

EAORC BULLETIN 939 – 13 June 2021

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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.

ACADEMIA.EDU – Finding our way: a review on the evolution of human spatial cognition

Cadernos do GEEvH 3:1, 7-37 (2014)

MARIA ANA CORREIA, EUGÉNIA CUNHA & SUSANA CARVALHO – Finding our way: a review on the evolution of human spatial cognition

Most developmental processes, from the molecular to the cognitive level, have many similarities throughout the animal kingdom. The aim of the present study was to examine the evolution of human spatial cognition by contextualizing it in a developmental cognition framework. In order to achieve this, a thorough literature review on significant research was conducted, including data from primatology, cognitive science, archaeology and human evolution. The fascinating result of this literature review consists in the novel suggestion that ontogenetic data can be useful for understanding human cognitive evolution. Further investigation in this field is required to achieve more conclusive results.

https://www.academia.edu/8489779/Finding_our_way_a_review_on_the_evolution_of_human_spatial_cognition

ACADEMIA.EDU – The cervical spine of *Australopithecus sediba*

Journal of Human Evolution 104, 32-49 (2017)

MARC R. MEYER et al with LEE R. BERGER – The cervical spine of *Australopithecus sediba*

Cervical vertebrae are rare in the early hominin fossil record, presenting a challenge for understanding the evolution of the neck and head carriage in hominin evolution. Here, we examine the cervical vertebrae of *Australopithecus sediba*, which

unlike other South African taxa is known from associated cervical vertebrae. The *A. sediba* cervical vertebrae exhibit human-like values for wedging, pedicle cross-sectional areas, and articular facet heights, indicating reduced ventral loading relative to African apes. These features combine with a pattern of vertebral body bone distribution and caudally progressive size expansion suggesting a mode of cervical lordosis, load mitigation, and head carriage similar to humans and distinct from the cantilevered mode of head carriage of the extant African great apes. Yet these derived features in *A. sediba* are accompanied by ape-like vertebral body and dorsal pillar sizes, articular facet orientation, and uncinate process morphology signaling reduced lateral and rotational coupled movements between vertebral elements and indicate a considerably stiffer neck than in humans. A primitively long and horizontally-oriented C7 spinous process is likely related to a prognathic viscerocranum, although the complimentary C3 spinous process is short, implying large moments emanating from scapular and shoulder elevators rather than large muscles of head stabilization. Cross-sectional spinous process shape and robust anterior tubercles similarly signal increased arm elevation consistent with climbing behavior in corroboration with arboreal signatures previously observed in the shoulder, arms, and hand of *A. sediba*. Spinal canal shape and size suggests that *A. sediba* lacked the cervical spinal cord enlargement of *Homo* that confers humans with enhanced motor control to the upper limbs. The cervical spine of *A. sediba* thus presents a mosaic of primitive and derived characters, with anatomical features relating to neck posture and head carriage mirroring humans juxtaposed with most other aspects of functional anatomy that resemble chimpanzees.

https://www.academia.edu/31478168/The_cervical_spine_of_Australopithecus_sediba

ACADEMIA.EDU – The vertebrae and ribs of *Homo naledi*

Journal of Human Evolution 104, 136-154 (2017)

SCOTT A. WILLIAMS et al with LEE R. BERGER – The vertebrae and ribs of *Homo naledi*

Hominin evolution featured shifts from a trunk shape suitable for climbing and housing a large gut to a trunk adapted to bipedalism and higher quality diets. Our knowledge regarding the tempo, mode, and context in which these derived traits evolved has been limited, based largely on a small-bodied Australopithecus partial skeleton (A.L. 288-1; “Lucy”) and a juvenile *Homo erectus* skeleton (KNM-WT 15000; “Turkana Boy”). Two recent discoveries, of a large-bodied Australopithecus *afarensis* (KSD-VP-1/1) and two Australopithecus *sediba* partial skeletons (MH1 and MH2), have added to our understanding of thorax evolution; however, little is known about thorax morphology in early *Homo*. Here we describe hominin vertebrae, ribs, and sternal remains from the Dinaledi chamber of the Rising Star cave system attributed to *Homo naledi*. Although the remains are highly fragmented, the best-preserved specimens – two lower thoracic vertebrae and a lower rib – were found in association and belong to a small-bodied individual. A second lower rib may belong to this individual as well. All four of these individual elements are amongst the smallest known in the hominin fossil record. *H. naledi* is characterized by robust, relatively uncurved lower ribs and a relatively large spinal canal. We expect that the recovery of additional material from Rising Star Cave will clarify the nature of these traits and shed light on *H. naledi* functional morphology and phylogeny.

https://www.academia.edu/30969288/The_vertebrae_and_ribs_of_Homo_naledi

ACADEMIA.EDU – The upper limb of *Homo naledi*

Journal of Human Evolution 104, 155-173 (2017)

