Virtual Neanderthals : a study in agent-based modelling Late Pleistocene hominins in western Europe

Scherjon, F.

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REFERENCES

The software and data used in this research is credited according to the guidelines given at GitHub, the data storage and versioning service[48].

Paleoclimate data sets

- NOAA, National Climatic Data Center: Paleoclimatology data: http://www.ncdc.noaa.gov/paleo/model.html (accessed 29 May 2013, verified 17 September 2017).
- WorldClim – Global Climate Data – Past conditions: http://www.worldclim.org/past (verified 17 September 2017).
- PMIP – Paleoclimate Modelling Intercomparison Project Phase II: http://pmip2.lsce.ipsl.fr/ (verified 17 September 2017).
- CCSM – Community Climate System Model, a Global Climate Model (Wikipedia entry): http://en.wikipedia.org/wiki/Community_Climate_System_Model (verified 17 September 2017).
- MIROC3.2 (Model for Interdisciplinary Research on Climate) – model information: http://www-pcmdi.llnl.gov/ipcc/model_documentation/MIROC3.2_medres.htm (verified 17 September 2017).

Topographical data sets

- VTP – Undersea Terrain Elevation (Bathymetry) – model description: http://vterrain.org/Elevation/Bathy/ (verified 17 September 2017).
- World Map of Carbonate Rock Outcrops v3.0, http://web.env.auckland.ac.nz/our_research/karst/, accessed 17 September 2013. Data is available as shape files (verified 17 September 2017).

Software tools used in this study

- SAM – Spatial Analysis in Macroecology, v4.0: http://www.ecoevol.ufg.br/sam/ (verified 17 September 2017).
- Repast Simphony, version 2.2: https://repast.github.io/download.html (accessed 17 November 2016, verified 17 September 2017).
- IBM SPSS Statistics - http://www-01.ibm.com/software/analytics/spss/downloads/ (verified 17 September 2017).

Literature

Abar, S., G.K. Theodoropoulos, P. Lemarinier and G.M.P. O'Hare, 2017. Agent Based Modelling and Simulation tools: A review of the state-of-art software. *Computer Science Review* 24 (Supplement C): 13-33.

Ackerman, A.F., L.S. Buchwald and F.H. Lewski, 1989. Software inspections: an effective verification process. *IEEE software* 6 (3): 31-36.

Adler, D.S., G. Barz, A. Belfer-Cohen and O. Bar-Yosef, 2006. Ahead of the Game: Middle and Upper Palaeolithic Hunting Behaviors in the Southern Caucasus. *Current Anthropology* 47: 89-118.

Agustí, J. and X. Rubio-Campillo, 2017. Were Neanderthals responsible for their own extinction? *Quaternary International* 431: 232-237.

[48] http://mr-c.github.io/shouldacite/index.html, accessed 21-04-2016.

Aiello, L.C. and P. Wheeler, 2003. Neanderthal Thermoregulation and the Glacial Climate. In *Neanderthals and Modern Humans in the European Landscape during the Last Glaciation: Archaeological Results of the Stage 3 Project*, edited by T. H. Van Andel and W. Davies. Cambridge: McDonald Institute for Archaeological Research Monograph Series, 147-166.

Akazawa, T., Y. Nishiaki and K. Aoki, 2013. *Dynamics of Learning in Neanderthals and Modern Humans Volume 1: Cultural Perspectives*: Springer.

Aldrich, J., 1995. Correlations genuine and spurious in Pearson and Yule. *Statistical science*: 364-376.

Aleksandra, B.D., M.E. Jovan and A.D. Rakic, 1997. Genetic algorithms for continuous optimization problems - a concept of parameter-space size adjustment. *Journal of Physics A: Mathematical and General* 30 (22): 7849.

Alexander, R.M., 2002. Energetics and Optimization of Human Walking and Running: The 2000 Raymond Pearl Memorial Lecture. *American Journal of Human Biology* 14: 641-648.

Allaby, M., 2005. A dictionary of Ecology (3rd ed). edited by M. Allaby. Oxford: Oxford University Press.

Allen, J.R.M., U. Brandt, A. Brauer, H.-W. Hubberten, B. Huntley, J. Keller, M. Kraml, A. Mackensen, J. Mingram, J.F.W. Negendank, N.R. Nowaczyk, H. Oberhansli, W.A. Watts, S. Wulf and B. Zolitschka, 1999. Rapid environmental changes in southern Europe during the last glacial period. *Nature* 400 (6746): 740-743.

Amante, C. and B.W. Eakins, 2009. ETOPO1 1 Arc-Minute Global Relief Model: Procedures, Data Sources and Analysis. *NOAA Technical Memorandum NESDIS NGDC-24*.

Ammerman, A.J. and L.L. Cavalli-Sforza, 1984. *The Neolithic transition and the genetics of populations in Europe*: Princeton University Press Princeton.

Anderson, R.P., 2003. Real vs. Artefactual Absences in Species Distributions: Tests for Oryzomys albigularis (Rodentia: Muridae) in Venezuela. *Journal of Biogeography* 30 (4): 591-605.

