EAORC BULLETIN 956 – 10 October 2021

CONTENTS

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 – The Geometry and Symbolic Architecture of Basque Stone Octagons

ROSLYN M. FRANK – The Geometry and Symbolic Architecture of Basque Stone Octagons: The Pastoral Sarobe

In the Basque Country (Euskal Herria) stone octagons, known as sarobe in Basque (Euskara), were built using specified dimensions, based on a "geometric foot" standard (0.278m). This standard was incorporated into a septarian system of measurements, e.g., rods of 7 g.ft. in length, called gizabete, and poles of 21 g.ft. The dimensions of the stone octagons suggest that ritual importance was attributed to their geometric design, to the size of their perimeter and their orientation. According to local tradition and Basque legal codes, the eight stones on the perimeter had to be oriented to the cardinal and inter-cardinal directions. Field work indicates that over 500octagons may have existed inside Euskal Herria at some point in the past. In the study region the stone octagons are linked specifically to localized transhumant practices of Basque-speaking

shepherds, well documented socio-cultural practices that appear to date back to the Late Bronze Age if not earlier. Inferential evidence suggests that the cognitive origins of their architectural design might reach back to the Neolithic and be related to similar pastoral traditions as well as septarian units of measure encountered along the Atlantic façade. Thus far, even though several of the sites have been Carbon-14 dated, the absolute terminus ante quem non of the design of the octagons is still uncertain.
https://www.academia.edu/45615097/The_Geometry_and_Symbolic_Architecture_of_Basque_Stone_Octagons_The_Pastoral_Sarobe

OTHER PUBLICATIONS – Deep learning-based speaker separation and dereverberation

The Journal of the Acoustical Society of America 150:2526 (2021)

ERIC W. HEALY et al – Deep learning-based speaker separation and dereverberation can generalize across different languages to improve intelligibility

The practical efficacy of deep learning-based speaker separation and/or dereverberation hinges on its ability to generalize to conditions not employed during neural network training. The current study was designed to assess the ability to generalize across extremely different training versus test environments. Training and testing were performed using different languages having no known common ancestry and correspondingly large linguistic differences—English for training and Mandarin for testing. Additional generalizations included untrained speech corpus/recording channel, target-to-interferer energy ratios, reverberation room impulse responses, and test talkers. A deep computational auditory scene analysis algorithm, employing complex time-frequency masking to estimate both magnitude and phase, was used to segregate two concurrent talkers and simultaneously remove large amounts of room reverberation to increase the intelligibility of a target talker. Significant intelligibility improvements were observed for the normal-hearing listeners in every condition. Benefit averaged 43.5% points across conditions and was comparable to that obtained when training and testing were performed both in English. Benefit is projected to be considerably larger for individuals with hearing impairment. It is concluded that a properly designed and trained deep speaker separation/dereverberation network can be capable of generalization across vastly different acoustic environments that include different languages.
https://asa.scitation.org/doi/10.1121/10.0006565

FUNDING ALERT – Progress Meetings in Evolutionary Biology

We are excited to announce the next round of this initiative by the European Society of Evolutionary Biology (ESEB), in partnership with the Journal of Evolutionary Biology (/JEB/).
We invite applications for funding to support focussed conference or workshops on a topical issue where rapid progress is currently being made in understanding Evolutionary Biology. ESEB will supply funds up to €15,000 to assist with workshop planning (venue, travel or attendance support). We encourage proposals on any topic. We expect these meetings to bring together a range of researchers focussed around a topic for a "state of the art" conference, ideally proposing a new synthesis, viewpoint or technical or analytical breakthrough facilitating new avenues of research. Attendees would represent researchers from all career stages and must accord with our Equal Opportunities guidelines. Attendance should be open to all, but ESEB members should be prioritised. Typically, meetings would last 2-3 days.
An important condition of the funding is that the meeting has a clear objective to produce either a Special Issue or Target Review for /JEB/. Organisers should aim to have the manuscript(s) produced within 4 months of the end of the meeting, and should detail how this will be done in their applications. In the case of a Special Issue, the organisers of the meeting or appropriate nominees may serve as Guest Editors (where appropriate), handling the peer review process for manuscripts arising from the meeting with assistance from /JEB/ editors.
There will be one call for applications per year, with this year's deadline being DECEMBER 17, 2021. Applicants should be members of ESEB or our sister society, the Society for the Study of Evolution. There is no official application form. The application document should include

- The title of the conference and why this is suitable for a Progress Meeting.
- Names and addresses of the organisers, with short (1 page each) CVs
- List of keynote speakers, with justification (potentially key recent references). They should have agreed in principle to participate
- A 2-page description of the aims and potential scope of the conference
- Conference venue details
- Methods of selecting participants
- Publication plans

Queries and applications should be submitted to the ESEB Office (office@eseb.org) by the deadline. The successful application will be chosen by an ESEB committee.

FUNDING ALERT – NSF-funded Research Experiences

The University of Iowa is offering ten NSF-funded Research Experiences for Undergraduates (REU) opportunities during the summer of 2022. Research projects span a range of topics, including evolution of behavior, origin of species, cancer evolution, evolution of sex, evo-devo, evolution of pathogens, and paleontology. REU students work on one project, but

through interactions with their cohort ultimately receive a broad exposure to evolutionary science. Students in the program: receive training in research best practices, participate in career workshops, create a digital exhibit based on their research for the University of Iowa Natural History Museum, and make formal research presentations based on their work. Free housing, a meal allowance, a $6000 stipend, and a travel allowance will be provided to all participants. Students from groups historically excluded from science because of their ethnicity or race and/or who have limited research opportunities at their home institution are especially encouraged to apply.
The REU program website and application form can be found here: https://biology.uiowa.edu/reu
Questions? Contact Andrew Forbes (andrew-forbes@uiowa.edu) or Maurine Neiman (maurine-neiman@uiowa.edu).
Application Deadline: February 1, 2022.

NEWS

SCIENCE DAILY – Late persistence of human ancestors at the margins of the monsoon in India

New dating of an archaeological site in the Thar Desert to 177,000 years ago shows the use of stone handaxes persisted for over 1 million years in India, and may have endured until the arrival of Homo sapiens.
https://www.sciencedaily.com/releases/2021/10/211005101847.htm

SCIENCE DAILY – Honeybees' waggle dance reveals bees in rural areas travel farther for food

By decoding honeybees' waggle dances, which tell other bees where to find food, researchers have found that bees in agricultural areas travel farther for food than those in urban areas.
https://www.sciencedaily.com/releases/2021/10/211006080552.htm

THE CONVERSATION – Would we still see ourselves as 'human' if other hominin species weren't extinct?

