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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, do 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, do let me know.

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

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### ACADEMIA.EDU – Flake modification in European Early & Early-Middle Pleistocene tool assemblages

*In Quaternary International 316, 140-154 (2013).*

#### **DEBORAH BARSKY et al – Flake modification in European Early and Early-Middle Pleistocene stone tool assemblages**

Early and Early-Middle Pleistocene archeological sites provide data about human dispersals into Europe from at least 1.2 Ma. Up to now, the fragmentary archeological record indicated only sporadic hominin presence, with punctuated migration "waves" not necessarily leading to colonization. We consider an alternative demographical picture in which hominin presence in Europe could have been sustained from this time. This paper explores the possibility that early hominin groups confronted different landscapes by adapting their technology to changing ecosystems. Innovative technological achievements were developed into new forms out of potential existing within the variability of early stone industries, leading to the production of a more diversified toolkit. Among these innovations, the increased secondary knapping of flakes points to conceptually more complex production sequences. This paper proposes a comparative view of secondary knapped flakes from some key Early-Middle Pleistocene sites in order to explore the hypothesis of demographical stability in Western Europe from this time.

<https://www.sciencedirect.com/science/article/abs/pii/S1040618213002735>

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## ACADEMIA.EDU – On the origin of the European Acheulian

*In Journal of Anthropological Archaeology 44, 87-104 (2016).*

### **KENNETH MARTÍNEZ & JOAN GARCIA GARRIGA – On the origin of the European Acheulian**

The Mode 1 to Mode 2 transition in Europe has become a key research debate on early hominins. In this paper, the available data are used to propose a new interpretation of the origin of the Acheulian by analysing the transition through the lithic industry at key circum-Mediterranean sites with Early-Middle Pleistocene chronology: Vallparadís, Gran Dolina TD6, Barranc de la Boella, and Caune de l'Arago 'P' levels. Regarding these lithic records, we propose here the hypothesis based on an evolution of new technological behaviours in Europe before 0.5 Myr carried out from autochthonous populations with Mode 1 industries, combined with external adaptive and technological influences. We interpret the chronology and lithic assemblages of these sites within the transition process towards Acheulian, in which structural continuity of Mode 1 is complemented with the gradual appearance of some foreign innovations (bifacial technology). This technological transition is envisaged as a historical process: the outcome of the cultural evolution resulted from contacts and exchanges between hominin groups from western Eurasia with different social and technological adaptations, in contact and competition with each other. This historical process would explain the time lag between Africa, Levant, and Europe in the spread of the Acheulian, as well as a technological evolution of the European Mode 1 and the gradual expansion of the Acheulian across Europe.

[https://www.academia.edu/28813295/On\\_the\\_origin\\_of\\_the\\_European\\_Acheulian](https://www.academia.edu/28813295/On_the_origin_of_the_European_Acheulian)

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## CONFERENCE ALERT – Joint Conference on Language Evolution

**Submission system is now open!**

Please submit your abstract / paper here: <https://easychair.org/conferences/?conf=jcole2022>

The submission deadline for abstracts / papers is February 1st, 2022!

**Also, don't forget to submit your workshop proposal!**

The submission deadline for workshop proposals is January 5th, 2022!

Call for papers:

<https://sites.google.com/view/joint-conf-language-evolution/calls>

Submission guidelines:

<https://sites.google.com/view/joint-conf-language-evolution/submission>

### **Accessibility policy**

The Joint Conference on Language Evolution is committed to offering an accessible environment for all.

Sign language interpreting: We will offer sign language interpreting in American Sign Language (ASL) or International Sign (IS) for the scientific program of our conference and guarantee 1) the sign language interpreting of all keynote and invited talks, 2) the interpreting of the presentations given in ASL or IS into spoken English, and 3) the sign language interpreting of one parallel session.

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## NEWS

### **SCIENCE DAILY – Experiment gives rise to social conventions between baboons**

A research team has demonstrated that members of a group of baboons can establish shared social conventions -- in this case, by all agreeing on how to solve a problem in order to get a reward faster. This is the first time that such conventions have been studied experimentally in an animal species.

<https://www.sciencedaily.com/releases/2021/12/211213121810.htm>

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### **SCIENCE DAILY – Tooth cavities provide unique ecological insight into living primates and fossil humans**

Tooth decay is a common and unfortunate problem for many of us, but two University of Otago studies show it is also an issue for other primates, as well as our fossil relatives and ancestors.

<https://www.sciencedaily.com/releases/2021/12/211213121841.htm>

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### **SCIENCE DAILY – Earliest adorned female infant burial in Europe significant for evolution of personhood**

Ten thousand years ago, a group of hunter-gatherers buried an infant girl in an Italian cave with a rich selection of their treasured beads and pendants, showing that even the youngest females were recognized as full persons in their society. The excavations and analysis of the discovery offer insight into the early Mesolithic period, from which few recorded burials are known.

<https://www.sciencedaily.com/releases/2021/12/211214084538.htm>

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### **SOCIETY FOR SCIENCE – 2021 research reinforced that mating across groups drove human evolution**

Fossils and DNA point to mixing and mingling among Homo groups across vast areas.

<http://click.societyforscience-email.com/?qs=1076b707030f41a6da063ad4b04ad1a2c9c61eef953ab539051cec30e4268c458b75ed95bd18ff5dd66470bd80a54dcfce684ffd7146713c15e835c6404d0c04>

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**SOCIETY FOR SCIENCE – Neandertals were first hominids to turn forest into grassland 125,000 years ago**  
Neandertals' campfires, hunting and other activities altered the land over 2,000 years, making them the first known hominids to impact their environs.

