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References

Aktuell

Burt 2017

Michelle Burt, Jeremy Firestone, John A. Madsen, Dana E. Veron & Richard Bowers, *Tall towers, long blades and manifest destiny, The migration of land-based wind from the Great Plains to the thirteen colonies*. Applied Energy **206** (2017), 487–497.

Until recently, it was not economically feasible to install wind turbines in many locations, including in large portions of the states that border the Atlantic Ocean in the United States, due to the low wind speeds. Newer designs allow turbines to be deployed at higher hub heights (> 100 m) where wind speeds are greater, and come with longer blades, allowing them to produce significantly more energy at lower wind speeds. We undertake a case study, using rural Sussex County, Delaware, US, to study their economic feasibility. We take an interdisciplinary approach, move beyond theory and general models, and consider micro-scale wind resources (the primary driver of revenue); local site geology, which influences project feasibility and foundation cost; local transmission constraints and expenses related to transmission and connection to the existing electrical grid; local values attributable to the environmental attributes of wind power; operation and maintenance costs (including insurance and replacement parts); land use and zoning considerations, including setbacks from roads, structures and airports; taxes; and rents/royalties. We find the base case levelized cost of energy (LCOE) to be ≈ $ 70/MWh (before accounting for the federal production tax credit) based on a 25 year-life of a wind turbine. Sensitivity analyses are undertaken around project life, project finance, the discount rate, and wind speed.

Keywords: Wind power | Tall towers | Rotor diameter | Low wind performance | Levelized cost of energy (LCOE) | Micro-scale data

Gebru 2017

Timnit Gebru, Jonathan Krause, Yilun Wang, Duyun Chen, Jia Deng, Erez Lieberman Aiden & Li Fei-Fei, *Using deep learning and Google Street View to estimate the demographic makeup of neighborhoods across the United States*. PNAS **114** (2017), 13108–13113.

The United States spends more than $ 250 million each year on the American Community Survey (ACS), a labor-intensive door-todoor study that measures statistics relating to race, gender, education, occupation, unemployment, and other demographic factors. Although a comprehensive source of data, the lag between demographic changes and their appearance in the ACS can exceed several years. As digital imagery becomes ubiquitous and machine vision techniques improve, automated data analysis may become an increasingly practical supplement to the ACS. Here, we present a method that estimates socioeconomic characteristics of regions spanning 200 US cities by using 50 million images of street scenes gathered with Google Street View cars. Using deep learning-based computer vision techniques, we determined the make, model, and year of all motor vehicles encountered in particular neighborhoods. Data from this census of motor vehicles, which enumerated 22 million automobiles in total (8 % of all automobiles in the

United States), were used to accurately estimate income, race, education, and voting patterns at the zip code and precinct level. (The average US precinct contains ≈1,000 people.) The resulting associations are surprisingly simple and powerful. For instance, if the number of sedans encountered during a drive through a city is higher than the number of pickup trucks, the city is likely to vote for a Democrat during the next presidential election (88 % chance); otherwise, it is likely to vote Republican (82 %). Our results suggest that automated systems for monitoring demographics may effectively complement labor-intensive approaches, with the potential to measure demographics with fine spatial resolution, in close to real time.

Keywords: computer vision | deep learning | social analysis | demography

Significance: We show that socioeconomic attributes such as income, race, education, and voting patterns can be inferred from cars detected in Google Street View images using deep learning. Our model works by discovering associations between cars and people. For example, if the number of sedans in a city is higher than the number of pickup trucks, that city is likely to vote for a Democrat in the next presidential election (88 % chance); if not, then the city is likely to vote for a Republican (82 % chance).

Hoggard 2017

Christian Steven Hoggard, *Considering the function of Middle Palaeolithic blade technologies through an examination of experimental blade edge angles.* Journal of Archaeological Science: Reports **16** (2017), 233–239.

Over the last three decades a number of archaeological investigations have demonstrated the widespread use of both laminar and Levallois methods of blade manufacture throughout the European Middle Palaeolithic. These strategies are observed in varying quantities in both Early and Late Middle Palaeolithic contexts, and have been documented in a number of archaeological horizons concurrently and in isolation of one another. However, despite their (co-)occurrence investigations have not considered the potential practical benefits of either blade strategy, and the actual functionality of these blade manufacturing techniques. Using an experimental dataset, this article investigates differences in the function of both strategies through a consideration of their edge angle, an important functional attribute of lithic artefacts. A null hypothesis of 'no difference' was examined through a statistical framework to assess the degree of variance between both blade strategies. Analyses demonstrate considerable difference in both the distribution of edge angles produced, and the mean edge angle values observed. Through the analytical framework it can be demonstrated that both blade production methods would have provided distinct differences for past hominin populations, with respect to their microfracturing properties and attrition rate. However, when reviewed against other edge angle analyses, against a functional backdrop, their edge angle in isolation cannot explain their appearance and subsequent use. Further work considering the functional attributes of these blade strategies is now important in conjunction with technological analysis to assess the role of artefact design during the Middle Palaeolithic, and the different 'potentials' of both blade manufacturing techniques to past hominin populations.

Keywords: Lithic technology | Neanderthal | Experimental archaeology | Morphometric analysis | Middle Palaeolithic

Leader 2017

George Leader, Aylar Abdolahzadeh, Sam C. Lin & Harold L. Dibble,

The effects of platform beveling on flake variation. Journal of Archaeological Science: Reports **16** (2017), 213–223.

