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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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### SOCIETY FOR SCIENCE – Monkeys may share a key grammar-related skill with humans

A contested study suggests the ability to embed sequences within other sequences, a skill called recursion and crucial to grammar, has ancient roots.

<http://click.societyforscience-email.com/?qs=eb2de9dd631f3f04e0bec90821632a92db7f905f67657ea7c190894859388ee1893e90934c50959e574f327b361d50e4c08bf3b94bf2a79d>

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### SOCIETY FOR SCIENCE – Dolphins can learn from peers how to use shells as tools

While most foraging skills are picked up from mom, some bottlenose dolphins seem to look to their peers to learn how to trap prey in shells.

<http://click.societyforscience-email.com/?qs=eb2de9dd631f3f04cc454b52f47acc1a54ce4ebdf17cf810f0564fd6cdda4e7152398de6c8df416596913c2445a914867a94a81c793b096c>

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### BREAKING SCIENCE – Bottlenose Dolphins Learn Foraging Skills from Their Peers

Indian Ocean bottlenose dolphins (*Tursiops aduncus*) are not only capable of learning new ways to catch prey, but they are also motivated to learn from their peers, not just from their mothers, according to a new study published in the journal *Current Biology*. “Our study shows that the foraging behavior ‘shelling’ spreads through social learning [...]

[http://feedproxy.google.com/~r/BreakingScienceNews/~3/MotnzgaaHp8/dolphin-shelling-08581.html?utm\\_source=feedburner&utm\\_medium=email](http://feedproxy.google.com/~r/BreakingScienceNews/~3/MotnzgaaHp8/dolphin-shelling-08581.html?utm_source=feedburner&utm_medium=email)

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## BREAKING SCIENCE – Cometary Debris May Have Destroyed Paleolithic Settlement 12,800 Years Ago

Fragments of an exploding short-period comet may have caused destruction of the Paleolithic settlement at Abu Hureyra in northern Syria about 12,800 years ago, according to new research led by Comet Research Group scientists. Abu Hureyra is a mound settlement (commonly known as a 'tell') located in northern Syria along the Euphrates River.

[http://feedproxy.google.com/~r/BreakingScienceNews/~3/daLp\\_wxsm0k/cometary-debris-abu-hureyra-settlement-08596.html?utm\\_source=feedburner&utm\\_medium=email](http://feedproxy.google.com/~r/BreakingScienceNews/~3/daLp_wxsm0k/cometary-debris-abu-hureyra-settlement-08596.html?utm_source=feedburner&utm_medium=email)

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## SCIENCE DAILY – Humans and monkeys show similar thinking patterns

Humans and monkeys may not speak the same lingo, but our ways of thinking are a lot more similar than previously thought, according to new research.

<https://www.sciencedaily.com/releases/2020/06/200629090018.htm>

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## SCIENCE DAILY – Why some words may be more memorable than others

In a recent study of epilepsy patients and healthy volunteers, researchers found that our brains may withdraw some common words, like "pig," "tank," and "door," much more often than others, including "cat," "street," and "stair." By combining memory tests, brain wave recordings, and surveys of billions of words published in books, news articles and internet encyclopedia pages, the researchers not only showed how our brains may recall words but also memories of our past experiences.

<https://www.sciencedaily.com/releases/2020/06/200629120204.htm>

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## SCIENCE DAILY – Life-hack: Rituals spell anxiety relief

Researchers are examining the important roles rituals play in reducing our anxiety levels.

<https://www.sciencedaily.com/releases/2020/06/200630111504.htm>

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## SCIENCE DAILY – First confirmed underwater Aboriginal archaeological sites found off Australian coast

Ancient submerged Aboriginal archaeological sites await underwater rediscovery off the coast of Australia, according to a study.

<https://www.sciencedaily.com/releases/2020/07/200701151722.htm>

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## ACADEMIA.EDU – We have never been behaviourally modern

*Quaternary International 405:A (2016), 8-20*

### **PATRICK ROBERTS – ‘We have never been behaviourally modern’: The implications of Material Engagement Theory and Metaplasticity for understanding the Late Pleistocene record of human behaviour**

The emergence of the human mind is a topic that has been of considerable interest to the disciplines of archaeology, cognitive archaeology and neuroscience in recent years. Most research in this regard has tended to focus on what material culture associated with early Homo sapiens might reflect in terms of the timing and nature of early cognitive capacities and ‘behavioural modernity’. In recent years, however, both the concept of ‘behavioural modernity’ and its passive treatment of material culture have become highly criticised. Yet, until now, there has remained some confusion as to where to turn in its absence. Recently, Lambros Malafouris outlined the theoretical frameworks of Material Engagement Theory and Metaplasticity as a means to understand the active role of material culture in the constitution of the human mind. However, despite Malafouris' application of these theoretical frameworks to a series of case studies previously associated with human cognitive ‘modernity’ (including tool manufacture, early body ornamentation, and ritual art), the Late Pleistocene archaeological community has done little to engage with this work. In this paper I outline and then apply MET and Metaplasticity to two further case studies often considered pertinent to the development of human cognition in the Late Pleistocene namely, long-distance resource sourcing and/or exchange and the development of composite technologies. In doing so, I hope to demonstrate that there is somewhere to turn in the wake of the statement ‘we have never been behaviourally modern’.