ELEN M. FEUERRIEGEL et al with LEE R. BERGER – The upper limb of *Homo naledi*

The evolutionary transition from an ape-like to human-like upper extremity occurred in the context of a behavioral shift from an upper limb predominantly involved in locomotion to one adapted for manipulation. Selection for overarm throwing and endurance running is thought to have further shaped modern human shoulder girdle morphology and its position about the thorax. *Homo naledi* (Dinaledi Chamber, Rising Star Cave, Cradle of Humankind, South Africa) combines an australopith-like cranial capacity with dental characteristics akin to early *Homo*. Although the hand, foot, and lower limb display many derived morphologies, the upper limb retains many primitive traits. Here, we describe the *H. naledi* upper extremity (excluding the hand) in detail and in a comparative context to evaluate the diversity of clavicular, scapular, humeral, radial, and ulnar morphology among early hominins and later *Homo*. *Homo naledi* had a scapula with a markedly cranially-oriented glenoid, a humerus with extremely low torsion, and an australopith-like clavicle. These traits indicate that the *H. naledi* scapula was situated superiorly and laterally on the thorax. This shoulder girdle configuration is more similar to that of *Australopithecus* and distinct from that of modern humans, whose scapulae are positioned low and dorsally about the thorax. Although early *Homo erectus* maintains many primitive clavicular and humeral features, its derived scapular morphology suggests a loss of climbing adaptations. In contrast, the *H. naledi* upper limb is markedly primitive, retaining morphology conducive to climbing while lacking many of the derived features related to effective throwing or running purported to characterize other members of early *Homo*.

https://www.academia.edu/30404622/The_upper_limb_of_Homo_naledi

ACADEMIA.EDU – The thigh and leg of *Homo naledi*

Journal of Human Evolution 104, 174-204 (2017)

DAMIANO MARCHI et al with LEE R. BERGER – The thigh and leg of *Homo naledi*

This paper describes the 108 femoral, patellar, tibial, and fibular elements of a new species of *Homo* (*Homo naledi*) discovered in the Dinaledi chamber of the Rising Star cave system in South Africa. *Homo naledi* possesses a mosaic of

primitive, derived, and unique traits functionally indicative of a bipedal hominin adapted for long distance walking and possibly running. Traits shared with australopiths include an anteroposteriorly compressed femoral neck, a mediolaterally compressed tibia, and a relatively circular fibular neck. Traits shared with *Homo* include a well-marked linea aspera, anteroposteriorly thick patellae, relatively long tibiae, and gracile fibulae with laterally oriented lateral malleoli. Unique features include the presence of two pillars on the superior aspect of the femoral neck and a tubercular distal insertion of the pes anserinus on the tibia. The mosaic morphology of the *H. naledi* thigh and leg appears most consistent with a species intermediate between *Australopithecus* spp. and *Homo erectus* and, accordingly, may offer insight into the nature of the earliest members of genus *Homo*. These fossils also expand the morphological diversity of the *Homo* lower limb, perhaps indicative of locomotor diversity in our genus.

https://www.academia.edu/29884026/The_thigh_and_leg_of_Homo_naledi

SCIENCE DIRECT – Voice Modulation: A Window into the Origins of Human Vocal Control?

Trends in Cognitive Sciences 20:4, 304-318 (2016)

KATARZYNA PISANSKI et al – Voice Modulation: A Window into the Origins of Human Vocal Control?

An unresolved issue in comparative approaches to speech evolution is the apparent absence of an intermediate vocal communication system between human speech and the less flexible vocal repertoires of other primates. We argue that humans' ability to modulate nonverbal vocal features evolutionarily linked to expression of body size and sex (fundamental and formant frequencies) provides a largely overlooked window into the nature of this intermediate system. Recent behavioral and neural evidence indicates that humans' vocal control abilities, commonly assumed to subserve speech, extend to these nonverbal dimensions. This capacity appears in continuity with context-dependent frequency modulations recently identified in other mammals, including primates, and may represent a living relic of early vocal control abilities that led to articulated human speech.

<https://www.sciencedirect.com/science/article/abs/pii/S1364661316000206>

SCIENCE DIRECT – The origins of the vocal brain in humans

Neuroscience & Biobehavioral Reviews 77, 177-193 (2017)

MICHEL BELYK & STEVEN BROWN – The origins of the vocal brain in humans

The evolution of vocal communication in humans required the emergence of not only voluntary control of the vocal apparatus and a flexible vocal repertoire, but the capacity for vocal learning. All of these capacities are lacking in non-human primates, suggesting that the vocal brain underwent significant modifications during human evolution. We review research spanning from early neurophysiological descriptions of great apes to the state of the art in human neuroimaging on the neural organization of the larynx motor cortex, the major regulator of vocalization for both speech and song in humans. We describe changes to the location, structure, function, and connectivity of the larynx motor cortex in humans compared with non-human primates, including critical gaps in the current understanding of the brain systems mediating vocal control and vocal learning. We explore a number of models of the origins of the vocal brain that incorporate findings from comparative neuroscience, and conclude by presenting a summary of contemporary hypotheses that can guide future research.