There are many ways by which knappers can influence the morphology of the flakes they produce. This article presents the results of a set of controlled experiments designed to isolate and describe the effects of platform beveling, or the removal of material from either the exterior portion of platform surface or laterally adjacent to it. We show that there is a relationship between various aspects of flake morphology, including both size and shape, and the location, shape, and depth of bevels. These results, which are supported by analyses of archaeological materials, have implications for understanding how past knappers manipulated their cores in order to achieve specific results.

Li 2017

Yangtao Li, Amir Khajepour, Cécile Devaud & Kaimin Liu, *Power and fuel economy optimizations of gasoline engines using hydraulic variable valve actuation system*. Applied Energy **206** (2017), 577–593.

The hydraulic variable valve actuation (HVVA) system can provide greater freedoms to the engine valve motions than most of the traditional cam-based valve train systems do. By considering the characteristics of the HVVA system, the strategies of putting its outstanding flexibilities into use for further improving the performances of gasoline engines with respect to power and fuel economy are developed in this research. A new GT-suite HVVA engine model is proposed which is able to realize the interdependencies of the HVVA system and the engine. In addition, the model is calibrated by experimental data and the proposed genetic algorithm (GA) optimization schemes are carried out for optimizing the engine outputs at full engine load and fuel economy at partial engine load. A potential average improvement of 10.4 % on the engine outputs at full load over the entire operating speed range of the test engine is noticed from implementing the optimized HVVA valve motions. Moreover, the advanced GA algorithm for fuel economy optimization ensures the GA optimizer could maintain its proper functionality while non-linear constraints are taken into considerations. The late exhaust valve closure (LEVC) and early intake valve closure (EIVC) strategies are adopted at the same time for granting the engine an internal exhaust gas recirculation (IEGR) feature and together evolved into the HVVA strategy for fulfilling the partial engine loads without throttling. By conducting the advanced GA optimizations with the proposed HVVA strategy for partial engine load operations, the resulted break specific fuel consumption (BSFC) of the HVVA engine could be brought down by 13.1 % on average with a maximum of 15.8 % over its working speed range at the exemplary 7 Nm load point comparing to those of the original test engine.

Keywords: HVVA system | Gasoline engine | Valve motion strategies | Genetic algorithm | Full load output optimization | Partial load BSFC optimization

Mosyak 2017

A. Mosyak, E. Galili, D. Daniel, I. Rozinsky, B. Rosen & G. Yossifon, *Thermodynamics of a brazier cooking system modeled to mimic the lead brazier of a Roman ship*. Journal of Archaeological Science: Reports **16** (2017), 19–26.

Underwater explorations along the Israeli coast recovered more than twenty lead braziers, used for cooking aboard, dated to the Roman-Early Byzantine period. Few lead braziers from additional underwater Mediterranean sites were reported. To thermodynamically study the operation of this unique innovation, a steel model of a typical lead brazier was designed and constructed. The model, topped by a

copper alloy cooking pot holding water, was used to experimentally analyze the temperatures, combustion, energy balance and effciency of this "cooking system". The energy sources were charcoal and fire-wood. Water in the brazier's double-sided walls dispersed and absorbed the heat, preventing thermal melting of the original lead braziers. Maximum temperature measured at the fire bowl's bottom, when burning charcoal and firewood, did not exceed 104 °C and 101 °C, respectively. Thermal efficiency: the ratio between energy used for heating and evaporation of the water in the cooking pot, to the energy released by the burning fuel, depended on the type and mass of the fuel. It significantly increased from 5.7 % to 14.5 % with the increase in charcoal mass, from 0.250 kg (minimum mass in the present study) to 0.315 kg (maximum mass). The thermal effciency of 0.604 kg wood was ≈15.8 %. Practical cooking using the model was successful. The results provide deeper understanding of the technology used for cooking aboard during the Roman period. Although the available repertoire of materials and technologies was limited relative to modernity, the final result shows the overall competence of Roman craftsman to define an engineering problem and solve it satisfactorily.

Keywords: Lead brazier | Experimental archaeology | Roman ship | Water cooling

Palmer 2017

Kate Palmer, James E. Tate, Zia Wadud & John Nellthorp, *Total cost of ownership and market share for hybrid and electric vehicles in the UK, US and Japan*. Applied Energy **209** (2017), 108–119.

New powertrain technologies, such as Hybrid Electric Vehicles, have a price premium which can often be offset by lower running costs. Total Cost of Ownership combines these purchase and operating expenses to identify the most economical choice of vehicle. This is a valuable assessment for private and fleet purchasers alike. Studies to date have not compared Total Cost of Ownership across more than two vehicle markets or analysed historic costs. To address this gap, this research provides a more extensive Total Cost of Ownership assessment of conventional, Hybrid, Plug-in Hybrid and Battery Electric Vehicles in three industrialized countries – the UK, USA (using California and Texas as case studies) and Japan – for the time period 1997–2015. Finally, the link between Hybrid Electric Vehicle Total Cost of Ownership and market share is analysed with a panel regression model.

