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NOTICES

PUBLICATION ALERTS

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

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

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

EAORC NEWS – 1,000th Issue

To mark this achievement, I have included a short history-in-bulletins of EAORC, which can be seen here:

http://martinedwardes.me.uk/eaorc/eaorc_bulletins.html.

I have also revisited the book list, and a new list is available at: http://martinedwardes.me.uk/eaorc/eaorc_books.html. This list is far from exhaustive. If you have any books that you feel should be included, let me know.

If there is anything else you want added to the website, let me know.

ACADEMIA.EDU – Red ochre, body painting and language: interpreting the Blombos ochre

In Rudolf Botha & Chris Knight (eds.), The Cradle of Language. Oxford University Press: Oxford, UK (2009).

IAN WATTS – Red ochre, body painting and language: interpreting the Blombos ochre

Whereas language leaves no material trace, collective ritual—with its formal characteristics of amplified, stereotypical, redundant display—might be expected to leave a loud archeological signature. Does the archeological record of ochre use provide such a signature, and can it indirectly contribute to our understanding of the evolution of language? I begin by highlighting the formal differences between language and ritual as modes of communication. Why, despite having opposed characteristics, is ritual widely regarded (Durkheim 1961; Rappaport 1999; Knight 1999) as establishing the social conditions for language? I then turn to the principal theories and inductive hypotheses that can be brought to bear on the interpretation of early (pre-45ky) ochre use. In addition to being the first major theorist to posit a link between language and ritual, Durkheim drew attention to the role of body-painting in grounding the collective representations central to ritual action. Subsequent theoretical perspectives can be distributed along a spectrum. At one extreme is the innatist view that biology provides sufficient constraint to account for universal features of color labeling (Berlin and Kay 1969). Although this “Basic Colour Term” (BCT) theory is biological, it is not evolutionary and generates no predictions as to when pigments should be expected to emerge. It has, however, been used to predict the order in which different pigments should appear (Hovers et al. 2003). At the other extreme is the “Female Cosmetic Coalitions” (FCC) model (Knight et al. 1995; Power and Aiello 1997; Power this volume). This sets out from premises in human behavioral ecology, prioritizing the role of reproductive strategies in driving early pigment use and generating archeologically testable predictions. Between these two poles is the qualified innatism of Deacon (1997: 119), who treats the evolution of BCTs as subject to constraints from both neurophysiology and “pragmatic constraints of human uses.” Deacon’s model specifies a ritual and a temporal context, but is indistinguishable from BCT theory with respect to the sequence in which terms should arise. Finally, challenging the presumption that ochre was a pigment, several utilitarian hypotheses have been proposed (Klein 1995; Wadley et al. 2004; Wadley 2005a). I evaluate these perspectives and their implications in the light of a survey of early potential pigments and my research on the Blombos Cave ochre assemblage.

https://www.academia.edu/1560509/Red_ochre_body_painting_and_language_interpreting_the_Blombos_ochre

ACADEMIA.EDU – Homo Symbolicus: The dawn of language, imagination and spirituality

In Christopher S. Henshilwood & Francesco D’Errico (eds.), Homo Symbolicus: The dawn of language, imagination and spirituality. John Benjamins Publishing Co: Amsterdam, Netherlands (2011).

CHRISTOPHER S. HENSHILWOOD & FRANCESCO D’ERRICO (eds.) – Homo Symbolicus: The dawn of language, imagination and spirituality

Few of us take the time to reflect on the role that symbols play in our everyday lives, both on a conscious and sub-conscious level, and how these symbols have become an intricate part of our humanity. Symbols can be inscribed on our bodies from birth through to later life, for example, in the form of circumcision, scarification, mutilation and tattoos. We also cover our bodies with symbols each day with the application of make-up, donning of clothing and accessories and the way we dress our hair. The artificial environments in which we live at home and at work are permeated with symbols and we attribute symbolic meanings to the natural world as well, including far away planets, stars and galaxies. A myriad of symbols are created and stored in our minds; we establish dialogues among them within our heads and are able to transmit these representations to others despite the fact they exist only in our imagination.

https://www.academia.edu/8249416/Henshilwood_C_and_d_Errico_F_editors_2011_Homo_symbolicus_The_dawn_of_language_imagination_and_spirituality_Amsterdam_Benjamins

HRAF SELECTED PAPERS – Evidence for Direct Geographic Influences on Linguistic Sounds

In PLoS ONE 8:6, e65275 (2013).

CALEB EVERETT – Evidence for Direct Geographic Influences on Linguistic Sounds: The Case of Ejectives

We present evidence that the geographic context in which a language is spoken may directly impact its phonological form. We examined the geographic coordinates and elevations of 567 language locations represented in a worldwide phonetic database. Languages with phonemic ejective consonants were found to occur closer to inhabitable regions of high elevation, when contrasted to languages without this class of sounds. In addition, the mean and median elevations of the locations of languages with ejectives were found to be comparatively high. The patterns uncovered surface on all major world landmasses, and are not the result of the influence of particular language families. They reflect a significant and positive worldwide correlation between elevation and the likelihood that a language employs ejective phonemes. In addition to documenting this correlation in detail, we offer two plausible motivations for its existence. We suggest that ejective sounds might be facilitated at higher elevations due to the associated decrease in ambient air pressure, which reduces the physiological effort required for the compression of air in the pharyngeal cavity—a unique articulatory component of ejective sounds. In addition, we hypothesize that ejective sounds may help to mitigate rates of water vapor loss through exhaled air. These explications demonstrate how a reduction of ambient air density could promote the usage of ejective phonemes in a

given language. Our results reveal the direct influence of a geographic factor on the basic sound inventories of human languages.

<https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0065275>

PEERJ ARCHIVE – From Lucy to Kadanuumuu: only moderate skeletal dimorphism

In PeerJ 3, e925 (2015).

