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NOTICES

PUBLICATION ALERTS

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

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

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

EAORC NEWS – Replacing the Membership Page on the Website

The new membership page is now live. If you wish to add a comment, just send me a few kind words about EAORC and I'll include them.

You can add a comment no matter how you receive the bulletin – first-hand by email every Sunday, by copied email, by ResearchGate notification, or any way you access the bulletin.

Many thanks in anticipation, and especial thanks to those who have already responded.

Martin

ACADEMIA.EDU – Body mass estimates of hominin fossils and the evolution of human body size

In Journal of Human Evolution 85, 75-93 (2015)

MARK GRABOWSKI et al – Body mass estimates of hominin fossils and the evolution of human body size

Body size directly influences an animal's place in the natural world, including its energy requirements, home range size, relative brain size, locomotion, diet, life history, and behavior. Thus, an understanding of the biology of extinct organisms, including species in our own lineage, requires accurate estimates of body size. Since the last major review of hominin body size based on postcranial morphology over 20 years ago, new fossils have been discovered, species attributions have been clarified, and methods improved. Here, we present the most comprehensive and thoroughly vetted set of individual fossil hominin body mass predictions to date, and estimation equations based on a large (n = 220) sample of modern humans of known body masses. We also present species averages based exclusively on fossils with reliable taxonomic attributions, estimates of species averages by sex, and a metric for levels of sexual dimorphism. Finally, we identify individual traits that appear to be the most reliable for mass estimation for each fossil species, for use when only one measurement is available for a fossil. Our results show that many early hominins were generally smaller-bodied than previously thought, an outcome likely due to larger estimates in previous studies resulting from the use of large-bodied modern human reference samples. Current evidence indicates that modern human-like large size first appeared by at least 3-3.5 Ma in some Australopithecus afarensis individuals. Our results challenge an evolutionary model arguing that body size increased from Australopithecus to early Homo. Instead, we show that there is no reliable evidence that the body size of non-erectus early Homo differed from that of australopiths, and confirm that Homo erectus evolved larger average body size than earlier hominins.

[https://www.academia.edu/30544370/Body mass estimates of hominin fossils and the evolution of human body size](https://www.academia.edu/30544370/Body_mass_estimates_of_hominin_fossils_and_the_evolution_of_human_body_size)

NEWS

BREAKING SCIENCE – Avian Vocal Learning Begins Before Birth, Study Says

An international team of scientists led by Flinders University has found evidence of prenatal auditory learning in embryos of three vocal learning species (superb fairy-wren, red-winged fairy-wren and Darwin's small ground finch) and two vocal non-learning species (little penguin and Japanese quail).

http://feedproxy.google.com/~r/BreakingScienceNews/~3/DV4UvfsWdD0/avian-vocal-learning-10038.html?utm_source=feedburner&utm_medium=email

BREAKING SCIENCE – Middle Paleolithic Neanderthals Used Sophisticated Tool-Making Techniques

Archaeologists have examined a large assemblage of 45,000-year-old stone tools and by-products of tool-making process from the site of Heidenschmiede in the Swabian Jura, southwestern Germany. Heidenschmiede is a rockshelter, just below the castle of Hellenstein in the city of Heidenheim at the Brenz river in the eastern part of the Swabian Jura.

http://feedproxy.google.com/~r/BreakingScienceNews/~3/zXPU8_SW4Hs/middle-paleolithic-neanderthals-tool-making-techniques-10047.html?utm_source=feedburner&utm_medium=email

NATURE BRIEFING – No hands, no problem: clever parrots craft and wield tools

The Goffin's cockatoo joins chimpanzees and others in the small club of animals that can make implements.

<https://nature.us17.list-manage.com/track/click?u=2c6057c528fdc6f73fa196d9d&id=67e562291a&e=1db4b9a19b>

NATURE BRIEFING – Made-up words convey across cultures

Nonsense words can be recognizable to people around the world — and not just when they're onomatopoeic. Researchers asked English-speaking people, mostly from the United States, to make up sounds to represent a wide range of concepts, including 'sleep', 'tiger', 'many' and 'good'. These vocalizations were played for volunteers in 7 countries, who spoke a total of 28 languages, and had to guess the sounds' meanings from a list of options. Across the board, people guessed the intended meanings at rates better than chance. The findings might hint at 'iconic' sounds that serve as the foundations for language.

<https://nature.us17.list-manage.com/track/click?u=2c6057c528fdc6f73fa196d9d&id=b505a8d0e7&e=1db4b9a19b>

SAPIENS – Pottery and ancient diets

Archaeologists, armed with new technology and old fragments of food containers, are piecing together what humans in the past cooked and ate.

<https://sapiens.us11.list-manage.com/track/click?u=80f6cf678900daf984bf763b7&id=a5c1690204&e=dc0eff6180>

SCIENCE DAILY – Learning by doing: How the brain's motor system can support vocabulary learning

Neuroscientists present new findings on how the motor cortex can help learn foreign vocabulary more quickly. The new data suggests that learning techniques that involve the performance of gestures instead of simple audio or visual information can benefit learners.

<https://www.sciencedaily.com/releases/2021/09/210909123911.htm>

SCIENCE DAILY – Environmental conditions of early humans in Europe

The conditions under which early members of the genus *Homo* dispersed outside Africa were analysed on a broader scale, across Europe during the Early and Middle Pleistocene. The model is based on the comparison of functional trait distribution of large herbivorous mammals in sites with archaeological or fossil evidence of human presence and in sites, which lack evidence of human presence.

<https://www.sciencedaily.com/releases/2021/09/210908180505.htm>

SOCIETY FOR SCIENCE – Infants may laugh like some apes in their first months of life

Laughter seems to change over life's early months, perhaps influenced by the unconscious feedback parents give when they play with their little ones.