In all regions the incremental Total Cost of Ownership of hybrid and electric vehicles compared to conventional vehicles has reduced from the year of introduction and 2015. Year on year Hybrid Electric Vehicles Total Cost of Ownership was found to vary least in the UK due to the absence of subsidies. Market share was found to be strongly linked to Hybrid Electric Vehicle Total Cost of Ownership through a panel regression analysis. Financial subsidies have enabled Battery Electric Vehicles to reach cost parity in the UK, California and Texas, but this is not the case for Plug-in Hybrid Electric Vehicles which haven't received as much financial backing. This research has implications for fleet purchasers and private owners who are considering switching to a lowemission vehicle. The findings are also of interest to policymakers that are keen to develop effective measures to stimulate decarbonisation of the fleet and improve air quality.

Keywords: Hybrid Electric Vehicle | Battery Electric Vehicle | Total Cost of Ownership | Consumer demand | Technology adoption

Rodman 2017

Alexandra M. Rodman, Katherine E. Powers & Leah H. Somerville, *Development of self-protective biases in response to social evaluative*

feedback. PNAS **114** (2017), 13158–13163.

Adolescence is a developmental period marked by heightened attunement to social evaluation. While adults have been shown to enact self-protective processes to buffer their self-views from evaluative threats like peer rejection, it is unclear whether adolescents avail themselves of the same defenses. The present study examines how social evaluation shapes views of the self and others differently across development. N = 107 participants ages 10–23 completed a reciprocal social evaluation task that involved predicting and receiving peer acceptance and rejection feedback, along with assessments of self-views and likability ratings of peers. Here, we show that, despite equivalent experiences of social evaluation, adolescents internalized peer rejection, experiencing a feedbackinduced drop in self-views, whereas adults externalized peer rejection, reporting a task-induced boost in self-views and deprecating the peers who rejected them. The results identify codeveloping processes underlying why peer rejection may lead to more dramatic alterations in self-views during adolescence than other phases of the lifespan.

Keywords: social development | self-views | social evaluation | rejection | self-enhancement

Significance: The growing popularity of social media, especially among youth, has resulted in peer feedback (including rejection) pervading everyday life. Given that peer ostracism has been linked to depression and suicide, it is critical to understand the psychological impact of peer feedback from a developmental perspective. We demonstrate that adolescents and adults use peer feedback to inform views of themselves and of others in very different ways. Of particular interest, early adolescents internalized rejection from peers and felt worse about themselves, whereas adults exhibited evidence of self-protective biases that preserved positive self-views. This work advances theoretical insights into how development shapes socialevaluative experiences and informs sources of vulnerability that could put adolescents at unique risk for negative mental health outcomes.

Uddin 2017

Kotub Uddin, Rebecca Gough, Jonathan Radcliffe, James Marco & Paul Jennings, *Techno-economic analysis of the viability of residential photovoltaic systems using lithium-ion batteries for energy storage in the United Kingdom*. Applied Energy **206** (2017), 12–21.

Rooftop photovoltaic systems integrated with lithium-ion battery storage are a promising route for the decarbonisation of the UK's power sector. From a consumer perspective, the financial benefits of lower utility costs and the potential of a financial return through providing grid services is a strong incentive to invest in PV-battery systems. Although battery storage is generally considered an effective means for reducing the energy mismatch between photovoltaic supply and building demand, it remains unclear when and under which conditions battery storage can be profitably operated within residential photovoltaic systems. This fact is particularly pertinent when battery degradation is considered within the decision framework. In this work, a commercially available coupled photovoltaic lithium-ion battery system is installed within a mid-sized UK family home. Photovoltaic energy generation and household electricity demand is recorded for more than one year. A comprehensive battery degradation model based on long-term ageing data collected from more than fifty long-term degradation experiments on commercial Lithium-ion batteries is developed. The comprehensive model accounts for all established modes of degradation including calendar ageing, capacity throughput, ambient temperature, state of charge, depth of discharge and current rate. The model is validated using cycling data and exhibited an average maximum transient error of 7.4 % in capacity loss estimates and 7.3 % in resistance rise estimates for

over a year of cycling. The battery ageing model is used to estimate the cost of battery degradation associated with cycling the battery according to the power profile logged from the residential property. A detailed cost-benefit analysis using the data collected from the property and the battery degradation model shows that, in terms of utility savings and export revenue, the integration of a battery yields no added benefit. This result was, in-part, attributed to the relatively basic control strategy and effciency of the system. Furthermore, when the cost of battery degradation is included, the homeowner is subject to a significant financial loss.

Keywords: Photovoltaic | Lithium ion battery | Solar power | Battery degradation

Altpaläolithikum

Sahle 2017

Yonatan Sahle, Sireen El Zaatari & Tim D. White, *Hominid butchers and biting crocodiles in the African Plio–Pleistocene*. PNAS **114** (2017), 13164–13169.

Zooarchaeologists have long relied on linear traces and pits found on the surfaces of ancient bones to infer ancient hominid behaviors such as slicing, chopping, and percussive actions during butchery of mammal carcasses. However, such claims about Plio– Pleistocene hominids rely mostly on very small assemblages of bony remains. Furthermore, recent experiments on trampling animals and biting crocodiles have shown each to be capable of producing mimics of such marks. This equifinality—the creation of similar products by different processes—makes deciphering early archaeological bone assemblages difficult. Bone modifications among Ethiopian Plio–Pleistocene hominid and faunal remains at Asa Issie, Maka, Hadar, and Bouri were reassessed in light of these findings. The results show that crocodiles were important modifiers of these bone assemblages. The relative roles of hominids, mammalian carnivores, and crocodiles in the formation of Oldowan zooarchaeological assemblages will only be accurately revealed by better bounding equifinality. Critical analysis within a consilience-based approach is identified as the pathway forward. More experimental studies and increased archaeological fieldwork aimed at generating adequate samples are now required.