<http://click.societyforscience-email.com/?qs=87cdcf88e212d2b8d3c64c2fbf12705059322b1730f43c84403976651208cf79b4ddafbf497aa518876d3e33c198ae7628414e3163a9b2dbe4354112b3ce721>

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**SOCIETY FOR SCIENCE – 2021 research reinforced that mating across groups drove human evolution**

Fossils and DNA point to mixing and mingling among Homo groups across vast areas.

<http://click.societyforscience-email.com/?qs=2c6c4d5d4f7b130229e1abb0aa11b03bf7866f34ff6f7aed283530d02c4df9783307696109ba467a1de989fbccb160a5ca0a5a45d950d335d88ade081d517a5a>

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## PUBLICATIONS

eLife

### PAPERS

**LUKAS ALEXANDER HAHN et al – Working memory capacity of crows and monkeys arises from similar neuronal computations**

Complex cognition relies on flexible working memory, which is severely limited in its capacity. The neuronal computations underlying these capacity limits have been extensively studied in humans and in monkeys, resulting in competing theoretical models. We probed the working memory capacity of crows (*Corvus corone*) in a change detection task, developed for monkeys (*Macaca mulatta*), while we performed extracellular recordings of the prefrontal-like area nidopallium caudolaterale. We found that neuronal encoding and maintenance of information were affected by item load, in a way that is virtually identical to results obtained from monkey prefrontal cortex. Contemporary neurophysiological models of working memory employ divisive normalization as an important mechanism that may result in the capacity limitation. As these models are usually conceptualized and tested in an exclusively mammalian context, it remains unclear if they fully capture a general concept of working memory or if they are restricted to the mammalian neocortex. Here, we report that carrion crows and macaque monkeys share divisive normalization as a neuronal computation that is in line with mammalian models. This indicates that computational models of working memory developed in the mammalian cortex can also apply to non-cortical associative brain regions of birds.

<https://elifesciences.org/articles/72783>

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## Evolutionary Anthropology

### PAPERS

**PAIGE MADISON – Brutish Neanderthals: History of a merciless characterization**

The idea that Neanderthals were brutish and unintelligent is often traced back to Marcellin Boule, a French paleontologist who examined the specimen known as the Old Man in the first decades of the 20th century. This article examines the work of Boule's predecessors and aggregate a variety of literature to underline an argument that this idea has much earlier origins and is rooted in the first recognized specimen discovered in the Neander Valley in 1856. Reorienting our understanding of the brutish Neanderthal to account for its 19th-century origins, allows for a reexamination of the factors in 19th-century culture, science, and society which contributed to this caricature, especially the concepts of race and species' extinction. Such a reexamination dismantles the narrative of Boule's error while providing a new vantage point to think about Neanderthals in the present.

<https://onlinelibrary.wiley.com/doi/abs/10.1002/evan.21918>

**STACY LINDSHIELD et al – Chimpanzees (*Pan troglodytes*) in savanna landscapes**

Chimpanzees (*Pan troglodytes*) are the only great apes that inhabit hot, dry, and open savannas. We review the environmental pressures of savannas on chimpanzees, such as food and water scarcity, and the evidence for chimpanzees' behavioral responses to these landscapes. In our analysis, savannas were generally associated with low chimpanzee population densities and large home ranges. In addition, thermoregulatory behaviors that likely reduce hyperthermia risk, such as cave use, were frequently observed in the hottest and driest savanna landscapes. We hypothesize that such responses are evidence of a "savanna landscape effect" in chimpanzees and offer pathways for future research to understand its evolutionary processes and mechanisms. We conclude by discussing the significance of research on savanna chimpanzees to modeling the evolution of early hominin traits and informing conservation programs for these endangered apes.

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## Frontiers in Psychology

### PAPERS

#### **CHANGZHI ZHAO et al – A Longitudinal Study of the Relations Between Theory of Mind, Executive Function, and Lying in Children**

This study used longitudinal cross-lagged modeling to examine the contribution of theory of mind (ToM), executive function (EF) to children's lying development and of children's lying to ToM and EF development. Ninety-seven Chinese children (initial Mage = 46 months, 47 boys) were tested three times approximately 4 months apart. Results showed that the diverse desire understanding and knowledge access understanding components of ToM, as well as the inhibitory control component of EF predicted the development of children's lying, while the diverse belief understanding and false belief understanding components of ToM, and the working memory component of EF did not predict development of children's lying. Meanwhile, children's lying predicted development of children's belief-emotion understanding components of ToM, but not any other ToM components, or EF components. These findings provide longitudinal evidence for the relation between ToM, EF, and children's lying during the preschool years.

<https://www.frontiersin.org/articles/10.3389/fpsyg.2021.766891/full>

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## Nature Ecology & Evolution

### ARTICLES

#### **CLAIRE BOWERN – Drivers of language loss**

A macroecological view suggests some global drivers of language endangerment and continuity, but a focus on individual languages will be important to stem the tide of language loss.

