

References

Aktuell

CÔTÉ 2015

Stéphane Côté, Julian House & Robb Willer, *High economic inequality leads higher-income individuals to be less generous*. [PNAS 112 \(2015\), 15838–15843](#).

Research on social class and generosity suggests that higher-income individuals are less generous than poorer individuals. We propose that this pattern emerges only under conditions of high economic inequality, contexts that can foster a sense of entitlement among higher-income individuals that, in turn, reduces their generosity. Analyzing results of a unique nationally representative survey that included a real-stakes giving opportunity ($n = 1,498$), we found that in the most unequal US states, higher-income respondents were less generous than lower-income respondents. In the least unequal states, however, higher-income individuals were more generous. To better establish causality, we next conducted an experiment ($n = 704$) in which apparent levels of economic inequality in participants' home states were portrayed as either relatively high or low. Participants were then presented with a giving opportunity. Higher-income participants were less generous than lower-income participants when inequality was portrayed as relatively high, but there was no association between income and generosity when inequality was portrayed as relatively low. This research finds that the tendency for higher-income individuals to be less generous pertains only when inequality is high, challenging the view that higher-income individuals are necessarily more selfish, and suggesting a previously undocumented way in which inequitable resource distributions undermine collective welfare.

Keywords: inequality | income | generosity

Significance: Recent research finds that higher-income individuals are less generous than lower-income individuals. This work has received widespread academic and media attention, but the formulation is likely oversimplistic because it neglects the role of economic inequality. We test a new, multilevel perspective on the relationship between income and generosity that incorporates economic inequality. In a nationally representative survey study and an experiment, we find that higher-income individuals are only less generous if they reside in a highly unequal area or when inequality is experimentally portrayed as relatively high. Our findings offer a more complete understanding of the association between income and generosity and have implications for contemporary debates about the social impact of unequal resource distributions.

DENNIG 2015

Francis Dennig, Mark B. Budolfson, Marc Fleurbaey, Asher Siebert & Robert H. Socolow, *Inequality, climate impacts on the future poor, and carbon prices*. [PNAS 112 \(2015\), 15827–15832](#).

Integrated assessment models of climate and the economy provide estimates of the social cost of carbon and inform climate policy. We create a variant of the Regional Integrated model of Climate and the Economy (RICE)—a regionally disaggregated version of the Dynamic Integrated model of Climate and the Economy (DICE)—in which we introduce a more fine-grained representation of economic

inequalities within the model's regions. This allows us to model the common observation that climate change impacts are not evenly distributed within regions and that poorer people are more vulnerable than the rest of the population. Our results suggest that this is important to the social cost of carbon—as significant, potentially, for the optimal carbon price as the debate between Stern and Nordhaus on discounting.

Keywords: climate change | RICE | inequality | damage distribution | social cost of carbon

Significance: Hundreds of published papers produce “optimal” trajectories of global emissions of carbon dioxide, and corresponding carbon prices, over this century, taking into account future damages inflicted by climate change. To our knowledge, in all instances the models ignore inequalities in economic variables beyond regional differences. Here, we introduce heterogeneous subregional populations (distributed by income) and explore how the optimal trajectories are affected by whether regional damage afflicts the poor predominantly. We find that when future damage falls especially hard on the poor, considerably greater global mitigation effort is optimal than when damage is proportional to income.

EDITORIAL 2015

Fishy limits. [nature 528 \(2015\), 435.](#)

The European Union has set a worrying trend by ignoring scientific advice on overfishing. It must put long-term sustainability plans ahead of short-term political gains.

GARCÍA-LÓPEZ 2015

Victor García-López et al., *Unimolecular Submersible Nanomachines. Synthesis, Actuation, and Monitoring.* [ACS Nanoletters 15 \(2015\), 8229–8239.](#)

Victor García-López, Pinn-Tsong Chiang, Fang Chen, Gedeng Ruan, Angel A. Martí, Anatoly B. Kolomeisky, Gufeng Wang, & James M. Tour

Unimolecular submersible nanomachines (USNs) bearing light-driven motors and fluorophores are synthesized. NMR experiments demonstrate that the rotation of the motor is not quenched by the fluorophore and that the motor behaves in the same manner as the corresponding motor without attached fluorophores. No photo or thermal decomposition is observed. Through careful design of control molecules with no motor and with a slow motor, we found using single molecule fluorescence correlation spectroscopy that only the molecules with fast rotating speed (MHz range) show an enhancement in diffusion by 26 % when the motor is fully activated by UV light. This suggests that the USN molecules give ≈ 9 nm steps upon each motor actuation. A non-unidirectional rotating motor also results in a smaller, 10 %, increase in diffusion. This study gives new insight into the light actuation of motorized molecules in solution.