Angus, S. and B. Hassani-Mahmooei, 2015. "Anarchy" Reigns: A Quantitative Analysis of Agent-Based Modelling Publication Practices in JASSS, 2001-2012. *Journal of Artificial Societies and Social Simulation* 18 (4): 16.

Antoine, P., J.P. Coutard, P. Gibbard, B. Hallegouet, J.P. Lautridou and J.C. Ozouf, 2003. The Pleistocene rivers of the English channel region. *Journal of Quaternary Science* 18 (3-4): 227-243.

Antón, S.C., R. Potts and L.C. Aiello, 2014. Evolution of early Homo: An integrated biological perspective. *Science* 345 (6192): 1236828.

Anwar, N., K. MacDonald, W. Roebroeks and A. Verpoorte, 2007. The Evolution of the Human Niche: Integrating Models with the Fossil Record. In *Guts and Brains. An Integrative Approach to the Hominin Record*, edited by W. Roebroeks. Leiden: Leiden University Press, 235-269.

Appenzeller, T., 2013. Neanderthal culture: Old masters. *Nature* 497: 302.

Archer, W. and D.R. Braun, 2013. Investigating the Signature of Aquatic Resource Use within Pleistocene Hominin Dietary Adaptations. *PLoS ONE* 8 (8): e69899.

Arenas, M., O. François, M. Currat, N. Ray and L. Excoffier, 2013. Influence of admixture and paleolithic range contractions on current European diversity gradients. *Molecular biology and evolution* 30 (1): 57-61.

Ashton, N., 2002. Absence of Humans in Britain during the last interglacial (oxygen isotope stage 5e). In *Le Dernier Interglaciaire et les occupations humaines du Paléolithique moyen*, edited by A. Tuffreau and W. Roebroeks. Lille: CERP/Universite des Sciences et Technologies de Lille, 93-103.

Ashton, N., C.R.E. Harris and S.G. Lewis, 2018. Frontiers and route-ways from Europe: the Early Middle Palaeolithic of Britain. *Journal of Quaternary Science*: n/a-n/a.

Ashton, N. and S.G. Lewis, 2002. Deserted Britain: declining populations in the British late Middle Pleistocene. *Antiquity* 76: 388-396.

Ashton, N., S.G. Lewis and R. Hosfield, 2011. Mapping the Human Record: Population Change in Britain During the Early Palaeolithic. In *The Ancient Human Occupation of Britain*, edited by N. M. Ashton, S. G. Lewis and C. B. Stringer. Amsterdam: Elsevier, 39-51.

Ashton, N. and B. Scott, 2016. The British Middle Palaeolithic. *Quaternary International* 411 (Part A): 62-76.

Attenbrow, V. and P. Hiscock, 2015. Dates and demography: are radiometric dates a robust proxy for long-term prehistoric demographic change? *Archaeology in Oceania* 50 (S1): 30-36.

Augustine, D. and S. McNaughton, 2006. Interactive Effects of Ungulate Herbivores, Soil Fertility, and Variable Rainfall on Ecosystem Processes in a Semi-arid Savanna. *Ecosystems* 9 (8): 1242-1256.

Axelrod, R., 1997. Advancing the Art of Simulation in the Social Sciences. In *Simulating Social Phenomena*, edited by R. Conte, R. Hegselmann and P. Terna. Berlin, Heidelberg: Springer Berlin Heidelberg, 21-40.

Babbage, C., 1864. *Passages from the life of a philosopher*. London: Longman, Green, Longman, Roberts, & Green.

Bacchelli, A. and C. Bird, 2013. Expectations, outcomes, and challenges of modern code review. Proceedings of the 2013 international conference on software engineering.

Back, T., F. Hoffmeister and H.-P. Schwefel, 1991. A survey of evolution strategies. Proceedings of the fourth international conference on genetic algorithms.

Bailey, H.P., 1960. A method of determining the warmth and temperateness of climate. *Geografiska Annaler* 42 (1): 1-16.

Baker, R.R., 1978. *The evolutionary ecology of animal migration*. Vol. 1012: Hodder and Stoughton London.

Bankes, S.C., 2002. Agent-based modeling: A revolution? *Proceedings of the National Academy of Sciences of the United States of America* 99 (Suppl 3): 7199-7200.

Banks, W.E., F. d'Errico, A.T. Peterson, M. Kageyama, A. Sima and M.-F. Sánchez-Goñi, 2008. Neanderthal Extinction by Competitive Exclusion. *PLoS ONE* 3 (12): e3972.

Banks, W.E., F. d'Errico, A.T. Peterson, M. Vanhaeren, M. Kageyama, P. Sepulchre, G. Ramstein, A. Jost and D. Lunt, 2008. Human ecological niches and ranges during the LGM in Europe derived from an application of eco-cultural niche modeling. *Journal of Archaeological Science* 35 (2): 481-491.