<http://click.societyforscience->

email.com/?qs=7620b96af412f1c464de0d85c735bd6a43dbca2af678b8286bdfbbe38a9d3acc86d9d8b45784e171ee664c8661af6ed459bd94bb2ae07fa3

THE CONVERSATION – Exposure of faked dishonesty study makes me proud to be a behavioural scientist

Some thought Dan Ariely's faked data study might be a blow to behavioural science, but actually its exposure shows how behavioural scientists are rooting out false research.

<https://theconversationuk.cmail19.com/t/r-l-trniit-khhiliah-a/>

PUBLICATIONS

American Journal of Physical Anthropology

PAPERS

SCOTT A. WILLIAMS & DAVID PILBEAM – Homeotic change in segment identity derives the human vertebral formula from a chimpanzee-like one

One of the most contentious issues in paleoanthropology is the nature of the last common ancestor of humans and our closest living relatives, chimpanzees and bonobos (panins). The numerical composition of the vertebral column has featured prominently, with multiple models predicting distinct patterns of evolution and contexts from which bipedalism evolved. Here, we study total numbers of vertebrae from a large sample of hominoids to quantify variation in and patterns of regional and total numbers of vertebrae in hominoids.

We compile and study a large sample ($N = 893$) of hominoid vertebral formulae (numbers of cervical, thoracic, lumbar, sacral, caudal segments in each specimen) and analyze full vertebral formulae, total numbers of vertebrae, and super-regional numbers of vertebrae: presacral (cervical, thoracic, lumbar) vertebrae and sacrococcygeal vertebrae. We quantify within- and between-taxon variation using heterogeneity and similarity measures derived from population genetics.

We find that humans are most similar to African apes in total and super-regional numbers of vertebrae. Additionally, our analyses demonstrate that selection for bipedalism reduced variation in numbers of vertebrae relative to other hominoids.

<https://onlinelibrary.wiley.com/doi/abs/10.1002/ajpa.24356>

JOEL D. IRISH & MARK GRABOWSKI – Relative tooth size, Bayesian Inference, and *Homo naledi*

Size-corrected tooth crown measurements were used to estimate phenetic affinities among *Homo naledi* (~335–236 ka) and 11 other Plio-Pleistocene and recent species. To assess further their efficacy, and identify dental evolutionary trends, the data were then quantitatively coded for phylogenetic analyses. Results from both methods contribute additional characterization of *H. naledi* relative to other hominins.

After division by their geometric mean, scaled mesiodistal and buccolingual dimensions were used in tooth size apportionment analysis to compare *H. naledi* with *Australopithecus africanus*, *A. afarensis*, *Paranthropus robustus*, *P. boisei*, *H. habilis*, *H. ergaster*, *H. erectus*, *H. heidelbergensis*, *H. neanderthalensis*, *H. sapiens*, and *Pan troglodytes*. These data produce equivalently scaled samples unaffected by interspecific size differences. The data were then gap-weighted for Bayesian inference.

Congruence in interspecific relationships is evident between methods, and with many inferred from earlier systematic studies. However, the present results place *H. naledi* as a sister taxon to *H. habilis*, based on a symplesiomorphic pattern of relative tooth size. In the preferred Bayesian phylogram, *H. naledi* is nested within a clade comprising all *Homo* species, but it shares some characteristics with australopiths and, particularly, early *Homo*.

<https://onlinelibrary.wiley.com/doi/full/10.1002/ajpa.24353>

Current Biology

PAPERS

CLÉMENTINE BODIN et al with PASCAL BELIN – Functionally homologous representation of vocalizations in the auditory cortex of humans and macaques

How the evolution of speech has transformed the human auditory cortex compared to other primates remains largely unknown. While primary auditory cortex is organized largely similarly in humans and macaques,¹ the picture is much less clear at higher levels of the anterior auditory pathway,² particularly regarding the processing of conspecific vocalizations (CVs). A “voice region” similar to the human voice-selective areas^{3,4} has been identified in the macaque right anterior temporal lobe with functional MRI;⁵ however, its anatomical localization, seemingly inconsistent with that of the human temporal voice areas (TVAs), has suggested a “repositioning of the voice area” in recent human evolution.⁶ Here we report a functional homology in the cerebral processing of vocalizations by macaques and humans, using comparative fMRI and a condition-rich auditory stimulation paradigm. We find that the anterior temporal lobe of both species possesses cortical voice areas that are bilateral and not only prefer conspecific vocalizations but also implement a representational geometry categorizing them apart from all other sounds in a species-specific but homologous manner. These results reveal a more similar functional organization of higher-level auditory cortex in macaques and humans than currently known.

[https://www.cell.com/current-biology/fulltext/S0960-9822\(21\)01147-7](https://www.cell.com/current-biology/fulltext/S0960-9822(21)01147-7)

eLife

PAPERS

YANG ZHOU et al – Distributed functions of prefrontal and parietal cortices during sequential categorical decisions

Comparing sequential stimuli is crucial for guiding complex behaviors. To understand mechanisms underlying sequential decisions, we compared neuronal responses in the prefrontal cortex (PFC), the lateral intraparietal (LIP), and medial intraparietal (MIP) areas in monkeys trained to decide whether sequentially presented stimuli were from matching (M) or nonmatching (NM) categories. We found that PFC leads M/NM decisions, whereas LIP and MIP appear more involved in stimulus evaluation and motor planning, respectively. Compared to LIP, PFC showed greater nonlinear integration of currently visible and remembered stimuli, which correlated with the monkeys’ M/NM decisions. Furthermore, multi-module recurrent networks trained on the same task exhibited key features of PFC and LIP encoding, including nonlinear integration in the PFC-like module, which was causally involved in the networks’ decisions. Network analysis found that nonlinear units have stronger and more widespread connections with input, output, and within-area units, indicating putative circuit-level mechanisms for sequential decisions.

