently attached to the nouns' semantics, since container classifiers are pragmatically attached to the nouns they classify, and the default classifiers index a noun without specifying the semantics. By contrast, container classifiers are pragmatically attached, and default classifiers index a noun without specifying the semantics. Using eye tracking and the "visual world paradigm", we had Chinese speakers (N = 20) listen to sentences and we observed that they looked spontaneously within 150 ms after offset of the Sortal classifier. After about 200 ms the same occurred for the container classifiers, but with the default classifier only after about 700 ms. This looking pattern was absent in a control group of non-Chinese speakers and the Chinese speakers' gaze behavior can therefore only be ascribed to classifier semantics and not to artifacts of the visual objects. Thus, we found that classifier types affect the rapidity of spontaneously looking at the target objects on a screen. These significantly different latencies indicate that the stronger the semantic relatedness between a classifier and its noun, the more efficient the deployment of overt attention.
https://www.frontiersin.org/articles/10.3389/flang.2023.1222982/full

## Frontiers in Psychology

### PAPERS

**YANG HU et al – Empathy and bystander helping behavior in cyberbullying among adolescents: the mediating role of internet moral judgment and the moderating role of internet self-efficacy**
Cyberbullying poses a significant challenge among adolescents. If bystanders stand up and help victims, their helping behavior may be able to reduce the frequency and negative impact of cyberbullying. This study investigates the association of empathy, internet moral judgment, and internet self-efficacy with bystander helping behavior among adolescents, building upon the empathy-altruism hypothesis, bystander intervention model, and dual-process model of morality.
A sample of 919 Chinese adolescents from 3 schools in Hunan, Jiangxi and Guangdong provinces completed the Basic Empathy Scale, Internet Moral Judgment Questionnaire, Internet Self-Efficacy Questionnaire and Styles of Bystander Intervention Scale. And we constructed a moderated mediation model to examine the relationship between empathy and bystander helping behavior in cyberbullying and assessed the mediating role of internet moral judgment and the moderating role of internet self-efficacy.

Our findings revealed a significant positive correlation between empathy and bystander helping behavior in cyberbullying. Internet moral judgment mediated the relationship between empathy and helping behavior, whereas internet self-efficacy moderated the latter half of the mediation pathway. Specifically, the association between internet moral judgment and helping behavior was stronger for bystanders with higher levels of internet self-efficacy compared with those that have lower levels.

These results further deepen our understanding of the mechanisms involved in bystander helping behavior in cyberbullying, thus providing a basis for future interventions to encourage more helping actions from bystanders during cyberbullying incidents.

https://www.frontiersin.org/articles/10.3389/fpsyg.2023.1196571/full

**GERARD J. STEEN – Thinking by metaphor, fast and slow: Deliberate Metaphor Theory offers a new model for metaphor and its comprehension**

The immense increase in metaphor theory and research over the past decades is posing a threat of fragmentation to the field, which has been responded to by calls for new and more encompassing approaches to virtually all aspects metaphorical. This article argues that the opposite response may be more productive. By focusing on a different way of theorizing metaphor and its comprehension, existing theories and data can be re-ordered in an alternative and coherent way, which moreover breaks new grounds in tying up both with a general theory for all utterance comprehension as well as a general theory for all cognition as involving fast and slow thinking. The core of the new theory highlights the differentiation between deliberate and non-deliberate metaphor use, related to how people see the use of a metaphor as a metaphor in communication, that is, as a metaphor that counts as a metaphor between language users. It shows how this distinction can be employed to make sense of many insights about metaphor and its comprehension in innovative ways. The article outlines the foundations of the new theory and discusses how existing data, old and new, can be seen as supporting the new proposals.

https://www.frontiersin.org/articles/10.3389/fpsyg.2023.1242888/full

**HAMAD AL-AZARY & ALBERT N. KATZ – On choosing the vehicles of metaphors 2.0: the interactive effects of semantic neighborhood density and body-object interaction on metaphor production**

