

## EAORC BULLETIN 1,116 – 3 November 2024

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## NOTICES

### FORMATTED VERSION OF THIS BULLETIN

A pdf formatted version if this Bulletin is available for download at [martinedwardes.me.uk/eaorc/eaorc\\_bulletins.htm](http://martinedwardes.me.uk/eaorc/eaorc_bulletins.htm).

## PUBLICATION ALERTS

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

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

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

## EDITORIAL INTERJECTIONS

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

## ACADEMIA.EDU – Modern Human Behavior in the Middle Paleolithic

*In Transitions Before the Transition: Evolution and Stability in the Middle Paleolithic and Middle Stone Age. Erella Hovers and Steven L. Kuhn (eds.), Springer, 295-304 (2006).*

### ERELLA HOVERS & ANNA BELFER-COHEN – “Now You See it. Now You Don’t” – Modern Human Behavior in the Middle Paleolithic

An intriguing phenomenon of the Middle Paleolithic archaeological record is the sporadic occurrence of traits commonly associated with alleged modern behavior. Given the antiquity in the hominin lineage of the organic systems that control such behaviors, the question of interest is not whether Middle Paleolithic people were capable of such behaviors, but rather why its occurrence is so haphazard and irregular. We suggest that the archaeological finds reflect only those elements of human knowledge that have been accepted and incorporated into societal normative behaviors, stored and kept for repeated use through canonization and rituals. Instability of demographic systems and population crashes prevented the continuous accumulation of such knowledge in certain regions of the Old World, dictating that technological and symbolic innovations be “re-invented” time and again throughout the Middle Paleolithic period.

[https://www.academia.edu/223062/Hovers\\_E\\_and\\_Belfer\\_Cohen\\_A\\_2006\\_Now\\_you\\_see\\_it\\_now\\_you\\_don\\_t\\_modern\\_human\\_behavior\\_in\\_the\\_Middle\\_Paleolithic\\_In\\_Hovers\\_E\\_Kuhn\\_S\\_L\\_Eds\\_Transitions\\_Before\\_The\\_Transition\\_Evolution\\_and\\_Stability\\_in\\_the\\_Middle\\_Paleolithic\\_and\\_Middle\\_Stone\\_Age\\_Springer\\_New\\_York\\_pp\\_295\\_304](https://www.academia.edu/223062/Hovers_E_and_Belfer_Cohen_A_2006_Now_you_see_it_now_you_don_t_modern_human_behavior_in_the_Middle_Paleolithic_In_Hovers_E_Kuhn_S_L_Eds_Transitions_Before_The_Transition_Evolution_and_Stability_in_the_Middle_Paleolithic_and_Middle_Stone_Age_Springer_New_York_pp_295_304)

## NEWS

### JOHN TEMPLETON FOUNDATION – I Want to Believe: Our Fascination with the Supernatural

“Do you believe in the existence of extraterrestrials?”

So Agent Fox Mulder asked Agent Dana Scully in the first episode of *The X-Files*, which aired a little over 31 years ago. Much further back than that—millennia—human beings have been fascinated and repelled by the supernatural: from the ancient Egyptian Book of the Dead, which offered spells to ward off evil spirits, to Dante’s *Inferno* which depicted the nine circles of Hell, all the way to recent cinematic interpretations of meeting alien life, such as *Close Encounters of the Third Kind*, *Independence Day*, and *Star Trek: First Contact*. But why are people so interested in “spooky” things that terrify them—ghosts, aliens, witches, and the paranormal?

<https://www.templeton.org/news/i-want-to-believe-our-fascination-with-the-supernatural>

### SCIENCEADVISER – Kissing may have gotten its start as an ape grooming ritual

Whether it’s two newlyweds going in for a smooch after saying “I do” or a parent soothing their child’s scraped knee, kissing is one of humanity’s most recognizable symbols of affection. Clay tablets from Ancient Mesopotamia dating to 2500 B.C.E. provide the earliest archaeological evidence of romantic kissing. The behavior may even be older than civilization itself, with some studies suggesting neanderthals swapped spit with modern humans— and shared each other’s oral microbes—more than 100,000 years ago.

Why did humans start kissing in the first place? Some researchers have suggested it evolved from sniffing, nursing babies, or even parents passing chewed-up food to their children. But in an article published last week in *Evolutionary Anthropology*, evolutionary psychologist Adriano Lameira suggests that kissing got its start as a fur grooming ritual still observed in modern-day chimpanzees and other great apes. After searching through its companion’s coat for parasites or debris, he explains, one ape will typically pucker its lips and remove the offending item with its mouth.

Over time, as our ape-like ancestors gradually lost their fur, grooming started to lose its relevance as a hygienic ritual. But the “groomer’s last kiss” may have been preserved, Lameira tells Science reporter Phie Jacobs, eventually taking on the symbolic meaning familiar to every modern rom-com lover.

<https://www.science.org/content/article/did-human-kiss-begin-ape-grooming-ritual>

### SCIENCE DAILY – What animal societies can teach us about aging

Red deer may become less sociable as they grow old to reduce the risk of picking up diseases, while older house sparrows seem to have fewer social interactions as their peers die off, according to new research which shows humans are not the only animals to change our social behavior as we age.

<https://www.sciencedaily.com/releases/2024/10/241028211432.htm>

### SCIENCE DAILY – Why our brains are effective at quickly processing short messages

A team of linguistics and psychology researchers has discovered that when a brief sentence is flashed, our brains detect its basic linguistic structure extremely quickly -- in roughly 150 milliseconds, or about the speed of a blink of an eye.

<https://www.sciencedaily.com/releases/2024/10/241023141840.htm>

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### SCIENCE DAILY – 'With a grain of salt': How humans learn from others

When we make decisions, we are often guided by the opinions and experiences of those around us. Yet we actually have quite different preferences, tastes and goals. A research team investigated how we learn from others despite individual differences. The scientists found that humans tend to treat social information as a recommendation -- with some skepticism. They also use it to save themselves costly exploration. The results open up new paths to incorporate similar learning principles into artificial intelligence (AI).