<https://elifesciences.org/articles/58782>

Evolutionary Anthropology

PAPERS

SARAH E. DETROY, DANIEL B. M. HAUN & EDWIN J. C. VAN LEEUWEN – What isn't social tolerance? The past, present, and possible future of an overused term in the field of primatology

In the past four decades, the term social tolerance has been utilized to describe, explain, and predict many different aspects of primates' sociality and has been measured with a large range of traits and behaviors. To date, however, there has been little discussion on whether these different phenomena all reflect one and the same construct. This paper opens the discussion by presenting the historical development of the term social tolerance and a structured overview of its current, overextended use. We argue that social tolerance has developed to describe two distinct concepts: social tolerance as the social structure of a group and social tolerance as the dyadic or group-level manifestation of tolerant behaviors. We highlight how these two concepts are based on conflicting theoretical understandings and practical assessments. In conclusion, we present suggestions for future research on primate social tolerance, which will allow for a more systematic and comparable investigation of primate sociality.

<https://onlinelibrary.wiley.com/doi/full/10.1002/evan.21923>

Frontiers in Ecology and Evolution

PAPERS

DYLAN S. DAVIS & KRISTINA DOUGLASS – Remote Sensing Reveals Lasting Legacies of Land-Use by Small-Scale Foraging Communities in the Southwestern Indian Ocean

Archaeologists interested in the evolution of anthropogenic landscapes have productively adopted Niche Construction Theory (NCT), in order to assess long-term legacies of human-environment interactions. Applications of NCT have especially been used to elucidate co-evolutionary dynamics in agricultural and pastoral systems. Meanwhile, foraging and/or highly mobile small-scale communities, often thought of as less intensive in terms of land-use than agropastoral economies, have received less theoretical and analytical attention from a landscape perspective. Here we address this lacuna by contributing a novel remote sensing approach for investigating legacies of human-environment interaction on landscapes that have a long history of co-evolution with highly mobile foraging communities. Our study is centered on coastal southwest Madagascar, a region inhabited by foraging and fishing communities for close to two millennia. Despite significant environmental changes in southwest Madagascar's environment following human settlement, including a wave of faunal extinctions, little is known

about the scale, pace and nature of anthropogenic landscape modification. Archaeological deposits in this area generally bear ephemeral traces of past human activity and do not exhibit readily visible signatures of intensive land-use and landscape modification (e.g., agricultural modifications, monumental architecture, etc.). In this paper we use high-resolution satellite imagery and vegetative indices to reveal a legacy of human-landscape co-evolution by comparing the characteristics – vegetative productivity and geochemical properties – of archaeological sites to those of locations with no documented archaeological materials. Then, we use a random forest (RF) algorithm and spatial statistics to quantify the extent of archaeological activity and use this analysis to contextualize modern-day human-environment dynamics. Our results demonstrate that coastal foraging communities in southwest Madagascar over the past 1,000 years have extensively altered the landscape. Our study thus expands the temporal and spatial scales at which we can evaluate human-environment dynamics on Madagascar, providing new opportunities to study early periods of the island's human history when mobile foraging communities were the dominant drivers of landscape change.

<https://www.frontiersin.org/articles/10.3389/fevo.2021.689399/full>

Nature Communications

PAPERS

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

AMALIA P. M. BASTOS et al – Self-care tooling innovation in a disabled kea (*Nestor notabilis*)

Tooling is associated with complex cognitive abilities, occurring most regularly in large-brained mammals and birds. Among birds, self-care tooling is seemingly rare in the wild, despite several anecdotal reports of this behaviour in captive parrots. Here, we show that Bruce, a disabled parrot lacking his top mandible, deliberately uses pebbles to preen himself. Evidence for this behaviour comes from five lines of evidence: (i) in over 90% of instances where Bruce picked up a pebble, he then used it to preen; (ii) in 95% of instances where Bruce dropped a pebble, he retrieved this pebble, or replaced it, in order to resume preening; (iii) Bruce selected pebbles of a specific size for preening rather than randomly sampling available pebbles in his environment; (iv) no other kea in his environment used pebbles for preening; and (v) when other individuals did interact with stones, they used stones of different sizes to those Bruce preened with. Our study provides novel and empirical evidence for deliberate self-care tooling in a bird species where tooling is not a species-specific behaviour. It also supports claims that tooling can be innovated based on ecological necessity by species with sufficiently domain-general cognition.

<https://www.nature.com/articles/s41598-021-97086-w>

ALESSANDRO GALLO et al – First evidence of yawn contagion in a wild monkey species

Yawn contagion occurs when individuals yawn in response to the yawn of others (triggers). This is the first account of yawn contagion in wild geladas (*Theropithecus gelada*), a monkey species that shows yawn contagion in captivity and is organized in core units (one-male/bachelor groups) forming multilevel associations. In a population of geladas from the Kundi plateau (Ethiopia) we found that the yawning response was highest when geladas could perceive a triggering yawn, which confirms that yawn contagion is present in the wild. Yawn duration, mouth-opening degree and presence/absence of vocalisation (possibly modulating yawn detectability) did not affect the likelihood of contagion. Males and females, known to be both implicated in movement initiation within groups, were similarly powerful as yawn triggers. Instead, group membership and responder sex had a significant role in shaping the phenomenon. Yawn contagion was highest between individuals belonging to different core units and males were most likely to respond to others' yawns. Because males have a non-negligible role in inter-group coordination, our results suggest that yawn contagion may have a communicative function that goes beyond the basic unit level.