In a metaphor, such as language is a bridge, two distinct concepts known as the topic (i.e., language) and vehicle (i.e., bridge) are juxtaposed to produce figurative meaning. Previous work demonstrated that, when creating metaphors, participants choose vehicles that are concrete, rather than abstract, and are also a moderate semantic distance away from the topic. However, little is known about the semantic representations underlying metaphor production beyond topic-vehicle semantic distance and vehicle concreteness. Here, we studied the role of two semantic richness variables in metaphor production – semantic neighborhood density (SND), which measures the proximity of a word and its associations in semantic space, and body-object interaction (BOI), which reflects the ease with which a human body can motorically interact with a word's referent. In each trial, participants were presented with an abstract topic, such as miracle, and were instructed to make an apt and comprehensible metaphor by choosing a vehicle word (e.g., lighthouse). All of the topics were abstract but half were high-SND (from dense semantic neighborhoods) and half were low-SND (from sparse semantic neighborhoods). Similarly, half of the potential vehicle words were either high or low in SND and also differed on BOI such that half were high-BOI (e.g., bicycle), whereas half were low-BOI (e.g., rainbow). We observed a three-way interaction such that participants selected low-BOI, rather than high-BOI, vehicle words when topics or vehicles were high-SND. We interpret this finding to suggest that participants attempt to reduce the overall semantic richness of their created metaphors.

https://www.frontiersin.org/articles/10.3389/fpsyg.2023.1216561/full

**FRANCESCO-ALESSIO URSINI & YUE SARA ZHANG – Place and place names: a unified model**

The goal of this paper is to offer a unified account of Place as a central theoretical notion across different disciplines. We show that while psychology, geography and other sciences have been converging to a unified view of this notion, linguistics still offers a fragmented perspective. Consequently, place names lack a full-fledged analysis that connects this category to the psychological concept of place. We propose to overcome this impasse by introducing a multi-modal Discourse Representation Theory (DRT) account of place as a conceptual construct and place concepts as specific instances of this construct. We show that current variants of DRT permit us to model place names and their senses, i.e., the meaning(s) that individuals associate with Sydney. We then model non-linguistic place concepts, i.e., the mental representation(s) that individuals can have of the city carrying this name. We present a model of the relation between linguistic meaning and conceptual content via the notion of anchoring relations applied to place. We pair this formal treatment with a morpho-syntactic account of place names building on current generative syntax treatments of proper names. Once we have a morpho-syntactic and semantic model of place names, we use a frame semantics treatment to account for lexical relations among place names. We test the overarching model on a set of recalcitrant problems afflicting current linguistic and multi-disciplinary treatments of place. These are the grammatical complexity and lexical content of place names, place concepts and their networks, and inter-subjective, communicative models of place in discourse. By solving these problems, our account integrates several frameworks (DRT, conceptual analysis, generative syntax, frame semantics) and connects several

disciplines (linguistics, psychology, geographic information science, communication models) via a novel, multi-modal account of place. We conclude by discussing the theoretical and empirical import of these results.
https://www.frontiersin.org/articles/10.3389/fpsyg.2023.1237422/full

## Heliyon

### PAPERS

**PAULO BARRAZA & EUGENIO RODRÍGUEZ – Executive functions and theory of mind in teachers and non-teachers**
Human teaching is a key behavior for the socialization of cultural knowledge. Previous studies suggest that human teaching behavior would support the development of executive and ToM skills, which in turn would refine the teaching behavior. Given this connection, it raises the question of whether subjects with professional training in teaching also have more efficient executive and ToM systems. To shed light on this issue, in the present study we compared the performance of professional teachers (N = 20, age range = 35–61 years) with a matched control group of non-teachers (N = 20, age range: 29–64 years) on tasks measuring working memory (Sternberg Task), cognitive flexibility (Wisconsin Card Sorting Test), executive control (Attention Network Test), along with online ToM skills (Frith–Happé Animations Task), emotion recognition (Reading the Mind in the Eyes Test) and first-order and second-order ToM (Yoni Task). We found that teachers were significantly more accurate on tasks involving cognitive flexibility (p = .014) and working memory (p = .040), and more efficient on tasks requiring executive control of attention (p = .046), compared to non-teachers. In ToM tasks, differences in accuracy between teachers and non-teachers were not found. But, teachers were slower to respond than non-teachers (about 2 s difference) on tasks involving emotion recognition (p = .0007) and the use of second-order affective ToM (p = .006). Collectively, our findings raise an interesting link between professional teaching and the development of cognitive skills critical for decision-making in challenging social contexts such as the classroom. Future research could explore ways to foster teachers' strengths in cognitive flexibility, working memory, and executive control of attention to enhance teaching strategies and student learning outcomes. Additionally, exploring factors behind slower response times in affective ToM tasks can guide teacher-training programs focused on interpersonal skills and improve teacher-student interactions.
https://www.cell.com/heliyon/fulltext/S2405-8440(23)07123-2

