

EAORC BULLETIN 911 – 29 November 2020

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EAORC NOTICES

PUBLICATION ALERTS

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

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

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

ACADEMIA.EDU – Primate Vocalization, Gesture, and the Evolution of Human Language

Journal of Anthropological Archaeology 32 (2013) 614–629

MICHELLE C. LANGLEY – Storied landscapes makes us (Modern) Human: Landscape socialisation in the Palaeolithic and consequences for the archaeological record

The unusual nature of the Neanderthal archaeological record has attracted the attention of archaeologists for the past 150 years. On the one hand, the technical skill apparent in their lithic technology, the practice of symbolic cultural behaviours (such as burials), and their successful survival in harsh environmental conditions for more than 200,000 years demonstrate the adaptive success and underlying humanity of the Neanderthal populations. On the other hand, the apparent lack of abundant and repeated use of symbolic material culture has resulted in a number of researchers arguing that these populations were largely incapable of symbolism – a conclusion with significant implications for social organisation. This paper reviews ideas regarding the use of ‘place’ or ‘landscape’ by Neanderthals and argues that the identified differences between the archaeological records of Neanderthals and late Pleistocene Modern Humans is not so much the result of significant variance in cognitive capacities, but rather the use of contrasting approaches to interaction with the physical landscape. ‘Landscape socialisation’ is a Modern Human universal, but what if Neanderthals did not participate in this kind of landscape interaction? Would this difference in behaviour result in the apparently contradictory archaeological record which has been created? The ideas presented in this paper are drawn together as a hypothesis to be developed and tested.

https://www.academia.edu/5101619/Storied_landscapes_makes_us_Modern_Human_Landscape_socialisation_in_the_Palaeolithic_and_consequences_for_the_archaeological_record?email_work_card=view-paper

ACADEMIA.EDU – Communicative roots of complex sociality and cognition

Biological Review 95:1, (2019), 51-73.

ANNA I. ROBERTS & SAM G. B. ROBERTS – Communicative roots of complex sociality and cognition

Mammals living in more complex social groups typically have large brains for their body size and many researchers have proposed that the primary driver of the increase in brain size through primate and hominin evolution was the selection pressures associated with sociality. Many mammals, and especially primates, use flexible signals that show a high degree of voluntary control and these signals may play an important role in forming and maintaining social relationships between group members. However, the specific role that cognitive skills play in this complex communication, and how in turn this relates to sociality, is still unclear. The hypothesis for the communicative roots of complex sociality and cognition posits that cognitive demands behind the communication needed to form and maintain bonded social relationships in complex social settings drives the link between brain size and sociality. We review the evidence in support of this hypothesis and why key features of cognitively complex communication such as intentionality and referentiality should be more effective in forming and maintaining bonded relationships as compared with less cognitively complex communication. Exploring the link between cognition, communication and sociality provides insights into how increasing flexibility in communication can facilitate the emergence of social systems characterised by bonded social relationships, such as those found in non-human primates and humans. To move the field forward and carry out both within- and among-species comparisons, we advocate the use of social network analysis, which provides a novel way to describe and compare social structure. Using this approach can lead to a new, systematic way of examining social and communicative complexity across species, something that is lacking in current comparative studies of social structure.

https://www.academia.edu/40620377/Communicative_roots_of_complex_sociality_and_cognition?email_work_card=title

NEWS

SCIENCE NEWS – Californian cave artists may have used hallucinogens, find reveals

With recurring zigzags, spirals, and other simple geometric patterns, ancient rock art is sometimes surprisingly similar across the globe. One hypothesis is that the artists were all using psychoactive compounds, which nudged the brain toward certain patterns. Now, a new find from a roughly 500-year-old cave used by Native Americans suggests such compounds may indeed have been an important component of their rock art. But the art itself may not have depicted the experience of tripping.

https://www.sciencemag.org/news/2020/11/californian-cave-artists-may-have-used-hallucinogens-find-reveals?utm_campaign=news_daily_2020-11-23&et rid=17774313&et cid=3570228

SCIENCE NEWS – For €9500, Nature journals will now make your paper free to read

The elite Nature family of journals, including the flagship Nature, today announced it is taking the plunge into open access in scientific publishing. The journals will become among the first highly selective titles to allow any author to pay a publishing fee to make articles immediately free to read when published. Such open-access arrangements are being required by some European funders and foundations that seek to eliminate subscription paywalls in order to speed the flow of scientific information. Nature's author fee, €9500, is thought to be the highest of any journal. But the Nature Research publishing group says it is necessary to cover the costs of the full-time editors and others who produce Nature and its 32 other primary research journals.

