# EAORC BULLETIN 1,049 – 23 July 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 – Beyond the Tools: Social Innovation and Hominin Evolution
*PaleoAnthropology 2011, 111-129. (2011).*

**FIONA COWARD & MATT GROVE – Beyond the Tools: Social Innovation and Hominin Evolution**

Archaeological interest in innovation traditionally focuses on creativity in material culture and, in the case of the Paleolithic, particularly on the changing morphology of stone tools. However, this is only one result of a constellation of innovative processes that occur both between and within hominin groups evolving towards the unique modern human lifeway. The adaptations scaffolding such innovative processes include not only the cognitive mechanisms and biological and skeletal adaptations that underpin technological innovation and cultural transmission, but also the behavioral strategies pursued by hominin groups and individuals. In this paper, we draw from a Social Brain approach to argue that it is hominins' innovative social and group-oriented behavioral strategies that drive technological developments and distinguish us from other primates. A variety of models and methodologies developed to investigate the interrelationships between the crucial ecological, social, and behavioral variables are reviewed here for an archaeological audience in order to stimulate research to test and refine these models with archaeological data.

https://www.academia.edu/800340/Coward_F_and_Grove_M_Beyond_the_tools_social_innovation_and_hominin_evolution

## ACADEMIA.EDU – Networks, environments and material culture in the Epipalaeolithic and early Neolithic
*In Carl Knappett (ed.), Network Analysis in Archaeology: New approaches to regional interaction, Oxford University Press (2013).*

**FIONA COWARD – Grounding the Net: Networks, environments and material culture in the Epipalaeolithic and early Neolithic of the Near East**

This chapter first briefly discusses the basis for empirically studying social change using social network analysis to analyse patterns of material culture distribution in order to infer social relations between and within groups in prehistory. It then reviews previous work in this area before focusing on this issue of the significance of geography for the structure of social networks by examining the interaction between material and social networks over the course of the Epipalaeolithic and early Neolithic periods. In particular, it looks at one significant aspect of the scaling-up of social systems that may have occurred over this period — that of the increasing supplementing of relationships based largely on geographical proximity with largely, if not completely, a-spatial 'weak ties'.

https://www.academia.edu/24638108/Grounding_the_net_networks_environments_and_material_culture_in_the_Epipalaeolithic_and_early_Neolithic_of_the_Near_East

## RESEARCHGATE – Animal communication and language evolution in introductory linguistics textbooks
*Journal of Language Evolution 7:2 (2023).*

**SLAWOMIR WACEWICZ et al with PRZEMYSŁAW ŻYWICZYŃSKI – The representation of animal communication and language evolution in introductory linguistics textbooks**

The last three decades have brought a wealth of new empirical data and methods that have transformed investigations of language evolution into a fast-growing field of scientific research. In this paper, we investigate how the results of this research are represented in the content of the most popular introductory linguistic textbooks. We carried out a comprehensive computer-assisted qualitative study, in which we inspected eighteen English-language textbooks for all content related to the evolutionary emergence of language and its uniqueness in nature, in order to evaluate its thematic scope, selection of topics, theories covered, researchers cited, structural soundness, currency, and factual accuracy. Overall, we found that the content of interest lacks a defined canonical representation across the textbooks. The coverage of animal communication was relatively broad, with some recurring classic examples, such as vervet monkeys or honeybees; this content was mostly structured around the 'design features' approach. In contrast, the coverage of topics related to language origins and evolution was much less extensive and systematic, and tended to include a relatively large the proportion of content of historical value (i.e. creation myths, 'bow-wow' theories). We conclude by making recommendations for future editions of textbooks, in particular, a better representation of important frameworks such as signalling theory, and of current research results in this fast-paced field.

https://www.researchgate.net/publication/370115215_The_representation_of_animal_communication_and_language_evolution_in_introductory_linguistics_textbooks

## RESEARCHGATE – Experimental Semiotics: the Bootstrapping of Communication Systems
*Biosemiotics (2023).*

**ANGELO DELLIPONTI et al with PRZEMYSŁAW ŻYWICZYŃSKI & SŁAWOMIR WACEWICZ – Experimental Semiotics: A Systematic Categorization of Experimental Studies on the Bootstrapping of Communication Systems**

Experimental Semiotics (ES) is the study of novel forms of communication that communicators develop in laboratory tasks whose designs prevent them from using language. Thus, ES relates to pragmatics in a "pure," radical sense, capturing the process of creating the relation between signs and their interpreters as biological, psychological, and social agents. Since such

a creation of meaning-making from scratch is of central importance to language evolution research, ES has become the most prolific experimental approach in this field of research. In our paper, we report the results of a study on the scope of recent ES and evaluate the ways in which it is relevant to the study of language origins. We coded for multiple levels across 13 dimensions related to the properties of the emergent communication systems or properties of the study designs, such as type of goal (coordination versus referential), modality of communication, absence or presence of turn-taking, or the presence of vertical vs. horizontal transmission. We discuss our findings and our classification, focusing on the advantages and limitations of those trends in ES, and in particular their ecological validity in the context of bootstrapping communication and the evolution of language.

https://www.researchgate.net/publication/370774927_Experimental_Semiotics_A_Systematic_Categorization_of_Experimental_Studies_on_the_Bootstrapping_of_Communication_Systems

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## PREPRINTS – Linguistic preference outcompetes alignment as a predictor for assessing cooperativeness

**THERESA MATZINGER et al with PRZEMYSŁAW ŻYWICZYŃSKI & SLAWOMIR WACEWICZ – Linguistic preference outcompetes alignment as a predictor for assessing others' cooperativeness**

An important quality to assess in others is their cooperativeness. Since linguistic communication requires a high degree of cooperation between interaction partners, 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 suggests that general linguistic alignedness, which is a potential indicator of group membership and may be associated with in-group cooperation benefits such as reputation, reciprocity and normative behavior, is a more important predictor of cooperation partner choice than dynamic alignment, which can be regarded as a first cognitive investment in the cooperation or a signal of out-groups showing the willingness to adapt. This has important implications for communication in intercultural settings where members of diverse linguistic groups negotiate cooperative actions.

https://www.researchgate.net/publication/370146357_Linguistic_preference_outcompetes_alignment_as_a_predictor_for_assessing_others'_cooperativeness

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## PREPRINTS – Dissociating language and thought in large language models: a cognitive perspective

**KYLE MAHOWALD et al with NANCY KANWISHER – Dissociating language and thought in large language models: a cognitive perspective**

Today's large language models (LLMs) routinely generate coherent, grammatical and seemingly meaningful paragraphs of text. This achievement has led to speculation that these networks are -- or will soon become -- "thinking machines", capable of performing tasks that require abstract knowledge and reasoning. Here, we review the capabilities of LLMs by considering their performance on two different aspects of language use: 'formal linguistic competence', which includes knowledge of rules and patterns of a given language, and 'functional linguistic competence', a host of cognitive abilities required for language understanding and use in the real world. Drawing on evidence from cognitive neuroscience, we show that formal competence in humans relies on specialized language processing mechanisms, whereas functional competence recruits multiple extralinguistic capacities that comprise human thought, such as formal reasoning, world knowledge, situation modeling, and social cognition. In line with this distinction, LLMs show impressive (although imperfect) performance on tasks requiring formal linguistic competence, but fail on many tests requiring functional competence. Based on this evidence, we argue that (1) contemporary LLMs should be taken seriously as models of formal linguistic skills; (2) models that master real-life language use would need to incorporate or develop not only a core language module, but also multiple non-language-specific cognitive capacities required for modeling thought. Overall, a distinction between formal and functional linguistic competence helps clarify the discourse surrounding LLMs' potential and provides a path toward building models that understand and use language in human-like ways.

https://arxiv.org/abs/2301.06627

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## PREPRINTS – Modern language models refute Chomsky's approach to language

*lingbuzz/007180 (2023).*

**STEVEN PIANTADOSI – Modern language models refute Chomsky's approach to language**

The rise and success of large language models undermines virtually every strong claim for the innateness of language that has been proposed by generative linguistics. Modern machine learning has subverted and bypassed the entire theoretical framework of Chomsky's approach, including its core claims to particular insights, principles, structures, and processes. I describe the sense in which modern language models implement genuine theories of language, including representations of syntactic and semantic structure. I highlight the relationship between contemporary models and prior approaches in linguistics, namely those based on gradient computations and memorized constructions. I also respond to several critiques of

large language models, including claims that they can't answer ``why'' questions, and skepticism that they are informative about real life acquisition. Most notably, large language models have attained remarkable success at discovering grammar without using any of the methods that some in linguistics insisted were necessary for a science of language to progress.
https://lingbuzz.net/lingbuzz/007180

# NEWS

## BBC – The languages that make maths easier
Language can influence how quickly kids learn to count – but does it make a difference in the long run?
https://www.bbc.com/future/article/20230511-whats-the-best-language-for-learning-maths

## NATURE BRIEFING – Genetic map of human bipedalism
A map of genomic regions that could explain the evolution of our unique skeletal architecture, which enables us to walk upright. Researchers used deep learning to analyse measurements from whole-body X-rays of more than 31,000 people, and combined them with their genetic data. One hallmark of walking upright is having longer legs relative to arms; another is narrower hips. Genomic regions linked to these features bore signs of evolutionary selection in humans. The work also points to regions of our DNA that place us at risk of the common skeletal disease osteoarthritis.
https://nature.us17.list-manage.com/track/click?u=2c6057c528fdc6f73fa196d9d&id=7b55b9fc4d&e=1db4b9a19b