**XINRAN SHEN – Choice of cooperation strategy under demand updating and altruistic behavior**
The integration of logistics service supply chains to improve the service quality of has become the choice of many logistics integrator. This paper considers two common cooperation modes, namely, enabling cooperation and merger cooperation. Meanwhile, this paper takes demand updating and integrator's altruistic behavior into account, establishes a Stackelberg game model and draws the following key conclusions. First, this paper determines the conditions of cooperation, when provider's profit distribution ratio is in the middle, the integrator and the provider cooperate successfully and adopt the merger strategy. Second, this paper finds that demand updating affects the scope of cooperation. When demand decreases (increases), the scope of cooperation between suppliers and integrator decreases (increases). Finally, when the demand reduction degree is small, the demand updating benefits the integrator's profit. In this situation, integrator has incentive to share updated demand information to provider.
https://www.cell.com/heliyon/fulltext/S2405-8440(23)07052-4

## iScience

### PAPERS

**NIKOLAOS SMIT et al – Socially bonded females face more sexual coercion in a female-philopatric primate**
Sexual coercion is a manifestation of sexual conflict increasing male mating success while inflicting costs to females. Although previous work has examined inter-individual variation in male sexually coercive tactics, little is known about female counter-strategies. We investigated whether social bonding mitigates the extent of sexual coercion faced by female mandrills (Mandrills sphinx), as a putative mechanism linking sociality with fitness. Surprisingly, females faced the most coercion from those males with whom they formed the strongest bonds, while the strength of a female-male bond was also positively correlated with coercion from all other males. Finally, greater social integration in the female network was positively correlated with coercion, through a direct 'public exposure' mechanism and not mediated by female reproductive success or retaliation potential. Altogether, this study shows that neither between- nor within-sex bonds are protective against sexual coercion and identifies, instead, a hidden cost of social bonding.
https://www.cell.com/iscience/fulltext/S2589-0042(23)01435-9

## Nature Communications

### PAPERS

**EDWARD ARMSTRONG et al – North African humid periods over the past 800,000 years**
The Sahara region has experienced periodic wet periods over the Quaternary and beyond. These North African Humid Periods (NAHPs) are astronomically paced by precession which controls the intensity of the African monsoon system. However, most climate models cannot reconcile the magnitude of these events and so the driving mechanisms remain poorly constrained. Here, we utilise a recently developed version of the HadCM3B coupled climate model that simulates 20 NAHPs

over the past 800 kyr which have good agreement with NAHPs identified in proxy data. Our results show that precession determines NAHP pacing, but we identify that their amplitude is strongly linked to eccentricity via its control over ice sheet extent. During glacial periods, enhanced ice-albedo driven cooling suppresses NAHP amplitude at precession minima, when humid conditions would otherwise be expected. This highlights the importance of both precession and eccentricity, and the role of high latitude processes in determining the timing and amplitude of the NAHPs. This may have implications for the out of Africa dispersal of plants and animals throughout the Quaternary.
https://www.nature.com/articles/s41467-023-41219-4

## Nature Ecology & Evolution

### PAPERS

**HAMSINI SURESH et al – Comparative single-cell transcriptomic analysis of primate brains highlights human-specific regulatory evolution**

Enhanced cognitive function in humans is hypothesized to result from cortical expansion and increased cellular diversity. However, the mechanisms that drive these phenotypic innovations remain poorly understood, in part because of the lack of high-quality cellular resolution data in human and non-human primates. Here, we take advantage of single-cell expression data from the middle temporal gyrus of five primates (human, chimp, gorilla, macaque and marmoset) to identify 57 homologous cell types and generate cell type-specific gene co-expression networks for comparative analysis. Although orthologue expression patterns are generally well conserved, we find 24% of genes with extensive differences between human and non-human primates (3,383 out of 14,131), which are also associated with multiple brain disorders. To assess the functional significance of gene expression differences in an evolutionary context, we evaluate changes in network connectivity across meta-analytic co-expression networks from 19 animals. We find that a subset of these genes has deeply conserved co-expression across all non-human animals, and strongly divergent co-expression relationships in humans (139 out of 3,383, <1% of primate orthologues). Genes with human-specific cellular expression and co-expression profiles (such as NHEJ1, GTF2H2, C2 and BBS5) typically evolve under relaxed selective constraints and may drive rapid evolutionary change in brain function.
https://www.nature.com/articles/s41559-023-02186-7

