

## EAORC BULLETIN 1,024 – 29 January 2023

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## NOTICES

### PUBLICATION ALERTS

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

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

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

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### ACADEMIA.EDU – Can models of evolutionary transition clarify debates over the Neolithic Revolution?

*Philosophical Transactions of the Royal Society B 378, 20210413 (2023).*

#### **AYELET SHAVIT & GONEN SHARON – Can models of evolutionary transition clarify the debates over the Neolithic Revolution?**

The ‘Neolithic Revolution,’ sometimes referred to as the emergence of agriculture at its earliest in the southern Levant, is the most significant shift in human history, shaping the world we live in today. Yet, after 100 years of study, its major cause, tempo (gradual or revolutionary), and impact of human intentionality remain disputed. Here, we examine the research potential of an evolutionary transition in individuality (ETI) to clarify this dramatic shift. Applying an ETI research perspective reveals how different causes and conditions lead to the same result, enabling a holistic view rather than a reduction of ‘Neolithic’ to ‘agriculture,’ or to one major climatic condition, inheritance system or standard evolutionary model, thus allowing us to clarify and bypass some of these heated, unresolved disputes. Additionally, unlike current archaeological emphasis on ‘where,’ ‘when,’ ‘why’ and ‘how’ questions, the ETI perspective offers a productive path for resolving a fundamental preliminary anomaly: why and how could the Neolithic lifeway evolve at all, given the selfish interest of individuals in a hunter–gatherer group? We do not intend to solve the shift to Neolithic lifeways, only to offer a fresh lens for examining it, emphasizing the relevance of tracking within and between group differences.

[https://www.academia.edu/95584382/Can\\_models\\_of\\_evolutionary\\_transition\\_clarify\\_the\\_debates\\_over\\_the\\_Neolithic\\_Revolution](https://www.academia.edu/95584382/Can_models_of_evolutionary_transition_clarify_the_debates_over_the_Neolithic_Revolution)

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### ACADEMIA.EDU – Human brain activity during stone tool production

*Iowa Research Online, <http://ir.uiowa.edu/etd/2133>*

#### **SHELBY STACKHOUSE PUTT – Human brain activity during stone tool production: Tracing the evolution of cognition and language**

Some of the biggest questions in human evolution are why we have such large brains and how our ancestors acquired language and exceptional intelligence. Our extreme reliance on technology has set us humans and our ancestors apart from other primates for more than three million years. It is widely thought that tools from the distant past may hold the clues to answering these questions because they represent all that is left of ancient minds at work. This study addresses these questions by using brain imaging technology to determine which areas of the brain of modern-day humans become most active as they make two types of tools from the past, one from as early as 2.6 million years ago (Ma) known as the Oldowan industry, and the other from 1.75 Ma known as the early Acheulian industry. Because it remains unclear whether early humans possessed language this far back in the past, an instructor taught half of the participants in this study to make stone tools with language, while the other half learned by nonverbal imitation. The analysis of the resulting brain imaging data revealed that Acheulian toolmaking requires higher-order conceptualization than Oldowan toolmaking. Selection for individuals who could store and manipulate more information and therefore make the most productive Acheulian tools may have been the prime reason for the evolution of large brain size in humans. The complex cognition that evolved as a result of such technology likely provided the framework on which language could build.

[https://www.academia.edu/33081159/Human\\_brain\\_activity\\_during\\_stone\\_tool\\_production\\_tracing\\_the\\_evolution\\_of\\_cognition\\_and\\_language\\_2016](https://www.academia.edu/33081159/Human_brain_activity_during_stone_tool_production_tracing_the_evolution_of_cognition_and_language_2016)

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### ACADEMIA.EDU – What Makes the Early History of European Shamanism and Ritual Healers So Unique?

*Iowa Research Online, (2023).*

#### **ROSLYN M. FRANK – What Makes the Early History of European Shamanism and Ritual Healers So Unique? Some Thoughts on a Little Studied Question**

Over the past forty years I have dedicated much of my time to looking for residual evidence of bear ceremonialism in Europe and by extension documenting the early history of bears as healers. What started me off was the discovery back in the late 1980s—while I was doing fieldwork in Euskal Herria—that the Basque people used to believe humans descended from bears. Until that time no written evidence whatsoever had surfaced concerning this old belief. This fact suggests that for Basque speakers the belief itself had been considered special knowledge and had been handed down orally from one generation of Basque-speakers to the next without it ever being recorded in written form.

Over the centuries care appears to have been taken not to share this knowledge with outsiders, that is, with anyone who didn’t know Basque. The documentation for this belief finally surfaced in a recorded interview with one of the last two bear hunters in the Pyrenees, a father and his son who were both Basque speakers. The anthropologist Txomin Peillen (1986) who

did that interview was a Basque-speaker himself. In the interview it was Petiri Prébonde, the father, who gave away the secret although he waited to talk about the belief until the tape recorder had been turned off, assuming, I guess, that the interviewer wasn't going to share the information unless it was on tape. The interview itself was conducted in the small and earlier quite remote Basque village of Urdax-Santa-Grazi (Sainte Engrâce) in the northern Basque province of Zuberoa (Soule), located in southwestern France. That village became readily accessible to visitors only in the 20th century.

[https://www.academia.edu/95747801/What\\_Makes\\_the\\_Early\\_History\\_of\\_European\\_Shamanism\\_and\\_Ritual\\_Healers\\_So\\_Unique\\_Some\\_Thoughts\\_on\\_a\\_Little\\_Studied\\_Question](https://www.academia.edu/95747801/What_Makes_the_Early_History_of_European_Shamanism_and_Ritual_Healers_So_Unique_Some_Thoughts_on_a_Little_Studied_Question)

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## CONFERENCE ALERT – 3rd International Student Symposium on Animal Behaviour and Cognition

**UNAM, Mexico City, Mexico**

**21-23 June 2023**

We are excited to invite you to the 3rd International Student Symposium on Animal Behaviour and Cognition, set to take place at the Amoxcalli building at UNAM in Mexico City, Mexico, June 21st-23rd 2023. This hybrid conference aims to bring together early career researchers in animal behaviour from all over the world to present their work, learn and network. We have a heavy focus on making our conference as accessible and diverse as possible, hoping to bring the field of animal behaviour to all students regardless of their racial, educational, geographical and socioeconomic backgrounds, gender, sexual orientation or any disabilities they may have. For the 3rd ISSABC, we are extremely happy to include workshops on ecophysiology, animal welfare and telemetry, as well as plenary talks by outstanding early career researchers in a variety of fields of animal behaviour and cognition. Our invited speakers will be Sonja Wild, Filipa Abreu, Birgit Szabo, Mark O'Hara and Berenika Mioduszevska!

We are also very happy to announce that we are in the position to offer travel grants and fee waivers to students that want to attend but do not possess the means necessary!

Register for the 3rd ISSABC here: <https://issabc.org/register/>

Abstract submission (Deadline February 5th): <https://issabc.org/abstract-submission/>

Travel grants: <https://issabc.org/travel-grants-and-waivers/>

Contact: <mailto:infoissabc@ciencias.unam.mx>

For more information visit our website (issabc.org) or our social media!

The ISSABC 2023 organising team – [twitter.com/ISS\\_ABC](https://twitter.com/ISS_ABC); [facebook.com/ISSABC2023](https://facebook.com/ISSABC2023); [instagram.com/ISS.ABC](https://instagram.com/ISS.ABC)

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## NEWS

### SOCIETY FOR SCIENCE – Fossils suggest early primates lived in a once-swampy Arctic

Teeth and jawbones found on Ellesmere Island, Canada, suggest that two early primate species migrated there 52 million years ago.