<https://www.nature.com/articles/s41559-021-01621-x>

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## Nature Genetics

### PAPERS

#### **EMMANUELLE SZENKER-RAVI et mul – Discovery of a genetic module essential for assigning left–right asymmetry in humans and ancestral vertebrates**

The vertebrate left–right axis is specified during embryogenesis by a transient organ: the left–right organizer (LRO). Species including fish, amphibians, rodents and humans deploy motile cilia in the LRO to break bilateral symmetry, while reptiles, birds, even-toed mammals and cetaceans are believed to have LROs without motile cilia. We searched for genes whose loss during vertebrate evolution follows this pattern and identified five genes encoding extracellular proteins, including a putative protease with hitherto unknown functions that we named ciliated left–right organizer metalloproteinase (CIROP). Here, we show that CIROP is specifically expressed in ciliated LROs. In zebrafish and *Xenopus*, CIROP is required solely on the left side, downstream of the leftward flow, but upstream of *DAND5*, the first asymmetrically expressed gene. We further ascertained 21 human patients with loss-of-function CIROP mutations presenting with recessive situs anomalies. Our findings posit the existence of an ancestral genetic module that has twice disappeared during vertebrate evolution but remains essential for distinguishing left from right in humans.

<https://www.nature.com/articles/s41588-021-00970-4>

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## Nature Neuroscience

### ARTICLES

#### **WENLIANG WANG, MARK A. G. ELDRIDGE & BARRY J. RICHMOND – Novelty seeking for novelty's sake**

Our brains are wired to steer us toward novel experiences. Ogasawara et al. define nodes in a network that underlies novelty-seeking behavior distinct from novelty-orienting responses. In this network, anterior ventral medial temporal cortex (AVMTC) mediates novelty-related sensory processing, and zona incerta uses input from AVMTC to guide gaze shifts for novelty seeking.

<https://www.nature.com/articles/s41593-021-00965-8>

### PAPERS

#### **TAKAYA OGASAWARA et al – A primate temporal cortex–zona incerta pathway for novelty seeking**

Primates interact with the world by exploring visual objects; they seek opportunities to view novel objects even when these have no extrinsic reward value. How the brain controls this novelty seeking is unknown. Here we show that novelty seeking in monkeys is regulated by the zona incerta (ZI). As monkeys made eye movements to familiar objects to trigger an opportunity to view novel objects, many ZI neurons were preferentially activated by predictions of novel objects before the gaze shift. Low-intensity ZI stimulation facilitated gaze shifts, whereas ZI inactivation reduced novelty seeking. ZI-dependent novelty seeking was not regulated by neurons in the lateral habenula or by many dopamine neurons in the substantia nigra, traditionally associated with reward seeking. But the anterior ventral medial temporal cortex, an area important for object

vision and memory, was a prominent source of novelty predictions. These data uncover a functional pathway in the primate brain that regulates novelty seeking.

<https://www.nature.com/articles/s41593-021-00950-1>

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## Nature Scientific Reports

### PAPERS

#### **GONZALO J. LINARES-MATÁS et al – Hyaenas and early humans in the latest Early Pleistocene of South-Western Europe**

Throughout the Pleistocene, early humans and carnivores frequented caves and large rock-shelters, usually generating bone accumulations. The well-preserved late Early Pleistocene sedimentary sequence at Cueva Negra del Estrecho del Río Quípar (CNERQ) has provided substantial evidence concerning the behavioural and adaptive skills of early humans in Western Europe, such as butchery practices, lithic technology or tending fire, whilst also bearing witness to the bone-altering activities of carnivores. Recent fieldwork has allowed the re-examination of the spatial and taphonomical nature of the macrofaunal assemblage from the upper layers of Complex 2. These layers are somewhat different from most of the underlying sequence, in showing quite a high representation of cranial and post-cranial bones of large mammals, including several *Megaloceros carthaginiensis* antlers. The presence of *Crocota* sp. at Cueva Negra represents one of the earliest instances of this genus in Western Eurasia. Identification of several juvenile *Crocota* sp. remains alongside coprolites and bones with carnivore damage, indicates sporadic hyaenid denning activity. Furthermore, the presence of bones with percussion and cut-marks near to several hammerstones suggests a clear albeit limited anthropogenic input. We interpret the available taphonomical and spatial evidence from these layers as reflecting a multi-patterned palimpsest, likely representing the non-simultaneous and short-lived co-existence of hyaenas, humans, and other small carnivores in the Cueva Negra palaeolandscape during the final phase of sedimentation preserved at the site.

<https://www.nature.com/articles/s41598-021-03547-7>

#### **BOREL ANTONY et al – Optimization of use-wear detection and characterization on stone tool surfaces**

Debates and doubt around the interpretation of use-wear on stone tools called for the development of quantitative analysis of surfaces to complement the qualitative description of traces. Recently, a growing number of studies showed that prehistoric activities can be discriminated thanks to quantitative characterization of stone tools surface alteration due to use. However, stone tool surfaces are microscopically very heterogeneous and the calculated parameters may highly vary depending on the areas selected for measurement. Indeed, it may be impacted by the effects from the raw material topography and not from the altered zones only, if non-altered part of the surface is included in the measurement. We propose here to discuss this issue and present a workflow involving the use of masks to separate worn and unworn parts of the surface. Our results show that this step of extraction, together with suitable filtering, could have a high impact on the optimization of the detection and thus characterization of use traces. This represents the basis for future automatic routines allowing the detection, extraction and characterization of wear on stone tools.