Keywords: Unimolecular submersible nanomachines | light-driven motor | diffusion coefficient | fluorophores

GART 2015

Sean Gart, John J. Socha, Pavlos P. Vlachos & Sunghwan Jung, *Dogs lap using acceleration-driven open pumping.* [PNAS 112 \(2015\), 15798–15802.](#)

[pnas112-15798-Supplement1.mp4](#), [pnas112-15798-Supplement2.mov](#)

Dogs lap because they have incomplete cheeks and cannot suck. When lapping, a dog's tongue pulls a liquid column from the bath, suggesting that the hydrodynamics of column formation are critical to understanding how dogs drink. We

measured lapping in 19 dogs and used the results to generate a physical model of the tongue's interaction with the air–fluid interface. These experiments help to explain how dogs exploit the fluid dynamics of the generated column. The results demonstrate that effects of acceleration govern lapping frequency, which suggests that dogs curl the tongue to create a larger liquid column. Comparing lapping in dogs and cats reveals that, despite similar morphology, these carnivores lap in different physical regimes: an unsteady inertial regime for dogs and steady inertial regime for cats.

Keywords: drinking | lapping | open pumping | biomechanics

KLARREICH 2016

Erica Klarreich, *Keine Rettung vor dem Abgrund*. [Spektrum der Wissenschaft 2016](#), i, 68–71.

Bei einem makabren Spiel zwischen einem Gefangenen und einem sadistischen Wärter gibt es auf die Dauer kein Entrinnen. Diese 80 Jahre alte Vermutung hat Terence Tao jetzt bewiesen.

MELILLO 2015

Stephanie M. Melillo, *An alternative interpretation of the Australopithecus scapula*. [PNAS 112 \(2015\)](#), E7159.

Young et al. invoke a trade-off between primitive and derived functions to explain the slow and sustained pace of morphological change: in their view, continued arboreality explains why Australopithecus scapula morphology differs in some ways from Homo. However, slow and sustained morphological evolution is equally well-explained by a progressive increase in the selective advantage of Homo-like morphology alone, as tool use came to have a greater impact on hominin fitness. In the broader context of the extensive changes in the A. afarensis postcranial skeleton that reduced arboreal efficiency, derived morphology in the scapula is similarly best understood as indicating committed terrestriality.

YOUNG 2015

Nathan M. Young, Terence D. Capellini, Neil T. Roach & Zeresenay Alemseged, *Woranso-Mille is consistent with an australopithecine shoulder intermediate between African apes and Homo*, *Reply to Melillo*. [PNAS 112 \(2015\)](#), E7160.

Instead, we based our conclusion on the well-established principle that the simplest explanation is preferred. Because the ape convergence model posits living hominoids evolved from a more primitive shared ancestral morphotype, similar blade shapes would have had to independently evolve five times: once each between gorillas, chimpanzees/bonobos, and humans, and twice between gibbons and orangutans. In contrast, the African ape model predicts one event to evolve the African ape blade shape from a more primitive one shared by Asian apes, a much more parsimonious explanation.

Anthropologie

MATHIESON 2015

Iain Mathieson et al., *Genome-wide patterns of selection in 230 ancient Eurasians*. [nature 528 \(2015\)](#), 499–503.

Iain Mathieson, Iosif Lazaridis, Nadin Rohland, Swapan Mallick, Nick Patterson, Songül Alpaslan Roodenberg, Eadaoin Harney, Kristin Stewardson, Daniel

Fernandes, Mario Novak, Kendra Sirak, Cristina Gamba, Eppie R. Jones, Bastien Llamas, Stanislav Dryomov, Joseph Pickrell, Juan Lu s Arsuaga, Jos  Mar a Berm dez de Castro, Eudald Carbonell, Fokke Gerritsen, Aleksandr Khokhlov, Pavel Kuznetsov, Marina Lozano, Harald Meller, Oleg Mochalov, Vyacheslav Moiseyev, Manuel A. Rojo Guerra, Jacob Roodenberg, Josep Maria Verg s, Johannes Krause, Alan Cooper, Kurt W. Alt, Dorcas Brown, David Anthony, Carles Lalueza-Fox, Wolfgang Haak, Ron Pinhasi & David Reich

Ancient DNA makes it possible to observe natural selection directly by analysing samples from populations before, during and after adaptation events. Here we report a genome-wide scan for selection using ancient DNA, capitalizing on the largest ancient DNA data set yet assembled: 230 West Eurasians who lived between 6500 and 300 BC, including 163 with newly reported data. The new samples include, to our knowledge, the first genome-wide ancient DNA from Anatolian Neolithic farmers, whose genetic material we obtained by extracting from petrous bones, and who we show were members of the population that was the source of Europe’s first farmers. We also report a transect of the steppe region in Samara between 5600 and 300 BC, which allows us to identify admixture into the steppe from at least two external sources. We detect selection at loci associated with diet, pigmentation and immunity, and two independent episodes of selection on height.

Arch ologie

H LSCHER 2002

Tonio H lscher, *Klassische Arch ologie, Grundwissen.* (Stuttgart 2006).