<http://click.societyforscience->

[email.com/?qs=d453535f1b96934423ec0a34498ad0344b131b170933f34ae0cf55a729108a4a086c078dc91d47b0b4a5af34d78aa200762f3c91b6be48690e5d9ef00411d96d](http://click.societyforscience-email.com/?qs=d453535f1b96934423ec0a34498ad0344b131b170933f34ae0cf55a729108a4a086c078dc91d47b0b4a5af34d78aa200762f3c91b6be48690e5d9ef00411d96d)

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### OTHER NEWS – BBC – Humans and wild apes share common sign language

Humans share common sign language with other apes, understanding many of the gestures wild chimps and bonobos use to communicate with one another.

<https://www.bbc.co.uk/news/science-environment-64387401>

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## PUBLICATIONS

### Animal Behaviour

#### PAPERS

#### **R.K. BRÜGGER, E.P. WILLEMS & J.M. BURKART – Looking out for each other: coordination and turn taking in common marmoset vigilance**

For small, arboreal marmoset monkeys, antipredator vigilance is essential to ensure survival. However, since antipredator vigilance is incompatible with some other behaviours, such as feeding in a head-down position, it has to be regulated efficiently within individuals and perhaps even at the group level. To investigate what drives individual differences in vigilance and feeding behaviour in common marmosets, *Callithrix jacchus*, and whether they adjust these behaviours to each other, we collected behavioural data on 14 marmosets in contexts where feeding and vigilance were mutually exclusive. The presence of infants resulted in higher overall vigilance and less feeding. Moreover, individuals increased their vigilance when the pair mate was feeding and thus could not be vigilant itself. They thus adjusted their own vigilance to the risk level of their pair mate, which resulted in a turn taking-like pattern of feeding and being vigilant in the pair. This flexibility of vigilance is consistent with marmosets' sensitivity to other's needs in another context, food sharing, when sharing is increased when

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food is more difficult to obtain. Together, these results suggest considerable awareness of the current state of group members in common marmosets.

<https://www.sciencedirect.com/science/article/pii/S000334722200313X>

## Biology Letters

### PAPERS

#### **EMMA J. GODFREY, ELISSA Z. CAMERON & GRAHAM J. HICKLING – Social learning in a nocturnal marsupial: is it a possum-ability?**

Social learning can reduce the costs associated with trial-and-error learning. There is speculation that social learning could contribute to trap and bait avoidance in invasive species like the common brushtail possum (*Trichosurus vulpecula*)—a marsupial for which social learning has not previously been investigated. In large outdoor pens, we presented wild-caught ‘demonstrator’ possums with puzzle devices containing an attractive food reward; 2 of 8 demonstrators accessed the reward the first night the puzzle was presented and another three succeeded on later nights. Meanwhile, ‘observer’ possums in adjacent pens watched the demonstrators for five nights and then were given the opportunity to solve the puzzle themselves; 15 of 15 succeeded on their first night (a highly significant improvement). This experiment thus provides strong evidence of social learning by common brushtail possums. Future research should investigate whether information about aversive stimuli (such as traps and toxic baits) can similarly be transmitted between possums by social learning; if so, this could have important implications for possum pest control.

<https://royalsocietypublishing.org/doi/full/10.1098/rsbl.2022.0460>

## Current Biology

### ARTICLES

#### **Interview: Joseph LeDoux**

Joseph LeDoux is a University Professor and the Henry and Lucy Moses Professor of Science, and Professor of Neural Science, Psychology, Psychiatry, and Child and Adolescent Psychiatry at New York University. He also directs the Emotional Brain Institute at NYU. His work is focused on the brain mechanisms of emotion, memory, and consciousness. LeDoux has received numerous awards for his research, including the Fyssen Prize in Cognitive Science, The Karl Spencer Lashley Prize from the American Philosophical Society, and the William James Award from the Association for Psychological Science. He is an elected member of the American Academy of Arts and Sciences and of the National Academy of Sciences USA and is the 2023 President-Elect of the Association for the Scientific Study of Consciousness. LeDoux is the author of several books, including *The Emotional Brain*, *Synaptic Self*, *Anxious* (2016 APA William James Book Award), and *The Deep History of Ourselves* (finalist for the 2020 Pen America E.O. Wilson Award for Literary Science Writing). His forthcoming book, *The Realms of Existence*, is due out in October 2023. As a side line, he is the lead singer and songwriter in the rock band *The Amygdaloids* and in the acoustic duo *So We Are*.

[https://www.cell.com/current-biology/fulltext/S0960-9822\(22\)01910-8](https://www.cell.com/current-biology/fulltext/S0960-9822(22)01910-8)

#### **DIANDRA DUENGEN, W. TECUMSEH FITCH & ANDREA RAVIGNANI – Hoover the talking seal**

No summary.

[https://www.cell.com/current-biology/fulltext/S0960-9822\(22\)01959-5](https://www.cell.com/current-biology/fulltext/S0960-9822(22)01959-5)

#### **KATHARINA RIEBEL & NAOMI E. LANGMORE – Birdsong: Not all contest but also cooperation?**

Birdsong generally functions to defend territories from same-sex competitors and to attract mates. Wild zebra finch males now are shown to sing prolifically outside the breeding season and without defending territories, suggesting potential social functions for birdsong beyond competition.

[https://www.cell.com/current-biology/fulltext/S0960-9822\(22\)01915-7](https://www.cell.com/current-biology/fulltext/S0960-9822(22)01915-7)

### PAPERS

#### **HUGO LONING et al – The social role of song in wild zebra finches**

Male songbirds sing to establish territories and to attract mates. However, increasing reports of singing in non-reproductive contexts and by females show that song use is more diverse than previously considered. Therefore, alternative functions of song, such as social cohesion<sup>3</sup> and synchronization of breeding, by and large, were overlooked even in such well-studied species such as the zebra finch (*Taeniopygia guttata*). In these social songbirds, only the males sing, and pairs breed synchronously in loose colonies, following aseasonal rain events in their arid habitat. As males are not territorial, and pairs form long-term monogamous bonds early in life, conventional theory predicts that zebra finches should not sing much at all; however, they do and their song is the focus of hundreds of lab-based studies. We hypothesize that zebra finch song functions to maintain social cohesion and to synchronize breeding. Here, we test this idea using data from 5 years of field studies, including observational transects, focal and year-round audio recordings, and a large-scale playback experiment. We show that zebra finches frequently sing while in groups, that breeding status influences song output at the nest and at aggregations, that they sing year round, and that they predominantly sing when with their partner, suggesting that the song

remains important after pair formation. Our playback reveals that song actively features in social aggregations as it attracts conspecifics. Together, these results demonstrate that birdsong has important functions beyond territoriality and mate choice, illustrating its importance in coordination and cohesion of social units within larger societies.

[https://www.cell.com/current-biology/fulltext/S0960-9822\(22\)01838-3](https://www.cell.com/current-biology/fulltext/S0960-9822(22)01838-3)

### **JEREMY M. WOLFE et al – Spatial and temporal massive memory in humans**

It is well known that humans have a massive memory for pictures and scenes. They show an ability to encode thousands of images with only a few seconds of exposure to each. In addition to this massive memory for “what” observers have seen, three experiments reported here show that observers have a “spatial massive memory” (SMM) for “where” stimuli have been seen and a “temporal massive memory” (TMM) for “when” stimuli have been seen. The positions in time and space for at least dozens of items can be reported with good, if not perfect accuracy. Previous work has suggested that there might be good memory for stimulus location, but there do not seem to have been concerted efforts to measure the extent of this memory. Moreover, in our method, observers are recalling where items were located and not merely recognizing the correct location. This is interesting because massive memory is sometimes thought to be limited to recognition tasks based on sense of familiarity.