<https://www.sciencedaily.com/releases/2024/10/241023131037.htm>

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### SCIENCE DAILY – Similarities in brain development between marmosets and humans

In common marmosets, the brain regions that process social interactions develop very slowly, extending until early adulthood, like in humans. During this time, all group members are involved in raising the infants, which contributes to the species' strong socio-cognitive skills.

<https://www.sciencedaily.com/releases/2024/10/241030145650.htm>

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### SCIENCE DAILY – Keeping fewer friends protects aging monkeys from diseases

Becoming less sociable protects older monkeys from getting ill, new research shows.

<https://www.sciencedaily.com/releases/2024/10/241028132045.htm>

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### SCIENCE.ORG NEWS – Did the human kiss begin as an ape grooming ritual?

An evolutionary psychologist talks with Science about his hypothesis on the origin of locking lips.

<https://www.science.org/content/article/did-human-kiss-begin-ape-grooming-ritual>

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## PUBLICATIONS

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### Biology Letters

#### PAPERS

#### **CHEDHAWAT CHOKECHAIPAISARN & ANDY GARDNER – Density-dependent dispersal reduces conflict over the sex ratio**

Haplodiploids—in particular, wasps—are the workhorses of sex-allocation research. This is owing to their unusual system of sex determination, which provides a ready means of sex ratio adjustment. Notably, their sexually asymmetrical mode of genetic inheritance leads mothers and fathers to come into conflict over the sex ratio of their offspring. In the simplest outbreeding scenario, a mother is favoured to employ an even sex ratio while a father prefers that all his mate's offspring are female. An important modulator of evolutionary conflict between mating partners is genetic relatedness, raising the possibility that this sex ratio conflict is reduced in low-dispersal settings with mating occurring between relatives. However, the impact of population viscosity on sex ratio conflict in haplodiploids remains unknown. Here, we develop and analyse a kin-selection model to investigate how the rate of dispersal modulates sex ratio conflict in a haplodiploid, viscous population setting. We find that population viscosity is associated with a reduction in the extent of sex ratio conflict—the effect being very weak under density-independent dispersal and much stronger under density-dependent dispersal.

<https://royalsocietypublishing.org/doi/10.1098/rsbl.2024.0378>

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### Cell Reports

#### PAPERS

#### **DAOHAN ZHANG et al – A brain-to-text framework for decoding natural tonal sentences**

Speech brain-computer interfaces (BCIs) directly translate brain activity into speech sound and text. Despite successful applications in non-tonal languages, the distinct syllabic structures and pivotal lexical information conveyed through tonal nuances present challenges in BCI decoding for tonal languages like Mandarin Chinese. Here, we designed a brain-to-text framework to decode Mandarin sentences from invasive neural recordings. Our framework dissects speech onset, base syllables, and lexical tones, integrating them with contextual information through Bayesian likelihood and a Viterbi decoder. The results demonstrate accurate tone and syllable decoding during naturalistic speech production. The overall word error rate (WER) for 10 offline-decoded tonal sentences with a vocabulary of 40 high-frequency Chinese characters is 21% (chance: 95.3%) averaged across five participants, and tone decoding accuracy reaches 93% (chance: 25%), surpassing previous

intracranial Mandarin tonal syllable decoders. This study provides a robust and generalizable approach for brain-to-text decoding of continuous tonal speech sentences.

[https://www.cell.com/cell-reports/fulltext/S2211-1247\(24\)01275-0](https://www.cell.com/cell-reports/fulltext/S2211-1247(24)01275-0)

## Current Anthropology

### PAPERS

#### **EUGÈNE MORI et al with REBECCA BLIEGE BIRD – Why Do Humans Hunt Cooperatively?**

We analyze a new ethnographic and ethnohistoric database of quantitative cases ( $n = 139$ ) and qualitative information on a neglected form of forager subsistence—communal drive hunts (CDHs)—using a human behavioral ecology perspective. Among our key findings are that (i) in specific contexts, CDHs achieve higher return rates or lower odds of failure than encounter hunting; (ii) CDHs increase the rate of success for hunting large ungulates that cluster and have long flight initiation distances and high predator escape velocities; (iii) CDHs engage the benefits and problems of collaborative, sometimes community-wide behavior at scales from the small and opportunistic to the large and institutionalized; (iv) although formerly commonplace, CDHs largely disappeared by the late nineteenth century because of colonial impacts on Indigenous societies and the adoption of repeating rifles and dogs, favoring encounter hunting; (v) cooperative hunting by great apes and indirect archaeological evidence suggest that collaborative hunting is potentially a practice of considerable antiquity and is thus important in the evolution of hominin prosocial behavior; and (vi) while human behavioral ecology has robust models for the analysis of the social distribution of subsistence resources, the development of complementary models for social production is just beginning.

<https://www.journals.uchicago.edu/doi/epdf/10.1086/732354>

## Frontiers in Language Sciences

### PAPERS

#### **HEATHER C. P. LEMEN, ELENA V. M. LIEVEN & ANNA L. THEAKSTON – The influence of pragmatic function on children's comprehension of complex because- and if-sentences**

In complex adverbial sentences, the connectives because and if can perform different pragmatic functions (e.g. Content, Speech-Act), although this is often overlooked in studies investigating children's acquisition of these connectives. In this study, we investigated whether pragmatic variation is responsible for some of the difficulty young children have in understanding because- and if-sentences and tested the extent to which patterns of acquisition are related to the cognitive complexity or input frequency of the different pragmatic types.

Ninety-two children (aged 3–5;  $F = 39$ ) and 20 adults ( $F = 12$ ) took part in a forced-choice picture task where they had to identify correct pictures after hearing Content and Speech-Act because- and if-sentences.

Results showed that children were most accurate on the sentence type where cognitive simplicity and input frequency converge (If Content), but this pattern was largely driven by the girls in the study. For response times, children were fastest with the least cognitively complex sentence types. However, for because Speech-Act sentences, there was an inverse relationship between response time and input frequency.

Taken together, these findings suggest that neither account (cognitive complexity or input frequency) can fully explain the findings. Instead, we suggest that the relative contributions of both factors are best understood in terms of the relevance of these utterances to children and the precise contexts in which children hear these utterances produced.