## SAPIENS – The Humans We Haven't Met Yet
One anthropologist contends that far too many species have been lumped into one category: Our story is more complicated, he argues.
https://www.sapiens.org/biology/human-fossil-record/

## SAPIENS – How We Found an Elusive Hominin in China
An ancient jawbone collected by a monk has been identified as the first Denisovan discovered outside of Siberia.
https://www.sapiens.org/biology/xiahe-jaw-denisovan/

## SAPIENS – New Hominin Shakes the Family Tree—Again
What does the discovery of Homo luzonensis mean for our understanding of humanity's history?
https://www.sapiens.org/biology/homo-luzonensis-discovery/

## SCIENCE.ORG NEWS – Costly invite? Scientists hit with massive bills after speaking at COVID-19 'webinars'
Researchers are fighting back against a mysterious conference organizer and an arbitration court that may not exist.
https://www.science.org/content/article/costly-invite-scientists-hit-with-massive-bills-after-speaking-at-covid-19-conferences

## SCIENCE.ORG NEWS – Male killer whales are mamma's boys
When male killer whales fight, their moms rise to their defense—and by doing so, may help boost the odds that the family's genes will be passed on, according to a new study in Current Biology.
https://www.science.org/content/article/killer-whale-moms-protect-their-sons-fights-other-whales

## THE CONVERSATION – Classic psychology warped our view of human nature as cruel and selfish
Modern psychologists are challenging classic studies that portrayed humanity as individualistic.
https://theconversationuk.cmail20.com/t/r-l-ttddthn-khhlilahh-p/

## THE CONVERSATION – Drawing in the sand at the beach? Our ancestors did the same 140,000 years ago
Ammoglyphs – ancient 'sand art' – are a relatively new find.
https://theconversationuk.cmail20.com/t/r-l-ttddthn-khhlilahh-v/

# PUBLICATIONS

## American Journal of Biological Anthropology

### PAPERS

**ANGELA ACHORN et al with JILL D. PRUETZ – Reciprocity and beyond: Explaining meat transfers in savanna-dwelling chimpanzees at Fongoli, Senegal**

To understand the function of food sharing among our early hominin ancestors, we can turn to our nonhuman primate relatives for insight. Here, we examined the function of meat sharing by Fongoli chimpanzees, a community of western chimpanzees (Pan troglodytes verus) in southeastern Sénégal.

We tested three non-mutually exclusive hypotheses that have been used to explain patterns of food sharing: kin selection, generalized reciprocity, and meat-for-mating opportunities. We analyzed meat sharing events (n = 484) resulting from hunts, along with data on copulations, age-sex class, and kinship to determine which variables predict the likelihood of meat sharing during this study period (2006–2019).

We found full or partial support for kin selection, direct reciprocity, and meat-for-mating-opportunities. However, the analyses reveal that reciprocity and a mother/offspring relationship were the strongest predictors of whether or not an individual shared meat.

The results of this study emphasize the complexity of chimpanzee meat sharing behaviors, especially at a site where social tolerance offers increased opportunities for meat sharing by individuals other than dominant males. These findings can be placed in a referential model to inform hypotheses about the sensitivity of food sharing to environmental pressures, such as resource scarcity in savanna landscapes.

https://onlinelibrary.wiley.com/doi/abs/10.1002/ajpa.24815

**ALEXANDRA M. GREENWALD et al – Sex-biased parental investment and female wealth accumulation in ancient California**

The mortuary record at Middle Period site Kalawwasa Rummeytak (CA-SCL-134) (2600-1225 cal BP) in California's southern Santa Clara Valley shows pronounced wealth inequality; Olivella shell bead wealth, as well as other grave goods, are concentrated in the burials of several older adult females. The concentration of wealth among women, along with regional strontium isotopic evidence of male-biased residential shifts in early adulthood, suggests a matrilineal kinship system that practiced matrilocal post-marital residence patterns. We suggest local resource enhancement effects incentivized keeping women in their natal communities and investing more in female offspring.

With the consent of, and in collaboration with, the Muwekma Ohlone Tribe of the San Francisco Bay Area, this paper employs isotopic analysis ($\delta15N$ and $\delta13C$, 86Sr/87Sr) to examine duration of exclusive breastfeeding, weaning age (complete cessation of breastmilk consumption), early childhood diet, and lifetime residential mobility of individuals interred at Kalawwasa Rummeytak to test the assumption that the site inhabitants favored matrilocality and that female offspring received greater levels of investment in groups with female wealth/status attainment. First molars, third molars, and bone was sampled from 22 individuals.

The average weaning age for females at Kalawwasa Rummeytak is 36.3 months ± 9.7 (1 SD), or just over 3 years. The average weaning age for males is 31.2 ± 7.9 months (1 SD), or about 2.6 years. Infants at the site were provisioned with supplemental foods dominated by C3 plants and terrestrial herbivores, as well as anadromous fish. After weaning, individuals consumed a diet dominated by acorns, C3 plants, and terrestrial herbivores, with periodic inclusion of anadromous fish. 30% of the sampled population of females exhibit local first molar 87Sr/86Sr values, suggesting that Kalawwasa Rummeytak is their natal community. None of the males interred at the site are locals.

Despite the small sample size often unavoidable in archaeological contexts, we find possible female-biased parental investment strategies. Cessation of breastfeeding (weaning) was, on average, 5 months earlier for males compared to females. There are no differences between females and males in the consumption of supplemental or post-weaning foods. Strontium data suggest a flexible postmarital residence system that favored matrilocality. This may have incentivized greater investment in female offspring.

https://onlinelibrary.wiley.com/doi/abs/10.1002/ajpa.24806

### REVIEWS

**KEVIN A. BIRD – What's DNA got to say about who you are?**

Review of 'Ancestry reimagined: Dismantling the myth of genetic ethnicities' by Kostas Kampourakis (Ed.), Oxford University Press, 2023.

https://onlinelibrary.wiley.com/doi/abs/10.1002/ajpa.24813

# Biology Letters

## PAPERS

### XIAOQIAN SUN et al – Keep numbers in view: red-eared sliders (Trachemys scripta elegans) learn to discriminate relative quantities

The ability to discriminate relative quantities, one of the numerical competences, is considered an adaptive trait in uncertain environments. Besides humans, previous studies have reported this capacity in several non-human primates and birds. Here, we test whether red-eared sliders (Trachemys scripta elegans) can discriminate different relative quantities. Subjects were first trained to distinguish different stimuli with food reward. Then, they were tested with novel stimulus pairs to demonstrate how they distinguished the stimuli. The results show that most subjects can complete the initial training and use relative quantity rather than absolute quantity to make choices during the testing phase. This study provides behavioural evidence of relative quantity discrimination in a reptile species and suggests that such capacity may be widespread among vertebrates.

https://royalsocietypublishing.org/doi/10.1098/rsbl.2023.0203

# Cell Reports Medicine

## ARTICLES

### ANNE-LISE GIRAUD & YAQING SU – Reconstructing language from brain signals and deconstructing adversarial thought-reading

Tang et al. report a noninvasive brain-computer interface (BCI) that reconstructs perceived and intended continuous language from semantic brain responses. The study offers new possibilities to radically facilitate neural speech decoder applications and addresses concerns about misuse in non-medical scenarios.

https://www.cell.com/cell-reports-medicine/fulltext/S2666-3791(23)00243-4

# Current Biology

## PAPERS

### CHARLI GRIMES et al – Postreproductive female killer whales reduce socially inflicted injuries in their male offspring

Understanding the evolution of menopause presents a long-standing scientific challenge—why should females cease ovulation prior to the end of their natural lifespan? In human societies, intergenerational resource transfers, for example, food sharing and caregiving, are thought to have played a key role in the evolution of menopause, providing a pathway by which postreproductive females can boost the fitness of their kin. To date however, other late-life contributions that postreproductive females may provide their kin have not been well studied. Here, we test the hypothesis that postreproductive female resident killer whales (Orcinus orca) provide social support to their offspring by reducing the socially inflicted injuries they experience. We found that socially inflicted injuries, as quantified by tooth rake marks, are lower for male offspring in the presence of their postreproductive mother. In contrast, we find no evidence that postreproductive mothers reduce rake marking in their daughters. Similarly, we find no evidence that either reproductive mothers or grandmothers (reproductive or postreproductive) reduce socially inflicted injuries in their offspring and grandoffspring, respectively. Moreover, we find that postreproductive females have no effect on reducing the rake marks for whales in their social unit who are not their offspring. Taken together, our results highlight that directing late-life support may be a key pathway by which postreproductive females transfer social benefits to their male offspring.