[https://www.academia.edu/11765387/We\\_have\\_never\\_been\\_behaviourally\\_modern\\_The\\_implications\\_of\\_Material\\_Engagement\\_Theory\\_and\\_Metaplasticity\\_for\\_understanding\\_the\\_Late\\_Pleistocene\\_record\\_of\\_human\\_behaviour?email\\_work\\_card=view-paper](https://www.academia.edu/11765387/We_have_never_been_behaviourally_modern_The_implications_of_Material_Engagement_Theory_and_Metaplasticity_for_understanding_the_Late_Pleistocene_record_of_human_behaviour?email_work_card=view-paper)

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## THE CONVERSATION – New Stonehenge discovery: how we found a prehistoric monument hidden in data

Archaeologists reveal two-kilometre ring of pits around the neolithic Durrington Walls by studying old geophysical surveys.

<https://theconversationuk.cmail19.com/t/r-l-jktdex-khhilillah-yd/>

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## THE CONVERSATION – What primates can teach us about managing arguments during lockdown

Primates have evolved behavioural strategies that can minimise the risk and costs of conflict

<https://theconversationuk.cmail19.com/t/r-l-jktkuylk-khhilillah-g/>

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## THE CONVERSATION – Researchers uncover ancient Aboriginal archaeological site preserved on seabed

Submerged in the waters off Western Australia lies an ancient site home to Aboriginal people thousands of years ago, when sea levels were lower than they are today.

<https://theconversationuk.cmail20.com/t/r-l-jkirwit-khhilillah-f/>

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## PUBLICATIONS

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### American Journal of Physical Anthropology

#### PAPERS

#### **RICHARD J. SMITH – $p > .05$ : The incorrect interpretation of “not significant” results is a significant problem**

Statistically nonsignificant ( $p > .05$ ) results from a null hypothesis significance test (NHST) are often mistakenly interpreted as evidence that the null hypothesis is true—that there is “no effect” or “no difference.” However, many of these results occur because the study had low statistical power to detect an effect. Power below 50% is common, in which case a result of no statistical significance is more likely to be incorrect than correct. The inference of “no effect” is not valid even if power is high. NHST assumes that the null hypothesis is true;  $p$  is the probability of the data under the assumption that there is no effect. A statistical test cannot confirm what it assumes. These incorrect statistical inferences could be eliminated if decisions based on  $p$  values were replaced by a biological evaluation of effect sizes and their confidence intervals. For a single study, the observed effect size is the best estimate of the population effect size, regardless of the  $p$  value. Unlike  $p$  values, confidence intervals provide information about the precision of the observed effect. In the biomedical and pharmacology literature, methods have been developed to evaluate whether effects are “equivalent,” rather than zero, as tested with NHST. These methods could be used by biological anthropologists to evaluate the presence or absence of meaningful biological effects. Most of what appears to be known about no difference or no effect between sexes, between populations, between treatments, and other circumstances in the biological anthropology literature is based on invalid statistical inference.

<https://onlinelibrary.wiley.com/doi/abs/10.1002/ajpa.24092?campaign=wolearlyview>

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### Current Biology

#### ARTICLES

#### **W. FORD DOOLITTLE – Evolutions’ [sic] next major transition**

*Journal pre-proof*

The Major Transitions in Evolution, a book authored by the late John Maynard Smith and Eörs Szathmáry, was published a quarter-century ago. Its publication was greeted with relief by many evolutionary biologists, because it legitimized putting a positive spin on “evolutionary progress”. Although many of us privately felt that life has in fact become more complex and sophisticated over the last billions of years, we’d been persuaded that such beliefs were inconsistent with a Darwinian perspective. Charles Darwin himself was not uncomfortable with the notion that creatures have gotten more adapted – “better” – with time, but in the last half of the last century we had come to believe that what really drives evolutionary change is environmental change, a random force allowing for progression but not progress. Evolution tracks environmental change but has no inherent tendencies, we thought.

[https://www.cell.com/current-biology/fulltext/S0960-9822\(20\)30931-3?dgcid=raven\\_jbs\\_aip\\_email](https://www.cell.com/current-biology/fulltext/S0960-9822(20)30931-3?dgcid=raven_jbs_aip_email)

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### Frontiers in Neuroscience

#### PAPERS

#### **HUI ZHANG et al – Evidence for Reciprocal Structural Network Interactions Between Bilateral Crus Lobes and Broca’s Complex**

While the proximal dentatothalamocortical tracts are considered pivotal in the occurrence of cerebellar mutism syndrome (CMS) after medulloblastoma resection, how the cerebellum participates in motor–speech networks through direct structural connectivity is still unclear. Via tractography, we provide evidence of cerebellar streamlines projecting into the left inferior frontal gyrus majorly connecting Broca’s complex and the bilateral Crus lobes. The streamlines, named Crus–Broca tracts, originated from the bilateral Crus lobes, synapsed onto the dentate nucleus, ascended into the superior cerebellar peduncle (where these streamlines were closely superior to the superior border of the supratonsillar cleft and the superolateral roof of the fourth ventricle), surprisingly bypassed the left red nucleus and the left thalamus, and ended at the subregions of Broca’s complex. The streamlines, named Broca–Crus tracts, originated from the subregions of Broca’s complex and ended predominantly at the right Crus lobes. If verified, the existence of these connections would support the notion of the bilateral cerebellums’ participation in motor–speech planning, and the anatomical relationship of Broca–Crus tracts with the supratonsillar cleft would merit consideration for further studies aimed at further elucidating CMS mechanisms.

