References

Aktuell

DE DOMENICO 2017

Manlio de Domenico & Alex Arenas, *Modeling structure and resilience of the dark network.* Physical Review E **95** (2017), 22313. DOI:10.1103/PhysRevE.95.022313.

While the statistical and resilience properties of the Internet are no longer changing significantly across time, the Darknet, a network devoted to keep anonymous its traffic, still experiences rapid changes to improve the security of its users. Here we study the structure of the Darknet and find that its topology is rather peculiar, being characterized by a nonhomogeneous distribution of connections, typical of scale-free networks; very short path lengths and high clustering, typical of small-world networks; and lack of a core of highly connected nodes. We propose a model to reproduce such features, demonstrating that the mechanisms used to improve cybersecurity are responsible for the observed topology. Unexpectedly, we reveal that its peculiar structure makes the Darknet much more resilient than the Internet (used as a benchmark for comparison at a descriptive level) to random failures, targeted attacks, and cascade failures, as a result of adaptive changes in response to the attempts of dismantling the network across time.

JAKOB 2016

Michael Jakob, Dorothea Kübler, Jan Christoph Steckel & Roel van Veldhuizen, *Clean up your own mess, An experimental study of moral responsibility and efficiency.* Wissenschaftszentrum Berlin für Sozialforschung **2016**, Discussion Paper S215, 1–31.

Although market-based environmental policy instruments feature prominently in economic theory and are widely employed, they often meet with public resistance. We argue that such resistance may be driven by a feeling of moral responsibility where citizens prefer to tackle environmental problems themselves, rather than delegating the task to others by means of a market mechanism. Using a laboratory experiment that isolates moral responsibility from alternative explanations, we show that moral responsibility induces participants to incur a sizable cost on themselves as well as on other participants. We discuss the implications of this finding for the design and implementation of environmental policies.

Keywords: Laboratory Experiment | Moral Responsibility | Environmental Policy | Market Mechanism | Climate Change

MORROW 2017

Ryan M. Morrow et al., *Mitochondrial energy deficiency leads to.* PNAS **114** (2017), 2705–2710.

Ryan M. Morrow, Martin Picard, Olga Derbeneva, Jeremy Leipzig, Meagan J. McManus, Gilles Gouspillou, Sébastien Barbat-Artigas, Carlos Dos Santos, Russell T. Hepple, Deborah G. Murdock & Douglas C. Wallace

Diabetes is associated with impaired glucose metabolism in the presence of excess insulin. Glucose and fatty acids provide reducing equivalents to mitochondria to generate energy, and studies have reported mitochondrial dysfunction in type

II diabetes patients. If mitochondrial dysfunction can cause diabetes, then we hypothesized that increased mitochondrial metabolism should render animals resistant to diabetes. This was confirmed in mice in which the heart–muscle–brain adenine nucleotide translocator isoform 1 (ANT1) was inactivated. ANT1-deficient animals are insulin-hypersensitive, glucose-tolerant, and resistant to high fat diet (HFD)-induced toxicity. In ANT1-deficient skeletal muscle, mitochondrial gene expression is induced in association with the hyperproliferation of mitochondria. The ANT1-deficient muscle mitochondria produce excess reactive oxygen species (ROS) and are partially uncoupled. Hence, the muscle respiration under nonphosphorylating conditions is increased.Muscle transcriptome analysis revealed the induction of mitochondrial biogenesis, down-regulation of diabetes-related genes, and increased expression of the genes encoding the myokines FGF21 and GDF15. However, FGF21 was not elevated in serum, and FGF21 and UCP1 mRNAs were not induced in liver or brown adipose tissue (BAT). Hence, increased oxidation of dietary-reducing equivalents by elevated muscle mitochondrial respiration appears to be the mechanism by which ANT1-deficient mice prevent diabetes, demonstrating that the rate of mitochondrial oxidation of calories is important in the etiology of metabolic disease.

Significance: Mitochondrial dysfunction is associated with type II diabetes and metabolic syndrome, but whether it is cause or consequence is debated. By showing that increased mitochondrial respiration can impart glucose tolerance, insulin sensitivity, and resistance to high fat diet (HFD) toxicity, we provide evidence that mitochondria contributes to the etiology of metabolic disease. Inactivation of adenine nucleotide translocator isoform 1 (ANT1) results in proliferation of partially uncoupled muscle mitochondrial respiration, creating a sink for excess calories. Although ANT1-deficient muscle induces expression of Fgf21, FGF21 level is not elevated in blood, and FGF21 and UCP1 mRNAs are not increased in liver or brown adipose tissue (BAT). If increased mitochondrial respiration prevents HFD toxicity, then decreased mitochondrial respiration may contribute to metabolic disease.

Rimfeld 2017

Kaili Rimfeld et al., *Phenotypic and genetic evidence for a unifactorial structure of spatial abilities.* PNAS **114** (2017), 2777–2782.