PHILIP L. RENO & C. OWEN LOVEJOY – From Lucy to Kadanuumuu: balanced analyses of Australopithecus afarensis assemblages confirm only moderate skeletal dimorphism

Sexual dimorphism in body size is often used as a correlate of social and reproductive behavior in *Australopithecus afarensis*. In addition to a number of isolated specimens, the sample for this species includes two small associated skeletons (A.L. 288-1 or “Lucy” and A.L. 128/129) and a geologically contemporaneous death assemblage of several larger individuals (A.L. 333). These have driven both perceptions and quantitative analyses concluding that *Au. afarensis* was markedly dimorphic. The Template Method enables simultaneous evaluation of multiple skeletal sites, thereby greatly expanding sample size, and reveals that *A. afarensis* dimorphism was similar to that of modern humans. A new very large partial skeleton (KSD-VP-1/1 or “Kadanuumuu”) can now also be used, like Lucy, as a template specimen. In addition, the recently developed Geometric Mean Method has been used to argue that *Au. afarensis* was equally or even more dimorphic than gorillas. However, in its previous application Lucy and A.L. 128/129 accounted for 10 of 11 estimates of female size. Here we directly compare the two methods and demonstrate that including multiple measurements from the same partial skeleton that falls at the margin of the species size range dramatically inflates dimorphism estimates. Prevention of the dominance of a single specimen’s contribution to calculations of multiple dimorphism estimates confirms that *Au. afarensis* was only moderately dimorphic.

<https://peerj.com/articles/925/>

PEERJ ARCHIVE – Sex differences in human gregariousness

In PeerJ 3, e974 (2015).

JOYCE F. BENENSON, SANDRA STELLA & ANTHONY FERRANTI – Sex differences in human gregariousness

Research on human sociality rarely includes kinship, social structure, sex, and familiarity, even though these variables influence sociality in non-human primates. However, cross-cultural ethnographic and observational studies with humans indicate that, beginning after age 5 years, males and females form differing social structures with unrelated individuals in a community. Specifically, compared with females, human males exhibit greater tolerance for and form larger, interconnected groups of peers which we term “gregariousness.” To examine sex differences in gregariousness early in life when children first interact with peers without adult supervision, 3- to 6-year-old children were given the choice to enter one of three play areas: an empty one, one with an adult, or one with a familiar, same-sex peer. More males than females initially chose the play area with the same-sex peer, especially after age 5 years. Sex differences in gregariousness with same-sex peers likely constitute one facet of human sociality.

<https://peerj.com/articles/974/>

PEERJ ARCHIVE – Spontaneous cooperation with free partner choice in chimpanzees

In PeerJ 2, e417 (2014).

MALINI SUCHAK et al with FRANS B.M. DE WAAL – Ape duos and trios: spontaneous cooperation with free partner choice in chimpanzees

The purpose of the present study was to push the boundaries of cooperation among captive chimpanzees (*Pan troglodytes*). There has been doubt about the level of cooperation that chimpanzees are able to spontaneously achieve or understand. Would they, without any pre-training or restrictions in partner choice, be able to develop successful joint action? And would they be able to extend cooperation to more than two partners, as they do in nature? Chimpanzees were given a chance to cooperate with multiple partners of their own choosing. All members of the group (N = 11) had simultaneous access to an apparatus that required two (dyadic condition) or three (triadic condition) individuals to pull in a tray baited with food. Without any training, the chimpanzees spontaneously solved the task a total of 3,565 times in both dyadic and triadic combinations. Their success rate and efficiency increased over time, whereas the amount of pulling in the absence of a partner decreased, demonstrating that they had learned the task contingencies. They preferentially approached the apparatus when kin or nonkin of similar rank were present, showing a preference for socially tolerant partners. The forced partner combinations typical of cooperation experiments cannot reveal these abilities, which demonstrate that in the midst of a complex social environment, chimpanzees spontaneously initiate and maintain a high level of cooperative behavior.

<https://peerj.com/articles/417/>

NEWS

SAPIENS – Did Neanderthals Make Art?

Neanderthals generally get a bad rap. They're depicted as unintelligent and less imaginative than humans—not just in popular culture but among researchers who seem, at times, unwilling to accept that these hominins were capable of symbolic thought and creativity. But several sites, including a recently dated bone carving in Germany and a cave painting in

Spain, point to the likelihood that Neanderthals were producing art well before modern humans. So, why do the stereotypes persist?

<https://sapiens.us11.list-manage.com/track/click?u=80f6cf678900daf984bf763b7&id=da22f5ccdd&e=dc0eff6180>

SCIENCE NEWS – Your simple throat is the reason you don't sound like a chimp

Loss of vocal folds enabled a clearer, more stable speech, study argues.

<https://www.science.org/content/article/your-simple-throat-reason-you-don-t-sound-chimp>

SOCIETY FOR SCIENCE – Zoo gorillas use a weird new call that sounds like a sneezy cough

A novel vocalization made by the captive great apes may help them draw human attention.

<http://click.societyforscience->

email.com/?qs=12f25bec726e0e2c583f48de5e9115ea09d641947ec184f207ad74d2e1c8c9006a14d31ebdf5b8cee6608110a9fddf2cc2b89f7dbed6078ab68696c043feca7f

PUBLICATIONS

Biology Letters

PAPERS

SATOSHI HIRATA, KRISTIN HAVERCAMP, YUMI YAMANASHI & TOSHIFUMI UDONO – Hepatitis C virus infection reduces the lifespan of chimpanzees used in biomedical research

Chimpanzees were used in hepatitis research for over three decades with the aim to identify and develop treatments for the virus, a leading cause of chronic liver disease in humans. We used a dataset of 120 chimpanzees housed at a single institution in Japan, 22 of whom became chronically infected with hepatitis C virus (HCV), to examine whether HCV infection results in a reduced lifespan as reported in humans. Survival analysis showed that HCV carriers experienced a higher mortality risk compared with non-carriers. Although no chimpanzee died from hepatic disease, carriers showed higher gamma-glutamyl transpeptidase (γ GTP) levels compared with non-carriers suggesting that HCV infection negatively affected their liver condition. These results provide evidence that special attention is necessary to monitor the long-term condition of ex-biomedical primates.