<https://www.sciencedirect.com/science/article/abs/pii/S0149763416306583>

NEWS

SAPIENS – Discovering Africa's oldest burial

A team of archaeologists are busy learning about human evolution, symbolism, and ritual from the remains of a child laid to rest in a Kenyan cave during the Middle Stone Age—the oldest-known human burial on the African continent to date.

<https://sapiens.us11.list-manage.com/track/click?u=80f6cf678900daf984bf763b7&id=da39d81cd1&e=dc0eff6180>

SCIENCE DAILY – Porpoises seem to cooperate in surprisingly sophisticated group hunting

Drone footage shows that porpoises may be more social and cooperative than previously thought.

<https://www.sciencedaily.com/releases/2021/06/210608113210.htm>

SCIENCE DAILY – Experiments show natural selection opposes sexual selection

Natural selection can reverse evolution that occurs through sexual selection and this can lead to better females, new research shows.

<https://www.sciencedaily.com/releases/2021/06/210608083947.htm>

SCIENCE DAILY – Study finds brain areas involved in seeking information about bad possibilities

Researchers have identified the brain regions involved in choosing whether to find out if a bad event is about to happen.

<https://www.sciencedaily.com/releases/2021/06/210611110807.htm>

SCIENCE NEWS – The tamer the cow, the smaller the brain

Compare a wild boar with a domestic pig and you may notice a few key differences, including the fact that the pig will likely have a smaller head—and brain—than the boar. Scientists have known for decades that domesticated animals like sheep, pigs, cats, and dogs have smaller brains than their wild counterparts—part of what scientists refer to as “domestication syndrome.” Now, the first large-sale study of brain sizes across cattle breeds reveals a new wrinkle: Breeds that tolerate more interaction with humans have smaller brains than those that live more independent lives.

<https://www.sciencemag.org/news/2021/06/tamer-cow-smaller-brain>

SOCIETY FOR SCIENCE – New clues suggest people reached the Americas around 30,000 years ago

Ancient rabbit bones from a Mexican rock-shelter point to humans arriving on the continent as much as 10,000 years earlier than often assumed.

<http://click.societyforscience-.email.com/?qs=f24e6d4e60517a028901ac67c370086fc7b9582d5ef72bb64d6c1acc70c3d5066fd4e81572e618a046f5d70960216e1c70767150bf46fc54d5f1d9083571a2cf>

SOCIETY FOR SCIENCE – These ferns may be the first plants known to share work like ants

Staghorn ferns grow in massive colonies where individual plants contribute different jobs. This may make them “eusocial,” like ants or termites.

<http://click.societyforscience-.email.com/?qs=f24e6d4e60517a0267fdce25cecec66a51b674c5aaebcbbe106f4568f1e3755d6e4d32f13924cf4c2b7027c031a5bec44647dedd632e9d3c6a136170d6d6dc9e>

SOCIETY FOR SCIENCE – A deep look at a speck of human brain reveals never-before-seen quirks

Three-dimensional views of 50,000 cells from a woman’s brain yield one of the most detailed maps yet.

<http://click.societyforscience-.email.com/?qs=7c8d5e6b3aefed56eaa897a341154178007f1b6c480411f3b2887e8313df24dacd608e7fe440bc3da3c8d3cc2bc805de43352d96371bd125>

PUBLICATIONS

Current Biology

PAPERS

CAMILLE TESTARD et al – Rhesus macaques build new social connections after a natural disaster

Climate change is increasing the frequency and intensity of weather-related disasters such as hurricanes, wildfires, floods, and droughts. Understanding resilience and vulnerability to these intense stressors and their aftermath could reveal adaptations to extreme environmental change. In 2017, Puerto Rico suffered its worst natural disaster, Hurricane Maria, which left 3,000 dead and provoked a mental health crisis. Cayo Santiago island, home to a population of rhesus macaques (*Macaca mulatta*), was devastated by the same storm. We compared social networks of two groups of macaques before and after the hurricane and found an increase in affiliative social connections, driven largely by monkeys most socially isolated before Hurricane Maria. Further analysis revealed monkeys invested in building new relationships rather than strengthening existing ones. Social adaptations to environmental instability might predispose rhesus macaques to success in rapidly changing anthropogenic environments.

[https://www.cell.com/current-biology/fulltext/S0960-9822\(21\)00368-7](https://www.cell.com/current-biology/fulltext/S0960-9822(21)00368-7)

VLADIMIR PRAVOSUDOV – Animal culture: Newcomers help adopt more efficient behaviors

Novel behaviors spread via social learning and may persist in groups even when alternative, more efficient solutions become available. A study in birds shows that adoption of more efficient behaviors can be achieved via population turnover as new group members learn and spread more efficient behaviors.