<https://www.frontiersin.org/journals/language-sciences/articles/10.3389/flang.2024.1420237/full>

## Frontiers in Psychiatry

### PAPERS

#### **HAIDAN LU et al – Characterization of implicit and explicit mind-reading in children with autism based on eye movements**

This study aimed to investigate differences in mind-reading abilities between children with autism and typically developing children across various tasks.

Sixteen children with autism (aged 5–8 years) were compared to 16 typically developing children matched in language ability. The unexpected location task and unexpected content task were used to assess implicit and explicit mind-reading abilities using an eye tracker and illustrated storybooks.

For implicit mind, using differential looking scores shows a no significant difference between the scores of children with autism and typically developing children in the implicit tasks ( $P=0.399$ ). However, the pupil size show some significant difference between two groups. Second, for the explicit, a significant difference between the scores of children with autism and typically developing children in the explicit tasks ( $P=0.006$ ). Additionally, only a significant correlation between implicit and explicit mind-reading abilities in children with autism in the unexpected location task was found.

The mechanism of implicit mind-reading still not very clear. Pupil-Linked arousal response can be consider as a further tool. Further research on implicit and explicit mind-reading abilities is warranted.

<https://www.frontiersin.org/journals/psychiatry/articles/10.3389/fpsy.2024.1449995/full>

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## Frontiers in Psychology

### PAPERS

#### **ANDREAS HAGA – Morally “loaded” labels in the built environment influence perceptions and social judgments**

Products and artifacts with morally loaded labels (e.g., environmentally friendly) appear to influence people's perceptions and behaviors. Previous studies have shown that desktop lamps labeled “environmentally friendly” can enhance perceived color discrimination and improve certain reading activities compared to a physically identical lamp labeled “conventional.” This effect may occur because people tend to align their behavior with moral principles. The present study explored the generalizability and robustness of this label effect by asking participants to make trait judgments of photographed faces. In an experimental design, participants evaluated photos illuminated by a desktop lamp that was either labeled environmentally friendly or not labeled at all. The results revealed that participants assigned more positive traits to individuals in the photographs when the lamp was labeled “environmentally friendly,” particularly those with high altruistic values. The pattern was reversed for participants with low altruistic values. Moreover, participants rated the light from the lamp labeled “environmentally friendly” as more comfortable and claimed that the light increased (perceived) visibility. In conclusion, the source of the light—whether from an environmentally friendly or conventional lamp—affects both the evaluation of the light itself and the judgments made about other individuals. This study explores theoretical explanations for these label effects and discusses their potential implications for pro-environmental interventions.

<https://www.frontiersin.org/journals/psychology/articles/10.3389/fpsyg.2024.1294220/full>

#### **MARGHERITA ATTANASIO et al – Does ChatGPT have a typical or atypical theory of mind?**

In recent years, the capabilities of Large Language Models (LLMs), such as ChatGPT, to imitate human behavioral patterns have been attracting growing interest from experimental psychology. Although ChatGPT can successfully generate accurate theoretical and inferential information in several fields, its ability to exhibit a Theory of Mind (ToM) is a topic of debate and interest in literature. Impairments in ToM are considered responsible for social difficulties in many clinical conditions, such as Autism Spectrum Disorder (ASD). Some studies showed that ChatGPT can successfully pass classical ToM tasks, however, the response style used by LLMs to solve advanced ToM tasks, comparing their abilities with those of typical development (TD) individuals and clinical populations, has not been explored. In this preliminary study, we administered the Advanced ToM Test and the Emotion Attribution Task to ChatGPT 3.5 and ChatGPT-4 and compared their responses with those of an ASD and TD group. Our results showed that the two LLMs had higher accuracy in understanding mental states, although ChatGPT-3.5 failed with more complex mental states. In understanding emotional states, ChatGPT-3.5 performed significantly worse than TDs but did not differ from ASDs, showing difficulty with negative emotions. ChatGPT-4 achieved higher accuracy, but difficulties with recognizing sadness and anger persisted. The style adopted by both LLMs appeared verbose, and repetitive, tending to violate Grice's maxims. This conversational style seems similar to that adopted by high-functioning ASDs. Clinical implications and potential applications are discussed.

<https://www.frontiersin.org/journals/psychology/articles/10.3389/fpsyg.2024.1488172/full>

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## Nature

### ARTICLES

#### **KERRI SMITH, NIK SPENCER & PHIL WHEELER – What's so special about the human brain?**

Torrents of data from cell atlases, brain organoids and other methods are finally delivering answers to an age-old question.

<https://www.nature.com/immersive/d41586-024-03425-y/index.html>

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## Nature Communications

### PAPERS

#### **CHRISTOPHER J. BAE & XIUJIE WU – Making sense of eastern Asian Late Quaternary hominin variability**

A greater degree of Late Quaternary hominin morphological variability is present in eastern Asia than previously assumed. Indeed, a number of distinct populations are present, some that now have new specific names: *Homo floresiensis*; *H. luzonensis*; *H. longi*; *H. juluensis*. With this piece, we describe the various groupings based on the current hominin fossil record of eastern Asia.

<https://www.nature.com/articles/s41467-024-53918-7>

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## Nature Ecology & Evolution

### COMMENTARIES

#### **LEONARDO CARMIGNANI et al – An Initial Upper Palaeolithic attribution is not empirically supported at Shlyu, northern China**

Initial Upper Palaeolithic (IUP) assemblages are increasingly thought to be linked to the first widespread dispersal of *Homo sapiens* across Eurasia between 55 and 40 thousand years ago (kya cal bp). As a result, today the identification of IUP assemblages plays a key role in archaeological research focused on this key period, which is also characterized by the eventual disappearance of Neandertals and Denisovans from the fossil record. In a recent paper, Yang et al.<sup>1</sup> claim to have

identified the oldest and easternmost IUP at Shiyu, northern China, dated to ~45 kya cal bp and with this to transform knowledge of the routes and timing of the migration of *H. sapiens* in Asia. We argue, however, that this attribution is based on a biased sample of artefacts, the misuse of technological definitions and the misreading of stone artefacts central to their argument. Furthermore, it relies on the questionable assumption that the studied material (750 lithic artefacts from an original number of ~15,000) is a representative sample of a single assemblage. Although we recognize the value of technological re-evaluations of previously excavated assemblages, we believe that an IUP attribution is not empirically supported. In fact, it detracts attention from more pressing issues concerning the character of this technology, the association between lithics and personal ornaments and the overall integrity of the assemblage. Below, we highlight the key problems in the conclusions reached by Yang et al.