<https://www.nature.com/articles/s41598-021-96423-3>

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>

New Scientist

NEWS

Wild cockatoos make utensils out of tree branches to open fruit pits

Some wild cockatoos whittle tree branches into utensils that they use to open and dig into the seed-laden pits, or stones, of tropical fruit. This is the first known instance of wild, non-primate animals making and using tool sets, say Mark O'Hara and Berenika Mioduszewska at the University of Veterinary Medicine, Vienna.

<https://www.newscientist.com/article/2288714-wild-cockatoos-make-utensils-out-of-tree-branches-to-open-fruit-pits/#ixzz760BRBCH9>

Philosophical Transactions of the Royal Society B

PAPERS

SAMANTHA CAROUSO-PECK, MICHAEL H. GOLDSTEIN & W. TECUMSEH FITCH – The many functions of vocal learning

The capacity to learn novel vocalizations has evolved convergently in a wide range of species. Courtship songs of male birds or whales are often treated as prototypical examples, implying a sexually selected context for the evolution of this ability. However, functions of learned vocalizations in different species are far more diverse than courtship, spanning a range of socio-positive contexts from individual identification, social cohesion, or advertising pair bonds, as well as agonistic contexts such as territorial defence, deceptive alarm calling or luring prey. Here, we survey the diverse usages and proposed functions of learned novel signals, to build a framework for considering the evolution of vocal learning capacities that extends beyond sexual selection. For each function that can be identified for learned signals, we provide examples of species using unlearned signals to accomplish the same goals. We use such comparisons to generate hypotheses concerning when vocal learning is adaptive, given a particular suite of socio-ecological traits. Finally, we identify areas of uncertainty where improved understanding would allow us to better test these hypotheses. Considering the broad range of potential functions of vocal learning will yield a richer appreciation of its evolution than a narrow focus on a few prototypical species.

<https://royalsocietypublishing.org/doi/abs/10.1098/rstb.2020.0235>

WILLIAM A. SEARCY et al with STEPHEN NOWICKI – Variation in vocal production learning across songbirds

Songbirds as a whole are considered to be vocal production learners, meaning that they modify the structure of their vocalizations as a result of experience with the vocalizations of others. The more than 4000 species of songbirds, however, vary greatly in crucial features of song development. Variable features include: (i) the normality of the songs of early-deafened birds, reflecting the importance of innate motor programmes in song development; (ii) the normality of the songs of isolation-reared birds, reflecting the combined importance of innate auditory templates and motor programmes; (iii) the degree of selectivity in choice of external models; (iv) the accuracy of copying from external models; and (v) whether or not learning from external models continues into adulthood. We suggest that because of this variability, some songbird species, specifically those that are able to develop songs in the normal range without exposure to external models, can be classified as limited vocal learners. Those species that require exposure to external models to develop songs in the normal range can be considered complex vocal learners.

<https://royalsocietypublishing.org/doi/abs/10.1098/rstb.2020.0257>

CAREL TEN CATE – Re-evaluating vocal production learning in non-oscine birds

The study of vocal production learning in birds is heavily biased towards oscine songbirds, making the songbird model the reference for comparative studies. However, as vocal learning was probably ancestral in songbirds, interspecific variations might all be variations on a single theme and need not be representative of the nature and characteristics of vocal learning in other bird groups. To assess the possible mechanisms of vocal learning and its evolution therefore requires knowledge about independently evolved incidences of vocal learning. This review examines the presence and nature of vocal production learning in non-songbirds. Using a broad definition of vocal learning and a comparative phylogenetic framework, I evaluate the evidence for vocal learning and its characteristics in non-oscine birds, including well-known vocal learners such as parrots and hummingbirds but also (putative) cases from other taxa. Despite the sometimes limited evidence, it is clear that vocal

learning occurs in a range of different, non-related, taxa and can be caused by a variety of mechanisms. It is more widespread than often realized, calling for more systematic studies. Examining this variation may provide a window onto the evolution of vocal learning and increase the value of comparative research for understanding vocal learning in humans.

<https://royalsocietypublishing.org/doi/full/10.1098/rstb.2020.0249>

SAMANTHA CAROUSO-PECK & MICHAEL H. GOLDSTEIN – Evolving the capacity for socially guided vocal learning in songbirds: a preliminary study

Socially guided vocal learning, the ability to use contingent reactions from social partners to guide immature vocalizations to more mature forms, is thought to be a rare ability known to be used only by humans, marmosets and two unrelated songbird species (brown-headed cowbirds and zebra finches). However, this learning strategy has never been investigated in the vast majority of species that are known to modify their vocalizations over development. We propose a novel, preliminary evolutionary modelling approach that uses ecological, reproductive and developmental traits to predict which species may incorporate social influences as part of their vocal learning system. We demonstrate our model using data from 28 passerines. We found three highly predictive traits: temporal overlap between sensory (memorization) and sensorimotor (practice) phases of song learning, song used for mate attraction, and social gregariousness outside the breeding season. Species with these traits were distributed throughout the clade, suggesting that a trait-based approach may yield new insights into the evolution of learning strategies that cannot be gleaned from phylogenetic relatedness alone. Our model suggests several previously uninvestigated and unexpected species as likely socially guided vocal learners and offers new insight into the evolution and development of vocal learning.

<https://royalsocietypublishing.org/doi/abs/10.1098/rstb.2020.0246>

VINCENT M. JANIK & MIRJAM KNÖRNSCHILD – Vocal production learning in mammals revisited

Vocal production learning, the ability to modify the structure of vocalizations as a result of hearing those of others, has been studied extensively in birds but less attention has been given to its occurrence in mammals. We summarize the available evidence for vocal learning in mammals from the last 25 years, updating earlier reviews on the subject. The clearest evidence comes from cetaceans, pinnipeds, elephants and bats where species have been found to copy artificial or human language sounds, or match acoustic models of different sound types. Vocal convergence, in which parameter adjustments within one sound type result in similarities between individuals, occurs in a wider range of mammalian orders with additional evidence from primates, mole-rats, goats and mice. Currently, the underlying mechanisms for convergence are unclear with vocal production learning but also usage learning or matching physiological states being possible explanations. For experimental studies, we highlight the importance of quantitative comparisons of seemingly learned sounds with vocal repertoires before learning started or with species repertoires to confirm novelty. Further studies on the mammalian orders presented here as well as others are needed to explore learning skills and limitations in greater detail.