Bibel

ZWICKEL 2016

Wolfgang Zwickel, *Wie entstand Israel?* [Spektrum der Wissenschaft 2016, i, 62–67.](#)

Laut Altem Testament bildete sich das Volk Israel w hrend der 40-j hrigen Wanderung durch die W ste und der anschlieenden Eroberung des gelobten Landes Kanaan. Historische und arch ologische Quellen zeichnen nun ein anderes Bild: Israel war schon damals ein Schmelztiegel der Kulturen.

1 Die Wirtschaftskraft der Levante-St dte des 2. Jahrtausends v. Chr. beruhte vor allem auf dem Fernhandel. Eine Schw che der Schutzmacht  gypten auf der einen, r uberische  berf lle durch “Habiru” auf der anderen Seite brachten ihn jedoch allm hlich zum Erliegen.

2 Im 13. Jahrhundert v. Chr. setzte eine zunehmende Trockenheit an den K sten des  stlichen Mittelmeers eine Spirale aus Hunger und Aggression in Gang. “Seev lker” attackierten die St dte, die nun nach und nach aufgegeben wurden.

3 Das Bergland Pal stinas war klimatisch beg nstigt und bot freien Siedlungsraum. Im Lauf von 200 Jahren entstanden dort b uerliche Gesellschaften, die sich aus Alteingesessenen und Migranten konstituierten.

Biologie

FRISTOE 2015

Trevor S. Fristoe, Joseph R. Burger, Meghan A. Balk, Imran Khaliq, Christian Hof & James H. Brown, *Metabolic heat production and thermal conductance are mass-independent adaptations to thermal environment in birds and mammals*. [PNAS 112 \(2015\), 15934–15939](#).

[pnas112-15934-Supplement.docx](#)

The extent to which different kinds of organisms have adapted to environmental temperature regimes is central to understanding how they respond to climate change. The Scholander–Irving (S-I) model of heat transfer lays the foundation for explaining how endothermic birds and mammals maintain their high, relatively constant body temperatures in the face of wide variation in environmental temperature. The S-I model shows how body temperature is regulated by balancing the rates of heat production and heat loss. Both rates scale with body size, suggesting that larger animals should be better adapted to cold environments than smaller animals, and vice versa. However, the global distributions of $\approx 9,000$ species of terrestrial birds and mammals show that the entire range of body sizes occurs in nearly all climatic regimes. Using physiological and environmental temperature data for 211 bird and 178 mammal species, we test for mass-independent adaptive changes in two key parameters of the S-I model: basal metabolic rate (BMR) and thermal conductance. We derive an axis of thermal adaptation that is independent of body size, extends the S-I model, and highlights interactions among physiological and morphological traits that allow endotherms to persist in a wide range of temperatures. Our macrophysiological and macroecological analyses support our predictions that shifts in BMR and thermal conductance confer important adaptations to environmental temperature in both birds and mammals.

Keywords: macrophysiology | Bergmann’s rule | body size | metabolic rate | thermal conductance

Significance: How different kinds of organisms adapt to environmental temperature is central to understanding how they respond to past, present, and future climate change. We applied the Scholander–Irving model of thermoregulation to data on hundreds of species of birds and mammals to assess the contributions of three avenues of adaptation to environmental temperature: body size, basal metabolic rate (BMR), and thermal conductance. Adaptation via body size is limited; the entire ranges of body sizes of birds and mammals occur in nearly all climatic regimes. Using physiological and environmental data for 211 bird and 178 mammal species, we demonstrate that birds and mammals have adapted to geographic variation in environmental temperature regimes by concerted changes in both BMR and thermal conductance.

GOLDENBERG 2016

Shifra Z. Goldenberg, Iain Douglas-Hamilton & George Wittemyer, *Vertical Transmission of Social Roles Drives Resilience to Poaching in Elephant Networks*. [Current Biology 26 \(2016\), 1–5](#).

Network resilience to perturbation is fundamental to functionality in systems ranging from synthetic communication networks to evolved social organization [1]. While theoretical work offers insight into causes of network robustness, examination of natural networks can identify evolved mechanisms of resilience and how they are related to the selective pressures driving structure. Female African elephants (*Loxodonta africana*) exhibit complex social networks with node heterogeneity in which older individuals serve as connectivity hubs [2, 3]. Recent ivory

poaching targeting older elephants in a well-studied population has mirrored the targeted removal of highly connected nodes in the theoretical literature that leads to structural collapse [4, 5]. Here we tested the response of this natural network to selective knockouts. We find that the hierarchical network topology characteristic of elephant societies was highly conserved across the 16-year study despite $\approx 70\%$ turnover in individual composition of the population. At a population level, the oldest available individuals persisted to fill socially central positions in the network. For analyses using known mother-daughter pairs, social positions of daughters during the disrupted period were predicted by those of their mothers in years prior, were unrelated to individual histories of family mortality, and were actively built. As such, daughters replicated the social network roles of their mothers, driving the observed network resilience. Our study provides a rare bridge between network theory and an evolved system, demonstrating social redundancy to be the mechanism by which resilience to perturbation occurred in this socially advanced species.