<https://www.nature.com/articles/s41559-024-02548-9>

**SHI-XIA YANG et al with FRANCESCO D'ERRICO & MICHAEL PETRAGLIA – Reply to: An Initial Upper Palaeolithic attribution is not empirically supported at Shiyu, northern China**

Carmignani and colleagues contend that our identification of the oldest and easternmost Initial Upper Palaeolithic (IUP) attribution at Shiyu, northern China is based on a misuse of technological definitions and biased artefact sampling. However, this criticism is hampered by restrictive Eurocentric definitions and methodological misunderstandings. Carmignani et al. apply a narrow definition of the Asian IUP based on the presence of points and blades reduced from sub-volumetric, non-Levallois-system burin cores. Shiyu does not perfectly conform to this definition, so they exclude its lithic industry from the IUP. We argue that this definition hampers understanding of modern human dispersals across Eurasia. Like any other discipline where classification is central, archaeologists define categories of objects and assemblages based on similarities in sets of traits. These categories are not inherently meaningful; rather, their significance arises from assumptions about underlying biological and cultural processes. The assumption that lends meaning to the IUP is that it reflects a combination of demic and cultural diffusion processes associated with the spread of *Homo sapiens* throughout Eurasia.

<https://www.nature.com/articles/s41559-024-02554-x>

**Original Paper: SHI-XIA YANG et al with FRANCESCO D'ERRICO & MICHAEL PETRAGLIA – Initial Upper Palaeolithic material culture by 45,000 years ago at Shiyu in northern China**

[EAORC Bulletin 1,075.]

<https://www.nature.com/articles/s41559-023-02294-4>

## Nature Humanities & Social Sciences Communications

### PAPERS

**GREGORY KROLICZAK & LUKASZ PRZYBYLSKI – Handedness and the control of human technology and language**

The impact of handedness on neural substrates of common tool processing and tool use skills as proxies to the mechanisms underlying modern reciprocal relationships among humans and their brains, the tools they create and use, and technologies they implement and utilise, has only recently started to be elucidated. Yet, as most of the reports on lateralisation of such processing or skills focused on a single task, and sharp divisions of participants into right-, left-, and mixed-handed, or non-righthanded for the latter two groups combined, little is known about interrelationships between the neuronal underpinnings of different skilled manual actions—e.g., manual praxis skills in the form of disparate hand-tool interactions, including their most common neural phenotypes in the population at large. Here, in 62 individuals with different handedness status, we studied the laterality of two praxic abilities involving common tools. Even though their neural substrates were expected to be closely linked, we identified numerous cases (in 7/28 righthanders [RH] – 25%, and in 6/21 lefthanders [LH] – 29% of participants) with hemispheric dissociations in the underlying mechanisms. They involved both right-lateralised functional grasp planning vs. left-lateralised visual tool use (8% of all tested cases, 3/28 RH: ~11%, and 2/21 LH: ~10%), and vice versa (13% of all cases, 4/28 RH: ~14%, and 4/21 LH: ~19% of participants). The laterality/organisation of these praxic skills was also compared to the laterality/organisation of productive language, with only few cases of dissociations identified. The observed phenotypes are discussed in the context of coevolutionary hypotheses linking ancient toolmaking and tool use skills, the associated cultural evolution, technological innovations, and language to the cortical expansion and functional lateralisation in human evolution.

<https://www.nature.com/articles/s41599-024-03985-4>

## Nature Scientific Reports

### PAPERS

**JACQUES PRIEUR, KATJA LIEBAL & SIMONE PIKA – Social negotiation and “accents” in Western lowland gorillas’ gestural communication**

Recent findings on chimpanzee infants’ gestural development show that they use some gesture types flexibly and adjust them depending on their interaction partner and social context, suggesting that gestural communication is partly learnt and partly genetically determined. However, how gesture types are shaped by social and demographic factors remains unclear. We addressed this question by focusing on gesture type morphology and conducted a fine-grained analysis of gestural form

during intraspecific social-play interactions in two captive groups of Western lowland gorillas (*Gorilla gorilla gorilla*). We focused on the most frequent gesture types (beat chest, slap body, slap ground and touch body) produced by subadults (infants, juveniles and adolescents). We considered twelve morphological gesture characteristics (e.g., horizontal and vertical hand trajectories, fingers flexion and spread). Our multifactorial investigation shows that morphological characteristics of distinct gesture types can be shaped by social factors, namely signaller's sociodemographic characteristics (group and kinship), signaller's behavioural characteristics (body posture) and context-related characteristics (recipient's sex, attentional state and position in the signaller's visual field). We nurtured the lively debate concerning gesture origins by revealing the existence of "accents" in non-verbal communication and the highly variable adjustment of gestural form to different conspecifics and interactional characteristics, which supports the revised social negotiation hypothesis.

<https://www.nature.com/articles/s41598-024-75238-y>

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**SERGIO LO IACONO, BURAK SONMEZ & MALCOLM FAIRBROTHER – The effect of trusting contexts in social dilemmas with collective and individual solutions**

Trust encourages members of communities to cooperate and provide public goods. However, the literature has yet to fully investigate how high and low trusting communities deal with collective action dilemmas with multiple solutions. The latter may raise the risk of coordination failure. Using a preregistered interactive experiment (N participants/groups = 371/70), we investigated people's decisions when they have three possible choices in confronting a collective action dilemma: investing in an individual solution, investing in a collective solution, and free-riding. We manipulated the incentives for trusting and trustworthy interactions among community members, and, consistent with our expectations, we found that people in high-trust contexts invest more in collective solutions, compared to people in low-trust contexts. In the latter case, participants opted more for individual solutions, using resources less efficiently. However, we found no difference in the prevalence of free-riding in high- compared to low-trust contexts.

