

## EAORC BULLETIN 1,057 – 17 September 2023

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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.

### EDITORIAL INTERJECTIONS

Comments in curly brackets are editorial interjections. The Editor reserves the right to be wrong.

### ACADEMIA.EDU – Neo-Pragmatism and Enactive Intentionality

*In J. Schulkin (ed.), Action, Perception and the Brain. Palgrave-Macmillan, 117-146 (2012).*

#### SHAUN GALLAGHER & KATSUNORI MIYAHARA – Neo-Pragmatism and Enactive Intentionality

In this chapter we address the following question: can enactive and extended conceptions of the mind agree on a model of intentionality? We explore several conceptions of intentionality in order to ask which one best supports the concept of mind implied by both the enactive and the extended views. We argue (1) that, although both enactive and extended views champion a non-Cartesian, noninternalist conception of mind, we only start to see what this conception of mind is when we adopt an enactivist conception of intentionality; (2) only by adopting this model of intentionality will the proponents of the extended mind hypothesis be able to fend off those critics who insist on defining the “mark of the mental” in terms of nonderivative (narrow or internal) content; and (3) working out this model of intentionality requires resolutions to a number of debates in the area of social cognition.

[https://www.academia.edu/106417138/Gallagher\\_S\\_and\\_Miyahara\\_K\\_2012\\_Neo\\_Pragmatism\\_and\\_Enactive\\_Intentionality](https://www.academia.edu/106417138/Gallagher_S_and_Miyahara_K_2012_Neo_Pragmatism_and_Enactive_Intentionality)

### ACADEMIA.EDU – From the origin of language to the diversification of languages

*In F.d'Errico & J.-M. Hombert (eds.), Becoming Eloquent: Advances in the emergence of language, human cognition, and modern cultures. John Benjamins Publishing Company, 13-68 (2009).*

#### FRANCESCO D'ERRICO et al with CHRISTOPHER HENSHILWOOD & GRAEME LAWSON – From the origin of language to the diversification of languages: What can archaeology and palaeoanthropology say?

In this paper we recall the arguments put forward in an attempt to link language origins and specific elements of the fossil record (pigment use, burial practices, personal ornaments, production of depictions and carvings, musical traditions, various anatomical features), and summarise the scenarios proposed by palaeoanthropologists and archaeologists to account for the emergence of modern behavioral traits. This review challenges the idea of a strict link between biological and behavioural change and suggests that modern cognition and language are results of a gradual, complex and non-linear process to whose advancement different human populations and possibly a number of fossil human species have contributed.

[https://www.academia.edu/28117469/From\\_the\\_origin\\_of\\_language\\_to\\_the\\_diversification\\_of\\_languages\\_What\\_archaeology\\_and\\_paleoanthropology\\_say](https://www.academia.edu/28117469/From_the_origin_of_language_to_the_diversification_of_languages_What_archaeology_and_paleoanthropology_say)

## NEWS

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### SAPIENS – Archaeologists reveal largest paleolithic cave art site in Eastern Iberia

An excavation off the Iberian Coast has unearthed what may be one of the largest Paleolithic cave sites in eastern Iberia to date. So far, researchers have reported finding over 100 cave paintings and engravings estimated to be at least 24,000 years old.

<https://phys.org/news/2023-09-archaeologists-reveal-largest-paleolithic-cave.html>

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### SCIENCEADVISER – Stone Age artists were on the right track with their hyper-realistic engravings

Rock art from a site in western Namibia in may date back to the final millennium B.C.E. LENSSEN-ERZ ET AL.

Thousands of years ago, hunter-gatherers in what is now western Namibia carved hundreds of images into sandstone boulders. Some of the engravings in this ancient art gallery are of human figures and animals like giraffes, elephants, and ostriches, but the majority depict human and animal footprints.

<https://www.science.org/content/article/prehistoric-artists-carved-incredibly-lifelike-animal-tracks>

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### SCIENCE.ORG NEWS – Scientific retractions may become easier to spot

Five-year deal will share journal watchdog's widely used database with Crossref in return for stable funding.

<https://www.science.org/content/article/scientific-retractions-may-become-easier-spot-retraction-watch-finds-new-partner>

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### SCIENCE.ORG NEWS – Prehistoric artists carved incredibly lifelike animal tracks

The carvings are so realistic that today, Indigenous trackers can recognize their species, age, and sex.

<https://www.science.org/content/article/prehistoric-artists-carved-incredibly-lifelike-animal-tracks>

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## PUBLICATIONS

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### Acta Linguistica Hafniensia

#### PAPERS

#### **CHRISTOPHE BÉCHET & LIESELOTTE BREMS – From complex prepositions to complex subordinators: challenging generalizations**

This paper presents a first approximation of the relationships within and between complex prepositions and complex subordinators from a cognitive vantage point. Because of the similarities between the two categories at the syntactic and functional levels of analysis, we first hypothesize the existence of a common productive schema that encompasses members of both classes within the framework of Construction Grammar. We then put forward a methodology developed in Diachronic Construction Grammar to analyze the within- and between-category constructional links in complex prepositions and complex subordinators in American English. We use multivariate quantitative methods to highlight the similarities and dissimilarities between the categories and make them visually identifiable. The application of this methodology to historical corpus data reveals that contrary to our expectations, complex prepositions form a relatively stable schema over time, without converging towards a common schema with the loosely connected complex subordinators under scrutiny.

<https://www.tandfonline.com/doi/abs/10.1080/03740463.2023.2246001>

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### American Journal of Biological Anthropology

#### PAPERS

#### **ALEJANDRA PASCUAL-GARRIDO, SUSANA CARVALHO & KATARINA ALMEIDA-WARREN – Primate archaeology 3.0**

The new field of primate archaeology investigates the technological behavior and material record of nonhuman primates, providing valuable comparative data on our understanding of human technological evolution. Yet, paralleling hominin archaeology, the field is largely biased toward the analysis of lithic artifacts. While valuable comparative data have been gained through an examination of extant nonhuman primate tool use and its archaeological record, focusing on this one single aspect provides limited insights. It is therefore necessary to explore to what extent other non-technological activities, such as non-tool aided feeding, traveling, social behaviors or ritual displays, leave traces that could be detected in the archaeological record. Here we propose four new areas of investigation which we believe have been largely overlooked by primate archaeology and that are crucial to uncovering the full archaeological potential of the primate behavioral repertoire, including that of our own: (1) Plant technology; (2) Archaeology beyond technology; (3) Landscape archaeology; and (4) Primate cultural heritage. We discuss each theme in the context of the latest developments and challenges, as well as propose future directions. Developing a more “inclusive” primate archaeology will not only benefit the study of primate evolution in its own right but will aid conservation efforts by increasing our understanding of changes in primate-environment interactions over time.