- Poaching targets older elephants, removing key social individuals
- After poaching disruption, elephants maintain hierarchical social structure
- Daughters leverage their mothers' prior social context to reconstruct networks

JOHNSON 2016

Richard J. Johnson & Peter Andrews, *In den Fängen des Fettgens. Spektrum der Wissenschaft* **2016**, i, 20–26.

Von den frühen Menschenaffen stammt eine Mutation, die dem Körper mit Hilfe von Fruchtzucker ermöglicht, besonders leicht Speck anzusetzen. Was früher über Hungerzeiten hinweghalf, erweist sich in unserer Überflussgesellschaft als fatal.

1 Vor rund 16 Millionen Jahren trat bei europäischen oder westasiatischen Menschenaffen eine Genmutante auf, wegen der alle heutigen Großen Menschenaffen und der Mensch keine Harnsäure mehr abbauen können – ihnen fehlt das dafür zuständige Enzym Uricase.

2 Im sich damals abkühlenden Klima Eurasiens brachte die Mutation während des nahrungsarmen Winters Vorteile, denn dadurch konnten sich die Menschenaffen leichter Speck anfuttern. Hierbei legt fruchtzuckerreiche Nahrung einen “Fettschalter” um.

3 Dieser Effekt scheint durch erhöhte Harnsäurespiegel vermittelt zu werden, die das Fehlen von Uricase erst ermöglicht. In unserer Überflussgesellschaft disponiert der Gendefekt jedoch für Wohlstandskrankheiten wie Diabetes und Arteriosklerose.

VOGT 2015

Günter Vogt et al., *The marbled crayfish as a paradigm for saltational speciation by autopolyploidy and parthenogenesis in animals. Biology Open* **4** (2015), 1583–1594.

Günter Vogt, Cassandra Falckenhayn, Anne Schrimpf, Katharina Schmid, Katharina Hanna, Jörn Panteleit, Mark Helm, Ralf Schulz & Frank Lyko

The parthenogenetic all-female marbled crayfish is a novel research model and potent invader of freshwater ecosystems. It is a triploid descendant of the sexually reproducing slough crayfish, *Procambarus fallax*, but its taxonomic status has remained unsettled. By cross-breeding experiments and parentage analysis we show here that marbled crayfish and *P. fallax* are reproductively separated. Both crayfish copulate readily, suggesting that the reproductive barrier is set at the cytogenetic rather than the behavioural level. Analysis of complete mitochondrial genomes of marbled crayfish from laboratory lineages and wild populations demonstrates genetic identity and indicates a single origin. Flow cytometric comparison of DNA contents of haemocytes and analysis of nuclear microsatellite loci confirm triploidy and suggest autopolyploidisation as its cause. Global DNA methylation

is significantly reduced in marbled crayfish implying the involvement of molecular epigenetic mechanisms in its origination. Morphologically, both crayfish are very similar but growth and fecundity are considerably larger in marbled crayfish, making it a different animal with superior fitness. These data and the high probability of a divergent future evolution of the marbled crayfish and *P. fallax* clusters suggest that marbled crayfish should be considered as an independent asexual species. Our findings also establish the *P. fallax*–marbled crayfish pair as a novel paradigm for rare chromosomal speciation by autopolyploidy and parthenogenesis in animals and for saltational evolution in general.

Keywords: Marbled crayfish | Autopolyploidy | Parthenogenesis | Epigenetics | Chromosomal speciation | Saltational evolution

Datierung

BAILLIE 1988

M. G. L. Baillie & M. A. R. Munro, *Irish tree rings, Santorini and volcanic dust veils*. *nature* **332** (1988), 344–346.

There has recently been renewed interest in the dating of the violent eruption of the Aegean island of Santorini in the second millennium BC, both by its possible effects on tree-ring growth in the United States (suggesting a date of 1628–1626 BC), and by acidity peaks in ice cores from South Greenland (suggesting 1645 BC). We now show that oak trees growing on bogs in Northern Ireland produce significant concentrations of extremely narrow rings within a few periods less than 20 years long and that these periods correspond to the dates suggested by other methods for major volcanic eruptions. In particular, one of them, corresponding to a short period beginning in 1628 BC, was probably caused by Santorini. This date is qualitatively better than those derived from carbon-14 or ice cores, because it is based on an absolute tree-ring chronology.

HAMMER 1987

C. U. Hammer, H. B. Clausen, W. L. Friedrich & H. Tauber, *The Minoan eruption of Santorini in Greece dated to 1645 BC?* *nature* **328** (1987), 517–519.

The eruption on Santorini (Thera: 36.40° N, 25.40° E) in the Aegean Sea during Late Minoan time is considered the most violent volcanic event in the Mediterranean in the second millennium BC. The eruption buried a number of developing Bronze Age settlements on the island (one of which is presently being excavated at the village Akrotiri) and spread huge amounts of tephra over the eastern Mediterranean and adjacent lands. This event is therefore an important time marker both for archaeologists and Earth scientists. A dating of the eruption has previously been attempted by archaeological inference and by radiocarbon dating, but the two methods have tended to give ages that deviate by up to 150 years. Here we present a new ice-core dating of the eruption, which suggests an age of 1645 BC based on variations in acid fallout in the annual ice layers in a core drilled at the site Dye 3 (65.18° N, 43.49° W) in South Greenland.