What looks like a bright, sharp dividing line between humans and other animals is really an artefact of extinction.
https://theconversationuk.cmail20.com/t/r-l-tryuiuiy-khhlilahh-b/

PUBLICATIONS

Australian Journal of Linguistics

PAPERS

YUTIN QIN – Putting time in context: There is no causal link between temporal focus and implicit space–time mappings on the front–back axis

The temporal-focus hypothesis (TFH) states that people's mental conceptualization of past or future as in front is determined by their cultural attitudes towards time. Whereas previous studies have found that personally and contextually-relevant factors (e.g. studying and visiting experience) can cause people's attentional focus to shift, and their implicit space–time mappings to change accordingly, the current study instead shows that Chinese participants adhered to a future-in-front mapping and maintained a future-focus irrespective of experimentally-induced or naturally-occurring contextual stimuli and that temporal focus was not a reliable predictor of temporal representation. These findings call into question the generalizability of the TFH and the inherent reliability of its assessment instruments, thus arguing that further replication studies need to be conducted before concluding that implicit space–time mappings are a function of cultural attitudes towards time.
https://www.tandfonline.com/doi/abs/10.1080/07268602.2021.1920885

Language

PAPERS

JOHN BEAVERS et al – States and changes of state: A crosslinguistic study of the roots of verbal meaning

What are the basic building blocks of verb meanings, how are they composed into more complex meanings, and how does this explain the grammatical properties of verbs and their relationships to other words with related meanings? These questions are fundamental to the study of verb meaning, and some of the most fruitful attempts to answer them have come from event-structural theories, wherein verb meanings are assumed to be decomposed into an event template, which captures the verb's broad temporal and causal contours, and an idiosyncratic root shared across templates, which describes specific actions and states for a given verb. An open question is what the division of labor is between the template and the root in a given verb's event template, and whether their meanings are bifurcated: are broad eventive lexical entailments introduced only by the templates, never the idiosyncratic roots? Since event templates and not roots are the primary semantic correlates of a verb's grammatical properties, bifurcation would make strong predictions about the correlation of a verb's broad temporal and causal semantics and its syntax and morphology. We argue against this bifurcation by comparing translation equivalents of Levin's (1993) non-deadjectival vs. deadjectival change-of-state verb roots in English (e.g. result vs. property concept roots) across languages. A broad-scale typological study reveals that property concept roots tend to have unmarked stative forms and marked verbal forms, while result roots have the opposite pattern. Semantic studies of several languages confirm that terms built on result roots always entail change, while terms based on property concept roots do not.

This supports a theory wherein result roots entail change independent of the template, contra bifurcation. This supports a more complex, albeit still principled, theory of possible event-structural meaning and its grammatical correlates, one that takes subclasses of roots into account, while showing the value of this type of crosslinguistic methodology for testing the predictions of event-structural approaches.
https://muse.jhu.edu/article/806345

GERD CARLING & CHUNDRA CATHCART – Reconstructing the evolution of Indo-European grammar
This study uses phylogenetic methods adopted from computational biology in order to reconstruct features of Proto-Indo-European morphosyntax. We estimate the probability of the presence of typological features in Proto-Indo-European on the assumption that these features change according to a stochastic process governed by evolutionary transition rates between them. We compare these probabilities to previous reconstructions of Proto-Indo-European morphosyntax, which use either the comparative-historical method or implicational typology. We find that our reconstruction yields strong support for a canonical model (synthetic, nominative-accusative, head-final) of the protolanguage and low support for any alternative model. Observing the evolutionary dynamics of features in our data set, we conclude that morphological features have slower rates of change, whereas syntactic traits change faster. Additionally, more frequent, unmarked traits in grammatical hierarchies have slower change rates when compared to less frequent, marked ones, which indicates that universal patterns of economy and frequency impact language change within the family.
https://muse.jhu.edu/article/806348

Mind & Language

PAPERS

ANNA DROŻDŻOWICZ – Experiences of linguistic understanding as epistemic feelings
Language understanding comes with a particular kind of phenomenology. It is often observed that when listening to utterances in a familiar language, competent language users can have experiences of understanding the meanings of these utterances. The nature of such experiences is a much debated topic. In this paper, I develop a new proposal according to which experiences of understanding are a particular kind of epistemic feelings of fluency that result from evaluative monitoring processes. The perceptual experience that accompanies linguistic comprehension results from the deployment of early stage auditory processes of speech perception that lead to the recognition of words.
https://onlinelibrary.wiley.com/doi/abs/10.1111/mila.12346

Nature

ARTICLES

JENELLE L. WALLACE & ALEX A. POLLEN – The genetic symphony underlying evolution of the brain's prefrontal cortex
The prefrontal cortex of the human brain is larger than that of other species. Comparisons of mouse, macaque and human brains uncover some of the genetic and molecular factors behind these differences.
https://www.nature.com/articles/d41586-021-02460-3

ALISON ABBOTT – How the world's biggest brain maps could transform neuroscience
Scientists around the world are working together to catalogue and map cells in the brain. What have these huge projects revealed about how it works?
https://www.nature.com/articles/d41586-021-02661-w

PAPERS

MIKIHITO SHIBATA et al – Hominini-specific regulation of CBLN2 increases prefrontal spinogenesis
The similarities and differences between nervous systems of various species result from developmental constraints and specific adaptations. Comparative analyses of the prefrontal cortex (PFC), a cerebral cortex region involved in higher-order cognition and complex social behaviours, have identified true and potential human-specific structural and molecular specializations, such as an exaggerated PFC-enriched anterior–posterior dendritic spine density gradient. These changes are probably mediated by divergence in spatiotemporal gene regulation, which is particularly prominent in the midfetal human cortex. Here we analysed human and macaque transcriptomic data and identified a transient PFC-enriched and laminar-specific upregulation of cerebellin 2 (CBLN2), a neurexin (NRXN) and glutamate receptor-δ GRID/GluD-associated synaptic organizer, during midfetal development that coincided with the initiation of synaptogenesis. Moreover, we found that species differences in level of expression and laminar distribution of CBLN2 are, at least in part, due to Hominini-specific deletions containing SOX5-binding sites within a retinoic acid-responsive CBLN2 enhancer. In situ genetic humanization of the mouse Cbln2 enhancer drives increased and ectopic laminar Cbln2 expression and promotes PFC dendritic spine formation. These findings suggest a genetic and molecular basis for the anterior-posterior cortical gradient and disproportionate increase in the Hominini PFC of dendritic spines and a developmental mechanism that may link dysfunction of the NRXN–GRID–CBLN2 complex to the pathogenesis of neuropsychiatric disorders.
https://www.nature.com/articles/s41586-021-03952-y

TRYGVE E. BAKKEN et mul – Comparative cellular analysis of motor cortex in human, marmoset and mouse
The primary motor cortex (M1) is essential for voluntary fine-motor control and is functionally conserved across mammals1. Here, using high-throughput transcriptomic and epigenomic profiling of more than 450,000 single nuclei in humans, marmoset monkeys and mice, we demonstrate a broadly conserved cellular makeup of this region, with similarities that mirror evolutionary distance and are consistent between the transcriptome and epigenome. The core conserved molecular identities of neuronal and non-neuronal cell types allow us to generate a cross-species consensus classification of cell types, and to infer conserved properties of cell types across species. Despite the overall conservation, however, many species-dependent specializations are apparent, including differences in cell-type proportions, gene expression, DNA methylation and chromatin state. Few cell-type marker genes are conserved across species, revealing a short list of candidate genes and regulatory mechanisms that are responsible for conserved features of homologous cell types, such as the GABAergic chandelier cells. This consensus transcriptomic classification allows us to use patch–seq (a combination of whole-cell patch-clamp recordings, RNA sequencing and morphological characterization) to identify corticospinal Betz cells from layer 5 in non-human primates and humans, and to characterize their highly specialized physiology and anatomy. These findings highlight the robust molecular underpinnings of cell-type diversity in M1 across mammals, and point to the genes and regulatory pathways responsible for the functional identity of cell types and their species-specific adaptations.
https://www.nature.com/articles/s41586-021-03465-8