https://www.cell.com/current-biology/fulltext/S0960-9822(23)00824-2

# eLife

## PAPERS

### PAUL A. G. FORBES et al – Acute stress reduces effortful prosocial behaviour

Acute stress can change our cognition and emotions, but what specific consequences this has for human prosocial behaviour is unclear. Previous studies have mainly investigated prosociality with financial transfers in economic games and produced conflicting results. Yet a core feature of many types of prosocial behaviour is that they are effortful. We therefore examined how acute stress changes our willingness to exert effort that benefits others. Healthy male participants – half of whom were put under acute stress – made decisions whether to exert physical effort to gain money for themselves or another person. With this design, we could independently assess the effects of acute stress on prosocial, compared to self-benefitting, effortful behaviour. Compared to controls (n=45), participants in the stress group (n=46) chose to exert effort more often for self- than for other- benefitting rewards at a low level of effort. Additionally, the adverse effects of stress on prosocial effort were particularly pronounced in more selfish participants. Neuroimaging combined with computational modelling revealed a putative neural mechanism underlying these effects: more stressed participants showed increased activation to subjective value in the dorsal anterior cingulate cortex and anterior insula when they themselves could benefit from their exerted effort, relative to when someone else could. By using an effort-based task that better approximates real-life prosocial behaviour and incorporating trait differences in prosocial tendencies, our study provides important insights into how acute stress affects prosociality and its associated neural mechanisms.

https://elifesciences.org/reviewed-preprints/87271

**SUNG WON HUR et al – Correlated signatures of social behavior in cerebellum and anterior cingulate cortex**
The cerebellum has been implicated in the regulation of social behavior. Its influence is thought to arise from communication, via the thalamus, to forebrain regions integral in the expression of social interactions, including the anterior cingulate cortex (ACC). However, the signals encoded or the nature of the communication between the cerebellum and these brain regions remains poorly understood. Here, we describe an approach that overcomes technical challenges in exploring the coordination of distant brain regions at high temporal and spatial resolution during social behavior. We developed the E-Scope, an electrophysiology-integrated miniature microscope, to synchronously measure extracellular electrical activity in the cerebellum along with calcium imaging of the ACC. This single coaxial cable device combined these data streams to provide a powerful tool to monitor the activity of distant brain regions in freely behaving animals. During social behavior, we recorded the spike timing of multiple single units in cerebellar right Crus I (RCrus I) Purkinje cells (PCs) or dentate nucleus (DN) neurons while synchronously imaging calcium transients in contralateral ACC neurons. We find that during social interactions, a significant subpopulation of cerebellar PCs were robustly inhibited, while most modulated neurons in the DN were activated. As expected, we find that there are higher correlations in the activity of cerebellar and ACC neurons that are similarly excited or inhibited by social interaction than in the activity of those modulated in an opposing manner. Surprisingly, these distinctions in correlations largely disappear when only non-social bouts were analyzed, suggesting that cerebellar-cortical interactions were social behavior specific. Our work provides new insights into the complexity of cerebellar activation and co-modulation of the ACC during social behavior, and a valuable open-source tool for simultaneous, multimodal recordings in freely behaving mice.
https://elifesciences.org/reviewed-preprints/88439

**AUDREY DUREUX et al – Gaze patterns and brain activations in humans and marmosets in the Frith-Happé theory-of-mind animation task**
Theory of Mind (ToM) refers to the cognitive ability to attribute mental states to other individuals. This ability extends even to the attribution of mental states to animations featuring simple geometric shapes, such as the Frith-Happé animations in which two triangles move either purposelessly (Random condition), exhibit purely physical movement (Goal-directed condition), or move as if one triangle is reacting to the other triangle's mental states (ToM condition). While this capacity in humans has been thoroughly established, research on nonhuman primates has yielded inconsistent results. This study explored how marmosets (Callithrix jacchus), a highly social primate species, process Frith-Happé animations by examining gaze patterns and brain activations of marmosets and humans as they observed these animations. We revealed that both marmosets and humans exhibited longer fixations on one of the triangles in ToM animations, compared to other conditions. However, we did not observe the same pattern of longer overall fixation duration on the ToM animations in marmosets as identified in humans. Furthermore, our findings reveal that both species activated extensive and comparable brain networks when viewing ToM versus Random animations, suggesting that marmosets differentiate between these scenarios similarly to humans. While marmosets did not mimic human overall fixation patterns, their gaze behavior and neural activations indicate a distinction between ToM and non-ToM scenarios. This study expands our understanding of nonhuman primate cognitive abilities, shedding light on potential similarities and differences in ToM processing between marmosets and humans.
https://elifesciences.org/articles/86327

**SHUYUN XIAO, VALERIE MICHAEL & RICHARD MOONEY – Nested circuits mediate the decision to vocalize**
Vocalizations facilitate mating and social affiliation but may also inadvertently alert predators and rivals. Consequently, the decision to vocalize depends on brain circuits that can weigh and compare these potential benefits and risks. Male mice produce ultrasonic vocalizations (USVs) during courtship to facilitate mating, and previously isolated female mice produce USVs during social encounters with novel females. Earlier we showed that a specialized set of neurons in the midbrain periaqueductal gray (PAG-USV neurons) are an obligatory gate for USV production in both male and female mice, and that both PAG-USV neurons and USVs can be switched on by their inputs from the preoptic area (POA) of the hypothalamus and switched off by their inputs from neurons on the border between the central and medial amygdala (AmgC/M-PAG neurons) (Michael et al., 2020). Here, we show that the USV-suppressing AmgC/M-PAG neurons are strongly activated by predator cues or during social contexts that suppress USV production in male and female mice. Further, we explored how vocal promoting and vocal suppressing drives are weighed in the brain to influence vocal production in male mice, where the drive and courtship function for USVs are better understood. We found that AmgC/M-PAG neurons receive monosynaptic inhibitory input from POA neurons that also project to the PAG, that these inhibitory inputs are active in USV-promoting social contexts, and that optogenetic activation of POA cell bodies that make divergent axonal projections to the amygdala and PAG is sufficient to elicit USV production in socially isolated male mice. Accordingly, AmgC/M-PAG neurons, along with POAPAG and PAG-USV neurons, form a nested hierarchical circuit in which environmental and social information converges to influence the decision to vocalize.
https://elifesciences.org/articles/85547

**JÖRN K POMPER et al – Non-shared coding of observed and executed actions prevails in macaque ventral premotor mirror neurons**

According to the mirror mechanism the discharge of F5 mirror neurons of a monkey observing another individual performing an action is a motor representation of the observed action that may serve to understand or learn from the action. This hypothesis, if strictly interpreted, requires mirror neurons to exhibit an action tuning that is shared between action observation and execution. Due to insufficient data it remains contentious if this requirement is met. To fill in the gaps, we conducted an experiment in which identical objects had to be manipulated in three different ways in order to serve distinct action goals. Using three methods, including cross-task classification, we found that at most time points F5 mirror neurons did not encode observed actions with the same code underlying action execution. However, in about 20% of neurons there were time periods with a shared code. These time periods formed a distinct cluster and cannot be considered a product of chance. Population classification yielded non-shared coding for observed actions in the whole population, which was at times optimal and consistently better than shared coding in differentially selected subpopulations. These results support the hypothesis of a representation of observed actions based on a strictly defined mirror mechanism only for small subsets of neurons and only under the assumption of time-resolved readout. Considering alternative concepts and recent findings, we propose that during observation mirror neurons represent the process of a goal pursuit from the observer's viewpoint. Whether the observer's goal pursuit, in which the other's action goal becomes the observer's action goal, or the other's goal pursuit is represented remains to be clarified. In any case, it may allow the observer to use expectations associated with a goal pursuit to directly intervene in or learn from another's action.

https://elifesciences.org/articles/77513

## Frontiers in Education

**PAPERS**

**TRACY GRIFFIN SPIES – The forgotten language skill: finding a prominent place for listening in meaningful programming for multilingual learners with learning disabilities**

Listening is the primary vehicle through which children learn, is fundamental to all other communication competencies, is a core component of multimodal instruction, and is key to learning language. At the same time, listening comprehension is the least understood language skill and is challenging for teachers in the provision of high quality instruction. For multilingual learners with learning disabilities it also presents certain challenges at the intersection of students' disability and developing language proficiency. This article presents a conceptual analysis of listening comprehension across the perspectives of learning disability and second language acquisition in an effort to link disconnected understandings from the fields to address the intersectional needs of multilingual learners with disabilities. These findings are integrated into a framework of listening comprehension for multilingual learners with learning disabilities highlighting the cognitive and linguistic processes necessary for effective listening. Various examples of how to use the framework to plan multilingual learners with learning disabilities' meaningful access to the general education curriculum are presented including its use in planning students' individualized education plans.

https://www.frontiersin.org/articles/10.3389/feduc.2023.1214535/full

## Frontiers in Psychology

**PAPERS**

**GUY A. LAVENDER FORSYTH, ANANISH CHAUDHURI & QUENTIN DOUGLAS ATKINSON – Validating the dual evolutionary foundations of political values in a US sample**

Psychological research repeatedly identifies two dimensions of political values. Recent work argues that these dimensions reflect the dual evolutionary foundations of human social and political life: a trade-off between cooperation and competition that generates differences in values about social inequality, and a trade-off in managing group coordination that generates differences in values about social control. Existing scales used to measure political values, however, were created prior to this framework. Here, we introduce the Dual Foundations Scale, designed to capture values about the two trade-offs. We validate the scale across two studies, showing it accurately and reliably measures both dimensions. Our results support key predictions of the dual foundations framework and pave the way for future work on the foundations of political ideology.

https://www.frontiersin.org/articles/10.3389/fpsyg.2023.1189771/full

**HONGBO CUI et al – Family function and adolescent altruistic behavior: the multiple mediating effects of self-affirmation and psychological resilience**

The current study aimed to explore the relationship between family function and adolescent altruistic behavior, as well as the mediating effects of self-affirmation and psychological resilience in this relationship.