{In other words, let's suckle on academic funds to feed our organisational bloat. This is precisely the sort of behaviour I complained about a couple of weeks ago.}

https://www.sciencemag.org/news/2020/11/9500-nature-journals-will-now-make-your-paper-free-read?utm_campaign=news_daily_2020-11-24&et rid=17774313&et cid=3571731

BREAKING SCIENCE – Neanderthal Thumbs were Better Adapted to Holding Tools with Handles

Neanderthals may have found precision grips (where objects are held between the tip of the finger and thumb) more challenging than power squeeze grips (where objects are held like a hammer, between the fingers and the palm with the thumb directing force), according to new research led by the University of Kent.

http://feedproxy.google.com/~r/BreakingScienceNews/~3/2mRcy2gPgnU/neanderthal-thumbs-09095.html?utm_source=feedburner&utm_medium=email

SCIENCE DAILY – Zebra finches amazing at unmasking the bird behind the song

Like humans who can instantly tell which friend or relative is calling by the timbre of the person's voice, zebra finches have a near-human capacity for language mapping.

<https://www.sciencedaily.com/releases/2020/11/201121104309.htm>

SCIENCE DAILY – Ancient people relied on coastal environments to survive the Last Glacial Maximum

Excavations on the south coast of South Africa have uncovered evidence of human occupations from the end of the last ice age, approximately 35,000 years ago, through the complex transition to the modern time, known as the Holocene and adaptations that were key to our species ability to survive wide climate and environmental fluctuations.

<https://www.sciencedaily.com/releases/2020/11/201123173450.htm>

SCIENCE DAILY – A hunger for social contact

Neuroscientists have found that the longings for social interaction felt during isolation are neurologically very similar to the food cravings people experience when hungry.

<https://www.sciencedaily.com/releases/2020/11/201123120724.htm>

SCIENCE DAILY – Children more willing to punish if the wrongdoer is 'taught a lesson'

Many children are willing to make personal sacrifices to punish wrongdoers -- and even more so if they believe punishment will teach the transgressor a lesson, a new study shows.

<https://www.sciencedaily.com/releases/2020/11/201123112508.htm>

SCIENCE DAILY – Coppery titi monkeys do not deceive their partners

Since methods for genetic paternity analyses were introduced it became clear that many pair-living animal species, including humans, do not take partnership fidelity that seriously. In most species there is some proportion of offspring that is not sired by their social father. Coppery titi monkeys living in the Amazon lowland rainforest seem to be an exception. Scientists could not find evidence for extra-pair paternity in their study population in Peru. Mate choice seems to be so successful that a potential genetic advantage does not outweigh the social costs of infidelity.

<https://www.sciencedaily.com/releases/2020/11/201123085328.htm>

THE CONVERSATION – Lightning bolts, abortion bans and the glorious history of women going on strike

Protestors in Poland have forced the government to pause plans to effectively ban terminations.

<https://theconversationuk.cmail20.com/t/r-l-juiuyut-khhiliah-n/>

PUBLICATIONS

Frontiers in Communication

PAPERS

INGO HERTRICH, SUSANNE DIETRICH & HERMANN ACKERMANN – The Margins of the Language Network In the Brain

This review paper summarizes the various brain modules that are involved in speech and language communication in addition to a left-dominant “core” language network that, for the present purpose, has been restricted to elementary formal-linguistic and more or less disembodied functions such as abstract phonology, syntax, and very basic lexical functions. This left-dominant perisylvian language network comprises parts of inferior frontal gyrus, premotor cortex, and upper temporal lobe, and a temporoparietal interface. After introducing this network, first, the various roles of neighboring and functionally connected brain regions are discussed. As a second approach, entire additional networks were considered rather than single regions, mainly motivated by resting-state studies indicating more or less stable connectivity patterns within these networks. Thirdly, some examples are provided for language tasks with functional demands exceeding the operating domain of the core language network. The rationale behind this approach is to present some outline of how the brain produces and perceives language, accounting, first, for a bulk of clinical studies showing typical forms of aphasia in case of left-hemispheric lesions in the core language network and second, for wide-spread activation patterns beyond this network in various experimental studies with language tasks. Roughly, the brain resources that complement the core language system in a task-specific way can be described as a number of brain structures and networks that are related to (1) motor representations, (2) sensory-related representations, (3) non-verbal memory structures, (4) affective/emotional processing, (5) social cognition and theory of mind, (6) meaning in context, and (7) cognitive control. After taking into account all these aspects, first, it seems clear that natural language communication cannot really work without additional systems. Second, it also becomes evident that during language acquisition the core language network has to be built up from outside, that is, from various neuronal activations that are related to sensory input, motor imitation, nursing, pre-linguistic sound communication, and pre-linguistic pragmatics. Furthermore, it might be worth considering that also in cases of aphasia the language network might be restored by being trained from outside.

https://www.frontiersin.org/articles/10.3389/fcomm.2020.519955/full?utm_source=FAAE&utm_medium=EMLF&utm_campaign=MRK_1490157_14_Commun_20201124_arts_A

Frontiers in Psychology

PAPERS

MIRJAM KNÖRNSCHILD & AHANA A. FERNANDEZ – Do Bats Have the Necessary Prerequisites for Symbolic Communication?