Keywords: zooarchaeology | Oldowan | taphonomy | cutmarks | equifinality

Significance: The idea that early Australopithecus shaped stone tools to butcher large mammals before the emergence of Homo around 2 million years ago has excited both primatologists and archaeologists. Such claims depend on interpreting modifications found on the surfaces of fossil bones. Recent experiments involving the feeding of mammal carcasses to modern crocodiles have revealed that equifinality—the creation of similar products by different processes—is more important than previously appreciated by zooarchaeologists. Application of these findings to Ethiopian fossils casts doubt on claims for the earliest large mammal butchery and indicates the need for reassessment of all Oldowan-associated bone assemblages to determine the degree to which equifinality compromises earlier interpretations of hominid subsistence activities and their role in human evolution.

Toth 2017

Nicholas Toth, *Revised taphonomic perspective on African Plio–Pleistocene fauna*. PNAS **114** (2017), 13066–13067.

This realization that crocodiles can produce marks on bone surfaces that mimic those produced by the sharp edges of stone tools has been a major game changer in zooarchaeological studies of African Plio–Pleistocene sites.

Archäologie

Ortman 2017

Scott G. Ortman & Grant D. Coffey, *Settlement Scaling in Middle-Range Societies*. American Antiquity **82** (2017), 662–682.

The contemporary relevance of archaeology would be greatly enhanced if archaeologists could develop theory that frames human societies of all scales in the same terms. We present evidence that an approach known as settlement scaling theory can contribute to such a framework. The theory proposes that a variety of aggregate socioeconomic properties of human networks emerge from individuals arranging themselves in space so as to balance the costs of movement with the benefits of social interactions. This balancing leads to settlements that concentrate human interactions and their products in space and time in an open-ended way. The parameters and processes embedded in settlement scaling models are very basic, and this suggests that scaling phenomena should be observable in the archaeological record of middle-range societies just as readily as they have been observed in contemporary first-world nations. In this paper, we show that quantitative scaling relationships observed for modern urban systems, and more recently for early civilizations, are also apparent in settlement data from the Central Mesa Verde and northern Middle Missouri regions of North America. These findings suggest that settlement scaling theory may help increase the practical relevance of archaeology for present-day concerns.

Bibel

Zenger 1995

Erich Zenger, *Einleitung in das Alte Testament*. Studienbücher Theologie 1/1 (Stuttgart ^{2}1996).

Biologie

Berghänel 2017

Andreas Berghänel, Michael Heistermann, Oliver Schülke & Julia Ostner, *Prenatal stress accelerates offspring growth to compensate for reduced maternal investment across mammals*. PNAS **114** (2017), E10658–E10666.

pnas114-E10658-Supplement1.xlsx

Across mammals, prenatal maternal stress (PREMS) affects many aspects of offspring development, including offspring growth. However, how PREMS translates to offspring growth is inconsistent, even within species. To explain the full range of reported effects of prenatal adversity on offspring growth, we propose an integrative hypothesis: developmental constraints and a counteracting adaptive growth plasticity work in opposition to drive PREMS effects on growth. Mothers experiencing adversity reduce maternal investment leading to stunted growth (developmental constraints). Concomitantly, the pace of offspring life history is recalibrated to partly compensate for these developmental constraints (adaptive growth plasticity). Moreover, the relative importance of each process changes across ontogeny with increasing offspring independence. Thus, offspring exposed to PREMS may grow at the same rate as controls during gestation and lactation, but faster after weaning when direct maternal investment has ceased. We tested these

predictions with a comparative analysis on the outcomes of 719 studies across 21 mammal species. First, the observed growth changes in response to PREMS varied across offspring developmental periods as predicted. We argue that the observed growth acceleration after weaning is not "catch-up growth," because offspring that were small for age grew slower. Second, only PREMS exposure early during gestation produced adaptive growth plasticity. Our results suggest that PREMS effects benefit the mother's future reproduction and at the same time accelerate offspring growth and possibly maturation and reproductive rate. In this sense, PREMS effects on offspring growth allow mother and offspring to make the best of a bad start.

Keywords: phenotypic plasticity | developmental plasticity | growth plasticity | catch-up growth | developmental constraints

Significance: Maternal stress during gestation causes numerous effects on infant physiology that extend well into adulthood. We contribute to the ongoing debate on whether these effects are adaptive outcomes or merely the product of energetic constraints by presenting an integrated hypothesis that predicts the diversity of observed maternal effects on offspring growth, incorporating both theoretical explanations into one coherent framework. Empirical tests of this hypothesis across mammals suggest that the timing of the stressor during gestation and a simultaneous consideration of maternal investment and adaptive growth plasticity effects are crucial for a full comprehension of prenatal stress effects on offspring growth. The results support an adaptive life history perspective on maternal effects that is relevant for evolutionary biology, medicine, and psychology.

Landis 2017

Michael J. Landis & Joshua G. Schraiber, *Pulsed evolution shaped modern vertebrate body sizes*. PNAS **114** (2017), 13224–13229.

