Liste erstellt am 2014-01-18

Literatur

Aktuell

Bortolini 2014

Maria Cátira Bortolini, Rolando González-José, Sandro L. Bonatto & Fabricio R. Santos, *Reconciling pre-Columbian settlement hypotheses requires integrative, multidisciplinary, and model-bound approaches*. PNAS **111** (2014), E213–E214.

Bouckaert 2014

R. Bouckaert et al., *Correction for: Mapping the origins and expansion of the Indo-European language family*. science **342** (2014), 1446.

Two points in the main text also need correcting. First, the analysis, in which the authors constrain the tree topology to fit with an alternative pattern of diversification, still shows strong support for an Anatolian origin, but the Bayes factors are slightly different (BFSteppe I = 174.02, BFSteppe II = 145.35). Second, in the revised analysis, the five major Indo-European subfamilies—Celtic, Germanic, Italic, Balto-Slavic, and Indo-Iranian—all emerged as distinct lineages between 4000 and 7000 years ago, not between 4000 and 6000 years ago as previously stated.

Gibbons 2013

Ann Gibbons, *The Thousand-Year Graveyard*. science **342** (2013), 1306–1310.

Scientists uncover a tortured history of disease and death from the Middle Ages onward.

Hazari 2013

Zahra Hazari, Geoff Potvin, Robynne M. Lock, Florin Lung, Gerhard Sonnert & Philip M. Sadler, *Factors that affect the physical science career interest of female students, Testing five common hypotheses*. Physical Review Special Topics – Physics Education Research **9** (2013), 20115. DOI:10.1103/PhysRevSTPER.9.020115.

There are many hypotheses regarding factors that may encourage female students to pursue careers in the physical sciences. Using multivariate matching methods on national data drawn from the Persistence Research in Science and Engineering (PRiSE) project (n = 7505), we test the following five commonly held beliefs regarding what factors might impact females' physical science career interest: (i) having a single-sex physics class, (ii) having a female physics teacher, (iii) having female scientist guest speakers in physics class, (iv) discussing the work of female scientists in physics class, and (v) discussing the underrepresentation of women in physics class. The effect of these experiences on physical science career interest is compared for female students who are matched on several factors, including prior science interests, prior mathematics interests, grades in science, grades in mathematics, and years of enrollment in high school physics. No significant effects are found for single-sex classes, female teachers, female scientist guest speakers, and discussing the work of female scientists. However, discussions about women's underrepresentation have a significant positive effect.

Hilbe 2014

Christian Hilbe, Arne Traulsen, Torsten Röhl & Manfred Milinski, *Democratic decisions establish stable authorities that overcome the paradox of second-order punishment*. PNAS **111** (2014), 752–756.
Individuals usually punish free riders but refuse to sanction those who cooperate but do not punish. This missing second-order peer punishment is a fundamental problem for the stabilization of cooperation. To solve this problem, most societies today have implemented central authorities that punish free riders and tax evaders alike, such that second-order punishment is fully established. The emergence of such stable authorities from individual decisions, however, creates a new paradox: it seems absurd to expect individuals who do not engage in second-order punishment to strive for an authority that does. Herein, we provide a mathematical model and experimental results from a public goods game where subjects can choose between a community with and without second-order punishment in two different ways. When subjects can migrate continuously to either community, we identify a bias toward institutions that do not punish tax evaders. When subjects have to vote once for all rounds of the game and have to accept the decision of the majority, they prefer a society with second-order punishment. These findings uncover the existence of a democracy premium. The majority-voting rule allows subjects to commit themselves and to implement institutions that eventually lead to a higher welfare for all.
evolution of cooperation | pool punishment | institution formation

Inzlicht 2014

Michael Inzlicht, Brandon J. Schmeichel & C. Neil Macrae, *Why self-control seems (but may not be) limited*. Trends in Cognitive Sciences (2014), preprint, 1–7. DOI:10.1016/j.tics.2013.12.009.
Self-control refers to the mental processes that allow people to override thoughts and emotions, thus enabling behavior to vary adaptively from moment to moment. Dominating contemporary research on this topic is the viewpoint that self-control relies upon a limited resource, such that engaging in acts of restraint depletes this inner capacity and undermines subsequent attempts at control (i.e., ego depletion). Noting theoretical and empirical problems with this view, here we advance a competing model that develops a nonresourcebased account of self-control. We suggest that apparent regulatory failures reflect the motivated switching of task priorities as people strive to strike an optimal balance between engaging cognitive labor to pursue 'have-to' goals versus preferring cognitive leisure in the pursuit of 'want-to' goals.