BRAIN INITIATIVE CELL CENSUS NETWORK (BICCN) – A multimodal cell census and atlas of the mammalian primary motor cortex
Here we report the generation of a multimodal cell census and atlas of the mammalian primary motor cortex as the initial product of the BRAIN Initiative Cell Census Network (BICCN). This was achieved by coordinated large-scale analyses of single-cell transcriptomes, chromatin accessibility, DNA methylomes, spatially resolved single-cell transcriptomes, morphological and electrophysiological properties and cellular resolution input–output mapping, integrated through cross-modal computational analysis. Our results advance the collective knowledge and understanding of brain cell-type organization. First, our study reveals a unified molecular genetic landscape of cortical cell types that integrates their transcriptome, open chromatin and DNA methylation maps. Second, cross-species analysis achieves a consensus taxonomy of transcriptomic types and their hierarchical organization that is conserved from mouse to marmoset and human. Third, in situ single-cell transcriptomics provides a spatially resolved cell-type atlas of the motor cortex. Fourth, cross-modal analysis provides compelling evidence for the transcriptomic, epigenomic and gene regulatory basis of neuronal phenotypes such as their physiological and anatomical properties, demonstrating the biological validity and genomic underpinning of neuron types. We further present an extensive genetic toolset for targeting glutamatergic neuron types towards linking their molecular and developmental identity to their circuit function. Together, our results establish a unifying and mechanistic framework of neuronal cell-type organization that integrates multi-layered molecular genetic and spatial information with multi-faceted phenotypic properties.
https://www.nature.com/articles/s41586-021-03950-0

JOSEPH R. MCCONNELL et al – Hemispheric black carbon increase after the 13th-century Māori arrival in New Zealand
New Zealand was among the last habitable places on earth to be colonized by humans1. Charcoal records indicate that wildfires were rare prior to colonization and widespread following the 13th- to 14th-century Māori settlement, but the precise timing and magnitude of associated biomass-burning emissions are unknown, as are effects on light-absorbing black carbon aerosol concentrations over the pristine Southern Ocean and Antarctica. Here we used an array of well-dated Antarctic ice-core records to show that while black carbon deposition rates were stable over continental Antarctica during the past two millennia, they were approximately threefold higher over the northern Antarctic Peninsula during the past 700 years. Aerosol modelling demonstrates that the observed deposition could result only from increased emissions poleward of 40° S—implicating fires in Tasmania, New Zealand and Patagonia—but only New Zealand palaeofire records indicate coincident increases. Rapid deposition increases started in 1297 (±30 s.d.) in the northern Antarctic Peninsula, consistent with the late 13th-century Māori settlement and New Zealand black carbon emissions of 36 (±21 2 s.d.) Gg y−1 during peak deposition in the 16th century. While charcoal and pollen records suggest earlier, climate-modulated burning in Tasmania and southern Patagonia, deposition in Antarctica shows that black carbon emissions from burning in New Zealand dwarfed other preindustrial emissions in these regions during the past 2,000 years, providing clear evidence of large-scale environmental effects associated with early human activities across the remote Southern Hemisphere.
https://www.nature.com/articles/s41586-021-03858-9

Nature Communications

PAPERS

AGRIM GUPTA et al – Embodied intelligence via learning and evolution
The intertwined processes of learning and evolution in complex environmental niches have resulted in a remarkable diversity of morphological forms. Moreover, many aspects of animal intelligence are deeply embodied in these evolved morphologies. However, the principles governing relations between environmental complexity, evolved morphology, and the learnability of intelligent control, remain elusive, because performing large-scale in silico experiments on evolution and learning is challenging. Here, we introduce Deep Evolutionary Reinforcement Learning (DERL): a computational framework which can

evolve diverse agent morphologies to learn challenging locomotion and manipulation tasks in complex environments. Leveraging DERL we demonstrate several relations between environmental complexity, morphological intelligence and the learnability of control. First, environmental complexity fosters the evolution of morphological intelligence as quantified by the ability of a morphology to facilitate the learning of novel tasks. Second, we demonstrate a morphological Baldwin effect i.e., in our simulations evolution rapidly selects morphologies that learn faster, thereby enabling behaviors learned late in the lifetime of early ancestors to be expressed early in the descendants lifetime. Third, we suggest a mechanistic basis for the above relationships through the evolution of morphologies that are more physically stable and energy efficient, and can therefore facilitate learning and control.
https://www.nature.com/articles/s41467-021-25874-z

MOISÈS COLL MACIÀ et al – Different historical generation intervals in human populations inferred from Neanderthal fragment lengths and mutation signatures
After the main Out-of-Africa event, humans interbred with Neanderthals leaving 1–2% of Neanderthal DNA scattered in small fragments in all non-African genomes today. Here we investigate what can be learned about human demographic processes from the size distribution of these fragments. We observe differences in fragment length across Eurasia with 12% longer fragments in East Asians than West Eurasians. Comparisons between extant populations with ancient samples show that these differences are caused by different rates of decay in length by recombination since the Neanderthal admixture. In concordance, we observe a strong correlation between the average fragment length and the mutation accumulation, similar to what is expected by changing the ages at reproduction as estimated from trio studies. Altogether, our results suggest differences in the generation interval across Eurasia, by up 10–20%, over the past 40,000 years. We use sex-specific mutation signatures to infer whether these changes were driven by shifts in either male or female age at reproduction, or both. We also find that previously reported variation in the mutational spectrum may be largely explained by changes to the generation interval. We conclude that Neanderthal fragment lengths provide unique insight into differences among human populations over recent history.
https://www.nature.com/articles/s41467-021-25524-4

Nature Scientific Reports

PAPERS

IRIS BERENT et al – Infants differentially extract rules from language
Infants readily extract linguistic rules from speech. Here, we ask whether this advantage extends to linguistic stimuli that do not rely on the spoken modality. To address this question, we first examine whether infants can differentially learn rules from linguistic signs. We show that, despite having no previous experience with a sign language, six-month-old infants can extract the reduplicative rule (AA) from dynamic linguistic signs, and the neural response to reduplicative linguistic signs differs from reduplicative visual controls, matched for the dynamic spatiotemporal properties of signs. We next demonstrate that the brain response for reduplicative signs is similar to the response to reduplicative speech stimuli. Rule learning, then, apparently depends on the linguistic status of the stimulus, not its sensory modality. These results suggest that infants are language-ready. They possess a powerful rule system that is differentially engaged by all linguistic stimuli, speech or sign.
https://www.nature.com/articles/s41598-021-99539-8