Barceló, J.A., F. del Castillo, L. Mameli and E. Moreno, 2008. The Computer Simulation of Social Dynamics and Historical Evolution. *Unpublished Paper presented at the II Jornadas sobre Simulación Social y Análisis de Sociedades Artificiales Barcelona, 20-21 noviembre 2008*.

Barnes, K., 2010. Georgia's fossils on view. *Nature* 463: 162.

Barrows, T.T., J.O. Stone, L.K. Fifield and R.G. Cresswell, 2002. The timing of the Last Glacial Maximum in Australia. *Quaternary Science Reviews* 21 (1–3): 159-173.

Bates, S.J., J. Sienz and D.S. Langley, 2003. Formulation of the Audze–Eglais Uniform Latin Hypercube design of experiments. *Advances in Engineering Software* 34 (8): 493-506.

Belovsky, G.E., 1988. An optimal foraging-based model of hunter-gatherer population dynamics. *Journal of Anthropological Archaeology* 7 (4): 329-372.

Benito, B.M., J.-C. Svenning, T. Kellberg-Nielsen, F. Riede, G. Gil-Romera, T. Mailund, P.C. Kjaergaard and B.S. Sandel, 2016. The ecological niche and distribution of Neanderthals during the Last Interglacial. *Journal of Biogeography* 44 (1): 51-61.

Benke, A.C. and A.D. Huryn, 2006. Secondary production of macroinvertebrates. In *Methods in stream ecology 2nd ed*, edited by F. R. Hauer and G. A. Lamberti. Burlington: Academic Press, 691-710.

Bentley, R.A., 2006. Strontium Isotopes from the Earth to the Archaeological Skeleton: A Review. *Journal of Archaeological Method and Theory* 13 (3): 135-187.

Bernbeck, R., 1997. *Theorien in der Archäologie*: Francke Tübingen.

Bertran, P., L. Sitzia, W.E. Banks, M.D. Bateman, P.-Y. Demars, M. Hernandez, M. Lenoir, N. Mercier and F. Prodeo, 2013. The Landes de Gascogne (southwest France): periglacial desert and cultural frontier during the Palaeolithic. *Journal of Archaeological Science* 40 (5): 2274-2285.

Biesele, M. and S. Barclay, 2001. Ju/'hoan women's tracking knowledge and its contribution to their husbands' hunting success. *African Study Monographs* 26: 67-84.

Binford, L.R., 1980. Willow Smoke and Dogs' Tails: Hunter-Gatherer Settlement Systems and Archaeological Site Formation. *American Antiquity* 45 (1): 4-20.

Binford, L.R., 1982. The Archaeology of Place. *Journal of Anthropological Archaeology* 1: 5-31.

Binford, L.R., 1991. When the going gets tough, the tough gets going: Nunamiut local groups, camping patterns and economic organization. In *Ethnoarchaeological approaches to mobile campsites: hunter-gatherer and pastoralist case studies*, edited by C. S. Gamble and W. A. Boismier. Ann Arbor: International monographs in prehistory, Ethnoarchaeological series 1, 25-138.

Binford, L.R., 2001. *Constructing Frames of Reference: An Analytical Method for Archaeological Theory Building Using Hunter-Gatherer and Environmental Data Sets*: University of California Press, Berkeley and Los Angeles, California.

Bintanja, R. and R.S.W. van de Wal, 2008. North American ice-sheet dynamics and the onset of 100,000-year glacial cycles. *Nature* 454 (7206): 869-872.

Bintanja, R., R.S.W. van de Wal and J. Oerlemans, 2005. Modelled atmospheric temperatures and global sea levels over the past million years. *Nature* 437 (7055): 125-128.

Bird, D.W., R.B. Bird and B.F. Codding, 2009. In pursuit of mobile prey: Martu hunting strategies and archaeofaunal interpretation. *American Antiquity* 74: 3-29.

Bird, D.W. and R. Bliege Bird, 2005. Martu children´s foraging strategies in the Western Desert, Australia. In *Hunter gatherer childhoods*, edited by B. S. Hewlett and M. E. Lamb. New Brunswick, New Jersey: Transaction Publishers, 129-46.

Birdsell, J.B., 1968. Some predictions for the pleistocene based on equilibrium systems among recent hunter-gatherers. In *Man the Hunter*, edited by R. B. Lee and I. DeVore. Chicago: Aldine, 229-240.

Blackwell, B., M. Bisson, A. Skinner and P. Beelitz, 2007. ESR dating bovid teeth from the Neandertal layer at La Ferrassie, France. GSA Denver Annual Meeting.

Bocherens, H., G. Baryshnikov and W. Van Neer, 2013. Were bears or lions involved in salmon accumulation in the Middle Palaeolithic of the Caucasus? An isotopic investigation in Kudaro 3 cave. *Quaternary International*.

Bocherens, H., D.G. Drucker, D. Billiou, M. Patou-Mathis and B. Vandermeersch, 2005. Isotopic evidence for diet and subsistence pattern of the Saint-Césaire I Neanderthal: review and use of a multi-source mixing model. *Journal of Human Evolution* 49: 71-87.

