

# EAORC BULLETIN 901 – 20 September 2020

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## EAORC 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.

### EAORC NEWS – Biennial Membership Check – Please Respond

2020 is a membership checking year, when I ask for confirmation that you wish to continue receiving the bulletins. So please let me know that you wish to continue by emailing me with **Bulletin Yes**, or something similar. If you do not wish to continue receiving the bulletin then you need do nothing. Anyone who has not indicated they wish to continue will be taken off the list at the end of October. This biennial membership check has been in operation since 2008, and GDPR has made it even more important that it is carried out regularly.

Many thanks to everyone who has responded so far. I already have enough to ensure the continued existence of the list.

When I am about to purge the list, you will receive a separate email, either confirmation of your continued membership, or notification of your final issue.

### EAORC NEWS – A small bit of personal news

This week I got an “award” from ResearchGate. It said:

Way to go, Martin!

With 1,109 new reads, your book was the most read research item from your institution

Achieved on September 14, 2020

Book: The Origins of Self: An Anthropological Perspective

Nothing stunning, but it’s nice to know Anthropological Linguistics can still beat out all those papers on Covid-19.

## NEWS

### SCIENCE NEWS – These 120,000-year-old footprints offer early evidence for humans in Arabia

One day about 120,000 years ago, a few humans wandered along the shore of an ancient lake in what is now the Nefud Desert in Saudi Arabia. They may have paused for a drink of fresh water or to track herds of elephants, wild asses, and camels that were trampling the mudflats. Within hours of passing through, the humans’ and animals’ footprints dried out and eventually fossilized.

[https://www.sciencemag.org/news/2020/09/these-120000-year-old-footprints-offer-early-evidence-humans-arabia?utm\\_campaign=news\\_daily\\_2020-09-17&et rid=17774313&et cid=3485359](https://www.sciencemag.org/news/2020/09/these-120000-year-old-footprints-offer-early-evidence-humans-arabia?utm_campaign=news_daily_2020-09-17&et rid=17774313&et cid=3485359)

### SOCIETY FOR SCIENCE – ‘The Origins of You’ explores how kids develop into their adult selves

A new book describes the interplay of nature and nurture as children, at least in Western societies, grow up.

<http://click.societyforscience-email.com/?qs=c1fb816f592fe704ea1c60d28ab911aa96c7020c0822edc052e8ae2570392f4fa1bae7c37eaf5df043634812b075aae03f22abf525602ca3>

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### **SOCIETY FOR SCIENCE – Seven footprints may be the oldest evidence of humans on the Arabian Peninsula**

In what's now desert, people and other animals stopped to drink at a lake more than 100,000 years ago, a new study suggests.

<http://click.societyforscience-email.com/?qs=d395f4b11920afc0a9b2c469d276812a64443c1eb8030756241e7344423015f9868a3cf09c56b7797dbfabfd95b11057895851476075b6c2>

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### **BREAKING SCIENCE – Archaic Humans May Have Boiled Their Food in Hot Springs**

An international team of researchers has found evidence that hot springs existed in Olduvai Gorge — a paleoanthropological site in the Great Rift Valley in Tanzania that has yielded some of the most significant fossils of hominins, such as *Paranthropus boisei*, *Homo habilis* and *Homo erectus* — around 1.7 million years ago.

[http://feedproxy.google.com/~r/BreakingScienceNews/~3/J-gJQ-TiQwU/olduvai-gorge-hot-springs-08858.html?utm\\_source=feedburner&utm\\_medium=email](http://feedproxy.google.com/~r/BreakingScienceNews/~3/J-gJQ-TiQwU/olduvai-gorge-hot-springs-08858.html?utm_source=feedburner&utm_medium=email)

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### **LIVESCIENCE – Study casts doubt on 'sky disk' thought to be oldest representation of the heavens**

The Nebra Sky Disk of bronze decorated with gold is one of Germany's most famous archaeological artifacts. But a new study suggests it dates to the Iron Age, at least 1,000 years later than scientists had thought.