<https://royalsocietypublishing.org/doi/full/10.1098/rstb.2020.0244>

JULIE N. OSWALD et al – Species information in whistle frequency modulation patterns of common dolphins

The most flexible communication systems are those of open-ended vocal learners that can acquire new signals throughout their lifetimes. While acoustic signals carry information in general voice features that affect all of an individual's vocalizations, vocal learners can also introduce novel call types to their repertoires. Delphinids are known for using such learned call types in individual recognition, but their role in other contexts is less clear. We investigated the whistles of two closely related, sympatric common dolphin species, *Delphinus delphis* and *Delphinus bairdii*, to evaluate species differences in whistle contours. Acoustic recordings of single-species groups were obtained from the Southern California Bight. We used an unsupervised neural network to categorize whistles and compared the resulting whistle types between species. Of the whistle types recorded in more than one encounter, 169 were shared between species and 60 were species-specific (32 *D. delphis* types, 28 *D. bairdii* types). *Delphinus delphis* used 15 whistle types with an oscillatory frequency contour while only one such type was found in *D. bairdii*. Given the role of vocal learning in delphinid vocalizations, we argue that these differences in whistle production are probably culturally driven and could help facilitate species recognition between *Delphinus* species.

<https://royalsocietypublishing.org/doi/full/10.1098/rstb.2021.0046>

ANGELA S. STOEGER & ANTON BAOTIC – Operant control and call usage learning in African elephants

Elephants exhibit remarkable vocal plasticity, and case studies reveal that individuals of African savannah (*Loxodonta africana*) and Asian (*Elephas maximus*) elephants are capable of vocal production learning. Surprisingly, however, little is known about contextual learning (usage and comprehension learning) in elephant communication. Usage learning can be demonstrated by training animals to vocalize in an arbitrary (cue-triggered) context. Here we show that adult African savannah elephants ($n = 13$) can vocalize in response to verbal cues, reliably producing social call types such as the low-frequency rumble, trumpets and snorts as well as atypical sounds using various mechanisms, thus displaying compound vocal control. We further show that rumbles emitted upon trainer cues differ significantly in structure from rumbles triggered by social contexts of the same individuals ($n = 6$). Every form of social learning increases the complexity of a communication system. In elephants, we only poorly understand their vocal learning abilities and the underlying cognitive mechanisms.

Among other research, this calls for controlled learning experiments in which the prerequisite is operant/volitional control of vocalizations.

<https://royalsocietypublishing.org/doi/full/10.1098/rstb.2020.0254>

DIANE COLOMBELLI-NÉGREL et al – Prenatal auditory learning in avian vocal learners and non-learners

Understanding when learning begins is critical for identifying the factors that shape both the developmental course and the function of information acquisition. Until recently, sufficient development of the neural substrates for any sort of vocal learning to begin in songbirds was thought to be reached well after hatching. New research shows that embryonic gene activation and the outcome of vocal learning can be modulated by sound exposure in ovo. We tested whether avian embryos across lineages differ in their auditory response strength and sound learning in ovo, which we studied in vocal learning (Maluridae, Geospizidae) and vocal non-learning (Phasianidae, Spheniscidae) taxa. While measuring heart rate in ovo, we exposed embryos to (i) conspecific or heterospecific vocalizations, to determine their response strength, and (ii) conspecific vocalizations repeatedly, to quantify cardiac habituation, a form of non-associative learning. Response strength towards conspecific vocalizations was greater in two species with vocal production learning compared to two species without. Response patterns consistent with non-associative auditory learning occurred in all species. Our results demonstrate a capacity to perceive and learn to recognize sounds in ovo, as evidenced by habituation, even in species that were previously assumed to have little, if any, vocal production learning.

<https://royalsocietypublishing.org/doi/full/10.1098/rstb.2020.0247>

CARIEN MOL, JOHAN J. BOLHUIS & SANNE MOORMAN – Vocal learning in songbirds: the role of syllable order in song recognition

Songbird vocal learning has interesting behavioural and neural parallels with speech acquisition in human infants. Zebra finch males sing one unique song that they imitate from conspecific males, and both sexes learn to recognize their father's song. Although males copy the stereotyped syllable sequence of their father's song, the role of sequential information in recognition remains unclear. Here, we investigated father's song recognition after changing the serial order of syllables (switching the middle syllables, first and last syllables, or playing all syllables in inverse order). Behavioural approach and call responses of adult male and female zebra finches to their father's versus unfamiliar songs in playback tests demonstrated significant recognition of father's song with all syllable-order manipulations. We then measured behavioural responses to normal versus inversed-order father's song. In line with our first results, the subjects did not differentiate between the two. Interestingly, when males' strength of song learning was taken into account, we found a significant correlation between song imitation scores and the approach responses to the father's song. These findings suggest that syllable sequence is not essential for recognition of father's song in zebra finches, but that it does affect responsiveness of males in proportion to the strength of vocal learning.