[https://www.cell.com/current-biology/fulltext/S0960-9822\(21\)00475-9](https://www.cell.com/current-biology/fulltext/S0960-9822(21)00475-9)

REYHAN YAKA et mul – Variable kinship patterns in Neolithic Anatolia revealed by ancient genomes

The social organization of the first fully sedentary societies that emerged during the Neolithic period in Southwest Asia remains enigmatic, mainly because material culture studies provide limited insight into this issue. However, because Neolithic Anatolian communities often buried their dead beneath domestic buildings, household composition and social structure can be studied through these human remains. Here, we describe genetic relatedness among co-burials associated with domestic buildings in Neolithic Anatolia using 59 ancient genomes, including 22 new genomes from Aşıklı Höyük and Çatalhöyük. We infer pedigree relationships by simultaneously analyzing multiple types of information, including autosomal and X chromosome kinship coefficients, maternal markers, and radiocarbon dating. In two early Neolithic villages dating to the 9th and 8th millennia BCE, Aşıklı Höyük and Boncuklu, we discover that siblings and parent-offspring pairings were frequent within domestic structures, which provides the first direct indication of close genetic relationships among co-

burials. In contrast, in the 7th millennium BCE sites of Çatalhöyük and Barçın, where we study subadults interred within and around houses, we find close genetic relatives to be rare. Hence, genetic relatedness may not have played a major role in the choice of burial location at these latter two sites, at least for subadults. This supports the hypothesis that in Çatalhöyük, and possibly in some other Neolithic communities, domestic structures may have served as burial location for social units incorporating biologically unrelated individuals. Our results underscore the diversity of kin structures in Neolithic communities during this important phase of sociocultural development.

[https://www.cell.com/current-biology/fulltext/S0960-9822\(21\)00423-1](https://www.cell.com/current-biology/fulltext/S0960-9822(21)00423-1)

eLife

PAPERS

SAMUEL FREDERICK MOCK HART et al – Pleiotropic mutations can rapidly evolve to directly benefit self and cooperative partner despite unfavorable conditions

Cooperation, paying a cost to benefit others, is widespread. Cooperation can be promoted by pleiotropic ‘win-win’ mutations which directly benefit self (self-serving) and partner (partner-serving). Previously, we showed that partner-serving should be defined as increased benefit supply rate per intake benefit. Here, we report that win-win mutations can rapidly evolve even under conditions unfavorable for cooperation. Specifically, in a well-mixed environment we evolved engineered yeast cooperative communities where two strains exchanged costly metabolites, lysine and hypoxanthine. Among cells that consumed lysine and released hypoxanthine, ecm21 mutations repeatedly arose. ecm21 is self-serving, improving self’s growth rate in limiting lysine. ecm21 is also partner-serving, increasing hypoxanthine release rate per lysine consumption and the steady state growth rate of partner and of community. ecm21 also arose in monocultures evolving in lysine-limited chemostats. Thus, even without any history of cooperation or pressure to maintain cooperation, pleiotropic win-win mutations may readily evolve to promote cooperation.

<https://elifesciences.org/articles/57838>

Evolutionary Anthropology

PAPERS

SIMON T. POWERS, CAREL P. VAN SCHAIK & LAURENT LEHMANN – Cooperation in large-scale human societies—What, if anything, makes it unique, and how did it evolve?

To resolve the major controversy about why prosocial behaviors persist in large-scale human societies, we propose that two questions need to be answered. First, how do social interactions in small-scale and large-scale societies differ? By reviewing the exchange and collective-action dilemmas in both small-scale and large-scale societies, we show they are not different. Second, are individual decision-making mechanisms driven by self-interest? We extract from the literature three types of individual decision-making mechanism, which differ in their social influence and sensitivity to self-interest, to conclude that humans interacting with non-relatives are largely driven by self-interest. We then ask: what was the key mechanism that allowed prosocial behaviors to continue as societies grew? We show the key role played by new social interaction mechanisms—change in the rules of exchange and collective-action dilemmas—devised by the interacting individuals, which allow for self-interested individuals to remain prosocial as societies grow.

{We know that human interactions with non-relatives are driven by self-interest. The weird thing is the way we define and model the self that is interested, and what it is interested in.}

<https://onlinelibrary.wiley.com/doi/full/10.1002/evan.21909>

Nature Communications

PAPERS

ARUNAS L. RADZVILAVICIUS, TAYLOR A. KESSINGER & JOSHUA B. PLOTKIN – Adherence to public institutions that foster cooperation

Humans typically consider altruism a moral good and condition their social behavior on the moral reputations of others. Indirect reciprocity explains how social norms and reputations support cooperation: individuals cooperate with others who are considered good. Indirect reciprocity works when an institution monitors and publicly broadcasts moral reputations. Here we develop a theory of adherence to public monitoring in societies where individuals are, at first, independently responsible for evaluating the reputations of their peers. Using a mathematical model, we show that adherence to an institution of moral assessment can evolve and promote cooperation under four different social norms, including norms that previous studies found to perform poorly. We determine how an institution’s size and its degree of tolerance towards anti-social behavior affect the rate of cooperation. Public monitoring serves to eliminate disagreements about reputations, which increases cooperation and payoffs, so that adherence evolves by social contagion and remains robust against displacement.