[https://www.frontiersin.org/articles/10.3389/fnana.2020.00027/full?utm\\_source=F-AAE&utm\\_medium=EMLF&utm\\_campaign=MRK\\_1365539\\_55\\_Neuro\\_20200630\\_arts\\_A](https://www.frontiersin.org/articles/10.3389/fnana.2020.00027/full?utm_source=F-AAE&utm_medium=EMLF&utm_campaign=MRK_1365539_55_Neuro_20200630_arts_A)

#### **JOHANNA K. BLOMSTER LYSHOL, LOTTE THOMSEN & BEATE SEIBT – Moved by Observing the Love of Others: Kama Muta Evoked Through Media Fosters Humanization of Out-Groups**

People often view out-groups as less human than their in-group. Some media video content is heart-warming and leaves one feeling touched or moved. Recent research indicates that this reflects a positive social emotion, kama muta, which is evoked by a sudden increase in interpersonal closeness, specifically by the relational model of communal sharing. Because forming strong, close, and communal bonds exemplifies valued human qualities, and because other humans are our primary target partners of communal sharing, we predicted that feeling kama muta in response to observing communal sharing among out-group strangers would make people view out-groups as more human. In Study 1, we replicated a model obtained through a large exploratory preliminary study which indicated that videos depicting out-group members enacting communal sharing evoked kama muta and increased protagonist humanization. This, in turn, led to decreased blatant dehumanization of the entire out-group via perceived out-group warmth and motivation to develop a communal sharing relationship with the protagonist. The preregistered Study 2 further tested our model, demonstrating (1) that the relationship between protagonist humanization and kama muta is bidirectional such that baseline humanization of the protagonist also increases feelings of kama muta in response to acts of communal sharing; (2) that watching videos of communal sharing, as compared to funny videos, increased protagonist humanization; and (3) that kama muta videos, compared to funny videos, had an indirect effect on the reduction of out-group blatant dehumanization, which was mediated by protagonist humanization and out-group warmth.

[https://www.frontiersin.org/articles/10.3389/fpsyg.2020.01240/full?utm\\_source=F-AAE&utm\\_medium=EMLF&utm\\_campaign=MRK\\_1365539\\_69\\_Psycho\\_20200630\\_arts\\_A](https://www.frontiersin.org/articles/10.3389/fpsyg.2020.01240/full?utm_source=F-AAE&utm_medium=EMLF&utm_campaign=MRK_1365539_69_Psycho_20200630_arts_A)

#### **TINA A. G. VENEMA et al – When in Doubt, Follow the Crowd? Responsiveness to Social Proof Nudges in the Absence of Clear Preferences**

Nudges have gained popularity as a behavioral change tool that aims to facilitate the selection of the sensible choice option by altering the way choice options are presented. Although nudges are designed to facilitate these choices without interfering with people's prior preferences, both the relation between individuals' prior preferences and nudge effectiveness, as well as the notion that nudges 'facilitate' decision-making have received little empirical scrutiny. Two studies examine the hypothesis that a social proof nudge is particularly effective when people have no clear prior preference, either because people are indifferent (in a color-categorization task; Study 1, N = 255) or because people experience a choice conflict (making shopping decisions about meat products; Study 2, N = 97). Both studies employed a social proof nudge to steer participants' choices. The potential facilitating effect of the nudge was tested using a mouse-tracker paradigm that implicitly assessed experienced uncertainty during decision-making. Results showed that the nudge was effective in steering participants' decisions; the facilitation effect (i.e., reduced uncertainty regarding the decision) was only observed for conflicting preferences, but not under indifference. A better understanding of when and how nudges can influence individuals' behavior may help in deciding whether nudges are an appropriate policy tool for changing particular undesirable behavior.

[https://www.frontiersin.org/articles/10.3389/fpsyg.2020.01385/full?utm\\_source=F-AAE&utm\\_medium=EMLF&utm\\_campaign=MRK\\_1365539\\_69\\_Psycho\\_20200630\\_arts\\_A](https://www.frontiersin.org/articles/10.3389/fpsyg.2020.01385/full?utm_source=F-AAE&utm_medium=EMLF&utm_campaign=MRK_1365539_69_Psycho_20200630_arts_A)

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## Nature Ecology & Evolution

### PAPERS

#### **CHRISTOPHER J. DUNMORE et al with LEE R. BERGER & JEAN-JACQUES HUBLIN – The position of Australopithecus sediba within fossil hominin hand use diversity**

The human lineage is marked by a transition in hand use, from locomotion towards increasingly dexterous manipulation, concomitant with bipedalism. The forceful precision grips used by modern humans probably evolved in the context of tool manufacture and use, but when and how many times hominin hands became principally manipulative remains unresolved. We analyse metacarpal trabecular and cortical bone, which provide insight into behaviour during an individual's life, to demonstrate previously unrecognized diversity in hominin hand use. The metacarpals of the palm in *Australopithecus sediba* have trabecular morphology most like orangutans and consistent with locomotor power-grasping with the fingers, while that of the thumb is consistent with human-like manipulation. This internal morphology is the first record of behaviour consistent with a hominin that used its hand for both arboreal locomotion and human-like manipulation. This hand use is distinct from other fossil hominins in this study, including *A. afarensis* and *A. africanus*.