LAMARCHE 1984

Valmore C. LaMarche Jr & Katherine K. Hirschboeck, *Frost rings in trees as records of major volcanic eruptions*. *nature* **307** (1984), 121–126.

New data about climatically-effective volcanic eruptions during the past several thousand years may be contained in frost-damage zones in the annual rings of

trees. There is good agreement in the timing of frost events and recent eruptions, and the damage can be plausibly linked to climatic effects of stratospheric aerosol veils on hemispheric and global scales. The cataclysmic proto-historic eruption of Santorini (Thera), in the Aegean, is tentatively dated to 1628-26 BC from frosting evidence.

TOFFOLO 2013

Michael B. Toffolo et al., *Towards an Absolute Chronology for the Aegean Iron Age, New Radiocarbon Dates from Lefkandi, Kalapodi and Corinth*. [PLoS ONE 8 \(2013\), e83117](#).
[DOI:10.1371/journal.pone.0083117](#).

Michael B. Toffolo, Alexander Fantalkin, Irene S. Lemos, Rainer C. S. Felsch, Wolf-Dietrich Niemeier, Guy D. R. Sanders, Israel Finkelstein & Elisabetta Boaretto

The relative chronology of the Aegean Iron Age is robust. It is based on minute stylistic changes in the Submycenaean, Protogeometric and Geometric styles and their sub-phases. Yet, the absolute chronology of the time-span between the final stages of Late Helladic IIIc in the late second millennium BCE and the archaic colonization of Italy and Sicily toward the end of the 8th century BCE lacks archaeological contexts that can be directly related to events carrying absolute dates mentioned in Egyptian/Near Eastern historical sources, or to well-dated Egyptian/Near Eastern rulers. The small number of radiocarbon dates available for this time span is not sufficient to establish an absolute chronological sequence. Here we present a new set of short-lived radiocarbon dates from the sites of Lefkandi, Kalapodi and Corinth in Greece. We focus on the crucial transition from the Submycenaean to the Protogeometric periods. This transition is placed in the late 11th century BCE according to the Conventional Aegean Chronology and in the late 12th century BCE according to the High Aegean Chronology. Our results place it in the second half of the 11th century BCE.

WARDLE 2014

Kenneth Wardle, Thomas Higham & Bernd Kromer, *Dating the End of the Greek Bronze Age, A Robust Radiocarbon-Based Chronology from Assiros Toumba*. [PLoS ONE 9 \(2014\), e106672](#).
[DOI:10.1371/journal.pone.0106672](#).

[pone09-e0106672-Supplement.pdf](#)

Over 60 recent analyses of animal bones, plant remains, and building timbers from Assiros in northern Greece form an unique series from the 14th to the 10th century BC. With the exception of Thera, the number of ¹⁴C determinations from other Late Bronze Age sites in Greece has been small and their contribution to chronologies minimal. The absolute dates determined for Assiros through Bayesian modelling are both consistent and unexpected, since they are systematically earlier than the conventional chronologies of southern Greece by between 70 and 100 years. They have not been skewed by reference to assumed historical dates used as priors. They support high rather than low Iron Age chronologies from Spain to Israel where the merits of each are fiercely debated but remain unresolved.

Energie

CHEN 2015

Lian-Yi Chen et al., *Processing and properties of magnesium containing*

a dense uniform dispersion of nanoparticles. *nature* **528** (2015), 539–543.

n528-0539-Supplement1.mp4, n528-0539-Supplement2.mp4

Lian-Yi Chen, Jia-Quan Xu, Hongseok Choi, Marta Pozuelo, Xiaolong Ma, Sanjit Bhowmick, Jenn-Ming Yang, Suveen Mathaudhu & Xiao-Chun Li

Magnesium is a light metal, with a density two-thirds that of aluminium, is abundant on Earth and is biocompatible; it thus has the potential to improve energy efficiency and system performance in aerospace, automobile, defence, mobile electronics and biomedical applications^{1–5}. However, conventional synthesis and processing methods (alloying and thermomechanical processing) have reached certain limits in further improving the properties of magnesium and other metals⁶. Ceramic particles have been introduced into metal matrices to improve the strength of the metals⁷, but unfortunately, ceramic microparticles severely degrade the plasticity and machinability of metals⁷, and nanoparticles, although they have the potential to improve strength while maintaining or even improving the plasticity of metals^{8,9}, are difficult to disperse uniformly in metal matrices^{10–14}. Here we show that a dense uniform dispersion of silicon carbide nanoparticles (14 per cent by volume) in magnesium can be achieved through a nanoparticle self-stabilization mechanism in molten metal. An enhancement of strength, stiffness, plasticity and high-temperature stability is simultaneously achieved, delivering a higher specific yield strength and higher specific modulus than almost all structural metals.

