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NOTICES

PUBLICATION ALERTS

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

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

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

EAORC NEWS – ResearchGate retiring Projects on March 31, 2023

After much consideration, ResearchGate have decided to discontinue Projects. You can no longer create new projects, and all current projects will be removed at the end of March. Read the blog to find out what this means for you and what they are working on next: <https://www.researchgate.net/researchgate-updates/retiring-projects>.

This means no weekly reminders about the EAORC bulletin on ResearchGate. It will still be available each week as before at http://martinedwardes.me.uk/eaorc/eaorc_bulletins.html, so you can continue to read them; but if you wish a weekly reminder you will have to add your name to the EAORC list. Joining instructions are at <http://martinedwardes.me.uk/eaorc/index.html>. If you are already an EAORC member, you will not be affected by this change.

EAORC LETTERS – From Martin P.J. Edwardes – Looking for readers

I have just finished the first draft of my next book, “The Origins of Grammar: An anthropological perspective (2nd edition)”, and I would be grateful to anyone willing to read and comment on this draft. If you are interested in reading a chapter or two, or even the whole thing, let me know (martin.edwardes@btopenworld.com). If you just want a preview without commenting, that’s OK, too.

This is an extensive update and rewrite of the first edition (published 2010). The bibliography now has over 700 entries, the mean first publication date is 1996 and the median is 2005. I believe this rewrite is considerably improved compared to the original, and I hope to publish it with UCL Press, alongside “The Origins of Self: An anthropological perspective”. That means a pdf downloadable version will be available for free. I can recommend UCL press in terms of getting your work out into the World: where OOG e1 sold under 150 in 12 years, OOS has sold 215 and has 33,809 downloads in under 4 years.

The contents (currently) are as follows.

PROLOGUE – THE ORIGINS OF GRAMMAR ... AGAIN?

What is Grammar? - Telling the story of grammar - Mapping the Journey - The purpose of this book

CHAPTER 1 – WHY ALL THE FUSS?

The Problem of Brainpower - Two Legs, Two Hands - Making Tools - Hunting and Culture - Language: the final frontier? - The Genetic Problem of Language - What Is Language for?

CHAPTER 2 – THE STORY SO FAR

Language Is Making and Using Tools - Language Is Play - Language Is a Signal of Fitness - Language Is Embodied - Language Is Multimodal - Language Is Cognition - Language Is Social Construction - Language Just Is

CHAPTER 3 – THE HEAVY HAND OF GENERATIVE LINGUISTICS

Linguistic Structure - Extending Structure - Principles and Parameters - Small is Beautiful - Generative Linguistics and the Origins of Grammar - Is Generative Grammar an Inimical Environment for Grammar Origins?

CHAPTER 4 – SOME VIEWS FROM STRUCTURALISM

A System of Functions - Systemic Functional Grammar - Other Views on Functional Grammar - Grammar without Tiers? - Linear Grammars - Functionalist Linguistics and the Origins of Grammar

CHAPTER 5 – IT’S ALL IN THE MIND

A Short History of Cognitive Linguistics - The Nature of Cognitive Linguistics - Embodiment - The Modularity Debate - The Nature of Cognitive Grammar - Cognitive Linguistics and the Origins of Grammar

CHAPTER 6 – BECOMING HUMAN

Manual Dexterity - Dexterity and Working Together - The Costs of Reproduction - Beating the Cheats - Making Models

CHAPTER 7 – THE WEIRDNESS OF SELF

The Structure of Social Modelling - Planning and Modelling - The Self and Language - From Selfishness to Awareness of Self - Awareness of Self and Modelling a Self - Awareness of Selfness

CHAPTER 8 – THE SOCIALISATION OF HUMANITY

Altruistic Punishment - Metaphor in Cognition - THE GROUP IS AN ENTITY - THE GROUP IS AN ENTITY: building social structures - THE GROUP IS AN ENTITY: an ancient metaphor? - What Happened, and When?

CHAPTER 9 – HOW DID WE COME TO USE GRAMMAR?

Grammaticalization - Grammaticalization and Grammar Origins - Overture and Beginners, Please - Not Required at the Origin of Grammar - Becoming Complex - From Non-grammar to Grammar

CHAPTER 10 – WHAT NONHUMANS TELL US ABOUT BEING HUMAN

Animals and Grammar - Primate, Know Thyself - Empathy and Theory of Mind - Accommodating Others - Multiple Intelligences - Not about Language?

CHAPTER 11 – WHAT YOUNG HUMANS TELL US ABOUT BEING HUMAN

Children and Human Language Grammar Origins - Children and Cooperation - Children and Selfhood - Children and Language

CHAPTER 12 – WHAT TIME TELLS US ABOUT BEING HUMAN

Getting Tense - Doing Other Things with Time - Adding Depth - Time, Uncertainty and Fiction - How We Came to Share Time in Language - From Complex Language 1 to Complex Language 2 - How Children Become Time-aware - Three Time Points, Three Persons? - Time and Being Human

CHAPTER 13 – THE EVOLUTION OF GRAMMAR

Basic Communication - Social Modelling - Uttering Language - What Language Did Next - Are There Grammar Universals? - The Socialisation-Cognition-Communication Braid

EPILOGUE – BEING HUMAN

Differences and Similarities - And Finally ...

OTHER PUBLICATIONS – Predictive coding under the free-energy principle

In Philosophical Transactions of the Royal Society B 364, 1211-1221 (2009).

KARL FRISTON & STEFAN KIEBEL – Predictive coding under the free-energy principle

This paper considers prediction and perceptual categorization as an inference problem that is solved by the brain. We assume that the brain models the world as a hierarchy or cascade of dynamical systems that encode causal structure in the sensorium. Perception is equated with the optimization or inversion of these internal models, to explain sensory data. Given a model of how sensory data are generated, we can invoke a generic approach to model inversion, based on a free energy bound on the model's evidence. The ensuing free-energy formulation furnishes equations that prescribe the process of recognition, i.e. the dynamics of neuronal activity that represent the causes of sensory input. Here, we focus on a very general model, whose hierarchical and dynamical structure enables simulated brains to recognize and predict trajectories or sequences of sensory states. We first review hierarchical dynamical models and their inversion. We then show that the brain has the necessary infrastructure to implement this inversion and illustrate this point using synthetic birds that can recognize and categorize birdsongs.

<https://royalsocietypublishing.org/doi/10.1098/rstb.2008.0300>

OTHER PUBLICATIONS – Accuracy of Deception Judgments

In Personality and Social Psychology Review 10:3 (2006)

CHARLES F. BOND, JR. & BELLA M. DEPAULO – Accuracy of Deception Judgments

We analyze the accuracy of deception judgments, synthesizing research results from 206 documents and 24,483 judges. In relevant studies, people attempt to discriminate lies from truths in real time with no special aids or training. In these circumstances, people achieve an average of 54% correct lie-truth judgments, correctly classifying 47% of lies as deceptive and 61% of truths as nondeceptive. Relative to cross-judge differences in accuracy, mean lie-truth discrimination abilities are nontrivial, with a mean accuracy d of roughly .40. This produces an effect that is at roughly the 60th percentile in size, relative to others that have been meta-analyzed by social psychologists. Alternative indexes of lie-truth discrimination accuracy correlate highly with percentage correct, and rates of lie detection vary little from study to study. Our meta-analyses reveal that people are more accurate in judging audible than visible lies, that people appear deceptive when motivated to be believed, and that individuals regard their interaction partners as honest. We propose that people judge others' deceptions more harshly than their own and that this double standard in evaluating deceit can explain much of the accumulated literature.

https://journals.sagepub.com/doi/10.1207/s15327957pspr1003_2

CALL FOR CONTENT – Evolutionary Human Sciences now accepting 2023 submissions!