[https://www.cell.com/current-biology/fulltext/S0960-9822\(22\)01977-7](https://www.cell.com/current-biology/fulltext/S0960-9822(22)01977-7)

## Evolutionary Anthropology

### PAPERS

#### **AMÉLIE BEAUDET – The Australopithecus assemblage from Sterkfontein Member 4 (South Africa) and the concept of variation in palaeontology**

Interpreting morphological variation within the early hominin fossil record is particularly challenging. Apart from the fact that there is no absolute threshold for defining species boundaries in palaeontology, the degree of variation related to sexual dimorphism, temporal depth, geographic variation or ontogeny is difficult to appreciate in a fossil taxon mainly represented by fragmentary specimens, and such variation could easily be conflated with taxonomic diversity. One of the most emblematic examples in paleoanthropology is the Australopithecus assemblage from the Sterkfontein Caves in South Africa. Whereas some studies support the presence of multiple Australopithecus species at Sterkfontein, others explore alternative hypotheses to explain the morphological variation within the hominin assemblage. In this review, I briefly summarize the ongoing debates surrounding the interpretation of morphological variation at Sterkfontein Member 4 before exploring two promising avenues that would deserve specific attention in the future, that is, temporal depth and nonhuman primate diversity.

<https://onlinelibrary.wiley.com/doi/full/10.1002/evan.21972>

## Interface: Journal of the Royal Society

### PAPERS

#### **ZEINAB S. JALALI, JOSH INTRONE & SUCHETA SOUNDARAJAN – Social stratification in networks: insights from co-authorship networks**

It has been observed that real-world social networks often exhibit stratification along economic or other lines, with consequences for class mobility and access to opportunities. With the rise in human interaction data and extensive use of online social networks, the structure of social networks (representing connections between individuals) can be used for measuring stratification. However, although stratification has been studied extensively in the social sciences, there is no single, generally applicable metric for measuring the level of stratification in a network. In this work, we first propose the novel Stratification Assortativity (StA) metric, which measures the extent to which a network is stratified into different tiers. Then, we use the StA metric to perform an in-depth analysis of the stratification of five co-authorship networks. We examine the evolution of these networks over 50 years and show that these fields demonstrate an increasing level of stratification over time, and, correspondingly, the trajectory of a researcher’s career is increasingly correlated with her entry point into the network.

<https://royalsocietypublishing.org/doi/full/10.1098/rsif.2022.0555>

#### **TAKUYA TAKAHASHI & YASUO IHARA – Spatial evolution of human cultures inferred through Bayesian phylogenetic analysis**

Spatial distribution of human culture reflects both descent from the common ancestor and horizontal transmission among neighbouring populations. To analyse empirically documented geographical variations in cultural repertoire, we will describe a framework for Bayesian statistics in a spatially explicit model. To consider both horizontal transmission and mutation of the cultural trait in question, our method employs a network model in which populations are represented by nodes. Using algorithms borrowed from Bayesian phylogenetic analysis, we will perform a Markov chain Monte Carlo (MCMC) method to compute the posterior distributions of parameters, such as the rate of horizontal transmission and the mutation rates among trait variants, as well as the identity of trait variants in unobserved populations. Besides the inference of model parameters, our method enables the reconstruction of the genealogical tree of the focal trait, provided that the mutation rate is

sufficiently small. We will also describe a heuristic algorithm to reduce the dimension of the parameter space explored in the MCMC method, where we simulate the coalescent process in the network of populations. Numerical examples show that our algorithms compute the posterior distribution of model parameters within a practical computation time, although the posterior distribution tends to be broad if we use uninformative priors.

<https://royalsocietypublishing.org/doi/full/10.1098/rsif.2022.0543>

### **AMANDA L. SMITH et al – Does the model reflect the system? When two-dimensional biomechanics is not ‘good enough’**

Models are mathematical representations of systems, processes or phenomena. In biomechanics, finite-element modelling (FEM) can be a powerful tool, allowing biologists to test form–function relationships *in silico*, replacing or extending results of *in vivo* experimentation. Although modelling simplifications and assumptions are necessary, as a minimum modelling requirement the results of the simplified model must reflect the biomechanics of the modelled system. In cases where the three-dimensional mechanics of a structure are important determinants of its performance, simplified two-dimensional modelling approaches are likely to produce inaccurate results. The vertebrate mandible is one among many three-dimensional anatomical structures routinely modelled using two-dimensional FE analysis. We thus compare the stress regimes of our published three-dimensional model of the chimpanzee mandible with a published two-dimensional model of the chimpanzee mandible and identify several fundamental differences. We then present a series of two-dimensional and three-dimensional FE modelling experiments that demonstrate how three key modelling parameters, (i) dimensionality, (ii) symmetric geometry, and (iii) constraints, affect deformation and strain regimes of the models. Our results confirm that, in the case of the primate mandible (at least), two-dimensional FEM fails to meet this minimum modelling requirement and should not be used to draw functional, ecological or evolutionary conclusions.

<https://royalsocietypublishing.org/doi/10.1098/rsif.2022.0536>

## Nature Communications Biology

### PAPERS

#### **LISA BARTHA-DOERING et al – Fetal temporal sulcus depth asymmetry has prognostic value for language development**

In most humans, the superior temporal sulcus (STS) shows a rightward depth asymmetry. This asymmetry can not only be observed in adults, but is already recognizable in the fetal brain. As the STS lies adjacent to brain areas important for language, STS depth asymmetry may represent an anatomical marker for language abilities. This study investigated the prognostic value of STS depth asymmetry in healthy fetuses for later language abilities, language localization, and language-related white matter tracts. Less right lateralization of the fetal STS depth was significantly associated with better verbal abilities, with fetal STS depth asymmetry explaining more than 40% of variance in verbal skills 6–13 years later. Furthermore, less right fetal STS depth asymmetry correlated with increased left language localization during childhood. We hypothesize that earlier and/or more localized fetal development of the left temporal cortex is accompanied by an earlier development of the left STS and is favorable for early language learning. If the findings of this pilot study hold true in larger samples of healthy children and in different clinical populations, fetal STS asymmetry has the potential to become a diagnostic biomarker of the maturity and integrity of neural correlates of language.

<https://www.nature.com/articles/s42003-023-04503-z>

## Nature Human Behaviour

### PAPERS

#### **ENRIQUE BAQUEDANO et mul – A symbolic Neanderthal accumulation of large herbivore crania**

This work examines the possible behaviour of Neanderthal groups at the Cueva Des-Cubierta (central Spain) via the analysis of the latter’s archaeological assemblage. Alongside evidence of Mousterian lithic industry, Level 3 of the cave infill was found to contain an assemblage of mammalian bone remains dominated by the crania of large ungulates, some associated with small hearths. The scarcity of post-cranial elements, teeth, mandibles and maxillae, along with evidence of anthropogenic modification of the crania (cut and percussion marks), indicates that the carcasses of the corresponding animals were initially processed outside the cave, and the crania were later brought inside. A second round of processing then took place, possibly related to the removal of the brain. The continued presence of crania throughout Level 3 indicates that this behaviour was recurrent during this level’s formation. This behaviour seems to have no subsistence-related purpose but to be more symbolic in its intent.

<https://www.nature.com/articles/s41562-022-01503-7>

#### **OLIVER SHEEHAN et al with SCOTT CLAESSENS & QUENTIN D. ATKINSON – Coevolution of religious and political authority in Austronesian societies**

Authority, an institutionalized form of social power, is one of the defining features of the large-scale societies that evolved during the Holocene. Religious and political authority have deep histories in human societies and are clearly interdependent, but the nature of their relationship and its evolution over time is contested. We purpose-built an ethnographic dataset of 97 Austronesian societies and used phylogenetic methods to address two long-standing questions about the evolution of

religious and political authority: first, how these two institutions have coevolved, and second, whether religious and political authority have tended to become more or less differentiated. We found evidence for mutual interdependence between religious and political authority but no evidence for or against a long-term pattern of differentiation or unification in systems of religious and political authority. Our results provide insight into how political and religious authority have worked synergistically over millennia during the evolution of large-scale societies.