{Copy available from Kristin Havercamp, have0122@umn.edu.}

<https://royalsocietypublishing.org/doi/abs/10.1098/rsbl.2022.0048>

Current Biology

PAPERS

JAMES R. DAVIES et al – Episodic-like memory in common bottlenose dolphins

Episodic memory involves the conscious recollection of personally experienced events, which has often been argued to be a uniquely human ability. However, evidence for conscious episodic recall in humans is centered around language-based reports. With no agreed upon non-linguistic behavioral markers of consciousness, episodic-like memory therefore represents the behavioral characteristics of human episodic memory, in the absence of evidence for subjective experience during recall. Here, we provide compelling evidence for episodic-like memory in common bottlenose dolphins (*Tursiops truncatus*), based on the incidental encoding and unexpected question paradigm. This methodology aims to capture the incidental encoding characteristic of human episodic memory, in that when we recall an experience, we remember information that was trivial at the time of encoding, but was encoded automatically. We show that dolphins are able to use incidentally encoded spatial (“where”) and social (“who”) information to solve an unexpected memory task, using only a single test trial per test type, which ensured that the dolphins did not have the opportunity to semantically learn “rules” to pass the test. All participating dolphins made correct choices in both the “where” and “who” tests. These results suggest that dolphins are capable of encoding, recalling, and accessing incidental information within remembered events, which is an ability indicative of episodic memory in humans. We argue that the complex socio-ecological background of dolphins may have selected for the ability to recall both spatial and social information in an episodic-like manner.

[https://www.cell.com/current-biology/fulltext/S0960-9822\(22\)00991-5](https://www.cell.com/current-biology/fulltext/S0960-9822(22)00991-5)

Evolutionary Anthropology

COMMENTARIES

MIRJANA ROKSANDIC et al – Homo bodoensis and why it matters

In our original paper, we proposed a new species, *Homo bodoensis*, to replace the problematical taxa *Homo heidelbergensis* and *Homo rhodesiensis*, with the goal of streamlining communication about human evolution in the Chibanian. We received two independent responses. Given their substantial overlap, we provide one combined reply. In this response: (1) we are encouraged that the primary proposal in our paper, to discontinue the use of *H. heidelbergensis* (as a junior synonym to *Homo neanderthalensis*) due to its' nomenclatural problems, is acknowledged. (2) we provide additional clarification about the rules governing taxonomic nomenclature as outlined by the International Code of Zoological Nomenclature and join the growing calls for a revision to these rules. (3) we discuss further why *H. rhodesiensis* should be abandoned, particularly in

light of the current sensitivity to using culturally inappropriate names. We conclude that H. bodoensis is a better solution than the proposed alternatives.

<https://onlinelibrary.wiley.com/doi/abs/10.1002/evan.21954>

Frontiers in Human Neuroscience

PAPERS

TIAN CHRISTINA ZHAO et al with PATRICIA K. KUHL – Language experience during the sensitive period narrows infants' sensory encoding of lexical tones—Music intervention reverses it

The sensitive period for phonetic learning (6~12 months), evidenced by improved native speech processing and declined non-native speech processing, represents an early milestone in language acquisition. We examined the extent that sensory encoding of speech is altered by experience during this period by testing two hypotheses: (1) early sensory encoding of non-native speech declines as infants gain native-language experience, and (2) music intervention reverses this decline. We longitudinally measured the frequency-following response (FFR), a robust indicator of early sensory encoding along the auditory pathway, to a Mandarin lexical tone in 7- and 11-months-old monolingual English-learning infants. Infants received either no intervention (language-experience group) or music intervention (music-intervention group) randomly between FFR recordings. The language-experience group exhibited the expected decline in FFR pitch-tracking accuracy to the Mandarin tone, while the music-intervention group did not. Our results support both hypotheses and demonstrate that both language and music experiences alter infants' speech encoding.

<https://www.frontiersin.org/articles/10.3389/fnhum.2022.941853/full>

Mind & Language

PAPERS

ELMAR UNNSTEINSSON – The social epistemology of introspection

I argue that introspection recruits the same mental mechanism as that which is required for the production of ordinary speech acts. In introspection, in effect, we intentionally tell ourselves that we are in some mental state, aiming thereby to produce belief about that state in ourselves. On one popular view of speech acts, however, this is precisely what speakers do when speaking to others. On this basis, I argue that every bias discovered by social epistemology applies to introspection and other forms of self-directed representation. If so, it becomes unclear in what sense social epistemology is social.

{Cause and effect have been assumed here, not established. I argue that it is not introspection that drives speech acts, it is shared social "epistemology" that drives introspection. If so, it becomes obvious in what sense social "epistemology" is social, although what is epistemological about it is another matter.}

<https://onlinelibrary.wiley.com/doi/full/10.1111/mila.12438>

DEREK E. MONTGOMERY – Language and children's understanding of knowledge: Epistemic talk in early childhood

Research on children's theory of mind often restricts conceptually meaningful talk about knowledge to instances where know references a corresponding mental state. This article offers a reappraisal of that view. From a social-pragmatic perspective, even nonreferential talk is meaningful when appropriately embedded in social routines. A synthesis of corpus data suggests children's early talk about knowledge routinely occurs in question–answer contexts. It is argued that the influence of interrogative contexts is evident in children's over-attributions of knowledge when someone is only guessing. This influence is taken as evidence for the role of linguistic practices in shaping the concept of knowledge.

{... and here's the antidote.}

<https://onlinelibrary.wiley.com/doi/abs/10.1111/mila.12437>

Nature Communications

PAPERS

TAO YAO & WIM VANDUFFEL – Neuronal congruency effects in macaque prefrontal cortex

The interplay between task-relevant and task-irrelevant information may induce conflicts that impair behavioral performance, a.k.a. behavioral congruency effects. The neuronal mechanisms underlying behavioral congruency effects, however, are poorly understood. We recorded single unit activity in monkey prefrontal cortex using a task-switching paradigm and discovered a neuronal congruency effect (NCE) that is carried by target and distractor neurons which process target and distractor-related information, respectively. The former neurons provide more signal, the latter less noise in congruent compared to incongruent conditions, resulting in a better target representation. Such NCE is dominated by the level of congruency, and is not determined by the task rules the subjects used, their reaction times (RT), the length of the delay period, nor the response levels of the neurons. We propose that this NCE can explain behavioral congruency effects in general, as well as previous fMRI and EEG results in various conflict paradigms.