Evolutionary Human Sciences supports a unified approach to evolutionary human sciences. We are concerned with understanding how evolution has shaped humankind, from biology through to culture. The journal aims to attract papers in the fields of evolutionary anthropology, cultural evolution, human biology, evolutionary medicine, anthropological genetics, phylogenetics, paleoanthropology and evolutionary approaches to psychology, cognition, language, economics, archaeology, primatology, politics and anything else that can be considered to be part of the evolutionary human sciences.

SUBMIT NOW: <https://mc.manuscriptcentral.com/ehsci>

CONFERENCE ALERT – The Animal Behavior Society 2023 Conference

ABS 2023 Abstract Submission and Early Registration is Open!

60th Annual Conference of the Animal Behavior Society

Oregon Convention Center, Portland, Oregon

July 11-15, 2023

We invite you to join us at the 60th Annual Conference of the Animal Behavior Society in Portland, Oregon from July 11-15, 2023. Register early and save!

Due to the ongoing uncertainty caused by the COVID pandemic, ABS 2023 will have two options for participating in this year's meeting. The details of each participation option are listed here and include information for both authors and attendees.

REGISTER NOW: <https://www.animalbehaviorsociety.org/2023/registration.php>

The ABS is offering two NEW Awards for 2023. Please click the links below to find out more and to apply. There is a separate application form for these two awards, and they are not submitted through the abstract submission system.

Broadening Participation Award

Career Diversity Travel Award

There are so many different awards for ABS. Click the Award Eligibility Form button below to see which awards you are eligible to apply for. Early Registration Deadline is April 15th

AWARD INFORMATION: <https://www.animalbehaviorsociety.org/web/awards.php>

CONFERENCE ALERT – Evolution in Action

<https://www.evolution.uzh.ch/en/conference.html>

Evolution in Action, taking place at Monte Verité, Switzerland, June 11 - 15, 2023, provides fellowships for young researchers who face financial challenges in paying the cost of attendance.

Application deadline is April 15, 2023.

Guidelines: <https://www.evolution.uzh.ch/en/conference/financialsupport.html>

About the conference:

The International Conference Evolution in Action brings together researchers with a common interest in genomic technologies and their application to evolutionary questions. Evolutionary biology plays a central role in understanding mechanisms and processes that shape biological systems. Despite its relevance for many scientific fields, researchers addressing evolutionary questions often work somewhat isolated in their respective discipline, discouraging interdisciplinary discussions.

The genomic revolution has strongly altered the research field of evolutionary biology. Sequencing technologies have become so powerful and affordable that the genetic variability of entire genomes and even of many individuals can be directly studied. Such approaches enable research especially on rapid evolutionary changes and are key to understanding, e.g., the evolution of human, animal, and plant pathogens, domestication principles, and processes underlying rapid adaptation. These are socially important topics, as seen for example in the speedy emergence of virus variants in SARS-CoV-2 or the adaptation of wild species and crops to climate change.

With this conference, we aim to facilitate interdisciplinary research integrating biology, medicine, agricultural, and computer sciences to address evolutionary questions that are relevant to our changing world and society. Have a look at the complete program of the conference with all invited speakers here <https://www.evolution.uzh.ch/en/conference/program.html>.

URPP Evolution in Action, University of Zurich, Dept of Plant & Microbial Biology, Zollikerstrasse 107, CH-8008 Zurich

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www.evolution.uzh.ch

CONFERENCE ALERT – 9th symposium of the EEBST

The 9th symposium of the EEBST will take place in Istanbul on July 17-19 2023. (<https://eebst.ekoevo.org/>)

This year we aimed to organize a special session covering paleobiological and paleoanthropological studies (by oral and poster presentations) in Turkey and surrounding areas. Special attention will be given to the studies related to taxonomy and systematics of fossil vertebrates and invertebrates, evolutionary and ecological perspectives in mammal paleobiology, paleobiomolecules, human paleobiology/prehistory and hominin environments, computational approaches, and taphonomy, paleobiogeography, paleobiodiversity, paleoecology, paleoclimate, biochronology and biostratigraphy of the Neogene and Quaternary deposits in Turkey and surrounding regions.

Abstract submission is between March 10 and April 20 2023

Announcement of acceptances: June 10 2023

Announcement of symposium program: June 20 2023

Registration will be open between June 1 and July 16 2023

Early Bird Registration: June 1 – July 1 2023

Regular Registration: July 2 – July 16 2023

Desk Registration: July 17 – 18 2023

For more information please visit our website: <https://eebst.ekoevo.org/>

Ferhat Kaya, on behalf of the organizing committee

<https://www.oulu.fi/university/researcher/ferhat-kaya>

<https://www.oulu.fi/en/research-groups/deep-history-human-past>

<http://www.helsinki.fi/geo/staff/kaya/index.html>

NEWS

NATURE BRIEFING – Scientists are bad at predicting change

Social scientists' predictions about societal trends are no more accurate than those made by large groups of lay people. The largest-ever forecasting study asked more than 100 teams of scientists to make monthly predictions about social phenomena, including political polarization and life satisfaction. Often, the researchers' forecasts were worse than those made with statistical models. Scientists made slightly better predictions in their field of expertise, and multi-disciplinary teams tended to do better overall.

<https://nature.us17.list-manage.com/track/click?u=2c6057c528fdc6f73fa196d9d&id=ba1cfd736&e=1db4b9a19b>

SAPIENS – Molars and Math?

A paleoanthropologist explains what fossilized teeth can tell us about how brains have developed in utero over millions of years of human evolution.

<https://www.sapiens.org/biology/fossil-teeth-in-utero-brain/>

SAPIENS – What Ancient Stone “Swiss Army Knives” Mean

An archaeologist explains new evidence from stone tools that shows strong and wide social connections among our ancestors who lived 65,000 years ago in Southern Africa.

<https://www.sapiens.org/archaeology/ancient-stone-swiss-army-knives/>

SAPIENS – Meet the Ancient Technologists Who Changed Everything

A series of Stone Age geniuses invented a range of technologies that shaped human evolution and laid the foundation for our world.

<https://www.sapiens.org/archaeology/stone-age-geniuses/>

SAPIENS – The First Butchers

Were there other toolmakers and meat eaters in our family tree?

<https://www.sapiens.org/biology/homo-sapiens-and-tool-making/>

THE CONVERSATION – The limits of expert judgment: Lessons from forecasting during the pandemic

Imagine being a policymaker at the beginning of the COVID-19 pandemic. You have to decide which actions to recommend, how much risk to tolerate and what sacrifices to ask your citizens to bear. Who would you turn to for an accurate prediction about how people would react? Many would recommend going to the experts — social scientists. But we are here to tell you this would be bad advice.

<https://theconversation.com/the-limits-of-expert-judgment-lessons-from-social-science-forecasting-during-the-pandemic-201130>

PUBLICATIONS

Animal Behaviour

PAPERS

KYLE SHACKLETON et al – Honey bee waggle dances facilitate shorter foraging distances and increased foraging aggregation

Many social organisms assist their group mates in foraging. The honey bee waggle dance allows nestmates to communicate the locations of rewarding flower patches. This remarkable behaviour can increase colony food collection under certain environmental conditions. However, we know little about how it affects colony foraging distribution in the landscape. Here,

we predicted that dance communication influences foraging distances and increases the aggregation of foraging locations. We tested these predictions by manipulating the ability of *Apis mellifera* colonies situated in a heterogeneous landscape to communicate location information. Following established methodology, six study colonies in observation hives were turned horizontally and exposed to light treatments that produced either oriented or disoriented dancing. After 10–17 days, hives were then turned vertically and allowed to dance under normal conditions. We videoed and decoded dances to compare foraging patterns that had developed during the preceding treatment. This procedure was repeated throughout the foraging season from spring to autumn. Dance decoding revealed that, on average, bees from disoriented colonies recruited for food sources further away than oriented colonies. This effect was consistent throughout the year. Oriented colonies' recruitment was to a smaller area and was more spatially aggregated than that of disoriented colonies. However, experimental treatment did not affect colony weight gain. Our results show that dance communication plays an important role in the spatial distribution of foraging and is potentially beneficial in reducing commuting costs by directing recruits to closer foraging locations. These findings may be particularly relevant in heterogeneous landscapes.