Jones 2013

Nicola Jones, *The Quantum Company*. nature **498** (2013), 286–288.
D-Wave is pioneering a novel way of making quantum computers — but it is also courting controversy.

Jones 2014

Nicola Jones, *The Learning Machines*. nature **505** (2014), 146–148.
Using massive amounts of data to recognize photos and speech, deep-learning computers are taking a big step towards true artificial intelligence.

Kaiser 2014

David Kaiser, *Shut up and calculate!* nature **505** (2014), 153–155.

Practical, interdisciplinary ways of working forged during the Second World War had a lasting impact on a generation of physicists and their findings, says David Kaiser.

Amerika

FAGUNDES 2008

Nelson J. R. Fagundes, Ricardo Kanitz & Sandro L. Bonatto, *A Reevaluation of the Native American MtDNA Genome Diversity and Its Bearing on the Models of Early Colonization of Beringia*. PLoS ONE **3** (2008), e3157. DOI:10.1371/journal.pone.0003157.

The Americas were the last continents to be populated by humans, and their colonization represents a very interesting chapter in our species' evolution in which important issues are still contentious or largely unknown. One difficult topic concerns the details of the early peopling of Beringia, such as for how long it was colonized before people moved into the Americas and the demography of this occupation. A recent work using mitochondrial genome (mtDNA) data presented evidence for a so called "three-stage model" consisting of a very early expansion into Beringia followed by ,20,000 years of population stability before the final entry into the Americas. However, these results are in disagreement with other recent studies using similar data and methods. Here, we reanalyze their data to check the robustness of this model and test the ability of Native American mtDNA to discriminate details of the early colonization of Beringia. We apply the Bayesian Skyline Plot approach to recover the past demographic dynamic underpinning these events using different mtDNA data sets. Our results refute the specific details of the "three-stage model", since the early stage of expansion into Beringia followed by a long period of stasis could not be reproduced in any mtDNA data set cleaned from non-Native American haplotypes. Nevertheless, they are consistent with a moderate population bottleneck in Beringia associated with the Last Glacial Maximum followed by a strong population growth around 18,000 years ago as suggested by other recent studies. We suggest that this bottleneck erased the signals of ancient demographic history from recent Native American mtDNA pool, and conclude that the proposed early expansion and occupation of Beringia is an artifact caused by the misincorporation of non-Native American haplotypes.

MCMICHAEL 2014

C. H. McMichael et al., *Predicting pre-Columbian anthropogenic soils in Amazonia*. Proc. Royal Society B (2014), preprint, 1–9. DOI:10.1098/rspb.2013.2475.

ProcRSocB2014-preprint-Supplement0116.pdf

C. H. McMichael, M. W. Palace, M. B. Bush, B. Braswell, S. Hagen, E. G. Neves, M. R. Silman, E. K. Tamanaha & C. Czarnecki

The extent and intensity of pre-Columbian impacts on lowland Amazonia have remained uncertain and controversial. Various indicators can be used to gauge the impact of pre-Columbian societies, but the formation of nutrientenriched terra preta soils has been widely accepted as an indication of long-term settlement and site fidelity. Using known and newly discovered terra preta sites and maximum entropy algorithms (Maxent), we determined the influence of regional environmental conditions on the likelihood that terra pretas would have been formed at any given location in lowland Amazonia. Terra pretas were most frequently found in central and eastern Amazonia along the lower courses of the major Amazonian rivers. Terrain, hydrologic and soil characteristics were more important predictors of

terra preta distributions than climatic conditions. Our modelling efforts indicated that terra pretas are likely to be found throughout ca 154 063 km2 or 3.2 % of the forest. We also predict that terra preta formation was limited in most of western Amazonia. Model results suggested that the distribution of terra pretawas highly predictable based on environmental parameters.We provided targets for future archaeological surveys under the vast forest canopy and also highlighted how few of the long-term forest inventory sites in Amazonia are able to capture the effects of historical disturbance.