GENÇER 2015

Emre Gençer, Dharik S. Mallapragada, François Maréchal, Mohit Tawarmalani & Rakesh Agrawal, *Round-the-clock power supply and a sustainable economy via synergistic integration of solar thermal power and hydrogen processes*. *PNAS* **112** (2015), 15821–15826.

We introduce a paradigm—“hydricity”—that involves the coproduction of hydrogen and electricity from solar thermal energy and their judicious use to enable a sustainable economy. We identify and implement synergistic integrations while improving each of the two individual processes. When the proposed integrated process is operated in a standalone, solely power production mode, the resulting solar water power cycle can generate electricity with unprecedented efficiencies of 40–46%. Similarly, in standalone hydrogen mode, pressurized hydrogen is produced at efficiencies approaching $\approx 50\%$. In the coproduction mode, the coproduced hydrogen is stored for uninterrupted solar power production. When sunlight is unavailable, we envision that the stored hydrogen is used in a “turbine”-based hydrogen water power (H2WP) cycle with the calculated hydrogen-to-electricity efficiency of 65–70%, which is comparable to the fuel cell efficiencies. The H2WP cycle uses much of the same equipment as the solar water power cycle, reducing capital outlays. The overall sun-to-electricity efficiency of the hydricity process, averaged over a 24-h cycle, is shown to approach $\approx 35\%$, which is nearly the efficiency attained by using the best multijunction photovoltaic cells along with batteries. In comparison, our proposed process has the following advantages: (i) It stores energy thermochemically with a two- to threefold higher density, (ii) coproduced hydrogen has alternate uses in transportation/chemical/petrochemical industries, and (iii) unlike batteries, the stored energy does not discharge over time and the storage medium does not degrade with repeated uses.

Keywords: solar | electricity | hydrogen | solar thermal power | process synthesis

Significance: Diminishing fossil fuel resources and increasing atmospheric greenhouse gases present a compelling case for transitioning to a sustainable economy where all human needs can be met by using abundant solar energy. In this paper,

we introduce “hydricity,” a paradigm that proposes synergistic coproduction of solar thermal power and hydrogen. We realize hydricity by judiciously integrating solar water power cycle, solar thermal hydrogen production techniques, and turbine-based hydrogen power cycle and by suitably improving each one for compatibility and beneficial interaction. The proposed hydricity concept presents a potential breakthrough solution for continuous and efficient power supply and also an exciting opportunity to envision and create a sustainable economy to meet all the human needs—namely, food, chemicals, transportation, heating, and electricity.

Klima

NUR 2000

Amos Nur & Eric H. Cline, *Poseidon’s Horses, Plate Tectonics and Earthquake Storms in the Late Bronze Age Aegean and Eastern Mediterranean*. [Journal of Archaeological Science](#) **27** (2000), 43–63.

In light of the accumulated evidence now published, the oft-denigrated suggestion that major earthquakes took place in the Aegean and Eastern Mediterranean areas during the late 13th and early 12th centuries must be reconsidered. A new study of earthquakes occurring in the Aegean and Eastern Mediterranean region during the 20th century, utilizing data recorded since the invention of seismic tracking devices, shows that this area is criss-crossed with major fault lines and that numerous temblors of magnitude 6½ (enough to destroy modern buildings, let alone those of antiquity) occur frequently. It can be demonstrated that such major earthquakes often occur in groups, known as sequences or storms, in which one large quake is followed days, months, or even years later by others elsewhere on the now-weakened fault line. When a map of the areas in the Aegean and Eastern Mediterranean region affected (i.e. shaken) by 20th century earthquakes of magnitude 6½ and greater and with an intensity of VII or greater is overlaid on Robert Drews’ map of sites destroyed in these same regions during the so-called Catastrophe near the end of the Late Bronze Age, it is readily apparent that virtually all of these LBA sites lie within the high-shaking areas. While the evidence is not conclusive, based on these new data we would suggest that an earthquake storm may have occurred in the Late Bronze Age Aegean and Eastern Mediterranean during the years 1225–1175. This storm may have interacted with the other forces at work in these areas c. 1200 and merits consideration by archaeologists and prehistorians.

Keywords: Aegean | Eastern Mediterranean | Late Bronze Age | Earthquakes | Plate Tectonics

YOUNG 2015

Nicolás E. Young, Avriel D. Schweinsberg, Jason P. Briner & Joerg M. Schaefer, *Glacier maxima in Baffin Bay during the Medieval Warm Period coeval with Norse settlement*. [Science Advances](#) **1** (2015), e1500806. DOI:10.1126/sciadv.1500806.