[https://www.livescience.com/famous-nebra-sky-disk-debate.html?utm\\_source=Selligent&utm\\_medium=email&utm\\_campaign=9160&utm\\_content=LVS\\_newsletter+&utm\\_term=5353134&utm\\_i=OgudIX%2BdKPcdtXIhcZKQyR2y1Hxy%2BdR42bJR0oXLLLrWFAVZ7wHTezKslt8qbYFAlr4AXmOzgBGGcolWww eZGdIXDwdDyOCC2gS%2BaDGOOb](https://www.livescience.com/famous-nebra-sky-disk-debate.html?utm_source=Selligent&utm_medium=email&utm_campaign=9160&utm_content=LVS_newsletter+&utm_term=5353134&utm_i=OgudIX%2BdKPcdtXIhcZKQyR2y1Hxy%2BdR42bJR0oXLLLrWFAVZ7wHTezKslt8qbYFAlr4AXmOzgBGGcolWww eZGdIXDwdDyOCC2gS%2BaDGOOb)

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### **SCIENCE DAILY – Dust may have controlled ancient human civilization**

When early humans began to travel out of Africa and spread into Eurasia over a hundred thousand years ago, a fertile region around the eastern Mediterranean Sea called the Levant served as a critical gateway between northern Africa and Eurasia. A new study shows that the existence of that oasis depended almost entirely on something we almost never think about: dust.

<https://www.sciencedaily.com/releases/2020/09/200915152446.htm>

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### **SCIENCE DAILY – Chimpanzees show greater behavioral & cultural diversity in variable environments**

Scientists have investigated the influence of environmental variability on the behavioral repertoires of 144 social groups. The scientists found that chimpanzees living further away from historical forest refugia, under more seasonal conditions, and found in savannah woodland rather than closed forested habitats, were more likely to exhibit a larger set of behaviors.

<https://www.sciencedaily.com/releases/2020/09/200915121318.htm>

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### **SCIENCE DAILY – Did our early ancestors boil their food in hot springs?**

Scientists have found evidence of hot springs near sites where ancient hominids settled, long before the control of fire.

<https://www.sciencedaily.com/releases/2020/09/200915152440.htm>

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### **SCIENCE DAILY – Like humans, chimpanzees can suffer for life if orphaned before adulthood**

A new study shows that orphaned male chimpanzees are less competitive and have fewer offspring of their own than those who continue to live with their mothers. The remaining puzzle is, what is it that their mothers provide that keeps chimpanzees healthy and competitive?

<https://www.sciencedaily.com/releases/2020/09/200918154519.htm>

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### **SCIENCE DAILY – Ancient human footprints in Saudi Arabia give glimpse of Arabian ecology 120kya**

Using high resolution paleoecological information obtained from fossilized footprints, a new study presents ~120 thousand-year-old human and animal footprints from an ancient lake bed in northern Arabia. These findings represent the earliest evidence for humans in this part of the world and show that human and animal movements and landscape use were closely linked.

<https://www.sciencedaily.com/releases/2020/09/200918083715.htm>

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### **ACADEMIA.EDU – Climatically-forced extinctions of *Homo sapiens* and Neanderthals in Levant**

*In Quaternary Science Reviews* 27:23–24, 2253–2270. (2008).

## **JOHN J. SHEA – Transitions or turnovers? Climatically-forced extinctions of Homo sapiens and Neanderthals in the east Mediterranean Levant**

The East Mediterranean Levant is a focal point for debate about evolutionary continuity among Late Pleistocene hominin populations. Changes in the Levantine Middle and Upper Palaeolithic archaeological records are almost invariably described in terms of adaptive shifts and behavioural transitions, rather than as changes in hominin populations. This paper examines evidence for hominin evolutionary continuity in the Levant between 130 and 25 ka. Two inflection points, one within the Middle Palaeolithic ca 75 ka and the other between the Middle and Upper Palaeolithic ca 45 ka, are examined in light of recently-discovered evidence for rapid climate change and environmental deterioration. It is proposed that both periods mark regional extinctions and turnovers of hominin populations. The first of these occurred among early Homo sapiens, the second among Neanderthals. Each event was followed by dispersal of hominin populations into the Levant from adjacent regions. Differences in Middle vs. Upper Palaeolithic Homo sapiens' long-term success in the Levant may reflect recently-evolved strategies for coping with rapid climate change and with colder arid habitats.