<https://www.nature.com/articles/s41598-024-77190-3>

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**New Scientist**

**ARTICLES**

**CHRISTA LESTÉ-LASSERRE – Stone Age network reveals ancient Paris was an artisanal trading hub**

Ancient stone goods found across France may have been made by skilled craftspeople in what is now Paris, who traded along vast networks.

<https://www.newscientist.com/article/2453552-stone-age-network-reveals-ancient-paris-was-an-artisanal-trading-hub/>

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**Open Biology**

**PAPERS**

**JOSÉ HÉCTOR et al – Sex as a biological variable in ageing: insights and perspectives on the molecular and cellular hallmarks**

Sex-specific differences in lifespan and ageing are observed in various species. In humans, women generally live longer but are frailer and suffer from different age-related diseases compared to men. The hallmarks of ageing, such as genomic instability, telomere attrition or loss of proteostasis, exhibit sex-specific patterns. Sex chromosomes and sex hormones, as well as the epigenetic regulation of the inactive X chromosome, have been shown to affect lifespan and age-related diseases. Here we review the current knowledge on the biological basis of sex-biased ageing. While our review is focused on humans, we also discuss examples of model organisms such as the mouse, fruit fly or the killifish. Understanding these molecular differences is crucial as the elderly population is expected to double worldwide by 2050, making sex-specific approaches in the diagnosis, treatment, therapeutic development and prevention of age-related diseases a pressing need.

<https://royalsocietypublishing.org/doi/10.1098/rsob.240177>

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**Philosophical Transactions of the Royal Society B**

**PAPERS**

**JOE P. WOODMAN et al – The ecology of ageing in wild societies: linking age structure and social behaviour**

The age of individuals has consequences not only for their fitness and behaviour but also for the functioning of the groups they form. Because social behaviour often changes with age, population age structure is expected to shape the social organization, the social environments individuals experience and the operation of social processes within populations. Although research has explored changes in individual social behaviour with age, particularly in controlled settings, there is limited understanding of how age structure governs sociality in wild populations. Here, we synthesize previous research into age-related effects on social processes in natural populations, and discuss the links between age structure, sociality and ecology, specifically focusing on how population age structure might influence social structure and functioning. We highlight the potential for using empirical data from natural populations in combination with social network approaches to uncover pathways linking individual social ageing, population age structure and societal functioning. We discuss the broader implications of these insights for understanding the social impacts of anthropogenic effects on animal population demography and for building a deeper understanding of societal ageing in general.



<https://royalsocietypublishing.org/doi/full/10.1098/rstb.2022.0464>

**ROBERTO SALGUERO-GÓMEZ – More social species live longer, have longer generation times and longer reproductive windows**

The role of sociality in the demography of animals has become an intense focus of research in recent decades. However, efforts to understand the sociality–demography nexus have hitherto focused on single species or isolated taxonomic groups. Consequently, we lack generality regarding how sociality associates with demographic traits within the Animal Kingdom. Here, I propose a continuum of sociality, from solitary to tightly social, and test whether this continuum correlates with the key demographic properties of 152 species, from jellyfish to humans. After correction for body mass and phylogenetic relationships, I show that the sociality continuum is associated with key life history traits: more social species live longer, postpone maturity, have longer generation time and greater probability of achieving reproduction than solitary, gregarious, communal or colonial species. Contrary to the social buffering hypothesis, sociality does not result in more buffered populations. While more social species have a lower ability to benefit from disturbances, they display greater resistance than more solitary species. Finally, I also show that sociality does not shape reproductive or actuarial senescence rates. This cross-taxonomic examination of sociality across the demography of 13 taxonomic classes highlights key ways in which individual interactions shape most aspects of animal demography.

<https://royalsocietypublishing.org/doi/full/10.1098/rstb.2022.0459>

**JULIA SCHROEDER et al – Not so social in old age: demography as one driver of decreasing sociality**

Humans become more selective with whom they spend their time, and as a result, the social networks of older humans are smaller than those of younger ones. In non-human animals, processes such as competition and opportunity can result in patterns of declining sociality with age. While there is support for declining sociality with age in mammals, evidence from wild bird populations is lacking. Here, we test whether sociality declines with age in a wild, insular bird population, where we know the exact ages of individuals. Using 6 years of sociality data, we find that as birds aged, their degree and betweenness decreased. The number of same-age birds still alive also decreased with age. Our results suggest that a longitudinal change in sociality with age may be, in part, an emergent effect of natural changes in demography. This highlights the need to investigate the changing costs and benefits of sociality across a lifetime.

<https://royalsocietypublishing.org/doi/full/10.1098/rstb.2022.0458>

**INES FÜRTBAUER et al – Linking energy availability, movement and sociality in a wild primate (*Papio ursinus*)**

Proximate mechanisms of ‘social ageing’, i.e. shifts in social activity and narrowing of social networks, are understudied. It is proposed that energetic deficiencies (which are often seen in older individuals) may restrict movement and, in turn, sociality, but empirical tests of these intermediary mechanisms are lacking. Here, we study wild chacma baboons (*Papio ursinus*), combining measures of faecal triiodothyronine (fT3), a non-invasive proxy for energy availability, high-resolution GPS data (movement and social proximity) and accelerometry (social grooming durations). Higher (individual mean-centred) fT3 was associated with increased residency time (i.e. remaining in the same area longer), which, in turn, was positively related to social opportunities (i.e. close physical proximity). Individuals with more frequent social opportunities received more grooming, whereas for grooming given, fT3 moderated this effect, suggesting an energetic cost of giving grooming. While our results support the spirit of the energetic deficiencies hypothesis, the directionality of the relationship between energy availability and movement is unexpected and suggests that lower-energy individuals may use strategies to reduce the costs of intermittent locomotion. Thus, future work should consider whether age-related declines in sociality may be a by-product of a strategy to conserve energy.