The relative importance of different modes of evolution in shaping phenotypic diversity remains a hotly debated question. Fossil data suggest that stasis may be a common mode of evolution, while modern data suggest some lineages experience very fast rates of evolution. One way to reconcile these observations is to imagine that evolution proceeds in pulses, rather than in increments, on geological timescales. To test this hypothesis, we developed a maximum-likelihood framework for fitting L 'evy processes to comparative morphological data. This class of stochastic processes includes both an incremental and a pulsed component. We found that a plurality of modern vertebrate clades examined are best fitted by pulsed processes over models of incremental change, stationarity, and adaptive radiation. When we compare our results to theoretical expectations of the rate and speed of regime shifts for models that detail fitness landscape dynamics, we find that our quantitative results are broadly compatible with both microevolutionary models and observations from the fossil record.

Keywords: macroevolution | Levy process | pulsed evolution | adaptive landscape

Significance: The diversity of forms found among animals on Earth is striking. Despite decades of study, it has been difficult to reconcile the patterns of diversity seen between closely related species with those observed when studying single species on ecological timescales. We propose a set of models, called L 'evy processes, to attempt to reconcile rapid evolution between species with the relatively stable distributions of phenotypes seen within species. These models, which have been successfully used to model stock market data, allow for long periods of stasis followed by bursts of rapid change. We find that many vertebrate groups are well fitted by L ' evy models compared with models for which traits evolve toward a stationary optimum or evolve in an incremental and wandering manner.

Wagner 2017
Peter J. Wagner, *Vertebrate body size jumps the Wright way*. PNAS **114** (2017), 13068–13070.
In short, Landis and Schraiber's (4) approach only scratches the surface of how we should model anatomical evolution among living organisms. However, this is a very important (and, some paleobiologists might say, long overdue) scratch! Relevant work using fossil data suggests that morphological evolution often is more complex than any single model allows (20). Landis and Schraiber (4) themselves begin the "mix and match" game by combining jump models with continuous-change models. I expect this to be a stepping stone to combining pulsed models with speciational, early burst, driven trends, and numerous other models in the next few years. In doing so, we should capture a better idea of the relative contributions of pertinent processes to overall evolution while not assuming that any one need predominate.

Judentum

Ben-Chorin 1967
Schalom Ben-Chorin, *Bruder Jesus*, *Der Nazarener in jüdischer Sicht*. (München ^{5}1982).

Dalman 1898
Gustaf Dalman, *Die Worte Jesu mit Berücksichtigung des nachkanonischen jüdischen Schrifttums und der aramäischen Sprache*, *Band 1: Einleitung und wichtige Begriffe*. (Milton Keynes 2017).

Dalman 1922
Gustaf Dalman, *Jesus-Jeschua*, *Die drei Sprachen Jesu: Jesus in der Synagoge, auf dem Berge, beim Passahmahl, am Kreuz*. (Darmstadt 1697).

Eskhult 2013
Mats Eskhult & Josef Eskhult, *The Language of Jesus and related questions*, *A historical survey*. In: Reinhard G. Lehmann & Anna Elise Zernecke (Hrsg.), *Schrift und Sprache*, *Papers Read at the 10th Mainz International Colloquium on Ancient Hebrew (MICAH), Mainz, 28–30 October 2011*. KUSATU 15 (Kamen 2013), 315–373.
The discussion in bygone days to a large degree dealt with which of the three languages Aramaic, Hebrew, and Greek that was the language of Jesus. But the matter at hand has constantly manifested itself as a most elusive notion, not least so because several concepts tend to be mixed together: native tongue, idiom used in common parlance, and language chosen for formal address, or used when addressing non-Jews. All three languages were certainly used in first-century Palestine, but not to the same extent in speech as in writing, and not to the same degree in the various geographical, sociological, and ethnic environments. One should perhaps rather speak about the languages of Jesus in the plural. The question at issue, then, is rather what environment is to be judged as being of the greatest importance for Jesus in word and deed.

Klima

Ayala 2017

Gianna Ayala, John Wainwright, Joanna Walker, Rachel Hodara, Jerry M. Lloyd, Melanie Leng & Chris Doherty, *Palaeoenvironmental reconstruction of the alluvial landscape of Neolithic Çatalhöyük, central southern Turkey, The implications for early agriculture and responses to environmental change*. Journal of Archaeological Science **87** (2017), 30–43.

Archaeological discussions of early agriculture have often used the Neolithic village of Çatalhöyük in central southern Turkey as a key example of the restricting effect of environment on agricultural production and organization. Central to these discussions is the palaeoenvironmental reconstruction of the landscape surrounding the site. This paper presents an important new dataset from an intensive coring programme undertaken between 2007 and 2013 in the immediate environs of the site, designed to improve significantly the spatial resolution of palaeoenvironmental data. Using sediment analyses including organic content, magnetic susceptibility, particle size, total carbon and nitrogen contents and carbon isotope analysis, coupled with 3D modelling, we are able to present a new reconstruction of the palaeotopography and sedimentary environments of the site. Our findings have major implications for our understanding of Neolithic agricultural production and social practice.