Bocquet-Appel, J.-P. and A. Tuffreau, 2009. Technological Responses of Neanderthals to Macroclimatic Variations (240,000–40,000 BP). *Human Biology* 81 (2-3): 287-307.

Bogin, B., 1999. *Patterns of human growth*. Vol. 23. Cambridge: Cambridge University Press.

Boismier, W.A., C. Gamble and F. Coward, 2012. *Neanderthals among mammoths: excavations at Lynford Quarry, Norfolk UK*: English Heritage Monographs.

Boivin, N., D.Q. Fuller, R. Dennell, R. Allaby and M.D. Petraglia, 2013. Human dispersal across diverse environments of Asia during the Upper Pleistocene. *Quaternary International* 300: 32-47.

Bonabeau, E., 2002. Agent-based modeling: Methods and techniques for simulating human systems. *Proceedings of the National Academy of Sciences of the United States of America* 99 (Suppl 3): 7280-7287.

Bond, W., F. Woodward and G. Midgley, 2005. The global distribution of ecosystems in a world without fire. *New Phytologist* 165 (2): 525-538.

Borrill, P.L. and L. Tesfatsion, 2010. 11 Agent-based modeling: the right mathematics for the social sciences? In *The Elgar Companion to Recent Economic Methodology*, 228.

Bosch, M.D., M.A. Mannino, A.L. Prendergast, F.P. Wesselingh, T.C. O'Connell and J.-J. Hublin, 2017. Year-round shellfish exploitation in the Levant and implications for Upper Palaeolithic hunter-gatherer subsistence. *Journal of Archaeological Science: Reports*.

Boyd, R., P.J. Richerson and J. Henrich, 2011. Rapid cultural adaptation can facilitate the evolution of large-scale cooperation. *Behavioral Ecology and Sociobiology* 65 (3): 431-444.

Bradtmöller, M., A. Pastoors, B. Weninger and G.-C. Weniger, 2012. The repeated replacement model – Rapid climate change and population dynamics in Late Pleistocene Europe. *Quaternary International* 247: 38-49.

Brantingham, P.J., 2003. A neutral model of stone raw material procurement. *American Antiquity* 68 (3): 487-509.

Braun, D.R., J.W.K. Harris, N.E. Levin, J.T. McCoy, A.I.R. Herries, M.K. Bamford, L.C. Bishop, B.G. Richmond and M. Kibunjia, 2010. Early hominin diet included diverse terrestrial and aquatic animals 1.95 Ma in East Turkana, Kenya. *Proceedings of the National Academy of Sciences* 107 (22): 10002-10007.

Broadfield, D.C., R.L. Holloway, K. Mowbray, A. Silvers, M.S. Yuan and S. Márquez, 2001. Endocast of Sambungmacan 3 (Sm 3): a new *Homo erectus* from Indonesia. *The Anatomical Record* 262 (4): 369-379.

Broennimann, O., M.C. Fitzpatrick, P.B. Pearman, B. Petitpierre, L. Pellissier, N.G. Yoccoz, W. Thuiller, M.-J. Fortin, C. Randin, N.E. Zimmermann, C.H. Graham and A. Guisan, 2012. Measuring ecological niche overlap from occurrence and spatial environmental data. *Global Ecology and Biogeography* 21 (4): 481-497.

Broodbank, C., 2006. The origins and early development of Mediterranean maritime activity. *Journal of Mediterranean Archaeology* 19 (2).

Broodbank, C., 2014. So... What? Does the Paradigm Currently Want to Budge So Much? *Journal of Mediterranean Archaeology* 27 (2): 267-272.

Brooks, R., 2001. The relationship between matter and life. *Nature* 409 (6818): 409.

Brughmans, T. and J. Poblome, 2017. The case for computational modelling of the Roman economy: a reply to Van Oyen. *Antiquity* 91 (359): 1364-1366.

Burnham, K.P. and D.R. Anderson, 2003. *Model selection and multimodel inference: a practical information-theoretic approach*: Springer Science & Business Media.

Bynoe, R., J.K. Dix and F. Sturt, 2016. Of mammoths and other monsters: historic approaches to the submerged Palaeolithic. *Antiquity* 90 (352): 857-875.

Calvez, B. and G. Hutzler, 2006. Automatic Tuning of Agent-Based Models Using Genetic Algorithms. In *Multi-Agent-Based Simulation VI: International Workshop, MABS 2005, Utrecht, The Netherlands, July 25, 2005, Revised and Invited Papers*, edited by J. S. Sichman and L. Antunes. Berlin, Heidelberg: Springer Berlin Heidelberg, 41-57.

Carrión, J.S., C. Finlayson, S. Fernández, G. Finlayson, E. Allué, J.A. López-Sáez, P. López-García, G. Gil-Romera, G. Bailey and P. González-Sampériz, 2008. A coastal reservoir of biodiversity for Upper Pleistocene human populations: palaeoecological investigations in Gorham's Cave (Gibraltar) in the context of the Iberian Peninsula. *Quaternary Science Reviews* 27 (23): 2118-2135.