<https://www.nature.com/articles/s41562-022-01471-y>

### **GIULIANA SPADARO et al – Corrupt third parties undermine trust and prosocial behaviour between people**

Corruption is a pervasive phenomenon that affects the quality of institutions, undermines economic growth and exacerbates inequalities around the globe. Here we tested whether perceiving representatives of institutions as corrupt undermines trust and subsequent prosocial behaviour among strangers. We developed an experimental game paradigm modelling representatives as third-party punishers to manipulate or assess corruption and examine its relationship with trust and prosociality (trust behaviour, cooperation and generosity). In a sequential dyadic die-rolling task, the participants observed the dishonest behaviour of a target who would subsequently serve as a third-party punisher in a trust game (Study 1a, N = 540), in a prisoner's dilemma (Study 1b, N = 503) and in dictator games (Studies 2–4, N = 765, pre-registered). Across these five studies, perceiving a third party as corrupt undermined interpersonal trust and, in turn, prosocial behaviour. These findings contribute to our understanding of the critical role that representatives of institutions play in shaping cooperative relationships in modern societies.

<https://www.nature.com/articles/s41562-022-01457-w>

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## Nature Reviews Neuroscience

### PAPERS

### **ZHONGZHENG FU et al – Neurophysiological mechanisms of error monitoring in human and non-human primates**

Performance monitoring is an important executive function that allows us to gain insight into our own behaviour. This remarkable ability relies on the frontal cortex, and its impairment is an aspect of many psychiatric diseases. In recent years, recordings from the macaque and human medial frontal cortex have offered a detailed understanding of the neurophysiological substrate that underlies performance monitoring. Here we review the discovery of single-neuron correlates of error monitoring, a key aspect of performance monitoring, in both species. These neurons are the generators of the error-related negativity, which is a non-invasive biomarker that indexes error detection. We evaluate a set of tasks that allows the synergistic elucidation of the mechanisms of cognitive control across the two species, consider differences in brain anatomy and testing conditions across species, and describe the clinical relevance of these findings for understanding psychopathology. Last, we integrate the body of experimental facts into a theoretical framework that offers a new perspective on how error signals are computed in both species and makes novel, testable predictions.

<https://www.nature.com/articles/s41583-022-00670-w>

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## Nature Scientific Reports

### PAPERS

### **SALVATORE CITRARO et al – Feature-rich multiplex lexical networks reveal mental strategies of early language learning**

Knowledge in the human mind exhibits a dualistic vector/network nature. Modelling words as vectors is key to natural language processing, whereas networks of word associations can map the nature of semantic memory. We reconcile these paradigms—fragmented across linguistics, psychology and computer science—by introducing FEature-Rich MULTiplex LEXical (FERMULEX) networks. This novel framework merges structural similarities in networks and vector features of words, which can be combined or explored independently. Similarities model heterogeneous word associations across semantic/syntactic/phonological aspects of knowledge. Words are enriched with multi-dimensional feature embeddings including frequency, age of acquisition, length and polysemy. These aspects enable unprecedented explorations of cognitive knowledge. Through CHILDES data, we use FERMULEX networks to model normative language acquisition by 1000 toddlers between 18 and 30 months. Similarities and embeddings capture word homophily via conformity, which measures assortative mixing via distance and features. Conformity unearths a language kernel of frequent/polysemous/short nouns and verbs key for basic sentence production, supporting recent evidence of children's syntactic constructs emerging at 30 months. This kernel is invisible to network core-detection and feature-only clustering: It emerges from the dual vector/network nature of words. Our quantitative analysis reveals two key strategies in early word learning. Modelling word acquisition as random walks on FERMULEX topology, we highlight non-uniform filling of communicative developmental inventories (CDIs). Biased random walkers lead to accurate (75%), precise (55%) and partially well-recalled (34%) predictions of early word learning in CDIs, providing quantitative support to previous empirical findings and developmental theories.

<https://www.nature.com/articles/s41598-022-27029-6>

### **PIOTR FEDUREK et al – Status does not predict stress among Hadza hunter-gatherer men**

In recent years there has been much research regarding the extent to which social status is related to long-term indices of health. The majority of studies looking at the interplay between social status and health have been conducted in



industrialized societies. However, it has been argued that most of human evolution took place in small, mobile and egalitarian hunter-gatherer groups where individuals exhibited very little variation in terms of material wealth or possessions. In this study, we looked at the extent to which two domains of social status, hunting reputation (being perceived as a good hunter) and popularity (being perceived as a friend), are related to physiological stress levels among Hadza men, hunter-gatherers living in Northern Tanzania. The results of our study show that neither hunting reputation nor popularity is associated with stress levels. Overall, our data suggest that, in at least some traditional small-scale societies exhibiting an egalitarian social model, such as the Hadza, the variation in social status measures based on both popularity and hunting reputation does not translate into one of the commonly used indices of wellbeing.

<https://www.nature.com/articles/s41598-023-28119-9>

#### **ADAM S. JERMYN, DAVID J. STEVENSON & DANIEL J. LEVITIN – 1/f laws found in non-human music**

A compelling question at the intersection of physics, neuroscience, and evolutionary biology concerns the extent to which the brains of various species evolved to encode regularities of the physical world. It would be parsimonious and adaptive, for example, for brains to evolve an innate understanding of gravity and the laws of motion, and to be able to detect, auditorily, those patterns of noises that ambulatory creatures make when moving about the world. One such physical regularity of the world is fractal structure, generally characterized by power-law correlations or  $1/f$   $\beta$  spectral distributions. Such laws are found broadly in nature and human artifacts, from noise in physical systems, to coastline topography (e.g., the Richardson effect), to neuronal spike patterns. These distributions have also been found to hold for the rhythm and power spectral density of a wide array of human music, suggesting that human music incorporates regularities of the physical world that our species evolved to recognize and produce. Here we show for the first time that  $1/f\beta$  laws also govern the spectral density of a wide range of animal vocalizations (music), from songbirds, to whales, to howling wolves. We discovered this  $1/f\beta$  power-law distribution in the vocalizations within all of the 17 diverse species examined. Our results demonstrate that such power laws are prevalent in the animal kingdom, evidence that their brains have evolved a sensitivity to them as an aid in processing sensory features of the natural world.

<https://www.nature.com/articles/s41598-023-28444-z>

#### **PAULA PÉREZ FRAGA et al – Out-of-reach rewards elicit human-oriented referential communicative behaviours in family dogs but not in family pigs**

Human-oriented referential communication has been evidenced not only in domestic but also in some wild species, however, the importance of domestication-unrelated species' characteristics in the emergence of this capacity remains largely unexplored. One shared property of all species reported to exhibit referential communication is the efficient use of visual social signals. To assess the potential role of species-specific characteristics in the emergence of human-oriented referential communication, we compared similarly socialised companion animals from two domestic species: dogs, which rely heavily on conspecific visual social signals; and pigs, which do not. We used an out-of-reach reward paradigm with three conditions: both human and reward present, only human present, only reward present. Both species exhibited certain behaviours (e.g. orientation towards the human, orientation alternation between the human and the reward) more often in the human's presence. However, only dogs exhibited those behaviours more often in the simultaneous presence of the human and the reward. These results suggest similar readiness in dogs and pigs to attend to humans but also that pigs, unlike dogs, do not initiate referential communication with humans. The ability to referentially communicate with humans may not emerge in mammals, even if domesticated companion animals, that lack certain species characteristics, such as efficient intraspecific visual communication.