[https://www.academia.edu/2635329/John\\_J\\_Shea\\_2008\\_Transitions\\_or\\_Turnovers\\_Climatically\\_Forced\\_Extinctions\\_of\\_Homo\\_sapiens\\_and\\_Neanderthals\\_in\\_the\\_East\\_Mediterranean\\_Levant\\_Quaternary\\_Science\\_Reviews\\_27\\_23\\_24\\_2253\\_2270?email\\_work\\_card=title](https://www.academia.edu/2635329/John_J_Shea_2008_Transitions_or_Turnovers_Climatically_Forced_Extinctions_of_Homo_sapiens_and_Neanderthals_in_the_East_Mediterranean_Levant_Quaternary_Science_Reviews_27_23_24_2253_2270?email_work_card=title)

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## **ACADEMIA.EDU – Neanderthals and Modern Humans Across Eurasia**

*In T. Akazawa et al. (eds.), Dynamics of Learning in Neanderthals and Modern Humans Volume 1: Cultural Perspectives, 7 Replacement of Neanderthals by Modern Humans Series. Springer: Japan (2013).*

### **OFER BAR-YOSEF – Neanderthals and Modern Humans Across Eurasia**

Neanderthals, a European population was undoubtedly successful in surviving through several glacial periods. Their population, originally spread across Europe, composed of small communities but succeeded to maintain their relationships and their mating systems and thus secured their biological survival. Published samples of aDNA and teeth indicate that they formed a particular population, although morphological deviations from the western European relics are found at the edges of their geographic distribution. The expansions of Neanderthals into western Asia and reaching the Altai Mountains reflect their successful adaptations to variable environments. Their demise was caused, among others, by the expansion of groups of modern humans of African origins. The cultural traits of the new invading and colonizing people included high degree of mobility, signs of group identity, new cloths, use of ornaments, new hunting tools, and means of communication. The interactions of modern humans with the Neanderthals, discussed in the paper, provide a foundation for further research along economic and biological considerations that may provide a more sound explanation for the disappearance of a past successful meta-population.

[https://www.academia.edu/12664235/Neanderthals\\_and\\_Modern\\_Humans\\_Across\\_Eurasia?email\\_work\\_card=view-paper](https://www.academia.edu/12664235/Neanderthals_and_Modern_Humans_Across_Eurasia?email_work_card=view-paper)

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## **THE CONVERSATION – Chimpanzees in volatile habitats evolved to behave more flexibly**

As in humans, environmental changes provoked chimpanzees to develop a diverse range of behaviours.

<https://theconversationuk.cmail19.com/t/r-l-julthyjk-khhllilahl-k/>

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## **PUBLICATIONS**

### **American Journal of Physical Anthropology**

#### **PAPERS**

#### **GREGORIO OXILIA et al – Exploring late Paleolithic and Mesolithic diet in the Eastern Alpine region of Italy through multiple proxies**

The analysis of prehistoric human dietary habits is key for understanding the effects of paleoenvironmental changes on the evolution of cultural and social human behaviors. In this study, we compare results from zooarchaeological, stable isotope and dental calculus analyses as well as lower second molar macrowear patterns to gain a broader understanding of the diet of three individuals who lived between the end of the Late Pleistocene and the Early Holocene (ca., 17–8 ky cal BP) in the Eastern Alpine region of Italy.

We analyze individuals buried at the sites of Riparo Tagliente (Verona), Riparo Villabruna, and Mondeval de Sora (Belluno). The three burials provide a unique dataset for diachronically exploring the influence of climatic changes on human subsistence strategies.

Isotopic results indicate that all individuals likely relied on both terrestrial and freshwater animal proteins. Even though dental calculus analysis was, in part, hindered by the amount of mineral deposit available on the teeth, tooth macrowear study suggests that the dietary habits of the individuals included plant foods. Moreover, differences in macrowear patterns of lower second molars have been documented between Neanderthals and modern humans in the present sample, due to a prevalence of Buccal wear among the former as opposed to higher values of Lingual wear in modern human teeth.

<https://onlinelibrary.wiley.com/doi/full/10.1002/ajpa.24128?campaign=wolearlyview>

## **SONG-TAO GUO et al – Male social rank and food competition in a primate multi-level society**

Social animals often have dominance hierarchies, with high rank conferring preferential access to resources. In primates, competition among males is often assumed to occur predominantly over reproductive opportunities. However, competition for food may occur during food shortages, such as in temperate species during winter. Higher-ranked males may thus gain preferential access to high-profitability food, which would enable them to spend longer engaged in activities other than feeding.

We performed a field experiment with a breeding band of golden snub-nosed monkeys, a species that lives in a multi-level society in high-altitude forests in central China. We provisioned monkey's high-profitability food during winter when natural foods are limited, and then recorded the times individual adult males spent engaged in different behaviors.