Castellano, S., G. Parra, F.A. Sánchez-Quinto, F. Racimo, M. Kuhlwilm, M. Kircher, S. Sawyer, Q. Fu, A. Heinze, B. Nickel, J. Dabney, M. Siebauer, L. White, H.A. Burbano, G. Renaud, U. Stenzel, C. Lalueza-Fox, M. de la Rasilla, A. Rosas, P. Rudan, D. Brajković, Ž. Kucan, I. Gušic, M.V. Shunkov, A.P. Derevianko, B. Viola, M. Meyer, J. Kelso, A.M. Andrés and S. Pääbo, 2014. Patterns of coding variation in the complete exomes of three Neandertals. *Proceedings of the National Academy of Sciences*, 111(18), 6666-6671.

Castle, C.J. and A.T. Crooks, 2006. Principles and concepts of agent-based modelling for developing geospatial simulations. *Working paper 110*, Centre for Advanced Spatial Analysis, University College London.

Cegielski, W.H. and J.D. Rogers, 2016. Rethinking the role of Agent-Based Modeling in archaeology. *Journal of Anthropological Archaeology* 41: 283-298.

Chase, P.G., 1989. How different was Middle Palaeolithic subsistence? A zooarchaeological perspective on the Middle to Upper Palaeolithic transition. In *The Human Revolution: Behavioral and Biological Perspectives on the Origins of Modern Humans*, edited by P. Mellars and C. Stringer. New Jersey: Princeton University Press, 321-338.

Chernoff, H., 1973. The use of faces to represent points in k-dimensional space graphically. *Journal of the American statistical Association* 68 (342): 361-368.

Christiansen, J.H. and M.R. Altaweel, 2005. Understanding ancient societies: A new approach using agent-based holistic modeling. *Structure and Dynamics* 1 (2).

Churchill, S.E., 2005. Calorie count reveals Neandertals out-ate hardiest modern hunters. *Science* 307: 840.

Churchill, S.E., 2006. Bioenergetic Perspectives on Neanderthal Thermoregulatory and Activity Budgets. In *Neanderthals Revisited: New Approaches and Perspectives*, edited by K. Harvati and T. Harrison. Dordrecht: Springer, 113-134.

Churchill, S.E., 2009. Energetic competition between Neandertals and anatomically modern humans. *PaleoAnthropology* 96: 116.

Clarke, D., 1973. Archaeology: the loss of innocence. *Antiquity* 47 (185): 6.

Cliquet, D., N. Mercier, H. Valladas, L. Froget, D. Michel, B. van Vliet-Lanoë and G. Vilgrain, 2003. Apport de la thermoluminescence sur silex chauffés à la chronologie de sites paléolithiques de Normandie : nouvelles données et interprétations. *Quaternaire* 14 (1): 51 - 64.

Close, A.E., 2009. The Middle-Upper Palaeolithic hiatus of insular north Africa. In *The Mediterranean from 50 000 to 25 000 BP: Turning points and new directions*, edited by M. a. C. S. Camps. Oxford, UK: Oxbow Books, 35-50.

Codding, B.F. and T.L. Jones, 2013. Environmental productivity predicts migration, demographic, and linguistic patterns in prehistoric California. *Proceedings of the National Academy of Sciences* 110 (36): 14569-14573.

Coe, M., D. Cumming and J. Phillipson, 1976. Biomass and production of large African herbivores in relation to rainfall and primary production. *Oecologia* 22 (4): 341-354.

Coello Coello, C.A., 2002. Theoretical and numerical constraint-handling techniques used with evolutionary algorithms: a survey of the state of the art. *Computer Methods in Applied Mechanics and Engineering* 191 (11–12): 1245-1287.

Cohen, K. and P. Gibbard, 2011. Global chronostratigraphical correlation table for the last 2.7 million years: Submission on Quaternary Stratigraphy (International Commission on Stratigraphy). *Cambridge, England: Electronic document available at http://quaternary.stratigraphy.org/charts/, verified 9 April 2019.*

Cohen, K.M., K. MacDonald, J.C.A. Joordens, W. Roebroeks and P.L. Gibbard, 2012. The earliest occupation of north-west Europe: a coastal perspective. *Quaternary International* 271: 70-83.

Cole, L.E.S., S.A. Bhagwat and K.J. Willis, 2014. Recovery and resilience of tropical forests after disturbance. *Nature Communications* 5: 3906.

Collier, N. and M. North, 2010. Repast Java getting started.

Collins, W.D., C.M. Bitz, M.L. Blackmon, G.B. Bonan, C.S. Bretherton, J.A. Carton, P. Chang, S.C. Doney, J.J. Hack, T.B. Henderson, J.T. Kiehl, W.G. Large, D.S. McKenna, B.D. Santer and R.D. Smith, 2006. The Community Climate System Model version 3 (CCSM3). *Journal of Climate* 19 (11): 2122-2143.

Consortium, P.k., 2013. Continental-scale temperature variability during the past two millennia. *Nature Geoscience* 6 (5): 339-346.