A survey was conducted on 972 high school students in Guangdong Province using the Family APGAR, GHQSense of Adequacy, Chinese version of Connor-Davidson Resilience Scale, and Altruistic Behavior Scale.

Results found that the score of psychological resilience of males was significantly higher than that of females, but the score of altruistic behavior was significantly lower than that of females. Family function had a positive predictive effect on altruistic behavior. Psychological resilience played a mediating role between family function and altruistic behavior. Self-affirmation and psychological resilience played chain mediating roles between family function and altruistic behavior.

This study indicated that family care is crucial for the development of adolescent altruistic behavior, and that it can promote the development of altruistic behavior through the enhancement of self-affirmation and psychological resilience.
https://www.frontiersin.org/articles/10.3389/fpsyg.2023.1184985/full

## DOROTA K. GASKINS & GABRIELA RUNDBLAD – Metaphor production in the bilingual acquisition of English and Polish

Metaphor acquisition research has focused mostly on metaphor comprehension in monolingual children. Ours is the first study to examine metaphor production in young bilinguals. Sixty-two children aged three to six, with English and Polish, were tested on their ability to produce primary (e.g., a long day) and perceptual resemblance metaphors (e.g., You're my sunshine) in response to elicitation tasks. A univariate ANOVA revealed that the main factors to affect the production of conventional metaphors in bilingual children are their chronological age and their verbal skills in both English and Polish. No significant effect was found for non-verbal IQ, metaphor type, or testing language. These results are discussed in the context of both Conceptual Metaphor Theory, which has been concerned with the study of primary (and other conceptual) metaphors, and Structure Mapping Theory, which has focused on the use of perceptual resemblance metaphors. Usage-Based Theory is brought in to explain lexical effects in metaphor production.
https://www.frontiersin.org/articles/10.3389/fpsyg.2023.1162486/abstract

## DANIELA GATT, LIBERATO CAMILLERI & CHLOE GRECH – Word usage as measured by parental checklists and language samples: trends, comparisons and implications

Although parental checklists are well-known for their potential in indexing young children's lexicon size, they can also be used to track children's acquisition of individual words. Word-level data can be used to identify the checklist words most and least commonly employed across groups of children. Like parent-completed vocabulary checklists, samples of spontaneous language use collected from multiple children can also generate measures of word commonality, concerned with the numbers of children producing individual words. To our knowledge, comparisons of word usage as determined by parental checklist and language sample data obtained in parallel from the same children have not been carried out. Also scarce in the empirical literature are item-level analyses of early bilingual lexicons that explore word usage across two emerging languages. The present study aimed to contribute towards bridging both gaps through the analysis of data generated by a bilingual Maltese-English adaptation of the vocabulary checklist of the MacArthur Communicative Development Inventories: Words and Sentences (CDI: WS) and spontaneous language samples for the same children. An additional objective was to derive implications for revising the current version of the vocabulary checklist, in preparation for its eventual standardisation. For 44 Maltese children aged 12, 18, 24 and 30 months, the words reported by their main caregivers on the vocabulary checklist were identified, along with their respective semantic categories. For the same children, 20-minute language samples obtained during free play with the caregiver were transcribed orthographically. Words identified through parental report and language sampling were analysed for commonality, i.e. the number of children producing each word. Comparison of the word usage patterns obtained through both methods indicated differences in the words most commonly sampled and those most commonly reported, particularly in relation to grammatical categories. Notwithstanding these differences, positive and significant correlations emerged when considering all grammatical categories and languages across commonality levels. The commonality scores based on parental checklist data have implications for reconsidering the length and language balance of the Maltese-English adaptation of the CDI: WS vocabulary checklist. Sampled word usage patterns can contribute additional objectivity in updating the reporting instrument in preparation for its eventual standardisation.
https://www.frontiersin.org/articles/10.3389/fpsyg.2023.1214518/abstract

## KEITA UMEJIMA et al – Differential networks for processing structural dependencies in human language: linguistic capacity vs. memory-based ordering

Surface linear (left-to-right) arrangements of human languages are actually an amalgam of the core language system and systems that are not inherently related to language. It has been widely recognized that an unbounded array of hierarchically structured linguistic expressions is generated by the simplest combinatorial operation "Merge," and the notion of Merge-generability has been proposed as a key feature that characterizes structural dependencies among linguistic elements. Here we tested Merge-generable dependencies by using a Subject-Predicate matching task, which required both linguistic capacity and short-term memory. We used three types of dependency: Nesting, Crossing, and Grouping as the control. The Nesting dependency is totally Merge-generable, while the Crossing dependency requires some additional processes for memory-based ordering. In order to identify the regions employed for these two dependencies, we directly compared cortical responses to the sentence stimuli (with noun phrases and an adverb as the first half of stimuli, and with verbs as the latter) using functional magnetic resonance imaging (fMRI), and the following results were obtained. First, for the Nesting – Crossing contrast, significant activations were observed in the bilateral lateral premotor cortices (LPMCs) and inferior frontal gyri, left middle temporal gyrus, and bilateral angular/supramarginal gyri, indicating engagement of the syntax-related networks. In contrast, the Crossing – Nesting contrast showed focal activations in the left fusiform gyrus, lingual gyrus, and middle occipital gyrus (L. FG/LG/MOG). Secondly, for the first half of the Nesting stimuli, signal changes in the bilateral LPMCs were well fitted with the estimates of computational costs to search the workspace and to select items ($\Sigma$ operations). Moreover, for the latter half of the Crossing stimuli, the signal changes in the L. FG/LG/MOG were differentially fitted with the estimates of loads related to the ordering of elements/words (numbers of Ordering). Thirdly, these fitting models were by far more

likely than the exchanged estimates between bilateral LPMCs and L. FG/LG/MOG, confirming a double dissociation for primary processes with Σ and Ordering. In conclusion, these results indicate that separate cortical networks are differentially employed, and their careful elucidation will provide further insights and challenges.
https://www.frontiersin.org/articles/10.3389/fpsyg.2023.1153871/full

## Human Nature
### PAPERS

**ZE HONG – The Evolution of Inclusive Folk-Biological Labels and the Cultural Maintenance of Meaning**
How is word meaning established, and how do individuals acquire it? What ensures the uniform understanding of word meaning in a linguistic community? In this paper I draw from cultural attraction theory and use folk biology as an example domain and address these questions by treating meaning acquisition as an inferential process. I show that significant variation exists in how individuals understand the meaning of inclusive biological labels such as "plant" and "animal" due to variation in their salience in contemporary ethnic minority groups in southwest China, and I present historical textual evidence that the meaning of inclusive terms is often unstable but can be sustained by such cultural institutions as religion and education, which provide situations in which the meaning of linguistic labels can be unambiguously inferred.
https://link.springer.com/article/10.1007/s12110-023-09446-2

**COURTNEY HELFRECHT & SAMUEL JILO DIRA – The Sidama Model of Human Development**
Human ontogeny has been shaped through evolution, resulting in markers of physical, cognitive, and social development that are widely shared and often used to demarcate the lifespan. Yet, development is demonstrably biocultural and strongly influenced by context. As a result, emic age categories can vary in duration and composition, constituted by both common physical markers as well as culturally meaningful indicators, with implications for our understanding of the evolution of human life history. Semi-structured group interviews (n = 24) among Sidama adults and children, as well as individual interviews with children (n = 30), were used to identify age categories across the lifespan and to specifically investigate acquisition of sociocultural skills and cognitive development. Ten major age categories were identified, covering birth through death. These largely map onto patterning of human universals, but specific cultural beliefs and behaviors were indicated as important markers of development. Adults and children are oriented toward the dynamic relationships between physical development and acquisition of skills tied to social and cultural success. Culture, ecology, and ontogeny are co-determinants of human development, and the interactions among them should be considered in studies examining human life history and its evolution.
https://link.springer.com/article/10.1007/s12110-023-09449-z

**ANTONIO BENÍTEZ-BURRACO & ALEKSEY NIKOLSKY – The (Co)Evolution of Language and Music Under Human Self-Domestication**
Together with language, music is perhaps the most distinctive behavioral trait of the human species. Different hypotheses have been proposed to explain why only humans perform music and how this ability might have evolved in our species. In this paper, we advance a new model of music evolution that builds on the self-domestication view of human evolution, according to which the human phenotype is, at least in part, the outcome of a process similar to domestication in other mammals, triggered by the reduction in reactive aggression responses to environmental changes. We specifically argue that self-domestication can account for some of the cognitive changes, and particularly for the behaviors conducive to the complexification of music through a cultural mechanism. We hypothesize four stages in the evolution of music under self-domestication forces: (1) collective protomusic; (2) private, timbre-oriented music; (3) small-group, pitch-oriented music; and (4) collective, tonally organized music. This line of development encompasses the worldwide diversity of music types and genres and parallels what has been hypothesized for languages. Overall, music diversity might have emerged in a gradual fashion under the effects of the enhanced cultural niche construction as shaped by the progressive decrease in reactive (i.e., impulsive, triggered by fear or anger) aggression and the increase in proactive (i.e., premeditated, goal-directed) aggression.
https://link.springer.com/article/10.1007/s12110-023-09447-1