Higher-ranking males spent less time feeding overall and fed on provisioned foods at a higher rate than lower-ranking males. Higher-ranking males therefore had more time to spend on alternative behaviors. We found no significant difference according to rank in times spent moving or resting. However, high-ranking males spend significantly longer on affiliative behaviors with other members of their social sub-units, especially grooming and being groomed, behaviors known to promote social cohesion in primates.

<https://onlinelibrary.wiley.com/doi/abs/10.1002/ajpa.24141?campaign=wolearlyview>

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## **Evolutionary Anthropology**

### **PAPERS**

#### **GIANCARLO SCARDIA et al with IAN TATTERSALL – What kind of hominin first left Africa?**

Recent discoveries of stone tools from Jordan (2.5 Ma) and China (2.1 Ma) document hominin presence in Asia at the beginning of the Pleistocene, well before the conventional Dmanisi datum at 1.8 Ma. Although no fossil hominins documenting this earliest Out of Africa phase have been found, on chronological grounds a pre-Homo erectus hominin must be considered the most likely maker of those artifacts. If so, this sheds new light on at least two disputed subjects in paleoanthropology, namely the remarkable variation among the five Dmanisi skulls, and the ancestry of Homo floresiensis.

<https://onlinelibrary.wiley.com/doi/abs/10.1002/evan.21863?campaign=wolearlyview>

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## **Mind & Language**

### **PAPERS**

#### **MATTHIAS MICHEL & JORGE MORALES – Minority reports: Consciousness and the prefrontal cortex**

Whether the prefrontal cortex is part of the neural substrates of consciousness is currently debated. Against prefrontal theories of consciousness, many have argued that neural activity in the prefrontal cortex does not correlate with consciousness but with subjective reports. We defend prefrontal theories of consciousness against this argument. We surmise that the requirement for reports is not a satisfying explanation of the difference in neural activity between conscious and unconscious trials, and that prefrontal theories of consciousness come out of this debate unscathed.

{I think they are arguing against an Aunt Sally here. The problem is not that neural activity in the prefrontal cortex correlates to subjective reports better than consciousness, it is that consciousness is so under-defined that correlating any neural activity to consciousness is problematic.}

<https://onlinelibrary.wiley.com/doi/abs/10.1111/mila.12264?campaign=woletoc>

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#### **WOLFRAM HINZEN et al – Mind–Language = ? The significance of non-verbal autism**

The possibility and extent of thought without language have been subject to much controversy. Insight from non- or minimally verbal humans can inform this debate empirically. Since most such individuals are on the autism spectrum, of which they make up a sizable 25–30%, an important connection between language and autism transpires. Here we propose a model which makes sense of this link and explains why the non-verbal human mind, as present evidence suggests, represents a fundamentally different cognitive phenotype. This model views the relevant part of the autism spectrum as reflecting the breakdown of a cognitive phenotype of which language is an inherent element and which will manifest principled limitations in the latter's absence.

<https://onlinelibrary.wiley.com/doi/abs/10.1111/mila.12257?campaign=woletoc>

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## **Nature Communications**

### **PAPERS**

#### **AMMIE K. KALAN et mul with CRICKETTE SANZ, VOLKER SOMMER, ROMAN M. WITTIG & KLAUS ZUBERBÜHLER – Environmental variability supports chimpanzee behavioural diversity**

Large brains and behavioural innovation are positively correlated, species-specific traits, associated with the behavioural flexibility animals need for adapting to seasonal and unpredictable habitats. Similar ecological challenges would have been important drivers throughout human evolution. However, studies examining the influence of environmental variability on within-species behavioural diversity are lacking despite the critical assumption that population diversification precedes genetic divergence and speciation. Here, using a dataset of 144 wild chimpanzee (*Pan troglodytes*) communities, we show that chimpanzees exhibit greater behavioural diversity in environments with more variability — in both recent and historical timescales. Notably, distance from Pleistocene forest refugia is associated with the presence of a larger number of

behavioural traits, including both tool and non-tool use behaviours. Since more than half of the behaviours investigated are also likely to be cultural, we suggest that environmental variability was a critical evolutionary force promoting the behavioural, as well as cultural diversification of great apes.