## Nature Human Behaviour

### ARTICLES

**AI learns to encourage group cooperation by making new connections**

We trained an artificial intelligence (AI) system to recommend different interactions and connections between humans playing a group game together. Through trial and error, the AI system learned to take an encouraging approach to uncooperative individuals, keeping them engaged with the group and boosting cooperation levels for everyone.
https://www.nature.com/articles/s41562-023-01699-2

### PAPERS

**KEVIN R. MCKEE et al – Scaffolding cooperation in human groups with deep reinforcement learning**

Effective approaches to encouraging group cooperation are still an open challenge. Here we apply recent advances in deep learning to structure networks of human participants playing a group cooperation game. We leverage deep reinforcement learning and simulation methods to train a 'social planner' capable of making recommendations to create or break connections between group members. The strategy that it develops succeeds at encouraging pro-sociality in networks of human participants (N = 208 participants in 13 groups) playing for real monetary stakes. Under the social planner, groups finished the game with an average cooperation rate of 77.7%, compared with 42.8% in static networks (N = 176 in 11 groups). In contrast to prior strategies that separate defectors from cooperators (tested here with N = 384 in 24 groups), the social planner learns to take a conciliatory approach to defectors, encouraging them to act pro-socially by moving them to small highly cooperative neighbourhoods.
https://www.nature.com/articles/s41562-023-01686-7

## Nature Science of Learning

### PAPERS

**FEI GAO et al – Shared and distinct neural correlates of first and second language morphological processing in bilingual brain**

While morphology constitutes a crucial component of the human language system, the neural bases of morphological processing in the human brain remains to be elucidated. The current study aims at exploring the extent to which the second language (L2) morphological processing would resemble or differ from that of their first language (L1) in adult Chinese-English bilinguals. Bilingual participants were asked to complete a morphological priming lexical decision task drawing on derivational morphology, which is present for both Chinese and English, when their electrophysiological and optical responses were recorded concurrently. Functional near-infrared spectroscopy (fNIRS) revealed a neural dissociation between morphological and semantic priming effects in the left fronto-temporal network, while L1 Chinese engaged enhanced

activation in the left prefrontal cortex for morphological parsing relative to L2 English. In the early stage of lexical processing, cross-language morphological processing manifested a difference in degree, not in kind, as revealed by the early left anterior negativity (ELAN) effect. In addition, L1 and L2 shared both early and late structural parsing processes (P250 and 300 ~ 500 ms negativity, respectively). Therefore, the current results support a unified competition model for bilingual development, where bilinguals would primarily employ L1 neural resources for L2 morphological representation and processing.
https://www.nature.com/articles/s41539-023-00184-9

## Nature Scientific Data

### PAPERS

**SHUMON T. HUSSAIN et al with FELIX RIEDE – A pan-European dataset revealing variability in lithic technology, toolkits, and artefact shapes ~15-11 kya**

Comparative macro-archaeological investigations of the human deep past rely on the availability of unified, quality-checked datasets integrating different layers of observation. Information on the durable and ubiquitous record of Paleolithic stone artefacts and technological choices are especially pertinent to this endeavour. We here present a large expert-sourced collaborative dataset for the study of stone tool technology and artefact shape evolution across Europe between ~15.000 and 11.000 years before present. The dataset contains a compendium of key sites from the study period, and data on lithic technology and toolkit composition at the level of the cultural taxa represented by those sites. The dataset further encompasses 2D shapes of selected lithic artefact groups (armatures, endscrapers, and borers/perforators) shared between cultural taxa. These data offer novel possibilities to explore between-regional patterns of material culture change to reveal scale-dependent processes of long-term technological evolution in mobile hunter-gatherer societies at the end of the Pleistocene. Our dataset facilitates state-of-the-art quantitative analyses and showcases the benefits of collaborative data collation and synthesis.
https://www.nature.com/articles/s41597-023-02500-9

## Nature Scientific Reports

### PAPERS

**PAUL R. B. KOZOWYK, SEBASTIAN FAJARDO & GEESKE H. J. LANGEJANS – Scaling Palaeolithic tar production processes exponentially increases behavioural complexity**