<https://www.nature.com/articles/s41559-020-1207-5>

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## Nature Scientific Reports

### PAPERS

#### **CLAUDIA FUGAZZA et al – Mental representation and episodic-like memory of own actions in dogs**

We investigated whether dogs remember their spontaneous past actions relying on episodic-like memory. Dogs were trained to repeat a small set of actions upon request. Then we tested them on their ability to repeat other actions produced by

themselves, including actions performed spontaneously in everyday situations. Dogs repeated their own actions after delays ranging from a few seconds to 1 hour, with their performance showing a decay typical of episodic memory. The combined evidence of representing own actions and using episodic-like memory to recall them suggests a far more complex representation of a key feature of the self than previously attributed to dogs. Our method is applicable to various species, paving the way for comparative investigations on the evolution and complexity of self-representation.

<https://www.nature.com/articles/s41598-020-67302-0>

### **NINA KOWALIK et al – Tracing human mobility in central Europe during the Upper Paleolithic using sub-seasonally resolved Sr isotope records in ornaments**

Mobility of people and goods during the Upper Paleolithic has proven difficult to reconstruct given the relative rareness of remains. Nevertheless, archaeological contexts like the Late Pleistocene horizon of Borsuka Cave (Southern Poland) represent a unique opportunity to explore patterns of objects' transportation across Central Europe. We investigated the origin of four ornaments made of European elk (*Alces alces* L.) incisors recovered at Borsuka Cave – the oldest known burial site in Poland, possibly a child grave. Laser-ablation plasma source mass spectrometric analyses of trace elements and Sr isotopic compositions revealed that one elk was roaming within a geologically uniform area while the others changed their pastures during their lifetimes. The non-local origin of the elk teeth is inferred from their exotic Sr isotopic compositions and the lack of evidence for the presence of elk in this territory during the Pleistocene. Instead, the elks' Sr isotopic composition show good agreement with sites near the Austria-Slovakia border region and northern Hungary, ~250 km away from the study site. We argue that the artefacts were most likely brought to Borsuka Cave by humans or by a network of exchange, so far never reported in the time range 32.5–28.8 ka cal BP for Southern Poland.

<https://www.nature.com/articles/s41598-020-67017-2>

### **LAURENT PRÉTÔT, GORANA GONZALEZ & KATHERINE MCAULIFFE – Children avoid inefficient but fair partners in a cooperative game**

Human adults use a range of social cues to obtain information about potential partners in cooperative contexts: we prefer partners who are competent, wealthy and generous, and those who abide by moral and social rules. One factor that carries particular weight is whether a prospective partner is fair. Here we ask whether children share this preference for fair partners and, if so, whether a prospective partner's past fair behaviour influences children's behaviour in a cooperative dilemma. Six- to nine-year-olds chose between partners who accepted or rejected resource allocations that were either strongly advantageously unequal, strongly disadvantageously unequal, or equal. They then played a one-shot Prisoner's Dilemma Game with their chosen partner. Children overwhelmingly preferred to play with the partner who accepted rather than rejected allocations. Regardless of their partner choice decisions, children tended to defect in the Prisoner's Dilemma Game, yet expected that their partners would be relatively more cooperative. Finally, children were more likely to cooperate with those they believed would cooperate. Together, these findings shed new light on the links between partner choice, fairness and cooperation in child development.

<https://www.nature.com/articles/s41598-020-65452-9>

### **V. P. S. RITWIK et al – Exploratory dynamics of vocal foraging during infant-caregiver communication**

We investigated the hypothesis that infants search in an acoustic space for vocalisations that elicit adult utterances and vice versa, inspired by research on animal and human foraging. Infant-worn recorders were used to collect day-long audio recordings, and infant speech-related and adult vocalisation onsets and offsets were automatically identified. We examined vocalisation-to-vocalisation steps, focusing on inter-vocalisation time intervals and distances in an acoustic space defined by mean pitch and mean amplitude, measured from the child's perspective. Infant inter-vocalisation intervals were shorter immediately following a vocal response from an adult. Adult intervals were shorter following an infant response and adult inter-vocalisation pitch differences were smaller following the receipt of a vocal response from the infant. These findings are consistent with the hypothesis that infants and caregivers are foraging vocally for social input. Increasing infant age was associated with changes in inter-vocalisation step sizes for both infants and adults, and we found associations between response likelihood and acoustic characteristics. Future work is needed to determine the impact of different labelling methods and of automatic labelling errors on the results. The study represents a novel application of foraging theory, demonstrating how infant behaviour and infant-caregiver interaction can be characterised as foraging processes.

<https://www.nature.com/articles/s41598-020-66778-0>

### **RIMA-MARIA RAHAL, SUSANN FIEDLER & CARSTEN K. W. DE DREU – Prosocial Preferences Condition Decision Effort and Ingroup Biased Generosity in Intergroup Decision-Making**

Ingroup favoritism and discrimination against outgroups are pervasive in social interactions. To uncover the cognitive processes underlying generosity towards in- and outgroup members, we employ eye-tracking in two pre registered studies. We replicate the well-established ingroup favoritism effect and uncover that ingroup compared to outgroup decision settings are characterized by systematic differences in information search effort (i.e., increased response times and number of fixations, more inspected information) and attention distribution. Surprisingly, these results showed a stronger dependency on the in- vs. out-group setting for more individualistic compared to prosocial participants: Whereas individualistic decision makers invested relatively less effort into information search when decisions involved out-group members, prosocial decision

makers' effort differed less between in- and outgroup decisions. Therein, choice and processing findings showed differences, indicating that inferences about the decision process from choices alone can be misleading. Implications for intergroup research and the regulation of intergroup conflict are discussed.