<https://www.nature.com/articles/s41598-021-03663-4>

#### **JAMIE HODGKINS et al – An infant burial from Arma Veirana in northwestern Italy provides insights into funerary practices and female personhood in early Mesolithic Europe**

The evolution and development of human mortuary behaviors is of enormous cultural significance. Here we report a richly-decorated young infant burial (AVH-1) from Arma Veirana (Liguria, northwestern Italy) that is directly dated to 10,211–9910 cal BP (95.4% probability), placing it within the early Holocene and therefore attributable to the early Mesolithic, a cultural period from which well-documented burials are exceedingly rare. Virtual dental histology, proteomics, and aDNA indicate that the infant was a 40–50 days old female. Associated artifacts indicate significant material and emotional investment in the child's interment. The detailed biological profile of AVH-1 establishes the child as the earliest European near-neonate documented to be female. The Arma Veirana burial thus provides insight into sex/gender-based social status, funerary treatment, and the attribution of personhood to the youngest individuals among prehistoric hunter-gatherer groups and adds substantially to the scant data on mortuary practices from an important period in prehistory shortly following the end of the last Ice Age.

<https://www.nature.com/articles/s41598-021-02804-z>

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## New Scientist

### ARTICLES

#### **GRAHAM LAWTON – Did monkeys really sail the oceans on floating rafts of vegetation?**

The mystery of how some species colonised new continents is as old as the theory of evolution itself. Now, with fresh clues surfacing, the rafting hypothesis might finally sink or swim.

<https://www.newscientist.com/article/mg25233653-500-did-monkeys-really-sail-the-oceans-on-floating-rafts-of-vegetation/#ixzz7FG7eLPeb>

### **JOHNJOE MCFADDEN – Occam’s razor: The medieval monk who saw the power of simplicity**

William of Ockham was tried for heresy before the Pope, only to make a daring escape. His big idea, known as Occam’s razor, remains the keenest tool for honing our understanding of the world.

<https://www.newscientist.com/article/mg25233654-300-occams-razor-the-medieval-monk-who-saw-the-power-of-simplicity/#ixzz7FG85x9Nn>

### **DAVID ROBSON – The real reasons we laugh and what different types of laughter mean**

It is surprising that psychologists and neuroscientists were once reluctant to devote serious attention to laughter, with many believing expressions of mirth to be less important than those of unhappiness or despair. “Psychology still has a lot of catching up to do to balance out what is known about negative emotions with positive ones,” says Gina Mireault at Northern Vermont University.

<https://www.newscientist.com/article/mg25233654-400-the-real-reasons-we-laugh-and-what-different-types-of-laughter-mean/#ixzz7FG8i3rcb>

### **MICHAEL MARSHALL – When geckos play ball and spiders spar: The strange evolution of fun**

The ability to play is being spotted in some unexpected creatures, from swans to Komodo dragons. Are they really fooling around? And if so, why do they do it?

<https://www.newscientist.com/article/mg25233654-600-when-geckos-play-ball-and-spiders-spar-the-strange-evolution-of-fun/#ixzz7FG96Jiig>

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## NPJ Science of Learning

### PAPERS

#### **MINKANG KIM et al – Neural computations in children’s third-party interventions are modulated by their parents’ moral values**

One means by which humans maintain social cooperation is through intervention in third-party transgressions, a behaviour observable from the early years of development. While it has been argued that pre-school age children’s intervention behaviour is driven by normative understandings, there is scepticism regarding this claim. There is also little consensus regarding the underlying mechanisms and motives that initially drive intervention behaviours in pre-school children. To elucidate the neural computations of moral norm violation associated with young children’s intervention into third-party transgression, forty-seven preschoolers (average age 53.92 months) participated in a study comprising of electroencephalographic (EEG) measurements, a live interaction experiment, and a parent survey about moral values. This study provides data indicating that early implicit evaluations, rather than late deliberative processes, are implicated in a child’s spontaneous intervention into third-party harm. Moreover, our findings suggest that parents’ values about justice influence their children’s early neural responses to third-party harm and their overt costly intervention behaviour.

<https://www.nature.com/articles/s41539-021-00116-5>

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## Philosophical Transactions of the Royal Society B

### PAPERS

#### **MICHEL BELYK, NICOLE EICHERT & CAROLYN MCGETTIGAN – A dual larynx motor networks hypothesis**

Humans are vocal modulators par excellence. This ability is supported in part by the dual representation of the laryngeal muscles in the motor cortex. Movement, however, is not the product of motor cortex alone but of a broader motor network. This network consists of brain regions that contain somatotopic maps that parallel the organization in motor cortex. We therefore present a novel hypothesis that the dual laryngeal representation is repeated throughout the broader motor network. In support of the hypothesis, we review existing literature that demonstrates the existence of network-wide somatotopy and present initial evidence for the hypothesis’ plausibility. Understanding how this uniquely human phenotype in motor cortex interacts with broader brain networks is an important step toward understanding how humans evolved the ability to speak. We further suggest that this system may provide a means to study how individual components of the nervous system evolved within the context of neuronal networks. This article is part of the theme issue ‘Voice modulation: from origin and mechanism to social impact (Part I)’.

<https://royalsocietypublishing.org/doi/10.1098/rstb.2020.0392>

#### **ELLEN C. GARLAND, CLAIRE GARRIGUE & MICHAEL J. NOAD – When does cultural evolution become cumulative culture? A case study of humpback whale song**

Culture presents a second inheritance system by which innovations can be transmitted between generations and among individuals. Some vocal behaviours present compelling examples of cultural evolution. Where modifications accumulate over time, such a process can become cumulative cultural evolution. The existence of cumulative cultural evolution in non-human animals is controversial. When physical products of such a process do not exist, modifications may not be clearly visible over time. Here, we investigate whether the constantly evolving songs of humpback whales (*Megaptera novaeangliae*) are indicative of cumulative cultural evolution. Using nine years of song data recorded from the New Caledonian humpback whale population, we quantified song evolution and complexity, and formally evaluated this process in light of criteria for

cumulative cultural evolution. Song accumulates changes shown by an increase in complexity, but this process is punctuated by rapid loss of song material. While such changes tentatively satisfy the core criteria for cumulative cultural evolution, this claim hinges on the assumption that novel songs are preferred by females. While parsimonious, until such time as studies can link fitness benefits (reproductive success) to individual singers, any claims that humpback whale song evolution represents a form of cumulative cultural evolution may remain open to interpretation.