<https://onlinelibrary.wiley.com/doi/full/10.1002/ajpa.24835>

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**MATTHEW C. O'NEILL, AKINORI NAGANO & BRIAN R. UMBERGER – A three-dimensional musculoskeletal model of the pelvis and lower limb of *Australopithecus afarensis***

Musculoskeletal modeling is a powerful approach for studying the biomechanics and energetics of locomotion. *Australopithecus* (*A.*) *afarensis* is among the best represented fossil hominins and provides critical information about the evolution of musculoskeletal design and locomotion in the hominin lineage. Here, we develop and evaluate a three-dimensional (3-D) musculoskeletal model of the pelvis and lower limb of *A. afarensis* for predicting muscle-tendon moment arms and moment-generating capacities across lower limb joint positions encompassing a range of locomotor behaviors. A 3-D musculoskeletal model of an adult *A. afarensis* pelvis and lower limb was developed based primarily on the A.L. 288-1 partial skeleton. The model includes geometric representations of bones, joints and 35 muscle-tendon units represented using 43 Hill-type muscle models. Two muscle parameter datasets were created from human and chimpanzee sources. 3-D muscle-tendon moment arms and isometric joint moments were predicted over a wide range of joint positions. Predicted muscle-tendon moment arms generally agreed with skeletal metrics, and corresponded with human and chimpanzee models. Human and chimpanzee-based muscle parameterizations were similar, with some differences in maximum isometric force-producing capabilities. The model is amenable to size scaling from A.L. 288-1 to the larger KSD-VP-1/1, which subsumes a wide range of size variation in *A. afarensis*. This model represents an important tool for studying the integrated function of the neuromusculoskeletal systems in *A. afarensis*. It is similar to current human and chimpanzee models in musculoskeletal detail, and will permit direct, comparative 3-D simulation studies.

<https://onlinelibrary.wiley.com/doi/abs/10.1002/ajpa.24845>

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**Current Biology****PAPERS****JONAH K. MITTELSTADT & PATRICK O. KANOLD – Orbitofrontal cortex conveys stimulus and task information to the auditory cortex**

Auditory cortical neurons modify their response profiles in response to numerous external factors. During task performance, changes in primary auditory cortex (A1) responses are thought to be driven by top-down inputs from the orbitofrontal cortex (OFC), which may lead to response modification on a trial-by-trial basis. While OFC neurons respond to auditory stimuli and project to A1, the function of OFC projections to A1 during auditory tasks is unknown. Here, we observed the activity of putative OFC terminals in A1 in mice by using *in vivo* two-photon calcium imaging of OFC terminals under passive conditions and during a tone detection task. We found that behavioral activity modulates but is not necessary to evoke OFC terminal responses in A1. OFC terminals in A1 form distinct populations that exclusively respond to either the tone, reward, or error. Using tones against a background of white noise, we found that OFC terminal activity was modulated by the signal-to-noise ratio (SNR) in both the passive and active conditions and that OFC terminal activity varied with SNR, and thus task difficulty in the active condition. Therefore, OFC projections in A1 are heterogeneous in their modulation of auditory encoding and likely contribute to auditory processing under various auditory conditions.

[https://www.cell.com/current-biology/fulltext/S0960-9822\(23\)01139-9](https://www.cell.com/current-biology/fulltext/S0960-9822(23)01139-9)

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**eLife****PAPERS****ANNE LÖFFLER et al with DANIEL M. WOLPERT – Judging the difficulty of perceptual decisions**

Deciding how difficult it is going to be to perform a task allows us to choose between tasks, allocate appropriate resources, and predict future performance. To be useful for planning, difficulty judgments should not require completion of the task. Here we examine the processes underlying difficulty judgments in a perceptual decision making task. Participants viewed two patches of dynamic random dots, which were colored blue or yellow stochastically on each appearance. Stimulus coherence (the probability,  $p_{\text{blue}}$ , of a dot being blue) varied across trials and patches thus establishing difficulty,  $|p_{\text{blue}} - 0.5|$ . Participants were asked to indicate for which patch it would be easier to decide the dominant color. Accuracy in difficulty decisions improved with the difference in the stimulus difficulties, whereas the reaction times were not determined solely by this quantity. For example, when the patches shared the same difficulty, reaction times were shorter for easier stimuli. A comparison of several models of difficulty judgment suggested that participants compare the absolute accumulated evidence from each stimulus and terminate their decision when they differed by a set amount. The model predicts that when the dominant color of each stimulus is known, reaction times should depend only on the difference in difficulty, which we confirm empirically. We also show that this model is preferred to one that compares the confidence one would have in making each decision. The results extend evidence accumulation models, used to explain choice, reaction time and confidence to prospective judgments of difficulty.

<https://elifesciences.org/reviewed-preprints/86892>

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## Frontiers in Language Sciences

### PAPERS

#### **YASMEEN FAROQI-SHAH – A reconceptualization of sentence production in post-stroke agrammatic aphasia: the Synergistic Processing Bottleneck model**

The language production deficit in post-stroke agrammatic aphasia (PSA-G) tends to result from lesions to the left inferior frontal gyrus (LIFG) and is characterized by a triad of symptoms: fragmented sentences, errors in functional morphology, and a dearth of verbs. Despite decades of research, the mechanisms underlying production patterns in PSA-G have been difficult to characterize. Two major impediments to progress may have been the view that it is a purely morphosyntactic disorder and the (sometimes overzealous) application of linguistic theory without interceding psycholinguistic evidence. In this paper, empirical evidence is examined to present an integrated portrait of language production in PSA-G and to evaluate the assumption of a syntax-specific syndrome. In light of extant evidence, it is proposed that agrammatic language production results from a combination of morphosyntactic, phonomotor, and processing capacity limitations that cause a cumulative processing bottleneck at the point of articulatory planning. This proposed Synergistic Processing Bottleneck model of PSA-G presents a testable framework for future research. The paper ends with recommendations for future research on PSA-G.

<https://www.frontiersin.org/articles/10.3389/flang.2023.1118739/full>

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## Frontiers in Neurology

### PAPERS

#### **BINGYU LIU, JIAYU SHAN & YONG GU – Temporal and spatial properties of vestibular signals for perception of self-motion**

It is well recognized that the vestibular system is involved in numerous important cognitive functions, including self-motion perception, spatial orientation, locomotion, and vector-based navigation, in addition to basic reflexes, such as oculomotor or body postural control. Consistent with this rationale, vestibular signals exist broadly in the brain, including several regions of the cerebral cortex, potentially allowing tight coordination with other sensory systems to improve the accuracy and precision of perception or action during self-motion. Recent neurophysiological studies in animal models based on single-cell resolution indicate that vestibular signals exhibit complex spatiotemporal dynamics, producing challenges in identifying their exact functions and how they are integrated with other modality signals. For example, vestibular and optic flow could provide congruent and incongruent signals regarding spatial tuning functions, reference frames, and temporal dynamics. Comprehensive studies, including behavioral tasks, neural recording across sensory and sensory-motor association areas, and causal link manipulations, have provided some insights into the neural mechanisms underlying multisensory self-motion perception.