<https://www.nature.com/articles/s41598-020-64592-2>

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## New Scientist

### ARTICLES

#### **EMMA YOUNG – Evolution tells us why there are two types of leader in today's world**

The leadership styles of Donald Trump and Jacinda Ardern are dramatically different, but our evolutionary history explains both – and why our preferences have changed.

<https://www.newscientist.com/article/mg24632891-000-evolution-tells-us-why-there-are-two-types-of-leader-in-todays-world/#ixzz6R4TybFdY>

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## PLoS One

### PAPERS

#### **MARCUS J. HAMILTON et al – Scaling human sociopolitical complexity**

Human societies exhibit a diversity of social organizations that vary widely in size, structure, and complexity. Today, human sociopolitical complexity ranges from stateless small-scale societies of a few hundred individuals to complex states of millions, most of this diversity evolving only over the last few hundred years. Understanding how sociopolitical complexity evolved over time and space has always been a central focus of the social sciences. Yet despite this long-term interest, a quantitative understanding of how sociopolitical complexity varies across cultures is not well developed. Here we use scaling analysis to examine the statistical structure of a global sample of over a thousand human societies across multiple levels of sociopolitical complexity. First, we show that levels of sociopolitical complexity are self-similar as adjacent levels of jurisdictional hierarchy see a four-fold increase in population size, a two-fold increase in geographic range, and therefore a doubling of population density. Second, we show how this self-similarity leads to the scaling of population size and geographic range. As societies increase in complexity population density is reconfigured in space and quantified by scaling parameters. However, there is considerable overlap in population metrics across all scales suggesting that while more complex societies tend to have larger and denser populations, larger and denser populations are not necessarily more complex.

<https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0234615>

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## PNAS

### PAPERS

#### **SACHA KACKI et al with ERIK TRINKAUS – Complex mortuary dynamics in the Upper Paleolithic of the decorated Grotte de Cussac, France**

The Mid-Upper Paleolithic (Gravettian) karstic Grotte de Cussac (France) contains two areas of human remains in the context of abundant (and spectacular) parietal engravings. The first area (loci 1 and 2) includes the skeleton of a young adult male in a bear nest, rearranged by postdecomposition inundation, and the variably fragmentary remains of at least two individuals distributed across two bear nests, sorted anatomically and with most of the elements constrained to one side of one nest. The second area (locus 3) retains remains of two adults and an adolescent, in upper hollows and variably distributed down the slope, largely segregated into upper versus lower body groups. The only decoration associated with the human remains is red pigment on some of the bones or underlying sediment. The human remains indicate variable nonnatural deposition and manipulation of human bodies, body portions, and skeletal elements of at least six individuals. Moreover, Cussac is unusual in the association of these remains with exceptional parietal art. The complex Cussac mortuary pattern joins growing evidence from other Gravettian sites of variable treatment of individuals after death, within and across sites, in terms of formal deposition of the body versus postmortem manipulation versus surface abandonment. It provides a window onto the social diversity and the complex interactions of the living and the dead among these successful Late Pleistocene foragers.

<https://www.pnas.org/content/117/26/14851.abstract?etoc>

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#### **FABRIZIO MAFESSONI et al with KAY PRÜFER & SVANTE PÄÄBO – A high-coverage Neandertal genome from Chagyrskaya Cave**

We sequenced the genome of a Neandertal from Chagyrskaya Cave in the Altai Mountains, Russia, to 27-fold genomic coverage. We show that this Neandertal was a female and that she was more related to Neandertals in western Eurasia [Prüfer et al., *Science* 358, 655–658 (2017); Hajdinjak et al., *Nature* 555, 652–656 (2018)] than to Neandertals who lived earlier in Denisova Cave [Prüfer et al., *Nature* 505, 43–49 (2014)], which is located about 100 km away. About 12.9% of the Chagyrskaya genome is spanned by homozygous regions that are between 2.5 and 10 centiMorgans (cM) long. This is consistent with the fact that Siberian Neandertals lived in relatively isolated populations of less than 60 individuals. In contrast, a Neandertal from Europe, a Denisovan from the Altai Mountains, and ancient modern humans seem to have lived in populations of larger sizes. The availability of three Neandertal genomes of high quality allows a view of genetic features that were unique to Neandertals and that are likely to have been at high frequency among them. We find that genes highly

expressed in the striatum in the basal ganglia of the brain carry more amino-acid-changing substitutions than genes expressed elsewhere in the brain, suggesting that the striatum may have evolved unique functions in Neandertals.  
<https://www.pnas.org/content/117/26/15132.abstract?etoc>

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## Proceedings of the Royal Society B

### PAPERS

#### **CRISTINE H. LEGARE & MARK NIELSEN – Ritual explained: interdisciplinary answers to Tinbergen's four questions**

Convergent developments across social scientific disciplines provide evidence that rituals are a psychologically prepared and culturally inherited behavioural hallmark of our species. The dramatic diversity of ritual practices ranges from simple greetings to elaborate religious ceremonies, from the benign to life-threatening. Yet our scientific understanding of this core human trait remains limited. Explaining the universality, functionality and diversity of ritual requires insight from multiple disciplines. This special issue integrates research from anthropology, archaeology, biology, primatology, cognitive science, psychology, religious studies and demography to build an interdisciplinary account of ritual. The objective is to contribute to an integrative explanation of ritual by addressing Tinbergen's four key questions. These include answering ultimate questions about the (i) phylogeny and (ii) adaptive functions of ritual; and proximate questions about the (iii) mechanisms and (iv) ontogeny of ritual. The intersection of these four complementary lines of inquiry yields new avenues for theory and research into this fundamental aspect of the human condition, and in so doing, into the coevolution of cognition and culture.