<https://royalsocietypublishing.org/doi/full/10.1098/rstb.2020.0313>

### **HEATHER WILLIAMS & ROBERT F. LACHLAN – Evidence for cumulative cultural evolution in bird song**

In studies of cumulative cultural evolution in non-human animals, the focus is most often on incremental changes that increase the efficacy of an existing form of socially learned behaviour, such as the refinement of migratory pathways. In this paper, we compare the songs of different species to describe patterns of evolution in the acoustic structure of bird songs, and explore the question of what building blocks might underlie cumulative cultural evolution of bird song using a comparative approach. We suggest that three steps occurred: first, imitation of independent sounds, or notes, via social learning; second, the formation of categories of note types; and third, assembling note types into sequences with defined structures. Simple sequences can then be repeated to form simple songs or concatenated with other sequences to form segmented songs, increasing complexity. Variant forms of both the notes and the sequencing rules may then arise due to copy errors and innovation. Some variants may become established in the population because of learning biases or selection, increasing signal efficiency, or because of cultural drift. Cumulative cultural evolution of bird songs thus arises from cognitive processes such as vocal imitation, categorization during memorization and learning biases applied to basic acoustic building blocks.

<https://royalsocietypublishing.org/doi/full/10.1098/rstb.2020.0322>

### **SIMON KIRBY & MONICA TAMARIZ – Cumulative cultural evolution, population structure and the origin of combinatoriality in human language**

Language is the primary repository and mediator of human collective knowledge. A central question for evolutionary linguistics is the origin of the combinatorial structure of language (sometimes referred to as duality of patterning), one of language's basic design features. Emerging sign languages provide a promising arena to study the emergence of language properties. Many, but not all such sign languages exhibit combinatoriality, which generates testable hypotheses about its source. We hypothesize that combinatoriality is the inevitable result of learning biases in cultural transmission, and that population structure explains differences across languages. We construct an agent-based model with population turnover. Bayesian learning agents with a prior preference for compressible languages (modelling a pressure for language learnability) communicate in pairs under pressure to reduce ambiguity. We include two transmission conditions: agents learn the language either from the oldest agent or from an agent in the middle of their lifespan. Results suggest that (1) combinatoriality emerges during iterated cultural transmission under concurrent pressures for simplicity and expressivity and (2) population dynamics affect the rate of evolution, which is faster when agents learn from other learners than when they learn from old individuals. This may explain its absence in some emerging sign languages. We discuss the consequences of this finding for cultural evolution, highlighting the interplay of population-level, functional and cognitive factors.

<https://royalsocietypublishing.org/doi/full/10.1098/rstb.2020.0319>

### **ANTHONY FORMAUX et al – The experimental emergence of convention in a non-human primate**

Conventions form an essential part of human social and cultural behaviour and may also be important to other animal societies. Yet, despite the wealth of evidence that has accumulated for culture in non-human animals, we know surprisingly little about non-human conventions beyond a few rare examples. We follow the literature in behavioural ecology and evolution and define conventions as systematic behaviours that solve a coordination problem in which two or more individuals need to display complementary behaviour to obtain a mutually beneficial outcome. We start by discussing the literature on conventions in non-human primates from this perspective and conclude that all the ingredients for conventions to emerge are present and therefore that they ought to be more frequently observed. We then probe the emergence of conventions by using a unique novel experimental system in which pairs of Guinea baboons (*Papio papio*) can voluntarily participate together in touchscreen-based cognitive testing and we show that conventions readily emerge in our experimental set-up and that they share three fundamental properties of human conventions (arbitrariness, stability and efficiency). These results question the idea that observational learning, and imitation in particular, is necessary to establish conventions; they suggest that positive reinforcement is enough.

<https://royalsocietypublishing.org/doi/abs/10.1098/rstb.2020.0310>

### **CATHAL O'MADAGAIN & MICHAEL TOMASELLO – Shared intentionality, reason-giving and the evolution of human culture**

The biological approach to culture focuses almost exclusively on processes of social learning, to the neglect of processes of cultural coordination including joint action and shared intentionality. In this paper, we argue that the distinctive features of human culture derive from humans' unique skills and motivations for coordinating with one another around different types of action and information. As different levels of these skills of 'shared intentionality' emerged over the last several hundred thousand years, human culture became characterized first by such things as collaborative activities and pedagogy based on

cooperative communication, and then by such things as collaborative innovations and normatively structured pedagogy. As a kind of capstone of this trajectory, humans began to coordinate not just on joint actions and shared beliefs, but on the reasons for what we believe or how we act. Coordinating on reasons powered the kinds of extremely rapid innovation and stable cumulative cultural evolution especially characteristic of the human species in the last several tens of thousands of years.

