

## Literatur

### Afrika

WOTZKA 1991

Hans-Peter Wotzka, *Studien zur Archäologie des zentralafrikanischen Regenwaldes, Die Keramik des inneren Zaire-Beckens und ihre Stellung im Kontext der Bantu-Expansion*. Africa Praehistorica 6 (Köln 1995).

### Aktuell

BRINCH 2012

Christian N. Brinch & Taryn Ann Galloway, *Schooling in adolescence raises IQ scores*. *PNAS* **109** (2012), 425–430.

Although some scholars maintain that education has little effect on intelligence quotient (IQ) scores, others claim that IQ scores are indeed malleable, primarily through intervention in early childhood. The causal effect of education on IQ at later ages is often difficult to uncover because analyses based on observational data are plagued by problems of reverse causation and self-selection into further education. We exploit a reform that increased compulsory schooling from 7 to 9 y in Norway in the 1960s to estimate the effect of education on IQ. We find that this schooling reform, which primarily affected education in the middle teenage years, had a substantial effect on IQ scores measured at the age of 19 y.

BUTLER 2012

Thomas Charles Butler, Marc Benayoun, Edward Wallace, Wim van Dronghen, Nigel Goldenfeld & Jack Cowan, *Evolutionary constraints on visual cortex architecture from the dynamics of hallucinations*. *PNAS* **109** (2012), 606–609.

In the cat or primate primary visual cortex (V1), normal vision corresponds to a state where neural excitation patterns are driven by external visual stimuli. A spectacular failure mode of V1 occurs when such patterns are overwhelmed by spontaneously generated spatially self-organized patterns of neural excitation. These are experienced as geometric visual hallucinations. The problem of identifying the mechanisms by which V1 avoids this failure is made acute by recent advances in the statistical mechanics of pattern formation, which suggest that the hallucinatory state should be very robust. Here, we report how incorporating physiologically realistic long-range connections between inhibitory neurons changes the behavior of a model of V1. We find that the sparsity of long-range inhibition in V1 plays a previously unrecognized but key functional role in preserving the normal vision state. Surprisingly, it also contributes to the observed regularity of geometric visual hallucinations. Our results provide an explanation for the observed sparsity of long-range inhibition in V1—this generic architectural feature is an evolutionary adaptation that tunes V1 to the normal vision state. In addition, it has been shown that exactly the same long-range connections play a key role in the development of orientation preference maps. Thus V1's most striking long-range features—patchy excitatory connections and sparse inhibitory connections—are strongly constrained by two requirements: the need for the visual state to be robust and the developmental requirements of the orientational preference map.

## COUZIN 2011

Iain D. Couzin et al., *Uninformed Individuals Promote Democratic Consensus in Animal Groups*. [science 334 \(2011\), 1578–1580](#).

[s334-1578-Supplement.pdf](#)

Iain D. Couzin, Christos C. Ioannou, Güven Demirel, Thilo Gross, Colin J. Torney, Andrew Hartnett, Larissa Conradt, Simon A. Levin & Naomi E. Leonard

Conflicting interests among group members are common when making collective decisions, yet failure to achieve consensus can be costly. Under these circumstances individuals may be susceptible to manipulation by a strongly opinionated, or extremist, minority.

It has previously been argued, for humans and animals, that social groups containing individuals who are uninformed, or exhibit weak preferences, are particularly vulnerable to such manipulative agents. Here, we use theory and experiment to demonstrate that, for a wide range of conditions, a strongly opinionated minority can dictate group choice, but the presence of uninformed individuals spontaneously inhibits this process, returning control to the numerical majority. Our results emphasize the role of uninformed individuals in achieving democratic consensus amid internal group conflict and informational constraints.

## FRYER 2012

Roland G. Fryer Jr., *Financial incentives and student achievement: evidence from randomized trials*. [Quarterly Journal of Economics 126 \(2012\), 1755–1798](#).

[QJEcon126-1755-Supplement.pdf](#)

This article describes a series of school-based field experiments in over 200 urban schools across three cities designed to better understand the impact of financial incentives on student achievement. In Dallas, students were paid to read books. In New York, students were rewarded for performance on interim assessments. In Chicago, students were paid for classroom grades. I estimate that the impact of financial incentives on student achievement is statistically 0, in each city. Due to a lack of power, however, I cannot rule out the possibility of effect sizes that would have positive returns on investment. The only statistically significant effect is on English-speaking students in Dallas. The article concludes with a speculative discussion of what might account for intercity differences in estimated treatment effects.