<https://www.nature.com/articles/s41467-020-18176-3>

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## Nature Scientific Reports

### PAPERS

#### **FARSHAD ALIZADEH MANSOURI, DAVID J. FREEDMAN & MARK J. BUCKLEY – Emergence of abstract rules in the primate brain**

Various aspects of human cognition are shaped and enriched by abstract rules, which help to describe, link and classify discrete events and experiences into meaningful concepts. However, where and how these entities emerge in the primate brain and the neuronal mechanisms underlying them remain the subject of extensive research and debate. Evidence from imaging studies in humans and single-neuron recordings in monkeys suggests a pivotal role for the prefrontal cortex in the representation of abstract rules; however, behavioural studies in lesioned monkeys and data from neuropsychological examinations of patients with prefrontal damage indicate substantial functional dissociations and task dependency in the contribution of prefrontal cortical regions to rule-guided behaviour. This Review describes our current understanding of the dynamic emergence of abstract rules in primate cognition, and of the distributed neural network that supports abstract rule formation, maintenance, revision and task-dependent implementation.

<https://www.nature.com/articles/s41583-020-0364-5>

#### **HARRY SMIT & PETER HACKER – Two conceptions of consciousness and why only the neo-Aristotelian one enables us to construct evolutionary explanations**

Descartes separated the physical from the mental realm and presupposed a causal relation between conscious experience and neural processes. He denominated conscious experiences ‘thoughts’ and held them to be indubitable. However, the question of how we can bridge the gap between subjective experience and neural activity remained unanswered, and attempts to integrate the Cartesian conception with evolutionary theory has not resulted in explanations and testable hypotheses. It is argued that the alternative neo-Aristotelian conception of the mind as the capacities of intellect and will resolves these problems. We discuss how the neo-Aristotelian conception, extended with the notion that organisms are open thermodynamic systems that have acquired heredity, can be integrated with evolutionary theory, and elaborate how we can explain four different forms of consciousness in evolutionary terms.

<https://www.nature.com/articles/s41599-020-00591-y>

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## PLoS One

### PAPERS

#### **MANUEL WILL & NICHOLAS J. CONARD – Regional patterns of diachronic technological change in the Howiesons Poort of southern Africa**

The Howiesons Poort (HP) of southern Africa plays an important role in models on the early behavioral evolution of Homo sapiens. The HP is often portrayed as a coherent MSA industry characterized by early complex material culture. Recent work has emphasized parallel technological change through time across southern Africa potentially driven by ecological adaptations or demographic change. Here we examine patterns of diachronic variation within the HP and evaluate potential causal factors behind these changes. We test previous temporal assessments of the technocomplex at the local and regional level based on high-resolution quantitative data on HP lithic assemblages from Sibudu (KwaZulu-Natal) and comparisons with other southern African sites. At Sibudu, consistent unidirectional change in lithic technology characterizes the HP sequence. The results show a gradual reduction in typical HP markers such as the proportion of blades, backed pieces, and HP cores, as well as declining size of blades and backed artifacts. Quantitative comparisons with seven HP sites in South Africa suggest that lithic technology varies between regions over time instead of following similar changes. Concerning hypotheses of causal drivers, directional changes in lithic technology at Sibudu covary with shifting hunting patterns towards larger-sized bovinds and a gradual opening of the vegetation. In contrast, variation in lithic technology shows little association with site use, mobility patterns or demographic expansions. Unlike at Sibudu, diachronic changes at other HP sites such as Diepkloof, Klasies River and Klipdrift appear to be associated with aspects of mobility, technological organization and site use. The regional diachronic patterns in the HP partly follow paleoclimatic zones, which could imply different ecological adaptations and distinct connection networks over time. Divergent and at times decoupled changes in lithic traits across sites precludes monocausal explanations for the entire HP, supporting more complex models for the observed technological trajectories.

<https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0239195>

#### **JAMIE MOFFATT et al with CHARLES FERNYHOUGH – Inner experience differs in rumination and distraction without a change in electromyographical correlates of inner speech**

Ruminative thought is a style of thinking which involves repetitively focusing upon one’s own negative mood, its causes and its consequences. The negative effects of rumination are well-documented, but comparatively little is known about how rumination is experienced. The evaluative nature of rumination suggests that it could involve more inner speech than non-ruminative states. The present study (N = 31) combined facial electromyography and self-report questionnaires to determine

the type of inner experience that occurs in rumination. The results showed that induced rumination involved similar levels of muscle activity related to inner speech as periods of induced distraction. However, experience sampling and questionnaire responses showed that rumination involved more verbal thought, and also involved more evaluative and dialogic inner speech than distraction. These findings contribute to the understanding of inner speech as a flexible phenomenon and confirms the importance of employing multiple methods to investigate inner speech. Future research should clarify the link between inner speech in rumination and its negative effects on wellbeing.