Technological processes, reconstructed from the archaeological record, are used to study the evolution of behaviour and cognition of Neanderthals and early modern humans. In comparisons, technologies that are more complex infer more complex behaviour and cognition. The manufacture of birch bark tar adhesives is regarded as particularly telling and often features in debates about Neanderthal cognition. One method of tar production, the 'condensation technique', demonstrates a pathway for Neanderthals to have discovered birch bark tar. However, to improve on the relatively low yield, and to turn tar into a perennial innovation, this method likely needed to be scaled up. Yet, it is currently unknown how scaling Palaeolithic technological processes influences their complexity. We used Petri net models and the Extended Cyclomatic Metric to measure system complexity of birch tar production with a single and three concurrent condensation assemblies. Our results show that changing the number of concurrent tar production assemblies substantially increases the measured complexity. This has potential implications on the behavioural and cognitive capacities required by Neanderthals, such as an increase in cooperation or inhibition control.
https://www.nature.com/articles/s41598-023-41963-z

**PAUL R. B. KOZOWYK, LILIANA I. BARON & GEESKE H. J. LANGEJANS – Identifying Palaeolithic birch tar production techniques: challenges from an experimental biomolecular approach**

The intentional production of birch bark tar by European Neanderthals as early as 190,000 years ago plays an important role in discussions about the technological and behavioural complexity of Pleistocene hominins. However, research is hampered because it is currently unknown how Neanderthals were producing birch tar. There are several different techniques that could have been employed, but these differ in their apparent production complexity, time and resource efficiency. Identifying production processes in the archaeological record is therefore paramount for furthering research on the technical behavioural repertoire. Organic biomarkers, identified with Gas Chromatograph–Mass Spectrometry (GC–MS), have been used to identify possible production processes during the Neolithic. Here we test whether these biomarkers can also distinguish Palaeolithic (aceramic) tar production methods. We produced tar using five different methods and analysed their biomolecular composition with GC–MS. Our results show that the biomarkers used to distinguish Neolithic tar production strategies using ceramic technology cannot be reliably used to identify tar production processes using aceramic Palaeolithic techniques. More experimentation is required to produce a larger reference library of different tars for future comparisons. To achieve this, complete GC–MS datasets must also be made publicly available, as we have done with our data.
https://www.nature.com/articles/s41598-023-41898-5

**MATKO GLUNČIĆ et al – Tandem NBPF 3mer HORs (Olduvai triplets) in Neanderthal and two novel HOR tandem arrays in human chromosome 1 T2T-CHM13 assembly**

It is known that the ~ 1.6 kb Neuroblastoma BreakPoint Family (NBPF) repeats are human specific and contributing to cognitive capabilities, with increasing frequency in higher order repeat 3mer HORs (Olduvai triplets). From chimpanzee to modern human there is a discontinuous jump from 0 to ~ 50 tandemly organized 3mer HORs. Here we investigate the structure of NBPF 3mer HORs in the Neanderthal genome assembly of Pääbo et al., comparing it to the results obtained for human hg38.p14 chromosome 1. Our findings reveal corresponding NBPF 3mer HOR arrays in Neanderthals with slightly different monomer structures and numbers of HOR copies compared to humans. Additionally, we compute the NBPF 3mer HOR pattern for the complete telomere-to-telomere human genome assembly (T2T-CHM13) by Miga et al., identifying two novel tandem arrays of NBPF 3mer HOR repeats with 5 and 9 NBPF 3mer HOR copies. We hypothesize that these arrays correspond to novel NBPF genes (here referred to as NBPFA1 and NBPFA2). Further improving the quality of the Neanderthal genome using T2T-CHM13 as a reference would be of great interest in determining the presence of such distant novel NBPF genes in the Neanderthal genome and enhancing our understanding of human evolution.
https://www.nature.com/articles/s41598-023-41517-3

**DANIELA EUGENIA ROSSO, MARTINE REGERT & FRANCESCO D'ERRICO – First identification of an evolving Middle Stone Age ochre culture at Porc-Epic Cave, Ethiopia**

The use of mineral pigments, in particular iron-rich rocks, holds significant importance in understanding the emergence and evolution of human cultures. However, sites that have yielded a number of pieces large enough to precisely identify how the use of this material changed through time are rare. In this study, we examine one of the largest known Middle Stone Age (MSA) ochre collections, from Porc-Epic Cave, Ethiopia, consisting of more than 40 kg of ochre (n = 4213 pieces), 21 ochre processing tools and two ochre-stained artefacts. By combining the analysis of the elemental and mineralogical composition of the archaeological material with that of natural ochre collected in the surroundings of the site, and correlating this information with shifts in ochre modification techniques over time, we unveil how MSA inhabitants of Porc-Epic Cave exploited mineral resources. We show that they could predict the properties of different ochre types accessible in their environment, and gradually adapted their technology to cope with changes in raw material availability. Furthermore, the analysis of ochre residues on a painted pebble, likely used to produce red dots on a surface, identifies an ochre type that was specifically employed for symbolic purposes.
https://www.nature.com/articles/s41598-023-39957-y