Kaili Rimfeld, Nicholas G. Shakeshaft, Margherita Malanchini, Maja Rodic, Saskia Selzam, Kerry Schofield, Philip S. Dale, Yulia Kovas & Robert Plomin

Spatial abilities encompass several skills differentiable from general cognitive ability (g). Importantly, spatial abilities have been shown to be significant predictors of many life outcomes, even after controlling for g. To date, no studies have analyzed the genetic architecture of diverse spatial abilities using a multivariate approach. We developed "gamified" measures of diverse putative spatial abilities. The battery of 10 tests was administered online to 1,367 twin pairs (age 19–21) from the UK-representative Twins Early Development Study (TEDS). We show that spatial abilities constitute a single factor, both phenotypically and genetically, even after controlling for g. This spatial ability factor is highly heritable (69 %). We draw three conclusions: (i) The high heritability of spatial abilitymakes it a good target for gene-hunting research; (ii) some genes will be specific to spatial ability, independent of g; and (iii) these genes will be associated with all components of spatial ability.

Significance: Spatial ability is a strong predictor of several important outcomes, including success in science, technology, engineering, and mathematics (STEM) subjects and careers. This ability is widely believed to be multifactorial, with

numerous components and subdomains, such as "mental rotation," "scanning," and "mechanical reasoning." This large twin study allows the genetic and environmental etiology of diverse putative spatial abilities to be explored. The results indicate that this domain is in fact unifactorial, albeit dissociable from general intelligence, suggesting that its structure is much simpler than the sprawling literature suggests. This will aid genehunting efforts and allow this ability and its consequences to be examined with greater precision.

LE VAILLANT 2017

Margaux Le Vaillant, Stephen J. Barnes, James E. Mungall & Emma L. Mungall, *Role of degassing of the Noril'sk nickel deposits in the Permian–Triassic mass extinction event.* PNAS **114** (2017), 2485–2490.

The largest mass extinction event in Earth's history marks the boundary between the Permian and Triassic Periods at circa 252 Ma and has been linked with the eruption of the basaltic Siberian Traps large igneous province (SLIP). One of the kill mechanisms that has been suggested is a biogenic methane burst triggered by the release of vast amounts of nickel into the atmosphere. A proposed Ni source lies within the huge Noril'sk nickel ore deposits, which formed in magmatic conduits widely believed to have fed the eruption of the SLIP basalts. However, nickel is a nonvolatile element, assumed to be largely sequestered at depth in dense sulfide liquids that formed the orebodies, preventing its release into the atmosphere and oceans. Flotation of sulfide liquid droplets by surface attachment to gas bubbles has been suggested as a mechanism to overcome this problem and allow introduction of Ni into the atmosphere during eruption of the SLIP lavas. Here we use 2D and 3D X-ray imagery on Noril'sk nickel sulfide, combined with simple thermodynamic models, to show that the Noril'sk ores were degassing while they were forming. Consequent "bubble riding" by sulfide droplets, followed by degassing of the shallow, sulfide-saturated, and exceptionally volatile and Cl-rich SLIP lavas, permitted a massive release of nickel-rich volcanic gas and subsequent global dispersal of nickel released from this gas as aerosol particles.

Keywords: Noril'sk Ni–Cu–PGE deposits | Permian–Triassic mass extinction | sulfide flotation

Significance: The Noril'sk deposits represent one of the most valuable metal concentrations on Earth and are associated with the world's largest outpouring of mafic magma. Mass release of nickel into the atmosphere during ore formation has been postulated as one of the triggers for the Permian–Triassic Mass Extinction Event, by promoting the activity of the marine Archaea methanosarcina with catastrophic greenhouse climatic effects. The missing link has been understanding how nickel, normally retained at depth in magmatic minerals, could have been mobilized into magmatic gases. The flotation of magmatic sulfides to the surface by gas bubbles was suggested as a possible mechanism. Here, we provide evidence of physically attached nickel-rich sulfide droplets and former gas bubbles, frozen into the Noril'sk ores.

Amerika

VON CRAMON-TAUBADEL 2017

Noreen von Cramon-Taubadel, André Strauss & Mark Hubbe, *Evolutionary population history of early Paleoamerican cranial morphology.* Science Advances **3** (2017), e1602289. DOI:10.1126/sciadv.1602289.

The nature and timing of the peopling of the Americas is a subject of intense debate. In particular, it is unclear whether high levels of between-group craniometric

diversity in South America result from multiple migrations or from local diversification processes. Previous attempts to explain this diversity have largely focused on testing alternative dispersal or gene flow models, reaching conflicting or inconclusive results. Here, a novel analytical framework is applied to three-dimensional geometric morphometric data to partition the effects of population divergence from geographically mediated gene flow to understand the ancestry of the early South Americans in the context of global human history. The results show that Paleoamericans share a last common ancestor with contemporary Native American groups outside, rather than inside, the Americas. Therefore, and in accordance with some recent genomic studies, craniometric data suggest that the New World was populated by multiple waves of dispersal from northeast Asia throughout the late Pleistocene and early Holocene.

Kennett 2017

Douglas J. Kennett et al., *Archaeogenomic evidence reveals prehistoric matrilineal dynasty.* Nature Communications **8** (2017), 14115. DOI:10.1038/ncomms14115.