<https://www.frontiersin.org/articles/10.3389/fneur.2023.1266513/full>

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## Frontiers in Pain Research

### PAPERS

#### **MARK I. JOHNSON, MATT HUDSON & CORMAC G. RYAN – Perspectives on the insidious nature of pain metaphor: we literally need to change our metaphors**

Metaphorical language is used to convey one thing as representative or symbolic of something else. Metaphor is used in figurative language but is much more than a means of delivering “poetic imagination”. A metaphor is a conceptual tool for categorising, organizing, thinking about, and ultimately shaping reality. Thus, metaphor underpins the way humans think. Our viewpoint is that metaphorical thought and communication contribute to “painogenicity”, the tendency of socio-ecological environments (settings) to promote the persistence of pain. In this perspectives article, we explore the insidious nature of metaphor used in pain language and conceptual models of pain. We explain how metaphor shapes mental organisation to govern the way humans perceive, navigate and gain insight into the nature of the world, i.e., creating experience. We explain how people use metaphors to “project” their private sensations, feelings, and thoughts onto objects and events in the external world. This helps people to understand their pain and promotes sharing of pain experience with others, including health care professionals. We explore the insidious nature of “warmongering” and damage-based metaphors in daily parlance and demonstrate how this is detrimental to health and wellbeing. We explore how metaphors shape the development and communication of complex, abstract ideas, theories, and models and how scientific understanding of pain is metaphorical in nature. We argue that overly simplistic neuro-mechanistic metaphors of pain contribute to fallacies and misnomers and an unhealthy focus on biomedical research, in the hope of developing medical interventions that “prevent pain transmission [sic]”. We advocate reconfiguring pain language towards constructive metaphors that foster a salutogenic view of pain, focusing on health and well-being. We advocate reconfiguring metaphors to align with contemporary pain science, to encourage acceptance of non-medicalised strategies to aid health and well-being. We explore the role of enactive metaphors to facilitate reconfiguration. We conclude that being cognisant of the pervasive nature of metaphors will assist progress toward a more coherent conceptual understanding of pain and the use of healthier pain language. We hope our article catalyses debate and reflection.

<https://www.frontiersin.org/articles/10.3389/fpain.2023.1224139/full>

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**Frontiers in Psychology**
**PAPERS****RONALD J. PLANER – The evolution of hierarchically structured communication**

Human language sentences are standardly understood as exhibiting considerable hierarchical structure: they can and typically do contain parts that in turn contain parts, etc. In other words, sentences are thought to generally exhibit significant nested part-whole structure. As far as we can tell, this is not a feature of the gestural or vocal communication systems of our great ape relatives. So, one of the many challenges we face in providing a theory of human language evolution is to explain the evolution of hierarchically structured communication in our line. This article takes up that challenge. More specifically, I first present and motivate an account of hierarchical structure in language that departs significantly from the orthodox conception of such structure in linguistics and evolutionary discussions that draw on linguistic theory. On the account I propose, linguistic structure, including hierarchical structure, is treated as a special case of structured action. This account is rooted in the cognitive neuroscience of action, as opposed to (formal) linguistic theory. Among other things, such an account enables us to see how selection for enhanced capacities of act organization and act control in actors, and for act interpretation in observers, might have constructed the brain machinery necessary for the elaborate forms of hierarchically structured communication that we humans engage in. I flesh out this line of thought, emphasizing in particular the role of hominin technique and technology, and the social learning thereof, as evolutionary drivers of this brain machinery.

<https://www.frontiersin.org/articles/10.3389/fpsyg.2023.1224324/full>

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**Heliyon****PAPERS****SANTANU ACHARJEE & AKHIL THOMAS PANICKER – Trust levels in social networks**

Dunbar's number is the cognitive limit of an individual to maintain stable relationships with others in his network. It is based on the size of the neocortex of the human brain. On the other hand, trust is one of the major issues for one while selecting members for his social network and the evolution of his social network with time. Trust and Dunbar's number are interconnected in the case of one's stable social network. Trust needs time to be built after several social interactions, intimacy, etc. In this paper, we try to provide answers to the following important questions related to social networks: (i) Do trust levels remain the same for individuals from one's perspective in his social network when the network size increases?

(ii) What is the relation between the power-law exponent  $\alpha$  and the trust cutoff?

(iii) Do trust levels help to diffuse information quickly or vice versa to reach Dunbar's number 150 along with hierarchy layers of 5, 15, and 50 individuals in networks of different sizes?

We find that there is a requirement for trust levels to increase among the same individuals in one's social network if the size of the network increases. As a relation between the power-law exponent  $\alpha$  and the trust cutoff, it is found that  $\alpha \propto 1/(\text{trust cutoff})$ . Moreover, we also find that trust levels never help to diffuse information quickly or vice versa to reach Dunbar's number 150, along with hierarchy layers of 5, 15, and 50 individuals in networks of different sizes.

[https://www.cell.com/heliyon/fulltext/S2405-8440\(23\)07058-5](https://www.cell.com/heliyon/fulltext/S2405-8440(23)07058-5)

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**iScience****PAPERS****SONIA TIEO et al – Social and sexual consequences of facial femininity in a non-human primate**

In humans, femininity shapes women's interactions with both genders but its influence on animals remains unknown. Using 10 years of data on a wild primate, we developed an artificial intelligence-based method to estimate facial femininity from naturalistic portraits. Our method explains up to 30% of the variance in perceived femininity in humans, competing with classical methods using standardized pictures taken under laboratory conditions. We then showed that femininity estimated on 95 female mandrills significantly correlated with various socio-sexual behaviors. Unexpectedly, less feminine female mandrills were approached and aggressed more frequently by both sexes and received more male copulations, suggesting a positive valuation of masculinity attributes rather than a perception bias. This study contributes to understand the role of femininity on animal's sociality and offers a framework for non-invasive research on visual communication in behavioral ecology.

[https://www.cell.com/iscience/fulltext/S2589-0042\(23\)01978-8](https://www.cell.com/iscience/fulltext/S2589-0042(23)01978-8)

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**GIZEM SENEL et al – Imperceptible Body Transformation in Virtual Reality: Sallency of Self Representation**

Change blindness (CB) is the perceptual phenomenon whereby people are blind to dramatic changes in their visual environment. In virtual reality (VR) a person's body can be substituted by a life-sized virtual one which moves synchronously with their real body movements as their self-representation. We consider whether CB occurs in VR, and whether there are differences in the case of changes to their own virtual body compared with the body of another. Forty people took part in a Qi Gong lesson in VR led by a virtual instructor. During the lesson both their own and the instructor's face dramatically changed in appearance. Overall, 73% and 85% did not notice the changes to their own and instructor's face respectively.

People make iconic inferences about their visual surroundings without sampling detail, and reduced CB in the case of their own body may be a marker for self-representation.