<https://royalsocietypublishing.org/doi/full/10.1098/rstb.2019.0419>

#### **FEDERICA DAL PESCO & JULIA FISCHER – On the evolution of baboon greeting rituals**

To balance the trade-offs of male co-residence, males living in multi-male groups may exchange ritualized greetings. Although these non-aggressive signals are widespread in the animal kingdom, the repertoire described in the genus *Papio* is exceptional, involving potentially harmful behaviours such as genital fondling. Such greetings are among the most striking male baboon social interactions, yet their function remains disputed. Drawing on the comprehensive analysis from our own research on wild Guinea baboons, combined with a survey of the literature into other baboon species, we review the form and function of male–male ritualized greetings and their relation to the various social systems present in this genus. These ritualized signals differ between species in their occurrence, form and function. While ritualized greetings are rare in species with the most intense contest competition, the complexity of and risk involved in greeting rituals increase with the degree of male–male tolerance and cooperation. The variety of societies found in this genus, combined with its role as a model for human socioecological evolution, sheds light on the evolution of ritualized behaviour in non-human primates and rituals in humans.

<https://royalsocietypublishing.org/doi/full/10.1098/rstb.2019.0420>

#### **SUSAN PERRY & MARCO SMOLLA – Capuchin monkey rituals: an interdisciplinary study of form and function**

Many white-faced capuchin monkey dyads in Lomas Barbudal, Costa Rica, practise idiosyncratic interaction sequences that are not part of the species-typical behavioural repertoire. These interactions often include uncomfortable or risky elements. These interactions exhibit the following characteristics commonly featured in definitions of rituals in humans: (i) they involve an unusual intensity of focus on the partner, (ii) the behaviours have no immediate utilitarian purpose, (iii) they sometimes involve 'sacred objects', (iv) the distribution of these behaviours suggests that they are invented and spread via social learning, and (v) many behaviours in these rituals are repurposed from other behavioural domains (e.g. extractive foraging). However, in contrast with some definitions of ritual, capuchin rituals are not overly rigid in their form, nor do the sequences have specific opening and closing actions. In our 9260 h of observation, ritual performance rate was uncorrelated with amount of time dyads spent in proximity but (modestly) associated with higher relationship quality and rate of coalition formation across dyads. Our results suggest that capuchin rituals serve a bond-testing rather than a bond-strengthening function. Ritual interactions are exclusively dyadic, and between-dyad consistency in form is low, casting doubt on the alternative hypothesis that they enhance group-wide solidarity.

<https://royalsocietypublishing.org/doi/full/10.1098/rstb.2019.0422>

#### **CLAUDIO TENNIE & CAREL P. VAN SCHAİK – Spontaneous (minimal) ritual in non-human great apes?**

The potential for rituals in non-human great apes (apes) is an understudied topic. We derive a minimal definition of ritual and then examine the currently available evidence for it in untrained and non-enculturated apes. First, we examine whether such apes show evidence for the two main components of our minimal definition of ritual: symbolism and copying. Second, we examine if there are actual cases already identifiable today that may fit all aspects of our minimal definition of ritual—or whether there are at least cases that fit some aspects (proto-ritual). We find that apes are not likely to spontaneously practise minimal ritual, but we claim that the highest expected likelihood of occurrence is in the results-copying domain. Yet, we did not find actual cases of minimal ritual in apes—including those involving environmental results. We did, however, find some cases that may match at least part of our minimal ritual definition—which we termed proto-ritual. At least two out of three potential cases of such proto-rituals that we identified (rain dance, object-in-ear and surplus nest-making procedures) do revolve around results. Overall, apes do not show much, or very clear, evidence for even minimal ritual, but may sometimes show proto-ritual. However, dedicated ape ritual studies are currently lacking, and future work may identify ape

ritual (or clearer cases of proto-ritual). We discuss the implications of our preliminary finding for inferences of ritual in the last common ancestor of humans and apes.

<https://royalsocietypublishing.org/doi/full/10.1098/rstb.2019.0423>

### **ELIZABETH RENNER, ERIC M. PATTERSON & FRANCYS SUBIAUL – Specialization in the vicarious learning of novel arbitrary sequences in humans but not orangutans**

Sequence learning underlies many uniquely human behaviours, from complex tool use to language and ritual. To understand whether this fundamental cognitive feature is uniquely derived in humans requires a comparative approach. We propose that the vicarious (but not individual) learning of novel arbitrary sequences represents a human cognitive specialization. To test this hypothesis, we compared the abilities of human children aged 3–5 years and orangutans to learn different types of arbitrary sequences (item-based and spatial-based). Sequences could be learned individually (by trial and error) or vicariously from a human (social) demonstrator or a computer (ghost control). We found that both children and orangutans recalled both types of sequence following trial-and-error learning; older children also learned both types of sequence following social and ghost demonstrations. Orangutans' success individually learning arbitrary sequences shows that their failure to do so in some vicarious learning conditions is not owing to general representational problems. These results provide new insights into some of the most persistent discontinuities observed between humans and other great apes in terms of complex tool use, language and ritual, all of which involve the cultural learning of novel arbitrary sequences.