<https://www.sciencedirect.com/science/article/pii/S000334722300009X>

SIMONE M. GLASER & CHRISTOPH GRÜTER – Social and individual learners use different pathways to success in an ant minisociety

Animals can acquire information through individual learning or by copying others. Simulations suggest that social learning is expected to lead to better rewards, but experimental studies confirming this remain scarce. We tested how a well-known form of social learning in ants, tandem running, affects individual foraging success of *Temnothorax nylanderii* foragers in controlled laboratory experiments. We manipulated the number and the variability of food sources and assessed the foraging choices of ants searching individually (i.e. scouts) or using social learning (i.e. recruits). We found that social learners indeed discovered better food sources than individual learners, but only in rich environments. However, social learners collected less food than scouts during our trials. Interestingly, individual learners improved their success over time by switching food sources more frequently than social learners. These experimental findings highlight that the relative value of social and individual learning in an ant society depend on the foraging environment and show different temporal dynamics. The ability of individual learners to exploit profitable food sources through a strategy of food source switching, while avoiding the opportunity costs of social learning, can help explain why many social insects, especially those living in small colonies, do not use communication in foraging.

<https://www.sciencedirect.com/science/article/pii/S0003347223000234>

Cell Reports

PAPERS

YA WANG et al – Longitudinal development of the cerebellum in human infants during the first 800 days

Revealing early dynamic development of the normative cerebellar structures contributes to exploring cerebellum-related neurodevelopmental disorders. Here, leveraging infant-tailored cerebellar image processing techniques, we studied the dynamic volumetric developmental trajectories of cerebellum and 27 cerebellar sub-regions and their relationships with behavioral scores based on 511 high-resolution structural MRI scans during the first 800 postnatal days. The ratio of the entire cerebellum to the intracranial volume increases rapidly at first and then peaks at 13 months after birth. Both the absolute and relative volumes of most cerebellar sub-structures exhibit rapid increase at first, then the relative volumes decrease slightly after arriving at peaks (except for X lobules). Each lobule depicts larger absolute volume in males than in females. The within-subject variation of the cerebellar volumetric percentile score is generally stable. The volumetric development of several lobules (e.g., V, Crus I, and Crus II) has a significantly positive correlation with fine motor skills during the age range examined.

[https://www.cell.com/cell-reports/fulltext/S2211-1247\(23\)00292-9](https://www.cell.com/cell-reports/fulltext/S2211-1247(23)00292-9)

Current Biology

PAPERS

MANUEL ANGLADA-TORT et al – Large-scale iterated singing experiments reveal oral transmission mechanisms underlying music evolution

Speech and song have been transmitted orally for countless human generations, changing over time under the influence of biological, cognitive, and cultural pressures. Cross-cultural regularities and diversities in human song are thought to emerge from this transmission process, but testing how underlying mechanisms contribute to musical structures remains a key challenge. Here, we introduce an automatic online pipeline that streamlines large-scale cultural transmission experiments using a sophisticated and naturalistic modality: singing. We quantify the evolution of 3,424 melodies orally transmitted across 1,797 participants in the United States and India. This approach produces a high-resolution characterization of how oral transmission shapes melody, revealing the emergence of structures that are consistent with widespread musical features observed cross-culturally (small pitch sets, small pitch intervals, and arch-shaped melodic contours). We show how the emergence of these structures is constrained by individual biases in our participants—vocal constraints, working memory, and cultural exposure—which determine the size, shape, and complexity of evolving melodies. However, their ultimate effect

on population-level structures depends on social dynamics taking place during cultural transmission. When participants recursively imitate their own productions (individual transmission), musical structures evolve slowly and heterogeneously, reflecting idiosyncratic musical biases. When participants instead imitate others' productions (social transmission), melodies rapidly shift toward homogeneous structures, reflecting shared structural biases that may underpin cross-cultural variation. These results provide the first quantitative characterization of the rich collection of biases that oral transmission imposes on music evolution, giving us a new understanding of how human song structures emerge via cultural transmission.

[https://www.cell.com/current-biology/fulltext/S0960-9822\(23\)00243-9](https://www.cell.com/current-biology/fulltext/S0960-9822(23)00243-9)

TOM DAVY et al with PONTUS SKOGLUND – Hunter-gatherer admixture facilitated natural selection in Neolithic European farmers

Ancient DNA has revealed multiple episodes of admixture in human prehistory during geographic expansions associated with cultural innovations. One important example is the expansion of Neolithic agricultural groups out of the Near East into Europe and their consequent admixture with Mesolithic hunter-gatherers. Ancient genomes from this period provide an opportunity to study the role of admixture in providing new genetic variation for selection to act upon, and also to identify genomic regions that resisted hunter-gatherer introgression and may thus have contributed to agricultural adaptations. We used genome-wide DNA from 677 individuals spanning Mesolithic and Neolithic Europe to infer ancestry deviations in the genomes of admixed individuals and to test for natural selection after admixture by testing for deviations from a genome-wide null distribution. We find that the region around the pigmentation-associated gene *SLC24A5* shows the greatest overrepresentation of Neolithic local ancestry in the genome ($|Z| = 3.46$). In contrast, we find the greatest overrepresentation of Mesolithic ancestry across the major histocompatibility complex (MHC; $|Z| = 4.21$), a major immunity locus, which also shows allele frequency deviations indicative of selection following admixture ($p = 1 \times 10^{-56}$). This could reflect negative frequency-dependent selection on MHC alleles common in Neolithic populations or that Mesolithic alleles were positively selected for and facilitated adaptation in Neolithic populations to pathogens or other environmental factors. Our study extends previous results that highlight immune function and pigmentation as targets of adaptation in more recent populations to selection processes in the Stone Age.

[https://www.cell.com/current-biology/fulltext/S0960-9822\(23\)00189-6](https://www.cell.com/current-biology/fulltext/S0960-9822(23)00189-6)

eLife

PAPERS

JAVIER MASÍS et al – Strategically managing learning during perceptual decision making

Making optimal decisions in the face of noise requires balancing short-term speed and accuracy. But a theory of optimality should account for the fact that short-term speed can influence long-term accuracy through learning. Here, we demonstrate that long-term learning is an important dynamical dimension of the speed-accuracy trade-off. We study learning trajectories in rats and formally characterize these dynamics in a theory expressed as both a recurrent neural network and an analytical extension of the drift-diffusion model that learns over time. The model reveals that choosing suboptimal response times to learn faster sacrifices immediate reward, but can lead to greater total reward. We empirically verify predictions of the theory, including a relationship between stimulus exposure and learning speed, and a modulation of reaction time by future learning prospects. We find that rats' strategies approximately maximize total reward over the full learning epoch, suggesting cognitive control over the learning process.

<https://elifesciences.org/articles/64978>

XINZHU WEI et al with DAVID REICH – The lingering effects of Neanderthal introgression on human complex traits

The genetic variants introduced into the ancestors of modern humans from interbreeding with Neanderthals have been suggested to contribute an unexpected extent to complex human traits. However, testing this hypothesis has been challenging due to the idiosyncratic population genetic properties of introgressed variants. We developed rigorous methods to assess the contribution of introgressed Neanderthal variants to heritable trait variation relative to that of modern human variants. We applied these methods to analyze 235,592 introgressed Neanderthal variants and 96 distinct phenotypes measured in about 300,000 unrelated white British individuals in the UK Biobank. Introgressed Neanderthal variants have a significant contribution to trait variation consistent with the polygenic architecture of complex phenotypes (contributing 0.12% of heritable variation averaged across phenotypes). However, the contribution of introgressed variants tends to be significantly depleted relative to modern human variants matched for allele frequency and linkage disequilibrium (about 59% depletion on average), consistent with purifying selection on introgressed variants. Different from previous studies (McArthur 2021), we find no evidence for elevated heritability across the phenotypes examined. We identified 348 independent significant associations of introgressed Neanderthal variants with 64 phenotypes. Previous work (Skov 2020) has suggested that a majority of such associations are likely driven by statistical association with nearby modern human variants that are the true causal variants. We therefore developed a customized statistical fine-mapping methodology for introgressed variants that led us to identify 112 regions (at a false discovery proportion of 16%) across 47 phenotypes containing 4,303 unique genetic variants where introgressed variants are highly likely to have a phenotypic effect. Examination of these variants reveal their substantial impact on genes that are important for the immune system,

development, and metabolism. Our results provide the first rigorous basis for understanding how Neanderthal introgression modulates complex trait variation in present-day humans.