<https://www.nature.com/articles/s41467-021-23783-9>

BEIZHEN ZHANG et al – Transforming absolute value to categorical choice in primate superior colliculus during value-based decision making

Value-based decision making involves choosing from multiple options with different values. Despite extensive studies on value representation in various brain regions, the neural mechanism for how multiple value options are converted to motor

actions remains unclear. To study this, we developed a multi-value foraging task with varying menu of items in non-human primates using eye movements that dissociates value and choice, and conducted electrophysiological recording in the midbrain superior colliculus (SC). SC neurons encoded “absolute” value, independent of available options, during late fixation. In addition, SC neurons also represent value threshold, modulated by available options, different from conventional motor threshold. Electrical stimulation of SC neurons biased choices in a manner predicted by the difference between the value representation and the value threshold. These results reveal a neural mechanism directly transforming absolute values to categorical choices within SC, supporting highly efficient value-based decision making critical for real-world economic behaviors.

<https://www.nature.com/articles/s41467-021-23747-z>

SAIOA LÓPEZ et al – Evidence of the Interplay of genetics and culture In Ethiopia

The rich linguistic, ethnic and cultural diversity of Ethiopia provides an unprecedented opportunity to understand the level to which cultural factors correlate with—and shape—genetic structure in human populations. Using primarily new genetic variation data covering 1,214 Ethiopians representing 68 different ethnic groups, together with information on individuals' birthplaces, linguistic/religious practices and 31 cultural practices, we disentangle the effects of geographic distance, elevation, and social factors on the genetic structure of Ethiopians today. We provide evidence of associations between social behaviours and genetic differences among present-day peoples. We show that genetic similarity is broadly associated with linguistic affiliation, but also identify pronounced genetic similarity among groups from disparate language classifications that may in part be attributable to recent intermixing. We also illustrate how groups reporting the same culture traits are more genetically similar on average and show evidence of recent intermixing, suggesting that shared cultural traits may promote admixture. In addition to providing insights into the genetic structure and history of Ethiopia, we identify the most important cultural and geographic predictors of genetic differentiation and provide a resource for designing sampling protocols for future genetic studies involving Ethiopians.

<https://www.nature.com/articles/s41467-021-23712-w>

Nature Human Behaviour

PAPERS

DANIEL DUKES et mul with ANTONIO DAMASIO, ERNST FEHR, JOSEPH E. LEDOUX et al – The rise of affectivism

Research over the past decades has demonstrated the explanatory power of emotions, feelings, motivations, moods, and other affective processes when trying to understand and predict how we think and behave. In this consensus article, we ask: has the increasingly recognized impact of affective phenomena ushered in a new era, the era of affectivism?

<https://www.nature.com/articles/s41562-021-01130-8>

Nature Scientific Reports

PAPERS

ROGER M. WHITAKER, GUALTIERO B. COLOMBO & YARROW DUNHAM – The evolution of strongly-held group identities through agent-based cooperation

Identity fusion represents a strongly-held personal identity that significantly overlaps with that of a group, and is the current best explanation as to why individuals become empowered to act with extreme self-sacrifice for a group of non-kin. This is widely seen and documented, yet how identity fusion is promoted by evolution is not well-understood, being seemingly counter to the selfish pursuit of survival. In this paper we extend agent-based modelling to explore how and why identity fusion can establish itself in an unrelated population with no previous shared experiences. Using indirect reciprocity to provide a framework for agent interaction, we enable agents to express their identity fusion towards a group, and observe the effects of potential behaviours that are incentivised by a heightened fusion level. These build on the social psychology literature and involve heightened sensitivity of fused individuals to perceived hypocritical group support from others. We find that simple self-referential judgement and ignorance of perceived hypocrites is sufficient to promote identity fusion and this is easily triggered by a sub-group of the population. Interestingly the self-referential judgement that we impose is an individual-level behaviour with no direct collective benefit shared by the population. The study provides clues, beyond qualitative and observational studies, as to how hypocrisy may have established itself to reinforce the collective benefit of a fused group identity. It also provides an alternative perspective on the controversial proposition of group selection - showing how fluidity between an individual's reputation and that of a group may function and influence selection as a consequence of identity fusion.

<https://www.nature.com/articles/s41598-021-91333-w>

KUNHAO YANG, ITSUKI FUJISAKI & KAZUHIRO UEDA – Cooperation patterns of members in networks during co-creation

Cooperation (i.e., co-creation) has become the principal way of carrying out creative activities in modern society. In co-creation, different participants can play two completely different roles based on two different behaviours: some participants are the originators who generate initial contents, while others are the revisors who provide revisions or coordination. In this study, we investigated different participants' roles (i.e., the originator vs. the revisor) in co-creation and how these roles affected the final cooperation-group outcome. By using cooperation networks to represent cooperative relationships among

participants, we found that peripheral members (i.e., those in the periphery of the cooperation networks) and core members (i.e., those in the centre of the cooperation networks) played the roles of originators and revisors, respectively, mainly affecting the quantity versus the quality of their creative outcomes. These results were robust across the three different datasets and the three different indicators defining core and peripheral members. Previous studies have considered cooperation behaviours to be homogeneous, ignoring that different participants may play different roles in co-creation. This study discusses patterns of cooperation among participants based on a model in which different roles in co-creation are considered. Thus, this research advances the understanding of how co-creation occurs in networks.