## Neuron

### PAPERS

**SIMONE FERRARI-TONIOLO & WOLFRAM SCHULTZ – Reliable population code for subjective economic value from heterogeneous neuronal signals in primate orbitofrontal cortex**

Behavior-related neuronal signals often vary between neurons, which might reflect the unreliability of individual neurons or a truly heterogeneous code. This notion may also apply to economic ("value-based") choices and the underlying reward signals. Reward value is subjective and can be described by a nonlinearly weighted magnitude (utility) and probability. Defining subjective values relies on the continuity axiom, whose testing involves structured variations of a wide range of reward magnitudes and probabilities. Axiom compliance demonstrates understanding of the stimuli and the meaningful character of choices. Using these tests, we investigated the encoding of subjective economic value by neurons in a key economic-decision structure of the monkey brain, the orbitofrontal cortex (OFC). We found that individual neurons carry heterogeneous neuronal value signals that largely fail to match the animal's choices. However, neuronal population signals matched the animal's choices well, suggesting accurate subjective economic value encoding by a heterogeneous population of unreliable neurons.
https://www.cell.com/neuron/fulltext/S0896-6273(23)00620-7

## New Scientist

### NEWS

**Ancient humans may have worn shoes more than 100,000 years ago**

Three archaeological sites in South Africa feature impressions that might have been made by ancient footwear, but pinpointing when humans first wore shoes is challenging.
https://www.newscientist.com/article/2389497-ancient-humans-may-have-worn-shoes-more-than-100000-years-ago/

**Cave art pigments show how ancient technology changed over 4500 years**

The source of ochre minerals used by Stone Age humans in an Ethiopian cave changed over a 4500-year period, although it is unclear why.
https://www.newscientist.com/article/2391272-cave-art-pigments-show-how-ancient-technology-changed-over-4500-years/

**Our ancestors may have come close to extinction 900,000 years ago**
A genetic analysis suggests our ancestral population fell as low as around 1300 individuals nearly a million years ago, but other experts aren't convinced.
https://www.newscientist.com/article/2390124-our-ancestors-may-have-come-close-to-extinction-900000-years-ago/

## Philosophical Transactions of the Royal Society B

### PAPERS

**HERMAN PONTZER – The provisioned primate: patterns of obesity across lemurs, monkeys, apes and humans**
Non-human primates are potentially informative but underutilized species for investigating obesity. I examined patterns of obesity across the Primate order, calculating the ratio of body mass in captivity to that in the wild. This index, relative body mass, for n = 40 non-human primates (mean ± s.d.: females: 1.28 ± 0.30, range 0.67–1.78, males: 1.24 ± 0.28, range 0.70–1.97) overlapped with a reference value for humans (women: 1.52, men: 1.44). Among non-human primates, relative body mass was unrelated to dietary niche, and was marginally greater among female cohorts of terrestrial species. Males and females had similar relative body masses, but species with greater sexual size dimorphism (male/female mass) in wild populations had comparatively larger female body mass in captivity. Provisioned populations in wild and free-ranging settings had similar relative body mass to those in research facilities and zoos. Compared to the wild, captive diets are unlikely to be low in protein or fat, or high in carbohydrate, suggesting these macronutrients are not driving overeating in captive populations. Several primate species, including chimpanzees, a sister-species to humans, had relative body masses similar to humans. Humans are not unique in the propensity to overweight and obesity.
https://royalsocietypublishing.org/doi/10.1098/rstb.2022.0218