<https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0238920>

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## PNAS

### PAPERS

#### **AINARA SISTIAGA et al with AUDAX MABULLA – Microbial biomarkers reveal a hydrothermally active landscape at Olduvai Gorge at the dawn of the Acheulean, 1.7 Ma**

Landscape-scale reconstructions of ancient environments within the cradle of humanity may reveal insights into the relationship between early hominins and the changing resources around them. Many studies of Olduvai Gorge during Pliocene–Pleistocene times have revealed the presence of precession-driven wet–dry cycles atop a general aridification trend, though may underestimate the impact of local-scale conditions on early hominins, who likely experienced a varied and more dynamic landscape. Fossil lipid biomarkers from ancient plants and microbes encode information about their surroundings via their molecular structures and composition, and thus can shed light on past environments. Here, we employ fossil lipid biomarkers to study the paleolandscape at Olduvai Gorge at the emergence of the Acheulean technology, 1.7 Ma, through the Lower Augitic Sandstones layer. In the context of the expansion of savanna grasslands, our results represent a resource-rich mosaic ecosystem populated by groundwater-fed rivers, aquatic plants, angiosperm shrublands, and edible plants. Evidence of a geothermally active landscape is reported via an unusual biomarker distribution consistent with the presence of hydrothermal features seen today at Yellowstone National Park. The study of hydrothermalism in ancient settings and its impact on hominin evolution has not been addressed before, although the association of thermal springs in the proximity of archaeological sites documented here can also be found at other localities. The hydrothermal features and resources present at Olduvai Gorge may have allowed early hominins to thermally process edible plants and meat, supporting the possibility of a prefire stage of human evolution.

<https://www.pnas.org/content/early/2020/09/14/2004532117.abstract?etoc>

#### **ALEXANDER EHLERT et al – Human social preferences cluster and spread in the field**

While it is undeniable that the ability of humans to cooperate in large-scale societies is unique in animal life, it remains open how such a degree of prosociality is possible despite the risks of exploitation. Recent evidence suggests that social networks play a crucial role in the development of prosociality and large-scale cooperation by allowing cooperators to cluster; however, it is not well understood if and how this also applies to real-world social networks in the field. We study intrinsic social preferences alongside emerging friendship patterns in 57 freshly formed school classes ( $n = 1,217$ ), using incentivized measures. We demonstrate the existence of cooperative clusters in society, examine their emergence, and expand the evidence from controlled experiments to real-world social networks. Our results suggest that being embedded in cooperative environments substantially enhances the social preferences of individuals, thus contributing to the formation of cooperative clusters. Partner choice, in contrast, only marginally contributes to their emergence. We conclude that cooperative preferences are contagious; social and cultural learning plays an important role in the development and evolution of cooperation.

<https://www.pnas.org/content/117/37/22787.abstract?etoc>

#### **JOHANNES BILL et al – Hierarchical structure is employed by humans during visual motion perception**

In the real world, complex dynamic scenes often arise from the composition of simpler parts. The visual system exploits this structure by hierarchically decomposing dynamic scenes: When we see a person walking on a train or an animal running in a herd, we recognize the individual's movement as nested within a reference frame that is, itself, moving. Despite its ubiquity, surprisingly little is understood about the computations underlying hierarchical motion perception. To address this gap, we developed a class of stimuli that grant tight control over statistical relations among object velocities in dynamic scenes. We first demonstrate that structured motion stimuli benefit human multiple object tracking performance. Computational analysis revealed that the performance gain is best explained by human participants making use of motion relations during tracking. A second experiment, using a motion prediction task, reinforced this conclusion and provided fine-grained information about how the visual system flexibly exploits motion structure.

<https://www.pnas.org/content/early/2020/09/15/2008961117.abstract?etoc>

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## Science

### ARTICLES

#### **ELIAS GARCIA-PELEGRIN et al – An unexpected audience**

In the past decade, the study of magic effects has started to gain attention from the scientific community, particularly psychologists. This interest stems from what magic effects might reveal about the blind spots in our perception and

roadblocks in our thinking. The study of magic effects may offer researchers opportunities for new lines of inquiry about perception and attention. Moreover, because magic effects capitalize on our ability to remember what happened and our ability to anticipate what will happen next, using magical frameworks elicits ways to investigate complex cognitive abilities such as mental time travel (i.e., remembering the past and anticipating the future). Moving beyond the intersection between magic and the human mind, the application of magic effects to investigate the animal mind can prompt the comparison of behavioral reactions among diverse species, in which magic effects might exploit similar perceptive blind spots and cognitive roadblocks.