## JENKINS 2012

Charles R. Jenkins et al., *Safe storage and effective monitoring of CO<sub>2</sub> in depleted gas fields*. [PNAS 109 \(2012\), 353–354](#).

[pnas109-00353-Fulltext.pdf](#)

Charles R. Jenkins, Peter J. Cook, Jonathan Ennis-King, James Undershultz, Chris Boreham, Tess Dance, Patrice de Caritat, David M. Etheridge, Barry M. Freifeld, Allison Hortle, Dirk Kirste, Lincoln Paterson, Roman Pevzner, Ulrike Schacht, Sandeep Sharma, Linda Stalker and Milovan Urosevic

Carbon capture and storage (CCS) is vital to reduce CO<sub>2</sub> emissions to the atmosphere, potentially providing 20% of the needed reductions in global emissions. Research and demonstration projects are important to increase scientific understanding of CCS, and making processes and results widely available helps to reduce public concerns, which may otherwise block this technology. The Otway Project has provided verification of the underlying science of CO<sub>2</sub> storage in a depleted gas field, and shows that the support of all stakeholders can be earned and retained. Quantitative verification of long-term storage has been demonstrated. A direct measurement of storage efficiency has been

made, confirming that CO<sub>2</sub> storage in depleted gas fields can be safe and effective, and that these structures could store globally significant amounts of CO<sub>2</sub>.  
carbon storage | geosequestration | carbon dioxide | climate change | energy policy

#### LIAO 2012

Y. Liao, R. Pourzal, M. A. Wimmer, J. J. Jacobs, A. Fischer & L. D. Marks, *Graphitic Tribological Layers in Metal-on-Metal Hip Replacements*. [science 334 \(2012\), 1687–1690](#).

s334-1687-Supplement.pdf

Arthritis is a leading cause of disability, and when nonoperative methods have failed, a prosthetic implant is a cost-effective and clinically successful treatment. Metal-on-metal replacements are an attractive implant technology, a lower-wear alternative to metal-on-polyethylene devices. Relatively little is known about how sliding occurs in these implants, except that proteins play a critical role and that there is a tribological layer on the metal surface. We report evidence for graphitic material in the tribological layer in metal-on-metal hip replacements retrieved from patients. As graphite is a solid lubricant, its presence helps to explain why these components exhibit low wear and suggests methods of improving their performance; simultaneously, this raises the issue of the physiological effects of graphitic wear debris.

#### OGDEN 2012

Darcy E. Ogden & Norman H. Sleep, *Explosive eruption of coal and basalt and the end-Permian mass extinction*. [PNAS 109 \(2012\), 59–62](#).

The end-Permian extinction decimated up to 95 % of carbonate shell-bearing marine species and 80 % of land animals. Isotopic excursions, dissolution of shallow marine carbonates, and the demise of carbonate shell-bearing organisms suggest global warming and ocean acidification. The temporal association of the extinction with the Siberia flood basalts at approximately 250 Ma is well known, and recent evidence suggests these flood basalts may have mobilized carbon in thick deposits of organic-rich sediments. Large isotopic excursions recorded in this period are potentially explained by rapid venting of coal-derived methane, which has primarily been attributed to metamorphism of coal by basaltic intrusion. However, recently discovered contemporaneous deposits of fly ash in northern Canada suggest large-scale combustion of coal as an additional mechanism for rapid release of carbon. This massive coal combustion may have resulted from explosive interaction with basalt sills of the Siberian Traps. Here we present physical analysis of explosive eruption of coal and basalt, demonstrating that it is a viable mechanism for global extinction. We describe and constrain the physics of this process including necessary magnitudes of basaltic intrusion, mixing and mobilization of coal and basalt, ascent to the surface, explosive combustion, and the atmospheric rise necessary for global distribution.