SciAdv01-e1500806-Supplement.pdf

The climatic mechanisms driving the shift from the Medieval Warm Period (MWP) to the Little Ice Age (LIA) in the North Atlantic region are debated. We use cosmogenic beryllium-10 dating to develop a moraine chronology with century-scale resolution over the last millennium and show that alpine glaciers in Baffin Island and western Greenland were at or near their maximum LIA configurations during the proposed general timing of the MWP. Complimentary paleoclimate proxy data suggest that the western North Atlantic region remained cool, whereas

the eastern North Atlantic region was comparatively warmer during the MWP—a dipole pattern compatible with a persistent positive phase of the North Atlantic Oscillation. These results demonstrate that over the last millennium, glaciers approached their eventual LIA maxima before what is considered the classic LIA in the Northern Hemisphere. Furthermore, a relatively cool western North Atlantic region during the MWP has implications for understanding Norse migration patterns during the MWP. Our results, paired with other regional climate records, point to nonclimatic factors as contributing to the Norse exodus from the western North Atlantic region.

Kultur

D'HUY 2015

Julien d'Huy, *Die Urahnen der großen Mythen*. [Spektrum der Wissenschaft 2015](#), xii, 66–73.

Anthropologen und Ethnologen analysieren Märchen, Mythen und Sagen, um Entwicklungslinien aufzudecken. Mit den Algorithmen von Genetikern verfolgen sie die Evolution der “Mythenfamilien” bis in vorgeschichtliche Zeit – und rekonstruieren deren Urformen.

1 Drei Mythenfamilien sind weltweit in zahlreichen Varianten vertreten: “Kosmische Jagd”, “Pygmalion” und “Polyphem”. Jede Version lässt sich in ihre charakteristischen Einzelemente zerlegen, so genannte Mytheme.

2 Mytheme entsprechen in der Genetik den Grundbausteinen der DNA, sie kodieren gleichsam einen Mythos. Mit Hilfe phylogenetischer Algorithmen lassen sich daher Stammbäume und sogar die Urform einer Familie rekonstruieren.

3 Mythenstammbäume spiegeln auch die Besiedelungsgeschichte der Erde durch den Menschen wider. Insbesondere die “Kosmische Jagd” und “Polyphem” reichen offenbar bis in die Altsteinzeit zurück und gelangten im Zuge von Migrationen bis nach Nordamerika.

SASS 2015

Benjamin Sass, Yosef Garfinkel, Michael G. Hasel & Martin G. Klingbeil, *The Lachish Jar Sherd, An Early Alphabetic Inscription Discovered in 2014*. [Bulletin of the American Schools of Oriental Research 374 \(2015\)](#), 233–245.

The article presents a 12th-century b.c. alphabetic inscription unearthed at Lachish, Israel, during the 2014 excavation season.

Keywords: alphabet | Lachish | Late Bronze Age | Proto-Canaanite | Proto-Sinaitic | West Semitic palaeography

Methoden

WOOD 2015

Janice Wood & Ben Fitzhugh, *Wound ballistics in experimental archaeology, The prey specific implications of penetrating trauma injuries from prehistoric projectiles points*. ([Forthcoming 2015](#)), 1–24.

Research in the field of wound ballistics has identified three major types of penetrating trauma injuries that will affect wound severity of a projectile point into hard or soft tissues: incised, lacerated, and puncture. In this study, we report on

dual ballistics experiments conducted to better understand the wounding mechanisms of three prehistoric projectile point classes made respectfully of bifacially flaked stone, polished bone, and composite antler inset with microblades. Each class of projectiles were launched into the carcass of a deceased horse and into ballistics gelatin to explore the relative performance characteristics of each tip form in terms of penetration, wound infliction, and tool durability. Our methods of evaluation included a detailed measurement of projectile attributes before and after penetration of both carcass and gelatin that were then compared using tip-metrics, cavitation width, penetration depth, and total interior wound area. Our results strongly suggest that the wounding characteristics differed significantly between projectile point classes and in turn, strongly influenced wound severity. We infer that point mechanics may implicate a “prey specific” prehistoric hunting strategy and propose that such analyses can help us better understand prehistoric hunter-gather behavior and technological variability.

Keywords: Experimental Archaeology | Wound Ballistics | Microblades | Prehistoric | Hunting | Technological Variability | Projectile Points | Beringia | Alaska.

Physik

BERGER 1980

Walter Berger, *Zur Charakterisierung des Brandverhaltens von Werkstoffen*. *VFDB-Zeitschrift* 1980, ii, 45–47.

Moderne Chemiewerkstoffe sind im Gegensatz zu Naturstoffen meist chemisch sehr einheitlich aufgebaut. Entsprechend sind dann auch Verdampfung und Zersetzung auf enge Temperaturbereiche beschränkt. Die große Gefahr liegt nun darin, daß bei einer empirischen Prüfung ein solcher Temperaturbereich nicht erreicht wird und der Prüfbefund entsprechend günstig ausfällt. Wird dann im tatsächlichen Brandgeschehen der kritische Temperaturbereich überschritten, so kann es zu plötzlicher Verdampfung oder Zersetzung mit explosionsartiger Verbrennung und Bildung von gefährlichen Stichflammen kommen, die das Brandgeschehen außerordentlich stark beschleunigen und die Löscharbeiten und -mannschaften entsprechend gefährden.