Training animals such as apes, gray parrots, or dolphins that communicate via arbitrary symbols with humans has revealed astonishing mental capacities that may have otherwise gone unnoticed. Albeit bats have not yet been trained to communicate via symbols with humans, we are convinced that some species, especially captive Pteropodid bats (“flying

foxes”), show the potential to master this cognitive task. Here, we briefly review what is known about bats’ cognitive skills that constitute relevant prerequisites for symbolic communication with humans. We focus on social learning in general, trainability by humans, associative learning from humans, imitation, vocal production learning and usage learning, and social knowledge. Moreover, we highlight potential training paradigms that could be used to elicit simple “symbolic” bat-human communication, i.e., training bats to select arbitrary symbols on a touchscreen to elicit a desired behavior of the human caregiver. Touchscreen-proficient bats could participate in cognition research, e.g., to study their numerical competence or categorical perception, to further elucidate how nonhuman animals learn and perceive the world.

https://www.frontiersin.org/articles/10.3389/fpsyg.2020.571678/full?utm_source=F-AAE&utm_medium=EMLF&utm_campaign=MRK_1490157_69_Psycho_20201124_arts_A

Interface: Journal of the Royal Society

PAPERS

TUAN MINH PHAM et al – The effect of social balance on social fragmentation

With the availability of internet, social media, etc., the interconnectedness of people within most societies has increased tremendously over the past decades. Across the same timespan, an increasing level of fragmentation of society into small isolated groups has been observed. With a simple model of a society, in which the dynamics of individual opinion formation is integrated with social balance, we show that these two phenomena might be tightly related. We identify a critical level of interconnectedness, above which society fragments into sub-communities that are internally cohesive and hostile towards other groups. This critical communication density necessarily exists in the presence of social balance, and arises from the underlying mathematical structure of a phase transition known from the theory of disordered magnets called spin glasses. We discuss the consequences of this phase transition for social fragmentation in society.

<https://royalsocietypublishing.org/doi/full/10.1098/rsif.2020.0752>

FENG HUANG, MING CAO & LONG WANG – Learning enables adaptation in cooperation for multi-player stochastic games

Interactions among individuals in natural populations often occur in a dynamically changing environment. Understanding the role of environmental variation in population dynamics has long been a central topic in theoretical ecology and population biology. However, the key question of how individuals, in the middle of challenging social dilemmas (e.g. the ‘tragedy of the commons’), modulate their behaviours to adapt to the fluctuation of the environment has not yet been addressed satisfactorily. Using evolutionary game theory, we develop a framework of stochastic games that incorporates the adaptive mechanism of reinforcement learning to investigate whether cooperative behaviours can evolve in the ever-changing group interaction environment. When the action choices of players are just slightly influenced by past reinforcements, we construct an analytical condition to determine whether cooperation can be favoured over defection. Intuitively, this condition reveals why and how the environment can mediate cooperative dilemmas. Under our model architecture, we also compare this learning mechanism with two non-learning decision rules, and we find that learning significantly improves the propensity for cooperation in weak social dilemmas, and, in sharp contrast, hinders cooperation in strong social dilemmas. Our results suggest that in complex social–ecological dilemmas, learning enables the adaptation of individuals to varying environments.

<https://royalsocietypublishing.org/doi/full/10.1098/rsif.2020.0639>

LUIS A. MARTINEZ-VAQUERO, FRANCISCO C. SANTOS & VITO TRIANNI – Signalling boosts the evolution of cooperation in repeated group interactions

Many biological and social systems show significant levels of collective action. Several cooperation mechanisms have been proposed, yet they have been mostly studied independently. Among these, direct reciprocity supports cooperation on the basis of repeated interactions among individuals. Signals and quorum dynamics may also drive cooperation. Here, we resort to an evolutionary game-theoretical model to jointly analyse these two mechanisms and study the conditions in which evolution selects for direct reciprocity, signalling, or their combination. We show that signalling alone leads to higher levels of cooperation than when combined with reciprocity, while offering additional robustness against errors. Specifically, successful strategies in the realm of direct reciprocity are often not selected in the presence of signalling, and memory of past interactions is only exploited opportunistically in the case of earlier coordination failure. Differently, signalling always evolves, even when costly. In the light of these results, it may be easier to understand why direct reciprocity has been observed only in a limited number of cases among non-humans, whereas signalling is widespread at all levels of complexity.

<https://royalsocietypublishing.org/doi/abs/10.1098/rsif.2020.0635>

Nature

ARTICLES

YANG LUO – Neanderthal DNA highlights complexity of COVID risk factors

A genetic analysis reveals that some people who have severe reactions to the SARS-CoV-2 virus inherited certain sections of their DNA from Neanderthals. However, our ancestors can’t take all the blame for how someone responds to the virus.