<https://elifesciences.org/articles/80757>

Frontiers in Artificial Intelligence

PAPERS

SIMEON SCHÜZ, ALBERT GATT & SINA ZARRIEß – Rethinking symbolic and visual context in Referring Expression Generation

Situational context is crucial for linguistic reference to visible objects, since the same description can refer unambiguously to an object in one context but be ambiguous or misleading in others. This also applies to Referring Expression Generation (REG), where the production of identifying descriptions is always dependent on a given context. Research in REG has long represented visual domains through symbolic information about objects and their properties, to determine identifying sets of target features during content determination. In recent years, research in visual REG has turned to neural modeling and recasted the REG task as an inherently multimodal problem, looking at more natural settings such as generating descriptions for objects in photographs. Characterizing the precise ways in which context influences generation is challenging in both paradigms, as context is notoriously lacking precise definitions and categorization. In multimodal settings, however, these problems are further exacerbated by the increased complexity and low-level representation of perceptual inputs. The main goal of this article is to provide a systematic review of the types and functions of visual context across various approaches to REG so far and to argue for integrating and extending different perspectives on visual context that currently co-exist in research on REG. By analyzing the ways in which symbolic REG integrates context in rule-based approaches, we derive a set of categories of contextual integration, including the distinction between positive and negative semantic forces exerted by context during reference generation. Using this as a framework, we show that so far existing work in visual REG has considered only some of the ways in which visual context can facilitate end-to-end reference generation. Connecting with preceding research in related areas, as possible directions for future research, we highlight some additional ways in which contextual integration can be incorporated into REG and other multimodal generation tasks.

<https://www.frontiersin.org/articles/10.3389/frai.2023.1067125/full>

Frontiers in Behavioral Neuroscience

PAPERS

YA-QIN CHEN, SHU HAN & BIN YIN – Why help others? Insights from rodent to human early childhood research

Helping behavior are actions aiming at assisting another individual in need or to relieve their distress. The occurrence of this behavior not only depends on automated physiological mechanisms, such as imitation or emotional contagion, that is, the individual's emotion and physiological state matching with others, but also needs motivation to sustain. From a comparative and developmental perspective, we discover that the motivation for helping behavior has a deep foundation both phylogenetically and ontogenetically. For example, empathic concern for others, relieving personal distress and the desire for social contact are universal motivations across rodents, non-human primates and human early childhoods. Therefore, a circle-layered model integrating evidences for motivation for helping behavior from rodent to human early childhood research is proposed: the inner circle contains the emotional-behavioral system and the outer circle contains the affective-cognitive system. The application of this model has significance for both behavioral neuroscience research and cultivating prosocial behavior in human society.

<https://www.frontiersin.org/articles/10.3389/fnbeh.2023.1058352/full>

Frontiers in Psychology

PAPERS

CAMILO R. RONDEROS & INGRID LOSSIUS FALKUM – Suppression of literal meaning in single and extended metaphors

Within Relevance Theory, it has been suggested that extended metaphors might be processed differently relative to single metaphoric uses. While single metaphors are hypothesized to be understood via the creation of an ad hoc concept, extended metaphors have been claimed to require a switch to a secondary processing mode, which gives greater prominence to the literal meaning. Initial experimental evidence has supported a distinction by showing differences in reading times between single and extended metaphors. However, beyond potential differences in comprehension speed, Robyn Carston's 'lingering of the literal' account seems to predict qualitative differences in the interpretative mechanisms involved. In the present work, we test the hypothesis that during processing of extended metaphors, the mechanisms of enhancement and suppression of activation levels of literal-related features operate differently relative to single metaphors. We base our work on a study by Paula Rubio-Fernández, which showed that processing single metaphors involves suppressing features related exclusively to the literal meaning of the metaphoric vehicle after 1000 milliseconds of encountering the metaphor. Our goal was to investigate whether suppression is also involved in the comprehension of extended metaphors, or whether the 'lingering of the literal' leads to continued activation of literal-related features, as we take Carston's account to predict. We replicate existing results, in as much as we find that activation levels of literal-related features are reduced after 1000 milliseconds. Critically, we also show that the pattern of suppression does not hold for extended metaphors, for which literal-

related features remain activated after 1000 milliseconds. We see our results as providing support for Carston's view that extended metaphor processing involves a prominent role of literal meaning, contributing towards explicating the links between theoretical predictions within Relevance Theory and online sentence processing.

<https://www.frontiersin.org/articles/10.3389/fpsyg.2023.1135129/full>

Heliyon

PAPERS

SHURAN YANG – Storytelling and user experience in the cultural metaverse

Enthusiasm for the metaverse is intensifying in academia and industries. The metaverse is a complex concept, combining many technologies to create many different types of user experiences (UX), depending on the intended use. The cultural metaverse was first introduced in this study.

This study is an initial attempt to fill the gaps in the practical research and storytelling research in the metaverse. Augmented reality (AR) technology is an applicative tool in cultural experience, which displays computer – generated virtual information on a real-world scene. AR displays digital information realistically, making it appear to be part of the actual environment, deepening or expanding the user's understanding of “reality”. This study constructed a cultural metaverse using the innovative AR storytelling. The cultural metaverse is a new cultural ecology in which advanced information technologies are deeply integrated with cultural spaces and exhibits. It combines digital technologies and cultural industries, mixing virtual space and physical space to facilitate the UX in cultural experiences. In this study, the existing AR e-book and the innovative AR version were compared while measuring multiple aspects of UX, including presence, flow, enjoyment, education, and engagement.

By analyzing questionnaire data from two groups with a total of 368 participants, the results indicated that the innovative AR storytelling produced a better UX across all variables compared to the AR e-book application. Overall, innovative AR storytelling allows visitors to transition between real and virtual spaces, enriches their interactive experience, and improves user engagement with the metaverse exhibition of cultural experience. Therefore, practitioners can construct a primary cultural metaverse through innovative AR storytelling.

[https://www.cell.com/heliyon/fulltext/S2405-8440\(23\)01966-7](https://www.cell.com/heliyon/fulltext/S2405-8440(23)01966-7)

Interface: Journal of the Royal Society

PAPERS

MIRTA GALESIC et al with ALEX MESOUDI – Beyond collective Intelligence: Collective adaptation

We develop a conceptual framework for studying collective adaptation in complex socio-cognitive systems, driven by dynamic interactions of social integration strategies, social environments and problem structures. Going beyond searching for ‘intelligent’ collectives, we integrate research from different disciplines and outline modelling approaches that can be used to begin answering questions such as why collectives sometimes fail to reach seemingly obvious solutions, how they change their strategies and network structures in response to different problems and how we can anticipate and perhaps change future harmful societal trajectories. We discuss the importance of considering path dependence, lack of optimization and collective myopia to understand the sometimes counterintuitive outcomes of collective adaptation. We call for a transdisciplinary, quantitative and societally useful social science that can help us to understand our rapidly changing and ever more complex societies, avoid collective disasters and reach the full potential of our ability to organize in adaptive collectives.