<https://royalsocietypublishing.org/doi/full/10.1098/rstb.2020.0248>

AMANDA L. STANSBURY & VINCENT M. JANIK – The role of vocal learning in call acquisition of wild grey seal pups

Pinnipeds have been identified as one of the best available models for the study of vocal learning. Experimental evidence for their learning skills is demonstrated with advanced copying skills, particularly in formant structure when copying human speech sounds and melodies. By contrast, almost no data are available on how learning skills are used in their own communication systems. We investigated the impact of playing modified seal sounds in a breeding colony of grey seals (*Halichoerus grypus*) to study how acoustic input influenced vocal development of eight pups. Sequences of two or three seal pup calls were edited so that the average peak frequency between calls in a sequence changed up or down. We found that seals copied the specific stimuli played to them and that copies became more accurate over time. The differential response of different groups showed that vocal production learning was used to achieve conformity, suggesting that geographical variation in seal calls can be caused by horizontal cultural transmission. While learning of pup calls appears to have few benefits, we suggest that it also affects the development of the adult repertoire, which may facilitate social interactions such as mate choice.

<https://royalsocietypublishing.org/doi/full/10.1098/rstb.2020.0251>

ELLA Z. LATTENKAMP et al – The vocal development of the pale spear-nosed bat is dependent on auditory feedback

Human vocal development and speech learning require acoustic feedback, and humans who are born deaf do not acquire a normal adult speech capacity. Most other mammals display a largely innate vocal repertoire. Like humans, bats are thought to be one of the few taxa capable of vocal learning as they can acquire new vocalizations by modifying vocalizations according to auditory experiences. We investigated the effect of acoustic deafening on the vocal development of the pale spear-nosed bat. Three juvenile pale spear-nosed bats were deafened, and their vocal development was studied in comparison with an age-matched, hearing control group. The results show that during development the deafened bats increased their vocal activity, and their vocalizations were substantially altered, being much shorter, higher in pitch, and more aperiodic than the vocalizations of the control animals. The pale spear-nosed bat relies on auditory feedback for vocal development and, in the absence of auditory input, species-atypical vocalizations are acquired. This work serves as a basis for further research using the pale spear-nosed bat as a mammalian model for vocal learning, and contributes to comparative studies on hearing impairment across species.

<https://royalsocietypublishing.org/doi/full/10.1098/rstb.2020.0253>

SITA M. TER HAAR et al – Cross-species parallels in babbling: animals and algorithms

A key feature of vocal ontogeny in a variety of taxa with extensive vocal repertoires is a developmental pattern in which vocal exploration is followed by a period of category formation that results in a mature species-specific repertoire. Vocal development preceding the adult repertoire is often called ‘babbling’, a term used to describe aspects of vocal development in species of vocal-learning birds, some marine mammals, some New World monkeys, some bats and humans. The paper summarizes the results of research on babbling in examples from five taxa and proposes a unifying definition facilitating their comparison. There are notable similarities across these species in the developmental pattern of vocalizations, suggesting that vocal production learning might require babbling. However, the current state of the literature is insufficient to confirm this suggestion. We suggest directions for future research to elucidate this issue, emphasizing the importance of (i) expanding the descriptive data and seeking species with complex mature repertoires where babbling may not occur or may occur only to a minimal extent; (ii) (quasi-)experimental research to tease apart possible mechanisms of acquisition and/or self-organizing development; and (iii) computational modelling as a methodology to test hypotheses about the origins and functions of babbling.

<https://royalsocietypublishing.org/doi/full/10.1098/rstb.2020.0239>

D. KIMBROUGH OLLER et al – Protophones, the precursors to speech, dominate the human infant vocal landscape

Human infant vocalization is viewed as a critical foundation for vocal learning and language. All apes share distress sounds (shrieks and cries) and laughter. Another vocal type, speech-like sounds, common in human infants, is rare but not absent in other apes. These three vocal types form a basis for especially informative cross-species comparisons. To make such comparisons possible we need empirical research documenting the frequency of occurrence of all three. The present work provides a comprehensive portrayal of these three vocal types in the human infant from longitudinal research in various circumstances of recording. Recently, the predominant vocalizations of the human infant have been shown to be speech-like sounds, or ‘protophones’, including both canonical and non-canonical babbling. The research shows that protophones outnumber cries by a factor of at least five based on data from random-sampling of all-day recordings across the first year. The present work expands on the prior reports, showing the protophones vastly outnumber both cry and laughter in both all-day and laboratory recordings in various circumstances. The data provide new evidence of the predominance of protophones in the infant vocal landscape and illuminate their role in human vocal learning and the origin of language.

<https://royalsocietypublishing.org/doi/full/10.1098/rstb.2020.0255>

DAVIDE VALERIANI & KRISTINA SIMONYAN – The dynamic connectome of speech control

Speech production relies on the orchestrated control of multiple brain regions. The specific, directional influences within these networks remain poorly understood. We used regression dynamic causal modelling to infer the whole-brain directed (effective) connectivity from functional magnetic resonance imaging data of 36 healthy individuals during the production of meaningful English sentences and meaningless syllables. We identified that the two dynamic connectomes have distinct architectures that are dependent on the complexity of task production. The speech was regulated by a dynamic neural network, the most influential nodes of which were centred around superior and inferior parietal areas and influenced the whole-brain network activity via long-ranging coupling with primary sensorimotor, prefrontal, temporal and insular regions. By contrast, syllable production was controlled by a more compressed, cost-efficient network structure, involving sensorimotor cortico-subcortical integration via superior parietal and cerebellar network hubs. These data demonstrate the mechanisms by which the neural network reorganizes the connectivity of its influential regions, from supporting the fundamental aspects of simple syllabic vocal motor output to multimodal information processing of speech motor output.