We present four phases of environmental development. Phase 1 consists of the final phases of regression of Palaeolake Konya in the later parts of the Pleistocene, dominated by erosion due to wind and water that created an undulating surface of the marl deposited in the palaeolake. Phase 2 occurs in the latest Pleistocene and early Holocene, and indicates increased wetness, probably characteristic of a humid anabranching channel system, in which there are localized pockets of wetter conditions. In Phase 3a, this infilling continues, producing a flatter surface, and there are fewer pockets being occupied by wetter conditions. The fluvial régime shifts from humid to dryland anabranching conditions. The earliest period of occupation of the Neolithic East Mound coincides with this phase. Phase 3b coincides with the shift of occupation to the West Mound in the Chalcolithic, when there is evidence for a very localized wetter area to the southeast of the West Mound, but otherwise a continuation of the dryland anabranching system. Finally, Phase 4 shows a shift to the pre-modern style of fluvial environment, modified by channelization. This reanalysis demonstrates the importance of extensive spatial sampling as part of geoarchaeological investigations.

With this new evidence we demonstrate that the landscape was highly variable in time and space with increasingly dry conditions developing from the early Holocene onwards. In contrast to earlier landscape reconstructions that have presented marshy conditions during the early Holocene that impacted agriculture, we argue that localized areas of the floodplain would have afforded significant opportunities for agriculture closer to the site. In this way, the results have important implications for how we understand agricultural practices in the early Neolithic.

Keywords: Neolithic | Turkey | Geoarchaeology | Isotope analysis | Modelling | Agriculture

Chalk 2017

Thomas B. Chalk et al., *Causes of ice age intensification across the Mid-Pleistocene Transition*. PNAS **114** (2017), 13114–13119.

Thomas B. Chalk, Mathis P. Hain, Gavin L. Foster, Eelco J. Rohling, Philip F. Sexton, Marcus P. S. Badger, Soraya G. Cherry, Adam P. Hasenfratz, Gerald

H. Haug, Samuel L. Jaccard, Alfredo Martínez-García, Heiko Pälike, Richard D. Pancost & Paul A. Wilson

During the Mid-Pleistocene Transition (MPT; 1,200–800 kya), Earth's orbitally paced ice age cycles intensified, lengthened from ≈40,000 (≈40 ky) to ≈100 ky, and became distinctly asymmetrical. Testing hypotheses that implicate changing atmospheric CO2 levels as a driver of the MPT has proven difficult with available observations. Here, we use orbitally resolved, boron isotope CO2 data to show that the glacial to interglacial CO2 difference increased from ≈43 to ≈75 µatm across the MPT, mainly because of lower glacial CO2 levels. Through carbon cycle modeling, we attribute this decline primarily to the initiation of substantive dust-borne iron fertilization of the Southern Ocean during peak glacial stages. We also observe a twofold steepening of the relationship between sea level and CO2-related climate forcing that is suggestive of a change in the dynamics that govern ice sheet stability, such as that expected from the removal of subglacial regolith or interhemispheric ice sheet phase-locking. We argue that neither ice sheet dynamics nor CO2 change in isolation can explain the MPT. Instead, we infer that theMPT was initiated by a change in ice sheet dynamics and that longer and deeper post-MPT ice ages were sustained by carbon cycle feedbacks related to dust fertilization of the Southern Ocean as a consequence of larger ice sheets.

Keywords: boron isotopes | MPT | geochemistry | carbon dioxide | paleoclimate

Significance: Conflicting sets of hypotheses highlight either the role of ice sheets or atmospheric carbon dioxide (CO2) in causing the increase in duration and severity of ice age cycles ≈1 Mya during the Mid-Pleistocene Transition (MPT). We document early MPT CO2 cycles that were smaller than during recent ice age cycles. Using model simulations, we attribute this to post-MPT increase in glacial-stage dustiness and its effect on Southern Ocean productivity. Detailed analysis reveals the importance of CO2 climate forcing as a powerful positive feedback that magnified MPT climate change originally triggered by a change in ice sheet dynamics. These findings offer insights into the close coupling of climate, oceans, and ice sheets within the Earth System.

Roberts 2017

Neil Roberts, Jessie Woodbridge, Andrew Bevan, Alessio Palmisano, Stephen Shennan & Eleni Asouti, *Human responses and non-responses to climatic variations during the last Glacial-Interglacial transition in the eastern Mediterranean.* Quaternary Science Reviews (2017), preprint, 1–21. DOI:10.1016/j.quascirev.2017.09.011.

We review and evaluate human adaptations during the last glacial-interglacial climatic transition in southwest Asia. Stable isotope data imply that climatic change was synchronous across the region within the limits of dating uncertainty. Changes in vegetation, as indicated from pollen and charcoal, mirror step-wise shifts between cold-dry and warm-wet climatic conditions, but with lag effects for woody vegetation in some upland and interior areas. Palaeoenvironmental data can be set against regional archaeological evidence for human occupancy and economy from the later Epipalaeolithic to the aceramic Neolithic. Demographic change is evaluated from summed radiocarbon date probability distributions, which indicating contrasting – and in some cases opposite – population trajectories in different regions. Abrupt warming transitions at ≈14.5 and 11.7 ka BP may have acted as pacemakers for rapid cultural change in some areas, notably at the start of the Natufian and Pre-Pottery Neolithic cultures. However temporal synchroneity does not mean that climatic changes had the same environmental or societal consequences in different regions. During cold-dry time intervals, regions such as the Levant acted as refugia for plant and animal resources and human

population. In areas where socio-ecological continuity was maintained through periods of adverse climate (e.g. Younger Dryas) human communities were able to respond rapidly to subsequent climatic improvement. By contrast, in areas where there was a break in settlement at these times (e.g. central Anatolia), populations were slower to react to the new opportunities provided by the interglacial world.