**JENNI E. PETTAY et al – Parental Investment by Birth Fathers and Stepfathers: Roles of Mating Effort and Childhood Co-residence Duration**
This study investigates the determinants of paternal investment by birth fathers and stepfathers. Inclusive fitness theory predicts higher parental investment in birth children than stepchildren, and this has consistently been found in previous studies. Here we investigate whether paternal investment varies with childhood co-residence duration and differs between stepfathers and divorced birth fathers by comparing the investment of (1) stepfathers, (2) birth fathers who are separated from the child's mother, and (3) birth fathers who still are in a relationship with her. Path analysis was conducted using cross-sectional data from adolescents and younger adults (aged 17–19, 27–29, and 37–39 years) from the German Family Panel (pairfam), collected in 2010–2011 (n = 8326). As proxies of paternal investment, we used financial and practical help, emotional support, intimacy, and emotional closeness, as reported by the children. We found that birth fathers who were still in a relationship with the mother invested the most, and stepfathers invested the least. Furthermore, the investment of both separated fathers and stepfathers increased with the duration of co-residence with the child. However, in the case of

financial help and intimacy, the effect of childhood co-residence duration was stronger in stepfathers than in separated fathers. Our findings support inclusive fitness theory and mating effort theory in explaining social behavior and family dynamics in this population. Furthermore, social environment, such as childhood co-residence was associated with paternal investment.

https://link.springer.com/article/10.1007/s12110-023-09450-6

## AUSTIN W. REYNOLDS et al – Persistence of Matrilocal Postmarital Residence Across Multiple Generations in Southern Africa

Factors such as subsistence turnover, warfare, or interaction between different groups can be major sources of cultural change in human populations. Global demographic shifts such as the transition to agriculture during the Neolithic and more recently the urbanization and globalization of the twentieth century have been major catalysts for cultural change. Here, we test whether cultural traits such as patri/matrilocality and postmarital migration persist in the face of social upheaval and gene flow during the past 150 years in postcolonial South Africa. The recent history of South Africa has seen major demographic shifts that resulted in the displacement and forced sedentism of indigenous Khoekhoe and San populations. During the expansion of the colonial frontier, the Khoe-San admixed with European colonists and enslaved individuals from West/Central Africa, Indonesia, and South Asia, introducing novel cultural norms. We conducted demographic interviews among Nama and Cederberg communities representing nearly 3,000 individuals across three generations. Despite the history of colonial expansion, and the subsequent incorporation of Khoe-San and Khoe-San-descendant communities into a colonial society with strong patrilocal norms, patrilocality is the least common postmarital residence pattern in our study populations today. Our results suggest that more recent forces of integration into the market economy are likely the primary drivers of change in the cultural traits examined in our study. Birthplace had a strong effect on an individual's odds of migration, distance moved, and postmarital residence form. These effects are at least partially explained by the population size of the birthplace. Our results suggest that market factors local to birthplaces are important drivers of residence decisions, although the frequency of matrilocal residence and a geographic and temporal cline in migration and residence patterns also indicate the persistence of some historic Khoe-San cultural traits in contemporary groups.

https://link.springer.com/article/10.1007/s12110-023-09452-4

## GEORGE B. RICHARDSON et al – Testing Environmental Effects on Age at Menarche and Sexual Debut within a Genetically Informative Twin Design

Life-history-derived models of female sexual development propose menarche timing as a key regulatory mechanism driving subsequent sexual behavior. The current research utilized a twin subsample of the National Longitudinal Study of Adolescent to Adult Health (Add Health; n = 514) to evaluate environmental effects on timings of menarche and sexual debut, as well as address potential confounding of these effects within a genetically informative design. Results show mixed support for each life history model and provide little evidence rearing environment is important in the etiology of individual differences in age at menarche. This research calls into question the underlying assumptions of life-history-derived models of sexual development and highlights the need for more behavior genetic research in this area.

https://link.springer.com/article/10.1007/s12110-023-09451-5

## Interface: Journal of the Royal Society

### PAPERS

## GOPAL SHARMA et al – Small bots, big impact: solving the conundrum of cooperation in optional Prisoner's Dilemma game through simple strategies

Cooperation plays a crucial role in both nature and human society, and the conundrum of cooperation attracts the attention from interdisciplinary research. In this study, we investigated the evolution of cooperation in optional Prisoner's Dilemma games by introducing simple bots. We focused on one-shot and anonymous games, where the bots could be programmed to always cooperate, always defect, never participate or choose each action with equal probability. Our results show that cooperative bots facilitate the emergence of cooperation among ordinary players in both well-mixed populations and a regular lattice under weak imitation scenarios. Introducing loner bots has no impact on the emergence of cooperation in well-mixed populations, but it facilitates the dominance of cooperation in regular lattices under strong imitation scenarios. However, too many loner bots on a regular lattice inhibit the spread of cooperation and can eventually result in a breakdown of cooperation. Our findings emphasize the significance of bot design in promoting cooperation and offer useful insights for encouraging cooperation in real-world scenarios.

https://royalsocietypublishing.org/doi/10.1098/rsif.2023.0301

## Mind & Language

### PAPERS

### SHANNON SPAULDING – Motivating empathy

Critics of empathy argue that empathy is exhausting, easily manipulated, exacerbates rather than relieves conflict, and is too focused on individual experiences. Apparently, empathy not only fails to stop negative acts like sadism, bullying, and

terrorism, it motivates and promotes such acts. These scholars argue that empathy will not save us from partisanship and division. In fact, it might make us worse off. I will argue that empathy exhibits bias in the ways critics describe because empathy is motivated. Conceiving of empathy as motivated leads to surprising conclusions about our tools for moral decision-making.
https://onlinelibrary.wiley.com/doi/abs/10.1111/mila.12469

# Nature
## ARTICLES

**MARIANA LENHARO – The true cost of science's language barrier for non-native English speakers**
Survey quantifies the extra time that researchers whose first language isn't English need to read, write and present data.
https://www.nature.com/articles/d41586-023-02320-2

**DYANI LEWIS – Short arms and lanky legs: the genetic basis of walking on two legs**
Genome-wide map reveals regions associated with skeletal changes that enabled humans to walk upright.
https://www.nature.com/articles/d41586-023-02345-7

## PAPERS

**LEANDRO G. COSMO et al – Indirect effects shape species fitness in coevolved mutualistic networks**
Ecological interactions are one of the main forces that sustain Earth's biodiversity. A major challenge for studies of ecology and evolution is to determine how these interactions affect the fitness of species when we expand from studying isolated, pairwise interactions to include networks of interacting species. In networks, chains of effects caused by a range of species have an indirect effect on other species they do not interact with directly, potentially affecting the fitness outcomes of a variety of ecological interactions (such as mutualism). Here we apply analytical techniques and numerical simulations to 186 empirical mutualistic networks and show how both direct and indirect effects alter the fitness of species coevolving in these networks. Although the fitness of species usually increased with the number of mutualistic partners, most of the fitness variation across species was driven by indirect effects. We found that these indirect effects prevent coevolving species from adapting to their mutualistic partners and to other sources of selection pressure in the environment, thereby decreasing their fitness. Such decreases are distributed in a predictable way within networks: peripheral species receive more indirect effects and experience higher reductions in fitness than central species. This topological effect was also evident when we analysed an empirical study of an invasion of pollination networks by honeybees. As honeybees became integrated as a central species within networks, they increased the contribution of indirect effects on several other species, reducing their fitness. Our study shows how and why indirect effects can govern the adaptive landscape of species-rich mutualistic assemblages.
https://www.nature.com/articles/s41586-023-06319-7

**EMRE CAGLAYAN et al – Molecular features driving cellular complexity of human brain evolution**
Human-specific genomic changes contribute to the unique functionalities of the human brain. The cellular heterogeneity of the human brain and the complex regulation of gene expression highlight the need to characterize human-specific molecular features at cellular resolution. Here we analysed single-nucleus RNA-sequencing and single-nucleus assay for transposase-accessible chromatin with sequencing datasets for human, chimpanzee and rhesus macaque brain tissue from posterior cingulate cortex. We show a human-specific increase of oligodendrocyte progenitor cells and a decrease of mature oligodendrocytes across cortical tissues. Human-specific regulatory changes were accelerated in oligodendrocyte progenitor cells, and we highlight key biological pathways that may be associated with the proportional changes. We also identify human-specific regulatory changes in neuronal subtypes, which reveal human-specific upregulation of FOXP2 in only two of the neuronal subtypes. We additionally identify hundreds of new human accelerated genomic regions associated with human-specific chromatin accessibility changes. Our data also reveal that FOS::JUN and FOX motifs are enriched in the human-specifically accessible chromatin regions of excitatory neuronal subtypes. Together, our results reveal several new mechanisms underlying the evolutionary innovation of human brain at cell-type resolution.
https://www.nature.com/articles/s41586-023-06338-4

# Nature Africa
## ARTICLES

**GEOFFREY KAMADI – How landscapes shaped our early ancestors**
Studies on ape evolution show Africa had a more mixed habitat than previously thought.
https://www.nature.com/articles/d44148-023-00184-2