<https://www.nature.com/articles/s41598-021-90974-1>

New Scientist

NEWS

Puppies are born with the genetic ability to understand humans

Domestic dogs are born to socialise with people because we bred them that way. Two-month-old puppies can already recognise when people are pointing at objects and will gaze at our faces when they're spoken to – both signs that dogs have an innate capacity to interact with us through body language.

<https://www.newscientist.com/article/2279726-puppies-are-born-with-the-genetic-ability-to-understand-humans/#ixzz6xPhxRrbY>

PLoS One

PAPERS

HELEN SHIYANG LU & TOBEN H. MINTZ – Learning non-adjacent rules and non-adjacent dependencies from human actions in 9-month-old infants

Seven month old infants can learn simple repetition patterns, such as we-fo-we, and generalize the rules to sequences of new syllables, such as ga-ti-ga. However, repetition rule learning in visual sequences seems more challenging, leading some researchers to claim that this type of rule learning applies preferentially to communicative stimuli. Here we demonstrate that 9-month-old infants can learn repetition rules in sequences of non-communicative dynamic human actions. We also show that when primed with these non-adjacent repetition patterns, infants can learn non-adjacent dependencies that involve memorizing the dependencies between specific human actions—patterns that prior research has shown to be difficult for infants in the visual domain and in speech. We discuss several possible mechanisms that account for the apparent advantage stimuli involving human action sequences has over other kinds of stimuli in supporting non-adjacent dependency learning. We also discuss possible implications for theories of language acquisition.

<https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0252959>

VIRIDIANA L. BENITEZ & JENNY R. SAFFRAN – Two for the price of one: Concurrent learning of words and phonotactic regularities from continuous speech

To acquire the words of their language, learners face the challenge of tracking regularities at multiple levels of abstraction from continuous speech. In the current study, we examined adults' ability to track two types of regularities from a continuous artificial speech stream: the individual words in the speech stream (token level information), and a phonotactic pattern shared by a subset of those words (type level information). We additionally manipulated exposure time to the language to examine the relationship between the acquisition of these two regularities. Using a ratings test procedure, we found that adults can extract both the words in the language and their phonotactic patterns from continuous speech in as little as 3.5 minutes of listening time. Results from a 2AFC testing method provide converging evidence that adults rapidly learn both words and their phonotactic patterns. Together, the findings suggest that adults are capable of concurrently tracking regularities at multiple levels of abstraction from brief exposures to a continuous stream of speech.

<https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0253039>

CARLOS G. SANTIAGO-MARRERO et al – A microbotanical and microwear perspective to plant processing activities and foodways at Neolithic Çatalhöyük

Çatalhöyük is a renowned archaeological site in central Anatolia, best known for its Neolithic occupation dated from 7100 to 6000 cal BC. The site received worldwide attention early on for its large size, well-preserved mudbrick architecture, and elaborate wall paintings. Excavations at the site over almost three decades have unearthed rich archaeobotanical remains and a diverse ground stone assemblage produced by what once was a vibrant farming community. The study presented here adds to our understanding of crops and plant processing at Çatalhöyük by integrating phytoliths and starch analyses on grinding implements found at three domestic contexts attributed to the Middle (6700–6500 cal BC) and Late (6500–6300 cal BC) period of occupation. Our results reveal a rich microbotanical assemblage that testifies the use of a wide range of geophytes and wild seasonal resources previously unknown at the site. Moreover, by comparing results from the microbotanical proxies and microscopic wear patterns on artefacts, we are also able to discern various plant processing practices the analysed artefacts were employed for. In sum, this work further expands our understanding of plants and crop processing activities performed by the inhabitants of Neolithic Çatalhöyük.

<https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0252312>

STEFANIE KABOTH-BAHR et al – Paleo-ENSO influence on African environments and early modern humans

In this study, we synthesize terrestrial and marine proxy records, spanning the past 620 ky, to decipher pan-African climate variability and its drivers and potential linkages to hominin evolution. We find a tight correlation between moisture availability across Africa to El Niño Southern Ocean oscillation (ENSO) variability, a manifestation of the Walker Circulation, that was most likely driven by changes in Earth's eccentricity. Our results demonstrate that low-latitude insolation was a prominent driver of pan-African climate change during the Middle to Late Pleistocene. We argue that these low-latitude climate processes governed the dispersion and evolution of vegetation as well as mammals in eastern and western Africa by increasing resource-rich and stable ecotonal settings thought to have been important to early modern humans.