Cortés-Sánchez, M., A. Morales-Muñiz, M.D. Simón-Vallejo, M.C. Lozano-Francisco, J.L. Vera-Peláez, C. Finlayson, J. Rodríguez-Vidal, A. Delgado-Huertas, F.J. Jiménez-Espejo, F. Martínez-Ruiz, M.A. Martínez-Aguirre, A.J. Pascual-Granged, M.M. Bergadà-Zapata, J.F. Gibaja-Bao, J.A. Riquelme-Cantal, J.A. López-Sáez, M. Rodrigo-Gámiz, S. Sakai, S. Sugisaki, G. Finlayson, D.A. Fa and N.F. Bicho, 2011. Earliest Known Use of Marine Resources by Neanderthals. *PLoS ONE* 6 (9): e24026.

Crema, E.R., 2018. Statistical inference and archaeological simulations. *SAA Archaeological Record*: 20-23.

Crofoot, M.C. and I.C. Gilby, 2012. Cheating monkeys undermine group strength in enemy territory. *Proceedings of the National Academy of Sciences* 109 (2): 501-505.

Crooks, A., A. Croitoru, X. Lu, S. Wise, J.M. Irvine and A. Stefanidis, 2015. Walk this way: Improving pedestrian agent-based models through scene activity analysis. *ISPRS International Journal of Geo-Information* 4 (3): 1627-1656.

Crooks, A.T., 2007. The Repast Simulation/Modelling System for geospatial Simulation. In *Agent-Based Models for Spatial Systems in Social Sciences & Economic Science with Heterogeneous Interacting Agents (ABM–S4–ESHIA)* Agelonde, La Londe les Maures, France.

Cucart-Mora, C., S. Lozano and J. Fernández-López de Pablo, 2018. Bio-cultural interactions and demography during the Middle to Upper Palaeolithic transition in Iberia: An agent-based modelling approach. *Journal of Archaeological Science* 89: 14-24.

D'Abrera, H. and E. Lehmann, 1975. *Nonparametrics: statistical methods based on ranks*: Holden-day.

D'Errico, F., W.E. Banks, M. Vanhaeren, V. Laroulandie and M. Langlais, 2011. PACEA geo-referenced radiocarbon database. *PaleoAnthropology* 2011: 1-12.

Dafoe, A., 2014. Science deserves better: the imperative to share complete replication files. *PS: Political Science & Politics* 47 (1): 60-66.

Dalén, L., L. Orlando, B. Shapiro, M. Brandström-Durling, R. Quam, M.T.P. Gilbert, J.C.D. Fernández-Lomana, E. Willerslev, J.L. Arsuaga and A. Götherström, 2012. Partial genetic turnover in neandertals: continuity in the east and population replacement in the west. *Molecular biology and evolution* 29 (8): 1893-1897.

Damuth, J., 1991. Of size and abundance. *Nature* 351 (6324): 268-269.

Daura, J., M. Sanz, N. García, E. Allué, M. Vaquero, E. Fierro, J.S. Carrión, J.M. López-García, H.A. Blain, A. Sánchez-Marco, C. Valls, R.M. Albert, J.J. Fornós, R. Julià, J.M. Fullola and J. Zilhão, 2013. Terrasses de la Riera dels Canyars (Gavà, Barcelona): the landscape of Heinrich Stadial 4 north of the "Ebro frontier" and implications for modern human dispersal into Iberia. *Quaternary Science Reviews* 60: 26-48.

Davidson, I. and W. Noble, 1992. Why the first colonisation of the Australian region is the earliest evidence of modern human behaviour. *Archaeology in Oceania* 27(3): 135-142.

Davies, B., S.J. Holdaway and P.C. Fanning, 2016. Modelling the palimpsest: an exploratory agent-based model of surface archaeological deposit formation in a fluvial arid Australian landscape. *The Holocene* 26 (3): 450-463.

Davison, K., P. Dolukhanov, G.R. Sarson and A. Shukurov, 2006. The role of waterways in the spread of the Neolithic. *Journal of Archaeological Science* 33 (5): 641-652.

De Vynck, J.C., R. Anderson, C. Atwater, R.M. Cowling, E.C. Fisher, C.W. Marean, R.S. Walker, and K. Hill, 2016. Return rates from intertidal foraging from Blombos Cave to Pinnacle Point: Understanding early human economies. *Journal of Human Evolution* 92: 101-115.

Del Grosso, S., W. Parton, T. Stohlgren, D. Zheng, D. Bachelet, S. Prince, K. Hibbard and R. Olson, 2008. Global potential net primary production predicted from vegetation class, precipitation, and temperature. *Ecology* 89 (8): 2117-2126.

Dennell, R., 2003. Dispersal and colonisation, long and short chronologies: how continuous is the Early Pleistocene record for hominids outside East Africa? *Journal of Human Evolution* 45 (6): 421-440.

Dennell, R. and W. Roebroeks, 2005. An Asian perspective on early human dispersal from Africa. *Nature* 438 (7071): 1099-104.