[https://www.cell.com/iscience/fulltext/S2589-0042\(23\)02015-1](https://www.cell.com/iscience/fulltext/S2589-0042(23)02015-1)

**MANUEL CHICA, WILLIAM RAND & FRANCISCO C. SANTOS – The evolution and social cost of herding mentality promote cooperation**

Herding behavior has a social cost for individuals not following the herd, influencing human decision-making. This work proposes including a social cost derived from herding mentality into the payoffs of pairwise game interactions. We introduce a co-evolutionary asymmetric model with four individual strategies (cooperation vs. defection and herding vs. non-herding) to understand the co-emergence of herding behavior and cooperation. Computational experiments show how including herding costs promotes cooperation by increasing the parameter space under which cooperation persists. Results demonstrate a synergistic relationship between the emergence of cooperation and herding mentality: the highest cooperation is achieved when the herding mentality also achieves its highest level. Finally, we study different herding social costs and its relationship to cooperation and herding evolution. This study points to new social mechanisms, related to conformity-driven imitation behavior, that help to understand how and why cooperation prevails in human groups.

[https://www.cell.com/iscience/fulltext/S2589-0042\(23\)02004-7](https://www.cell.com/iscience/fulltext/S2589-0042(23)02004-7)

## Linguistic Anthropology

### PAPERS

**DEJAN DURIC – Rethinking politeness with Henri Bergson**

Review of 'Rethinking politeness with Henri Bergson', Alessandro Duranti (ed.), Oxford University Press (2022).

No abstract is available for this article.

<https://anthrosource.onlinelibrary.wiley.com/doi/abs/10.1111/jola.12406>

## Mind & Language

### PAPERS

**LEDA BERIO & KRISTINA MUSHOLT – How language shapes our minds: On the relationship between generics, stereotypes and social norms**

In this article, we discuss the role of labels and generics referring to social kinds in mindshaping practices, arguing that they promote generalizations that foster essentialist thinking and carry a normative force. We propose that their cognitive function consists in both contributing to the formation and reinforcement of schemata and scripts for social interaction and in activating these schemata in specific social situations. Moreover, we suggest that failure to meet the expectations engendered by these schemata and scripts leads to the activation of "reactive attitudes" embedded in feedback loops of reactive exchange that are constitutive of our mindshaping practices.

<https://onlinelibrary.wiley.com/doi/full/10.1111/mila.12449>

**RUTH GARRETT MILLIKAN – Self-signs and intensional contexts**

Paradigm intensional contexts result from the unmarked use of referential expressions as "self-signs", signs that refer to themselves as tokens, types, or members of Sellarsian "dot-quoted" kinds. Self-signing (but unquoted) linguistic expressions are more difficult to recognize than non-linguistic self-signs such as the color of a felt pen's casing that represents the color of ink inside. I will discuss non-linguistic self-signing, then examine self-signing in quotation, in "said that ..." contexts and in "believes that ..." contexts. The phenomenon of intensionality may reduce to a kind of equivocation, a matter of notation rather than a necessary feature of language.

<https://onlinelibrary.wiley.com/doi/abs/10.1111/mila.12436>

**PAWEŁ GŁADZIEJEWSKI – The rational role of the perceptual sense of reality**

Perceptual experience usually comes with "phenomenal force", a strong sense that it reflects reality as it is. Some philosophers have argued that it is in virtue of possessing phenomenal force that perceptual experiences are able to non-inferentially justify beliefs. In this article, I introduce an alternative, inferentialist take on the epistemic role of phenomenal force. Drawing on Bayesian modeling in cognitive science, I argue that the sense of reality that accompanies conscious vision can be viewed as epistemically appraisable in light of its rational etiology.

<https://onlinelibrary.wiley.com/doi/abs/10.1111/mila.12445>

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

Research on children's theory of mind often restricts conceptually meaningful talk about knowledge to instances where know references a corresponding mental state. This article offers a reappraisal of that view. From a social-pragmatic perspective, even nonreferential talk is meaningful when appropriately embedded in social routines. A synthesis of corpus data suggests children's early talk about knowledge routinely occurs in question-answer contexts. It is argued that the influence of



interrogative contexts is evident in children's over-attributions of knowledge when someone is only guessing. This influence is taken as evidence for the role of linguistic practices in shaping the concept of knowledge.

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

#### **LUCA GASPARRI et al – Notions of arbitrariness**

Arbitrariness is a distinctive feature of human language, and a growing body of comparative work is investigating its presence in animal communication. But what is arbitrariness, exactly? We propose to distinguish four notions of semiotic arbitrariness: a notion of opaque association between sign forms and semiotic functions, one of sign-function mapping optionality, one of acquisition-dependent sign-function coupling, and one of lack of motivatedness. We characterize these notions, illustrate the benefits of keeping them apart, and describe two reactions to our proposal: abandoning arbitrariness-talk in favor of the newly introduced conceptual vocabulary, or feeding the distinctions back into the parent concept.

<https://onlinelibrary.wiley.com/doi/abs/10.1111/mila.12443>

#### **COMMENTARIES**

##### **NICOLÒ D'AGRUMA – From the epistemic perspectives in experimental semantics to the ambiguity of proper names: Is the inference warranted? A critical notice of Jincal Li's The referential mechanism of proper names**

In her engaging book, *The referential mechanism of proper names*, Li presents empirical studies involving American and Chinese laypeople. Li interprets her results as supporting an epistemic-perspective reading of the variability in referential intuitions on proper names. Building upon this thesis, Li defends the ambiguity view, claiming that names are ambiguous between a descriptivist and a causal-historical meaning. I argue that either Li's data do not enable a comparison of the two theories of reference, or support for the ambiguity view is limited to the Chinese sample at most and does not rely upon the inference that Li employs.

<https://onlinelibrary.wiley.com/doi/abs/10.1111/mila.12472>

##### **MICHAEL DEVITT – Red herrings in experimental semantics: Cultural variation and epistemic perspectives. A critical notice of Jincal Li's The referential mechanism of proper names**

Concerns with cultural variation and epistemic perspectives have played major roles in experimental semantics. They dominate Li's book (2023). Li's own experimental work provides two promising explanations of the cultural variation: Chinese, but not Americans, tend to agree with a character's false statement because they think it is not her fault that she is wrong or because they are socially conforming. So, the notice argues, the cultural variation is a red herring to the theory of reference. Li preferred explanation is that Chinese and Americans take different epistemic perspectives. The notice argues that this is misguided and another red herring.

<https://onlinelibrary.wiley.com/doi/abs/10.1111/mila.12468>

##### **JINCAI LI – Cross-cultural variation and perspectivalism: Alignment of two red herrings?**

In this brief reply I respond to criticisms of my book, *The referential mechanism of proper names*, from Michael Devitt and Nicolò D'Agsuma. I focus on the question of whether the perspectivism advocated in the book explains the empirical results there detailed.