Keywords: Southwest Asia | Neolithic revolution | Agricultural origins | Palaeodemography | Charcoal | Pollen

Újvári 2017

Gábor Újvári et al., *Coupled European and Greenland last glacial dust activity driven by North Atlantic climate*. PNAS **114** (2017), E10632–E10638.

pnas114-E10632-Supplement1.xls, pnas114-E10632-Supplement2.xls

Gábor Újvári, Thomas Stevens, Mihály Molnár, Attila Demény, Fabrice Lambert, György Varga, A. J. Timothy Jull, Barna Páll-Gergely, Jan-Pieter Buylaert & János Kovács

Centennial-scale mineral dust peaks in last glacial Greenland ice cores match the timing of lowest Greenland temperatures, yet little is known of equivalent changes in dust-emitting regions, limiting our understanding of dust-climate interaction. Here, we present the most detailed and precise age model for European loess dust deposits to date, based on 125 accelerator mass spectrometry 14C ages from Dunaszekcso, Hungary. The record shows that variations in glacial dust deposition variability on centennial– millennial timescales in east central Europe and Greenland were synchronous within uncertainty. We suggest that precipitation and atmospheric circulation changes were likely the major influences on European glacial dust activity and propose that European dust emissions were modulated by dominant phases of the North Atlantic Oscillation, which had a major influence on vegetation and local climate of European dust source regions.

Keywords: dust | Dansgaard-Oeschger events | European loess | radiocarbon dating | mollusk shell

Significance: Atmospheric dust is a major component of climate change. However, the relationship between glacial continental dust activity and abrupt centennial–millennial-scale climate changes of the North Atlantic is poorly known. Recent advances in high-precision radiocarbon dating of small gastropods in continental loess deposits provide an opportunity to gain unprecedented insights into dust variations and its major drivers at centennial– millennial scales from a near-source dust archive. Here, we show that Late Quaternary North Atlantic temperature and dustiness in Greenland and Europe were largely synchronous and suggest that this coupling was driven via precipitation changes and large-scale atmospheric circulation.

Mesolithikum

Ramsey 2017

Monica N. Ramsey, Arlene M. Rosen & Dani Nadel, *Centered on the Wetlands, Integrating New Phytolith Evidence of Plant-Use From the 23,000-Year-Old Site of Ohalo II, Israel*. American Antiquity **82** (2017), 702–722.

Epipaleolithic hunter-gatherers are often interpreted as playing an important role in the development of early cereal cultivation and subsequent farming economies in the Levant. This focus has come at the expense of understanding these people as resilient foragers who exploited a range of changing micro habitats

through the Last GlacialMaximum. New phytolith data from Ohalo II seek to redress this. Ohalo II has the most comprehensive and important macrobotanical assemblage in Southwest Asia for the entire Epipaleolithic period. Here we present a phytolith investigation of 28 sediment samples to make three key contributions. First, by comparing the phytolith assemblage to a sample of the macrobotanical assemblage, we provide a baseline to help inform the interpretation of phytolith assemblages at other sites in Southwest Asia. Second, we highlight patterns of plant use at the site. We identify the importance of wetland plant resources to hut construction and provide evidence that supports previous work suggesting that grass and cereal processing may have been a largely "indoor" activity. Finally, drawing on ethnographic data from the American Great Basin, we reevaluate the significance of wetland plant resources for Epipaleolithic hunter-gatherers and argue that the wetland-centered lifeway at Ohalo II represents a wider Levantine adaptive strategy.

Metallzeiten

Jambon 2017

Albert Jambon, *Bronze Age iron, Meteoritic or not? A chemical strategy*. Journal of Archaeological Science **88** (2017), 47–53.

Bronze Age iron artifacts could be derived from either meteoritic (extraterrestrial) or smelted (terrestrial) iron. This unresolved question is the subject of a controversy: are some, all or none made of smelted iron? In the present paper we propose a geochemical approach, which permits us to differentiate terrestrial from extraterrestrial irons. Instead of evaluating the Ni abundance alone (or the Ni to Fe ratio) we consider the relationship between Fe, Co and Ni abundances and their ratios. The study of meteoritic irons, Bronze Age iron artifacts and ancient terrestrial irons permit us to validate this chemical approach. The major interest is that non-invasive p-XRF analyses provide reliable Fe:Co:Ni abundances, without the need to remove a sample; they can be performed in situ, in the museums where the artifacts are preserved. The few iron objects from the Bronze Age sensu stricto that could be analyzed are definitely made of meteoritic iron, suggesting that speculations about precocious smelting during the Bronze Age should be revised. In a Fe:Co:Ni array the trend exhibited by meteoritic irons departs unambiguously from modern irons and iron ores. The trend of Ni/Fe vs Ni/Co in different analysis points of a single object corroded to variable extents provides a robust criterion for identifying the presence of meteoritic iron. It opens the possibility of tracking when and where the first smelting operations happened, the threshold of a new era. It emphasizes the importance of analytical methods for properly studying the evolution of the use of metals and metal working technologies in our past cultures.