ELISENDA BUEICHEKÚ et al – Divergent connectomic organization delineates genetic evolutionary traits in the human brain
The relationship between human brain connectomics and genetic evolutionary traits remains elusive due to the inherent challenges in combining complex associations within cerebral tissue. In this study, insights are provided about the relationship between connectomics, gene expression and divergent evolutionary pathways from non-human primates to humans. Using in vivo human brain resting-state data, we detected two co-existing idiosyncratic functional systems: the segregation network, in charge of module specialization, and the integration network, responsible for information flow. Their topology was approximated to whole-brain genetic expression (Allen Human Brain Atlas) and the co-localization patterns yielded that neuron communication functionalities—linked to Neuron Projection—were overrepresented cell traits. Homologue-orthologue comparisons using dN/dS-ratios bridged the gap between neurogenetic outcomes and biological data, summarizing the known evolutionary divergent pathways within the Homo Sapiens lineage. Evidence suggests that a crosstalk between functional specialization and information flow reflects putative biological qualities of brain architecture, such as neurite cellular functions like axonal or dendrite processes, hypothesized to have been selectively conserved in the species through positive selection. These findings expand our understanding of human brain function and unveil aspects of our cognitive trajectory in relation to our simian ancestors previously left unexplored.
https://www.nature.com/articles/s41598-021-99082-6

BRUCE ROTHSCHILD & MARTIN HAEUSLER – Possible vertebral brucellosis infection in a Neanderthal
The La Chapelle-aux-Saints 1 skeleton of an old (>60-year-old) male Neanderthal is renowned for the advanced osteoarthritis of its spinal column and hip joint, and their implications for posture and lifestyle in these Mid- to Late Pleistocene humans. Reassessment of the pathologic lesions reveals erosions at multiple non-contiguous vertebrae and reactive bone formation extending far beyond the left hip joint, which suggests the additional diagnosis of brucellosis. This implies the earliest secure

evidence of this zoonotic disease in hominin evolution. Brucellosis might have been transmitted via butchering or eating raw meat and is well compatible with the range of prey animals documented for Neanderthals. The associated infertility could have represented an important aspect of health in these late archaic humans.
https://www.nature.com/articles/s41598-021-99289-7

JAMES BLINKHORN et al – Constraining the chronology and ecology of Late Acheulean and Middle Palaeolithic occupations at the margins of the monsoon
South Asia hosts the world's youngest Acheulean sites, with dated records typically restricted to sub-humid landscapes. The Thar Desert marks a major adaptive boundary between monsoonal Asia to the east and the Saharo-Arabian desert belt to the west, making it a key threshold to examine patterns of hominin ecological adaptation and its impacts on patterns of behaviour, demography and dispersal. Here, we investigate Palaeolithic occupations at the western margin of the South Asian monsoon at Singi Talav, undertaking new chronometric, sedimentological and palaeoecological studies of Acheulean and Middle Palaeolithic occupation horizons. We constrain occupations of the site between 248 and 65 thousand years ago. This presents the first direct palaeoecological evidence for landscapes occupied by South Asian Acheulean-producing populations, most notably in the main occupation horizon dating to 177 thousand years ago. Our results illustrate the potential role of the Thar Desert as an ecological, and demographic, frontier to Palaeolithic populations.
https://www.nature.com/articles/s41598-021-98897-7

ALEXANDER GAVASHELISHVILI et al – Landscape genetics and the genetic legacy of Upper Paleolithic and Mesolithic hunter-gatherers in the modern Caucasus
This study clarifies the role of refugia and landscape permeability in the formation of the current genetic structure of peoples of the Caucasus. We report novel genome-wide data for modern individuals from the Caucasus, and analyze them together with available Paleolithic and Mesolithic individuals from Eurasia and Africa in order (1) to link the current and ancient genetic structures via landscape permeability, and (2) thus to identify movement paths between the ancient refugial populations and the Caucasus. The ancient genetic ancestry is best explained by landscape permeability implying that human movement is impeded by terrain ruggedness, swamps, glaciers and desert. Major refugial source populations for the modern Caucasus are those of the Caucasus, Anatolia, the Balkans and Siberia. In Rugged areas new genetic signatures take a long time to form, but once they do so, they remain for a long time. These areas act as time capsules harboring genetic signatures of ancient source populations and making it possible to help reconstruct human history based on patterns of variation today.
https://www.nature.com/articles/s41598-021-97519-6

PeerJ

PAPERS

TIMO VAN LEEUWEN et al – Stress distribution in the bonobo (Pan paniscus) trapeziometacarpal joint during grasping
The primate thumb plays a central role in grasping and the basal trapeziometacarpal (TMC) joint is critical to its function. The TMC joint morphology varies across primates, yet little is known about form-function interaction within in the TMC joint. The purpose of this study was to investigate how stress distributions within the joint differ between five grasping types commonly employed by bonobos (Pan paniscus). Five cadaveric bonobo forearms were CT scanned in five standardized positions of the hand as a basis for the generation of parametric finite element models to compare grasps. We have developed a finite element analysis (FEA) approach to investigate stress distribution patterns in the TMC joint associated with each grasp type. We hypothesized that the simulated stress distributions for each position would correspond with the patterns expected from a saddle-shaped joint. However, we also expected differences in stress patterns arising from instraspecific variations in morphology. The models showed a high agreement between simulated and expected stress patterns for each of the five grasps (86% of successful simulations), while partially (52%) and fully (14%) diverging patterns were also encountered. We identified individual variations of key morphological features in the bonobo TMC joint that account for the diverging stress patterns and emphasized the effect of interindividual morphological variation on joint functioning. This study gives unprecedented insight in the form-function interactions in the TMC joint of the bonobo and provides an innovative FEA approach to modelling intra-articular stress distributions, a valuable tool for the study of the primate thumb biomechanics.
https://peerj.com/articles/12068/

Philosophical Transactions of the Royal Society B

PAPERS

PAT BARCLAY, REBECCA BLIEGE BIRD, GILBERT ROBERTS & SZABOLCS SZÁMADÓ – Cooperating to show that you care: costly helping as an honest signal of fitness interdependence
Social organisms often need to know how much to trust others to cooperate. Organisms can expect cooperation from another organism that depends on them (i.e. stake or fitness interdependence), but how do individuals assess fitness interdependence? Here, we extend fitness interdependence into a signalling context: costly helping behaviour can honestly signal one's stake in others, such that those who help are trusted more. We present a mathematical model in which agents help others based on their stake in the recipient's welfare, and recipients use that information to assess whom to trust. At

equilibrium, helping is a costly signal of stake: helping is worthwhile for those who value the recipient (and thus will repay any trust), but is not worthwhile for those who do not value the recipient (and thus will betray the trust). Recipients demand signals when they value the signallers less and when the cost of betrayed trust is higher; signal costs are higher when signallers have more incentive to defect. Signalling systems are more likely when the trust games resemble Prisoner's Dilemmas, Stag Hunts or Harmony Games, and are less likely in Snowdrift Games. Furthermore, we find that honest signals need not benefit recipients and can even occur between hostile parties. By signalling their interdependence, organisms benefit from increased trust, even when no future interactions will occur.
https://royalsocietypublishing.org/doi/abs/10.1098/rstb.2020.0292