<https://onlinelibrary.wiley.com/doi/abs/10.1111/mila.12470>

#### **Nature**

##### **NEWS**

##### **Ancient-human fossils sent to space: scientists slam 'publicity stunt'**

The decision to send hominin bones on a commercial spaceflight has raised eyebrows among human-evolution researchers.

<https://www.nature.com/articles/d41586-023-02882-1>

#### **Nature Communications**

##### **PAPERS**

##### **RUTH PAULI et al – Action initiation and punishment learning differ from childhood to adolescence while reward learning remains stable**

Theoretical and empirical accounts suggest that adolescence is associated with heightened reward learning and impulsivity. Experimental tasks and computational models that can dissociate reward learning from the tendency to initiate actions impulsively (action initiation bias) are thus critical to characterise the mechanisms that drive developmental differences. However, existing work has rarely quantified both learning ability and action initiation, or it has relied on small samples. Here, using computational modelling of a learning task collected from a large sample (N = 742, 9-18 years, 11 countries), we test differences in reward and punishment learning and action initiation from childhood to adolescence. Computational modelling reveals that whilst punishment learning rates increase with age, reward learning remains stable. In parallel, action initiation biases decrease with age. Results are similar when considering pubertal stage instead of chronological age. We

conclude that heightened reward responsivity in adolescence can reflect differences in action initiation rather than enhanced reward learning.

<https://www.nature.com/articles/s41467-023-41124-w>

### **RODRIGO QUIAN QUIROGA et al – Single neuron responses underlying face recognition in the human midfusiform face-selective cortex**

Faces are critical for social interactions and their recognition constitutes one of the most important and challenging functions of the human brain. While neurons responding selectively to faces have been recorded for decades in the monkey brain, face-selective neural activations have been reported with neuroimaging primarily in the human midfusiform gyrus. Yet, the cellular mechanisms producing selective responses to faces in this hominoid neuroanatomical structure remain unknown. Here we report single neuron recordings performed in 5 human subjects (1 male, 4 females) implanted with intracerebral microelectrodes in the face-selective midfusiform gyrus, while they viewed pictures of familiar and unknown faces and places. We observed similar responses to faces and places at the single cell level, but a significantly higher number of neurons responding to faces, thus offering a mechanistic account for the face-selective activations observed in this region. Although individual neurons did not respond preferentially to familiar faces, a population level analysis could consistently determine whether or not the faces (but not the places) were familiar, only about 50 ms after the initial recognition of the stimuli as faces. These results provide insights into the neural mechanisms of face processing in the human brain.

<https://www.nature.com/articles/s41467-023-41323-5>

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## Nature Communications Psychology

### NEWS

#### **Cognitive Psychology: First language and false memories**

When bilinguals perform a memory task in their second rather than their first language they are less likely to confuse lures for real memories or to agree with false information shared by another eye-witness, reports a study in *Journal of Experimental Psychology: General*.

<https://www.nature.com/articles/s44271-023-00015-y>

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## Nature Computational Science

### PAPERS

#### **QI SU, ALEX MCAVOY & JOSHUA B. PLOTKIN – Strategy evolution on dynamic networks**

Models of strategy evolution on static networks help us understand how population structure can promote the spread of traits like cooperation. One key mechanism is the formation of altruistic spatial clusters, where neighbors of a cooperative individual are likely to reciprocate, which protects prosocial traits from exploitation. However, most real-world interactions are ephemeral and subject to exogenous restructuring, so that social networks change over time. Strategic behavior on dynamic networks is difficult to study, and much less is known about the resulting evolutionary dynamics. Here we provide an analytical treatment of cooperation on dynamic networks, allowing for arbitrary spatial and temporal heterogeneity. We show that transitions among a large class of network structures can favor the spread of cooperation, even if each individual social network would inhibit cooperation when static. Furthermore, we show that spatial heterogeneity tends to inhibit cooperation, whereas temporal heterogeneity tends to promote it. Dynamic networks can have profound effects on the evolution of prosocial traits, even when individuals have no agency over network structures.

<https://www.nature.com/articles/s43588-023-00509-z>

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## Nature Human Behaviour

### PAPERS

#### **EAMONN FERGUSON et al – Warming up cool cooperators**

Explaining why someone repeats high-cost cooperation towards non-reciprocating strangers is difficult. Warm glow offers an explanation. We argue that warm glow, as a mechanism to sustain long-term cooperation, cools off over time but can be warmed up with a simple intervention message. We tested our predictions in the context of repeat voluntary blood donation (high-cost helping of a non-reciprocating stranger) across 6 studies: a field-based experiment (n = 5,821) comparing warm-glow and impure-altruism messages; an implementation study comparing a 3-yr pre-implementation period among all first-time donors in Australia (N = 270,353) with a 2-yr post-implementation period (N = 170, 317); and 4 studies (n = 716, 1,124, 932, 1,592) exploring mechanisms. We show that there are relatively warm and cool cooperators, not cooling cooperators. Cooperation among cool cooperators is enhanced by a warm-glow-plus-identity message. Furthermore, the behavioural facilitation of future cooperation, by booking an appointment, is associated with being a warm cooperator. Societal implications are discussed.

<https://www.nature.com/articles/s41562-023-01687-6>

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## Nature Reviews Neuroscience

### COMMENTARIES

#### **CHIA-WEN LO et al – When linguistic dogma rejects a neuroscientific hypothesis**

Kazanina and Tavano argue that delta-band oscillations cannot be involved in multi-word or multi-morpheme chunking during language comprehension because the timing of syntactic structure is too variable (Kazanina, N. & Tavano, A. What neural oscillations can and cannot do for syntactic structure building. *Nat. Rev. Neurosci.* 24, 113–128 (2023)). According to the authors, comprehension requires the formation of hierarchically organized non-adjacent dependencies between words or morphemes that arrive at variable points in time. Temporally regular chunking would break dependencies and disable the comprehension of compositional meaning.

<https://www.nature.com/articles/s41583-023-00738-1>

#### **NINA KAZANINA & ALESSANDRO TAVANO – Reply to ‘When linguistic dogma rejects a neuroscientific hypothesis’**

Lo, Henke, Matorell and Meyer criticize our recent Perspective (Kazanina, N. & Tavano, A. What neural oscillations can and cannot do for syntactic structure building. *Nat. Rev. Neurosci.* 24, 113–128 (2023)) by challenging the ‘dogma’ that syntax is hierarchical (Lo, C.-W., Henke, L., Martorell, J. & Meyer, L. When linguistic dogma rejects a neuroscientific hypothesis. *Nat. Rev. Neurosci.* <https://doi.org/10.1038/s41583-023-00738-1> (2023)). Their commentary cites construction grammar and dependency grammar as examples of grammars that do not use hierarchy. However, both grammars clearly feature hierarchical representations and relations that are not stateable on the basis of the linear order of elements in the sentence. (Incidentally, this dogma was asserted or assumed in earlier work by some of the commentators, for example, ref., among others.)