Douglas J. Kennett, Stephen Plog, Richard J. George, Brendan J. Culleton, Adam S. Watson, Pontus Skoglund, Nadin Rohland, Swapan Mallick, Kristin Stewardson, Logan Kistler, Steven A. LeBlanc, Peter M. Whiteley, David Reich & George H. Perry

For societies with writing systems, hereditary leadership is documented as one of the hallmarks of early political complexity and governance. In contrast, it is unknown whether hereditary succession played a role in the early formation of prehistoric complex societies that lacked writing. Here we use an archaeogenomic approach to identify an elite matriline that persisted between 800 and 1130 CE in Chaco Canyon, the centre of an expansive prehistoric complex society in the Southwestern United States. We show that nine individuals buried in an elite crypt at Pueblo Bonito, the largest structure in the canyon, have identical mitochondrial genomes. Analyses of nuclear genome data from six samples with the highest DNA preservation demonstrate mother–daughter and grandmother–grandson relationships, evidence for a multigenerational matrilineal descent group. Together, these results demonstrate the persistence of an elite matriline in Chaco for ≈330 years.

Anthropologie

Goldberg 2017

Amy Goldberg, Torsten Günther, Noah A. Rosenberg & Mattias Jakobsson, *Ancient X chromosomes reveal contrasting sex bias in Neolithic and Bronze Age Eurasian migrations.* PNAS **114** (2017), 2657–2662.

Dramatic events in human prehistory, such as the spread of agriculture to Europe from Anatolia and the late Neolithic/Bronze Age migration from the Pontic-Caspian Steppe, can be investigated using patterns of genetic variation among the people who lived in those times. In particular, studies of differing female and male demographic histories on the basis of ancient genomes can provide information about complexities of social structures and cultural interactions in prehistoric populations. We use a mechanistic admixture model to compare the sex-specifically–inherited X chromosome with the autosomes in 20 early Neolithic and 16 late Neolithic/Bronze Age human remains. Contrary to previous hypotheses suggested by the patrilocality ofmany agricultural populations, we find no

evidence of sex-biased admixture during the migration that spread farming across Europe during the early Neolithic. For later migrations from the Pontic Steppe during the late Neolithic/ Bronze Age, however, we estimate a dramatic male bias, with approximately five to 14 migrating males for every migrating female. We find evidence of ongoing, primarily male, migration from the steppe to central Europe over a period of multiple generations, with a level of sex bias that excludes a pulse migration during a single generation. The contrasting patterns of sex-specific migration during these two migrations suggest a view of differing cultural histories in which the Neolithic transition was driven by mass migration of both males and females in roughly equal numbers, perhaps whole families, whereas the later Bronze Age migration and cultural shift were instead driven by male migration, potentially connected to new technology and conquest.

Keywords: admixture | migration | Neolithic | sex bias | X chromosome

Significance: Studies of differing female and male demographic histories on the basis of ancient genomes can provide insight into the social structures and cultural interactions during major events in human prehistory. We consider the sex-specific demography of two of the largest migrations in recent European prehistory. Using genome-wide ancient genetic data from multiple Eurasian populations spanning the last 10,000 years, we find no evidence of sex-biased migrations from Anatolia, despite the shift to patrilocality associated with the spread of farming. In contrast, we infer a massive male-biased migration from the steppe during the late Neolithic and Bronze Age. The contrasting patterns of sex-specific migration during these two migrations suggest that different sociocultural processes drove the two events.

Pontzer 2017

Herman Pontzer, *The crown joules: energetics, ecology, and evolution in humans and other primates.* Evolutionary Anthropology **26** (2017), 12–24.

Biological diversity is metabolic diversity: Differences in anatomy, physiology, life history, and activity reflect differences in energy allocation and expenditure among traits and tasks. Traditional frameworks in primatology, human ecology, public health, and paleoanthropology view daily energy expenditure as being more variable within than between species, changing with activity level but essentially fixed for a given body size. Growing evidence turns this view on its head. Total energy expenditure (kcal/d), varies relatively little within species, despite variation in physical activity; it varies considerably among species even after controlling for the effect of body size. Embracing this emerging paradigm requires rethinking potential trade-offs in energy allocation within and between species, assessing evidence of metabolic acceleration within lineages, and abandoning activity-based estimates of total energy expenditure. Difficult and exciting work lies ahead in the effort to untangle the ecological and evolutionary pressures shaping primate metabolic diversity.

Keywords: metabolism | primate evolution | human evolution | total energy expenditure | doubly labeled water

Vandormael 2017

Hildward Vandormael, Santiago Herce Castañón, Jan Balaguer, Vickie Li & Christopher Summerfield, *Robust sampling of decision information during perceptual choice.* PNAS **114** (2017), 2771–2776.

Humans move their eyes to gather information about the visual world. However, saccadic sampling has largely been explored in paradigms that involve searching for a lone target in a cluttered array or natural scene. Here, we investigated the policy that humans use to overtly sample information in a perceptual decision task

that required information from across multiple spatial locations to be combined. Participants viewed a spatial array of numbers and judged whether the average was greater or smaller than a reference value. Participants preferentially sampled items that were less diagnostic of the correct answer ("inlying" elements; that is, elements closer to the reference value). This preference to sample inlying items was linked to decisions, enhancing the tendency to give more weight to inlying elements in the final choice ("robust averaging"). These findings contrast with a large body of evidence indicating that gaze is directed preferentially to deviant information during natural scene viewing and visual search, and suggest that humans may sample information "robustly" with their eyes during perceptual decision-making.