<https://royalsocietypublishing.org/doi/10.1098/rsif.2022.0736>

iScience

PAPERS

Y. AMIT & Y. YOVEL – Bat vocal sequences enhance contextual information independently of syllable order

Many animals, humans included, rely on acoustic vocalizations for communication. The complexity of non-human vocal communication has been under debate one of the main open questions being: What could be the function of multi-syllabic vocal sequences? We address this questions by analyzing fruit-bat vocal communication. We use neural networks to encode the vocalizations, and statistical models to examine the information conveyed by sequences of vocalizations. We show that fruit bat vocal sequences potentially convey more contextual information than individual syllables, but that the order of the syllables within the sequence is unimportant for context. Specifically, sequences are composed of slightly modified syllables, thus increasing the probability of context-specificity. We note that future behavioral, e.g., playback experiments are needed in order to validate the biological relevance of our statistical results. We hypothesize that such sequences might have served as pre-syntax precursors in the evolution of animal communication.

[https://www.cell.com/iscience/fulltext/S2589-0042\(23\)00543-6](https://www.cell.com/iscience/fulltext/S2589-0042(23)00543-6)

Language and Social Interaction

PAPERS

LAURENZ KORNFELD & GIOVANNI ROSSI – Enforcing Rules During Play: Knowledge, Agency, and the Design of Instructions and Reminders

Rules of behavior are fundamental to human sociality. Whether on the road, at the dinner table, or during a game, people monitor one another's behavior for conformity to rules and may take action to rectify violations. In this study, we examine two ways in which rules are enforced during games: instructions and reminders. Building on prior research, we identify instructions as actions produced to rectify violations based on another's lack of knowledge of the relevant rule; knowledge that the instruction is designed to impart. In contrast to this, the actions we refer to as reminders are designed to enforce rules presupposing the transgressor's competence and treating the violation as the result of forgetfulness or oversight. We show that instructing and reminding actions differ in turn design, sequential development, the epistemic stances taken by transgressors and enforcers, and in how the action affects the progressivity of the interaction. Data are in German and Italian from the Parallel European Corpus of Informal Interaction (PECII).

<https://www.tandfonline.com/doi/full/10.1080/08351813.2023.2170637>

Nature

CORRECTIONS

COSIMO POSTH et al with JOHANNES KRAUSE – Author Correction: Palaeogenomics of Upper Palaeolithic to Neolithic European hunter-gatherers

Correction to: Nature <https://doi.org/10.1038/s41586-023-05726-0> Published online 1 March 2023 [EAORC 1,029]

In the version of this article initially published, the affiliation listed for David Caramelli was incorrect (Kazan Federal University, Kazan, Russia). The affiliation has been corrected to the Department of Biology, University of Florence, Florence, Italy in the HTML and PDF versions of the article.

<https://www.nature.com/articles/s41586-023-05942-8>

Nature Communications Biology

PAPERS

ANTONIO PROFICO et al – Virtual excavation and analysis of the early Neanderthal cranium from Altamura (Italy)

Complete Neanderthal skeletons are almost unique findings. A very well-preserved specimen of this kind was discovered in 1993 in the deepest recesses of a karstic system near the town of Altamura in Southern Italy. We present here a detailed description of the cranium, after we virtually extracted it from the surrounding stalagmites and stalactites. The morphology of the Altamura cranium fits within the Neanderthal variability, though it retains features occurring in more archaic European samples. Some of these features were never observed in *Homo neanderthalensis*, i.e. in fossil specimens dated between 300 and 40 ka. Considering the U-Th age we previously obtained (>130 ka), the morphology of Altamura suggests that the archaic traits it retains may have been originated by geographic isolation of the early Neanderthal populations from Southern Italy.

<https://www.nature.com/articles/s42003-023-04644-1>

Nature Human Behaviour

PAPERS

THE FORECASTING COLLABORATIVE – Insights into the accuracy of social scientists' forecasts of societal change

How well can social scientists predict societal change, and what processes underlie their predictions? To answer these questions, we ran two forecasting tournaments testing the accuracy of predictions of societal change in domains commonly studied in the social sciences: ideological preferences, political polarization, life satisfaction, sentiment on social media, and gender-career and racial bias. After we provided them with historical trend data on the relevant domain, social scientists submitted pre-registered monthly forecasts for a year (Tournament 1; N = 86 teams and 359 forecasts), with an opportunity to update forecasts on the basis of new data six months later (Tournament 2; N = 120 teams and 546 forecasts). Benchmarking forecasting accuracy revealed that social scientists' forecasts were on average no more accurate than those of simple statistical models (historical means, random walks or linear regressions) or the aggregate forecasts of a sample from the general public (N = 802). However, scientists were more accurate if they had scientific expertise in a prediction domain, were interdisciplinary, used simpler models and based predictions on prior data.

<https://www.nature.com/articles/s41562-022-01517-1.epdf>

WARREN WOODRICH PETTINE et al – Human generalization of internal representations through prototype learning with goal-directed attention

The world is overabundant with feature-rich information obscuring the latent causes of experience. How do people approximate the complexities of the external world with simplified internal representations that generalize to novel examples or situations? Theories suggest that internal representations could be determined by decision boundaries that discriminate between alternatives, or by distance measurements against prototypes and individual exemplars. Each provide

advantages and drawbacks for generalization. We therefore developed theoretical models that leverage both discriminative and distance components to form internal representations via action-reward feedback. We then developed three latent-state learning tasks to test how humans use goal-oriented discrimination attention and prototypes/exemplar representations. The majority of participants attended to both goal-relevant discriminative features and the covariance of features within a prototype. A minority of participants relied only on the discriminative feature. Behaviour of all participants could be captured by parameterizing a model combining prototype representations with goal-oriented discriminative attention.

<https://www.nature.com/articles/s41562-023-01543-7>

CHARLOTTE CAUCHETEUX, ALEXANDRE GRAMFORT & JEAN-REMI KING – Hierarchical organization of language predictions in the brain

Human language processing is poorly matched by artificial intelligence algorithms. We analysed fMRI brain recordings of 304 participants while they listened to short stories and compared brain activations to artificial intelligence algorithms. Unlike such algorithms, we found that the human brain operates with a hierarchy of predictions that anticipate incoming words and phrases. [K. FRISTON & S. KIEBEL – Predictive coding under the free-energy principle. *Philosophical Transactions of the Royal Society B* 364, 1211-1221 (2009), above.]

<https://www.nature.com/articles/s41562-023-01534-8>

BRUNO VERSCHUERE & EWOUT MEIJER – A simple heuristic for distinguishing lie from truth

One of the reasons that people perform poorly when trying to detect deception is the difficulty of integrating multiple cues into a binary judgement. A simple heuristic of only judging the level of detail in the message consistently allowed people to discriminate lies from truths. [CHARLES F. BOND, JR. & BELLA M. DEPAULO – Accuracy of Deception Judgments. *Personality and Social Psychology Review* 10:3 (2006), above]

<https://www.nature.com/articles/s41562-023-01571-3>

Nature Humanities & Social Sciences Communications

PAPERS

XUEFANG FENG & JIE LIU – The developmental trajectories of L2 lexical-semantic networks

This study explored the developmental trajectories of L2 Lexical-semantic networks by comparing the structure of lexical-semantic networks of Chinese EFL learners at two levels of English: intermediate and advanced. Analyses of data from semantic fluency tasks found that with the improvement of language proficiency, the L2 lexical-semantic network becomes more connected but less centralized. Analyses of community structure revealed that the lexical-semantic network of advanced learners has denser clusters than that of intermediate learners. Examination of individual words in the L2 lexical-semantic network shows that words tend to reorganize themselves with the expanse of the network. In this process, more frequent and connected words tend to remain in the network as central words while less frequent words with fewer connections have the risk of being lost, although a large number of new words keep joining in the network. The results provide empirical evidence for the preferential attachment model of lexical-semantic network growth.