## Nature Communications
### PAPERS

**XUE L. GONG et al – Phonemic segmentation of narrative speech in human cerebral cortex**

Speech processing requires extracting meaning from acoustic patterns using a set of intermediate representations based on a dynamic segmentation of the speech stream. Using whole brain mapping obtained in fMRI, we investigate the locus of cortical phonemic processing not only for single phonemes but also for short combinations made of diphones and triphones. We find that phonemic processing areas are much larger than previously described: they include not only the classical areas in the dorsal superior temporal gyrus but also a larger region in the lateral temporal cortex where diphone features are best represented. These identified phonemic regions overlap with the lexical retrieval region, but we show that short word retrieval is not sufficient to explain the observed responses to diphones. Behavioral studies have shown that phonemic processing and lexical retrieval are intertwined. Here, we also have identified candidate regions within the speech cortical network where this joint processing occurs.

https://www.nature.com/articles/s41467-023-39872-w

**DANIEL A. LAUER et al – Disruption of trait-environment relationships in African megafauna occurred in the middle Pleistocene**

Mammalian megafauna have been critical to the functioning of Earth's biosphere for millions of years. However, since the Plio-Pleistocene, their biodiversity has declined concurrently with dramatic environmental change and hominin evolution. While these biodiversity declines are well-documented, their implications for the ecological function of megafaunal communities remain uncertain. Here, we adapt ecometric methods to evaluate whether the functional link between communities of herbivorous, eastern African megafauna and their environments (i.e., functional trait-environment relationships) was disrupted as biodiversity losses occurred over the past 7.4 Ma. Herbivore taxonomic and functional diversity began to decline during the Pliocene as open grassland habitats emerged, persisted, and expanded. In the mid-Pleistocene, grassland expansion intensified, and climates became more variable and arid. It was then that phylogenetic diversity declined, and the trait-environment relationships of herbivore communities shifted significantly. Our results divulge the varying implications of different losses in megafaunal biodiversity. Only the losses that occurred since the mid-Pleistocene were coincident with a disturbance to community ecological function. Prior diversity losses, conversely, occurred as the megafaunal species and trait pool narrowed towards those adapted to grassland environments.

https://www.nature.com/articles/s41467-023-39480-8

## Nature Humanities & Social Sciences Communications
### PAPERS

**CLAES ANDERSSON & CLAUDIO TENNIE – Zooming out the microscope on cumulative cultural evolution: 'Trajectory B' from animal to human culture**

It is widely believed that human culture originated in the appearance of Oldowan stone-tool production (circa 2.9 Mya) and a primitive but effective ability to copy detailed know-how. Cumulative cultural evolution is then believed to have led to modern humans and human culture via self-reinforcing gene-culture co-evolution. This outline evolutionary trajectory has come to be seen as all but self-evident, but dilemmas have appeared as it has been explored in increasing detail. Can we attribute even a minimally effective know-how copying capability to Oldowan hominins? Do Oldowan tools really demand know-how copying? Is there any other evidence that know-how copying was present? We here argue that this account, which we refer to as "Trajectory A", may be a red herring, and formulate an alternative "Trajectory B" that resolves these dilemmas. Trajectory B invokes an overlooked group-level channel of cultural inheritance (the Social Protocell) whereby networks of cultural traits can be faithfully inherited and potentially undergo cumulative evolution, also when the underpinning cultural traits are apelike in not being transmitted via know-how copying (Latent Solutions). Since most preconditions of Trajectory B are present in modern-day Pan, Trajectory B may even have its roots considerably before Oldowan toolmaking. The cumulative build-up of networks of non-cumulative cultural traits is then argued to have produced conditions that both called for and afforded a gradual appearance of the ability to copy know-how, but considerably later than the Oldowan.

https://www.nature.com/articles/s41599-023-01878-6

## Nature Machine Intelligence
### ARTICLES

**Language models and linguistic theories beyond words**

The development of large language models is mainly a feat of engineering and so far has been largely disconnected from the field of linguistics. Exploring links between the two directions is reopening longstanding debates in the study of language.

https://www.nature.com/articles/s42256-023-00703-8

## Nature Reviews Psychology

**PAPERS**

### ALICIA P. MELIS & NICHOLA J. RAIHANI – The cognitive challenges of cooperation in humans and animals

Cooperation is widespread in nature, occurring in every taxa on Earth. Nevertheless, the contexts in which cooperation occurs — and the forms it takes — vary widely. In this Review, we outline how cooperation can evolve in nature and the cognition needed to support cooperation in different scenarios. We argue that the cognitively simplest forms of cooperation are those where an organism does not need to recognize interaction partners individually and that do not depend upon individuals keeping track of their partners' actions and making contingent return investments. These simpler cooperative interactions occur most frequently among kin and among interdependent interaction partners and are relatively common in non-human animals. Conversely, cooperation involving individual recognition of interaction partners and where benefits depend upon contingent responses levy greater cognitive demands and occur in non-human animals only in limited contexts.
https://www.nature.com/articles/s44159-023-00207-7

### JUDITH E. FAN et al – Drawing as a versatile cognitive tool

Drawing is a cognitive tool that makes the invisible contents of mental life visible. Humans use this tool to produce a remarkable variety of pictures, from realistic portraits to schematic diagrams. Despite this variety and the prevalence of drawn images, the psychological mechanisms that enable drawings to be so versatile have yet to be fully explored. In this Review, we synthesize contemporary work in multiple areas of psychology, computer science and neuroscience that examines the cognitive processes involved in drawing production and comprehension. This body of findings suggests that the balance of contributions from perception, memory and social inference during drawing production varies depending on the situation, resulting in some drawings that are more realistic and other drawings that are more abstract. We also consider the use of drawings as a research tool for investigating various aspects of cognition, as well as the role that drawing has in facilitating learning and communication. Taken together, information about how drawings are used in different contexts illuminates the central role of visually grounded abstractions in human thought and behaviour.
https://www.nature.com/articles/s44159-023-00212-w

## Nature Scientific Reports

**PAPERS**

### MILICA NIKOLIĆ et al – Parental socialization of guilt and shame in early childhood

Self-conscious emotions emerge early in human development and they help children navigate social relationships. Little is known about the socialization of self-conscious emotions in early childhood. We theorized that parental mental state language use and warmth would be important for young children's self-conscious emotions and their consequent prosocial behaviors. Ninety-eight children residing in the Netherlands (52% girls) aged 2–5 (M = 48.66 months, SD = 13.50 months) visited the research lab with one parent. First, we observed parental mental state language and warmth. Afterward, children were led to believe that they caused a mishap (i.e., accidentally breaking the experimenter's favorite toy) to evoke their guilt and shame, which we micro-coded. In subsequent tasks, we observed children's helping behaviors toward the experimenter. We found that the combination of frequent parental mental state language and high warmth was associated with children's quicker helping to the previously harmed experimenter across toddlerhood and early childhood. More guilt was related to more helping whereas more shame-like avoidance was related to less helping. Our findings based on the sample of Dutch parents and children suggest that, parental frequent mental state talk, in combination with high warmth, may promote children's ability to repair social relationships and behave prosocially after mishaps.
https://www.nature.com/articles/s41598-023-38502-1

### GABRIEL BUDEL et al – Topological properties and organizing principles of semantic networks

Interpreting natural language is an increasingly important task in computer algorithms due to the growing availability of unstructured textual data. Natural Language Processing (NLP) applications rely on semantic networks for structured knowledge representation. The fundamental properties of semantic networks must be taken into account when designing NLP algorithms, yet they remain to be structurally investigated. We study the properties of semantic networks from ConceptNet, defined by 7 semantic relations from 11 different languages. We find that semantic networks have universal basic properties: they are sparse, highly clustered, and many exhibit power-law degree distributions. Our findings show that the majority of the considered networks are scale-free. Some networks exhibit language-specific properties determined by grammatical rules, for example networks from highly inflected languages, such as e.g. Latin, German, French and Spanish, show peaks in the degree distribution that deviate from a power law. We find that depending on the semantic relation type and the language, the link formation in semantic networks is guided by different principles. In some networks the connections are similarity-based, while in others the connections are more complementarity-based. Finally, we demonstrate how knowledge of similarity and complementarity in semantic networks can improve NLP algorithms in missing link inference.
https://www.nature.com/articles/s41598-023-37294-8

**T. JEAN M. ARSENEAU-ROBAR et al – Monkeys who experience more feeding competition utilize social information to learn foraging skills faster**

Animals must learn foraging skills to successfully survive and reproduce but the sources of interindividual variation in learning are poorly understood. For example, there is little consensus on the role motivation plays, even though it is a key factor impacting learning outcomes in humans. Here, we conduct a field experiment on a wild primate to investigate whether an individual's vulnerability to feeding competition impacts their motivation to learn a beneficial foraging technique. We provided a group of monkeys with a food reward (i.e., a half banana) that needed to be retrieved from a box. The monkeys discovered an efficient technique that consistently allowed them to retrieve the banana quickly, decreasing the risk of food loss to competitors. We found that individuals who frequently experienced feeding competition learned this efficient technique significantly faster than individuals who rarely foraged in the presence of a dominant competitor. They appeared to use social learning to learn faster as they were more attentive to the handling techniques others used and improved their foraging skills after opportunities to observe a skilled demonstrator. These findings support that an individual's vulnerability to feeding competition impacts their motivation to learn foraging skills that reduce food loss to competitors.