Keywords: decision-making | categorization | eye movements | numerical averaging | information sampling

Significance: When making decisions, humans and other primates move their eyes freely to gather information about their environment. A large literature has explored the factors that determine where the eyes fall during natural scene perception and visual search, concluding that deviant or surprising perceptual information attracts attention and gaze. Here, we describe a sampling policy that paradoxically shows that in a decision-making task, the eyes are attracted to expected rather than unexpected information: When classifying the average of an array of numbers, human observers looked by preference at the numbers that were closest to the mean. This policy drove a behavioral tendency to discount the influence of outliers when making choices, leading to "robust" choices about the stimulus array.

Anthropologie Politik

SPINNEY 2017

Laura Spinney, *The Shared Past That Wasn't.* nature **543** (2017), 168–170.

How Facebook, fake news and friends are altering memories and changing history.

His comparison of the two scenarios revealed the importance of 'weak links' in information propagation. These are links between, rather than within, networks — acquaintances, say, rather than friends — and they help to synchronize the versions held by separate networks. "They are probably what drives the formation of communitywide collective memories," he says.

One function of those weak links might be to remind people of information expunged through the processes of memory convergence. But timing is important. In unpublished work, Coman has shown that information introduced by a weak link is much more likely to shape the network's memory if it is introduced before its members talk among themselves. Once a network agrees on what happened, collective memory becomes relatively resistant to competing information.

Coman thinks that memory convergence bolsters group cohesion. "What we find is that adolescents and young adults who know more family stories show better psychological well-being,"

Bibel

EICHLER 2017

Raanan Eichler, *Aaron's Flowering Staff and Manasseh's Asherah.* unknown (2017), preprint, 1–10. .

The story of Aaron's flowering staff interprets the asherah in the temple of YHWH as the age-old staff of Aaron put there at YHWH's command in order to serve as a warning against usurpation of the Aaronic office. By means of this interpretation, the author of the story at once gave qualified approval for the asherah and appropriated its popularly conceived function, namely facilitating the grant of YHWH's blessing, to the Aaronides. In this sense, the story is a counterpart of the non-priestly account of the bronze snake (Num 21:4–9), which is an obvious etiology for the bronze snake Nehushtan destroyed by Hezekiah (2 Kgs 18:4), and which attributes that object's powers of revival to the will of YHWH as carried out through the exclusive authority of Moses.

If this conclusion is correct, it yields additional insights. First, it shows us that there was disagreement among the biblical authors about the very legitimacy of what was likely the central cultic object for many Israelites much of the time, and it illustrates a method by which a biblical author could give qualified approval to an object condemned by his peers. Second, it indicates that the story of Aaron's flowering staff in its essentials must have been composed before or around the time of Josiah's purge, as it is implausible that anyone would compose and successfully propagate a subversive etiology of an object that was not in contemporary use. Unfortunately, this insight cannot easily shed light on the composition of the rest of the priestly literature, the relation of this story to which is debated.

Lang 2017

Bernhard Lang, *New Light on the Levites, The Biblical Group that Invented Belief in Life after Death in Heaven.* In: Eve-Marie Becker, Jan Dietrich & Bo Kristian Holm (Hrsg.), *What is Human? Theological Encounters with Anthropology.* (Göttingen 2017), 65–85.

The Levites, a landless minority group in ancient Israel, were pastoralists. They were known for their ritual skills and the religious knowledge they cultivated. Levi, their eponymous ancestor, is a fictive person; his name means "(ritual) specialist," and can be etymologically explained from the cognate Akkadian adjective le'u, also spelled lewu, "capable, competent, skilled." We may think of the early Levites as itinerant, or at any rate as nomadic pastoralists, some of whom specialised in ritual knowledge, sought to live from it, and presumably recruited others to be trained in the profession.

Within ancient Israelite society, the Levites formed a minority group with a culture that significantly differed from that of the majority. They did not own agricultural land but practised pastoralism on land that was, we assume, not divided into individually owned sections but collectively owned. The land was excluded from their ideology. They did not venerate their ancestors; instead, they worshipped Yahweh, their heavenly patron. Their kin groupwas not held together by ancestor worship; accordingly, their kinship bonds were significantly weaker than those of the majority population. Finally, they hoped for a privileged place in the afterlife. Rather than expecting life after death in Sheol, the Hebrew Hades or netherworld, they expected life after death with God in heaven. We may, as suggested by Herbert Brichto, describe the ideology of the landowning population in terms of "kin, cult, land, and afterlife in Sheol" and define the cult as ancestor worship and the land as arable land. In the case of the Levites, the modified parallel formula would be "God, cult, and afterlife in heaven," a completely religious formula centred on the worship of Yahweh. The cult of the ancestors animated and integrated "kin, cult, land and afterlife in Sheol," forging a harmonious unit of the social, economic, and religious life. By contrast, the worship of Yahweh so dominated the levitical

unit of "God, cult, and afterlife in heaven" that more mundane concerns were excluded.

The shift from ancestor cult and Sheol to worship of God and heaven, though originating in a small group characterised by particular economic circumstances and marked by an elite religious mentality, made an enormous impact on the history of religion. It gave rise to a standard doctrine of the religion of the Western world – belief in a blissful afterlife in heaven.

Biologie

CROWSTON 2017

Jonathan Crowston & Ian Trounce, *Relief for retinal neurons under pressure.* science **355** (2017), 688–689.

A dietary supplement may offer protection from loss of vision in glaucoma.

Another surprising finding by Williams et al. is that the higher dose of dietary nicotinamide not only reversed the aging phenotype in the retina and protected retinal ganglion cells when eye pressure was increased, but also decreased eye pressure in the glaucoma mouse model.