<https://royalsocietypublishing.org/doi/full/10.1098/rstb.2022.0466>

**MATTHEW J. HASENJAGER & NINA H. FEFFERMAN – Social ageing and higher-order interactions: social selectiveness can enhance older individuals’ capacity to transmit knowledge**

In long-lived organisms, experience can accumulate with age, such that older individuals may act as repositories of ecological and social knowledge. Such knowledge is often beneficial and can spread via social transmission, leading to the expectation that ageing individuals will remain socially well-integrated. However, social ageing involves multiple processes that modulate the relationship between age and social connectivity in complex ways. We developed a generative model to explore how social ageing may drive changes in social network position and shape older individuals’ capacity to transmit knowledge to others. We further employ novel hypernetwork analyses that capture higher-order interactions (i.e. involving  $\geq 3$  participants) to reveal potential relationships between age and sociality that conventional dyadic networks may overlook. We find that older individuals in our simulations effectively facilitate transmission across a range of scenarios, especially when transmission resembles a complex contagion or when social selectivity (i.e. prioritization of key relationships) rapidly emerges with age. These patterns result from the formation of tight-knit sets of older associates that co-occur in multiple groups, thereby reinforcing one another’s capacity to transmit knowledge. Our findings suggest key avenues for future empirical work and illustrate the use of hypernetworks in advancing the study of social behaviour.

<https://royalsocietypublishing.org/doi/abs/10.1098/rstb.2022.0461>

**ERIN R. SIRACUSA et al – Social ageing can protect against infectious disease in a group-living primate**

The benefits of social living are well established, but sociality also comes with costs, including infectious disease risk. This cost–benefit ratio of sociality is expected to change across individuals' lifespans, which may drive changes in social behaviour with age. To explore this idea, we combine data from a group-living primate for which social ageing has been described with epidemiological models to show that having lower social connectedness when older can protect against the costs of a hypothetical, directly transmitted endemic pathogen. Assuming no age differences in epidemiological characteristics (susceptibility to, severity and duration of infection), older individuals suffered lower infection costs, which was explained largely because they were less connected in their social networks than younger individuals. This benefit of 'social ageing' depended on epidemiological characteristics and was greatest when infection severity increased with age. When infection duration increased with age, social ageing was beneficial only when pathogen transmissibility was low. Older individuals benefited most from having a lower frequency of interactions (strength) and network embeddedness (closeness) and benefited less from having fewer social partners (degree). Our study provides a first examination of the epidemiology of social ageing, demonstrating the potential for pathogens to influence the evolutionary dynamics of social ageing in natural populations.

<https://royalsocietypublishing.org/doi/full/10.1098/rstb.2022.0462>

**FERNANDO A. CAMPOS et al – Wild capuchin monkeys as a model system for investigating the social and ecological determinants of ageing**

Studying biological ageing in animal models can circumvent some of the confounds exhibited by studies of human ageing. Ageing research in non-human primates has provided invaluable insights into human lifespan and healthspan. Yet data on patterns of ageing from wild primates remain relatively scarce, centred around a few populations of catarrhine species. Here, we introduce the white-faced capuchin, a long-lived platyrrhine primate, as a promising new model system for ageing research. Like humans, capuchins are highly social, omnivorous generalists, whose healthspan and lifespan relative to body size exceed that of other non-human primate model species. We review recent insights from capuchin ageing biology and outline our expanding, integrative research programme that combines metrics of the social and physical environments with physical, physiological and molecular hallmarks of ageing across the natural life courses of multiple longitudinally tracked individuals. By increasing the taxonomic breadth of well-studied primate ageing models, we generate new insights, increase the comparative value of existing datasets to geroscience and work towards the collective goal of developing accurate, non-invasive and reliable biomarkers with high potential for standardization across field sites and species, enhancing the translatability of primate studies.

<https://royalsocietypublishing.org/doi/abs/10.1098/rstb.2023.0482>

**SAM K. PATTERSON et al – Early life adversity has sex-dependent effects on survival across the lifespan in rhesus macaques**

Exposure to early life adversity is linked to detrimental fitness outcomes across taxa. Owing to the challenges of collecting longitudinal data, direct evidence for long-term fitness effects of early life adversity from long-lived species remains relatively scarce. Here, we test the effects of early life adversity on male and female longevity in a free-ranging population of rhesus macaques (*Macaca mulatta*) on Cayo Santiago, Puerto Rico. We leveraged six decades of data to quantify the relative importance of 10 forms of early life adversity for 6599 macaques. Individuals that experienced more early life adversity died earlier than those that experienced less adversity. Mortality risk was highest during early life, defined as birth to 4 years old, but heightened mortality risk was also present in macaques that survived to adulthood. Females and males were affected differently by some forms of adversity, and these differences might be driven by varying energetic demands and dispersal patterns. Our results show that the fitness consequences of early life adversity are not uniform across individuals but vary as a function of the type of adversity, timing and social context, and thus contribute to our limited but growing understanding of the evolution of early life sensitivities.

<https://royalsocietypublishing.org/doi/10.1098/rstb.2022.0456>

**MATTHEW J. HASENJAGER & NINA H. FEFFERMAN – Social ageing and higher-order interactions: social selectiveness can enhance older individuals' capacity to transmit knowledge**

In long-lived organisms, experience can accumulate with age, such that older individuals may act as repositories of ecological and social knowledge. Such knowledge is often beneficial and can spread via social transmission, leading to the expectation that ageing individuals will remain socially well-integrated. However, social ageing involves multiple processes that modulate the relationship between age and social connectivity in complex ways. We developed a generative model to explore how social ageing may drive changes in social network position and shape older individuals' capacity to transmit knowledge to others. We further employ novel hypernetwork analyses that capture higher-order interactions (i.e. involving  $\geq 3$  participants) to reveal potential relationships between age and sociality that conventional dyadic networks may overlook. We find that older individuals in our simulations effectively facilitate transmission across a range of scenarios, especially when transmission resembles a complex contagion or when social selectivity (i.e. prioritization of key relationships) rapidly emerges with age. These patterns result from the formation of tight-knit sets of older associates that co-occur in multiple

groups, thereby reinforcing one another's capacity to transmit knowledge. Our findings suggest key avenues for future empirical work and illustrate the use of hypernetworks in advancing the study of social behaviour.