https://www.nature.com/articles/s41598-023-37536-9

**SOPHIA PILLER, IRENE SENNA & MARC O. ERNST – Visual experience shapes the Bouba-Kiki effect and the size-weight illusion upon sight restoration from congenital blindness**

The Bouba-Kiki effect is the systematic mapping between round/spiky shapes and speech sounds ("Bouba"/"Kiki"). In the size-weight illusion, participants judge the smaller of two equally-weighted objects as being heavier. Here we investigated the contribution of visual experience to the development of these phenomena. We compared three groups: early blind individuals (no visual experience), individuals treated for congenital cataracts years after birth (late visual experience), and typically sighted controls (visual experience from birth). We found that, in cataract-treated participants (tested visually/visuo-haptically), both phenomena are absent shortly after sight onset, just like in blind individuals (tested haptically). However, they emerge within months following surgery, becoming statistically indistinguishable from the sighted controls. This suggests a pivotal role of visual experience and refutes the existence of an early sensitive period: A short period of experience, even when gained only years after birth, is sufficient for participants to visually pick-up regularities in the environment, contributing to the development of these phenomena.

https://www.nature.com/articles/s41598-023-38486-y

## New Scientist

### NEWS

**Brain scans are putting a major theory of consciousness to the test**

A proposed way to measure consciousness called integrated information theory has been tested using data from human brain scans, and seems to work.

https://www.newscientist.com/article/2383152-brain-scans-are-putting-a-major-theory-of-consciousness-to-the-test/

**Early humans made jewellery from giant sloth bones**

The bones were shaped by people using stone tools before they were fossilised, adding new evidence for humans' arrival in the Americas before the end of the last glacial period.

https://www.newscientist.com/article/2381629-early-humans-made-jewellery-from-giant-sloth-bones/

**Llamas solve problems faster after watching people do it**

Llamas are able to learn from other llamas and even more effectively from humans, possibly because thousands of years of domestication gave them the ability to read human social cues.

https://www.newscientist.com/article/2381852-llamas-solve-problems-faster-after-watching-people-do-it/

**Birds from two different species raise chicks together in one nest**

A pair of common redstarts and a pair of black redstarts were seen brooding in the same nest in Italy – a kind of cooperative breeding that has never been documented before.

https://www.newscientist.com/article/2382126-birds-from-two-different-species-raise-chicks-together-in-one-nest/

**Pigs open doors to free companions in a possible show of empathy**

An experiment in which pigs showed an inclination to help other group members suggests they have an altruistic streak – but selfish motivations can't be ruled out.

https://www.newscientist.com/article/2382239-pigs-open-doors-to-free-companions-in-a-possible-show-of-empathy/

## ARTICLES

### KATE DOUGLAS – Revealed: What your thoughts look like and how they compare to others'

We finally have a grasp on the many different ways of thinking and how your inner mindscape affects your experience of reality.

https://www.newscientist.com/article/mg25934484-800-revealed-what-your-thoughts-look-like-and-how-they-compare-to-others/

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## PeerJ

### PAPERS

### ÓSCAR CARLÓN-BELTRÁN et al – Whistle characterization of long-beaked common dolphin (Delphinus delphis bairdii) in La Paz Bay, Gulf of California

Long-beaked common dolphin (Delphinus delphis bairdii) distribution is limited to the Eastern North Pacific Ocean. Its whistle repertoire is poorly investigated, with no studies in the Gulf of California. The aim of the present study is to characterize the whistles of this species and compare their parameters with different populations. Acoustic monitoring was conducted in La Paz Bay, Gulf of California. Recordings were inspected in spectrogram view in Raven Pro, selecting good quality whistles (n = 270). In the software Luscinia, contours were manually traced to obtain whistle frequencies and duration. Number of steps, inflection points and contour type were visually determined. We calculated the descriptive statistics of the selected whistle parameters and we compared the results with a dolphins population from the Eastern Pacific Ocean. Permutational multivariate analysis of variance (PERMANOVA) was performed to test the intraspecific variation of the whistle parameters among groups. In the present study the mean values (±SD) of the whistle parameters were: maximum frequency = 14.13 ± 3.71 kHz, minimum frequency = 8.44 ± 2.58 kHz and duration = 0.44 ± 0.31 s. Whistles with the upsweep contour were the most common ones (34.44%). The coefficient of variation (CV) values for modulation parameters were high (>100%), in accordance with other studies on dolphins. Whistle parameters showed significant differences among groups. Finally, ending and maximum frequencies, duration and inflection points of the whistles recorded in the present study were lower compared with the parameters of the long-beaked common dolphins from the Eastern Pacific Ocean. This study provides the first whistle characterization of long-beaked common dolphin from the Gulf of California and it will help future passive acoustic monitoring applications in the study area.

https://peerj.com/articles/15687/

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## PLoS One

### PAPERS

### RHONA M. AMOS et al – Purposeful listening in challenging conditions: A study of prediction during consecutive interpreting in noise

Prediction is often used during language comprehension. However, studies of prediction have tended to focus on L1 listeners in quiet conditions. Thus, it is unclear how listeners predict outside the laboratory and in specific communicative settings. Here, we report two eye-tracking studies which used a visual-world paradigm to investigate whether prediction during a consecutive interpreting task differs from prediction during a listening task in L2 listeners, and whether L2 listeners are able to predict in the noisy conditions that might be associated with this communicative setting. In a first study, thirty-six Dutch-English bilinguals either just listened to, or else listened to and then consecutively interpreted, predictable sentences presented on speech-shaped sound. In a second study, another thirty-six Dutch-English bilinguals carried out the same tasks in clear speech. Our results suggest that L2 listeners predict the meaning of upcoming words in noisy conditions. However, we did not find that predictive eye movements depended on task, nor that L2 listeners predicted upcoming word form. We also did not find a difference in predictive patterns when we compared our two studies. Thus, L2 listeners predict in noisy circumstances, supporting theories which posit that prediction regularly takes place in comprehension, but we did not find evidence that a subsequent production task or noise affects semantic prediction.

https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0288960

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### MARKÉTA CEHÁKOVÁ & JAN CHROMÝ – Garden-path sentences and the diversity of their (mis)representations

Previous studies have reliably shown that the initial misanalysis of garden-path sentences lingers even after the whole sentence is processed. However, other aspects of the resulting representation of these sentences are far from being clear. Some authors argue that comprehenders form a full analysis of the sentence which is faithful to the input and that the fact that the misanalysis lingers is due to an inhibition failure. Recently, it has been shown that comprehenders might not manage to create a coherent representation at all, at least in the case of more demanding garden-path structures. The aim of the current paper is to examine resulting representations of garden-path sentences in more detail. To do this, four self-paced reading experiments in Czech were conducted, which differed in the presentation mode (word-by-word and sentence-at-once) and comprehension question format (yes–no questions and open-ended questions). The experiments replicated effects typical for the lingering initial misanalysis, but provided mixed evidence for other aspects of resulting representations. In most cases, participants managed to build a coherent representation that was faithful to the input. However, both the quantitative and qualitative analysis of the results showed that comprehenders sometimes maintained multiple local

interpretations at once or even failed to build a coherent representation of a garden-path sentence. Thus, we argue that resulting representations of garden-path sentences are in fact not uniform, but rather diverse, and they vary both in their faithfulness to the presented input and in their internal coherence.
https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0288817

## ANNEMIEKE MILKS et al – A double-pointed wooden throwing stick from Schöningen, Germany: Results and new insights from a multianalytical study

The site of Schöningen (Germany), dated to ca. 300,000 years ago, yielded the earliest large-scale record of humanly-made wooden tools. These include wooden spears and shorter double-pointed sticks, discovered in association with herbivores that were hunted and butchered along a lakeshore. Wooden tools have not been systematically analysed to the same standard as other Palaeolithic technologies, such as lithic or bone tools. Our multianalytical study includes micro-CT scanning, 3-dimensional microscopy, and Fourier transform infrared spectroscopy, supporting a systematic technological and taphonomic analysis, thus setting a new standard for wooden tool analysis. In illustrating the biography of one of Schöningen's double-pointed sticks, we demonstrate new human behaviours for this time period, including sophisticated woodworking techniques. The hominins selected a spruce branch which they then debarked and shaped into an aerodynamic and ergonomic tool. They likely seasoned the wood to avoid cracking and warping. After a long period of use, it was probably lost while hunting, and was then rapidly buried in mud. Taphonomic alterations include damage from trampling, fungal attack, root damage and compression. Through our detailed analysis we show that Middle Pleistocene humans had a rich awareness of raw material properties, and possessed sophisticated woodworking skills. Alongside new detailed morphometrics of the object, an ethnographic review supports a primary function as a throwing stick for hunting, indicating potential hunting strategies and social contexts including for communal hunts involving children. The Schöningen throwing sticks may have been used to strategically disadvantage larger ungulates, potentially from distances of up to 30 metres. They also demonstrate that the hominins were technologically capable of capturing smaller fast prey and avian fauna, a behaviour evidenced at contemporaneous Middle Pleistocene archaeological sites.
https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0287719

## Proceedings of the Royal Society B

### PAPERS

### YANNICK JADOUL & ANDREA RAVIGNANI – Modelling the emergence of synchrony from decentralized rhythmic interactions in animal communication