ROGERS 2017

Rebekah L. Rogers & Montgomery Slatkin, *Excess of genomic defects in a woolly mammoth on Wrangel island.* PLoS Genetics **13** (2017), e1006601. DOI:10.1371/journal.pgen.1006601.

Woolly mammoths (Mammuthus primigenius) populated Siberia, Beringia, and North America during the Pleistocene and early Holocene. Recent breakthroughs in ancient DNA sequencing have allowed for complete genome sequencing for two specimens of woolly mammoths (Palkopoulou et al. 2015). One mammoth specimen is from a mainland population 45,000 years ago when mammoths were plentiful. The second, a 4300 yr old specimen, is derived from an isolated population on Wrangel island where mammoths subsisted with small effective population size more than 43-fold lower than previous populations. These extreme differences in effective population size offer a rare opportunity to test nearly neutral models of genome architecture evolution within a single species. Using these previously published mammoth sequences, we identify deletions, retrogenes, and non-functionalizing point mutations. In the Wrangel island mammoth, we identify a greater number of deletions, a larger proportion of deletions affecting gene sequences, a greater number of candidate retrogenes, and an increased number of premature stop codons. This accumulation of detrimental mutations is consistent with genomic meltdown in response to low effective population sizes in the dwindling mammoth population on Wrangel island. In addition, we observe high rates of loss of olfactory receptors and urinary proteins, either because these loci are non-essential or because they were favored by divergent selective pressures in island environments. Finally, at the locus of FOXQ1 we observe two independent loss-of-function mutations, which would confer a satin coat phenotype in this island woolly mammoth.

Author summary:

We observe an excess of detrimental mutations, consistent with genomic meltdown in woolly mammoths on Wrangel Island just prior to extinction. We observe an excess of deletions, an increase in the proportion of deletions affecting gene sequences, and an excess of premature stop codons in response to evolution under low effective population sizes. Large numbers of olfactory receptors appear to have

loss of function mutations in the island mammoth. These results offer genetic support within a single species for nearly-neutral theories of genome evolution. We also observe two independent loss of function mutations at the FOXQ1 locus, likely conferring a satin coat in this unusual woolly mammoth.

Williams 2017

Pete A. Williams et al., *Vitamin B₃ modulates mitochondrial vulnerability and prevents glaucoma in aged mice.* science **355** (2017), 756–760.

s355-0756-Supplement.pdf

Editor's Summary

Glaucoma is the most common cause of age-related blindness in the United States. There is currently no cure, and once vision is lost, the condition is irreversible. Williams et al. now report that vitamin B3 (also known as niacin) prevents eye degeneration in glaucoma-prone mice (see the Perspective by Crowston and Trounce). Supplementing the diets of young mice with vitamin B3 averted early signs of glaucoma. Vitamin B3 also halted further glaucoma development in aged mice that already showed signs of the disease. Thus, healthy intake of vitamin B3 may protect eyesight.

Glaucomas are neurodegenerative diseases that cause vision loss, especially in the elderly. The mechanisms initiating glaucoma and driving neuronal vulnerability during normal aging are unknown. Studying glaucoma-prone mice, we show that mitochondrial abnormalities are an early driver of neuronal dysfunction, occurring before detectable degeneration. Retinal levels of nicotinamide adenine dinucleotide (NAD+, a key molecule in energy and redox metabolism) decrease with age and render aging neurons vulnerable to disease-related insults. Oral administration of the NAD+ precursor nicotinamide (vitamin B3), and/or gene therapy (driving expression of Nmnat1, a key NAD+-producing enzyme), was protective both prophylactically and as an intervention. At the highest dose tested, 93 % of eyes did not develop glaucoma. This supports therapeutic use of vitamin B3 in glaucoma and potentially other age-related neurodegenerations.

Klima

Bradley 2014

Raymond S. Bradley, *Paleoclimatology*, *Reconstructing Climates of the Quaternary.* (Amsterdam ³2015).

All sections have been comprehensively revised and updated, but in particular, the book includes new material on dating (including updates on calibration of the radiocarbon timescale and surface exposure dating) extensively revised chapters on ice cores and marine sediments and ocean circulation in the past, new chapters on loess, speleothems, lake sediments, and corals and greatly revised chapters on insects, pollen analysis, tree rings, and historical records.

Over 1200 new references have been added, almost all of them published within the last decade, and there are ≈200 new figures, all with detailed explanatory captions.

Kultur

FRACHETTI 2017

Michael D. Frachetti, C. Evan Smith, Cynthia M. Traub & Tim Williams, *Nomadic ecology shaped the highland geography of Asia's Silk Roads.* nature **543** (2017), 193–198.

There are many unanswered questions about the evolution of the ancient 'Silk Roads' across Asia. This is especially the case in their mountainous stretches, where harsh terrain is seen as an impediment to travel. Considering the ecology and mobility of inner Asian mountain pastoralists, we use 'flow accumulation' modelling to calculate the annual routes of nomadic societies (from 750 m to 4,000 m elevation). Aggregating 500 iterations of the model reveals a high-resolution flow network that simulates how centuries of seasonal nomadic herding could shape discrete routes of connectivity across the mountains of Asia. We then compare the locations of known high-elevation Silk Road sites with the geography of these optimized herding flows, and find a significant correspondence in mountainous regions. Thus, we argue that highland Silk Road networks (from 750 m to 4,000 m) emerged slowly in relation to long-established mobility patterns of nomadic herders in the mountains of inner Asia.