<https://www.pnas.org/content/118/23/e2018277118.abstract>

CHRISTIAN THÖNI & STEFAN VOLK – Converging evidence for greater male variability in time, risk, and social preferences

There is continuing interest in the study of gender differences in economic and social outcomes. An important factor underlying gender differences in outcomes are gender differences in fundamental economic preferences, which are at the core of many differential choices of women and men. We provide strong evidence for greater male variability in preferences. We find that men are more likely to have extreme time, risk, and social preferences, while women are more likely to have moderate preferences. With the focus on mean differences, the current literature underestimates the importance of gender differences and their effects on differential choices and outcomes between women and men.

<https://www.pnas.org/content/118/23/e2026112118.abstract?etoc>

Proceedings of the Royal Society B**A. M. BALCARCEL et al – Intensive human contact correlates with smaller brains: differential brain size reduction in cattle types**

Cattle are one of the most intensively bred domestic animals, providing humans with a multitude of products and uses. Using data from the fossil record, we test if their domestication, as for other taxa, has resulted in a reduction of their brain size. We not only conclude that *Bos taurus* (domestic cattle) have smaller brains than their wild ancestor, *Bos primigenius* (aurochs), but that brain size varies significantly by breed, with some having much smaller brains than others. Differences in husbandry practices between several breed categories align with a range of human engagement, which also aligns with the degree of selection for docility. Sampling 317 domestics from 71 breeds, we investigate if differences in brain size correlate with the intensity of human contact. A clear pattern emerges whereby a brain reduction gradient parallels a gradient in behavioural selection. Bullfighting cattle, which are bred for fighting and aggressive temperament, have much larger brains than dairy breeds, which are intensively selected for docility. Our results add to a fundamental aspect of animal domestication theory: the interplay between basic features of the domestic environment—selection for docility, absence of predators and human provision of resources—seems to explain differences in brain size.

<https://royalsocietypublishing.org/doi/full/10.1098/rspb.2021.0813>

URI HERTZ – Learning how to behave: cognitive learning processes account for asymmetries in adaptation to social norms

Changes to social settings caused by migration, cultural change or pandemics force us to adapt to new social norms. Social norms provide groups of individuals with behavioural prescriptions and therefore can be inferred by observing their behaviour. This work aims to examine how cognitive learning processes affect adaptation and learning of new social norms. Using a multiplayer game, I found that participants initially complied with various social norms exhibited by the behaviour of bot-players. After gaining experience with one norm, adaptation to a new norm was observed in all cases but one, where an active-harm norm was resistant to adaptation. Using computational learning models, I found that active behaviours were learned faster than omissions, and harmful behaviours were more readily attributed to all group members than beneficial behaviours. These results provide a cognitive foundation for learning and adaptation to descriptive norms and can inform future investigations of group-level learning and cross-cultural adaptation.

<https://royalsocietypublishing.org/doi/full/10.1098/rspb.2021.0293>

TIMOTHY M. WARING & ZACHARY T. WOOD – Long-term gene–culture coevolution and the human evolutionary transition

It has been suggested that the human species may be undergoing an evolutionary transition in individuality (ETI). But there is disagreement about how to apply the ETI framework to our species, and whether culture is implicated as either cause or consequence. Long-term gene–culture coevolution (GCC) is also poorly understood. Some have argued that culture steers human evolution, while others proposed that genes hold culture on a leash. We review the literature and evidence on long-term GCC in humans and find a set of common themes. First, culture appears to hold greater adaptive potential than genetic

inheritance and is probably driving human evolution. The evolutionary impact of culture occurs mainly through culturally organized groups, which have come to dominate human affairs in recent millennia. Second, the role of culture appears to be growing, increasingly bypassing genetic evolution and weakening genetic adaptive potential. Taken together, these findings suggest that human long-term GCC is characterized by an evolutionary transition in inheritance (from genes to culture) which entails a transition in individuality (from genetic individual to cultural group). Thus, research on GCC should focus on the possibility of an ongoing transition in the human inheritance system.

<https://royalsocietypublishing.org/doi/abs/10.1098/rspb.2021.0538>

TERRY J. ORD et al – Conspicuous animal signals avoid the cost of predation by being Intermittent or novel: confirmation in the wild using hundreds of robotic prey

Social animals are expected to face a trade-off between producing a signal that is detectable by mates and rivals, but not obvious to predators. This trade-off is fundamental for understanding the design of many animal signals, and is often the lens through which the evolution of alternative communication strategies is viewed. We have a reasonable working knowledge of how conspecifics detect signals under different conditions, but how predators exploit conspicuous communication of prey is complex and hard to predict. We quantified predation on 1566 robotic lizard prey that performed a conspicuous visual display, possessed a conspicuous ornament or remained cryptic. Attacks by free-ranging predators were consistent across two contrasting ecosystems and showed robotic prey that performed a conspicuous display were equally likely to be attacked as those that remained cryptic. Furthermore, predators avoided attacking robotic prey with a fixed, highly visible ornament that was novel at both locations. These data show that it is prey familiarity—not conspicuousness—that determine predation risk. These findings replicated across different predator–prey communities not only reveal how conspicuous signals might evolve in high predation environments, but could help resolve the paradox of aposematism and why some exotic species avoid predation when invading new areas.