Subject Areas: ecology, environmental science
Keywords: Amazonia, anthrosols, maxent algorithms, modified soils, pre-Columbian impacts, terra preta

Anthropologie

Cahill 2014

Larry Cahill, *Fundamental sex difference in human brain architecture*. PNAS **111** (2014), 577–578.

Biomedical research in general, and neuroscience in particular, has been built on a false assumption. I refer to the assumption that one may safely ignore potential sex influences, for essentially every domain outside sexual functions and sex-specific issues like prostate function, and still learn everything fundamental there is to learn. Widespread acceptance of this false assumption among neuroscientists is the reason they still overwhelmingly use only males in their animal experiments while implying that their results will apply equally to females and why potential sex influences are still routinely ignored or dismissed even when both sexes are studied, as in many human subject and knockout mouse studies.

This neuroanatomical conclusion is striking, as it appears to dovetail nicely with one of, if not the, most consistently supported principle in the literature regarding human sex differences, namely, that the brains of men tend to be more asymmetrically organized across the two hemispheres than are those of women, as documented in numerous reviews (5–7). Ingalhalikar et al. now give this well-established sex difference a very plausible anatomical basis.

Theirs is a landmark paper that should accelerate acceptance of the notion that, for those who want to understand how brains function, sex matters.

Ingalhalikar 2014

Madhura Ingalhalikar et al., *Sex differences in the structural connectome of the human brain*. PNAS **111** (2014), 823–828.

Madhura Ingalhalikar, Alex Smith, Drew Parker, Theodore D. Satterthwaite, Mark A. Elliott, Kosha Ruparel, Hakon Hakonarson, Raquel E. Gur, Ruben C. Gur & Ragini Verma

Sex differences in human behavior show adaptive complementarity: Males have better motor and spatial abilities, whereas females have superior memory and social cognition skills. Studies also show sex differences in human brains but do not explain this complementarity. In this work, we modeled the structural connectome using diffusion tensor imaging in a sample of 949 youths (aged 8–22 y, 428 males and 521 females) and discovered unique sex differences in brain connectivity during the course of development. Connection-wise statistical analysis, as well as analysis of regional and global network measures, presented a comprehensive description of network characteristics. In all supratentorial regions, males had greater within-hemispheric connectivity, as well as enhanced modularity and transitivity,

whereas between-hemispheric connectivity and cross-module participation predominated in females. However, this effect was reversed in the cerebellar connections. Analysis of these changes developmentally demonstrated differences in trajectory between males and females mainly in adolescence and in adulthood. Overall, the results suggest thatmale brains are structured to facilitate connectivity between perception and coordinated action, whereas female brains are designed to facilitate communication between analytical and intuitive processing modes.
diffusion imaging | gender differences

Oosterbeek 2010

Luiz Oosterbeek, Stefano Grimaldi, Pierluigi Rosina, Sara Cura, Pedro P. Cunha & António Martins, *The earliest Pleistocene archaeological sites in western Iberia: Present evidence and research prospects*. Quaternary International **223** (2010), 399–407.

Archaeological evidence for the earliest human presence in western Iberia is summarised and discussed. Western Iberia is geologically characterised by magmatic and metamorphic rocks (Hesperian Massif) but also by siliciclastic and carbonate Mesozoic and Cenozoic formations. The geological context affects the distribution of Pleistocene archaeological sites, as the most of the archaeological evidence known today is located in river terrace formations or in karst deposits. Very few sites have been fully investigated; the older ones are tentatively dated as middle/late Middle Pleistocene. Recent results have been obtained using an archaeological and geomorphological approach carried out in the Portuguese region of Alto Ribatejo. Dating of the lithic assemblages found in fluvial terraces or in cave deposits indicates that the first human presence in Portugal is not older than the OIS 8–9. However, it remains difficult to explain the long chronological gap between the archaeological evidences in western Iberia and the older sites in central and eastern Iberia, such as those in the Sierra de Atapuerca and Guadix Baxa areas.