HARROWER 2017

Michael J. Harrower & Ioana A. Dumitru, *Digital maps illuminate ancient trade routes.* nature **543** (2017), 188–189.

How did the relationship between human societies and their surrounding terrain shape the formation of long-distance trade networks such as the Silk Road? Digital mapping and computer modelling offer insights.

MATTIOLI 2017

Tommaso Mattioli & Margarita Díaz-Andreu, *Hearing rock art landscapes, A survey of the acoustical perception in the Sierra de San Serván area in Extremadura (Spain).* Time and Mind **10** (2017), 81–96.

This article focuses on the augmented audibility of distant sounds that is experienced in some rock art sites. We propose a method developed in acoustical physics to measure this acoustic phenomenon, the Transmission Loss (TL) analysis. We have assessed the validity of the method in our study area, the Sierra de San Serván in the region of Extremadura (Spain), an area where from the hundreds of shelters only sixty five were decorated with Schematic art during prehistory. The analysis undertaken in it has provided unequivocal data that indicate that augmented audibility of distant sounds seemed to be a factor considered by the prehistoric artists for the selection of rock art shelters to paint in. This is especially made clear when a comparison between the results obtained in shelters with rock art and others in the same area without it is made. From all the sites one stands out, that of Las Palomas 2, with the best results. This site is also special for other features that no other site in the area has in terms of difficult access and high visibility.

Keywords: Rock art | acoustics | augmented audibility of distant sounds | control of the landscape | Transmission Loss (TL) analysis

Metallzeiten

ADAMS 2017

Matthew J. Adams, *Djehutihotep and Megiddo in the Early Middle Bronze Age.* Journal of Ancient Egyptian Interconnections **13** (2017), 48–58.

The fragment of an Egyptian statue of Djehutihotep found at Megiddo by the Oriental Institute of the University of Chicago (OI) has been long known. It was found with three uninscribed Egyptian statue fragments reused in the foundations of Temple 2048, attributed to Stratum VII, which was dated by them to the Late Bronze Age IIB, 13th– 12th century BCE. A recent reevaluation of the stratigraphy of the cultic area of Megiddo (OI: Area BB; TAU: Area J) based on new excavations, however, demonstrates that the foundation of Temple 2048 should be assigned to Stratum XII dated to the early Middle Bronze Age II. The new dating of the findspot of the Djehutihotep statue fragment narrows the window of time for the arrival of the statue at Megiddo to the lifetime of Djehutihotep, supports a high chronology for the Middle Bronze Age, and demonstrates direct contact between Egypt and Megiddo in the Middle Bronze Age I. This paper reviews the new data on the archaeological context and reevaluates the implications of Djehutihotep at Megiddo.

Mittelpaläolithikum

CALLAWAY 2017

Ewen Callaway, *Plaque DNA hints at Neanderthal lifestyle.* nature **543** (2017), 163.

Tooth analysis paints intimate picture of ancient lives.

However, Hervé Bocherens, a palaeobiologist at the University of Tübingen, Germany, is unconvinced that the plaque DNA identifies meals and dietary differences. Databases of plant and animal DNA tend to lack the extinct species that Neanderthals would have eaten, and previous studies have suggested that both groups ate meat. "At the moment I would not consider the conclusion robust," he says.

Neolithikum

KRAUSS 2017

Raiko Krauß, Elena Marinova, Hanne De Brue & Bernhard Weninger, *The rapid spread of early farming from the Aegean into the Balkans via the Sub-Mediterranean-Aegean Vegetation Zone.* Quaternary International (2017), preprint, 1–18. DOI:10.1016/j.quaint.2017.01.019.

Close examination of the geographic position of Early Neolithic settlements in SE-Europe shows that the oldest sites are almost exclusively situated in some very specific biogeographic areas. These earliest Neolithic settlements are all concentrated in a region that Pavle Cikovac calls the Sub-MediterraneanAegean (SMA) biogeographic region. It covers the northern and north-western edge of the Aegean, including Thessaly, Greek Macedonia and Greek Thrace, and extends further into the Balkans, but only along the valleys of the Vardar (Axios), Struma (Strymon) and Mesta (Nestos) rivers. Surprisingly, although Thrace is the closest landscape to Anatolia, it does not contain any sites of the earliest phase of the Neolithic at all beyond the narrow zone of the northern Marmara. In the present paper

we explain this remarkable situation in terms of the natural environment in this particular region of the Southern Balkans. To begin, we propose that the lack of oldest Early Neolithic settlements in Thrace is related to the extreme microclimate of this region. As shown by modern vegetation analogues, Thracian oriental hornbeam-downy oak forests are exposed to stronger continental influence with frosts in the winter and average temperatures during the coldest months that are ca. 2–3 .C lower than those in the Central Balkans that have Sub-Mediterranean vegetation. In general terms, what we may expect is that the earliest Neolithic groups would first appear in regions with similarly mild conditions, on a yearly average, to those in the Mediterranean. Such mild conditions are indeed present in the SMA biogeographic region. On the other hand, before moving further to the north along the north-south oriented river systems of the Central Balkans, the Neolithic economy based on agriculture and stockbreeding would first have to be adapted to the relatively harsh winters in the Balkans. In consequence, it would have been possible to apply the new Neolithic lifestyle in the neighbouring areas of Thrace, Walachia, Dobrudzha and the Carpathian Basin only after a certain period of adaptation. Available 14C-data show that the adaptation period is identical to the time-span of Rapid Climate Change (RCC: 6550-6050 calBC) as defined in previous studies.