<https://royalsocietypublishing.org/doi/10.1098/rstb.2022.0461>

**RICHARD P. MANN – Agents seeking long-term access to the wisdom of the crowd reduce immediate decision-making accuracy**

Living in groups offers social animals the significant advantage of accessing collective wisdom and enhanced information processing, enabling more accurate decisions related to foraging, navigation and habitat selection. Preserving group membership is crucial for sustaining access to collective wisdom, incentivizing animals to prioritize group cohesion. However, when individuals encounter divergent information about the quality of various options, this can create a conflict between pursuing immediate rewards and the maintenance of group membership to improve access to future pay-offs. In this study, I show that rational agents who seek to maximize long-term rewards will be more inclined to follow the decisions of their peers than those with short-term horizons. In doing so, they necessarily make less-rewarding decisions in the short-term, which manifests in a lower individual accuracy when choosing the better of two options. Furthermore, I demonstrate that intuitions about collective wisdom can be misleading in groups of agents who prioritize long-term rewards, with disagreement being a better signal for the accuracy of collective choices than consensus. These results demonstrate that observed patterns of sociality should be interpreted in the context of the life history of an individual and its peers, rather than through the lens of an isolated decision.

<https://royalsocietypublishing.org/doi/10.1098/rstb.2022.0467>

**PLoS Biology**

**PAPERS**

**MINGHUI ZHAO et al – Object color knowledge representation occurs in the macaque brain despite the absence of a developed language system**

*This is an uncorrected proof.*

Animals guide their behaviors through internal representations of the world in the brain. We aimed to understand how the macaque brain stores such general world knowledge, focusing on object color knowledge. Three functional magnetic resonance imaging (fMRI) experiments were conducted in macaque monkeys: viewing chromatic and achromatic gratings, viewing grayscale images of their familiar fruits and vegetables (e.g., grayscale strawberry), and viewing true- and false-colored objects (e.g., red strawberry and green strawberry). We observed robust object knowledge representations in the color patches, especially the one located around TE0: the activity patterns could classify grayscale pictures of objects based on their memory color and response patterns in these regions could translate between chromatic grating viewing and grayscale object viewing (e.g., red grating—grayscale images of strawberry), such that classifiers trained by viewing chromatic gratings could successfully classify grayscale object images according to their memory colors. Our results showed direct positive evidence of object color memory in macaque monkeys. These results indicate the perceptually grounded knowledge representation as a conservative memory mechanism and open a new avenue to study this particular (semantic) memory representation with macaque models.

<https://journals.plos.org/plosbiology/article?id=10.1371/journal.pbio.3002863>

**Proceedings of the Royal Society B**

**PAPERS**

**YASUO IHARA – Models of animal coalitions and their implications for human evolution**

Social interaction is a prime driver for the evolution of animal behaviour. Dyadic interaction, in particular, has been the focus of intensive research on the evolution of mutualistic, altruistic, selfish or spiteful behaviours. Meanwhile, triadic interaction has been the minimal framework for the study of animal coalition as observed in some species of primates, as well as in carnivores and cetaceans, where two or more individuals act jointly against a third party in a competitive context. Previous mathematical models of animal coalition have either failed to explain the observed diversity in the configuration of coalition or presumed fine-tuned decision-making that may be unrealistic for non-human animals. To approach these issues, the present study develops a new model that is fairly simple, but still able to account for the observed diversity in animal coalitions. Analysis of the model specifies key parameters affecting the predicted types of coalition: the nature of the benefit being contested, the cost-to-benefit ratio associated with fighting and the synergistic effect in coalition formation. Additionally, the model is used to evaluate the social selection hypothesis, which claims that coalition formation induced social selection favouring reduced aggression and lower fighting abilities during human evolution.

<https://royalsocietypublishing.org/doi/10.1098/rspb.2024.1227>

**THODORIS DANIS & ANTONIS ROKAS – The evolution of gestation length in eutherian mammals**

Eutherian mammals exhibit considerable variation in their gestation lengths, which has traditionally been linked to variation in other traits, including body mass and lifespan. To understand how gestation length variation, including its association with body mass and lifespan variation, changed over mammalian evolution, we conducted phylogeny-informed analyses of 845

representative extant species. We found that gestation length substantially differed in both whether and how strongly it was associated with body mass and lifespan across mammals. For example, gestation length was not associated with lifespan or body mass in Chiroptera and Cetacea but was strongly associated only with body mass in Carnivora. We also identified 52 evolutionary shifts in gestation length variation across the mammal phylogeny and 14 shifts when we jointly considered variation of all three traits; six shifts were shared. Notably, two of these shifts, both positive, occurred at the roots of Cetacea and Pinnipedia, respectively, coinciding with the transition of these clades to the marine environment, whereas a negative shift occurred at the root of Chiroptera, coinciding with the evolution of flight in this clade. These results suggest that the relationship between gestation length and the two other traits has varied substantially across mammalian phylogeny.

<https://royalsocietypublishing.org/doi/10.1098/rspb.2024.1412>

## Royal Society Open Science

### PAPERS

#### **AYMAN BIN KAMRUDDIN et al – Modelling human navigation and decision dynamics in a first-person herding task**

This study investigated whether dynamical perceptual-motor primitives (DPMPs) could also be used to capture human navigation in a first-person herding task. To achieve this aim, human participants played a first-person herding game, in which they were required to corral virtual cows, called targets, into a specified containment zone. In addition to recording and modelling participants' movement trajectories during gameplay, participants' target-selection decisions (i.e. the order in which participants corralled targets) were recorded and modelled. The results revealed that a simple DPMP navigation model could effectively reproduce the movement trajectories of participants and that almost 80% of the participants' target-selection decisions could be captured by a simple heuristic policy. Importantly, when this policy was coupled to the DPMP navigation model, the resulting system could successfully simulate and predict the behavioural dynamics (movement trajectories and target-selection decisions) of participants in novel multi-target contexts. Implications of the findings for understanding complex human perceptual-motor behaviour and the development of artificial agents for robust human-machine interaction are discussed.