<https://royalsocietypublishing.org/doi/full/10.1098/rstb.2020.0320>

### **ROBIN SCHIMMELPFENNIG et al – Paradox of diversity in the collective brain**

Human societies are collective brains. People within every society have cultural brains—brains that have evolved to selectively seek out adaptive knowledge and socially transmit solutions. Innovations emerge at a population level through the transmission of serendipitous mistakes, incremental improvements and novel recombinations. The rate of innovation through these mechanisms is a function of (1) a society's size and interconnectedness (sociality), which affects the number of models available for learning; (2) fidelity of information transmission, which affects how much information is lost during social learning; and (3) cultural trait diversity, which affects the range of possible solutions available for recombination. In general, and perhaps surprisingly, all three levers can increase and harm innovation by creating challenges around coordination, conformity and communication. Here, we focus on the 'paradox of diversity'—that cultural trait diversity offers the largest potential for empowering innovation, but also poses difficult challenges at both an organizational and societal level. We introduce 'cultural evolvability' as a framework for tackling these challenges, with implications for entrepreneurship, polarization and a nuanced understanding of the effects of diversity. This framework can guide researchers and practitioners in how to reap the benefits of diversity by reducing costs.

<https://royalsocietypublishing.org/doi/full/10.1098/rstb.2020.0316>

### **IDA MOMENNEJAD – Collective minds: social network topology shapes collective cognition**

Human cognition is not solitary, it is shaped by collective learning and memory. Unlike swarms or herds, human social networks have diverse topologies, serving diverse modes of collective cognition and behaviour. Here, we review research that combines network structure with psychological and neural experiments and modelling to understand how the topology of social networks shapes collective cognition. First, we review graph-theoretical approaches to behavioural experiments on collective memory, belief propagation and problem solving. These results show that different topologies of communication networks synchronize or integrate knowledge differently, serving diverse collective goals. Second, we discuss neuroimaging studies showing that human brains encode the topology of one's larger social network and show similar neural patterns to neural patterns of our friends and community ties (e.g. when watching movies). Third, we discuss cognitive similarities between learning social and non-social topologies, e.g. in spatial and associative learning, as well as common brain regions involved in processing social and non-social topologies. Finally, we discuss recent machine learning approaches to collective communication and cooperation in multi-agent artificial networks. Combining network science with cognitive, neural and computational approaches empowers investigating how social structures shape collective cognition, which can in turn help design goal-directed social network topologies.

<https://royalsocietypublishing.org/doi/full/10.1098/rstb.2020.0315>

### **ANDREA BAMBERG MIGLIANO & LUCIO VINICIUS – The origins of human cumulative culture: from the foraging niche to collective intelligence**

Various studies have investigated cognitive mechanisms underlying culture in humans and other great apes. However, the adaptive reasons for the evolution of uniquely sophisticated cumulative culture in our species remain unclear. We propose that the cultural capabilities of humans are the evolutionary result of a stepwise transition from the ape-like lifestyle of earlier hominins to the foraging niche still observed in extant hunter–gatherers. Recent ethnographic, archaeological and genetic studies have provided compelling evidence that the components of the foraging niche (social egalitarianism, sexual and social division of labour, extensive co-residence and cooperation with unrelated individuals, multilocality, fluid sociality and high between-camp mobility) engendered a unique multilevel social structure where the cognitive mechanisms underlying cultural evolution (high-fidelity transmission, innovation, teaching, recombination, ratcheting) evolved as adaptations. Therefore, multilevel sociality underlies a 'social ratchet' or irreversible task specialization splitting the burden of cultural knowledge across individuals, which may explain why human collective intelligence is uniquely able to produce sophisticated cumulative culture. The foraging niche perspective may explain why a complex gene–culture dual inheritance system evolved uniquely in humans and interprets the cultural, morphological and genetic origins of *Homo sapiens* as a process of recombination of innovations appearing in differentiated but interconnected populations.

<https://royalsocietypublishing.org/doi/full/10.1098/rstb.2020.0317>

### **T. GRUBER et al – Efficiency fosters cumulative culture across species**

Recent studies in several taxa have demonstrated that animal culture can evolve to become more efficient in various contexts ranging from tool use to route learning and migration. Under recent definitions, such increases in efficiency might satisfy the core criteria of cumulative cultural evolution (CCE). However, there is not yet a satisfying consensus on the precise definition of efficiency, CCE or the link between efficiency and more complex, extended forms of CCE considered uniquely human. To bring clarity to this wider discussion of CCE, we develop the concept of efficiency by (i) reviewing recent potential

evidence for CCE in animals, and (ii) clarifying a useful definition of efficiency by synthesizing perspectives found within the literature, including animal studies and the wider iterated learning literature. Finally, (iii) we discuss what factors might impinge on the informational bottleneck of social transmission, and argue that this provides pressure for learnable behaviours across species. We conclude that framing CCE in terms of efficiency casts complexity in a new light, as learnable behaviours are a requirement for the evolution of complexity. Understanding how efficiency greases the ratchet of cumulative culture provides a better appreciation of how similar cultural evolution can be between taxonomically diverse species—a case for continuity across the animal kingdom.

<https://royalsocietypublishing.org/doi/full/10.1098/rstb.2020.0308>

### **ANDREW WHITEN et al – Collective knowledge and the dynamics of culture in chimpanzees**

Social learning in non-human primates has been studied experimentally for over 120 years, yet until the present century this was limited to what one individual learns from a single other. Evidence of group-wide traditions in the wild then highlighted the collective context for social learning, and broader ‘diffusion experiments’ have since demonstrated transmission at the community level. In the present article, we describe and set in comparative perspective three strands of our recent research that further explore the collective dimensions of culture and cumulative culture in chimpanzees. First, exposing small communities of chimpanzees to contexts incorporating increasingly challenging, but more rewarding tool use opportunities revealed solutions arising through the combination of different individuals’ discoveries, spreading to become shared innovations. The second series of experiments yielded evidence of conformist changes from habitual techniques to alternatives displayed by a unanimous majority of others but implicating a form of quorum decision-making. Third, we found that between-group differences in social tolerance were associated with differential success in developing more complex tool use to exploit an increasingly inaccessible resource. We discuss the implications of this array of findings in the wider context of related studies of humans, other primates and non-primate species.