<https://www.nature.com/articles/s41598-022-26503-5>

#### **VARDAN ARUTIUNIAN et al – Structural brain abnormalities and their association with language impairment in school-aged children with Autism Spectrum Disorder**

Language impairment is comorbid in most children with Autism Spectrum Disorder (ASD) but its neural basis is poorly understood. Using structural magnetic resonance imaging (MRI), the present study provides the whole-brain comparison of both volume- and surface-based characteristics between groups of children with and without ASD and investigates the relationships between these characteristics in language-related areas and the language abilities of children with ASD measured with standardized tools. A total of 36 school-aged children participated in the study: 18 children with ASD and 18 age- and sex-matched typically developing controls. The results revealed that multiple regions differed between groups of children in gray matter volume, gray matter thickness, gyrification, and cortical complexity (fractal dimension). White matter volume and sulcus depth did not differ between groups of children in any region. Importantly, gray matter thickness and gyrification of language-related areas were related to language functioning in children with ASD. Thus, the results of the present study shed some light on the structural brain abnormalities associated with language impairment in ASD.

<https://www.nature.com/articles/s41598-023-28463-w>

#### **BALARAJU BATTU & TALAL RAHWAN – Cooperation without punishment**

A fundamental question in social and biological sciences is whether self-governance is possible when individual and collective interests are in conflict. Free riding poses a major challenge to self-governance, and a prominent solution to this challenge

has been altruistic punishment. However, this solution is ineffective when counter-punishments are possible and when social interactions are noisy. We set out to address these shortcomings, motivated by the fact that most people behave like conditional cooperators—individuals willing to cooperate if a critical number of others do so. In our evolutionary model, the population contains heterogeneous conditional cooperators whose decisions depend on past cooperation levels. The population plays a repeated public goods game in a moderately noisy environment where individuals can occasionally commit mistakes in their cooperative decisions and in their imitation of the role models' strategies. We show that, under moderate levels of noise, injecting a few altruists into the population triggers positive reciprocity among conditional cooperators, thereby providing a novel mechanism to establish stable cooperation. More broadly, our findings indicate that self-governance is possible while avoiding the detrimental effects of punishment, and suggest that society should focus on creating a critical amount of trust to harness the conditional nature of its members.

<https://www.nature.com/articles/s41598-023-28372-y>

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## New Scientist

### NEWS

#### **Children aged 5 are better at switching their attention than chimps**

In a task based on switching between two sets of rules, 5-year-olds score highly, while 4-year-olds and chimpanzees lag behind.

<https://www.newscientist.com/article/2355174-children-aged-5-are-better-at-switching-their-attention-than-chimps/>

#### **Milk may have fuelled a growth spurt in ancient Europeans**

An analysis of ancient human skeletons finds that an increase in size and weight in some regions coincided with the rise of lactose tolerance.

<https://www.newscientist.com/article/2355745-milk-may-have-fuelled-a-growth-spurt-in-ancient-europeans/>

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## Philosophical Transactions of the Royal Society B

### PAPERS

#### **JAMES GRIESEMER & AYELET SHAVIT – Scaffolding individuality: coordination, cooperation, collaboration and community**

Processes of evolutionary transition (ET), becoming part of a new reproducing collective while losing the capacity of independent reproduction, seem difficult to track without circularity, since their features—units of selection, individuality, inheritance at multiple levels (MLS1, MLS2)—are products of one process. We describe ET in a non-circular way, noting kinds of interactions among community members necessary for such major transitions that are not instances of those same interactions within community members. Reproducing 'systems' tend to hybridize with environmental components, employing eco–devo scaffolding interactions forming communities. Communities are developmentally scaffolded systems of diverse members engaged in heterogeneous interactions. They may become individuals in their own right with the potential to evolve an inheritance system at the emergent community level. We argue for the explanatory benefits of treating 'individuality' as a special case of 'collectivity'. We characterize an idealized sequence of collective processes—coordination, cooperation and collaboration (3Cs)—which scaffolds transitions to new forms of collective individuality: communities. Hominid evolution and learning draw attention to developmental interactions driving both dimensions of ET: new 'levels of individuality' and inherited 'information systems'. Here, we outline a theoretical perspective that we suggest applies across a wide range of cases and scenarios.

<https://royalsocietypublishing.org/doi/full/10.1098/rstb.2021.0398>

#### **DINAH R. DAVISON & RICHARD E. MICHOD – Steps to individuality in biology and culture**

Did human culture arise through an evolutionary transition in individuality (ETI)? To address this question, we examine the steps of biological ETIs to see how they could apply to the evolution of human culture. For concreteness, we illustrate the ETI stages using a well-studied example, the evolution of multicellularity in the volvocine algae. We then consider how those stages could apply to a cultural transition involving integrated groups of cultural traditions and the hominins that create and transmit traditions. We focus primarily on the early Pleistocene and examine hominin carnivory and the cultural change from Oldowan to Acheulean technology. We use Pan behaviour as an outgroup comparison. We summarize the important similarities and differences we find between ETI stages in the biological and cultural realms. As we are not cultural anthropologists, we may overlook or be mistaken in the processes we associate with each step. We hope that by clearly describing these steps to individuality and illustrating them with cultural principles and processes, other researchers may build upon our initial exercise. Our analysis supports the hypothesis that human culture has undergone an ETI beginning with a Pan-like ancestor, continuing during the Pleistocene, and culminating in modern human culture.

<https://royalsocietypublishing.org/doi/full/10.1098/rstb.2021.0407>

**KALEDA K. DENTON, YOAV RAM & MARCUS W. FELDMAN – Conditions that favour cumulative cultural evolution**

The emergence of human societies with complex language and cumulative culture is considered a major evolutionary transition. Why such a high degree of cumulative culture is unique to humans is perplexing given the potential fitness advantages of cultural accumulation. Here, Boyd & Richerson's (1996 Why culture is common, but cultural evolution is rare. Proc. Br. Acad. 88, 77–93) discrete-cultural-trait model is extended to incorporate arbitrarily strong selection; conformist, anti-conformist and unbiased frequency-dependent transmission; random and periodic environmental variation; finite population size; and multiple 'skill levels.' From their infinite-population-size model with success bias and a single skill level, Boyd and Richerson concluded that social learning is favoured over individual learning under a wider range of conditions when social learning is initially common than initially rare. We find that this holds only if the number  $n$  of individuals observed by a social learner is sufficiently small, but with a finite population and/or a combination of success-biased and conformist or unbiased transmission, this result holds with larger  $n$ . Assuming social learning has reached fixation, the increase in a population's mean skill level is lower if cumulative culture is initially absent than initially present, if population size is finite, or if cultural transmission has a frequency-dependent component. Hence, multiple barriers to cultural accumulation may explain its rarity.

<https://royalsocietypublishing.org/doi/full/10.1098/rstb.2021.0400>

**YOTAM BEN-OREN, OREN KOLODNY & NICOLE CREANZA – Cultural specialization as a double-edged sword: division into specialized guilds might promote cultural complexity at the cost of higher susceptibility to cultural loss**

The transition to specialization of knowledge within populations could have facilitated the accumulation of cultural complexity in humans. Specialization allows populations to increase their cultural repertoire without requiring that members of that population increase their individual capacity to accumulate knowledge. However, specialization also means that domain-specific knowledge can be concentrated in small subsets of the population, making it more susceptible to loss. Here, we use a model of cultural evolution to demonstrate that specialized populations can be more sensitive to stochastic loss of knowledge than populations without subdivision of knowledge, and that demographic and environmental changes have an amplified effect on populations with knowledge specialization. Finally, we suggest that specialization can be a double-edged sword; specialized populations may have an advantage in accumulating cultural traits but may also be less likely to expand and establish themselves successfully in new demes owing to the increased cultural loss that they experience during the population bottlenecks that often characterize such expansions.