MILENA TSVETKOVA – The effects of reputation on inequality in network cooperation games
In the last several decades, ample evidence from across evolutionary biology, behavioural economics and econophysics has solidified our knowledge that reputation can promote cooperation across different contexts and environments. Higher levels of cooperation entail higher final payoffs on average, but how are these payoffs distributed among individuals? This study investigates how public and objective reputational information affects payoff inequality in repeated social dilemma interactions in large groups. I consider two aspects of inequality: excessive dispersion of final payoffs and diminished correspondence between final payoff and cooperative behaviour. I use a simple heuristics-based agent model to demonstrate that reputational information does not always increase the dispersion of final payoffs in strategically updated networks, and actually decreases it in randomly rewired networks. More importantly, reputational information almost always improves the correspondence between final payoffs and cooperative behaviour. I analyse empirical data from nine experiments of the repeated Trust, Helping, Prisoner's Dilemma and Public Good games in networks of ten or more individuals to provide partial support for the predictions. Our research suggests that reputational information not only improves cooperation but may also reduce inequality.
https://royalsocietypublishing.org/doi/full/10.1098/rstb.2020.0299

SHIRSENDU PODDER, SIMONE RIGHI & FRANCESCA PANCOTTO – Reputation and punishment sustain cooperation in the optional public goods game
Cooperative behaviour has been extensively studied as a choice between cooperation and defection. However, the possibility to not participate is also frequently available. This type of problem can be studied through the optional public goods game. The introduction of the 'Loner' strategy' allows players to withdraw from the game, which leads to a cooperator–defector–loner cycle. While pro-social punishment can help increase cooperation, anti-social punishment—where defectors punish cooperators—causes its downfall in both experimental and theoretical studies. In this paper, we introduce social norms that allow agents to condition their behaviour to the reputation of their peers. We benchmark this with respect both to the standard optional public goods game and to the variant where all types of punishment are allowed. We find that a social norm imposing a more moderate reputational penalty for opting out than for defecting increases cooperation. When, besides reputation, punishment is also possible, the two mechanisms work synergically under all social norms that do not assign to loners a strictly worse reputation than to defectors. Under this latter set-up, the high levels of cooperation are sustained by conditional strategies, which largely reduce the use of pro-social punishment and almost completely eliminate anti-social punishment.
https://royalsocietypublishing.org/doi/abs/10.1098/rstb.2020.0293

CATHERINE MOLHO & JUNHUI WU – Direct punishment and indirect reputation-based tactics to intervene against offences
Punishment and reputation-based mechanisms play a major role in supporting the evolution of human cooperation. Theoretical accounts and field observations suggest that humans use multiple tactics to intervene against offences—including confrontation, gossip and ostracism—which have unique benefits and costs. Here, we draw a distinction between direct punishment tactics (i.e. physical and verbal confrontation) and indirect reputation-based tactics (i.e. gossip and ostracism). Based on this distinction, we sketch the common and unique social functions that different tactics are tailored to serve and describe information-processing mechanisms that potentially underlie decisions concerning how to intervene against offences. We propose that decision rules guiding direct and indirect tactics should weigh information about the benefits of changing others' behaviour versus the costs of potential retaliation. Based on a synthesis of existing evidence, we highlight the role of situational, relational and emotional factors in motivating distinct punishment tactics. We suggest that delineating between direct and indirect tactics can inform debates about the prevalence and functions of punishment and the reputational consequences of third-party intervention against offences. We emphasize the need to study how people use reputation-based tactics for partner recalibration and partner choice, within interdependent relationships and social networks, and in daily life situations.
https://royalsocietypublishing.org/doi/abs/10.1098/rstb.2020.0289

KÁROLY TAKÁCS et al – Networks of reliable reputations and cooperation: a review
Reputation has been shown to provide an informal solution to the problem of cooperation in human societies. After reviewing models that connect reputations and cooperation, we address how reputation results from information exchange embedded in a social network that changes endogenously itself. Theoretical studies highlight that network topologies have

different effects on the extent of cooperation, since they can foster or hinder the flow of reputational information. Subsequently, we review models and empirical studies that intend to grasp the coevolution of reputations, cooperation and social networks. We identify open questions in the literature concerning how networks affect the accuracy of reputations, the honesty of shared information and the spread of reputational information. Certain network topologies may facilitate biased beliefs and intergroup competition or in-group identity formation that could lead to high cooperation within but conflicts between different subgroups of a network. Our review covers theoretical, experimental and field studies across various disciplines that target these questions and could explain how the dynamics of interactions and reputations help or prevent the establishment and sustainability of cooperation in small- and large-scale societies.
https://royalsocietypublishing.org/doi/full/10.1098/rstb.2020.0297

JUNHUI WU et al with SZABOLCS SZÁMADÓ – Honesty and dishonesty in gossip strategies: a fitness interdependence analysis

Gossip, or sharing information about absent others, has been identified as an effective solution to free rider problems in situations with conflicting interests. Yet, the information transmitted via gossip can be biased, because gossipers may send dishonest information about others for personal gains. Such dishonest gossip makes reputation-based cooperation more difficult to evolve. But when are people likely to share honest or dishonest gossip? We build formal models to provide the theoretical foundation for individuals' gossip strategies, taking into account the gossiper's fitness interdependence with the receiver and the target. Our models across four different games suggest a very simple rule: when there is a perfect match (mismatch) between fitness interdependence and the effect of honest gossip, the gossiper should always be honest (dishonest); however, in the case of a partial match, the gossiper should make a choice based on their fitness interdependence with the receiver and the target and the marginal cost/benefit in terms of pay-off differences caused by possible choices of the receiver and the target in the game. Moreover, gossipers can use this simple rule to make optimal decisions even under noise. We discuss empirical examples that support the predictions of our model and potential extensions.
https://royalsocietypublishing.org/doi/abs/10.1098/rstb.2020.0300

FLÓRA SAMU & KÁROLY TAKÁCS – Evaluating mechanisms that could support credible reputations and cooperation: cross-checking and social bonding

Gossip is believed to be an informal device that alleviates the problem of cooperation in humans. Communication about previous acts and passing on reputational information could be valuable for conditional action in cooperation problems and pose a punishment threat to defectors. It is an open question, however, what kind of mechanisms can make gossip honest and credible and reputational information reliable, especially if intense competition for reputations does not exclusively dictate passing on honest information. We propose two mechanisms that could support the honesty and credibility of gossip under such a conflict of interest. One is the possibility of voluntary checks of received evaluative information from different sources and the other is social bonding between the sender and the receiver. We tested the efficiency of cross-checking and social bonding in a laboratory experiment where subjects played the Prisoner's Dilemma with gossip interactions. Although individuals had confidence in gossip in both conditions, we found that, overall, neither the opportunities for cross-checking nor bonding were able to maintain cooperation. Meanwhile, strong competition for reputation increased cooperation when individuals' payoffs depended greatly on their position relative to their rivals. Our results suggest that intense competition for reputation facilitates gossip functioning as an informal device promoting cooperation.
https://royalsocietypublishing.org/doi/full/10.1098/rstb.2020.0302

FRANCESCA GIARDINI et al – Gossip and competitive altruism support cooperation in a Public Good game