<https://royalsocietypublishing.org/doi/abs/10.1098/rstb.2020.0256>

JOZSEF ARATO & W. TECUMSEH FITCH – Phylogenetic signal in the vocalizations of vocal learning and vocal non-learning birds

Some animal vocalizations develop reliably in the absence of relevant experience, but an intriguing subset of animal vocalizations is learned: they require acoustic models during ontogeny in order to develop, and the learner's vocal output reflects those models. To what extent do such learned vocalizations reflect phylogeny? We compared the degree to which phylogenetic signal is present in vocal signals from a wide taxonomic range of birds, including both vocal learners (songbirds) and vocal non-learners. We used publically available molecular phylogenies and developed methods to analyse spectral and temporal features in a carefully curated collection of high-quality recordings of bird songs and bird calls, to yield acoustic distance measures. Our methods were initially developed using pairs of closely related North American and European bird species, and then applied to a non-overlapping random stratified sample of European birds. We found strong similarity in acoustic and genetic distances, which manifested itself as a significant phylogenetic signal, in both samples. In songbirds, both learned song and (mostly) unlearned calls allowed reconstruction of phylogenetic trees nearly isomorphic to the phylogenetic trees derived from genetic analysis. We conclude that phylogeny and inheritance constrain vocal structure to a surprising degree, even in learned birdsong.

<https://royalsocietypublishing.org/doi/abs/10.1098/rstb.2020.0241>

LIES ZANDBERG et al – Global cultural evolutionary model of humpback whale song

Humpback whale song is an extraordinary example of vocal cultural behaviour. In northern populations, the complex songs show long-lasting traditions that slowly evolve, while in the South Pacific, periodic revolutions occur when songs are adopted from neighbouring populations and rapidly spread. In this species, vocal learning cannot be studied in the laboratory, learning is instead inferred from the songs' complexity and patterns of transmission. Here, we used individual-based cultural evolutionary simulations of the entire Southern and Northern Hemisphere humpback whale populations to formalize this process of inference. We modelled processes of song mutation and patterns of contact among populations and compared our model with patterns of song theme sharing measured in South Pacific populations. Low levels of mutation in combination with rare population interactions were sufficient to closely fit the pattern of diversity in the South Pacific, including the distinctive pattern of west-to-east revolutions. Interestingly, the same learning parameters that gave rise to revolutions in the Southern Hemisphere simulations gave rise to evolutionary patterns of cultural evolution in the Northern Hemisphere populations. Our study demonstrates how cultural evolutionary approaches can be used to make inferences about the learning processes underlying cultural transmission and how they might generate emergent population-level processes.

<https://royalsocietypublishing.org/doi/full/10.1098/rstb.2020.0242>

PLoS Biology

PAPERS

JOAN ORPELLA et al – Language statistical learning responds to reinforcement learning principles rooted in the striatum

This is an uncorrected proof.

Statistical learning (SL) is the ability to extract regularities from the environment. In the domain of language, this ability is fundamental in the learning of words and structural rules. In lack of reliable online measures, statistical word and rule learning have been primarily investigated using offline (post-familiarization) tests, which gives limited insights into the dynamics of SL and its neural basis. Here, we capitalize on a novel task that tracks the online SL of simple syntactic structures combined with computational modeling to show that online SL responds to reinforcement learning principles rooted in striatal function. Specifically, we demonstrate—on 2 different cohorts—that a temporal difference model, which relies on prediction errors, accounts for participants' online learning behavior. We then show that the trial-by-trial development of predictions through learning strongly correlates with activity in both ventral and dorsal striatum. Our results thus provide a detailed mechanistic account of language-related SL and an explanation for the oft-cited implication of the striatum in SL tasks. This work, therefore, bridges the long-standing gap between language learning and reinforcement learning phenomena.

<https://journals.plos.org/plosbiology/article?id=10.1371/journal.pbio.3001119>

PLoS One

PAPERS

BERRIN ÇEP et al – Adaptive capacity and flexibility of the Neanderthals at Heidenschmiede (Swabian Jura) with regard to core reduction strategies

The branched reduction system at the Heidenschmiede described here is hitherto exceptional for the Middle Paleolithic of the Swabian Jura. By means of refits and supporting objects, we are able to describe a superordinate reduction system that combines several individual reduction concepts, such as Levallois and blade production, within one volume. In the Middle Paleolithic of the Swabian Jura, blade technology has thus far played a rather minor role. On the one hand, it is possible to split a selected volume (nodule) into three parts, which are reduced separately according to individual concepts. On the other hand, it is also possible to reduce parts of a volume with one concept first and then with another. The hypothetical reduction system can be branched or linear, thus emphasizing the technological flexibility in core reduction, which requires a high degree of cognitive skills of three-dimensional imagination.

<https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0257041>

MATHIEU DECLERCK & NEIL W. KIRK – Is it easier to use one language variety at a time, or mix them? An investigation of voluntary language switching with bidialectals

Previous language production research with bidialectals has provided evidence for similar language control processes as during bilingual language production. In the current study, we aim to further investigate this claim by examining bidialectals with a voluntary language switching paradigm. Research with bilinguals performing the voluntary language switching paradigm has consistently shown two effects. First, the cost of switching languages, relative to staying in the same language, is similar across the two languages. The second effect is more uniquely connected to voluntary language switching, namely a benefit when performing in mixed language blocks relative to single language blocks, which has been connected to proactive language control. If a similar pattern could be observed with bidialectals in a voluntary language switching paradigm, then this would provide additional evidence in favor of similar control processes underlying bidialectal and bilingual language production.

<https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0256554>

EVELINA LEIVADA, NATALIA MITROFANOVA & MARIT WESTERGAARD – Bilinguals are better than monolinguals in detecting manipulative discourse

One of the most contentious topics in cognitive science concerns the impact of bilingualism on cognitive functions and neural resources. Research on executive functions has shown that bilinguals often perform better than monolinguals in tasks that require monitoring and inhibiting automatic responses. The robustness of this effect is a matter of an ongoing debate, with both sides approaching bilingual cognition mainly through measuring abilities that fall outside the core domain of language processing. However, the mental juggling that bilinguals perform daily involves language. This study takes a novel path to bilingual cognition by comparing the performance of monolinguals and bilinguals in a timed task that features a special category of stimulus, which has the peculiar ability to manipulate the cognitive parser into treating it as well-formed while it is not: grammatical illusions. The results reveal that bilinguals outperform monolinguals in detecting illusions, but they are also slower across the board in judging the stimuli, illusory or not. We capture this trade-off by proposing the Plurilingual Adaptive Trade-off Hypothesis (PATH), according to which the adaptation of bilinguals' cognitive abilities may (i) decrease fallibility to illusions by means of recruiting sharpened top-down control processes, but (ii) this is part of a larger bundle of effects, not all of which are necessarily advantageous.