<https://www.nature.com/articles/s41467-022-32382-1>

YUDIAN CAI et al – Time-sensitive prefrontal involvement in associating confidence with task performance illustrates metacognitive introspection in monkeys

Metacognition refers to the ability to be aware of one's own cognition. Ample evidence indicates that metacognition in the human primate is highly dissociable from cognition, specialized across domains, and subserved by distinct neural substrates. However, these aspects remain relatively understudied in macaque monkeys. In the present study, we investigated the functionality of macaque metacognition by combining a confidence proxy, hierarchical Bayesian meta-d' computational modelling, and a single-pulse transcranial magnetic stimulation technique. We found that Brodmann area 46d (BA46d) played a critical role in supporting metacognition independent of task performance; we also found that the critical role of this region in meta-calculation was time-sensitive. Additionally, we report that macaque metacognition is highly domain-specific with respect to memory and perception decisions. These findings carry implications for our understanding of metacognitive introspection within the primate lineage.

<https://www.nature.com/articles/s42003-022-03762-6>

Nature Scientific Data

PAPERS

ANTONÍN ŠKOCH et al – Human brain structural connectivity matrices–ready for modelling

The human brain represents a complex computational system, the function and structure of which may be measured using various neuroimaging techniques focusing on separate properties of the brain tissue and activity. We capture the organization of white matter fibers acquired by diffusion-weighted imaging using probabilistic diffusion tractography. By segmenting the results of tractography into larger anatomical units, it is possible to draw inferences about the structural relationships between these parts of the system. This pipeline results in a structural connectivity matrix, which contains an estimate of connection strength among all regions. However, raw data processing is complex, computationally intensive, and requires expert quality control, which may be discouraging for researchers with less experience in the field. We thus provide brain structural connectivity matrices in a form ready for modelling and analysis and thus usable by a wide community of scientists. The presented dataset contains brain structural connectivity matrices together with the underlying raw diffusion and structural data, as well as basic demographic data of 88 healthy subjects.

<https://www.nature.com/articles/s41597-022-01596-9>

Nature Scientific Reports

PAPERS

PIERLUIGI PIERUCCINI et al – Stratigraphic reassessment of Grotta Romanelli sheds light on Middle-Late Pleistocene palaeoenvironments and human settling in the Mediterranean

During the last century, Grotta Romanelli (Southern Italy) has been a reference site for the European Late Pleistocene stratigraphy, due to its geomorphological setting and archaeological and palaeontological content. The beginning of the sedimentation inside the cave was attributed to the Last Interglacial (MISs 5e) and the oldest unearthed evidence of human occupation, including remains of hearths, was therefore referred to the Middle Palaeolithic. Recent surveys and excavations produced new U/Th dates, palaeoenvironmental interpretation and a litho-, morpho- and chrono-stratigraphical reassessment, placing the oldest human frequentation of the cave between MIS 9 and MIS 7, therefore embracing Glacial and Interglacial cycles. These new data provide evidence that the sea reached the cave during the Middle Pleistocene and human occupation occurred long before MISs 5e and persisted beyond the Pleistocene- Holocene boundary.

<https://www.nature.com/articles/s41598-022-16906-9>

Philosophical Transactions of the Royal Society B

PAPERS

SAM G. B. ROBERTS, ROBIN I. M. DUNBAR & ANNA I. ROBERTS – Communicative roots of complex sociality and cognition: neuropsychological mechanisms underpinning the processing of social information

Primate social bonds are described as being especially complex in their nature, and primates have unusually large brains for their body size compared to other mammals. Communication in primates has attracted considerable attention because of the important role it plays in social bonding. It has been proposed that differentiated social relationships are cognitively complex because primates need to continuously update their knowledge about different types of social bonds. Therefore, primates infer whether an opportunity for social interaction is rewarding (valuable to individual goals) based on their knowledge of the social relationships of the interactants. However, exposure to distraction and stress has detrimental effects on the dopaminergic system, suggesting that understanding social relationships as rewarding is affected in these conditions. This paper proposes that complex communication evolved to augment the capacity to form social relationships during stress through flexibly modifying intentionality in communication (audience checking, response waiting and elaboration). Intentional communication may upregulate dopamine dynamics to allow recognition that an interaction is rewarding during stress. By examining these associations between complexity of communication and stress, we provide new insights into the cognitive skills involved in forming social bonds in primates and the evolution of communication systems in both primates and humans.

<https://royalsocietypublishing.org/doi/abs/10.1098/rstb.2021.0295>

SUSANNE SHULTZ & ROBIN I. M. DUNBAR – Socioecological complexity in primate groups and its cognitive correlates

Characterizing non-human primate social complexity and its cognitive bases has proved challenging. Using principal component analyses, we show that primate social, ecological and reproductive behaviours condense into two components: socioecological complexity (including most social and ecological variables) and reproductive cooperation (comprising mainly a suite of behaviours associated with pairbonded monogamy). We contextualize these results using a meta-analysis of 44 published analyses of primate brain evolution. These studies yield two main consistent results: cognition, sociality and cooperative behaviours are associated with absolute brain volume, neocortex size and neocortex ratio, whereas diet composition and life history are consistently associated with relative brain size. We use a path analysis to evaluate the causal relationships among these variables, demonstrating that social group size is predicted by the neocortex, whereas ecological traits are predicted by the volume of brain structures other than the neocortex. That a range of social and technical behaviours covary, and are correlated with social group size and brain size, suggests that primate cognition has evolved along a continuum resulting in an increasingly flexible, domain-general capacity to solve a range of socioecological challenges culminating in a capacity for, and reliance on, innovation and social information use in the great apes and humans.