Politik Anthropologie

Kahan 2017

Dan M. Kahan, Asheley Landrum, Katie Carpenter, Laura Helft & Kathleen Hall Jamieson, *Science Curiosity and Political Information Processing.* Advances in Political Psychology **38** (2017), Supplement 1, 179–199.

This article describes evidence suggesting that science curiosity counteracts politically biased information processing. This finding is in tension with two bodies of research. The first casts doubt on the existence of "curiosity" as a measurable disposition. The other suggests that individual differences in cognition related to science comprehension—of which science curiosity, if it exists, would presumably be one—do not mitigate politically biased information processing but instead aggravate it. The article describes the scale-development strategy employed to overcome the problems associated with measuring science curiosity. It also reports data, observational and experimental, showing that science curiosity promotes open-minded engagement with information that is contrary to individuals' political predispositions. We conclude by identifying a series of concrete research questions posed by these results.

Keywords: science curiosity | motivated reasoning | polarization

Religion

Becker 2017

Eve-Marie Becker, Jan Dietrich & Bo Kristian Holm (Hrsg.), *What is Human? Theological Encounters with Anthropology.* (Göttingen 2017).

Already Scripture asks many questions regarding anthropological problems. In the 20th century, the scholarly field of anthropology has become a lot more complex heuristically, methodically and hermeneutically. Therefore, modern research needs to answer arisen questions considering a wide range of disciplines: Sociology,

Philosophy, Ethics and also Empirical Research. This volume is an interdisciplinary project within theology. Contributions seek to not only reflect the state of the art in anthropological research from a theological point of view, but also provide a theological interpretation of one virulent question: What is a Human?

Zündung

D'ADAMO 2017

Alessandro d'Adamo, Sebastiano Breda, Stefano Fontanesi, Adrian Irimescu, Simona Silvia Merola & Cinzia Tornatore, *A RANS knock model to predict the statistical occurrence of engine knock.* Applied Energy **191** (2017), 251–263.

Highlights:
- Development of a new RANS model for SI engine knock probability.
- Turbulence-derived transport equations for variances of mixture fraction and enthalpy.
- Gasoline autoignition delay times calculated from detailed chemical kinetics.
- Knock probability validated against experiments on optically accessible GDI unit.
- PDF-based knock model accounting for the random nature of SI engine knock in RANS simulations.

In the recent past engine knock emerged as one of the main limiting aspects for the achievement of higher efficiency targets in modern spark-ignition (SI) engines. To attain these requirements, engine operating points must be moved as close as possible to the onset of abnormal combustions, although the turbulent nature of flow field and SI combustion leads to possibly ample fluctuations between consecutive engine cycles. This forces engine designers to distance the target condition from its theoretical optimum in order to prevent abnormal combustion, which can potentially damage engine components because of few individual heavy-knocking cycles.

A statistically based RANS knockmodel is presented in this study,whose aim is the prediction not only of the ensemble average knock occurrence, poorly meaningful in such a stochastic event, but also of a knock probability. The model is based on look-up tables of autoignition times from detailed chemistry, coupled with transport equations for the variance of mixture fraction and enthalpy. The transported perturbations around the ensemble average value are based on variable gradients and on a local turbulent time scale. Amulti-variate cell-based Gaussian-PDF model is proposed for the unburnt mixture, resulting in a statistical distribution for the in-cell reaction rate. An average knock precursor and its variance are independently calculated and transported; this results in the prediction of an earliest knock probability preceding the ensemble average knock onset, as confirmed by the experimental evidence. The proposedmodel estimates not only the regions where the average knock is promoted, but also where and when the first knock is more likely to be encountered.

The application of themodel to a RANS simulation of amodern turbocharged direct injection (DI) SI engine with optical access is presented and the analysis of the knock statistical occurrence obtained by the proposed model adds an innovative contribution to overcome the limitation of consolidated "average knock" analyses typical of a RANS approach.

Keywords: Knock | Knock probability | Spark ignition | Autoignition | SI combustion | Detailed chemistry

Badawy 2017

Tawfik Badawy, XiuChao Bao & Hongming Xu, *Impact of spark plug gap on flame kernel propagation and engine performance.* Applied Energy **191** (2017), 311–327.

Highlights:

- Effects of the spark plug gap on flame kernel growth area and radius were examined.
- Flame front development on the horizontal swirl plane were investigated.
- Effects of the spark plug gap on engine performance and emissions were investigated.