When there is an opportunity to gain a positive reputation, individuals are more willing to sacrifice their immediate self-interest. Partner choice creates opportunities for competitive altruism, i.e. individuals compete to be regarded as more generous and to be chosen for future partnerships. Tests of the competitive altruism hypothesis have focused so far on reputation based on direct observation, whereas the role of gossip has not been theoretically and empirically addressed. Partner choice can create an incentive to cooperate and to send truthful messages, but it can also work in the opposite direction. In order to understand the consequences of partner choice on cooperation and gossip, we designed an experimental study in which participants played a sequence of Public Goods games and gossip rounds. In our two treatments, we observed that cooperation increased when there was an opportunity to be selected, but also that cooperators sent more honest messages than defectors, and that this strategy was prevalent in the treatment in which inter-group competition was implemented. We also found evidence that participants detached themselves from the information more often when lying. Taken together, our study fills a theoretical and empirical gap by showing that partner choice increases both cooperation and honesty of gossip.
https://royalsocietypublishing.org/doi/abs/10.1098/rstb.2020.0303

MIGUEL A. FONSECA & KIM PETERS – Is it costly to deceive? People are adept at detecting gossipers' lies but may not reward honesty

The possibility that gossipers may share dishonest reputational information is a key challenge to claims that gossip can shore up cooperation in social groups. It has been suggested that imposing social costs on dishonest gossipers should increase the

honesty of these reputational signals. However, at present, there is little evidence of people's willingness to impose costs on dishonest gossipers; there is also little evidence of their ability to detect gossipers' lies in the first place. This paper aims to shed light on people's abilities to detect dishonest gossip and their treatment of those who share it. To do this, we report the results of two trust game studies using the strategy method (study 1) and repeated interactions in the laboratory (study 2). We show that in an environment where gossipers tell spontaneous lies people are more inclined to believe honest than dishonest gossip. We also show that people are more likely to treat favourably gossipers they believe to be honest, but that this does not always result in more favourable treatment for gossipers who were actually honest. We discuss the implications for the potential utility of social sanctions as a tool for securing honesty.
https://royalsocietypublishing.org/doi/abs/10.1098/rstb.2020.0304

WOJTEK PRZEPIORKA & ANDREAS DIEKMANN – Parochial cooperation and the emergence of signalling norms
Why do people adorn themselves with elaborate body piercings or tattoos, wear obstructing garbs, engage in life-threatening competitions and other wasteful and harmful but socially stipulated practices? Norms of cooperation and coordination, which promote the efficient attainment of collective benefits, can be explained by theories of collective action. However, social norms prescribing wasteful and harmful behaviours have eluded such explanations. We argue that signalling theory constitutes the basis for the understanding of the emergence of such norms, which we call signalling norms. Signalling norms emerge as a result of the uncertainty about who is a friend and who is a foe. The need to overcome this uncertainty arises when different groups compete for scarce resources and individuals must be able to identify, trust and cooperate with their fellow group members. After reviewing the mechanisms that explain the emergence of cooperation and coordination norms, we introduce the notion of signalling norms as markers of group distinction. We argue that adherence to signalling norms constitutes a commitment promoting parochial cooperation rather than a quality-revealing signal facilitating partner choice. We formalize our argument in a game-theoretic model that allows us to specify the boundary conditions for the emergence of signalling norms. Our paper concludes with a discussion of potential applications of our model and a comparison of signalling norms with related concepts.
https://royalsocietypublishing.org/doi/abs/10.1098/rstb.2020.0294

MARION DUMAS, JESSICA L. BARKER & ELEANOR A. POWER – When does reputation lie? Dynamic feedbacks between costly signals, social capital and social prominence
Performing a dramatic act of religious devotion, creating an art exhibit, or releasing a new product are all examples of public acts that signal quality and contribute to building a reputation. Signalling theory predicts that these public displays can reliably reveal quality. However, data from ethnographic work in South India suggests that more prominent individuals gain more from reputation-building religious acts than more marginalized individuals. To understand this phenomenon, we extend signalling theory to include variation in people's social prominence or social capital, first with an analytical model and then with an agent-based model. We consider two ways in which social prominence/capital may alter signalling: (i) it impacts observers' priors, and (ii) it alters the signallers' pay-offs. These two mechanisms can result in both a 'reputational shield,' where low quality individuals are able to 'pass' as high quality thanks to their greater social prominence/capital, and a 'reputational poverty trap,' where high quality individuals are unable to improve their standing owing to a lack of social prominence/capital. These findings bridge the signalling theory tradition prominent in behavioural ecology, anthropology and economics with the work on status hierarchies in sociology, and shed light on the complex ways in which individuals make inferences about others.
https://royalsocietypublishing.org/doi/abs/10.1098/rstb.2020.0298

NICOLE H. HESS & EDWARD H. HAGEN – Competitive gossip: the impact of domain, resource value, resource scarcity and coalitions
Those with better reputations often obtain more resources than those with poorer reputations. Consequently, gossip might be an evolved strategy to compete for valuable and scarce material and social resources. Influenced by models of non-human primate competition, we test the hypotheses that gossip: (i) targets aspects of reputation relevant to the domain in which the competition is occurring, (ii) increases when contested resources are more valuable, and (iii) increases when resources are scarcer. We then test hypotheses derived from informational warfare theory, which proposes that coalitions strategically collect, analyse and disseminate gossip. Specifically, we test whether: (iv) coalitions deter negative gossip, and (v) whether they increase expectations of reputational harm to competitors. Using experimental methods in a Mechanical Turk sample (n = 600), and survey and ego network analysis methods in a sample of California sorority women (n = 74), we found that gossip content is specific to the context of the competition; that more valuable and scarcer resources cause gossip, particularly negative gossip, to intensify; and that allies deter negative gossip and increase expectations of reputational harm to an adversary. These results support social competition theories of gossip.
https://royalsocietypublishing.org/doi/abs/10.1098/rstb.2020.0305

TERENCE D. DORES CRUZ et al – Gossip and reputation in everyday life
Gossip—a sender communicating to a receiver about an absent third party—is hypothesized to impact reputation formation, partner selection, and cooperation. Laboratory experiments have found that people gossip about others' cooperativeness and that they use gossip to condition their cooperation. Here, we move beyond the laboratory and test several predictions

from theories of indirect reciprocity and reputation-based partner selection about the content of everyday gossip and how people use it to update the reputation of others in their social network. In a Dutch community sample (N = 309), we sampled daily events in which people either sent or received gossip about a target over 10 days (ngossip = 5284). Gossip senders frequently shared information about targets' cooperativeness and did so in ways that minimize potential retaliation from targets. Receivers overwhelmingly believed gossip to be true and updated their evaluation of targets based on gossip. In turn, a positive shift in the evaluation of a target was associated with higher intentions to help them in future interactions, and with lower intentions to avoid them in the future. Thus, gossip is used in daily life to impact and update reputations in a way that enables partner selection and indirect reciprocity.
https://royalsocietypublishing.org/doi/full/10.1098/rstb.2020.0301