<https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0256173>

MICHAŁ SZULAWSKI, IZABELA KAŻMIERCZAK & MONIKA PRUSIK – Is self-determination good for your effectiveness? A study of factors which influence performance within self-determination theory

Despite the vast body of studies within self-determination theory, the impact of factors which influence performance in experimental paradigm is still underresearched. The aim of the two studies presented in this paper was to investigate the impact of basic psychological needs on performance with the simultaneous presence of external incentives. Study 1 tested whether the satisfaction of competence and relatedness during task performance (while external incentives were present) can impact individual's performance. Study 2, on the other hand, investigated whether the basic psychological needs and provision of external incentives can impact an individual's performance. Moreover, in both studies the mechanisms behind the need–performance relationship was checked. Our results showed that out of the three basic needs, competence had the strongest positive impact on performance, which was partially mediated by the subjective evaluation of the levels of difficulty and intrinsic motivation. The weak relationship between relatedness and task performance was fully mediated by the level of intrinsic motivation.

<https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0256558>

PNAS

PAPERS

ABDULLAH ALMAATOUQ et al – Task complexity moderates group synergy

Complexity—defined in terms of the number of components and the nature of the interdependencies between them—is clearly a relevant feature of all tasks that groups perform. Yet the role that task complexity plays in determining group performance remains poorly understood, in part because no clear language exists to express complexity in a way that allows for straightforward comparisons across tasks. Here we avoid this analytical difficulty by identifying a class of tasks for which complexity can be varied systematically while keeping all other elements of the task unchanged. We then test the effects of task complexity in a preregistered two-phase experiment in which 1,200 individuals were evaluated on a series of tasks of varying complexity (phase 1) and then randomly assigned to solve similar tasks either in interacting groups or as independent individuals (phase 2). We find that interacting groups are as fast as the fastest individual and more efficient than the most efficient individual for complex tasks but not for simpler ones. Leveraging our highly granular digital data, we define and precisely measure group process losses and synergistic gains and show that the balance between the two switches signs at intermediate values of task complexity. Finally, we find that interacting groups generate more solutions more rapidly and explore the solution space more broadly than independent problem solvers, finding higher-quality solutions than all but the highest-scoring individuals.

<https://www.pnas.org/content/118/36/e2101062118.abstract>

HAN G. YI et al – Learning nonnative speech sounds changes local encoding in the adult human cortex

Adults can learn to identify nonnative speech sounds with training, albeit with substantial variability in learning behavior. Increases in behavioral accuracy are associated with increased separability for sound representations in cortical speech areas. However, it remains unclear whether individual auditory neural populations all show the same types of changes with learning, or whether there are heterogeneous encoding patterns. Here, we used high-resolution direct neural recordings to examine local population response patterns, while native English listeners learned to recognize unfamiliar vocal pitch patterns in Mandarin Chinese tones. We found a distributed set of neural populations in bilateral superior temporal gyrus and ventrolateral frontal cortex, where the encoding of Mandarin tones changed throughout training as a function of trial-by-trial accuracy (“learning effect”), including both increases and decreases in the separability of tones. These populations were distinct from populations that showed changes as a function of exposure to the stimuli regardless of trial-by-trial accuracy. These learning effects were driven in part by more variable neural responses to repeated presentations of acoustically identical stimuli. Finally, learning effects could be predicted from speech-evoked activity even before training, suggesting that intrinsic properties of these populations make them amenable to behavior-related changes. Together, these results

demonstrate that nonnative speech sound learning involves a wide array of changes in neural representations across a distributed set of brain regions.

<https://www.pnas.org/content/118/36/e2101777118.abstract>

Proceedings of the Royal Society B

COMMENTARIES

DON DE MAHY, N. ALEX ESTEVE & ANDREA SANTARIELLO – New test, old problems: comment on ‘New Caledonian crows plan for specific future tool use’

No abstract provided.

<https://royalsocietypublishing.org/doi/pdf/10.1098/rspb.2021.0186>

M. BOECKLE et al with T. SUDDENDORF – New Caledonian crows' planning behaviour: a reply to de Mahy et al.

No abstract provided.

<https://royalsocietypublishing.org/doi/abs/10.1098/rspb.2021.1271>

Trends in Cognitive Sciences

PAPERS

YANCHAO BI – Dual coding of knowledge in the human brain

How does the human brain code knowledge about the world? While disciplines such as artificial intelligence represent world knowledge based on human language, neurocognitive models of knowledge have been dominated by sensory embodiment, in which knowledge is derived from sensory/motor experience and supported by high-level sensory/motor and association cortices. The neural correlates of an alternative disembodied symbolic system had previously been difficult to establish. A recent line of studies exploring knowledge about visual properties, such as color, in visually deprived individuals converge to provide positive, compelling evidence for non-sensory, language-derived, knowledge representation in dorsal anterior temporal lobe and extended language network, in addition to the sensory-derived representations, leading to a sketch of a dual-coding knowledge neural framework.

[https://www.cell.com/trends/cognitive-sciences/fulltext/S1364-6613\(21\)00176-5](https://www.cell.com/trends/cognitive-sciences/fulltext/S1364-6613(21)00176-5)

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