<https://www.nature.com/articles/s41583-023-00739-0>

#### **CAS W. COOPMANS et al – What oscillations can do for syntax depends on your theory of structure building**

In their timely Perspective article (Kazanina, N. & Tavano, A. What neural oscillations can and cannot do for syntactic structure building. *Nat. Rev. Neurosci.* 24, 113–128 (2023)), Kazanina and Tavano argue that neural oscillations cannot linearly chunk (or segment) speech into syntactic constituents because constituents are defined in terms of hierarchical relations. Instead, they propose that oscillations could support syntactic structure building (SSB) through ‘multi-scale integration’ of hierarchically organized constituents. We agree with their arguments against the utility of chunking for SSB. However, the dichotomy between ‘oscillations for chunking’ and ‘oscillations for integration’ does not accurately represent the literature: the integratory role of oscillations is well-accepted, and chunking is not a candidate model of SSB. Here, we show that recent work on oscillations and syntax does not assume chunking and we identify principal challenges for the integration proposal put forward by Kazanina and Tavano.

<https://www.nature.com/articles/s41583-023-00734-5>

#### **NINA KAZANINA & ALESSANDRO TAVANO – Reply to ‘What oscillations can do for syntax depends on your theory of structure building’**

We thank Coopmans et al. for their comments on our recent Perspective (Kazanina, N. & Tavano, A. What neural oscillations can and cannot do for syntactic structure building. *Nat. Rev. Neurosci.* 24, 113–128 (2023)), which are valuable (Coopmans, C. W., Mai, A., Slaats, S., Weissbart, H. & Martin, A. E. What oscillations can do for syntax depends on your theory of structure building. *Nat. Rev. Neurosci.* <https://doi.org/10.1038/s41583-023-00734-5> (2023)).

<https://www.nature.com/articles/s41583-023-00735-4>

#### **ORIGINAL PAPER: NINA KAZANINA & ALESSANDRO TAVANO – What neural oscillations can and cannot do for syntactic structure building**

See EAORC Bulletin 1,016, 4 December 2022

<https://www.nature.com/articles/s41583-022-00659-5>

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## Nature Scientific Reports

### PAPERS

#### **ALEXANDER KOPLINIG, SASCHA WOLFER & PETER MEYER – A large quantitative analysis of written language challenges the idea that all languages are equally complex**

One of the fundamental questions about human language is whether all languages are equally complex. Here, we approach this question from an information-theoretic perspective. We present a large scale quantitative cross-linguistic analysis of written language by training a language model on more than 6500 different documents as represented in 41 multilingual text collections consisting of ~ 3.5 billion words or ~ 9.0 billion characters and covering 2069 different languages that are spoken as a native language by more than 90% of the world population. We statistically infer the entropy of each language model as an index of what we call average prediction complexity. We compare complexity rankings across corpora and show that a language that tends to be more complex than another language in one corpus also tends to be more complex in another

corpus. In addition, we show that speaker population size predicts entropy. We argue that both results constitute evidence against the equi-complexity hypothesis from an information-theoretic perspective.

<https://www.nature.com/articles/s41598-023-42327-3>

### **LENA SOPHIE PFEIFER et al – A deep phenotyping approach to assess the association of handedness, early life factors and mental health**

The development of handedness and other form of functional asymmetries is not yet understood in its critical determinants. Early life factors (e.g., birth weight, birth order) have been discussed to contribute to individual manifestations of functional asymmetries. However, large-scale data such as the UK Biobank suggest that the variance in handedness that is explained by early life factors is minimal. Additionally, atypical handedness has been linked to clinical outcomes such as neurodevelopmental and psychiatric disorders. Against the background of this triad, the current study investigated associations between different forms of functional asymmetries and (a) early life factors as well as (b) clinical outcomes. Functional asymmetries were determined by means of a deep phenotyping approach which notably extends previous work. In our final sample of N = 598 healthy participants, the different variables were tested for associations by means of linear regression models and group comparisons (i.e., ANOVAs and Chi-squared tests). Confirming previous findings from larger cohorts with shallow phenotyping, we found that birth factors do not explain a substantial amount of variance in functional asymmetries. Likewise, functional asymmetries did not seem to have comprehensive predictive power concerning clinical outcomes in our healthy participants. Future studies may further investigate postulated relations in healthy and clinical samples while acknowledging deep phenotyping of laterality.

<https://www.nature.com/articles/s41598-023-42563-7>

### **HARIN HAPUARACHCHI et al – Empathic embarrassment towards non-human agents in virtual environments**

Humans feel empathic embarrassment by witnessing others go through embarrassing situations. We examined whether we feel such empathic embarrassment even with robot avatars. Participants observed a human avatar and a robot avatar face a series of embarrassing and non-embarrassing scenarios. We collected data for their empathic embarrassment and the cognitive empathy on a 7-point Likert scale. Both empathic embarrassment and cognitive empathy were significantly higher in the embarrassed condition compared to the non-embarrassed condition with both avatars, and the cognitive empathy was significantly higher with the human avatar. There was a tendency of participants showing a higher level of skin conductance while watching the human avatar go through embarrassing situations compared to the robot avatar. A following experiment showed that the average plausibility of the embarrassed condition was significantly higher with the human avatar compared to the robot avatar. However, plausibility scores for emotion were not significantly different among the conditions. These results suggest that humans can feel empathic embarrassment as well as cognitive empathy for robot avatars while cognitive empathy for robot avatars is comparatively lower, and that part of the empathic difference between human and robot avatars might be due to the difference of their plausibility.

<https://www.nature.com/articles/s41598-023-41042-3>

## **New Scientist**

### **NEWS**

#### **Cave art pigments show how ancient technology changed over 4500 years**

The source of ochre minerals used by Stone Age humans in an Ethiopian cave changed over a 4500-year period, although it is unclear why.

<https://www.newscientist.com/article/2391272-cave-art-pigments-show-how-ancient-technology-changed-over-4500-years/>

#### **Mysterious ancient stones were deliberately made into spheres**

Stone balls found at a site used by early humans about 1.4 million years ago didn't become round after being used as hammers, but were intentionally knapped into spheres.

<https://www.newscientist.com/article/2390655-mysterious-ancient-stones-were-deliberately-made-into-spheres/>

## **PLoS Biology**

### **PAPERS**

#### **GUILLERMO GALLARDO et al with ANGELA D. FRIEDERICI – Morphological evolution of language-relevant brain areas**

*[This is an uncorrected proof]*

Human language is supported by a cortical network involving Broca's area, which comprises Brodmann Areas 44 and 45 (BA44 and BA45). While cytoarchitectonic homolog areas have been identified in nonhuman primates, it remains unknown how these regions evolved to support human language. Here, we use histological data and advanced cortical registration methods to precisely compare the morphology of BA44 and BA45 in humans and chimpanzees. We found a general expansion of Broca's areas in humans, with the left BA44 enlarging the most, growing anteriorly into a region known to process syntax. Together with recent functional and receptorarchitectural studies, our findings support the conclusion that BA44 evolved from an action-related region to a bipartite system, with a posterior portion supporting action and an anterior

portion supporting syntactic processes. Our findings add novel insights to the longstanding debate on the relationship between language and action, and the evolution of Broca's area.