Biologie

Pennisi 2013

Elizabeth Pennisi, *Cave Fish Study Supports Controversial Evolutionary Mechanism*. science **342** (2013), 1304.

Rohner 2013

Nicolas Rohner et al., *Cryptic Variation in Morphological Evolution, HSP90 as a Capacitor for Loss of Eyes in Cavefish*. science **342** (2013), 1372–1375.

s342-1372-Supplement.pdf
Nicolas Rohner, Dan F. Jarosz, Johanna E. Kowalko, Masato Yoshizawa, William R. Jeffery, Richard L. Borowsky, Susan Lindquist & Clifford J. Tabin
In the process of morphological evolution, the extent to which cryptic, preexisting variation provides a substrate for natural selection has been controversial. We provide evidence that heat shock protein 90 (HSP90) phenotypically masks standing eye-size variation in surface populations of the cavefish Astyanax mexicanus. This variation is exposed by HSP90 inhibition and can be selected for, ultimately yielding a reduced-eye phenotype even in the presence of full HSP90 activity. Raising surface fish under conditions found in caves taxes the HSP90 system, unmasking the same phenotypic variation as does direct inhibition of HSP90. These results suggest that cryptic variation played a role in the evolution of eye loss in cavefish

and provide the first evidence for HSP90 as a capacitor for morphological evolution in a natural setting.

Energie

Renneberg 2011

Wolfgang Renneberg, *Grenzen und Sicherheitsrisiken des Lastfolgebetriebs von Kernkraftwerken*, *Studie im Auftrag von Greenpeace*. (Bonn 2011). <http://www.atomsicherheit.de/studien-und-statements/risiken-des-lastfolgewechsels/> (2014-01-13).

Insbesondere durch die Einspeisung von Wind- und Solarstrom kommt es bereits jetzt und in weit erhöhtem Maße in der Zukunft immer öfter zu einem kurz- bis mittelfristigem zeitlich sehr schwankenden Überangebot von elektrischer Energie im Stromnetz. Dies zwingt die Energieversorgungsunternehmen dazu, auch die Leistung von Kernkraftwerken immer öfter und immer weiter herunter zu regeln und etwa bei Windflaute oder Bewölkung kurzfristig wieder hochzufahren.
Legt man ein gesichertes Regelvolumen von 30 % der installierten Kernkraftwerksleistung zugrunde sowie die heute verfügbare Leistung von 20, 37 GW, so stehen unter Berücksichtigung der laufzeitbedingten Abschaltung von ein bis zwei Kernkraftwerken bis zu diesem Zeitpunkt höchsten 5 GW Regelreserve aus dem gesamten Kernkraftwerkspark zur Verfügung. Dieses Regelpotential steht einer witterungsbedingten Einspeisung aus Wind- und Solarstromanlagen von mehr als 60 GW gegenüber (ewi, gws, prognos, 2010) (IWES, 2009). Im Verhältnis zur Schwankung der Einspeisung Wind- und Solarstromerzeugung um 50 GW betrüge das Regelpotential der Kernenergie 10 %. Die Kernenergie könnte damit lediglich 10 % der Schwankungen der Wind- und Solarstromeinspeisung ausgleichen.

Klima

Barrows 2014

Timothy T. Barrows et al., *A White Nile megalake during the last interglacial period*. Geology (2014), preprint, 1–5. DOI:10.1130/G35238.1.