## PLoS Biology

### PAPERS

**GAIL L. PATRICELLI – Behavioral ecology: New technology enables a more holistic view of complex animal behavior**
Behavior is more than just a suite of traits; it is the crux where the inside of the organism meets and interacts with the external environment. On the inside of the organism, behavior emerges through an interaction of genetic, physiological, cognitive, and developmental processes, which can be affected, in turn, by that organism's behavior and experience. Behavior is also how organisms respond to—and influence—the biotic and physical environment, which includes potential mates, rivals, offspring, group members, predators, prey, and pathogens—all with their own behaviors—interacting amidst changing seasons and climates. And behaviors may manifest at multiple scales, from individuals to swarms. For the past 20 years and going forward, many of the exciting frontiers in the study of animal behavior involve grappling with this complexity in a more holistic way, examining the causes and functions of variability in behavior over space and time, and scaling up from components to systems, examining interaction networks that function as a whole.
https://journals.plos.org/plosbiology/article?id=10.1371/journal.pbio.3002264

## PLoS One

### PAPERS

**JOHAN LIND et al with MAGNUS ENQUIST – A test of memory for stimulus sequences in great apes**
Identifying cognitive capacities underlying the human evolutionary transition is challenging, and many hypotheses exist for what makes humans capable of, for example, producing and understanding language, preparing meals, and having culture on a grand scale. Instead of describing processes whereby information is processed, recent studies have suggested that there are key differences between humans and other animals in how information is recognized and remembered. Such constraints may act as a bottleneck for subsequent information processing and behavior, proving important for understanding differences between humans and other animals. We briefly discuss different sequential aspects of cognition and behavior and the importance of distinguishing between simultaneous and sequential input, and conclude that explicit tests on non-human great apes have been lacking. Here, we test the memory for stimulus sequences-hypothesis by carrying out three tests on bonobos and one test on humans. Our results show that bonobos' general working memory decays rapidly and that they fail to learn the difference between the order of two stimuli even after more than 2,000 trials, corroborating earlier findings in other animals. However, as expected, humans solve the same sequence discrimination almost immediately. The explicit test on whether bonobos represent stimulus sequences as an unstructured collection of memory traces was not informative as no differences were found between responses to the different probe tests. However, overall, this first empirical study of sequence discrimination on non-human great apes supports the idea that non-human animals, including the closest relatives to humans, lack a memory for stimulus sequences. This may be an ability that sets humans apart from other animals and could be one reason behind the origin of human culture.
https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0290546

## Proceedings of the Royal Society B

### PAPERS

**SHIJIA HUA, ZITONG HUI & LINJIE LIU – Evolution of conditional cooperation in collective-risk social dilemma with repeated group interactions**

The evolution and long-term sustenance of cooperation has consistently piqued scholarly interest across the disciplines of evolutionary biology and social sciences. Previous theoretical and experimental studies on collective risk social dilemma games have revealed that the risk of collective failure will affect the evolution of cooperation. In the real world, individuals usually adjust their decisions based on environmental factors such as risk intensity and cooperation level. However, it is still not well understood how such conditional behaviours affect the evolution of cooperation in repeated group interactions scenario from a theoretical perspective. Here, we construct an evolutionary game model with repeated interactions, in which defectors decide whether to cooperate in subsequent rounds of the game based on whether the risk exceeds their tolerance threshold and whether the number of cooperators exceeds the collective goal in the early rounds of the game. We find that the introduction of conditional cooperation strategy can effectively promote the emergence of cooperation, especially when the risk is low. In addition, the risk threshold significantly affects the evolutionary outcomes, with a high risk promoting the emergence of cooperation. Importantly, when the risk of failure to reach collective goals exceeds a certain threshold, the timely transition from a defective strategy to a cooperative strategy by conditional cooperators is beneficial for maintaining high-level cooperation.
https://royalsocietypublishing.org/doi/10.1098/rspb.2023.0949

## Royal Society Open Science

### PAPERS

**LUKE D. FANNIN et al – Downclimbing and the evolution of ape forelimb morphologies**

The forelimbs of hominoid primates (apes) are decidedly more flexible than those of monkeys, especially at the shoulder, elbow and wrist joints. It is tempting to link the greater mobility of these joints to the functional demands of vertical climbing and below-branch suspension, but field-based kinematic studies have found few differences between chimpanzees and monkeys when comparing forelimb excursion angles during vertical ascent (upclimbing). There is, however, a strong theoretical argument for focusing instead on vertical descent (downclimbing), which motivated us to quantify the effects of climbing directionality on the forelimb kinematics of wild chimpanzees (Pan troglodytes) and sooty mangabeys (Cercocebus atys). We found that the shoulders and elbows of chimpanzees and sooty mangabeys subtended larger joint angles during bouts of downclimbing, and that the magnitude of this difference was greatest among chimpanzees. Our results cast new light on the functional importance of downclimbing, while also burnishing functional hypotheses that emphasize the role of vertical climbing during the evolution of apes, including the human lineage.
https://royalsocietypublishing.org/doi/10.1098/rsos.230145