#### RESHEF 2011

David N. Reshef et al., *Detecting Novel Associations in Large Data Sets*. [science 334 \(2011\), 1518–1524](#).

s334-1518-Supplement.pdf

David N. Reshef, Yakir A. Reshef, Hilary K. Finucane, Sharon R. Grossman, Gilean McVean, Peter J. Turnbaugh, Eric S. Lander, Michael Mitzenmacher & Pardis C. Sabeti  
Identifying interesting relationships between pairs of variables in large data sets is increasingly important. Here, we present a measure of dependence for two-variable relationships: the maximal information coefficient (MIC). MIC captures a wide range of associations both functional and not, and for functional relationships provides a score that roughly equals the coefficient of determination (R<sup>2</sup>) of the data relative to the regression function. MIC belongs to a larger class of maximal information-based nonparametric

exploration (MINE) statistics for identifying and classifying relationships. We apply MIC and MINE to data sets in global health, gene expression, major-league baseball, and the human gut microbiota and identify known and novel relationships.

#### SPEED 2011

Terry Speed, *A Correlation for the 21st Century*. [science 334 \(2011\), 1502–1503](#).

A novel statistical approach has been developed that can uncover nonlinear associations in large data sets.

The common correlation coefficient  $r$  was invented in 1888 by Charles Darwin's half-cousin Francis Galton. Galton's method for estimating  $r$  was very different from the one we use now, but was amenable to hand calculation for samples of up to 1000 individuals. Francis Ysidro Edgeworth and later Karl Pearson gave us the modern formula for estimating  $r$ , and it very definitely required a manual or electromechanical calculator to convert 1000 pairs of values into a correlation coefficient. In marked contrast, the MIC requires a modern digital computer for its calculation; there is no simple formula, and no one could compute it on any calculator. This is another instance of computer-intensive methods in statistics.

#### SPIEGEL 2012

David S. Spiegel & Edwin L. Turner, *Bayesian analysis of the astrobiological implications of life's early emergence on Earth*. [PNAS 109 \(2012\), 395–400](#).

Life arose on Earth sometime in the first few hundred million years after the young planet had cooled to the point that it could support water-based organisms on its surface. The early emergence of life on Earth has been taken as evidence that the probability of abiogenesis is high, if starting from young Earth-like conditions. We revisit this argument quantitatively in a Bayesian statistical framework. By constructing a simple model of the probability of abiogenesis, we calculate a Bayesian estimate of its posterior probability, given the data that life emerged fairly early in Earth's history and that, billions of years later, curious creatures noted this fact and considered its implications. We find that, given only this very limited empirical information, the choice of Bayesian prior for the abiogenesis probability parameter has a dominant influence on the computed posterior probability. Although terrestrial life's early emergence provides evidence that life might be abundant in the universe if early-Earth-like conditions are common, the evidence is inconclusive and indeed is consistent with an arbitrarily low intrinsic probability of abiogenesis for plausible uninformative priors. Finding a single case of life arising independently of our lineage (on Earth, elsewhere in the solar system, or on an extrasolar planet) would provide much stronger evidence that abiogenesis is not extremely rare in the universe.

#### WEST 2011

Jevin D. West & Carl T. Bergstrom, *Can Ignorance Promote Democracy?* [science 334 \(2011\), 1503–1504](#).

When a group needs to reach a consensus decision, uninformed members can help to reduce the influence of a manipulative minority.

If a group has intransitive preferences—its members collectively prefer A to B and B to C in pairwise comparisons, yet they also prefer C to A—there is no straightforward way to select a single best course of action. This poses a serious social choice problem, because even when no single individual has intransitive preferences, the aggregate preferences of the group can be intransitive.

One might expect groups with uninformed members to be particularly susceptible to tactical behavior by minority subpopulations. If that tactical behavior involved some sort of active proselytizing to accelerate conversion to the minority opinion, one would

be right. But Couzin et al. show that when the tactical behavior involves intransigence, uninformed individuals have the opposite effect. Their presence allows the majority to wrest control back from a manipulative minority. In each of their models, this occurs because the uninformed individuals tend to adopt the opinions of those around them, amplifying the majority opinion and preventing erosion by an intransigent minority. In this way, adding uninformed individuals to a group can facilitate fair representation during the process of information integration. Jefferson's passionate arguments on the importance of education for democratic society notwithstanding (11), Couzin et al. have identified circumstances in which ignorance can promote democracy.