<https://journals.plos.org/plosbiology/article?id=10.1371/journal.pbio.3002266>

## PLoS One

### PAPERS

#### **ROMMEL MAHMOUD ALALI & ALI AHMAD AL-BARAKAT – Instructional illustrations in children's learning between normative and realism: An evaluation study**

Many studies indicate the importance of including the instructional illustrations (pictures, drawings, concrete objects ...etc.) in childhood education learning materials and employing them in a way that suits the psychological and cognitive levels of young children. In this context, the current study aimed to develop a list of standards to be considered and adopted in designing instructional illustrations, and to reveal the perceptions of childhood teachers about the extent to which these standards are considered in instructional illustrations used in children's learning materials. The participants were childhood education teachers in the Jordanian region of Irbid, who were randomly selected. Two hundred thirty-four teachers completed the questionnaire online. The scale consisted of a total of 34 items distributed over four dimensions. The results showed that the scores of teachers' estimation about employing design standards in the instructional illustrations used in childhood education came at low levels, ranging from average to low, and did not reach high ratings. The study also revealed that there is an impact attributed to teaching experience on teachers' perceptions about the extent to which these standards are employed in instructional illustrations, while there is no impact of gender, academic qualification, or the classes taught by the teachers.

<https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0291532>

#### **AZALEA REYES-AGUILAR et al – Contribution and functional connectivity between cerebrum and cerebellum on sub-lexical and lexical-semantic processing of verbs**

Language comprehension involves both sub-lexical (e.g., phonological) and lexical-semantic processing. We conducted a task using functional magnetic resonance imaging (fMRI) to compare the processing of verbs in these two domains. Additionally, we examined the representation of concrete-motor and abstract-non-motor concepts by including two semantic categories of verbs: motor and mental. The findings indicate that sub-lexical processing during the reading of pseudo-verbs primarily involves the left dorsal stream of the perisylvian network, while lexical-semantic representation during the reading of verbs predominantly engages the ventral stream. According to the embodied or grounded cognition approach, modality-specific mechanisms (such as sensory-motor systems) and the well-established multimodal left perisylvian network contribute to the semantic representation of both concrete and abstract verbs. Our study identified the visual system as a preferential modality-specific system for abstract-mental verbs, which exhibited functional connectivity with the right crus I/lobule VI of the cerebellum. Taken together, these results confirm the dissociation between sub-lexical and lexical-semantic processing and provide neurobiological evidence of functional coupling between specific visual modality regions and the right cerebellum, forming a network that supports the semantic representation of abstract concepts. Further, the results shed light on the underlying mechanisms of semantic processing and contribute to our understanding of how the brain processes abstract concepts.

<https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0291558>

#### **JENNIFER GOLBECK – Benford's Law applies to word frequency rank in English, German, French, Spanish, and Italian**

Benford's Law states that, in many real-world data sets, the frequency of numbers' first digits is predicted by the formula  $\log(1 + (1/d))$ . Numbers beginning with a 1 occur roughly 30% of the time, and are six times more common than numbers beginning with a 9. We show that Benford's Law applies to the the frequency rank of words in English, German, French, Spanish, and Italian. We calculated the frequency rank of words in the Google Ngram Viewer corpora. Then, using the first significant digit of the frequency rank, we found the FSD distribution adhered to the expected Benford's Law distribution. Over a series of additional corpora from sources ranging from news to books to social media and across the languages studied, we consistently found adherence to Benford's Law. Furthermore, at the user-level on social media, we found Benford's Law holds for the vast majority of users' collected posts and significant deviations from Benford's Law tends to be a mark of spam bots.

<https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0291337>

#### **TILMAN LENSSEN-ERZ et al – Animal tracks and human footprints in prehistoric hunter-gatherer rock art of the Doro! nawas mountains (Namibia), analysed by present-day indigenous tracking experts**

Namibia is rich in hunter-gatherer rock art from the Later Stone Age (LSA); this is a tradition of which well-executed engravings of animal tracks in large numbers are characteristic. Research into rock art usually groups these motifs together with geometric signs; at best, therefore, it may provide summary lists of them. To date, the field has completely disregarded the fact that tracks and trackways are a rich medium of information for hunter-gatherers, alongside their deeper, culture-specific connotations. A recent research project, from which this article has emerged, has attempted to fill this research gap; it entailed indigenous tracking experts from the Kalahari analysing engraved animal tracks and human footprints in a rock art

region in central Western Namibia, the Doro! nawas Mountains, which is the site of recently discovered rock art. The experts were able to define the species, sex, age group and exact leg of the specific animal or human depicted in more than 90% of the engravings they analysed (N = 513). Their work further demonstrates that the variety of fauna is much richer in engraved tracks than in depictions of animals in the same engraving tradition. The analyses reveal patterns that evidently arise from culturally determined preferences. The study represents further confirmation that indigenous knowledge, with its profound insights into a range of particular fields, has the capacity to considerably advance archaeological research.

<https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0289560>

#### **MONICA F. CHAVES et al – Grammatical impairment in schizophrenia: An exploratory study of the pronominal and sentential domains**

Schizophrenia (SZ) is a severe mental disorder associated with a variety of linguistic deficits, and recently it has been suggested that these deficits are caused by an underlying impairment in the ability to build complex syntactic structures and complex semantic relations. Aiming at contributing to determining the specific linguistic profile of SZ, we investigated the usage of pronominal subjects and sentence types in two corpora of oral dream and waking reports produced by speakers with SZ and participants without SZ (NSZ), both native speakers of Brazilian Portuguese. Narratives of 40 adult participants (20 SZ, and 20 NSZ—sample 1), and narratives of 31 teenage participants (11 SZ undergoing first psychotic episode, and 20 NSZ—sample 2) were annotated and statistically analyzed. Overall, narratives of speakers with SZ presented significantly higher rates of matrix sentences, null pronouns—particularly null 3Person referential pronouns—and lower rates of non-anomalous truncated sentences. The high rate of matrix sentences correlated significantly with the total PANSS scores, suggesting an association between the overuse of simple sentences and SZ symptoms in general. In contrast, the high rate of null pronouns correlated significantly with positive PANSS scores, suggesting an association between the overuse of null pronominal forms and the positive symptoms of SZ. Finally, a cross-group analysis between samples 1 and 2 indicated a higher degree of grammatical impairment in speakers with multiple psychotic episodes. Altogether, the results strengthen the notion that deficits at the pronominal and sentential levels constitute a cross-cultural linguistic marker of SZ.