<https://www.nature.com/articles/s41599-023-01621-1>

Nature Scientific Reports

PAPERS

MIADA ABU SALIH et al – Evidence for cultural differences in affect during mother–infant interactions

Maternal care is considered a universal and even cross-species set of typical behaviors, which are necessary to determine the social development of children. In humans, most research on mother–infant bonding is based on Western cultures and conducted in European and American countries. Thus, it is still unknown which aspects of mother–infant behaviors are universal and which vary with culture. Here we test whether typical mother–infant behaviors of affect-communication and affect-regulation are equally represented during spontaneous interaction in Palestinian-Arab and Jewish cultures. 30 Palestinian-Arab and 43 Jewish mother–infant dyads were recruited and videotaped. Using AffectRegulation Coding System (ARCS), we behaviorally analyzed the second-by-second display of valence and arousal in each participant and calculated the dynamic patterns of affect co-regulation. The results show that Palestinian-Arab infants express more positive valence than Jewish infants and that Palestinian-Arab mothers express higher arousal compared to Jewish mothers. Moreover, we found culturally-distinct strategies to regulate the infant: increased arousal in Palestinian-Arab dyads and increased mutual affective match in Jewish dyads. Such cross-cultural differences in affect indicate that basic features of emotion that are often considered universal are differentially represented in different cultures. Affect communication and regulation patterns can be transmitted across generations in early-life socialization with caregivers.

<https://www.nature.com/articles/s41598-023-31907-y>

SCOTT CLAESSENS et al with QUENTIN D. ATKINSON – Cooperative and conformist behavioural preferences predict the dual dimensions of political ideology

Decades of research suggest that our political differences are best captured by two dimensions of political ideology. The dual evolutionary framework of political ideology predicts that these dimensions should be related to variation in social preferences for cooperation and group conformity. Here, we combine data from a New Zealand survey and a suite of incentivised behavioural tasks ($n = 991$) to test whether cooperative and conformist preferences covary with a pair of widely used measures of the two dimensions of political ideology—Social Dominance Orientation (SDO) and Right Wing Authoritarianism (RWA)—and related policy views. As predicted, we find that cooperative behaviour is negatively related to SDO and economically conservative policy views, while conformist behaviour in the form of social information use is positively related to RWA and socially conservative policy views. However, we did not find the predicted relationships between punitive and rule following behaviours and RWA or socially conservative views, raising questions about the interpretation of punishment and rule following tasks and the nature of authoritarian conformist preferences. These findings reveal how cooperative and conformist preferences that evolved to help us navigate social challenges in our ancestral past continue to track our political differences even today.

<https://www.nature.com/articles/s41598-023-31721-6>

Personality and Social Psychology Review**PAPERS****CHARLES F. BOND, JR. & BELLA M. DEPAULO – Accuracy of Deception Judgments**

We analyze the accuracy of deception judgments, synthesizing research results from 206 documents and 24,483 judges. In relevant studies, people attempt to discriminate lies from truths in real time with no special aids or training. In these circumstances, people achieve an average of 54% correct lie-truth judgments, correctly classifying 47% of lies as deceptive and 61% of truths as nondeceptive. Relative to cross-judge differences in accuracy, mean lie-truth discrimination abilities are nontrivial, with a mean accuracy d of roughly .40. This produces an effect that is at roughly the 60th percentile in size, relative to others that have been meta-analyzed by social psychologists. Alternative indexes of lie-truth discrimination accuracy correlate highly with percentage correct, and rates of lie detection vary little from study to study. Our meta-analyses reveal that people are more accurate in judging audible than visible lies, that people appear deceptive when motivated to be believed, and that individuals regard their interaction partners as honest. We propose that people judge others' deceptions more harshly than their own and that this double standard in evaluating deceit can explain much of the accumulated literature.

https://journals.sagepub.com/doi/10.1207/s15327957pspr1003_2

Philosophical Transactions of the Royal Society B**PAPERS****SARAH F. BROSAN & BART J. WILSON – Comparative economics: how studying other primates helps us better understand the evolution of our own economic decision making**

The origins of evolutionary games are rooted in both economics and animal behaviour, but economics has, until recently, focused primarily on humans. Although historically, specific games were used in targeted circumstances with non-human species (i.e. the Prisoner's Dilemma), experimental economics has been increasingly recognized as a valuable method for directly comparing both the outcomes of economic decisions and their underlying mechanisms across species, particularly in comparison with humans, thanks to the structured procedures that allow for them to be instantiated across a variety of animals. So far, results in non-human primates suggest that even when outcomes are shared, underlying proximate mechanisms can vary substantially. Intriguingly, in some contexts non-human primates more easily find a Nash equilibrium than do humans, possibly owing to their greater willingness to explore the parameter space, but humans excel at more complex outcomes, such as alternating between two Nash equilibria, even when deprived of language or instruction, suggesting potential mechanisms that humans have evolved to allow us to solve complex social problems. We consider what these results suggest about the evolution of economic decision-making and suggest future directions, in particular the need to expand taxonomic diversity, to expand this promising approach.

<https://royalsocietypublishing.org/doi/abs/10.1098/rstb.2021.0497>

XIAOMIN WANG et al – Cooperation and coordination in heterogeneous populations

One landmark application of evolutionary game theory is the study of social dilemmas. This literature explores why people cooperate even when there are strong incentives to defect. Much of this literature, however, assumes that interactions are symmetric. Individuals are assumed to have the same strategic options and the same potential pay-offs. Yet many interesting questions arise once individuals are allowed to differ. Here, we study asymmetry in simple coordination games. In our set-up, human participants need to decide how much of their endowment to contribute to a public good. If a group's collective contribution reaches a pre-defined threshold, all group members receive a reward. To account for possible asymmetries, individuals either differ in their endowments or their productivities. According to a theoretical equilibrium analysis, such games tend to have many possible solutions. In equilibrium, group members may contribute the same amount, different amounts or nothing at all. According to our behavioural experiment, however, humans favour the equilibrium in which

everyone contributes the same proportion of their endowment. We use these experimental results to highlight the non-trivial effects of inequality on cooperation, and we discuss to which extent models of evolutionary game theory can account for these effects.

<https://royalsocietypublishing.org/doi/full/10.1098/rstb.2021.0504>

ALEXANDER STEIN et al – Stackelberg evolutionary game theory: how to manage evolving systems

Stackelberg evolutionary game (SEG) theory combines classical and evolutionary game theory to frame interactions between a rational leader and evolving followers. In some of these interactions, the leader wants to preserve the evolving system (e.g. fisheries management), while in others, they try to drive the system to extinction (e.g. pest control). Often the worst strategy for the leader is to adopt a constant aggressive strategy (e.g. overfishing in fisheries management or maximum tolerable dose in cancer treatment). Taking into account the ecological dynamics typically leads to better outcomes for the leader and corresponds to the Nash equilibria in game-theoretic terms. However, the leader's most profitable strategy is to anticipate and steer the eco-evolutionary dynamics, leading to the Stackelberg equilibrium of the game. We show how our results have the potential to help in fields where humans try to bring an evolutionary system into the desired outcome, such as, among others, fisheries management, pest management and cancer treatment. Finally, we discuss limitations and opportunities for applying SEGs to improve the management of evolving biological systems.

<https://royalsocietypublishing.org/doi/full/10.1098/rstb.2021.0495>

ARNE TRAUlsen & NIKOLETA E. GLYNATSI – The future of theoretical evolutionary game theory

Evolutionary game theory is a truly interdisciplinary subject that goes well beyond the limits of biology. Mathematical minds get hooked up in simple models for evolution and often gradually move into other parts of evolutionary biology or ecology. Social scientists realize how much they can learn from evolutionary thinking and gradually transfer insight that was originally generated in biology. Computer scientists can use their algorithms to explore a new field where machines not only learn from the environment, but also from each other. The breadth of the field and the focus on a few very popular issues, such as cooperation, comes at a price: several insights are re-discovered in different fields under different labels with different heroes and modelling traditions. For example, reciprocity or spatial structure are treated differently. Will we continue to develop things in parallel? Or can we converge to a single set of ideas, a single tradition and eventually a single software repository? Or will these fields continue to cross-fertilize each other, learning from each other and engaging in a constructive exchange between fields? Ultimately, the popularity of evolutionary game theory rests not only on its explanatory power, but also on the intuitive character of its models.