<https://royalsocietypublishing.org/doi/full/10.1098/rstb.2021.0418>

**DANIEL DOR – Communication for collaborative computation: two major transitions in human evolution**

This paper presents and defends the following theoretical arguments: (1) The uniqueness of the human condition lies in the fact that only humans engage in collaborative computation, where different individuals work together on shared computational challenges. Collaborative computation is the foundation of our cumulative cultures. (2) Collaborative computation requires individuals to engage in instructive communication, where senders do not just send messages to receivers—but also send them instructions that the receivers are obliged to follow in the course of computing the messages. (3) The process of human evolution was driven throughout by the invention and development of tools of instructive communication. (4) In this process, two separate major transitions should be identified. The first was made possible by the toolkit of representational gestures (pointing, eye contact, manual demonstration, pantomime and more) that Merlin Donald called the toolkit of mimesis. Mimesis allows for collaborative computation as long as the information requiring computation is available for direct experiencing by the participants. The second was made possible by language, the tool that allowed its users, for the first time, to engage in collaborative computations of information they did not experience together—through the systematic instruction of the mental computations of imagination.

<https://royalsocietypublishing.org/doi/full/10.1098/rstb.2021.0404>

**KATI KISH BAR-ON & EHUD LAMM – The interplay of social identity and norm psychology in the evolution of human groups**

People's attitudes towards social norms play a crucial role in understanding group behaviour. Norm psychology accounts focus on processes of norm internalization that influence people's norm-following attitudes but pay considerably less attention to social identity and group identification processes. Social identity theory in contrast studies group identity but works with a relatively thin and instrumental notion of social norms. We argue that to best understand both sets of phenomena, it is important to integrate the insights of both approaches. Social status, social identity and social norms are considered separate phenomena in evolutionary accounts. We discuss assumptions and views that support this separation, and suggest an integrated view of our own. We argue that we should be open to the early origins of human social complexity, and conjecture that the longer that the human social world involved multi-level societies the more probable it is that norm psychology and social identity interacted in rich ways.

<https://royalsocietypublishing.org/doi/full/10.1098/rstb.2021.0412>

**ANDRÁS SZILÁGYI et al with EÖRS SZATHMÁRY – Evolutionary ecology of language origins through confrontational scavenging**

A dynamic model and an agent-based simulation model implementing the assumptions of the confrontational scavenging hypothesis on early protolanguage as an adaptive response of *Homo erectus* to gradual change in their habitat has been developed and studied. The core assumptions of the hypothesis and the model scenario are the pre-adaptation of our ancestors to occupy the ecological niche that they constructed for themselves by having evolved displaced communication and a rudimentary tool manufacture, two features allowing them to use a new, concentrated and abundant resource—megafauna carrion—on the savannahs replacing arboreal habitats owing to the drying climate of East Africa at about 2 Ma. The shift in diet required coordinated cooperation by the hominin scavengers confronted with concurrent predators. Power scavenging compelled displaced symbolic communication featuring a limited semantic range; syntax was not yet required. We show that phenotypic evolution on the accuracy of information transfer between cooperating hominins is a necessary and sufficient condition for the population of agents to survive the diet shift. Both the individual and the group fitness of the hominin horde increased with the accuracy of their protolanguage, with decreasing time allocated to foraging and thus more time left for culture.

<https://royalsocietypublishing.org/doi/full/10.1098/rstb.2021.0411>

**EHUD LAMM, MEIR FINKEL & OREN KOLODNY – Human major transitions from the perspective of distributed adaptations**

Distributed adaptations are cases in which adaptation is dependent on the population as a whole: the adaptation is conferred by a structural or compositional aspect of the population; the adaptively relevant information cannot be reduced to information possessed by a single individual. Possible examples of human-distributed adaptations are song lines, traditions, trail systems, game drive lanes and systems of water collection and irrigation. Here we discuss the possible role of distributed adaptations in human cultural macro-evolution. Several kinds of human-distributed adaptations are presented, and their evolutionary implications are highlighted. In particular, we discuss the implications of population size, density and bottlenecks on the distributed adaptations that a population may possess and how they in turn would affect the population's resilience to ecological change. We discuss the implications that distributed adaptations may have for human collective action and the possibility that they played a role in colonization of new areas and niches, in seasonal migration, and in setting constraints for minimal inter-population connectivity.

<https://royalsocietypublishing.org/doi/full/10.1098/rstb.2021.0401>

**CATHRYN TOWNSEND et al – Human cooperation and evolutionary transitions in individuality**

A major evolutionary transition in individuality involves the formation of a cooperative group and the transformation of that group into an evolutionary entity. Human cooperation shares principles with those of multicellular organisms that have undergone transitions in individuality: division of labour, communication, and fitness interdependence. After the split from the last common ancestor of hominoids, early hominins adapted to an increasingly terrestrial niche for several million years. We posit that new challenges in this niche set in motion a positive feedback loop in selection pressure for cooperation that ratcheted coevolutionary changes in sociality, communication, brains, cognition, kin relations and technology, eventually resulting in egalitarian societies with suppressed competition and rapid cumulative culture. The increasing pace of information innovation and transmission became a key aspect of the evolutionary niche that enabled humans to become formidable cooperators with explosive population growth, the ability to cooperate and compete in groups of millions, and emergent social norms, e.g. private property. Despite considerable fitness interdependence, the rise of private property, in concert with population explosion and socioeconomic inequality, subverts potential transition of human groups into evolutionary entities due to resurgence of latent competition and conflict.

<https://royalsocietypublishing.org/doi/full/10.1098/rstb.2021.0414>

**AYELET SHAVIT & GONEN SHARON – Can models of evolutionary transition clarify the debates over the Neolithic Revolution?**

The 'Neolithic Revolution,' sometimes referred to as the emergence of agriculture at its earliest in the southern Levant, is the most significant shift in human history, shaping the world we live in today. Yet, after 100 years of study, its major cause, tempo (gradual or revolutionary), and impact of human intentionality remain disputed. Here, we examine the research potential of an evolutionary transition in individuality (ETI) to clarify this dramatic shift. Applying an ETI research perspective reveals how different causes and conditions lead to the same result, enabling a holistic view rather than a reduction of 'Neolithic' to 'agriculture,' or to one major climatic condition, inheritance system or standard evolutionary model, thus allowing us to clarify and bypass some of these heated, unresolved disputes. Additionally, unlike current archaeological emphasis on 'where,' 'when,' 'why' and 'how' questions, the ETI perspective offers a productive path for resolving a fundamental preliminary anomaly: why and how could the Neolithic lifeway evolve at all, given the selfish interest of individuals in a hunter-gatherer group? We do not intend to solve the shift to Neolithic lifeways, only to offer a fresh lens for examining it, emphasizing the relevance of tracking within and between group differences.

<https://royalsocietypublishing.org/doi/full/10.1098/rstb.2021.0413>

**LISI KRALL – The economic superorganism in the complexity of evolution**

The transition to grain agriculture restructured human societies, creating a new whole, an economic superorganism. Homo sapiens became expansionary, structurally interdependent in material life, and a duality between them and Earth was created that had not previously existed. Yet H. sapiens are not the only species to make the transition to agriculture. Cross-species comparisons create an opening for a movement toward a focus on the universal and powerful agricultural system as a unique expression of the evolution of species cooperation. This shifts the focus around human social evolution away from culture and toward the formation and power of the economic system that took hold with the cultivation of annual grains. The basic structure and dynamic to economic life that began with grain agriculture has endured for 10 000 years and the duality between humans and Earth established therein is now reaching an apogee with the spectre of climate change and the mass extinction of other species on Earth. In this light, the questions emerge: Is the agricultural revolution an evolutionary transition adequately captured in existing frameworks of human social evolution? Is the human capacity for culture sufficient to override the power and dynamic of the economic superorganism?