ZACHARY H. GARFIELD et al – The content and structure of reputation domains across human societies: a view from the evolutionary social sciences
Reputations are an essential feature of human sociality and the evolution of cooperation and group living. Much scholarship has focused on reputations, yet typically on a narrow range of domains (e.g. prosociality and aggressiveness), usually in isolation. Humans can develop reputations, however, from any collective information. We conducted exploratory analyses on the content, distribution and structure of reputation domain diversity across cultures, using the Human Relations Area Files ethnographic database. After coding ethnographic texts on reputations from 153 cultures, we used hierarchical modelling, cluster analysis and text analysis to provide an empirical view of reputation domains across societies. Findings suggest: (i) reputational domains vary cross-culturally, yet reputations for cultural conformity, prosociality, social status and neural capital are widespread; (ii) reputation domains are more variable for males than females; and (iii) particular reputation domains are interrelated, demonstrating a structure consistent with dimensions of human uniqueness. We label these features: cultural group unity, dominance, neural capital, sexuality, social and material success and supernatural healing. We highlight the need for future research on the evolution of cooperation and human sociality to consider a wider range of reputation domains, as well as their social, ecological and gender-specific variability.
https://royalsocietypublishing.org/doi/abs/10.1098/rstb.2020.0296

A. ROMANO et al – Reputation and socio-ecology in humans
Reputation is a fundamental feature of human sociality as it sustains cooperative relationships among unrelated individuals. Research from various disciplines provides insights on how individuals form impressions of others, condition their behaviours based on the reputation of their interacting partners and spread or learn such reputations. However, past research has often neglected the socio-ecological conditions that can shape reputation systems and their effect on cooperation. Here, we outline how social environments, cultural values and institutions come to play a crucial role in how people navigate reputation systems. Moreover, we illustrate how these socio-ecological dimensions affect the interdependence underlying social interactions (e.g. potential recipients of reputational benefits, degree of dependence) and the extent to which reputation systems promote cooperation. To do so, we review the interdisciplinary literature that illustrates how reputation systems are shaped by the variation of prominent ecological features. Finally, we discuss the implications of a socio-ecological approach to the study of reputation and outline potential avenues for future research.
https://royalsocietypublishing.org/doi/abs/10.1098/rstb.2020.0295

GILBERT ROBERTS et al with REDOUAN BSHARY & PAT BARCLAY – The benefits of being seen to help others: indirect reciprocity and reputation-based partner choice
When one individual helps another, it benefits the recipient and may also gain a reputation for being cooperative. This may induce others to favour the helper in subsequent interactions, so investing in being seen to help others may be adaptive. The best-known mechanism for this is indirect reciprocity (IR), in which the profit comes from an observer who pays a cost to benefit the original helper. IR has attracted considerable theoretical and empirical interest, but it is not the only way in which cooperative reputations can bring benefits. Signalling theory proposes that paying a cost to benefit others is a strategic investment which benefits the signaller through changing receiver behaviour, in particular by being more likely to choose the signaller as a partner. This reputation-based partner choice can result in competitive helping whereby those who help are favoured as partners. These theories have been confused in the literature. We therefore set out the assumptions, the mechanisms and the predictions of each theory for how developing a cooperative reputation can be adaptive. The benefits of being seen to be cooperative may have been a major driver of sociality, especially in humans.
https://royalsocietypublishing.org/doi/abs/10.1098/rstb.2020.0290

FERNANDO P. SANTOS, JORGE M. PACHECO & FRANCISCO C. SANTOS – The complexity of human cooperation under indirect reciprocity
Indirect reciprocity (IR) is a key mechanism to understand cooperation among unrelated individuals. It involves reputations and complex information processing, arising from social interactions. By helping someone, individuals may improve their reputation, which may be shared in a population and change the predisposition of others to reciprocate in the future. The reputation of individuals depends, in turn, on social norms that define a good or bad action, offering a computational and mathematical appealing way of studying the evolution of moral systems. Over the years, theoretical and empirical research has unveiled many features of cooperation under IR, exploring norms with varying degrees of complexity and information

requirements. Recent results suggest that costly reputation spread, interaction observability and empathy are determinants of cooperation under IR. Importantly, such characteristics probably impact the level of complexity and information requirements for IR to sustain cooperation. In this review, we present and discuss those recent results. We provide a synthesis of theoretical models and discuss previous conclusions through the lens of evolutionary game theory and cognitive complexity. We highlight open questions and suggest future research in this domain.
https://royalsocietypublishing.org/doi/abs/10.1098/rstb.2020.0291

H. CLARK BARRETT & REBECCA R. SAXE – Are some cultures more mind-minded in their moral judgements than others?
Cross-cultural research on moral reasoning has brought to the fore the question of whether moral judgements always turn on inferences about the mental states of others. Formal legal systems for assigning blame and punishment typically make fine-grained distinctions about mental states, as illustrated by the concept of mens rea, and experimental studies in the USA and elsewhere suggest everyday moral judgements also make use of such distinctions. On the other hand, anthropologists have suggested that some societies have a morality that is disregarding of mental states, and have marshalled ethnographic and experimental evidence in support of this claim. Here, we argue against the claim that some societies are simply less 'mind-minded' than others about morality. In place of this cultural main effects hypothesis about the role of mindreading in morality, we propose a contextual variability view in which the role of mental states in moral judgement depends on the context and the reasons for judgement. On this view, which mental states are or are not relevant for a judgement is context-specific, and what appear to be cultural main effects are better explained by culture-by-context interactions.
https://royalsocietypublishing.org/doi/full/10.1098/rstb.2020.0288

HÉCTOR M. MANRIQUE et al with PAT BARCLAY – The psychological foundations of reputation-based cooperation
Humans care about having a positive reputation, which may prompt them to help in scenarios where the return benefits are not obvious. Various game-theoretical models support the hypothesis that concern for reputation may stabilize cooperation beyond kin, pairs or small groups. However, such models are not explicit about the underlying psychological mechanisms that support reputation-based cooperation. These models therefore cannot account for the apparent rarity of reputation-based cooperation in other species. Here, we identify the cognitive mechanisms that may support reputation-based cooperation in the absence of language. We argue that a large working memory enhances the ability to delay gratification, to understand others' mental states (which allows for perspective-taking and attribution of intentions) and to create and follow norms, which are key building blocks for increasingly complex reputation-based cooperation. We review the existing evidence for the appearance of these processes during human ontogeny as well as their presence in non-human apes and other vertebrates. Based on this review, we predict that most non-human species are cognitively constrained to show only simple forms of reputation-based cooperation.
https://royalsocietypublishing.org/doi/abs/10.1098/rstb.2020.0287

PLoS Biology

PAPERS

ROSA A. ROSSI-GOLDTHORPE et al – Paranoia, self-deception and overconfidence
This is an uncorrected proof.
Self-deception, paranoia, and overconfidence involve misbeliefs about the self, others, and world. They are often considered mistaken. Here we explore whether they might be adaptive, and further, whether they might be explicable in Bayesian terms. We administered a difficult perceptual judgment task with and without social influence (suggestions from a cooperating or competing partner). Crucially, the social influence was uninformative. We found that participants heeded the suggestions most under the most uncertain conditions and that they did so with high confidence, particularly if they were more paranoid. Model fitting to participant behavior revealed that their prior beliefs changed depending on whether the partner was a collaborator or competitor, however, those beliefs did not differ as a function of paranoia. Instead, paranoia, self-deception, and overconfidence were associated with participants' perceived instability of their own performance. These data are consistent with the idea that self-deception, paranoia, and overconfidence flourish under uncertainty, and have their roots in low self-esteem, rather than excessive social concern. The model suggests that spurious beliefs can have value–self-deception is irrational yet can facilitate optimal behavior. This occurs even at the expense of monetary rewards, perhaps explaining why self-deception and paranoia contribute to costly decisions which can spark financial crashes and devastating wars.
https://journals.plos.org/ploscompbiol/article?id=10.1371/journal.pcbi.1009453