Timothy T. Barrows, Martin A. J. Williams, Stephanie C. Mills, Geoff A. T. Duller, L. Keith Fifield, David Haberlah, Stephen G. Tims & Frances M. Williams
The eastern Sahara Desert of Africa is one of the most climatically sensitive areas on Earth, varying from lake-studded savannah woodland to hyperarid desert over the course of a glacial-interglacial cycle. In currently semiarid Sudan there is widespread evidence that a very large freshwater lake once filled the White Nile River valley. Here we present the first quantitative estimate for the dimensions of the lake and a direct age for the emplacement of its shoreline. Using a profile dating approach with the cosmogenic nuclide 10Be, we estimate an exposure age of 109 ± 8 ka for this megalake, indicating that it probably formed during the last interglacial period. This age is supported by optically stimulated luminescence dating of Blue Nile paleochannels associated with the lake. Using a high-resolution digital elevation model, we estimate that the lake was more than 45,000 km2 in area, making it comparable to the largest freshwater lakes on Earth today. We attribute the lake's existence to seasonal flood pulses as a result of local damming of the White Nile by a more southern position of the Blue Nile and greatly increased precipitation associated with an enhanced monsoon.

Lynch-Stieglitz 2014

Jean Lynch-Stieglitz et al., *Muted change in Atlantic overturning circulation over some glacial-aged Heinrich events*. Nature Geoscience (2014), preprint, 1–7. DOI:10.1038/NGEO2045.

NatGeo2014-preprint-Supplement0118a.pdf, NatGeo2014-preprint-Supplement0118b.xls

Jean Lynch-Stieglitz, Matthew W. Schmidt, L. Gene Henry, William B. Curry, Luke C. Skinner, Stefan Mulitza, Rong Zhang & Ping Chang

Heinrich events—surges of icebergs into the North Atlantic Ocean—punctuated the last glacial period. The events are associated with millennial-scale cooling in the Northern Hemisphere. Fresh water from the melting icebergs is thought to have interrupted the Atlantic meridional overturning circulation, thus minimizing heat transport into the northern North Atlantic. The northward flow of warm water passes through the Florida Straits and is reflected in the distribution of seawater properties in this region. Here we investigate the northward flow through this region over the past 40,000 years using oxygen isotope measurements of benthic foraminifera from two cores on either side of the Florida Straits. These measurements allow us to estimate water density, which is related to flow through the thermal wind balance. We infer a substantial reduction of flow during Heinrich Event 1 and the Younger Dryas cooling, but little change during Heinrich Events 2 and 3, which occurred during an especially cold phase of the last glacial period.We speculate that because glacial circulation was already weakened before the onset of Heinrich Events 2 and 3, freshwater forcing had little additional effect. However, low-latitude climate perturbations were observed during all events.We therefore suggest that these perturbations may not have been directly caused by changes in heat transport associated with Atlantic overturning circulation as commonly assumed.

Oh 2014

Jeseung Oh, Elizabeth Reischmann & José A. Rial, *Polar synchronization and the synchronized climatic history of Greenland and Antarctica*. Quaternary Science Reviews **83** (2014), 129–142.

Stable isotope proxies from ice cores show subtle differences in the climatic fluctuations of the Arctic and Antarctic, and recent analyses have revealed evidence of polar synchronization at the millennial time scale. At this scale, we analogize the polar climates of the last ice ages to two coupled nonlinear oscillators, which adjust their natural rhythms until they synchronize at a common frequency and constant phase shift. Heat and mass transfers across the intervening ocean and atmosphere make the coupling possible. Here we statistically demonstrate the existence of this phenomenon in polar proxy records with methane-matched age models, and quantify their phase relationship. We show that the time series of representative proxy records of the last glaciation recorded in Greenland (GRIP, NGRIP) and Antarctica (Byrd, Dome C) satisfy phase synchronization conditions, independently of age, for periods ranging 1–6 ky, and can be transformed into one another by a pi/2 phase shift, with Antarctica temperature variations leading Greenland's. Based on these results, we use the polar synchronization paradigm to replicate the 800 ky-long, Antarctic, EPICA time series from a theoretical model that extends Greenland's 100 ky-long GRIP record to 800 ky. Statistical analysis of the simulated and actual Antarctic records shows that the procedure is stable to change in adjustable parameters, and requires the coupling between the polar climates to be proportional mainly to the difference in heat storage between the two regions.