Keywords: Iron | Bronze age | Iron age | Meteorite | Iron ore

Methoden

Crema 2017

E. R. Crema, A. Bevan & S. Shennan, *Spatio-temporal approaches to archaeological radiocarbon dates*. Journal of Archaeological Science **87** (2017), 1–9.

Summed probability distributions of radiocarbon dates are an increasingly popular means by which to reconstruct prehistoric population dynamics, enabling more thorough cross-regional comparison and more robust hypothesis testing, for

example with regard to the impact of climate change on past human demography. Here we review another use of such summed distributions – to make spatially explicit inferences about geographic variation in prehistoric populations. We argue that most of the methods proposed so far have been strongly biased by spatially varying sampling intensity, and we therefore propose a spatial permutation test that is robust to such forms of bias and able to detect both positive and negative local deviations from pan-regional rates of change in radiocarbon date density. We test our method both on some simple, simulated population trajectories and also on a large real-world dataset, and show that we can draw useful conclusions about spatio-temporal variation in population across Neolithic Europe.

Keywords: Summed probability distribution of | radiocarbon dates | Prehistoric demography | Spatial analysis | European Neolithic | Simulation

Ramsey 2017

Christopher Bronk Ramsey, *Methods for Summarizing Radiocarbon Datasets*. Radiocarbon (2017), preprint, 1–25. DOI:10.1017/RDC.2017.108.

Bayesian models have proved very powerful in analyzing large datasets of radiocarbon (14C) measurements from specific sites and in regional cultural or political models. These models require the prior for the underlying processes that are being described to be defined, including the distribution of underlying events. Chronological information is also incorporated into Bayesian models used in DNA research, with the use of Skyline plots to show demographic trends. Despite these advances, there remain difficulties in assessing whether data conform to the assumed underlying models, and in dealing with the type of artifacts seen in Sum plots. In addition, existing methods are not applicable for situations where it is not possible to quantify the underlying process, or where sample selection is thought to have filtered the data in a way that masks the original event distribution. In this paper three different approaches are compared: "Sum" distributions, postulated undated events, and kernel density approaches. Their implementation in the OxCal program is described and their suitability for visualizing the results from chronological and geographic analyses considered for cases with and without useful prior information. The conclusion is that kernel density analysis is a powerful method that could be much more widely applied in a wide range of dating applications.

Keywords: Bayesian analysis | data analysis | kernel density | radiocarbon dating.

Neolithikum

Price 2017

Max Price, Kathryn Grossman & Tate Paulette, *Pigs and the pastoral bias, The other animal economy in northern Mesopotamia (3000-2000 BCE)*. Journal of Anthropological Archaeology **48** (2017), 46–62.

Discussion of the animal economy in Mesopotamia has been subject to a persistent, pastoral bias. Most general treatments assume that the Early Bronze Age (ca. 3000–2000 BCE) animal economy was dominated by the herding of sheep and goats. An examination of the abundant written evidence would support such a contention. Zooarchaeological evidence from northern Mesopotamia, however, clearly demonstrates that pigs played a major role in the diet, despite their virtual absence in the written record. In this paper, we attempt to lay bare and correct for the pastoral bias by reviewing the relatively meager written evidence for pig husbandry and by examining the zooarchaeological evidence for pigs from two angles. First, we use relative abundance data from sites across northern Mesopotamia to

demonstrate the ubiquity of pigs and to identify regional- and site-level patterning in pig consumption. Second, we use a series of proxy techniques to reconstruct pig husbandry practices at three sites: Tell 'Atij, Tell al-Raqa'i, and Tell Leilan. Ultimately, we argue that this "other" animal economy emerged to fill a niche opened up by the twin processes of urbanization and institutional expansion. For households struggling to deal with the impacts of these wide-ranging transformations, pigs offered an alternative means of subsistence and perhaps a way of maintaining some degree of autonomy.

Politik

Scheffer 2017

Marten Scheffer, Bas van Bavel, Ingrid A. van de Leemput & Egbert H. van Nes, *Inequality in nature and society*. PNAS **114** (2017), 13154–13157.

Most societies are economically dominated by a small elite, and similarly, natural communities are typically dominated by a small fraction of the species. Here we reveal a strong similarity between patterns of inequality in nature and society, hinting at fundamental unifying mechanisms. We show that chance alone will drive 1 % or less of the community to dominate 50 % of all resources in situations where gains and losses are multiplicative, as in returns on assets or growth rates of populations. Key mechanisms that counteract such hyperdominance include natural enemies in nature and wealth-equalizing institutions in society. However, historical research of European developments over the past millennium suggests that such institutions become ineffective in times of societal upscaling. A corollary is that in a globalizing world, wealth will inevitably be appropriated by a very small fraction of the population unless effective wealth-equalizing institutions emerge at the global level.

Keywords: ecology | economy | wealth | abundance | inequality

Significance: Inequality is one of the main drivers of social tension. We show striking similarities between patterns of inequality between species abundances in nature and wealth in society. We demonstrate that in the absence of equalizing forces, such large inequality will arise from chance alone. While natural enemies have an equalizing effect in nature, inequality in societies can be suppressed by wealth-equalizing institutions. However, over the past millennium, such institutions have been weakened during periods of societal upscaling. Our analysis suggests that due to the very same mathematical principle that rules natural communities (indeed, a "law of nature") extreme wealth inequality is inevitable in a globalizing world unless effective wealthequalizing institutions are installed on a global scale.