PETER FORD DOMINEY – Narrative event segmentation in the cortical reservoir
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Recent research has revealed that during continuous perception of movies or stories, humans display cortical activity patterns that reveal hierarchical segmentation of event structure. Thus, sensory areas like auditory cortex display high frequency segmentation related to the stimulus, while semantic areas like posterior middle cortex display a lower frequency segmentation related to transitions between events. These hierarchical levels of segmentation are associated with different time constants for processing. Likewise, when two groups of participants heard the same sentence in a narrative, preceded

by different contexts, neural responses for the groups were initially different and then gradually aligned. The time constant for alignment followed the segmentation hierarchy: sensory cortices aligned most quickly, followed by mid-level regions, while some higher-order cortical regions took more than 10 seconds to align. These hierarchical segmentation phenomena can be considered in the context of processing related to comprehension. In a recently described model of discourse comprehension word meanings are modeled by a language model pre-trained on a billion word corpus. During discourse comprehension, word meanings are continuously integrated in a recurrent cortical network. The model demonstrates novel discourse and inference processing, in part because of two fundamental characteristics: real-world event semantics are represented in the word embeddings, and these are integrated in a reservoir network which has an inherent gradient of functional time constants due to the recurrent connections. Here we demonstrate how this model displays hierarchical narrative event segmentation properties beyond the embeddings alone, or their linear integration. The reservoir produces activation patterns that are segmented by a hidden Markov model (HMM) in a manner that is comparable to that of humans. Context construction displays a continuum of time constants across reservoir neuron subsets, while context forgetting has a fixed time constant across these subsets. Importantly, virtual areas formed by subgroups of reservoir neurons with faster time constants segmented with shorter events, while those with longer time constants preferred longer events. This neurocomputational recurrent neural network simulates narrative event processing as revealed by the fMRI event segmentation algorithm provides a novel explanation of the asymmetry in narrative forgetting and construction. The model extends the characterization of online integration processes in discourse to more extended narrative, and demonstrates how reservoir computing provides a useful model of cortical processing of narrative structure.
https://journals.plos.org/ploscompbiol/article?id=10.1371/journal.pcbi.1008993

PLoS One

PAPERS

ANTONELLA PEDERGNANA et al – Early line and hook fishing at the Epipaleolithic site of Jordan River Dureijat (Northern Israel)

Dureijat in the Hula Valley of Israel represent the largest collection of fishing technology from the Epipaleolithic and Paleolithic periods. Although Jordan River Dureijat was occupied throughout the Epipaleolithic (~20–10 kya the fish hooks appear only at the later stage of this period (15,000–12,000 cal BP). This paper presents a multidimensional study of the hooks, grooved stones, site context, and the fish assemblage from macro and micro perspectives following technological, use wear, residue and zooarchaeological approaches. The study of the fish hooks reveals significant variability in hook size, shape and feature type and provides the first evidence that several landmark innovations in fishing technology were already in use at this early date. These include inner and outer barbs, a variety of line attachment techniques including knobs, grooves and adhesives and some of the earliest evidence for artificial lures. Wear on the grooved stones is consistent with their use as sinkers while plant fibers recovered from the grooves of one hook shank and one stone suggest the use of fishing line. This together with associations between the grooved stones and hooks in the same archaeological layers, suggests the emergence of a sophisticated line and hook technology. The complexity of this technology is highlighted by the multiple steps required to manufacture each component and combine them into an integrated system. The appearance of such technology in the Levantine Epipaleolithic record reflects a deep knowledge of fish behavior and ecology. This coincides with significant larger-scale patterns in subsistence evolution, namely broad spectrum foraging, which is an important first signal of the beginning of the transition to agriculture in this region.
https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0257710

PNAS

PAPERS

KRISTINA DOUGLASS et al – Late Pleistocene/Early Holocene sites in the montane forests of New Guinea yield early record of cassowary hunting and egg harvesting

How early human foragers impacted insular forests is a topic with implications across multiple disciplines, including resource management. Paradoxically, terminal Pleistocene and Early Holocene impacts of foraging communities have been characterized as both extreme—as in debates over human-driven faunal extinctions—and minimal compared to later landscape transformations by farmers and herders. We investigated how rainforest hunter-gatherers managed resources in montane New Guinea and present some of the earliest documentation of Late Pleistocene through mid-Holocene exploitation of cassowaries (Aves: Casuariidae). Worldwide, most insular ratites were extirpated by the Late Holocene, following human arrivals, including elephant birds of Madagascar (Aepyornithidae) and moa of Aotearoa/New Zealand (Dinornithiformes)—icons of anthropogenic island devastation. Cassowaries are exceptional, however, with populations persisting in New Guinea and Australia. Little is known of past human exploitation and what factors contributed to their survival. We present a method for inferring past human interaction with mega-avifauna via analysis of microstructural features of archaeological eggshell. We then contextualize cassowary hunting and egg harvesting by montane foragers and discuss the implications of human exploitation. Our data suggest cassowary egg harvesting may have been more common than the harvesting of adults. Furthermore, our analysis of cassowary eggshell microstructural variation reveals a distinct pattern of harvesting eggs in late ontogenetic stages. Harvesting eggs in later stages of embryonic growth may reflect human dietary preferences and foraging seasonality, but the observed pattern also supports the possibility that—as early as the Late Pleistocene—people were collecting eggs in order to hatch and rear cassowary chicks.

https://www.pnas.org/content/118/40/e2100117118.abstract

Science Advances

PAPERS

SIMON J. GREENHILL – Do languages and genes share cultural evolutionary history?
Languages and genes tell stories about the past but statistical analysis reveals that these are not always the same.
https://www.science.org/doi/full/10.1126/sciadv.abm2472

HALSZKA GLOWACKA & GARY T. SCHWARTZ – A biomechanical perspective on molar emergence and primate life history
The strong relationship between M1 emergence age and life history across primates provides a means of reconstructing fossil life history. The underlying process that leads to varying molar emergence schedules, however, remains elusive. Using three-dimensional data to quantify masticatory form in ontogenetic samples representing 21 primate species, we test the hypothesis that the location and timing of molar emergence are constrained to avoid potentially dangerous distractive forces at the temporomandibular joint (TMJ) throughout growth. We show that (i) molars emerge in a predictable position to safeguard the TMJ, (ii) the rate and duration of jaw growth determine the timing of molar emergence, and (iii) the rate and cessation age of jaw growth is related to life history. Thus, orofacial development is constrained by biomechanics throughout ontogeny. This integrative perspective on primate skull growth is consistent with a long sought-after causal explanation underlying the correlation between molar emergence and life history.
https://www.science.org/doi/full/10.1126/sciadv.abj0335

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