<https://royalsocietypublishing.org/doi/full/10.1098/rstb.2019.0442>

### **MARK NIELSEN et al – Homo neanderthalensis and the evolutionary origins of ritual in Homo sapiens**

There is a large, if disparate, body of archaeological literature discussing specific instantiations of symbolic material culture and the possibility of ritual practices in Neanderthal populations. Despite this attention, however, no single synthesis exists that draws upon cognitive, psychological and cultural evolutionary theories of ritual. Here, we review the evidence for ritual-practice among now-extinct *Homo neanderthalensis*, as well as the necessary cognitive pre-conditions for such behaviour, in order to explore the evolution of ritual in *Homo sapiens*. We suggest that the currently available archaeological evidence indicates that Neanderthals may have used 'ritualization' to increase the successful transmission of technical knowledge across generations—providing an explanation for the technological stability of the Middle Palaeolithic and attesting to a survival strategy differing from near-contemporary *H. sapiens*.

<https://royalsocietypublishing.org/doi/full/10.1098/rstb.2019.0424>

### **PASCAL BOYER & PIERRE LIÉNARD – Ingredients of 'rituals' and their cognitive underpinnings**

Ritual is not a proper scientific object, as the term is used to denote disparate forms of behaviour, on the basis of a faint family resemblance. Indeed, a variety of distinct cognitive mechanisms are engaged, in various combinations, in the diverse interactions called 'rituals' – and each of these mechanisms deserves study, in terms of its evolutionary underpinnings and cultural consequences. We identify four such mechanisms that each appear in some 'rituals', namely (i) the normative scripting of actions; (ii) the use of interactions to signal coalitional identity, affiliation, cohesiveness; (iii) magical claims based on intuitive expectations of contagion; and (iv) ritualized behaviour based on a specific handling of the flow of behaviour. We describe the cognitive and evolutionary background to each of these potential components of 'rituals', and their effects on cultural transmission.

<https://royalsocietypublishing.org/doi/full/10.1098/rstb.2019.0439>

### **MATT J. ROSSANO – Ritual as resource management**

This paper argues that rituals are mechanisms of resource management. The argument is based on four observations: (i) over the course of hominin evolution, fitness became contingent on psychological states; (ii) these psychological states can be understood as 'resources', not unlike material resources such as energy, food or fuel; (iii) ritual 'manages' these psychological resources—meaning that it cultivates, builds and directs them; and (iv) ritual management can be analytically decomposed, providing a new descriptive tool for understanding rituals and predictions about ritual survival.

<https://royalsocietypublishing.org/doi/full/10.1098/rstb.2019.0429>

### **ROHAN KAPITÁNY, CHRISTOPHER KAVANAGH & HARVEY WHITEHOUSE – Ritual morphospace revisited: the form, function and factor structure of ritual practice**

Human rituals exhibit bewildering diversity, from the Mauritian Kavadi to Catholic communion. Is this diversity infinitely plastic or are there some general dimensions along which ritual features vary? We analyse two cross-cultural datasets: one drawn from the anthropological record and another novel contemporary dataset, to examine whether a consistent underlying set of latent dimensions in ritual structure and experiences can be detected. First, we conduct a factor analysis on 651 rituals from 74 cultural groups, in which 102 binary variables are coded. We find a reliable set of dimensions emerged, which provide potential candidates for foundational elements of ritual form. Notably, we find that the expression of features associated with dysphoric and euphoric experiences in rituals appears to be largely orthogonal. Second, we follow-up with a pre-registered factor analysis examining contemporary ritual experiences of 779 individuals from Japan, India and the US. We find supporting evidence that ritual experiences are clustered in relatively orthogonal euphoric, dysphoric, frequency and cognitive dimensions. Our findings suggest that there are important regularities in the diversity of ritual expression and

experience observed across both time and culture. We discuss the implications of these findings for cognitive theories of ritual and cultural evolution.

<https://royalsocietypublishing.org/doi/full/10.1098/rstb.2019.0436>

### **MICHELE J. GELFAND et al – The cultural evolutionary trade-off of ritualistic synchrony**

From Australia to the Arctic, human groups engage in synchronous behaviour during communal rituals. Because ritualistic synchrony is widespread, many argue that it is functional for human groups, encouraging large-scale cooperation and group cohesion. Here, we offer a more nuanced perspective on synchrony's function. We review research on synchrony's prosocial effects, but also discuss synchrony's antisocial effects such as encouraging group conflict, decreasing group creativity and increasing harmful obedience. We further argue that a tightness–looseness (TL) framework helps to explain this trade-off and generates new predictions for how ritualistic synchrony should evolve over time, where it should be most prevalent, and how it should affect group well-being. We close by arguing that synthesizing the literature on TL with the literature on synchrony has promise for understanding synchrony's role in a broader cultural evolutionary framework.

<https://royalsocietypublishing.org/doi/full/10.1098/rstb.2019.0432>

### **HARRIET OVER, ADAM EGGLESTON & RICHARD COOK – Ritual and the origins of first impressions**

When encountering a stranger for the first time, adults spontaneously attribute to them a wide variety of character traits based solely on their physical appearance, most notably from their face. While these trait inferences exert a pervasive influence over our behaviour, their origins remain unclear. Whereas nativist accounts hold that first impressions are a product of gene-based natural selection, the Trait Inference Mapping framework (TIM) posits that we learn face–trait mappings ontogenetically as a result of correlated face–trait experience. Here, we examine the available anthropological evidence on ritual in order to better understand the mechanism by which first impressions from faces are acquired. Consistent with the TIM framework, we argue that examination of ritual body modification performed by communities around the world demonstrates far greater cross-cultural variability in face–trait mappings than currently appreciated. Furthermore, rituals of this type may be a powerful mechanism through which face–trait associations are transmitted from one generation to the next.