<https://www.nature.com/articles/d41586-020-02957-3>

PAPERS

HUGO ZEBERG & SVANTE PÄÄBO – The major genetic risk factor for severe COVID-19 is inherited from Neanderthals

A recent genetic association study¹ identified a gene cluster on chromosome 3 as a risk locus for respiratory failure after infection with severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). A separate study (COVID-19 Host Genetics Initiative)² comprising 3,199 hospitalized patients with coronavirus disease 2019 (COVID-19) and control individuals showed that this cluster is the major genetic risk factor for severe symptoms after SARS-CoV-2 infection and hospitalization. Here we show that the risk is conferred by a genomic segment of around 50 kilobases in size that is inherited from Neanderthals and is carried by around 50% of people in south Asia and around 16% of people in Europe.

<https://www.nature.com/articles/s41586-020-2818-3>

Nature Human Behaviour

PAPERS

JULIA MARSHALL, DANIEL A. YUDKIN & MOLLY J. CROCKETT – Children punish third parties to satisfy both consequentialist and retributive motives

Adults punish moral transgressions to satisfy both retributive motives (such as wanting antisocial others to receive their ‘just deserts’) and consequentialist motives (such as teaching transgressors that their behaviour is inappropriate). Here, we investigated whether retributive and consequentialist motives for punishment are present in children approximately between the ages of five and seven. In two preregistered studies (N = 251), children were given the opportunity to punish a transgressor at a cost to themselves. Punishment either exclusively satisfied retributive motives by only inflicting harm on the transgressor, or additionally satisfied consequentialist motives by teaching the transgressor a lesson. We found that children punished when doing so satisfied only retributive motives, and punished considerably more when doing so also satisfied consequentialist motives. Together, these findings provide evidence for the presence of both retributive and consequentialist motives in young children.

<https://www.nature.com/articles/s41562-020-00975-9>

Nature Neuroscience

PAPERS

WEI SONG ONG, SETH MADLON-KAY & MICHAEL L. PLATT – Neuronal correlates of strategic cooperation in monkeys

We recorded neural activity in male monkeys playing a variant of the game ‘chicken’ in which they made decisions to cooperate or not cooperate to obtain rewards of different sizes. Neurons in the middle superior temporal sulcus (mSTS)—previously implicated in social perception—signaled strategic information, including payoffs, intentions of the other player, reward outcomes and predictions about the other player. Moreover, a subpopulation of mSTS neurons selectively signaled cooperatively obtained rewards. Neurons in the anterior cingulate gyrus, previously implicated in vicarious reinforcement and empathy, carried less information about strategic variables, especially cooperative reward. Strategic signals were not reducible to perceptual information about the other player or motor contingencies. These findings suggest that the capacity to compute models of other agents has deep roots in the strategic social behavior of primates and that the anterior cingulate gyrus and the mSTS support these computations.

<https://www.nature.com/articles/s41593-020-00746-9>

Nature Scientific Reports

PAPERS

GISELA KAPLAN – Play behaviour, not tool using, relates to brain mass in a sample of birds

Play behaviour and tool using in birds, two well-delineated and amply researched behaviours, have generally been associated with cognitive abilities. In this study, these behaviours were related to relative brain mass in a sample of Australian native birds. Despite suggestive research results so far between cognition and tool using, this study found no significant difference in relative brain mass or in lifespan between tool-using birds and non-tool users. By contrast, in play behaviour, subdivided into social players and non-social players, the results showed statistically very clear differences in relative brain mass between social, non-social and non-players. Social play was associated with both the largest brain mass to body mass ratios and with the longest lifespans. The results show that play behaviour is a crucial variable associated with brain enlargement, not tool using. Since many of the tool using species tested so far also play, this study suggests that false conclusions can be drawn about the connection between tool using and cognitive ability when the silent variable (play behaviour) is not taken into account.

<https://www.nature.com/articles/s41598-020-76572-7>

PeerJ

PAPERS

RICHARD POLICHT et al – Hissing of geese: caller identity encoded in a non-vocal acoustic signal

Non-vocal, or unvoiced, signals surprisingly have received very little attention until recently especially when compared to other acoustic signals. Some sounds made by terrestrial vertebrates are produced not only by the larynx but also by the

syrinx. Furthermore, some birds are known to produce several types of non-syrinx sounds. Besides mechanical sounds produced by feathers, bills and/or wings, sounds can be also produced by constriction, anywhere along the pathway from the lungs to the lips or nostrils (in mammals), or to the bill (in birds), resulting in turbulent, aerodynamic sounds. These noises often emulate whispering, snorting or hissing. Even though hissing sounds have been studied in mammals and reptiles, only a few studies have analyzed hissing sounds in birds. Presently, only the hissing of small, nesting passerines as a defense against their respective predators have been studied. We studied hissing in domestic goose. This bird represents a ground nesting non-passerine bird which frequently produces hissing out of the nest in comparison to passerines producing hissing during nesting in holes e.g., parids. Compared to vocally produced alarm calls, almost nothing is known about how non-vocal hissing sounds potentially encode information about a caller's identity. Therefore, we aimed to test whether non-vocal air expirations can encode an individual's identity similar to those sounds generated by the syrinx or the larynx. We analyzed 217 hissing sounds from 22 individual geese. We calculated the Potential for Individual Coding (PIC) comparing the coefficient of variation both within and among individuals. In addition, we conducted a series of 15 a stepwise discriminant function analysis (DFA) models. All 16 acoustic variables showed a higher coefficient of variation among individuals. Twelve DFA models revealed 51.2–54.4% classification result (cross-validated output) and all 15 models showed 60.8–68.2% classification output based on conventional DFA in comparison to a 4.5% success rate when classification by chance. This indicates the stability of the DFA results even when using different combinations of variables. Our findings showed that an individual's identity could be encoded with respect to the energy distribution at the beginning of a signal and the lowest frequencies. Body weight did not influence an individual's sound expression. Recognition of hissing mates in dangerous situations could increase the probability of their surviving via a more efficient anti-predator response.