Dennell, R.W., J. Louys, H.J. O'Regan and D.M. Wilkinson, 2014. The origins and persistence of Homo floresiensis on Flores: biogeographical and ecological perspectives. *Quaternary Science Reviews* 96: 98-107.

Dennell, R.W., M. Martinón-Torres and J.M. Bermúdez de Castro, 2011. Hominin variability, climatic instability and population demography in Middle Pleistocene Europe. *Quaternary Science Reviews* 30 (11-12): 1511-1524.

Derricourt, R., 2005. Getting "Out of Africa": Sea Crossings, Land Crossings and Culture in the Hominin Migrations. *Journal of World Prehistory* 19: 119-132.

Dershowitz, N. and Y. Gurevich, 2008. A natural axiomatization of computability and proof of Church's Thesis. *The Bulletin of Symbolic Logic*: 299-350.

Diem, K. and C. Lentner, 1962. Documenta Geigy: Scientific tables. edited by K. Diem and C. Lentner: Geigy Pharmaceuticals.

Discamps, E. and J.-P. Faivre, 2017. Substantial biases affecting Combe-Grenal faunal record cast doubts on previous models of Neanderthal subsistence and environmental context. *Journal of Archaeological Science* 81: 128-132.

Discamps, E., J. Jaubert and F. Bachellerie, 2011. Human choices and environmental constraints: deciphering the variability of large game procurement: from Mousterian to Aurignacian times (MIS 5-3) in southwestern France. *Quaternary Science Reviews* 30 (19-20): 2755-2775.

Dobson, F.S., 1982. Competition for mates and predominant juvenile male dispersal in mammals. *Animal behaviour* 30 (4): 1183-1192.

Domingo, R., J.L. Peña-Monné, T. de Torres, J.E. Ortiz and P. Utrilla, 2017. Neanderthal highlanders: Las Callejuelas (Monteagudo del Castillo, Teruel, Spain), a high-altitude site occupied during MIS 5. *Quaternary International* 435: 129-143.

Drogoul, A. and J. Ferber, 1994. Multi-agent simulation as a tool for modeling societies: Application to social differentiation in ant colonies. In *Artificial Social Systems*: Springer, 2-23.

Du Toit, J.T. and D.H.M. Cumming, 1999. Functional significance of ungulate diversity in African savannas and the ecological implications of the spread of pastoralism. *Biodiversity & Conservation* 8 (12): 1643-1661.

Dunbar, R.I.M., 1993. Coevolution of neocortical size, group size and language in humans. *Behavioral and Brain Sciences* 16: 681-735.

Dusseldorp, G.L., 2009. *A View to a Kill: Investigating Middle Palaeolithic subsistence using an Optimal Foraging perspective.* Published Manuscript, Human Origins, Leiden University, Leiden.

Dynesius, M. and R. Jansson, 2000. Evolutionary consequences of changes in species' geographical distributions driven by Milankovitch climate oscillations. *Proceedings of the National Academy of Sciences* 97 (16): 9115-9120.

Edmonds, B. and J.J. Bryson, 2004. The insufficiency of formal design methods the necessity of an experimental approach-for the understanding and control of complex mas. *Proceedings of the Third International Joint Conference on Autonomous Agents and Multiagent Systems-* Volume 2.

Eisenberg, J. and G. McKay, 1974. Comparison of ungulate adaptations in the New World and Old World tropical forests with special reference to Ceylon and the rainforests of Central America. *The behavior of ungulates and its relation to management (V. Geist and F. Walther, eds.). International Union for Conservation of Nature, Morges, Switzerland*: 585-602.

Elith, J., C.H. Graham, R.P. Anderson, M. Dudik, S. Ferrier, A. Guisan, R.J. Hijmans, F. Huettmann, J.R. Leathwick, A. Lehmann, J. Li, L.G. Lohmann, B.A. Loiselle, G. Manion, C. Moritz, M. Nakamura, Y. Nakazawa, J.M. Overton, A.T. Peterson, S.J. Phillips, K. Richardson, R. Scachetti-Pereira, R.E. Schapire, J. Soberon, S. Williams, M.S. Wisz and N.E. Zimmermann, 2006. Novel methods improve prediction of species' distributions from occurrence data. *Ecography* 29 (2): 129-151.

Ellis, E.C. and N. Ramankutty, 2008. Putting people in the map: anthropogenic biomes of the world. *Frontiers in Ecology and the Environment* 6 (8): 439-447.

Epstein, J.M., 2006. *Generative Social Science: Studies in Agent-Based Computational Modeling*. STU - Student edition ed: Princeton University Press.

Eriksson, A., L. Betti, A.D. Friend, S.J. Lycett, J.S. Singarayer, N. von Cramon-Taubadel, P.J. Valdes, F. Balloux and A. Manica, 2012. Late Pleistocene climate change and the global expansion of anatomically modern humans. *Proceedings of the National Academy of Sciences* 109 (40): 16089-16094.

Fa, D.A., J.C. Finlayson, G. Finlayson, F. Giles-Pacheco, J. Rodríguez-Vidal and J.M. Gutiérrez-López, 2016. Marine mollusc exploitation as evidenced by the Gorham's Cave (Gibraltar) excavations 1998–2005: The Middle–Upper Palaeolithic transition. *Quaternary International* 407 (Part B): 16-28.