Keywords: Polar synchronization | Climate synchronization | Paleoclimate | Climate modeling | Non-linear oscillator | Non-linear coupling | Polar climate

Rial 1999

J. A. Rial, *Pacemaking the Ice Ages by Frequency Modulation of Earth's Orbital Eccentricity*. science **285** (1999), 564–568.
Evidence from power spectra of deep-sea oxygen isotope time series suggests that the climate system of Earth responds nonlinearly to astronomical forcing by frequency modulating eccentricity-related variations in insolation. With the help of a simple model, it is shown that frequency modulation of the approximate 100,000-year eccentricity cycles by the 413,000-year component accounts for the variable duration of the ice ages, the multiple-peak character of the time series spectra, and the notorious absence of significant spectral amplitude at the 413,000-year period. The observed spectra are consistent with the classic Milankovitch theories of insolation, so that climate forcing by 100,000-year variations in orbital inclination that cause periodic dust accretion appear unnecessary.

Rial 2013

José A. Rial, Jeseung Oh & Elizabeth Reischmann, *Synchronization of the climate systemto eccentricity forcing and the 100,000-year problem*. Nature Geoscience **6** (2013), 289–293.
NatGeo06-289-Supplement.pdf
Over the past million years, glacial–interglacial cycles have had a period of about 100,000 years, similar to the 100,000year period of change in the eccentricity of the Earth's orbit. However, the change in incoming solar radiation—insolation—at this timescale is small, and therefore difficult to reconcile with the amplitude of the glacial cycles1–5. This issue, known as the 100-kyr problem, is compounded by a lack of explanation for the transition of the length of the cycles from 41,000 to 100,000 years at the mid-Pleistocene transition 1.2 million years ago6. Individual discrepancies have been explained, for example, through interactions between other orbital frequencies such as obliquity and the 413,000-year period of eccentricity3–13, but a unified explanation is lacking. Here we show that climate oscillations over the past four million years can be explained by a single mechanism: the synchronization of nonlinear internal climate oscillations and the 413,000-year eccentricity cycle. Using spectral analyses aided by a numerical model, we find that the climate system first synchronized to the 413,000-year eccentricity cycle about 1.2 million years ago and has remained synchronized ever since. This synchronization results in a nonlinear transfer of power and frequency modulation that increases the amplitude of the 100,000-year cycle. We conclude that the forced synchronization can explain the strong 100,000-year glacial cycles through the alignment of insolation changes and internal climate oscillations.

Willis 1999

K. J. Willis, A. Kleczkowski, K. M. Briggs & C. A. Gilligan, *The Role of Sub-Milankovitch Climatic Forcing in the Initiation of the Northern Hemisphere Glaciation*. science **285** (1999), 568–571.
Mechanisms responsible for the initiation of major glaciation in the Northern Hemisphere at about 2.75 million years ago are poorly understood. A laminated terrestrial sequence from Pula maar, Hungary, containing about 320,000 years in annual layers between 3.05 and 2.60 million years ago, provides a detailed record of rates of climatic change across this dramatic transition. An analysis of the record implies that climatic variations at sub-Milankovitch frequencies (less than or equal

to 15,000 years) were an important driving force during this transitional interval and that, as the threshold was approached, these increased in frequency and amplitude, possibly providing the final trigger for the amplification of Northern Hemisphere ice sheets.

Kultur

Haynes 2014

Gary Haynes & Janis Klimowicz, *Recent elephant-carcass utilization as a basis for interpreting mammoth exploitation*. Quaternary International (2014), preprint, 1–19. DOI:10.1016/j.quaint.2013.12.040.

Studies of the patterned effects of human and non-human utilization of recent elephant carcasses provide context for understanding how similar processes in the past affected mammoth bones. This information might explain similarities and differences among mammoth sites and assemblages in different times and places in prehistory, such as the Pavlovian phase of early Gravettian in central Europe and the Clovis era in North America. Both Pavlovian and Clovis people often left behind sites dominated by proboscidean bones, but appear to have made very different uses of mammoth carcasses.