<https://royalsocietypublishing.org/doi/full/10.1098/rstb.2021.0508>

PIRET AVILA & CHARLES MULLON – Evolutionary game theory and the adaptive dynamics approach: adaptation where individuals interact

Evolutionary game theory and the adaptive dynamics approach have made invaluable contributions to understanding how gradual evolution leads to adaptation when individuals interact. Here, we review some of the basic tools that have come out of these contributions to model the evolution of quantitative traits in complex populations. We collect together mathematical expressions that describe directional and disruptive selection in class- and group-structured populations in terms of individual fitness, with the aims of bridging different models and interpreting selection. In particular, our review of disruptive selection suggests there are two main paths that can lead to diversity: (i) when individual fitness increases more than linearly with trait expression; (ii) when trait expression simultaneously increases the probability that an individual is in a certain context (e.g. a given age, sex, habitat, size or social environment) and fitness in that context. We provide various examples of these and more broadly argue that population structure lays the ground for the emergence of polymorphism with unique characteristics. Beyond this, we hope that the descriptions of selection we present here help see the tight links among fundamental branches of evolutionary biology, from life history to social evolution through evolutionary ecology, and thus favour further their integration.

<https://royalsocietypublishing.org/doi/abs/10.1098/rstb.2021.0502>

JEREMY VAN CLEVE – Evolutionarily stable strategy analysis and its links to demography and genetics through invasion fitness

Evolutionarily stable strategy (ESS) analysis pioneered by Maynard Smith and Price took off in part because it often does not require explicit assumptions about the genetics and demography of a population in contrast to population genetic models. Though this simplicity is useful, it obscures the degree to which ESS analysis applies to populations with more realistic genetics and demography: for example, how does ESS analysis handle complexities such as kin selection, group selection and variable environments when phenotypes are affected by multiple genes? In this paper, I review the history of the ESS concept and show how early uncertainty about the method lead to important mathematical theory linking ESS analysis to general population genetic models. I use this theory to emphasize the link between ESS analysis and the concept of invasion fitness. I give examples of how invasion fitness can measure kin selection, group selection and the evolution of linked modifier genes in response to variable environments. The ESSs in these examples depend crucially on demographic and genetic parameters, which highlights how ESS analysis will continue to be an important tool in understanding evolutionary

patterns as new models address the increasing abundance of genetic and long-term demographic data in natural populations.

<https://royalsocietypublishing.org/doi/10.1098/rstb.2021.0496>

INGELA ALGER – Evolutionarily stable preferences

The 50-year old concept of an evolutionarily stable strategy provided a key tool for theorists to model ultimate drivers of behaviour in social interactions. For decades, economists ignored ultimate drivers and used models in which individuals choose strategies based on their preferences—a proximate mechanism for behaviour—and the distribution of preferences in the population was taken to be fixed and given. This article summarizes some key findings in the literature on evolutionarily stable preferences, which in the past three decades has proposed models that combine the two approaches: individuals inherit their preferences, the preferences determine their strategy choices, which in turn determine evolutionary success. One objective is to highlight complementarities and potential avenues for future collaboration between biologists and economists.

<https://royalsocietypublishing.org/doi/10.1098/rstb.2021.0505>

ALLISON K. SHAW et al – Gaps in modelling animal migration with evolutionary game theory: infection can favour the loss of migration

Ongoing environmental changes alter how natural selection shapes animal migration. Understanding how these changes play out theoretically can be done using evolutionary game theoretic (EGT) approaches, such as looking for evolutionarily stable strategies. Here, we first describe historical patterns of how EGT models have explored different drivers of migration. We find that there are substantial gaps in both the taxa (mammals, amphibians, reptiles, insects) and mechanisms (mutualism, interspecific competition) included in past EGT models of migration. Although enemy interactions, including parasites, are increasingly considered in models of animal migration, they remain the least studied of factors for migration considered to date. Furthermore, few papers look at changes in migration in response to perturbations (e.g. climate change, new species interactions). To address this gap, we present a new EGT model to understand how infection with a novel parasite changes host migration. We find three possible outcomes when migrants encounter novel parasites: maintenance of migration (despite the added infection cost), loss of migration (evolutionary shift to residency) or population collapse, depending on the risk and cost of getting infected, and the cost currency. Our work demonstrates how emerging infection can alter animal behaviour such as migration.

<https://royalsocietypublishing.org/doi/10.1098/rstb.2021.0506>

ANDY GARDNER – The rarer-sex effect

The study of sex allocation—that is, the investment of resources into male versus female reproductive effort—yields among the best quantitative evidence for Darwinian adaptation, and has long enjoyed a tight and productive interplay of theoretical and empirical research. The fitness consequences of an individual's sex allocation decisions depend crucially upon the sex allocation behaviour of others and, accordingly, sex allocation is readily conceptualized in terms of an evolutionary game. Here, I investigate the historical development of understanding of a fundamental driver of the evolution of sex allocation—the rarer-sex effect—from its inception in the writing of Charles Darwin in 1871 through to its explicit framing in terms of consanguinity and reproductive value by William D. Hamilton in 1972. I show that step-wise development of theory proceeded through refinements in the conceptualization of the strategy set, the payoff function and the unbeatable strategy.

<https://royalsocietypublishing.org/doi/10.1098/rstb.2021.0500>

IAN C. W. HARDY & MIKE MESTERTON-GIBBONS – The evolutionarily stable strategy, animal contests, parasitoids, pest control and sociality

The evolutionarily stable strategy, ESS, concept was first used in biology to understand sex ratio bias and, shortly afterwards, to explore the logic of contests over essential and indivisible resources. ESS models formed the basis of much subsequent research on animal behaviour and placed game-theoretic thinking firmly within the behavioural ecology approach. Among behavioural ecologists studying parasitoids, it was those asking questions about the evolution of sex ratios who first made extensive use of the game-theoretic approach. A later growth of interest in parasitoid host defence and fighting behaviour made use of these tractable study species to explore contests and their connections to further aspects of life-history evolution plus some pest control applications. Our aims are to (i) introduce the topic of contests, which are engaged in by a very wide array of animal taxa, and the importance, both historical and conceptual, of the game-theoretic approach to their study, and (ii) review recent studies of parasitoid contests, including those that have considered the context of social evolution and the performance of parasitoids as agents of biological control. We consider that game-theoretic models are eminently testable and applicable and will likely endure as valuable tools in studies of parasitoid biology.

<https://royalsocietypublishing.org/doi/10.1098/rstb.2021.0498>

JUSSI LEHTONEN & JUN OTSUKA – Evolutionary game theory of continuous traits from a causal perspective

Modern evolutionary game theory typically deals with the evolution of continuous, quantitative traits under weak selection, allowing the incorporation of rich biological detail and complicated nonlinear interactions. While these models are commonly

used to find candidates for evolutionary endpoints and to approximate evolutionary trajectories, a less appreciated property is their potential to expose and clarify the causal structure of evolutionary processes. The mathematical step of differentiation breaks a nonlinear model into additive components which are more intuitive to interpret, and when combined with a proper causal hypothesis, partial derivatives in such models have a causal meaning. Such an approach has been used in the causal analysis of game-theoretical models in an informal manner. Here we formalize this approach by linking evolutionary game theory to concepts developed in causal modelling over the past century, from path coefficients to the recently proposed causal derivative. There is a direct correspondence between the causal derivative and the derivative used in evolutionary game theory. Some game theoretical models (e.g. kin selection) consist of multiple causal derivatives. Components of these derivatives correspond to components of the causal derivative, to path coefficients, and to edges on a causal graph, formally linking evolutionary game theory to causal modelling.