<https://science.sciencemag.org/content/369/6510/1424>

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## Science Advances

### PAPERS

#### **CATHERINE CROCKFORD et al with ROMAN M. WITTIG – Postweaning maternal care increases male chimpanzee reproductive success**

Humans are unusual among animals for continuing to provision and care for their offspring until adulthood. This “prolonged dependency” is considered key for the evolution of other notable human traits, such as large brains, complex societies, and extended post-reproductive lifespans. Prolonged dependency must therefore have evolved under conditions in which reproductive success is gained with parental investment and diminished with early parental loss. We tested this idea using data from wild chimpanzees, which have similarly extended immature years as humans and prolonged mother-offspring associations. Males who lost their mothers after weaning but before maturity began reproducing later and had lower average reproductive success. Thus, persistent mother-immature son associations seem vital for enhancing male reproductive success, although mothers barely provision sons after weaning. We posit that these associations lead to social gains, crucial for successful reproduction in complex social societies, and offer insights into the evolution of prolonged dependency.

[https://advances.sciencemag.org/content/6/38/eaaz5746?utm\\_campaign=toc\\_advances\\_2020-09-18&et rid=17774313&et cid=3486475](https://advances.sciencemag.org/content/6/38/eaaz5746?utm_campaign=toc_advances_2020-09-18&et rid=17774313&et cid=3486475)

#### **MATHEW STEWART et al – Human footprints provide snapshot of last interglacial ecology in the Arabian interior**

The nature of human dispersals out of Africa has remained elusive because of the poor resolution of paleoecological data in direct association with remains of the earliest non-African people. Here, we report hominin and non-hominin mammalian tracks from an ancient lake deposit in the Arabian peninsula, dated within the last interglacial. The findings, it is argued, likely represent the oldest securely dated evidence for homo sapiens in Arabia. The paleoecological evidence indicates a well-watered semi-arid grassland setting during human movements into the Nefud desert of Saudi Arabia. We conclude that visitation to the lake was transient, likely serving as a place to drink and to forage, and that late Pleistocene human and mammalian migrations and landscape use patterns in Arabia were inexorably linked.

[https://advances.sciencemag.org/content/6/38/eaba8940?utm\\_campaign=toc\\_advances\\_2020-09-18&et rid=17774313&et cid=3486475](https://advances.sciencemag.org/content/6/38/eaba8940?utm_campaign=toc_advances_2020-09-18&et rid=17774313&et cid=3486475)

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## Trends in Cognitive Sciences

### PAPERS

#### **FRIEDEMANN PULVERMÜLLER & LUIGI GRISONI – Semantic Prediction in Brain and Mind**

We highlight a novel brain correlate of prediction, the prediction potential (or PP), a slow negative-going potential shift preceding visual, acoustic, and spoken or written verbal stimuli that can be predicted from their context. The cortical sources underlying the prediction potential reflect perceptual and semantic features of anticipated stimuli before these appear.

[https://www.cell.com/trends/cognitive-sciences/fulltext/S1364-6613\(20\)30171-6?dgcid=raven\\_jbs\\_etoc\\_email](https://www.cell.com/trends/cognitive-sciences/fulltext/S1364-6613(20)30171-6?dgcid=raven_jbs_etoc_email)

#### **JONATHAN BIRCH, ALEXANDRA K. SCHNELL & NICOLA S. CLAYTON – Dimensions of Animal Consciousness**

How does consciousness vary across the animal kingdom? Are some animals ‘more conscious’ than others? This article presents a multidimensional framework for understanding interspecies variation in states of consciousness. The framework distinguishes five key dimensions of variation: perceptual richness, evaluative richness, integration at a time, integration across time, and self-consciousness. For each dimension, existing experiments that bear on it are reviewed and future experiments are suggested. By assessing a given species against each dimension, we can construct a consciousness profile for that species. On this framework, there is no single scale along which species can be ranked as more or less conscious. Rather, each species has its own distinctive consciousness profile.