<https://peerj.com/articles/10197/>

SOFIA FORSS et al – Chimpanzees' (Pan troglodytes) problem-solving skills are influenced by housing facility and captive care duration

Although a large body of primate cognition research is done in captive institutions, little is known about how much individuals from different facilities vary in their experiences and cognitive skills. Here we present the results of an experimental study investigating how physical cognitive skills vary between chimpanzees in relation to captive settings and their time in captivity. We tested 59 chimpanzees housed at two different captive facilities (a rehabilitation center (sanctuary) and a zoo) in three problem-solving tasks. Our results showed that chimpanzees at the two housing facilities significantly differed in overall task performance. On average, the sanctuary chimpanzees outperformed the chimpanzees housed at the zoo in the detour reaching task and the honey trap task. However, the zoo chimpanzees performed slightly better on average in the learning task. We propose that, for this particular sample, the documented differences result from a combination of factors, such as prior experience with cognitive testing, motivation levels and varying degrees of human exposure. Within the sanctuary sample, we found that chimpanzees who arrived at an earlier age at the sanctuary and had therefore spent a larger percentage of their lives in a captive environment, were better problem-solvers than those that arrived at a later age to the sanctuary. Thus, rehabilitation and time in captivity contributed to improved physical cognitive skills in sanctuary chimpanzees. Our results highlight the importance of studying intraspecific variation and the effect that previous experience and living conditions might have on physical cognitive skills in non-human apes. Accordingly, we should be cautious when extrapolating findings of cognitive studies from one population to the species as a whole.

<https://peerj.com/articles/10263/>

PLoS Biology

PAPERS

CEN YANG & YUJI NAYA – Hippocampal cells integrate past memory and present perception for the future

The ability to use stored information in a highly flexible manner is a defining feature of the declarative memory system. However, the neuronal mechanisms underlying this flexibility are poorly understood. To address this question, we recorded single-unit activity from the hippocampus of 2 nonhuman primates performing a newly devised task requiring the monkeys to retrieve long-term item-location association memory and then use it flexibly in different circumstances. We found that hippocampal neurons signaled both mnemonic information representing the retrieved location and perceptual information representing the external circumstance. The 2 signals were combined at a single-neuron level to construct goal-directed information by 3 sequentially occurring neuronal operations (e.g., convergence, transference, and targeting) in the hippocampus. Thus, flexible use of knowledge may be supported by the hippocampal constructive process linking memory and perception, which may fit the mnemonic information into the current situation to present manageable information for a subsequent action.

<https://journals.plos.org/plosbiology/article?id=10.1371/journal.pbio.3000876>

PLoS One

PAPERS

MICHAEL T. BIXTER et al – A test of a triadic conceptualization of future self-identification

People encounter intertemporal decisions every day and often engage in behaviors that are not good for their future. One factor that may explain these decisions is the perception of their distal future self. An emerging body of research suggests

that individuals vary in how they perceive their future self and many perceive their future self as a different person. The present research aimed to (1) build on and extend Hershfield's et al. (2011) review of the existing literature and advance the conceptualization of the relationship between the current and future self, (2) extend and develop measures of this relationship, and (3) examine whether and how this relationship predicts intrapsychic and achievement outcomes. The results of the literature review suggested that prior research mostly focused on one or two of the following components: (a) perceived relatedness between the current and future self in terms of similarity and connectedness, (b) vividness in imagining the future self, and (c) degree of positivity felt toward the future self. Additionally, differences in how researchers have labeled the overall construct lead us to propose future self-identification as a new label for the three-component construct. Our research built on existing measures to test the validity of a three-component model of future self-identification. Across three samples of first-year undergraduates, this research established the psychometric properties of the measure, and then examined the relationships between the components and four outcome domains of interest: (1) psychological well-being (self-esteem, hope), (2) imagination of the future (visual imagery of future events, perceived temporal distance), (3) self-control, and (4) academic performance. We demonstrated that the three components of future self-identification were correlated but independent factors. Additionally, the three components differed in their unique relationships with the outcome domains, demonstrating the utility of measuring all three components of future self-identification when seeking to predict important psychological and behavioral outcomes.