<https://royalsocietypublishing.org/doi/abs/10.1098/rspb.2021.0706>

ELIZABETH TINSLEY JOHNSON et al – The Goldilocks effect: female geladas in mid-sized groups have higher fitness

The cost–benefit ratio of group living is thought to vary with group size: individuals in ‘optimally sized’ groups should have higher fitness than individuals in groups that are either too large or too small. However, the relationship between group size and individual fitness has been difficult to establish for long-lived species where the number of groups studied is typically quite low. Here, we present evidence for optimal group size that maximizes female fitness in a population of geladas (*Theropithecus gelada*). Drawing on 14 years of demographic data, we found that females in small groups experienced the highest death rates, while females in mid-sized groups exhibited the highest reproductive performance. This group size effect on female reproductive performance was largely explained by variation in infant mortality (and, in particular, by infanticide from immigrant males) but not by variation in reproductive rates. Taken together, females in mid-sized groups are projected to attain optimal fitness due to conspecific infanticide and, potentially, predation. Our findings provide insight into how and why group size shapes fitness in long-lived species.

<https://royalsocietypublishing.org/doi/full/10.1098/rspb.2021.0820>

JOEL D. IRISH & DONATELLA USAI – The transition from hunting–gathering to agriculture in Nubia: dental evidence for and against selection, population continuity and discontinuity

Some researchers posit population continuity between Late Palaeolithic hunter–gatherers of the late Pleistocene and Holocene agriculturalists from Lower (northern) Nubia, in northeast Africa. Substantial craniodental differences in these time-successive groups are suggested to result from in situ evolution. Specifically, these populations are considered a model example for subsistence-related selection worldwide in the transition to agriculture. Others question continuity, with findings indicating that the largely homogeneous Holocene populations differ significantly from late Pleistocene Lower Nubians. If the latter are representative of the local populace, post-Pleistocene discontinuity is implied. So who was ancestral to the Holocene agriculturalists? Dental morphological analyses of 18 samples (1075 individuals), including one dated to the 12th millennium BCE from Al Khiday, near the Upper Nubian border, may provide an answer. It is the first Late Palaeolithic sample ($n = 55$) recovered within the region in approximately 50 years. Using the Arizona State University Dental Anthropology System to record traits and multivariate statistics to estimate biological affinities, Al Khiday is comparable to several Holocene samples, yet also highly divergent from contemporaneous Lower Nubians. Thus, population continuity is indicated after all, but with late Pleistocene Upper—rather than Lower Nubians as originally suggested—assuming dental traits are adequate proxies for ancient DNA.

<https://royalsocietypublishing.org/doi/abs/10.1098/rspb.2021.0969>

Science

ARTICLES

EMILY UNDERWOOD – A sense of self

Communication between the brain and other organs shapes how we think, remember, and feel.

<https://science.sciencemag.org/content/372/6547/1142>

SUDEEP BHATIA & LISHENG HE – Machine-generated theories of human decision-making

Imagine a choice between two gambles: getting \$100 with a probability of 20% or getting \$50 with a probability of 80%. In 1979, Kahneman and Tversky published prospect theory, a mathematically specified descriptive theory of how people make risky choices such as these. They explained numerous documented violations of expected utility theory, the dominant theory at the time, by using nonlinear psychophysical functions for perceiving underlying probabilities and evaluating resulting payoffs. Prospect theory revolutionized the study of choice behavior, showing that researchers could build formal models of decision-making based on realistic psychological principles. But in the ensuing decades, as dozens of competing theories have been proposed, there has been theoretical fragmentation, redundancy, and stagnation. There is little consensus on the best decision theory or model. On page 1209 of this issue, Peterson et al. demonstrate the power of a more recent approach: Instead of relying on the intuitions and (potentially limited) intellect of human researchers, the task of theory generation can be outsourced to powerful machine-learning algorithms.

<https://science.sciencemag.org/content/372/6547/1150>

PAPERS

JOSHUA C. PETERSON et al – Using large-scale experiments and machine learning to discover theories of human decision-making

Predicting and understanding how people make decisions has been a long-standing goal in many fields, with quantitative models of human decision-making informing research in both the social sciences and engineering. We show how progress toward this goal can be accelerated by using large datasets to power machine-learning algorithms that are constrained to produce interpretable psychological theories. Conducting the largest experiment on risky choice to date and analyzing the results using gradient-based optimization of differentiable decision theories implemented through artificial neural networks, we were able to recapitulate historical discoveries, establish that there is room to improve on existing theories, and discover a new, more accurate model of human decision-making in a form that preserves the insights from centuries of research.

<https://science.sciencemag.org/content/372/6547/1209>

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