[https://www.cell.com/trends/cognitive-sciences/fulltext/S1364-6613\(20\)30192-3?dgcid=raven\\_jbs\\_etoc\\_email](https://www.cell.com/trends/cognitive-sciences/fulltext/S1364-6613(20)30192-3?dgcid=raven_jbs_etoc_email)

#### **PATRICIA L. LOCKWOOD, MATTHEW A.J. APPS & STEVE W.C. CHANG – Is There a ‘Social’ Brain? Implementations and Algorithms**

A fundamental question in psychology and neuroscience is the extent to which cognitive and neural processes are specialised for social behaviour, or are shared with other ‘non-social’ cognitive, perceptual, and motor faculties. Here we apply the influential framework of Marr (1982) across research in humans, monkeys, and rodents to propose that information

processing can be understood as 'social' or 'non-social' at different levels. We argue that processes can be socially specialised at the implementational and/or the algorithmic level, and that changing the goal of social behaviour can also change social specificity. This framework could provide important new insights into the nature of social behaviour across species, facilitate greater integration, and inspire novel theoretical and empirical approaches.

[https://www.cell.com/trends/cognitive-sciences/fulltext/S1364-6613\(20\)30168-6?dgcid=raven\\_jbs\\_etoc\\_email](https://www.cell.com/trends/cognitive-sciences/fulltext/S1364-6613(20)30168-6?dgcid=raven_jbs_etoc_email)

## COMMENTARIES

### **FUMIHIRO KANO, JOSEP CALL & CHRISTOPHER KRUPENYE – Primates Pass Dynamically Social Anticipatory-Looking False-Belief Tests**

Three recent studies, inspired by seminal work with human infants, have shown that non-human apes and macaques pass anticipatory-looking (AL) false-belief (FB) tests. These results raise the possibility that both apes and monkeys understand that others' actions are driven not by reality but by beliefs about reality, even when those beliefs are false. In response, Horschler et al. argued that these findings 'should be interpreted cautiously due to methodological and theoretical challenges paralleling trends in the human literature.' We agree that continued work is necessary to identify factors that influence reproducibility of AL paradigms and also to specify the mechanisms and functions of the observed behaviors in primates. However, inferences from the human literature should be made with caution because key non-human results have largely been replicated and extended across different groups and species, so far providing a different picture from more variably replicable human studies. Moreover, non-human studies retain only the conceptual design of human paradigms with various improvements and optimization for non-human primates. What we see as the more pressing – but potentially interwoven – matter is resolving discrepancies among comparative findings: apes and monkeys have passed AL-FB tests (visually anticipating that an agent would search for an object where she falsely believed it to be), but monkeys have not succeeded in violation-of-expectation (VoE) FB paradigms (they do not look longer when an agent's search is inconsistent with her FBs). Here, we spotlight crucial methodological differences that may explain the unique success of non-human AL paradigms. In concluding, we discuss adaptive significance and future directions.

[https://www.cell.com/trends/cognitive-sciences/fulltext/S1364-6613\(20\)30172-8?dgcid=raven\\_jbs\\_etoc\\_email](https://www.cell.com/trends/cognitive-sciences/fulltext/S1364-6613(20)30172-8?dgcid=raven_jbs_etoc_email)

### **DANIEL J. HORSCHLER, EVAN L. MACLEAN & LAURIE R. SANTOS – Advancing Gaze-Based Research on Primate Theory of Mind**

In Horschler et al., we reviewed three new anticipatory looking (AL) studies of false belief (FB) representation in non-human primates (hereafter primates) in relation to similar studies in humans. We concluded that AL evidence of belief representation in primates should be interpreted cautiously due to challenges shared with the human literature, as well as a large body of work previously suggesting that primates do not represent others' beliefs. In response, Kano, Call, and Krupenye argue that comparative AL studies have been more replicable in primates than in humans, that resolving discrepant findings between AL and violation of expectation (VoE) paradigms should be prioritized, and that issues related to ecological validity may partially explain the lack of evidence for belief representation in previous comparative work. In this article, we address these three points, ultimately emphasizing our agreement on the powerful potential of gaze-based measures in theory of mind research.

[https://www.cell.com/trends/cognitive-sciences/fulltext/S1364-6613\(20\)30194-7?dgcid=raven\\_jbs\\_etoc\\_email](https://www.cell.com/trends/cognitive-sciences/fulltext/S1364-6613(20)30194-7?dgcid=raven_jbs_etoc_email)

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