<https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0242504>

LUKAS D. LOPEZ et al – Adult responses to infant prelinguistic vocalizations are associated with infant vocabulary: A home observation study

This study used LENA recording devices to capture infants' home language environments and examine how qualitative differences in adult responding to infant vocalizations related to infant vocabulary. Infant-directed speech and infant vocalizations were coded in samples taken from daylong home audio recordings of 13-month-old infants. Infant speech-related vocalizations were identified and coded as either canonical or non-canonical. Infant-directed adult speech was identified and classified into different pragmatic types. Multiple regressions examined the relation between adult responsiveness, imitating, recasting, and expanding and infant canonical and non-canonical vocalizations with caregiver-reported infant receptive and productive vocabulary. An interaction between adult like-sound responding (i.e., the total number of imitations, recasts, and expansions) and infant canonical vocalizations indicated that infants who produced more canonical vocalizations and received more adult like-sound responses had higher productive vocabularies. When sequences were analyzed, infant canonical vocalizations that preceded and followed adult recasts and expansions were positively associated with infant productive vocabulary. These findings provide insights into how infant-adult vocal exchanges are related to early vocabulary development.

<https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0242232>

PNAS

ARTICLES

RICHARD M. SHIFFRIN et al – The brain produces mind by modeling

The connection of brain and mind has been a source of intense speculation at least since humanity became aware that the brain was the source of our behavior. Brain refers to the neurons, cells, and chemicals that govern activities of the organism. Mind is often considered consciously aware perceptions and thoughts. However, there is a gradient from unconscious to conscious, demonstrated by enormous amounts of research, such as the effects upon behavior of subliminal primes, so that mind is best considered to be the conscious and unconscious processes that act as an intermediate stage between the organism's biology and its behavior, or a translation from one to the other.

<https://www.pnas.org/content/early/2020/11/19/1912340117?etoc=>

RICHARD BARANIUK, DAVID DONOHO & MATAN GAVISH – The science of deep learning

In image processing, speech and video processing, machine vision, natural language processing, and classic two-player games, in particular, the state-of-the-art has been rapidly pushed forward over the last decade, as a series of machine-learning performance records were achieved for publicly organized challenge problems. In many of these challenges, the records now meet or exceed human performance level.

<https://www.pnas.org/content/early/2020/11/17/2020596117?etoc=>

PAPERS

DAVID W. ROBINSON et al – Datura quids at Pinwheel Cave, California, provide unambiguous confirmation of the ingestion of hallucinogens at a rock art site

While debates have raged over the relationship between trance and rock art, unambiguous evidence of the consumption of hallucinogens has not been reported from any rock art site in the world. A painting possibly representing the flowers of Datura on the ceiling of a Californian rock art site called Pinwheel Cave was discovered alongside fibrous quids in the same ceiling. Even though Native Californians are historically documented to have used Datura to enter trance states, little evidence exists to associate it with rock art. A multianalytical approach to the rock art, the quids, and the archaeological context of this site was undertaken. Liquid chromatography–mass spectrometry (LC-MS) results found hallucinogenic

alkaloids scopolamine and atropine in the quids, while scanning electron microscope analysis confirms most to be *Datura wrightii*. Three-dimensional (3D) analyses of the quids indicate the quids were likely masticated and thus consumed in the cave under the paintings. Archaeological evidence and chronological dating shows the site was well utilized as a temporary residence for a range of activities from Late Prehistory through Colonial Periods. This indicates that *Datura* was ingested in the cave and that the rock painting represents the plant itself, serving to codify communal rituals involving this powerful entheogen. These results confirm the use of hallucinogens at a rock art site while calling into question previous assumptions concerning trance and rock art imagery.

<https://www.pnas.org/content/early/2020/11/18/2014529117.abstract?etoc>

CHRISTOPHER W. LYNN & DANIELLE S. BASSETT – How humans learn and represent networks

Humans receive information from the world around them in sequences of discrete items—from words in language or notes in music to abstract concepts in books and websites on the Internet. To model their environment, from a young age people are tasked with learning the network structures formed by these items (nodes) and the connections between them (edges). But how do humans uncover the large-scale structures of networks when they experience only sequences of individual items? Moreover, what do people’s internal maps and models of these networks look like? Here, we introduce graph learning, a growing and interdisciplinary field studying how humans learn and represent networks in the world around them. Specifically, we review progress toward understanding how people uncover the complex webs of relationships underlying sequences of items. We begin by describing established results showing that humans can detect fine-scale network structure, such as variations in the probabilities of transitions between items. We next present recent experiments that directly control for differences in transition probabilities, demonstrating that human behavior depends critically on the mesoscale and macroscale properties of networks. Finally, we introduce computational models of human graph learning that make testable predictions about the impact of network structure on people’s behavior and cognition. Throughout, we highlight open questions in the study of graph learning that will require creative insights from cognitive scientists and network scientists alike.