Experimental optical and thermal tests were carried out in a constant-volume combustion chamber and a single cylinder gasoline direct injection (GDI) engine to obtain a comprehensive understanding of the effects of spark plug electrode gap on flame kernel development, engine performance, and emissions. High-speed Schlieren visualization was utilized to study the flame kernel growth at different equivalence ratios. Planar Laser Induced Fluorescence (PLIF) was employed to investigate the combustion zone and the flame front development on the horizontal swirl plane after spark ignition. High-speed imaging technique was carried out to study turbulent flame propagation. Combustion analysis, using in-cylinder pressure data and Mass Fraction Burned (MFB) was employed, along with exhaust emissions measurement to obtain a better understanding of the spark plug gap effects on engine performance and emissions. It is found that the flame kernel growth area increases as the spark plug gap increases. PLIF imaging for the combustion process inside the GDI engine demonstrate a larger flame kernel associated with the larger gap. The maximum in-cylinder pressure, turbulent flame speed, heat release rate, and the mass fraction burned increases with the spark plug gap. The engine output increases slightly and the combustion process becomes more stable due to the reduction in cyclic variations as the spark plug gap increases. With the maximum spark plug gap, the engine produces minimum hydrocarbon emissions and particulate number concentration. NOx emissions are increased as the spark plug gap becomes wider due to the higher temperature accompanied with the increase in flame speed and in-cylinder pressure.

Keywords: GDI engine | Spark plug gap | Flame front | Combustion | Emissions

Pan 2017

Jiaying Pan, Haiqiao Wei, Gequn Shu, Mingzhang Pan, Dengquan Feng & Nan Li, *LES analysis for auto-ignition induced abnormal combustion based on a downsized SI engine.* Applied Energy **191** (2017), 183–192.

Highlights:

- Knock and super-knock are studied using LES with detailed chemistry solver.
- Classical knocking intensity varies proportionally with spark-ignition timing.
- Low-temperature chemical reaction plays important role in super-knock formation.
- Developing detonation can be induced by multiple or single hot-spot auto-ignition.
- Developing detonation wave directly by single hot-spot produce stronger knocking.

Engine knock and super-knock have become the main barriers to significantly improving engine thermal efficiency. To further study the nature of the abnormal combustion, this work quantitatively investigates engine knock and super-knock using a Large Eddy Simulation framework coupling detailed chemistry solver.

Firstly, classical knocking cycles with different knocking intensities have been calculated through adjusting spark-ignition timing. It shows that knocking onset and intensity vary proportionally with the advance of spark-ignition timing, however, super-knock events are not observed under the operation conditions. Then for a given spark-ignition timing, the blends of Primary Reference Fuels are introduced in order to obtain different octane number of mixture, through which super-knock events with stronger knocking intensity are observed. The results show that as the decreases of octane number, knocking onset is significantly advanced due to the enhancement of low-temperature chemical reactivity. Consequently, more auto-ignition centers appear at hot exhaust valve side and even cool intake valve side at very low octane number. But for the knocking intensity, it does not always show a proportional correlation with octane number during super-knock. Further auto-ignition scenarios show that developing detonation wave can be induced by both multiple hot-spots auto-ignition and directly by single hot-spot autoignition, with different reaction front curvatures. However, the later seems to produce much stronger knocking intensity, especially when there are several developing detonation waves during superknock. Therefore, how to effectively regulate local auto-ignition initiation and development seems the key to the avoidance of abnormal combustion in modern engines.

Keywords: Engine knock | Super-knock | Auto-ignition | Primary Reference Fuel | Developing detonation

Wang 2017

Chongming Wang, Soheil Zeraati-Rezaei, Liming Xiang & Hongming Xu, *Ethanol blends in spark ignition engines*, *RON, octane-added value, cooling effect, compression ratio, and potential engine efficiency gain.* Applied Energy **191** (2017), 603–619.

Highlights:
- Literature about ethanol blends in SI engines is reviewed.
- Octane-added value is proposed for ethanol blends.
- Charge cooling effect of ethanol fuels is quantitatively assessed.
- Engine efficiency gain from ethanol blends is predicted.

Identifying a sustainable, practical and low-emission energy supply for modern transportation has always been a challenge for energy and automotive researchers. While electrification of the vehicle powertrain is a promising long-term energy supply solution, bio-ethanol is currently playing an important role as a short- and mid-term solution for the popular spark ignition (SI) engine. The questions of how to use ethanol more effectively as an octane booster, how much potential engine thermal efficiency gain can be achieved by using ethanol blends and what their impacts on the vehicle mileage range are have become highly relevant. In this paper, a critical review and discussion regarding these questions is provided. Firstly, studies regarding octane rating and octane index of gasoline fuels, and K value (a scaling factor for calculating octane index) for various SI engines are reviewed. Then, a review of the research octane number (RON), motor octane number (MON) and octane sensitivity for ethanol blends is reported. Three established models for predicting RON of ethanol blends are reviewed and compared. In addition, a simple RON prediction model proposed by the authors of this paper is provided. Parameters such as octane value and octane-added index (OAI) are proposed to describe the effectiveness of using ethanol as an octane booster. It is found that there exits an optimised ethanol blend ratio that gives the maximum octane value; and this optimised blend ratio is insensitive to the octane rating of the base gasoline. Secondly, the charge cooling effect of ethanol blends and its corresponding equivalent octane number are discussed and reviewed. Thirdly, engine

thermal efficiency improvement due to increased compression ratios, which results from the octane index gain achieved by using ethanol blends, is reviewed. Finally, a discussion about the impact of ethanol blends on the vehicle mileage range is presented. The lower heating value of ethanol is about 33 % lower than that of typical gasoline, leading to a reduction in the mileage range of the vehicle, however, improved engine thermal efficiency achieved by using ethanol blends can partially, or even fully, offset the negative impact of the lower calorific value on the mileage range.