Die mit empirischen Prüfmethode erhaltenen Befunde und Gutachten über das Brandverhalten von Werkstoffen wurden bei tatsächlichen Großbränden bisher regelmäßig widerlegt. Und in unzähligen Gebäuden und anderen Objekten wurden aufgrund der Prüfbefunde falsche Materialien verwendet, die das Brandrisiko erhöhen.

Nicht brennbar ist ein Werkstoff nur dann, wenn er keine Bestandteile enthält, die exotherm mit Sauerstoff reagieren können. Begriffe wie “schwer entflammbar”, “feuerhemmend”, “selbstverlöschend” etc. gelten immer nur für begrenzte Temperaturbereiche, sie sind für die Charakterisierung des Brandverhaltens von Werkstoffen irreführend und sollten deshalb vermieden oder nur in Verbindung mit Temperaturangaben gebraucht werden.

HOSSENFELDER 2016

Sabine Hossenfelder, *Alles nur im Kopf*. *Spektrum der Wissenschaft* 2016, i, 45–47.

Einsteins Gedankenexperimente gehören zu den bedeutendsten der Wissenschaftsgeschichte. Damit hinterließ er der Welt ein weiteres Erbe neben seinen berühmten Theorien.

1 Einstein verstand es, komplexe physikalische Zusammenhänge auf gut vorstellbare Szenarien zu reduzieren. In Gedankenexperimenten konnte er zum Beispiel testen, welche Auswirkungen neue theoretische Spielregeln hätten.

2 Die Überlegungen brachten ihn auf die richtigen Ideen zu seiner Relativitätstheorie. Auf ähnlich trickreiche Weise versuchte er später, Interpretationen der Quantenmechanik zu widerlegen, die er für falsch hielt.

3 Vorstellungskraft allein nützt der Physik aber nur begrenzt. Die konstruierten Situationen müssen auch real überprüfbare Vorhersagen machen. Heutige Gedankenexperimente, etwa zu Schwarzen Löchern, haben kaum noch Bezüge zu messbaren Größen.

Politik

SAOUB 2015

Esther Saoub & Amir Musawy, *Schlagzeile geht schneller als Recherche – über die journalistische Arbeit zum Antikenraub*. [Archäologische Informationen](#) **39** (2015), 425–432.

When media talk about illegal digging and looting of archeological sites in Syria or Iraq, as well as the trade with looted antiquities, the articles contain many assumptions and only few proofs. In July 2015 the German TV program “Mittagsmagazin” broadcasted the first physical proof, that the so called Islamic State owns antiquities. Most media reacted with restraint. The assertion, that terrorism is financed by looting of antiquities, had been repeated so often, that it became a fact for many. The authors of this article – experienced TV-journalists who produced the story for “Mittagsmagazin” – have during the past years collected evidence that ISIS is trading with antiquities. In the film mentioned above they delivered the first physical proof. The fact, that the Islamic State owns antiquities, makes it very likely, that the terrorists are selling them, an assumption that has been partly proved through receipts. The scoop, we are talking about, was not accompanied by a big medial boom. But among experts it is an important part within a series of evidences, most of which are still in the dark.

Keywords: Antiquities | looting | cultural heritage | Islamic State | ISIS | Daesh | Syria | Iraq | Middle East | TV | journalism | mass-media

Wenn es um den Raub und Verkauf antiker Kulturgüter aus Syrien und dem Irak geht, wird in den Medien zuweilen mehr behauptet als tatsächlich nachgewiesen. Im Juli 2015 hat das ARD Mittagsmagazin erstmals einen physischen Beweis dafür gesendet, dass der sogenannte Islamische Staat (IS) Antiken besitzt. Die meisten Nachrichtenagenturen und Medien reagierten verhalten, für sie war die Behauptung der Terrorfinanzierung durch Antikenraub längst Tatsache geworden. Sie musste nur oft genug geschrieben werden. Die Autoren dieses Artikels – beide sind erfahrene Fernsehjournalisten und die Autoren des “Mittagsmagazin”-Beitrags – haben in den vergangenen Jahren eine Vielzahl von Hinweisen darauf gesammelt, dass der IS mit Antiken handelt. Mit dem erwähnten Film konnten sie nun auch einen im wahren Wortsinn greifbaren Beweis liefern. Die Tatsache, dass der IS Antiken besitzt, legt zudem sehr nahe, dass er auch damit handelt. Dies ist auch im Ansatz bewiesen, etwa durch Quittungen. Die mediale Entdeckung, die dieser Aufsatz beschreibt, ist nicht mit einem Theaterdonner aufgetreten. Für die Fachwelt aber ist sie ein wichtiger Stein in einer Beweiskette, deren größte Teile nach wie vor im Dunkeln liegen.

Keywords: Antiken | Raubgrabung | Kulturgut | Kulturgutschutz | Islamischer Staat | IS | Syrien | Irak | Naher Osten | Fernsehen | Journalismus | Massenmedien