<https://www.pnas.org/content/early/2020/11/19/1912328117?etoc=>

KELSEY R. ALLEN, KEVIN A. SMITH & JOSHUA B. TENENBAUM – Rapid trial-and-error learning with simulation supports flexible tool use and physical reasoning

Many animals, and an increasing number of artificial agents, display sophisticated capabilities to perceive and manipulate objects. But human beings remain distinctive in their capacity for flexible, creative tool use—using objects in new ways to act on the world, achieve a goal, or solve a problem. To study this type of general physical problem solving, we introduce the Virtual Tools game. In this game, people solve a large range of challenging physical puzzles in just a handful of attempts. We propose that the flexibility of human physical problem solving rests on an ability to imagine the effects of hypothesized actions, while the efficiency of human search arises from rich action priors which are updated via observations of the world. We instantiate these components in the “sample, simulate, update” (SSUP) model and show that it captures human performance across 30 levels of the Virtual Tools game. More broadly, this model provides a mechanism for explaining how people condense general physical knowledge into actionable, task-specific plans to achieve flexible and efficient physical problem solving.

<https://www.pnas.org/content/early/2020/11/19/1912341117.abstract?etoc>

MARIA K. ECKSTEIN & ANNE G. E. COLLINS – Computational evidence for hierarchically structured reinforcement learning in humans

Humans have the fascinating ability to achieve goals in a complex and constantly changing world, still surpassing modern machine-learning algorithms in terms of flexibility and learning speed. It is generally accepted that a crucial factor for this ability is the use of abstract, hierarchical representations, which employ structure in the environment to guide learning and decision making. Nevertheless, how we create and use these hierarchical representations is poorly understood. This study presents evidence that human behavior can be characterized as hierarchical reinforcement learning (RL). We designed an experiment to test specific predictions of hierarchical RL using a series of subtasks in the realm of context-based learning and observed several behavioral markers of hierarchical RL, such as asymmetric switch costs between changes in higher-level versus lower-level features, faster learning in higher-valued compared to lower-valued contexts, and preference for higher-valued compared to lower-valued contexts. We replicated these results across three independent samples. We simulated three models—a classic RL, a hierarchical RL, and a hierarchical Bayesian model—and compared their behavior to human results. While the flat RL model captured some aspects of participants’ sensitivity to outcome values, and the hierarchical Bayesian model captured some markers of transfer, only hierarchical RL accounted for all patterns observed in human behavior. This work shows that hierarchical RL, a biologically inspired and computationally simple algorithm, can capture human behavior in complex, hierarchical environments and opens the avenue for future research in this field.

<https://www.pnas.org/content/early/2020/11/19/1912330117.abstract?etoc>

ARIANA ORVELL, ETHAN KROSS & SUSAN A. GELMAN – “You” speaks to me: Effects of generic-you in creating resonance between people and ideas

Creating resonance between people and ideas is a central goal of communication. Historically, attempts to understand the factors that promote resonance have focused on altering the content of a message. Here we identify an additional route to evoking resonance that is embedded in the structure of language: the generic use of the word “you” (e.g., “You can’t understand someone until you’ve walked a mile in their shoes”). Using crowd-sourced data from the Amazon Kindle application, we demonstrate that passages that people highlighted—collectively, over a quarter of a million times—were substantially more likely to contain generic-you compared to yoked passages that they did not highlight. We also demonstrate in four experiments ($n = 1,900$) that ideas expressed with generic-you increased resonance. These findings illustrate how a subtle shift in language establishes a powerful sense of connection between people and ideas.

<https://www.pnas.org/content/early/2020/11/19/2010939117.abstract?etoc>

GIWON BAHG et al – Gaussian process linking functions for mind, brain, and behavior

The link between mind, brain, and behavior has mystified philosophers and scientists for millennia. Recent progress has been made by forming statistical associations between manifest variables of the brain (e.g., electroencephalogram [EEG], functional MRI [fMRI]) and manifest variables of behavior (e.g., response times, accuracy) through hierarchical latent variable models. Within this framework, one can make inferences about the mind in a statistically principled way, such that complex patterns of brain–behavior associations drive the inference procedure. However, previous approaches were limited in the flexibility of the linking function, which has proved prohibitive for understanding the complex dynamics exhibited by the brain. In this article, we propose a data-driven, nonparametric approach that allows complex linking functions to emerge from fitting a hierarchical latent representation of the mind to multivariate, multimodal data. Furthermore, to enforce biological plausibility, we impose both spatial and temporal structure so that the types of realizable system dynamics are constrained. To illustrate the benefits of our approach, we investigate the model’s performance in a simulation study and apply it to experimental data. In the simulation study, we verify that the model can be accurately fitted to simulated data, and latent dynamics can be well recovered. In an experimental application, we simultaneously fit the model to fMRI and behavioral data from a continuous motion tracking task. We show that the model accurately recovers both neural and behavioral data and reveals interesting latent cognitive dynamics, the topology of which can be contrasted with several aspects of the experiment.