**DOR SHILTON, SAM PASSMORE & PATRICK E. SAVAGE – Group singing is globally dominant and associated with social context**

Music is an interactive technology associated with religious and communal activities and was suggested to have evolved as a participatory activity supporting social bonding. In post-industrial societies, however, music's communal role was eclipsed by its relatively passive consumption by audiences disconnected from performers. It was suggested that as societies became larger and more differentiated, music became less participatory and more focused on solo singing. Here, we consider the prevalence of group singing and its relationship to social organization through the analysis of two global song corpora: 5776 coded audio recordings from 1024 societies, and 4709 coded ethnographic texts from 60 societies. In both corpora, we find that group singing is more common than solo singing, and that it is more likely in some social contexts (e.g. religious rituals, dance) than in others (e.g. healing, infant care). In contrast, relationships between group singing and social structure (community size or social differentiation) were not consistent within or between corpora. While we cannot exclude the possibility of sampling bias leading to systematic under-sampling of solo singing, our results from two large global corpora of different data types provide support for the interactive nature of music and its complex relationship with sociality.
https://royalsocietypublishing.org/doi/10.1098/rsos.230562

**ANTOINE MULLER et al – The limestone spheroids of 'Ubeidiya: intentional imposition of symmetric geometry by early hominins?**

Spheroids are one of the least understood lithic items yet are one of the most enduring, spanning from the Oldowan to the Middle Palaeolithic. Why and how they were made remains highly debated. We seek to address whether spheroids represent unintentional by-products of percussive tasks or if they were intentionally knapped tools with specific manufacturing goals. We apply novel three-dimensional analysis methods, including spherical harmonics and surface curvature, to 150 limestone spheroids from 'Ubeidiya (ca 1.4 Ma), presently the earliest Acheulean occurrence outside of Africa, to bring a new perspective to these enigmatic artefacts. We reconstruct the spheroid reduction sequence based on trends in their scar facets and geometry, finding that the spheroid makers at 'Ubeidiya followed a premeditated reduction strategy. During their manufacture, the spheroids do not become smoother, but they become markedly more spherical. They approach an ideal

sphere, a feat that likely required skilful knapping and a preconceived goal. Acheulean bifaces are currently thought to represent the earliest evidence of hominins imposing a premeditated, symmetrical shape on stone. The intentional production of sphere-like objects at 'Ubeidiya similarly shows evidence of Acheulean hominins desiring and achieving intentional geometry and symmetry in stone.
https://royalsocietypublishing.org/doi/10.1098/rsos.230671

## Trends in Cognitive Sciences

**PAPERS**

**SIXIN LIAO et al with ERIK D. REICHLE – Dynamic reading in a digital age: new insights on cognition**
People increasingly read text displayed on digital devices, including computers, handheld e-readers, and smartphones. Given this, there is rapidly growing interest in understanding how the cognitive processes that support the reading of static text (e.g., books, magazines, or newspapers) might be adapted to reading digital texts. Evidence from recent experiments suggests a complex interplay of visual and cognitive influences on how people engage with digital reading. Although readers can strategically adjust their reading behaviors in response to their immediate reading context, the efficacy of these strategies depends on cognitive, metacognitive, and motivational factors. A better understanding of the factors that influence reading offers the promise of leveraging digital technologies to enhance the reading experience.
https://www.cell.com/trends/cognitive-sciences/fulltext/S1364-6613(23)00198-5

**GAIA MOLINARO & ANNE G.E. COLLINS – A goal-centric outlook on learning**
Goals play a central role in human cognition. However, computational theories of learning and decision-making often take goals as given. Here, we review key empirical findings showing that goals shape the representations of inputs, responses, and outcomes, such that setting a goal crucially influences the central aspects of any learning process: states, actions, and rewards. We thus argue that studying goal selection is essential to advance our understanding of learning. By following existing literature in framing goal selection within a hierarchy of decision-making problems, we synthesize important findings on the principles underlying goal value attribution and exploration strategies. Ultimately, we propose that a goal-centric perspective will help develop more complete accounts of learning in both biological and artificial agents.
https://www.cell.com/trends/cognitive-sciences/fulltext/S1364-6613(23)00207-3

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