## Anthropologie

DOMÍNGUEZ-RODRIGO 2012

Manuel Domínguez-Rodrigo, Travis Rayne Pickering & Henry T. Bunn, *Experimental study of cut marks made with rocks unmodified by human flaking and its bearing on claims of  $\approx 3.4$ -million-year-old butchery evidence from Dikika, Ethiopia*. [Journal of Archaeological Science](#) **39** (2012), 205–214.

In order to assess further the recent claims of  $\approx 3.4$  Ma butchery marks on two fossil bones from the site of Dikika (Ethiopia), we broadened the actualistic-interpretive zooarchaeological framework by conducting butchery experiments that utilized naïve butchers and rocks unmodified by human flaking to deflesh chicken and sheep long limb bones. It is claimed that the purported Dikika cut marks present their unexpectedly atypical morphologies because they were produced by early hominins utilizing just such rocks. The composition of the cut mark sample produced in our experiments is quite dissimilar to the sample of linear bone surface modifications preserved on the Dikika fossils. This finding substantiates and expands our earlier conclusion that—considering the morphologies and patterns of the Dikika bone surface modifications and the inferred coarse-grained depositional context of the fossils on which they occur—the Dikika bone damage was caused incidentally by the movement of the fossils on and/or within their depositional substrate(s), and not by early hominin butchery. Thus, contrary to initial claims, the Dikika evidence does not warrant a major shift in our understanding of early hominin behavioral evolution with regard to carcass foraging and meat-eating.

Keywords: Early hominin carcass foraging | Taphonomy | Cut marks | Random striae | Trampling

## Grundlagen

HENRICH 2010

Joseph Henrich, *The Evolution of Innovation-Enhancing Institutions*. In: MICHAEL J. O'BRIEN (Hrsg.), *Innovation in cultural systems, contributions from evolutionary anthropology*. The Vienna series in theoretical biology (Cambridge 2010), 99–120.

This chapter applies an integrated approach to decision-making and cultural evolution to explore some of the characteristics that influence population-level differences in innovativeness and to understand how such differences emerge. In laying the foundation for subsequent arguments I begin by summarizing research showing how evolutionary theory can direct and inform our understanding of decision-making, social learning and cultural evolution. Then, extending insights from existing cultural evolutionary models, I examine how a population's size and degree of 'cultural interconnectedness' can influence rates of both innovation and invention. A simple model illustrates the relative importance of

cultural interconnectedness compared to individual invention. Combining ethno-historical and archaeological cases, I further explore the relative importance of “mother necessity” and “heroic genius” vs. recombination, lucky mistakes, and the accretion of small changes in driving invention. This discussion suggests that, at best, “necessity” is neither necessary nor sufficient to explain invention and that invention processes are dominated by incremental additions, recombinations, and lucky errors, not revolutionary insights. This means that inventiveness is—at least in part—a product of large populations (that generate more lucky errors) and greater interconnectedness that together with population size favors more recombinant inventions, as well as a greater likelihood of these diffusing widely. Lastly, I examine how increasing the interconnectedness in a population gives rise to an n-person cooperative dilemma. While some partial solutions to this dilemma have emerged across our species, only some societies have evolved the informal (and later formal) institutions—i.e., systems of reputation, signaling, and punishment—that favor the wide sharing of information, ideas and insights. Theoretical work has revealed three avenues to solving such n-person cooperative dilemmas, but crucially, all three generate multiple stable equilibria, meaning that while they can stabilize cooperative information sharing, they can also stabilize “information hiding and free-riding” as well as other non-group-beneficial states. In such circumstances, processes of cultural group selection, which operate through various forms of competition among groups, can favor the evolution of those institutional forms that best promote the open dissemination so crucial to innovation. This line of thinking proposes that cultural evolution has favored the emergence of institutions that increase cultural interconnectedness, thereby stimulating both greater inventiveness and more innovation at the population level.

## Isotope

ELSER 2011

James J. Elser, *A World Awash with Nitrogen*. [science](#) **334** (2011), 1504–1505.

Human disruption of the nitrogen cycle has left signs across the Northern Hemisphere since about 1895 C.E.