<https://www.pnas.org/content/early/2020/11/19/1912342117.abstract?etoc>

RUFUS A. JOHNSTONE et al – Exploitative leaders incite intergroup warfare in a social mammal

Collective conflicts among humans are widespread, although often highly destructive. A classic explanation for the prevalence of such warfare in some human societies is leadership by self-serving individuals that reap the benefits of conflict while other members of society pay the costs. Here, we show that leadership of this kind can also explain the evolution of collective violence in certain animal societies. We first extend the classic hawk–dove model of the evolution of animal aggression to consider cases in which a subset of individuals within each group may initiate fights in which all group members become involved. We show that leadership of this kind, when combined with inequalities in the payoffs of fighting, can lead to the evolution of severe intergroup aggression, with negative consequences for population mean fitness. We test our model using long-term data from wild banded mongooses, a species characterized by frequent intergroup conflicts that have very different fitness consequences for male and female group members. The data show that aggressive encounters between groups are initiated by females, who gain fitness benefits from mating with extragroup males in the midst of battle, whereas the costs of fighting are borne chiefly by males. In line with the model predictions, the result is unusually severe levels of intergroup violence. Our findings suggest that the decoupling of leaders from the costs that they incite amplifies the destructive nature of intergroup conflict.

<https://www.pnas.org/content/117/47/29759.abstract?etoc>

Proceedings of the Royal Society B

PAPERS

JOHN M. MCNAMARA & ZOLTAN BARTA – Behavioural flexibility and reputation formation

Limited flexibility in behaviour gives rise to behavioural consistency, so that past behaviour is partially predictive of current behaviour. The consequences of limits to flexibility are investigated in a population in which pairs of individuals play a game of trust. The game can either be observed by others or not. Reputation is based on trustworthiness when observed and acts as a signal of behaviour in future interactions with others. Individuals use the reputation of partner in deciding whether to trust them, both when observed by others and when not observed. We explore the effects of costs of exhibiting a difference in behaviour between when observed and when not observed (i.e. a cost of flexibility). When costs are low, individuals do not attempt to signal that they will later be trustworthy: their signal should not be believed since it will always pay them to be untrustworthy if trusted. When costs are high, their local optimal behaviour automatically acts as an honest signal. At intermediate costs, individuals are very trustworthy when observed in order to convince others of their trustworthiness when unobserved. It is hypothesized that this type of strong signalling might occur in other settings.

<https://royalsocietypublishing.org/doi/abs/10.1098/rspb.2020.1758>

LUCAS MOLLEMAN et al – Strategies for integrating disparate social information

Social information use is widespread in the animal kingdom, helping individuals rapidly acquire useful knowledge and adjust to novel circumstances. In humans, the highly interconnected world provides ample opportunities to benefit from social information but also requires navigating complex social environments with people holding disparate or conflicting views. It is, however, still largely unclear how people integrate information from multiple social sources that (dis)agree with them, and among each other. We address this issue in three steps. First, we present a judgement task in which participants could adjust their judgements after observing the judgements of three peers. We experimentally varied the distribution of this social information, systematically manipulating its variance (extent of agreement among peers) and its skewness (peer judgements clustering either near or far from the participant's judgement). As expected, higher variance among peers reduced their impact on behaviour. Importantly, observing a single peer confirming a participant's own judgement markedly decreased the influence of other—more distant—peers. Second, we develop a framework for modelling the cognitive processes underlying the integration of disparate social information, combining Bayesian updating with simple heuristics. Our model accurately accounts for observed adjustment strategies and reveals that people particularly heed social information that confirms personal judgements. Moreover, the model exposes strong inter-individual differences in strategy use. Third, using simulations, we explore the possible implications of the observed strategies for belief updating. These simulations show how confirmation-based weighting can hamper the influence of disparate social information, exacerbate filter bubble effects and deepen group polarization. Overall, our results clarify what aspects of the social environment are, and are not, conducive to changing people's minds.

<https://royalsocietypublishing.org/doi/full/10.1098/rspb.2020.2413>

Trends in Cognitive Sciences

PAPERS

MICHAEL PEER et al – Structuring Knowledge with Cognitive Maps and Cognitive Graphs

Humans and animals use mental representations of the spatial structure of the world to navigate. The classical view is that these representations take the form of Euclidean cognitive maps, but alternative theories suggest that they are cognitive graphs consisting of locations connected by paths. We review evidence suggesting that both map-like and graph-like representations exist in the mind/brain that rely on partially overlapping neural systems. Maps and graphs can operate simultaneously or separately, and they may be applied to both spatial and nonspatial knowledge. By providing structural frameworks for complex information, cognitive maps and cognitive graphs may provide fundamental organizing schemata that allow us to navigate in physical, social, and conceptual spaces.

[https://www.cell.com/trends/cognitive-sciences/fulltext/S1364-6613\(20\)30250-3?dgcid=raven_jbs_aip_email](https://www.cell.com/trends/cognitive-sciences/fulltext/S1364-6613(20)30250-3?dgcid=raven_jbs_aip_email)

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