<https://royalsocietypublishing.org/doi/full/10.1098/rstb.2021.0296>

CLAUDIA FICHEL & PETER M. KAPPELER – Coevolution of social and communicative complexity in lemurs

The endemic lemurs of Madagascar (Lemuriformes: Primates) exhibit great social and communicative diversity. Given their independent evolutionary history, lemurs provide an excellent opportunity to identify fundamental principles in the coevolution of social and communicative traits. We conducted comparative phylogenetic analyses to examine patterns of interspecific variation among measures of social complexity and repertoire sizes in the vocal, olfactory and visual modality, while controlling for environmental factors such as habitat and number of sympatric species. We also examined potential trade-offs in signal evolution as well as coevolution between body mass or brain size and communicative complexity. Repertoire sizes in the vocal, olfactory and visual modality correlated positively with group size, but not with environmental factors. Evolutionary changes in social complexity presumably antedated corresponding changes in communicative complexity. There was no trade-off in the evolution of signals in different modalities and neither body mass nor brain size correlated with any repertoire size. Hence, communicative complexity coevolved with social complexity across different modalities, possibly to service social relationships flexibly and effectively in pair- and group-living species. Our analyses shed light on the requirements and adaptive possibilities in the coevolution of core elements of social organization and social structure in a basal primate lineage.

<https://royalsocietypublishing.org/doi/abs/10.1098/rstb.2021.0297>

FILIPPO AURELI, COLLEEN M. SCHAFFNER & GABRIELE SCHINO – Variation in communicative complexity in relation to social structure and organization in non-human primates

Communicative complexity relates to social complexity, as individuals in more complex social systems either use more signals or more complex signals than individuals living in less complex ones. Taking the individual group member's perspective, here we examine communicative complexity in relation to social complexity, which arises from two components of social systems: social structure and social organization. We review the concepts of social relationships and social complexity and evaluate their implications for communicative and cognitive complexity using examples from primate species. We focus on spider monkeys (*Ateles geoffroyi*), as their social organization is characterized by flexibility in grouping dynamics and they use a variety of communicative signals. We conclude that no simple relationship exists among social complexity, communicative complexity and cognitive complexity, with social complexity not necessarily implying cognitive complexity, and communicative and cognitive complexity being independently linked to social complexity. To better understand the commonly implied link between social complexity and cognitive complexity it is crucial to recognize the complementary role of communicative complexity. A more elaborated communicative toolkit provides the needed flexibility to deal with dynamic and multifaceted social relationships and high variation in fission–fusion dynamics.

<https://royalsocietypublishing.org/doi/abs/10.1098/rstb.2021.0306>

CATHERINE HOBAITER, KIRSTY E. GRAHAM & RICHARD W. BYRNE – Are ape gestures like words? Outstanding issues in detecting similarities and differences between human language and ape gesture

Opinion piece: ape gestures are made intentionally, inviting parallels with human language; but how similar are their gestures to words? Here we ask this in three ways, considering: flexibility and ambiguity, first- and second-order intentionality, and usage in interactive exchanges. Many gestures are used to achieve several, often very distinct, goals. Such apparent ambiguity in meaning is potentially disruptive for communication, but—as with human language—situational and interpersonal context may largely resolve the intended meaning. Our evidence for first-order intentional use of gesture is abundant, but how might we establish a case for the second-order intentional use critical to language? Finally, words are rarely used in tidy signal–response sequences but are exchanged in back-and-forth interaction. Do gestures share this property? In this paper, we examine these questions and set out ways in which they can be resolved, incorporating data from wild chimpanzees.

<https://royalsocietypublishing.org/doi/full/10.1098/rstb.2021.0301>

FEDERICA AMICI & KATJA LIEBAL – The social dynamics of complex gestural communication in great and lesser apes (Pan troglodytes, Pongo abelii, Symphalangus syndactylus)

Gestures play an essential role in primate communication. However, little is known about how complexity of gestural use (in terms of repertoire size, intentional use, flexibility and use of gestural sequences) relates to individual and dyadic measures of sociality and whether more complex gestural use is more effective in eliciting a response. We observed 19 captive chimpanzees (*Pan troglodytes*), 16 Sumatran orangutans (*Pongo abelii*) and 18 siamangs (*Symphalangus syndactylus*) to assess the complexity and effectiveness of their gestural use. We found that, beyond interspecies variation, the number of gesture types used in a dyad was higher when individuals had stronger social bonds; the probability of accounting for others' attention increased with age, especially for visual gestures; and sequences were more likely used by younger or socially less integrated individuals. In terms of effectiveness, older individuals and those using fewer sequences were more likely to be responded to, while across dyads, the probability of obtaining a response was higher when both individuals accounted for the other's attention and when they used fewer sequences. Overall, this confirms the link between sociality and complex gestural use and suggests that more complex forms of communication, at least in terms of intentional use, may be more effective at achieving communicative goals.

<https://royalsocietypublishing.org/doi/abs/10.1098/rstb.2021.0299>

ANNA ILONA ROBERTS & SAM GEORGE BRADLEY ROBERTS – Intentional gesturing increases social complexity by allowing recipient's understanding of intentions when it is inhibited by stress

Examining the links between intentional communication and social relationships provides insights into the cognitive skills needed to manage a differentiated set of social bonds. Great apes gesture intentionally, but how this intentionality relates to sociality is still unclear. Stress in the form of dominant audience members inhibits understanding of intentions, downgrading cognition to understanding of behaviour, but intentional communication may enable social bonding in stressful conditions. We examined the associations between gestural communication, sociality, stress and the outcome of interactions in wild chimpanzees. Social network size was positively associated with intentional but not non-intentional communication. When a dominant bystander was present with whom the recipient was weakly bonded, and gesturing was non-intentional, recipients produced avoidance response toward signallers to whom they were weakly bonded, indicating understanding of behaviour. Signallers used intentional gestures more frequently to recipients who were stressed, and intentional gestures evoked approach behaviour by the recipients, indicating understanding of intentionality. These results suggest that the presence of dominant bystanders is stressful, inhibiting understanding of intentionality. However, intentional gestures facilitate social bonding by allowing understanding of intentions. The cognitive skills underpinning intentional gestures may therefore play a key role in enabling primates to meet the demands of sociality.