<https://royalsocietypublishing.org/doi/full/10.1098/rstb.2021.0417>

**ANNA MARIE PRENTISS et al – Evolution of the Okvik/Old Bering Sea culture of the Bering Strait as a major transition**

Great transitions are thought to embody major shifts in locus of selection, labour diversification and communication systems. Such expectations are relevant for biological and cultural systems as decades of research has demonstrated similar dynamics within the evolution of culture. The evolution of the Neo-Inuit cultural tradition in the Bering Strait provides an ideal context for examination of cultural transitions. The Okvik/Old Bering Sea (Okvik/OBS) culture of Bering Strait is the first representative of the Neo-Inuit tradition. Archaeological evidence drawn for settlement and subsistence data, technological traditions and mortuary contexts suggests that Okvik/OBS fits the definition of a major transition given change in the nature of group membership (from families to political groups with social ranking), task organization (emergent labour specialization) and communication (advent of complex art forms conveying social and ideological information). This permits us to develop a number of implications about the evolutionary process recognizing that transitions may occur on three scales: (1) ephemeral variants, as for example, simple technological entities; (2) integrated systems, spanning modular technology to socio-economic strategies; and (3) simultaneous change across all scales with emergent properties.

<https://royalsocietypublishing.org/doi/full/10.1098/rstb.2021.0415>

**YOHAY CARMEL – Human societal development: is it an evolutionary transition in individuality?**

An evolutionary transition in individuality (ETI) occurs when a previously independent organism becomes a lower level unit within a higher hierarchical level (for example, cells in an organism, ants in a colony). Using archaeological and historical accounts from the last 12 000 years, I empirically examine the proposition that human society increasingly functions as a higher hierarchical level within which individuals integrate as lower level units. I evaluate human societal development with respect to three criteria that together indicate complexity in biological systems and serve as an operationalization scheme for ETIs: size, inseparability and specialization. The size of the largest polity has increased seven orders of magnitude, from hundreds to billions. Inseparability became nearly complete since Mesopotamian city-states, following the first appearance of intricate specialization (division of labour). Connectivity within a polity has increased rapidly during the last few centuries, and particularly within the last few decades. In view of these results, I formulate the following hypothesis: human society is undergoing an evolutionary transition in individuality, driven by socio-cultural-technological processes. This proposition requires a detailed theoretical basis and further empirical testing. I propose four predictions derived from the hypothesis that may be used to test it.

<https://royalsocietypublishing.org/doi/full/10.1098/rstb.2021.0409>

**CLAES ANDERSSON & TAMÁS CZÁRÁN – The transition from animal to human culture—simulating the social protocell hypothesis**

The origin of human cumulative culture is commonly envisioned as the appearance (some 2.0–2.5 million years ago) of a capacity to faithfully copy the know-how that underpins socially learned traditions. While certainly plausible, this story faces a steep 'startup problem'. For example, it presumes that ape-like early Homo possessed specialized cognitive capabilities for faithful know-how copying and that early toolmaking actually required such a capacity. The social protocell hypothesis provides a leaner story, where cumulative culture may have originated even earlier—as cumulative systems of non-cumulative traditions ('institutions' and 'cultural lifestyles'), via an emergent group-level channel of cultural inheritance. This channel emerges as a side-effect of a specific but in itself unremarkable suite of social group behaviours. It is independent of faithful know-how copying, and an ancestral version is argued to persist in Pan today. Hominin cultural lifestyles would thereby have gained in complexity and sophistication, eventually becoming independent units of selection (socients) via a cultural evolutionary transition in individuality, abstractly similar to the origin of early cells. We here explore this hypothesis by simulating its basic premises. The model produces the expected behaviour and reveals several additional and non-trivial phenomena as fodder for future work.

<https://royalsocietypublishing.org/doi/full/10.1098/rstb.2021.0416>

**DANIEL W. MCSHEA – Four reasons for scepticism about a human major transition in social individuality**

The ‘major transitions in evolution’ are mainly about the rise of hierarchy, new individuals arising at ever higher levels of nestedness, in particular the eukaryotic cell arising from prokaryotes, multicellular individuals from solitary protists and individuated societies from multicellular individuals. Some lists include human societies as a major transition, but based on a comparison with the non-human transitions, there are reasons for scepticism. (i) The foundation of the major transitions is hierarchy, but the cross-cutting interactions in human societies undermine hierarchical structure. (ii) Natural selection operates in three modes—stability, growth and reproductive success—and only the third produces the complex adaptations seen in fully individuated higher levels. But human societies probably evolve mainly in the stability and growth modes. (iii) Highly individuated entities are marked by division of labour and commitment to morphological differentiation, but in humans differentiation is mostly behavioural and mostly reversible. (iv) As higher-level individuals arise, selection drains complexity, drains parts, from lower-level individuals. But there is little evidence of a drain in humans. In sum, a comparison with the other transitions gives reasons to doubt that human social individuation has proceeded very far, or if it has, to doubt that it is a transition of the same sort.

<https://royalsocietypublishing.org/doi/full/10.1098/rstb.2021.0403>

**PLoS Biology****ARTICLES****HANNA KOKKO & MICHAEL D. JENNIONS – Is more always better when it comes to mating?**

Fitness usually increases when a male mates with more females, but is the same true for females? A new meta-analysis in PLOS Biology shows that females, like males, tend to have a positive relationship between the number of mates and their reproductive output. But why?

<https://journals.plos.org/plosbiology/article?id=10.1371/journal.pbio.3001955>

**PAPERS****KIRSTY E. GRAHAM & CATHERINE HOBAITER – Towards a great ape dictionary: Inexperienced humans understand common nonhuman ape gestures**

In the comparative study of human and nonhuman communication, ape gesturing provided the first demonstrations of flexible, intentional communication outside human language. Rich repertoires of these gestures have been described in all ape species, bar one: us. Given that the majority of great ape gestural signals are shared, and their form appears biologically inherited, this creates a conundrum: Where did the ape gestures go in human communication? Here, we test human recognition and understanding of 10 of the most frequently used ape gestures. We crowdsourced data from 5,656 participants through an online game, which required them to select the meaning of chimpanzee and bonobo gestures in 20 videos. We show that humans may retain an understanding of ape gestural communication (either directly inherited or part of more general cognition), across gesture types and gesture meanings, with information on communicative context providing only a marginal improvement in success. By assessing comprehension, rather than production, we accessed part of the great ape gestural repertoire for the first time in adult humans. Cognitive access to an ancestral system of gesture appears to have been retained after our divergence from other apes, drawing deep evolutionary continuity between their communication and our own.

<https://journals.plos.org/plosbiology/article?id=10.1371/journal.pbio.3001939>

**PLoS One****PAPERS****SØREN WICHMANN & ERIC W. HOLMAN – Cross-linguistic conditions on word length**

Based on a dataset representing close to ¾ of the world’s languages we investigate differences among languages and between items on the Swadesh list with regard to mean word length from a linguistic typological point of view. Mapping the world-wide distribution of word length shows convergence at a continent-wide level, a Pacific Rim signature, and a tendency for large word length averages to be a recessive trait. The amount of data, which is unparalleled in previous, related studies, allows us to provide more solid estimates and accounts for the interrelationships between word length, phoneme segment inventory size, and population size than was previously possible. Word length differences between items exhibit robust, universal tendencies, which are discussed in relation to other quantities, including stability, synonymy, and attestation.

<https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0281041>

**GIORDANA GROSSI, ANNIE J. OLMSTEAD & DANIELLE LUKASZEWSKI – Does hand proximity enhance letter identification?**

Adam et al. (2012) found that letters were identified more accurately when presented near, compared to away from, the hands. Participants performed the task in two conditions: with their hands held stationary and with their hands moving towards and away from the target letters. The near-hands effect included the contribution of both static and dynamic trials. Further studies showed that accuracy in letter discrimination was higher when hands were away from a target (a far-hands effect) and moving toward it, suggesting an interaction between hand position and movement direction. The present study

aimed to test whether hand proximity affects letter identification when the hands are stationary, as it remains unclear if this effect can be reliably observed. Participants viewed strings of three consonants, briefly presented and masked, and had to verbally report their identity. Stimuli were presented under two different hand conditions: proximal and distal. The predicted effects of letter position and stimulus duration were all statistically significant and robust; however, we did not observe a hand proximity effect.