<https://royalsocietypublishing.org/doi/10.1098/rsos.231919>

#### **VICTOR CHUNG et al – Social bonding through shared experiences: the role of emotional intensity**

Sharing emotions with other individuals is a widespread phenomenon. Previous research proposed that experiencing intense and similar emotions with other individuals reinforces social bonds. However, several aspects of this phenomenon remain unclear, notably whether social bonding requires the convergence and synchronization of emotions in the group, and whether these effects generalize across positively valenced and negatively valenced emotional contexts. To address these questions, we measured subjective emotional experiences, physiological activity (cardiac, respiratory, electrodermal) and social attitudes in dyads of unacquainted individuals who watched videos in the presence of each other. We manipulated the emotional content of the videos and the type of shared attention between participants, to test for the contribution of interpersonal influence. The results revealed that intense emotions indexed by physiological arousal were associated with the emergence of reciprocal prosocial attitudes within dyads, and that this effect depended on joint attention. We did not observe the convergence and synchronization of emotions within dyads, which suggests that experiencing similar emotions was not necessary for social bonding. We discuss implications of this study for research on collective effervescence and the social consequences of shared experiences.

<https://royalsocietypublishing.org/doi/10.1098/rsos.240048>

## Trends in Cognitive Sciences

### PAPERS

#### **SUSAN GOLDIN-MEADOW & INBAL ARNON – Whole-to-part development in language creation**

Children approach language by learning parts and constructing wholes. But they can also first learn wholes and then discover parts. We demonstrate this understudied yet impactful process in children creating language without input. Whole-to-part learning thus need not be driven by hard-to-segment input and is a bias that children bring to language.

[https://www.cell.com/trends/cognitive-sciences/abstract/S1364-6613\(24\)00258-4](https://www.cell.com/trends/cognitive-sciences/abstract/S1364-6613(24)00258-4)

#### **ASHLEY E. MARTIN & MICHAEL L. SLEPIAN – The process of gendering: gender as a verb**

Gender is important to the social and cognitive sciences, as evidenced by hundreds of meta-analyses, thousands of studies, and millions of datapoints that examine how gender (as an independent variable) shapes cognition and behavior. In this expansive literature, gender is often understood as a noun – a social category that separates 'men' from 'women'. However, gender can also be studied and understood as a verb – a cognitive process used to conceptually divide both human and non-human entities by masculinity and femininity. In this review, we outline the cognitive process of gendering and propose a framework to understand gender as a verb that enables a better understanding of how gender operates, why it is important, and how it can change.

[https://www.cell.com/trends/cognitive-sciences/abstract/S1364-6613\(24\)00225-0](https://www.cell.com/trends/cognitive-sciences/abstract/S1364-6613(24)00225-0)

**KENNY R. COVENTRY & HOLGER DIESEL – Spatial communication systems and action**

Spatial cognition is fundamental to our species. One might therefore expect that spatial communication systems would have evolved to make common distinctions. However, many have argued that spatial communication systems exhibit considerable cross-linguistic diversity, challenging the view that space structures language. We review recent work on spatial communication that merits revisiting the relationship between language and space. We provide a framework that places action as the driver of spatial communication systems across languages, in which spatial demonstratives – the earliest spatial terms – play a fundamental role in honing attention and theory of mind capacities that are crucial for language and cognition more broadly. We discuss how demonstratives emerged early in language evolution to serve a combination of spatial, social, and functional needs

[https://www.cell.com/trends/cognitive-sciences/fulltext/S1364-6613\(24\)00262-6](https://www.cell.com/trends/cognitive-sciences/fulltext/S1364-6613(24)00262-6)

**Trends in Ecology and Evolution****PAPERS****ROXANNE S. BELTRAN et al – Maximizing biological insights from instruments attached to animals**

Instruments attached to animals ('biologgers') have facilitated extensive discoveries about the patterns, causes, and consequences of animal behavior. Here, we present examples of how biologging can deepen our fundamental understanding of ecosystems and our applied understanding of global change impacts by enabling tests of ecological theory. Applying the iterative process of science to biologging has enabled a diverse set of insights, including social and experiential learning in long-distance migrants, state-dependent risk aversion in foraging predators, and resource abundance driving movement across taxa. Now, biologging is poised to tackle questions and refine ecological theories at increasing levels of complexity by integrating measurements from numerous individuals, merging datasets from multiple species and their environments, and spanning disciplines, including physiology, behavior and demography.

[https://www.cell.com/trends/ecology-evolution/fulltext/S0169-5347\(24\)00248-9](https://www.cell.com/trends/ecology-evolution/fulltext/S0169-5347(24)00248-9)

**PETRA DOBOS & PÉTER PONGRÁCZ – The biological relevance of 'me': body awareness in animals**

Applying human concepts of self-awareness to animals often lacks anchoring in biologically meaningful contexts. We advocate a new, modular framework of self-representation, including body-awareness, which helps an individual to negotiate physical obstacles. We emphasize the importance of ecologically valid approaches that allow adaptivity-based hypotheses and discussion about self-representation.

[https://www.cell.com/trends/ecology-evolution/abstract/S0169-5347\(24\)00252-0](https://www.cell.com/trends/ecology-evolution/abstract/S0169-5347(24)00252-0)

**Trends in Neurosciences****PAPERS****ALISON D. DO et al – The claustrum and synchronized brain states**

Cortical activity is constantly fluctuating between distinct spatiotemporal activity patterns denoted by changes in brain state. States of cortical desynchronization arise during motor generation, increased attention, and high cognitive load. Synchronized brain states comprise spatially widespread, coordinated low-frequency neural activity during rest and sleep when disengaged from the external environment or 'offline'. The claustrum is a small subcortical structure with dense reciprocal connections with the cortex suggesting modulation by, or participation in, brain state regulation. Here, we highlight recent work suggesting that neural activity in the claustrum supports cognitive processes associated with synchronized brain states characterized by increased low-frequency network activity. As an example, we outline how claustrum activity could support episodic memory consolidation during sleep.

[https://www.cell.com/trends/neurosciences/abstract/S0166-2236\(24\)00200-5](https://www.cell.com/trends/neurosciences/abstract/S0166-2236(24)00200-5)

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