<https://royalsocietypublishing.org/doi/abs/10.1098/rstb.2021.0305>

LJUBICA DAMJANOVIC, SAM G. B. ROBERTS & ANNA ILONA ROBERTS – Language as a tool for social bonding: evidence from wild chimpanzee gestural, vocal and bimodal signals

The evolution of language has fascinated anthropologists, psychologists and biologists for centuries, seeking to infer language origins from the communication of primates, our closest living relatives. Capacity for intentional signalling is a key feature of transition to language in our hominin ancestors, facilitating complex social dynamics in complex social groups. However whether vocal, gestural and bimodal signals are differentiated according to intentional use and hence complex sociality has not been studied, making unclear the modality of language evolution. We addressed this question in wild chimpanzees. We found that larger social network size was associated with a larger network of gestural but not vocal or bimodal signals. Response waiting was more common in association with gestures than vocalizations, but elaborations were more common in vocal than gestural or bimodal signals. Overall, chimpanzees were more likely to manage weak social bonds through vocalizations, whereas strong social bonds were managed through gestures and bimodal signals. However, when social bonds were weak, gestures accompanied by response waiting were more likely to elicit approaches than vocalizations accompanied by elaboration, which elicited avoidance. This suggests that gestures were the primary modality of language evolution and that the use of more sophisticated gestural signalling led to evolution of complex social groups of hominin ancestors.

<https://royalsocietypublishing.org/doi/abs/10.1098/rstb.2021.0311>

MARGARITA BRISEÑO-JARAMILLO et al – Flexible use of contact calls in a species with high fission–fusion dynamics

The 'social complexity hypothesis' posits that complex social systems (which entail high uncertainty) require complex communicative systems (with high vocal flexibility). In species with fission–fusion dynamics, where the fluid composition of temporary subgroups increases the uncertainty with which group members must manage their social relationships, vocal communication must be particularly flexible. This study assessed whether contact call rates vary with caller and audience characteristics in free-living spider monkeys, as well as with fission and fusion events. Adult females and immature individuals called more when in small audience settings, while audience size did not influence adult males. Adults called more when in the presence of the opposite sex, whereas immatures vocalized more in subgroups composed only by females. Females also called more when with their mature sons. We found higher call rates in periods during which fission and fusion events took place than in periods with more stable compositions and when the composition after a fission or fusion event changed from one sex to two sexes. A flexible use of contact calls allows individuals to identify themselves when they join others, particularly if they are members of the opposite sex. This socio-spatial cohesion function reduces the uncertainty about subgroup composition.

PETER R. CLARK et al – Crested macaque facial movements are more intense and stereotyped in potentially risky social interactions

Ambiguity in communicative signals may lead to misunderstandings and thus reduce the effectiveness of communication, especially in unpredictable interactions such as between closely matched rivals or those with a weak social bond. Therefore, signals used in these circumstances should be less ambiguous, more stereotyped and more intense. To test this prediction, we measured facial movements of crested macaques (*Macaca nigra*) during spontaneous social interaction, using the Facial Action Coding System for macaques (MaqFACS). We used linear mixed models to assess whether facial movement intensity and variability varied according to the interaction outcome, the individuals' dominance relationship and their social bond. Movements were least intense and most variable in affiliative contexts, and more intense in interactions between individuals who were closely matched in terms of dominance rating. We found no effect of social bond strength. Our findings provide evidence for a reduction in ambiguity of facial behaviour in risky social situations but do not demonstrate any mitigating effect of social relationship quality. The results indicate that the ability to modify communicative signals may play an important role in navigating complex primate social interactions.

<https://royalsocietypublishing.org/doi/full/10.1098/rstb.2021.0307>

RAPHAELA HEESSEN et al with ZANNA CLAY – Flexible signalling strategies by victims mediate post-conflict interactions in bonobos

Compared to other animals, humans supposedly excel at voluntarily controlling and strategically displaying emotional signals. Yet, new data shows that nonhuman great apes' emotion expressions may also be subject to voluntary control. A key context to further explore this is during post-conflict (PC) periods, where signalling by distressed victims may influence bystander responses, including the offering of consolation. To address this, our study investigates the signalling behaviour of sanctuary-living bonobo victims following aggression and its relation to audience composition and PC interactions. Results show that the production of pedomorphic signals by victims (regardless of age) increased their chances of receiving consolation. In adults, the production of such signals additionally reduced the risk of renewed aggression from opponents. Signal production also increased with audience size, yet strategies differed by age: while immatures reduced signalling in proximity of close-social partners, adults did so especially after receiving consolation. These results suggest that bonobos can flexibly adjust their emotion signalling to influence the outcome of PC events, and that this tendency has a developmental trajectory. Overall, these findings highlight the potential role that flexible emotion communication played in the sociality of our last common ancestor with Pan.

<https://royalsocietypublishing.org/doi/abs/10.1098/rstb.2021.0310>

CLAIRE BARRAULT et al with CATHERINE HOBAITER & KLAUS ZUBERBÜHLER – Thermal imaging reveals social monitoring during social feeding in wild chimpanzees

Understanding the affective lives of animals has been a long-standing challenge in science. Recent technological progress in infrared thermal imaging has enabled researchers to monitor animals' physiological states in real-time when exposed to ecologically relevant situations, such as feeding in the company of others. During social feeding, an individual's physiological states are likely to vary with the nature of the resource and perceptions of competition. Previous findings in chimpanzees have indicated that events perceived as competitive cause decreases in nasal temperatures, whereas the opposite was observed for cooperative interactions. Here, we tested how food resources and audience structure impacted on how social feeding events were perceived by wild chimpanzees. Overall, we found that nasal temperatures were lower when meat was consumed as compared to figs, consistent with the idea that social feeding on more contested resources is perceived as more dangerous and stressful. Nasal temperatures were significantly affected by interactions between food type and audience composition, in particular the number of males, their dominance status, and their social bond status relative to the subject, while no effects for the presence of females were observed. Our findings suggest that male chimpanzees closely monitor and assess their social environment during competitive situations, and that infrared imaging provides an important complement to access psychological processes beyond observable social behaviours.