Raichlen 2014

David A. Raichlen, Brian M. Wood, Adam D. Gordon, Audax Z. P. Mabulla, Frank W. Marlowe & Herman Pontzer, *Evidence of Lévy walk foraging patterns in human hunter–gatherers*. PNAS **111** (2014), 728–733.

pnas111-00728-Supplement.xlsx

When searching for food, many organisms adopt a superdiffusive, scale-free movement pattern called a Lévy walk, which is considered optimal when foraging for heterogeneously located resources with little prior knowledge of distribution patterns [Viswanathan GM, da Luz MGE, Raposo EP, Stanley HE (2011) The Physics of Foraging: An Introduction to Random Searches and Biological Encounters]. Although memory of food locations and higher cognition may limit the benefits of random walk strategies, no studies to date have fully explored search patterns in human foraging. Here,we showthat human hunter–gatherers, the Hadza of northern Tanzania, perform Lévy walks in nearly one-half of all foraging bouts. Lévy walks occur when searching for a wide variety of foods from animal prey to underground tubers, suggesting that, even in the most cognitively complex forager on Earth, such patterns are essential to understanding elementary foraging mechanisms. This movement pattern may be fundamental to how humans experience and interact with the world across a wide range of ecological contexts, and it may be adaptive to food distribution patterns on the landscape,which previous studies suggested for organismswith more limited cognition. Additionally, Lévy walks may have become common early in our genus when hunting and gathering arose as a major foraging strategy, playing an important role in the evolution of human mobility.

Lévy flight | Brownian motion | superdiffusion | scale invariance | optimal foraging

Mittelpaläolithikum

Jennings 2011

Richard Jennings, Clive Finlayson, Darren Fa & Geraldine Finlayson, *Southern Iberia as a refuge for the last Neanderthal populations*. Journal of Biogeography **38** (2011), 1873–1885.

JBioGeo38-1873-Supplement.pdf

Aim This paper evaluates the role of southern Iberia as a glacial refugium for Neanderthal populations during the late Pleistocene.

Location Southern Iberia.

Methods A new methodology employing biogeographical principles was developed to determine the nature and extent of refugial environments in southern Iberia. Two climate maps drawing on present-day temperature and rainfall measurements from 338 weather stations across the study area were constructed. The maps were then subjected to incremental falls in temperature and rainfall, and redrawn accordingly within a geographical information system (GIS) framework. The resulting cool and dry models were then combined to replicate climate conditions in southern Iberia during the last glacial period.

Results The results indicated that not one but four different types of refugial environment were present: warm/wet, cool/dry, warm/dry and cool/wet. A dataset of 164 Middle Palaeolithic sites was examined with respect to these environments and shown by a chi-square test to be unevenly distributed. The overwhelming majority of sites fell within the warm/wet and cool/wet refugial environments, which shared the common characteristic of high rainfall levels. Within both these environments, it was possible to identify more specific refugia. An upland refugium was identified in the Betic Mountains in Co' rdoba/Jae'n provinces, and a resource-rich major refugium was located on the southerly and westerly foothills of the Ca'diz–Ma'laga sierras in an area that included the Guadalete River, two coastlines and the Rock of Gibraltar. The modelling procedure is supported by the identification within the major refugium of Gorham's Cave in Gibraltar; archaeological evidence suggests that the cave was home to the last Neanderthals of Europe, who disappeared around 28,000 years ago.

Main conclusions The persistence of good rainfall levels was a significant factor in the late survival of Neanderthal populations in southern Iberia. The potential application of the proposed climatic modelling technique to palaeobiogeography, historical biogeography and macroecology, in addition to palaeoanthropology, is considerable.

Keywords: Bioclimates, biogeography, climate models, ecology, GIS, Middle Palaeolithic, Neanderthal, refugium, southern Iberia, Upper Pleistocene.