<https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0291446>

#### **YONGQIONG YUAN et al – Aspiration-driven co-evolution of cooperation with individual behavioral diversity**

In evolutionary game, aspiration-driven updates and imitation updates are the two dominant game models, and individual behavior patterns are mainly categorized into two types: node player and link player. In more recent studies, the mixture strategy of different types of players has been proven to improve cooperation substantially. Motivated by such a co-evolution mechanism, we combine aspiration dynamics with individual behavioral diversity, where self-assessed aspirations are used to update imitation strategies. In this study, the node players and the link players are capable to transform into each other autonomously, which introduces new features to cooperation in a diverse population as well. In addition, by driving all the players to form specific behavior patterns, the proposed mechanism achieves a survival environment optimization of the cooperators. As expected, the interaction between node players and link players allows the cooperator to avoid the invasion of the defector. Based on the experimental evaluation, the proposed work has demonstrated that the co-evolution mechanism has facilitated the emergence of cooperation by featuring mutual transformation between different players. We hope to inspire a new way of thinking for a promising solution to social dilemmas.

<https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0291134>

## Proceedings of the Royal Society B

### PAPERS

#### **R. HEINSOHN et al – Individual preferences for sound tool design in a parrot**

The rarity of tool manufacture in wild parrots is surprising because they share key life-history traits with advanced tool-using species, including large brains, complex sociality and prolonged parental care. When it does occur, tool manufacture in parrots tends to be innovative, spontaneous and individually variable, but most cases have been in captivity. In the wild, only palm cockatoos (*Probosciger aterrimus*) have been observed using tools regularly. However, they are unusual because they use tools to enhance their displays rather than for foraging or self-maintenance. Males in northern Australia make two types of tool from sticks and seed pods, which they tap rhythmically against a tree during display. We analysed 256 sound tools retrieved from 70 display trees. Drumsticks (89% of tools) were used more often than seed pod tools; most males manufactured only drumsticks, but some made both types. Individual males differed significantly in the design of their drumsticks including the length, width and mass but we found no evidence that neighbours copied each other. We discuss the highly individualized preferences for sound tool design in context of the behavioural predispositions behind the rarity of tool manufacture in wild parrots.

<https://royalsocietypublishing.org/doi/10.1098/rspb.2023.1271>

## Science

### PAPERS

#### **JEAN-NICOLAS AUDET, MÉLANIE COUTURE & ERICH D. JARVIS – Songbird species that display more-complex vocal learning are better problem-solvers and have larger brains**

Complex vocal learning, a critical component of human spoken language, has been assumed to be associated with more-advanced cognitive abilities. Tests of this hypothesis between individuals within a species have been inconclusive and have not been done across species. In this work, we measured an array of cognitive skills—namely, problem-solving, associative and reversal learning, and self-control—across 214 individuals of 23 bird species, including 19 wild-caught songbird species, two domesticated songbird species, and two wild-caught vocal nonlearning species. We found that the greater the vocal learning abilities of a species, the better their problem-solving skills and the relatively larger their brains. These conclusions held when controlling for noncognitive variables and phylogeny. Our results support a hypothesis of shared genetic and cognitive mechanisms between vocal learning, problem-solving, and bigger brains in songbirds.

<https://www.science.org/doi/full/10.1126/science.adh3428>

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## Trends in Cognitive Sciences

### ARTICLES

#### **MASAKI ISODA – Decoding social rewards via inter-areal coordination frequency in the brain**

Vicarious reward plays a pivotal role in shaping altruism and prosociality. However, neural circuit mechanisms underlying the distinction between vicarious reward and experienced reward are poorly understood. Putnam et al. recently demonstrated that the two types of reward are represented by distinct coordination frequencies within the same cingulate–amygdala pathway.

[https://www.cell.com/trends/cognitive-sciences/fulltext/S1364-6613\(23\)00178-X](https://www.cell.com/trends/cognitive-sciences/fulltext/S1364-6613(23)00178-X)

### PAPERS

#### **RACHEL RYSKIN & MANTE S. NIEUWLAND – Prediction during language comprehension: what is next?**

Prediction is often regarded as an integral aspect of incremental language comprehension, but little is known about the cognitive architectures and mechanisms that support it. We review studies showing that listeners and readers use all manner of contextual information to generate multifaceted predictions about upcoming input. The nature of these predictions may vary between individuals owing to differences in language experience, among other factors. We then turn to unresolved questions which may guide the search for the underlying mechanisms. (i) Is prediction essential to language processing or an optional strategy? (ii) Are predictions generated from within the language system or by domain-general processes? (iii) What is the relationship between prediction and memory? (iv) Does prediction in comprehension require simulation via the production system? We discuss promising directions for making progress in answering these questions and for developing a mechanistic understanding of prediction in language.

[https://www.cell.com/trends/cognitive-sciences/fulltext/S1364-6613\(23\)00199-7](https://www.cell.com/trends/cognitive-sciences/fulltext/S1364-6613(23)00199-7)

#### **ESSI VIDING et al – An ‘embedded brain’ approach to understanding antisocial behaviour**

Antisocial behaviour (ASB) incurs substantial costs to the individual and society. Cognitive neuroscience has the potential to shed light on developmental risk for ASB, but it cannot achieve this potential in an ‘essentialist’ framework that focuses on the brain and cognition isolated from the environment. Here, we present the case for studying the social transactional and iterative unfolding of brain and cognitive development in a relational context. This approach, which we call the study of the ‘embedded brain’, is needed to fully understand how risk for ASB arises during development. Concentrated efforts are required to develop and unify methods to achieve this approach and reap the benefits for improved prevention and intervention of ASB.

[https://www.cell.com/trends/cognitive-sciences/fulltext/S1364-6613\(23\)00209-7](https://www.cell.com/trends/cognitive-sciences/fulltext/S1364-6613(23)00209-7)

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## Trends in Genetics

### PAPERS

#### **STACY LI, JUAN MANUEL VAZQUEZ & PETER H. SUDMANT – The evolution of aging and lifespan**

Aging is a nearly inescapable trait among organisms yet lifespan varies tremendously across different species and spans several orders of magnitude in vertebrates alone. This vast phenotypic diversity is driven by distinct evolutionary trajectories and tradeoffs that are reflected in patterns of diversification and constraint in organismal genomes. Age-specific impacts of selection also shape allele frequencies in populations, thus impacting disease susceptibility and environment-specific mortality risk. Further, the mutational processes that spawn this genetic diversity in both germline and somatic cells are strongly influenced by age and life history. We discuss recent advances in our understanding of the evolution of aging and lifespan at organismal, population, and cellular scales, and highlight outstanding questions that remain unanswered.

[https://www.cell.com/trends/genetics/fulltext/S0168-9525\(23\)00186-5](https://www.cell.com/trends/genetics/fulltext/S0168-9525(23)00186-5)

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