<https://royalsocietypublishing.org/doi/full/10.1098/rstb.2021.0302>

PLoS One

PAPERS

YEO JIN KIM et al – Effect of right hemispheric damage on structured spoken conversation

Patients with right hemisphere damage (RHD) occasionally complain of difficulties in conversation. A conversation is a type of communication between the speaker and listener, and several elements are required for a conversation to take place. However, it is unclear which of those elements affect communication in patients with RHD. Therefore, we prospectively enrolled 11 patients with right hemispheric damage due to acute cerebral infarction, within 1 week of onset. To evaluate patients' conversational abilities, we used a structured conversation task, namely, the "Hallym Conversation and Pragmatics Protocol". The topics of conversation were "family", "leisure", and "other/friends". The conversation characteristics were classified according to three indices: the "conversational participation index", "topic manipulation index", and "conversational breakdown index". Patients with RHD were compared with 11 age-, sex-, and years of education-matched

healthy adults. The most common site of damage in the patients with RHD was the periventricular white matter. There was no significant difference in performance between the two groups according to the conversation participation index and in the discontinuance rate assessed with the conversational breakdown index. However, patients with RHD showed a lower topic maintenance rate and higher topic initiation and topic switching rates, according to the topic manipulation index. Therefore, we explored the characteristics of impaired conversation abilities in patients with RHD by assessing their ability to converse and manage topics during structured conversations, and found difficulties with pragmatics and communication discourse in these patients.

<https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0271727>

ROBERTA SALMI, MONICA SZCZUPIDER & JODI CARRIGAN – A novel attention-getting vocalization in zoo-housed western gorillas

As a critical aspect of language, vocal learning is extremely rare in animals, having only been described in a few distantly related species. New evidence, however, extends vocal learning/innovation to the primate order, with zoo-housed chimpanzees and orangutans producing novel vocal signals to attract the attention of familiar human caregivers. If the ability to produce novel vocalizations as a means of navigating evolutionarily novel circumstances spans the Hominidae family, then we can expect to find evidence for it in the family's third genus, Gorilla. To explore this possibility, we conduct an experiment with eight gorillas from Zoo Atlanta to examine whether they use species-atypical vocalizations to get the attention of humans across three different conditions: just a human, just food, or a human holding food. Additionally, we survey gorilla keepers from other AZA-member zoos to compile a list of common attention-getting signals used by the gorillas in their care. Our experiment results indicated that Zoo Atlanta gorillas vocalized most often during the human-food condition, with the most frequently used vocal signal being a species-atypical sound somewhere between a sneeze and a cough ($n = 28$). This previously undescribed sound is acoustically different from other calls commonly produced during feeding (i.e., single grunts and food-associated calls). Our survey and analyses of recordings from other zoos confirmed that this novel attention-getting sound is not unique to Zoo Atlanta, although further work should be done to better determine the extent and patterns of transmission and/or potential independent innovation of this sound across captive gorilla populations. These findings represent one of the few pieces of evidence of spontaneous novel vocal production in non-enculturated individuals of this species, supporting the inclusion of great apes as moderate vocal learners and perhaps demonstrating an evolutionary function to a flexible vocal repertoire.

<https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0271871>

JOSHUA EMMITT et al – Machine learning for stone artifact identification: Distinguishing worked stone artifacts from natural clasts using deep neural networks

Stone artifacts are often the most abundant class of objects found in archaeological sites but their consistent identification is limited by the number of experienced analysts available. We report a machine learning based technology for stone artifact identification as part of a solution to the lack of such experts directed at distinguishing worked stone objects from naturally occurring lithic clasts. Three case study locations from Egypt, Australia, and New Zealand provide a data set of 6769 2D images, 3868 flaked artifact and 2901 rock images used to train and test a machine learning model based on an openly available PyTorch implementation of Faster R-CNN ResNet 50. Results indicate 100% agreement between the model and original human derived classifications, a better performance than the results achieved independently by two human analysts who reassessed the 2D images available to the machine learning model. Machine learning neural networks provide the potential to consistently assess the composition of large archaeological assemblages composed of objects modified in a variety of ways.

<https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0271582>

DANNY ROSENBERG et al – Long-distance trade in the Middle Chalcolithic of the southern Levant: The case of the olivine beads from Tel Tsaf, Jordan Valley, Israel

Eight olivine beads found at the Middle Chalcolithic site of Tel Tsaf (ca. 5,200–4,700 cal. BC), Jordan Valley, Israel, underscore a new facet of interregional exchange for this period. The current paper presents the olivine beads assemblage, its morphometric and technological characteristics, and chemical composition. The results of the chemical analysis suggest that all eight beads derive from the same source. By means of comparison with the chemical characteristics of known olivine sources, we argue for a northeastern African–western Arabian provenience and cautiously suggest Ethiopia as a probable origin. Finally, we discuss the significance of the assemblage, its possible origin, and the mechanisms that may have brought the beads to the site.

<https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0271547>

Proceedings of the Royal Society B

PAPERS

MIRIAM BRANDT et al – Promoting scientific literacy in evolution through citizen science

Evolutionary understanding is central to biology. It is also an essential prerequisite to understanding and making informed decisions about societal issues such as climate change. Yet, evolution is generally poorly understood by civil society and many misconceptions exist. Citizen science, which has been increasing in popularity as a means to gather new data and promote

scientific literacy, is one strategy through which people could learn about evolution. However, despite the potential for citizen science to promote evolution learning opportunities, very few projects implement them. In this paper, we make the case for incorporating evolution education into citizen science, define key learning goals, and suggest opportunities for designing and evaluating projects in order to promote scientific literacy in evolution.

<https://royalsocietypublishing.org/doi/full/10.1098/rspb.2022.1077>

OLOF LEIMAR et al – Behavioural specialization and learning in social networks

Interactions in social groups can promote behavioural specialization. One way this can happen is when individuals engage in activities with two behavioural options and learn which option to choose. We analyse interactions in groups where individuals learn from playing games with two actions and negatively frequency-dependent payoffs, such as producer–scrounger, caller–satellite, or hawk–dove games. Group members are placed in social networks, characterized by the group size and the number of neighbours to interact with, ranging from just a few neighbours to interactions between all group members. The networks we analyse include ring lattices and the much-studied small-world networks. By implementing two basic reinforcement-learning approaches, action–value learning and actor–critic learning, in different games, we find that individuals often show behavioural specialization. Specialization develops more rapidly when there are few neighbours in a network and when learning rates are high. There can be learned specialization also with many neighbours, but we show that, for action–value learning, behavioural consistency over time is higher with a smaller number of neighbours. We conclude that frequency-dependent competition for resources is a main driver of specialization. We discuss our theoretical results in relation to experimental and field observations of behavioural specialization in social situations.