Anthropogenic sources of nitrogen are often isotopically lighter than the nitrogen circulating through natural processes in ecosystems. Using  $^{15}/^{14}\text{N}$  stable isotope analysis, Holtgrieve et al. track the appearance of this isotopically light nitrogen in closely dated sediments of lakes throughout the Northern Hemisphere, including extremely remote lakes in Alaska (United States), the Svalbard archipelago (Norway), and the Rocky Mountains (Canada and United States).

Most studies of nitrogen deposition have focused in temperate regions, and little is known about how nitrogen deposition is affecting tropical regions. In another stable isotope analysis study, Hietz et al. (4) gathered data in tropical rainforests of Panama and Thailand. The results indicate that increasing levels of nitrogen deposition in the tropics have alleviated forest nitrogen limitation, producing an “open” N cycle. Modern leaves and tree rings have a heavier isotope composition than do archival samples. This is somewhat confusing relative to the lighter isotopic composition found by Holtgrieve et al. in modern lake sediments.

Reconciling the discrepancy in the nature of the isotopic signal between these two studies might require a certain degree of isotopic gymnastics. One likely mechanism is that these nitrogen-impacted tropical forests became extremely leaky for nitrogen, losing much through processes such as denitrification that preferentially leave heavy nitrogen ( $^{15}\text{N}$ ) behind for assimilation by the plants.

HIETZ 2011

Peter Hietz, Benjamin L. Turner, Wolfgang Wanek, Andreas Richter,

Charles A. Nock & S. Joseph Wright, *Long-Term Change in the Nitrogen Cycle of Tropical Forests*. [science](#) **334** (2011), 664–666.

s334-0664-Supplement.pdf

Deposition of reactive nitrogen (N) from human activities has large effects on temperate forests where low natural N availability limits productivity but is not known to affect tropical forests where natural N availability is often much greater. Leaf N and the ratio of N isotopes (d15N) increased substantially in a moist forest in Panama between  $\approx$ 1968 and 2007, as did tree-ring d15N in a dry forest in Thailand over the past century. A decade of fertilization of a nearby Panamanian forest with N caused similar increases in leaf N and d15N. Therefore, our results indicate regional increases in N availability due to anthropogenic N deposition. Atmospheric nitrogen dioxide measurements and increased emissions of anthropogenic reactive N over tropical land areas suggest that these changes are widespread in tropical forests.

#### HOLTGRIEVE 2011

Gordon W. Holtgrieve et al., *A Coherent Signature of Anthropogenic Nitrogen Deposition to Remote Watersheds of the Northern Hemisphere*. [science](#) **334** (2011), 1545–1548.

s334-1545-Supplement1.pdf, s334-1545-Supplement2.zip

Gordon W. Holtgrieve, Daniel E. Schindler, William O. Hobbs, Peter R. Leavitt, Eric J. Ward, Lynda Bunting, Guangjie Chen, Bruce P. Finney, Irene Gregory-Eaves, Sofia Holmgren, Mark J. Lisac, Peter J. Lisi, Koren Nydick, Lauren A. Rogers, Jasmine E. Saros, Daniel T. Selbie, Mark D. Shapley, Patrick B. Walsh & Alexander P. Wolfe

Humans have more than doubled the amount of reactive nitrogen (Nr) added to the biosphere, yet most of what is known about its accumulation and ecological effects is derived from studies of heavily populated regions. Nitrogen (N) stable isotope ratios ( $^{15}\text{N}:\text{}^{14}\text{N}$ ) in dated sediments from 25 remote Northern Hemisphere lakes show a coherent signal of an isotopically distinct source of N to ecosystems beginning in 1895  $\pm$  10 years (1 $\sigma$  standard deviation). Initial shifts in N isotope composition recorded in lake sediments coincide with anthropogenic CO<sub>2</sub> emissions but accelerate with widespread industrial Nr production during the past half century. Although current atmospheric Nr deposition rates in remote regions are relatively low, anthropogenic N has probably influenced watershed N budgets across the Northern Hemisphere for over a century.