<https://royalsocietypublishing.org/doi/10.1098/rstb.2021.0507>

OLOF LEIMAR & JOHN M. MCNAMARA – Game theory in biology: 50 years and onwards

Game theory in biology gained prominence 50 years ago, when Maynard Smith & Price formulated the concept of an evolutionarily stable strategy (ESS). Their aim was to explain why conflicts between animals of the same species usually are of a 'limited war' type, not causing serious injury. They emphasized that game theory is an alternative to previous ideas about group selection, which were used by ethologists to explain limited aggression. Subsequently, the ESS concept was applied to many phenomena with frequency dependence in the evolutionary success of strategies, including sex allocation, alternative mating types, contest behaviour and signalling, cooperation, and parental care. Both the analyses of signalling and cooperation were inspired by similar problems in economics and attracted much attention in biology. Here we give a perspective on which of the ambitions in the field have been achieved, with a focus on contest behaviour and cooperation. We evaluate whether the game-theoretical study of the evolution of cooperation has measured up to expectations in explaining the behaviour of non-human animals. We also point to potentially fruitful directions for the field, and emphasize the importance of incorporating realistic behavioural mechanisms into models.

<https://royalsocietypublishing.org/doi/10.1098/rstb.2021.0509>

PLoS One

PAPERS

BARBARA GAWDA – The novel narrative technique uncovers emotional scripts in individuals with psychopathy and high trait anxiety

Mental representations are of great importance for understanding human behaviour. The aim of this article is to present an innovative way to assess emotional scripts, which are a form of mental representations of emotional events, based on an analysis of narratives and their contents. Theoretical background on emotional schemas and scripts is provided along with information about types of related measures. Then, a rationale is presented for introducing an assessment of scripts related to specific emotions such as love, hate, and anxiety in a psychopathological context. This is followed by a perspective explaining the procedure of the relevant technique based on narrative data analysis. The technique has been successfully applied in two studies [I study (n= 200), II study (n= 280)]. A total of 1440 narratives about specific emotions have been analyzed to identify the indicators of scripts. The psychometric properties of the proposed technique have been established such as reliability, inter-rater agreement, and accuracy. The results show the value of the assessment of emotional script in individuals, particularly with high psychopathy and high trait anxiety. The contents of love and hate scripts are an illustration of cognitive distortions and deficits in the emotional information processing in individuals with psychopathy. The method enables the collection of informative data on romantic love, hate, and anxiety scripts which provides insight into how people may perceive and experience emotions and how they behave emotionally. Future research should focus on verification of the technique in other types of psychopathology and on the improvement of computer software dedicated to the narrative technique described in this paper.

<https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0283391>

Proceedings of the Royal Society B

ARTICLES

ROSA LI – Children are adaptive decision-makers: how environment shapes decision preferences

No abstract or summary.

<https://royalsocietypublishing.org/doi/10.1098/rspb.2022.2117>

PAPERS

JUAN DU et al – Post-marital residence patterns and the timing of reproduction: evidence from a matrilineal society

Humans exhibit a broad range of post-marital residence patterns and there is growing recognition that post-marital residence predicts women's reproductive success; however, the nature of the relationship is probably dependent on whether co-resident kin are cooperators or competitors. Here, we explore this relationship in a Tibetan population, where couples practice a mixture of post-marital residence patterns, co-residing in the same village with the wife's parents, the husband's

parents or endogamously with both sets of parents. Using detailed demographic data from 17 villages we find that women who live with only their own parents have an earlier age at first birth (AFB) and age at last birth (ALB) than women who live with only their parents-in-law. Women who co-reside with both sets of parents have the earliest AFB and ALB. However, those with co-resident older siblings postponed reproduction, suggestive of competition-related delay. Shifts to earlier reproductive timing were also observed in relation to the imposition of family planning policies, in line with Fisherian expectations. Our study provides evidence of the costs and benefits to women's direct fitness of co-residing with different kin, against a backdrop of adaptive responses to cultural constraints on completed fertility.

<https://royalsocietypublishing.org/doi/10.1098/rspb.2023.0159>

BEN THOMAS GLEESON & LAURA A. B. WILSON – Shared reproductive disruption, not neural crest or tameness, explains the domestication syndrome

Altered neural crest cell (NCC) behaviour is an increasingly cited explanation for the domestication syndrome in animals. However, recent authors have questioned this explanation, while others cast doubt on whether domestication syndrome even exists. Here, we review published literature concerning this syndrome and the NCC hypothesis, together with recent critiques of both. We synthesize these contributions and propose a novel interpretation, arguing shared trait changes under ancient domestication resulted primarily from shared disruption of wild reproductive regimes. We detail four primary selective pathways for 'reproductive disruption' under domestication and contrast these succinct and demonstrable mechanisms with cryptic genetic associations posited by the NCC hypothesis. In support of our perspective, we illustrate numerous important ways in which NCCs contribute to vertebrate reproductive phenotypes, and argue it is not surprising that features derived from these cells would be coincidentally altered under major selective regime changes, as occur in domestication. We then illustrate several pertinent examples of Darwin's 'unconscious selection' in action, and compare applied selection and phenotypic responses in each case. Lastly, we explore the ramifications of reproductive disruption for wider evolutionary discourse, including links to wild 'self-domestication' and 'island effect', and discuss outstanding questions.

<https://royalsocietypublishing.org/doi/10.1098/rspb.2022.2464>

Science Advances

PAPERS

KENJI W. KOYANO et al – Progressive neuronal plasticity in primate visual cortex during stimulus familiarization

The primate brain is equipped to learn and remember newly encountered visual stimuli such as faces and objects. In the macaque inferior temporal (IT) cortex, neurons mark the familiarity of a visual stimulus through response modification, often involving a decrease in spiking rate. Here, we investigate the emergence of this neural plasticity by longitudinally tracking IT neurons during several weeks of familiarization with face images. We found that most neurons in the anterior medial (AM) face patch exhibited a gradual decline in their late-phase visual responses to multiple stimuli. Individual neurons varied from days to weeks in their rates of plasticity, with time constants determined by the number of days of exposure rather than the cumulative number of presentations. We postulate that the sequential recruitment of neurons with experience-modified responses may provide an internal and graded measure of familiarity strength, which is a key mnemonic component of visual recognition.

<https://www.science.org/doi/full/10.1126/sciadv.ade4648>

MICHAEL CROSSLEY et al – A circuit mechanism linking past and future learning through shifts in perception

Long-term memory formation is energetically costly. Neural mechanisms that guide an animal to identify fruitful associations therefore have important survival benefits. Here, we elucidate a circuit mechanism in *Lymnaea*, which enables past memory to shape new memory formation through changes in perception. Specifically, strong classical conditioning drives a positive shift in perception that facilitates the robust learning of a subsequent and otherwise ineffective weak association. Circuit dissection approaches reveal the neural control network responsible, characterized by a mutual inhibition motif. This both sets perceptual state and acts as the master controller for gating new learning. Pharmacological circuit manipulation *in vivo* fully substitutes for strong paradigm learning, shifting the network into a more receptive state to enable subsequent weak paradigm learning. Thus, perceptual change provides a conduit to link past and future memory storage. We propose that this mechanism alerts animals to learning-rich periods, lowering the threshold for new memory acquisition.

<https://www.science.org/doi/full/10.1126/sciadv.add3403>

Trends in Cognitive Sciences

ARTICLES

KONSTANTINOS TSETOSOS – Unlocking a new dimension in the speed–accuracy trade-off

Why do we sometimes spend too much time on seemingly impossible-to-solve tasks instead of just moving on? Masís et al. [eLife above] provide a new perspective on the speed–accuracy trade-off (SAT), showing that, although prolonging deliberation looks suboptimal in the short run, it is a long-term investment that helps organisms reach proficient performance more rapidly.

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