<https://royalsocietypublishing.org/doi/full/10.1098/rspb.2022.0954>

MARCUS FREAN & STEPHEN MARSLAND – Holds enable one-shot reciprocal exchange

Strangers routinely cooperate and exchange goods without any knowledge of one another in one-off encounters without recourse to a third party, an interaction that is fundamental to most human societies. However, this act of reciprocal exchange entails the risk of the other agent defecting with both goods. We examine the choreography for safe exchange between strangers, and identify the minimum requirement, which is a shared hold, either of an object, or the other party; we show that competing agents will settle on exchange as a local optimum in the space of payoffs. Truly safe exchanges are rarely seen in practice, even though unsafe exchange could mean that risk-averse agents might avoid such interactions. We show that an ‘implicit’ hold, whereby an actor believes that they could establish a hold if the other agent looked to be defecting, is sufficient to enable the simple swaps that are the hallmark of human interactions and presumably provide an acceptable trade-off between risk and convenience. We explicitly consider the particular case of purchasing, where money is one of the goods.

<https://royalsocietypublishing.org/doi/abs/10.1098/rspb.2022.0723>

MICHAEL CHIMENTO et al – Cultural diffusion dynamics depend on behavioural production rules

Culture is an outcome of both the acquisition of knowledge about behaviour through social transmission, and its subsequent production by individuals. Acquisition and production are often discussed or modelled interchangeably, yet to date no study has explored the consequences of their interaction for cultural diffusions. We present a generative model that integrates the two, and ask how variation in production rules might influence diffusion dynamics. Agents make behavioural choices that change as they learn from their productions. Their repertoires may also change, and the acquisition of behaviour is conditioned on its frequency. We analyse the diffusion of a novel behaviour through social networks, yielding generalizable predictions of how individual-level behavioural production rules influence population-level diffusion dynamics. We then investigate how linking acquisition and production might affect the performance of two commonly used inferential models for social learning; network-based diffusion analysis, and experience-weighted attraction models. We find that the influence that production rules have on diffusion dynamics has consequences for how inferential methods are applied to empirical data. Our model illuminates the differences between social learning and social influence, demonstrates the overlooked role of reinforcement learning in cultural diffusions, and allows for clearer discussions about social learning strategies.

<https://royalsocietypublishing.org/doi/full/10.1098/rspb.2022.1001>

COLIN J. PALMER & COLIN W. G. CLIFFORD – Spatial selectivity in adaptation to gaze direction

A person's focus of attention is conveyed by the direction of their eyes and face, providing a simple visual cue fundamental to social interaction. A growing body of research examines the visual mechanisms that encode the direction of another person's gaze as we observe them. Here we investigate the spatial receptive field properties of these mechanisms, by testing the spatial selectivity of sensory adaptation to gaze direction. Human observers were adapted to faces with averted gaze presented in one visual hemifield, then tested in their perception of gaze direction for faces presented in the same or opposite hemifield. Adaptation caused strong, repulsive perceptual aftereffects, but only for faces presented in the same hemifield as the adapter. This occurred even though adapting and test stimuli were in the same external location across saccades. Hence, there was clear evidence for retinotopic adaptation and a relative lack of either spatiotopic or spatially invariant adaptation. These results indicate that adaptable representations of gaze direction in the human visual system have retinotopic spatial receptive fields. This strategy of coding others' direction of gaze with positional specificity relative to one's own eye position may facilitate key functions of gaze perception, such as socially cued shifts in visual attention.

Science

ARTICLES

HAROLD GOUZOULES – When less is more in the evolution of language

Did loss of vocal fold membranes typical of nonhuman primates enable human speech?

<https://www.science.org/doi/10.1126/science.add6331>

PAPERS

TAKESHI NISHIMURA et al with W. TECUMSEH FITCH – Evolutionary loss of complexity in human vocal anatomy as an adaptation for speech

Human speech production obeys the same acoustic principles as vocal production in other animals but has distinctive features: A stable vocal source is filtered by rapidly changing formant frequencies. To understand speech evolution, we examined a wide range of primates, combining observations of phonation with mathematical modeling. We found that source stability relies upon simplifications in laryngeal anatomy, specifically the loss of air sacs and vocal membranes. We conclude that the evolutionary loss of vocal membranes allows human speech to mostly avoid the spontaneous nonlinear phenomena and acoustic chaos common in other primate vocalizations. This loss allows our larynx to produce stable, harmonic-rich phonation, ideally highlighting formant changes that convey most phonetic information. Paradoxically, the increased complexity of human spoken language thus followed simplification of our laryngeal anatomy.

<https://www.science.org/doi/10.1126/science.abm1574>

Science Advances

PAPERS

ALEJANDRO ESTRADA et al – Global importance of Indigenous Peoples, their lands, and knowledge systems for saving the world's primates from extinction

Primates, represented by 521 species, are distributed across 91 countries primarily in the Neotropic, Afrotropic, and Indo-Malayan realms. Primates inhabit a wide range of habitats and play critical roles in sustaining healthy ecosystems that benefit human and nonhuman communities. Approximately 68% of primate species are threatened with extinction because of global pressures to convert their habitats for agricultural production and the extraction of natural resources. Here, we review the scientific literature and conduct a spatial analysis to assess the significance of Indigenous Peoples' lands in safeguarding primate biodiversity. We found that Indigenous Peoples' lands account for 30% of the primate range, and 71% of primate species inhabit these lands. As their range on these lands increases, primate species are less likely to be classified as threatened or have declining populations. Safeguarding Indigenous Peoples' lands, languages, and cultures represents our greatest chance to prevent the extinction of the world's primates.

<https://www.science.org/doi/full/10.1126/sciadv.abn2927>

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