## Klima

#### SCHEFUSS 2011

Enno Schefuß, Holger Kuhlmann, Gesine Mollenhauer, Matthias Prange & Jürgen Pätzold, *Forcing of wet phases in southeast Africa over the past 17,000 years*. [nature](#) **480** (2011), 509–512.

n480-0509-Supplement.pdf

Intense debate persists about the climatic mechanisms governing hydrologic changes in tropical and subtropical southeast Africa since the Last Glacial Maximum, about 20,000 years ago. In particular, the relative importance of atmospheric and oceanic processes is not firmly established<sup>1-5</sup>. Southward shifts of the intertropical convergence zone (ITCZ) driven by high-latitude climate changes have been suggested as a primary forcing<sup>2,3</sup>, whereas other studies infer a predominant influence of Indian Ocean sea surface temperatures on regional rainfall changes<sup>4,5</sup>. To address this question, a continuous record representing an integrated signal of regional climate variability is required, but has until now been missing. Here we show that remote atmospheric forcing by cold events in the northern high latitudes appears to have been the main driver of hydro-climatology in southeast Africa during rapid climate changes over the past 17,000 years. Our results are based on

a reconstruction of precipitation and river discharge changes, as recorded in a marine sediment core off the mouth of the Zambezi River, near the southern boundary of the modern seasonal ITCZ migration. Indian Ocean sea surface temperatures did not exert a primary control over southeast African hydrologic variability. Instead, phases of high precipitation and terrestrial discharge occurred when the ITCZ was forced southwards during Northern Hemisphere cold events, such as Heinrich stadial 1 (around 16,000 years ago) and the Younger Dryas (around 12,000 years ago), or when local summer insolation was high in the late Holocene, that is, during the past 4,000 years.

## Neolithikum

### BOCQUET-APPEL 2012

Jean-Pierre Bocquet-Appel, Stephan Naji, Marc Vander Linden & Janusz Kozłowski, *Understanding the rates of expansion of the farming system in Europe*. *Journal of Archaeological Science* **39** (2012), 531–546.

JArchSci39-0531-Supplement.pdf

If the overall expansion of the farming system was determined by the Neolithic Demographic Transition (NDT), i.e. by demographic pressure, what determined the rate of expansion? What is the link between the rate of expansion, the farming system and demographic density? In a first approach, the issue of the different rates of expansion of the farming system on the map is addressed in terms of 21 geo-ecological, climatic and cultural factors and forager populations, via an ordinary least square regression technique (OLS). In a second approach, the variability of the rate of expansion is analyzed in terms of specific patterns identified for the ceramic culture areas, via a cluster analysis. The expansion rate is negatively correlated with the intensification of the agricultural system, as well as with demographic density. Expansion is slow in ecosystems with an intensive farming system with relatively high demographic density, and vice-versa.

Keywords: Neolithic demographic transition | Rate of expansion | European | Neolithic farming system

### McNIVEN 2012

Ian J. McNiven et al., *Dating Aboriginal stone-walled fishtraps at Lake Condah, southeast Australia*. *Journal of Archaeological Science* **39** (2012), 268–286.

Ian J. McNiven, Joe Crouch, Thomas Richards, Nic Dolby, Geraldine Jacobsen & Gunditj Mirring Traditional Owners Aboriginal Corporation

Direct dating of stone-walled fishtraps has been a methodological challenge in archaeology and is generally considered insurmountable. Dating is usually associative, linking traps to local archaeological sites and geomorphological features of known age. Limited excavation of sediments burying the lower sections of stone-walled fishtrap features has been previously undertaken with limited success. Recent fine-grained excavation and comprehensive AMS dating and analysis of channel in-fill sediments associated with an elaborate freshwater fishtrap complex at Lake Condah, western Victoria, yields reliable insights into the phased construction and use of the feature. An early phase of basalt bedrock removal to create a bifurcated channel was subsequently in-filled with flood sediments incorporating stone artefacts and charcoal dated to c.6600 cal BP. After a hiatus, basalt blocks were added to the sides of the channel to create multi-tiered walls within the past 600e800 years. This site provides the first direct insights into the antiquity of the elaborate fishtrapping and aquaculture system developed by Aboriginal people in the Lake Condah region, and may represent one of the world's oldest known fishtraps.

Keywords: Fishtraps | Eels | Dating | Gunditjmarra | Lake Condah | Western Victoria