<https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0280991>

### **MERITA DRESHAJ et al – High-resolution Bayesian chronology of the earliest evidence of domesticated animals in the Dutch wetlands (Hardinxveld-Giessendam archaeological sites)**

The archaeological sites of Hardinxveld-Giessendam de Bruin and Polderweg, situated in the Rhine-Meuse delta, are the best-preserved Mesolithic sites in the Netherlands. Due to the early appearance of domesticated animals in their faunal assemblage, they are also integral to the research of the emergence of animal husbandry in the region. This study focuses on the precise chronology of the sites, using radiocarbon dating and Bayesian modelling of both newly acquired and legacy radiocarbon dates. To mitigate the risk of erroneous dates, we dated the bone collagen of 26 herbivorous and one aquatic mammals from clear archaeological contexts and discovered that the most recent occupational phases at both sites are several centuries younger than previously thought. This is consistent with material evidence of lifestyle changes in the final phase at Hardinxveld-Giessendam de Bruin, which is now, according to our chronology, contemporaneous with the similar patterns produced in the region.

<https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0280619>

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## Proceedings of the Prehistoric Society

### PAPERS

#### **KATY A. WHITAKER – ‘Connoisseurs of Stone’: Everyday Sarsen Stone in Neolithic Britain**

Sarsen stone boulders are familiar components of numerous British Neolithic megalithic monuments. Non-monumental uses of sarsen stone are, however, less well understood. This paper focuses on non-megalithic sarsen and its roles for communities, using case studies from three sites spanning the Neolithic in Wiltshire. Published data from Windmill Hill causewayed enclosure and analysis, using a new methodology, of recently excavated material from the West Kennet Avenue occupation site, and Marden henge enclosure are used to explore the varied ways in which sarsen was used. Rather than being an expedient ‘mundane’ stone this analysis demonstrates that non-megalithic sarsen could be just as meaning-laden as other more ‘attractive’ (larger, exotic) material. Daily encounters with sarsen stone for different purposes and in varied quotidian contexts afforded it with values which likely contributed to its use in monumental contexts. The importance of attending to sarsen in its multiple forms and contexts is thus made clear.

<https://www.cambridge.org/core/journals/proceedings-of-the-prehistoric-society/article/connoisseurs-of-stone-everyday-sarsen-stone-in-neolithic-britain/83DED44CA7B15C48B16A206667C51252>

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## Royal Society Open Science

### PAPERS

#### **KAIYANG QIN et al – Environmental control of social goals: using Pavlovian-to-instrumental transfer to test cue-based pro-self and pro-social outcome responses**

A large amount of literature demonstrates that social behaviour can be triggered by environmental cues. A long-standing debate involves the question of whether such stimuli trigger behaviour directly (i.e. habits) or whether these effects mediate goals. As studies on automatic goal pursuit typically use real-world cues that are already associated with the behaviour and potentially the goal, it is impossible to make strong claims about the nature of the effects. In the present paper, we use a paradigm inspired by the Pavlovian-to-instrumental transfer (PIT) literature to examine how the environment can trigger goal-directed behaviour. Building on the essence of pro-self and pro-social motives in humans, two experiments explored the PIT effect when the outcomes were framed in terms of self- versus other-interest. Participants performed actions to earn money for themselves or a charity. Each outcome was linked to a different cue. The results showed that a cue predictive of self-interest outcomes facilitated responses instrumental in gaining the outcome, while such specific PIT effect for other-interest outcomes only emerged when participants were free to donate the money. We briefly discuss these findings reflecting on whether the PIT effect in our paradigm is indeed sensitive to the value of social goals.

<https://royalsocietypublishing.org/doi/full/10.1098/rsos.220660>

#### **SUSKA NOLTE et al – Does tolerance allow bonobos to outperform chimpanzees on a cooperative task? A conceptual replication of Hare et al., 2007**

Across various taxa, social tolerance is thought to facilitate cooperation, and many species are treated as having species-specific patterns of social tolerance. Yet studies that assess wild and captive bonobos and chimpanzees result in contrasting findings. By replicating a cornerstone experimental study on tolerance and cooperation in bonobos and chimpanzees (Hare et al. 2007 *Cur. Biol.* 17, 619–623 (doi:10.1016/j.cub.2007.02.040)), we aim to further our understanding of current discrepant findings. We tested bonobos and chimpanzees housed at the same facility in a co-feeding and cooperation task. Food was

placed on dishes located on both ends or in the middle of a platform. In the co-feeding task, the tray was simply made available to the ape duos, whereas in the cooperation task the apes had to simultaneously pull at both ends of a rope attached to the platform to retrieve the food. By contrast to the published findings, bonobos and chimpanzees co-fed to a similar degree, indicating a similar level of tolerance. However, bonobos cooperated more than chimpanzees when the food was monopolizable, which replicates the original study. Our findings call into question the interpretation that at the species level bonobos cooperate to a higher degree because they are inherently more tolerant.

<https://royalsocietypublishing.org/doi/full/10.1098/rsos.220194>

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## Trends in Cognitive Sciences

### COMMENTARIES

#### **CECILIA HEYES – The cognitive reality of causal understanding**

Cultural evolutionists have an ambitious agenda. They seek to explain population-level changes in socially learned characteristics using resources from evolutionary biology. The characteristics range from stone tool-use and marriage customs to fairy stories and social media outrage. The resources include modelling techniques from population genetics and assumptions about the innate structure of minds. Starting in the late 1970s, the dominant school of cultural evolution, known as ‘dual inheritance theory’ and the ‘California school’, has argued that individual humans are not especially smart. Our success as a species is founded on our ability to copy one another, faithfully but without much insight. A thriving alternative, known as ‘cultural attraction theory’ and the ‘Paris school’, sees cultural evolution as a more intellectual business, involving ‘reconstruction’ rather than copying. They argue that any improvement in cultural practices is due, not to Darwinian selection where behavioural copying takes the place of genetic replication, but to powerful, innate cognitive processes that enable social learners to interpret and understand observed behaviour. Representing the Paris school, Osiurak, Claidière, and Federico recently made a compelling case that ‘cumulative technological culture’ (improvements in tool-use) depends on ‘causal understanding’. Their article underlines the need for better integration between cultural evolution and cognitive science to resolve the issues that divide California from Paris.

[https://www.cell.com/trends/cognitive-sciences/fulltext/S1364-6613\(22\)00295-9](https://www.cell.com/trends/cognitive-sciences/fulltext/S1364-6613(22)00295-9)

#### **FRANÇOIS OSIURAK, GIOVANNI FEDERICO & NICOLAS CLAIIDIÈRE – Technical reasoning: neither cognitive instinct nor cognitive gadget**

In our target article in TiCS [[https://www.cell.com/trends/cognitive-sciences/fulltext/S1364-6613\(22\)00245-5](https://www.cell.com/trends/cognitive-sciences/fulltext/S1364-6613(22)00245-5)], we argued that technical reasoning is a cognitive capacity that supports cumulative technological culture. Heyes rightly points out the ambiguity surrounding our use of the term ‘technical reasoning’ and sets a research agenda for the future: is technical reasoning general reasoning applied to the technological domain? Is it a form of reasoning that is specific to reasoning about technology? Has technical reasoning co-evolved with human tool use? Does it vary across cultures? Before providing additional elaboration on the concept of technical reasoning that may help start answering these questions, we discuss Heyes’ more general agenda, which seeks to determine whether cognitive capacities, such as technical reasoning, are instincts or gadgets, an issue Heyes raises in Box 1.

[https://www.cell.com/trends/cognitive-sciences/fulltext/S1364-6613\(22\)00333-3](https://www.cell.com/trends/cognitive-sciences/fulltext/S1364-6613(22)00333-3)

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