To communicate, an animal's strategic timing of rhythmic signals is crucial. Evolutionary, game-theoretical, and dynamical systems models can shed light on the interaction between individuals and the associated costs and benefits of signalling at a specific time. Mathematical models that study rhythmic interactions from a strategic or evolutionary perspective are rare in animal communication research. But new inspiration may come from a recent game theory model of how group synchrony emerges from local interactions of oscillatory neurons. In the study, the authors analyse when the benefit of joint synchronization outweighs the cost of individual neurons sending electrical signals to each other. They postulate there is a benefit for pairs of neurons to fire together and a cost for a neuron to communicate. The resulting model delivers a variant of a classical dynamical system, the Kuramoto model. Here, we present an accessible overview of the Kuramoto model and evolutionary game theory, and of the 'oscillatory neurons' model. We interpret the model's results and discuss the advantages and limitations of using this particular model in the context of animal rhythmic communication. Finally, we sketch potential future directions and discuss the need to further combine evolutionary dynamics, game theory and rhythmic processes in animal communication studies.
https://royalsocietypublishing.org/doi/10.1098/rspb.2023.0876

### CHRISTOPH J. VÖLTER et al – Dogs' expectations about occlusion events: from expectancy violation to exploration

Previous research on human infants has shown that violations of basic physical regularities can stimulate exploration, which may represent a type of hypothesis testing aimed at acquiring knowledge about new causal relationships. In this study, we examined whether a similar connection between expectancy violation and exploration exists in nonhuman animals. Specifically, we investigated how dogs react to expectancy violations in the context of occlusion events. Throughout three experiments, dogs exhibited longer looking times at expectancy-inconsistent events than at consistent ones. This finding was further supported by pupil size analyses in the first two eye-tracking experiments. Our results suggest that dogs expect objects to reappear when they are not obstructed by a screen and consider the size of the occluding screen in relation to the occluded object. In Experiment 3, expectancy violations increased the dogs' exploration of the target object, similar to the findings with human infants. We conclude that expectancy violations can provide learning opportunities for nonhuman animals as well.
https://royalsocietypublishing.org/doi/10.1098/rspb.2023.0696

## Royal Society Open Science
### PAPERS

### BJÖRN BREMBS et al – Replacing academic journals
Replacing traditional journals with a more modern solution is not a new idea. Here, we propose ways to overcome the social dilemma underlying the decades of inaction. Any solution needs to not only resolve the current problems but also be capable of preventing takeover by corporations: it needs to replace traditional journals with a decentralized, resilient, evolvable network that is interconnected by open standards and open-source norms under the governance of the scholarly community. It needs to replace the monopolies connected to journals with a genuine, functioning and well-regulated market. In this new market, substitutable service providers compete and innovate according to the conditions of the scholarly community, avoiding sustained vendor lock-in. Therefore, a standards body needs to form under the governance of the scholarly community to allow the development of open scholarly infrastructures servicing the entire research workflow. We propose a redirection of money from legacy publishers to the new network by funding bodies broadening their minimal infrastructure requirements at recipient institutions to include modern infrastructure components replacing and complementing journal functionalities. Such updated eligibility criteria by funding agencies would help realign the financial incentives for recipient institutions with public and scholarly interest.
https://royalsocietypublishing.org/doi/10.1098/rsos.230206

### BJÖRN BREMBS et al – Mastodon over Mammon: towards publicly owned scholarly knowledge
Twitter is in turmoil and the scholarly community on the platform is once again starting to migrate. As with the early internet, scholarly organizations are at the forefront of developing and implementing a decentralized alternative to Twitter, Mastodon. Both historically and conceptually, this is not a new situation for the scholarly community. Historically, scholars were forced to leave social media platform FriendFeed after it was bought by Facebook in 2006. Conceptually, the problems associated with public scholarly discourse subjected to the whims of corporate owners are not unlike those of scholarly journals owned by monopolistic corporations: in both cases the perils associated with a public good in private hands are palpable. For both short form (Twitter/Mastodon) and longer form (journals) scholarly discourse, decentralized solutions exist, some of which are already enjoying some institutional support. Here we argue that scholarly organizations, in particular learned societies, are now facing a golden opportunity to rethink their hesitations towards such alternatives and support the migration of the scholarly community from Twitter to Mastodon by hosting Mastodon instances. Demonstrating that the scholarly community is capable of creating a truly public square for scholarly discourse, impervious to private takeover, might renew confidence and inspire the community to focus on analogous solutions for the remaining scholarly record—encompassing text, data and code—to safeguard all publicly owned scholarly knowledge.
https://royalsocietypublishing.org/doi/10.1098/rsos.230207

### ANDRÉ S. PEREIRA et al – Kinship composition in mammals
Understanding the evolution of group-living and cooperation requires information on who animals live and cooperate with. Animals can live with kin, non-kin or both, and kinship structure can influence the benefits and costs of group-living and the evolution of within-group cooperation. One aspect of kinship structure is kinship composition, i.e. a group-level attribute of the presence of kin and/or non-kin dyads in groups. Despite its putative importance, the kinship composition of mammalian groups has yet to be characterized. Here, we use the published literature to build an initial kinship composition dataset in mammals, laying the groundwork for future work in the field. In roughly half of the 18 species in our sample, individuals lived solely with same-sex kin, and, in the other half, individuals lived with related and unrelated individuals of the same sex. These initial results suggest that it is not rare for social mammals to live with unrelated individuals of the same sex, highlighting the importance of considering indirect and direct fitness benefits as co-drivers of the evolution of sociality. We hope that our initial dataset and insights will spur the study of kinship structure and sociality towards new exciting avenues.
https://royalsocietypublishing.org/doi/10.1098/rsos.230486

## Science
### PAPERS

### EUCHARIST KUN et al – The genetic architecture and evolution of the human skeletal form
Humans are the only bipedal great apes, owing to our distinctive skeletal form. Morphological changes that contribute to our skeletal form have been studied extensively in paleoanthropology. With the exception of standing height, examining the genetic basis for differential and specific growth of individual bones and their evolution has been challenging because of limited sample sizes.
One approach to studying skeletal form is to obtain a map of regions in the genome that affect skeletal development and morphology. Previously, this has been examined mainly through animal models and comparative genomics, but these approaches are largely low throughput. A complementary approach is to examine the genetic basis of variation in skeletal traits in humans. In this work, we applied deep-learning models to 31,221 full-body dual-energy x-ray absorptiometry (DXA) images from the UK Biobank to extract 23 different image-derived phenotypes that include all long-bone lengths and hip and shoulder widths, which we analyzed while controlling for height.

All skeletal proportions (SPs) are highly heritable (~30 to 50%), and genome-wide association studies of these traits identified 145 independent loci. These loci are enriched in genes that regulate skeletal development as well as those that are associated with rare human skeletal diseases and abnormal mouse skeletal phenotypes. Genetic correlation and genomic structural equation modeling indicated that limb proportions exhibited strong genetic sharing but were genetically independent of width and torso proportions. Phenotypic and polygenic risk score analyses identified specific associations between osteoarthritis of the hip and knee, which are the leading causes of adult disability in the United States, and SPs of the corresponding regions. We also found genomic evidence of evolutionary change in arm-to-leg and hip-width proportions in humans, consistent with notable anatomical changes in these SPs in the hominin fossil record. In contrast to cardiovascular, autoimmune, metabolic, and other categories of traits, loci associated with these SPs are significantly enriched both in human accelerated regions and in regulatory elements of genes that are differentially expressed in humans and the great apes throughout development.

Our work validates the use of deep-learning models on DXA images to identify specific genetic variants that affect the human skeletal form. It also ties a major evolutionary facet of human anatomical change to pathogenesis.

https://www.science.org/doi/10.1126/science.adf8009

## Trends in Cognitive Sciences

### PAPERS

**JILLIAN J. JORDAN – A pull versus push framework for reputation**

Reputation has a profound influence on psychology and behavior, and can be leveraged for social good.

In many important contexts, however, we have strong evidence that reputation is functioning, but do not deeply understand how reputation is functioning, from a game-theoretic perspective.

The game-theoretic reputation literature highlights different ways that reputation systems can function. However, these insights have not been well connected to the empirical reputation literature, despite their potential to shed new light on established reputational phenomena, and guide the design of reputation-based interventions.

This article seeks to bridge this gap by proposing a reputation framework that highlights two fundamentally different ways that reputation can function, and by outlining how these mechanisms might give rise to divergent patterns of psychology and behavior.

https://www.cell.com/trends/cognitive-sciences/fulltext/S1364-6613(23)00149-3

## Trends in Ecology and Evolution

### PAPERS

**THORE J. BERGMAN & JACINTA C. BEEHNER – Information Ecology: an integrative framework for studying animal behavior**

Information is simultaneously a valuable resource for animals and a tractable variable for researchers. We propose the name Information Ecology to describe research focused on how individual animals use information to enhance fitness. An explicit focus on information in animal behavior is far from novel – we simply build on these ideas and promote a unified approach to how and why animals use information. The value of information to animals favors the theoretically rich adaptive approach of field-based research. Simultaneously, our ability to manipulate information lends itself to the strong methods of laboratory-based research. Information Ecology asks three questions: What information is available? How is it used (or not)? And, why is it used (or not)?

https://www.cell.com/trends/ecology-evolution/fulltext/S0169-5347(23)00140-4

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