<https://royalsocietypublishing.org/doi/full/10.1098/rstb.2020.0321>

### **S. WILD et al – Complex foraging behaviours in wild birds emerge from social learning and recombination of components**

Recent well-documented cases of cultural evolution towards increasing efficiency in non-human animals have led some authors to propose that other animals are also capable of cumulative cultural evolution, where traits become more refined and/or complex over time. Yet few comparative examples exist of traits increasing in complexity, and experimental tests remain scarce. In a previous study, we introduced a foraging innovation into replicate subpopulations of great tits, the ‘sliding-door puzzle’. Here, we track diffusion of a second ‘dial puzzle’, before introducing a two-step puzzle that combines both actions. We mapped social networks across two generations to ask if individuals could: (1) recombine socially-learned traits and (2) socially transmit a two-step trait. Our results show birds could recombine skills into more complex foraging behaviours, and naïve birds across both generations could learn the two-step trait. However, closer interrogation revealed that acquisition was not achieved entirely through social learning—rather, birds socially learned components before reconstructing full solutions asocially. As a consequence, singular cultural traditions failed to emerge, although subpopulations of birds shared preferences for a subset of behavioural variants. Our results show that while tits can socially learn complex foraging behaviours, these may need to be scaffolded by rewarding each component.

<https://royalsocietypublishing.org/doi/full/10.1098/rstb.2020.0307>

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PLoS One

PAPERS

### **TOSHIYUKI HAYAKAWA et al – Lower promoter activity of the ST8SIA2 gene has been favored in evolving human collective brains**

ST8SIA2 is an important molecule regulating expression of the phenotype involved in schizophrenia. Lowered promoter activity of the ST8SIA2 gene is considered to be protective against schizophrenia by conferring tolerance to psychosocial stress. Here, we examined the promoter-type composition of anatomically modern humans (AMHs) and archaic humans (AHs; Neanderthals and Denisovans), and compared the promoter activity at the population level (population promoter activity; PPA) between them. In AMHs, the TCT-type, showing the second lowest promoter activity, was most prevalent in the ancestral population of non-Africans. However, the detection of only the CGT-type from AH samples and recombination tracts in AH sequences showed that the CGT- and TGT-types, exhibiting the two highest promoter activities, were common in AH populations. Furthermore, interspecies gene flow occurred into AMHs from AHs and into Denisovans from Neanderthals, influencing promoter-type compositions independently in both AMHs and AHs. The difference of promoter-type composition makes PPA unique in each population. East and Southeast Asian populations show the lowest PPA. This results from the selective increase of the CGC-type, showing the lowest promoter activity, in these populations. Every non-African population shows significantly lower PPA than African populations, resulting from the TCT-type having the highest prevalence in the ancestral population of non-Africans. In addition, PPA reduction is also found among subpopulations within Africa via a slight increase of the TCT-type. These findings indicate a trend toward lower PPA in the spread of AMHs, interpreted as a continuous adaptation to psychosocial stress arising in migration. This trend is considered as genetic tuning for the evolution of collective brains. The inferred promoter-type composition of AHs differed markedly from that of AMHs, resulting in higher PPA in AHs than in AMHs. This suggests that the trend toward lower PPA is a unique feature in AMH spread.

**DAVID M. SCHRUTH, CHRISTOPHER N. TEMPLETON & DARRYL J. HOLMAN – On reappearance and complexity in musical calling**

Music is especially valued in human societies, but music-like behavior in the form of song also occurs in a variety of other animal groups including primates. The calling of our primate ancestors may well have evolved into the music of modern humans via multiple selective scenarios. But efforts to uncover these influences have been hindered by the challenge of precisely defining musical behavior in a way that could be more generally applied across species. We propose an acoustic focused reconsideration of “musicality” that could help enable independent inquiry into potential ecological pressures on the evolutionary emergence of such behavior. Using published spectrographic images ( $n = 832$  vocalizations) from the primate vocalization literature, we developed a quantitative formulation that could be used to help recognize signatures of human-like musicality in the acoustic displays of other species. We visually scored each spectrogram along six structural features from human music—tone, interval, transposition, repetition, rhythm, and syllabic variation—and reduced this multivariate assessment into a concise measure of musical patterning, as informed by principal components analysis. The resulting acoustic reappearance diversity index (ARDI) estimates the number of different reappearing syllables within a call type. ARDI is in concordance with traditional measures of bird song complexity yet more readily identifies shorter, more subtly melodic primate vocalizations. We demonstrate the potential utility of this index by using it to corroborate several origins scenarios. When comparing ARDI scores with ecological features, our data suggest that vocalizations with diversely reappearing elements have a pronounced association with both social and environmental factors. Musical calls were moderately associated with wooded habitats and arboreal foraging, providing partial support for the acoustic adaptation hypothesis. But musical calling was most strongly associated with social monogamy, suggestive of selection for constituents of small family-sized groups by neighboring conspecifics. In sum, ARDI helps construe musical behavior along a continuum, accommodates non-human musicality, and enables gradualistic co-evolutionary paths between primate taxa—ranging from the more inhibited locational calls of archaic primates to the more exhibitional displays of modern apes.