<https://royalsocietypublishing.org/doi/full/10.1098/rstb.2019.0435>

### **NICOLE J. WEN et al – Watch me, watch you: ritual participation increases in-group displays and out-group monitoring in children**

Collective rituals serve social functions for the groups that perform them, including identifying group members and signalling group commitment. A novel social group paradigm was used in an afterschool programme (N = 60 4–11-year-olds) to test the influence of participating in a ritual task on in-group displays and out-group monitoring over repeated exposures to the group. The results demonstrate that ritual participation increases in-group displays (i.e. time spent displaying materials to in-group members) and out-group monitoring (i.e. time spent looking at out-group members) compared with a control task across three time points. This study provides evidence for the processes by which rituals may influence children's behaviours towards in- and out-group members and discusses implications for understanding the development of ritual cognition and behaviour.

<https://royalsocietypublishing.org/doi/full/10.1098/rstb.2019.0437>

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## Science Advances

### PAPERS

### **BRANDI L. MACDONALD et al – Paleoindian ochre mines in the submerged caves of the Yucatán peninsula, Quintana Roo, Mexico**

Investigations in the now-submerged cave systems on the Yucatán peninsula continue to yield evidence for human presence during the Pleistocene-Holocene transition. Skeletal remains are scattered throughout the caves of Quintana Roo, most representing individuals who died in situ. The reasons why they explored these underground environments have remained unclear. Here, we announce the discovery of the first subterranean ochre mine of Paleoindian age found in the Americas, offering compelling evidence for mining in three cave systems on the eastern Yucatán over a ~2000-year period between ~12 and 10 ka. The cave passages exhibit preserved evidence for ochre extraction pits, speleothem digging tools, shattered and piled flowstone debris, cairn navigational markers, and hearths yielding charcoal from highly resinous wood species. The sophistication and extent of the activities demonstrate a readiness to venture into the dark zones of the caves to prospect and collect what was evidently a highly valued mineral resource.

[https://advances.sciencemag.org/content/6/27/eaba1219?utm\\_campaign=toc\\_advances\\_2020-07-02&et rid=17774313&et cid=3387187](https://advances.sciencemag.org/content/6/27/eaba1219?utm_campaign=toc_advances_2020-07-02&et rid=17774313&et cid=3387187)

### **L. ZAPPAROLI et al – How the effects of actions become our own**

Every day, we do things that cause effects in the outside world with little doubt about who caused what. To some, this sense of agency derives from a post hoc reconstruction of a likely causal relationship between an event and our preceding movements; others propose that the sense of agency originates from prospective comparisons of motor programs and their effects. Using functional magnetic resonance imaging, we found that the sense of agency is associated with a brain network

including the pre-supplementary motor area (SMA) and dorsal parietal cortex. Transcranial magnetic stimulation affected the sense of agency only when delivered over the pre-SMA and specifically when time-locked to action planning, rather than when the physical consequences of the actions appeared. These findings make a prospective theory of the sense of agency more likely.

[https://advances.sciencemag.org/content/6/27/eaay8301?utm\\_campaign=toc\\_advances\\_2020-07-02&et rid=17774313&et cid=3387187](https://advances.sciencemag.org/content/6/27/eaay8301?utm_campaign=toc_advances_2020-07-02&et rid=17774313&et cid=3387187)

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## Trends in Cognitive Sciences

### ARTICLES

#### **FRANZISKA BRÄNDLE, CHARLEY M. WU & ERIC SCHULZ – What Are We Curious about?**

What are we curious about? Dubey and Griffiths propose a rational theory of curiosity that unifies previously contradictory novelty-based and complexity accounts. It also paves the way for future investigations, such as studying approximate models of curiosity as well as what causes abnormal levels of exploration.

[https://www.cell.com/trends/cognitive-sciences/fulltext/S1364-6613\(20\)30134-0?dgcid=raven\\_jbs\\_aip\\_email](https://www.cell.com/trends/cognitive-sciences/fulltext/S1364-6613(20)30134-0?dgcid=raven_jbs_aip_email)

### PAPERS

#### **CARSTEN K.W. DE DREU et al – Group Cooperation, Carrying-Capacity Stress, and Intergroup Conflict**

Peaceful intergroup relations deteriorate when individuals engage in parochial cooperation and parochial competition. To understand when and why intergroup relations change from peaceful to violent, we present a theoretical framework mapping out the different interdependence structures between groups. According to this framework, cooperation can lead to group expansion and ultimately to carrying-capacity stress. In such cases of endogenously created carrying-capacity stress, intergroup relations are more likely to become negatively interdependent, and parochial competition can emerge as a response. We discuss the cognitive, neural, and hormonal building blocks of parochial cooperation, and conclude that conflict between groups can be the inadvertent consequence of human preparedness – biological and cultural – to solve cooperation problems within groups.

[https://www.cell.com/trends/cognitive-sciences/fulltext/S1364-6613\(20\)30146-7?dgcid=raven\\_jbs\\_aip\\_email](https://www.cell.com/trends/cognitive-sciences/fulltext/S1364-6613(20)30146-7?dgcid=raven_jbs_aip_email)

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