<https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0218006>

**NEUS CATALÀ et al with RAMON FERRER-I-CANCHO – Zipf’s laws of meaning in Catalan**

In his pioneering research, G. K. Zipf formulated a couple of statistical laws on the relationship between the frequency of a word with its number of meanings: the law of meaning distribution, relating the frequency of a word and its frequency rank, and the meaning-frequency law, relating the frequency of a word with its number of meanings. Although these laws were formulated more than half a century ago, they have been only investigated in a few languages. Here we present the first study of these laws in Catalan. We verify these laws in Catalan via the relationship among their exponents and that of the rank-frequency law. We present a new protocol for the analysis of these Zipfian laws that can be extended to other languages. We report the first evidence of two marked regimes for these laws in written language and speech, paralleling the two regimes in Zipf’s rank-frequency law in large multi-author corpora discovered in early 2000s. Finally, the implications of these two regimes will be discussed.

<https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0260849>

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**PNAS**

**PAPERS**

**ELIZABETH M. NIESPOLO et al – Integrative geochronology calibrates the Middle and Late Stone Ages of Ethiopia’s Afar Rift**

The Halibee member of the Upper Dawaitoli Formation of Ethiopia’s Middle Awash study area features a wealth of Middle and Later Stone Age (MSA and LSA) paleoanthropological resources in a succession of Pleistocene sediments. We introduce these artifacts and fossils, and determine their chronostratigraphic placement via a combination of established radioisotopic methods and a recently developed dating method applied to ostrich eggshell (OES). We apply the recently developed  $^{230}\text{Th}/\text{U}$  burial dating of OES to bridge the temporal gap between radiocarbon ( $^{14}\text{C}$ ) and  $^{40}\text{Ar}/^{39}\text{Ar}$  ages for the MSA and provide  $^{14}\text{C}$  ages to constrain the younger LSA archaeology and fauna to  $\sim 24$  to  $21.4$  ka. Paired  $^{14}\text{C}$  and  $^{230}\text{Th}/\text{U}$  burial ages of OES agree at  $\sim 31$  ka for an older LSA locality, validating the newer method, and in turn supporting its application to stratigraphically underlying MSA occurrences previously constrained only by a maximum  $^{40}\text{Ar}/^{39}\text{Ar}$  age. Associated fauna, flora, and *Homo sapiens* fossils are thereby now fixed between  $106 \pm 20$  ka and  $96.4 \pm 1.6$  ka (all errors  $2\sigma$ ). Additional  $^{40}\text{Ar}/^{39}$  results on an underlying tuff refine its age to  $158.1 \pm 11.0$  ka, providing a more precise minimum age for MSA lithic artifacts, fauna, and *H. sapiens* fossils recovered  $\sim 9$  m below it. These results demonstrate how chronological control can be obtained in tectonically active and stratigraphically complex settings to precisely calibrate crucial evidence of technological, environmental, and evolutionary changes during the African Middle and Late Pleistocene.

<https://www.pnas.org/content/118/50/e2116329118.abstract>

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## Science Advances

### PAPERS

#### **WIL ROEBROEKS et al – Landscape modification by Last Interglacial Neanderthals**

Little is known about the antiquity, nature, and scale of Pleistocene hunter-gatherer impact on their ecosystems, despite the importance for studies of conservation and human evolution. Such impact is likely to be limited, mainly because of low population densities, and challenging to detect and interpret in terms of cause-effect dynamics. We present high-resolution paleoenvironmental and archaeological data from the Last Interglacial locality of Neumark-Nord (Germany). Among the factors that shaped vegetation structure and succession in this lake landscape, we identify a distinct ecological footprint of hominin activities, including fire use. We compare these data with evidence from archaeological and baseline sites from the same region. At Neumark-Nord, notably open vegetation coincides with a virtually continuous c. 2000-year-long hominin presence, and the comparative data strongly suggest that hominins were a contributing factor. With an age of c. 125,000 years, Neumark-Nord provides an early example of a hominin role in vegetation transformation.

<https://www.science.org/doi/10.1126/sciadv.abj5567>

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## Trends in Ecology and Evolution

### PAPERS

#### **STUART SEMPLE, RAMON FERRER-I-CANCHO & MORGAN L. GUSTISON – Linguistic laws in biology**

Linguistic laws, the common statistical patterns of human language, have been investigated by quantitative linguists for nearly a century. Recently, biologists from a range of disciplines have started to explore the prevalence of these laws beyond language, finding patterns consistent with linguistic laws across multiple levels of biological organisation, from molecular (genomes, genes, and proteins) to organismal (animal behaviour) to ecological (populations and ecosystems). We propose a new conceptual framework for the study of linguistic laws in biology, comprising and integrating distinct levels of analysis, from description to prediction to theory building. Adopting this framework will provide critical new insights into the fundamental rules of organisation underpinning natural systems, unifying linguistic laws and core theory in biology.

[https://www.cell.com/trends/ecology-evolution/fulltext/S0169-5347\(21\)00230-5](https://www.cell.com/trends/ecology-evolution/fulltext/S0169-5347(21)00230-5)

#### **SOFIA M. LANDI & ELIZABETH A. BUFFALO – Value representation in the monkey hippocampus**

The hippocampus is thought to form cognitive maps across different domains of experience, including space and time. Recent work by Knudsen and Wallis identifies a map of abstract value space in the monkey hippocampus. We consider how these abstract variables might contribute to a comprehensive hippocampal representation of ongoing experience.

[https://www.cell.com/trends/cognitive-sciences/fulltext/S1364-6613\(21\)00262-X](https://www.cell.com/trends/cognitive-sciences/fulltext/S1364-6613(21)00262-X)

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