Fagan, M.E., 1976. Design and Code Inspections to Reduce Errors in Program Development. *IBM Systems Journal* 15 (3): 182-211.

Fairbanks, R.G., 1989. A 17, 000-year glacio-eustatic sea level record: influence of glacial melting rates on the Younger Dryas event and deep-ocean circulation. *Nature* 342 (6250): 637-642.

Fan, Y., H. Li and G. Miguez-Macho, 2013. Global Patterns of Groundwater Table Depth. *Science* 339 (6122): 940-943.

Féblot-Augustins, J., 1999. Raw material transport patterns and settlement systems in the European Lower and Middle Palaeolithic: continuity, change and variability. In *The Middle Palaeolithic Occupation of Europe*, edited by W. Roebroeks and C. S. Gamble. Leiden: University of Leiden, 193-214.

Féblot-Augustins, J., 2009. Revisiting European Upper Paleolithic raw material transfers: the demise of the cultural ecological paradigm? In *Lithic Materials and Paleolithic Societies*, edited by B. Adams and B. S. Blades: Blackwell Publishing, 25-46.

Feddema, J.J., K.W. Oleson, G.B. Bonan, L.O. Mearns, L.E. Buja, G.A. Meehl and W.M. Washington, 2005. The importance of land-cover change in simulating future climates. *Science* 310 (5754): 1674-1678.

Fernandes, P., J.-P. Raynal and M.-H. Moncel, 2008. Middle Palaeolithic raw material gathering territories and human mobility in the southern Massif Central, France: first results from a petro-archaeological study on flint. *Journal of Archaeological Science* 35 (8): 2357-2370.

Ferràndez-Cañadell, C., F. Ribot and L. Gibert, 2014. New fossil teeth of Theropithecus oswaldi (Cercopithecoidea) from the Early Pleistocene at Cueva Victoria (SE Spain). *Journal of Human Evolution* 74: 55-66.

Fick, S.E. and R.J. Hijmans, 2017. WorldClim 2: new 1-km spatial resolution climate surfaces for global land areas. *International Journal of Climatology* 37 (12): 4302-4315.

Finlayson, C., 2009. *The humans who went extinct: why Neanderthals died out and we survived*: Oxford University Press.

Finlayson, C. and F. Giles Pacheco, 2000. The southern Iberian Peninsula in the late Pleistocene: geography, ecology, and human occupation. *Neanderthals on the edge*: 139-154.

Finlayson, C., F. Giles Pacheco, J. Rodríguez-Vidal, D.A. Fa, J.M. Gutierrez López, A. Santiago Pérez, G. Finlayson, E. Allue, J. Baena Preysler, I. Cáceres, J.S. Carrión, Y. Fernández Jalvo, C.P. Gleed-Owen, F.J. Jimenez Espejo, P. López, J. Antonio López Sáez, J. Antonio Riquelme Cantal, A. Sánchez Marco, F. Giles Guzman, K. Brown, N. Fuentes, C.A. Valarino, A. Villalpando, C.B. Stringer, F. Martinez Ruiz and T. Sakamoto, 2006. Late survival of Neanderthals at the southernmost extreme of Europe. *Nature* 443: 850-853.

Fiore, I., M. Gala, M. Romandini, E. Cocca, A. Tagliacozzo and M. Peresani, 2016. From feathers to food: Reconstructing the complete exploitation of avifaunal resources by Neanderthals at Fumane cave, unit A9. *Quaternary International* 421 (9): 134-153.

Fisher, R.A., 1937. The wave of advance of advantageous genes. *Annals of Eugenics* 7 (4): 355-369.

Fletcher, M. and G.R. Lock, 2005. *Digging Numbers: Elementary Statistics for Archaeologists*. Second ed. Vol. 33, *Oxford University School of Archaeology Monograph*: Oxford University Committee for Archaeology.

Flores, J., 1997. A mathematical model for Neanderthal extinction. *arXiv preprint physics/9712024*.

Flores, J., 1998. A mathematical model for Neanderthal extinction. *Journal of theoretical Biology* 191 (3): 295-298.

Flores, J., 2011. Diffusion coefficient of modern humans outcompeting Neanderthals. *Journal of theoretical biology* 280 (1): 189-190.

Ford, D.C. and P. Williams, 2007. *Karst hydrogeology and geomorphology*: John Wiley & Sons.

Forrest, S., 1993. Genetic algorithms: principles of natural selection applied to computation. *Science* 261 (5123): 872.

Forseth, I.H., 2012. Terrestrial Biomes. *Nature Education Knowledge*.

Forster, M.R., 2000. Key Concepts in Model Selection: Performance and Generalizability. *Journal of Mathematical Psychology* 44 (1): 205-231.

Frakes, S., 2003. NGS Toolkit, Part 4: General Geodetic Computations. *Professional Surveyor Magazine* 23 (9).

Freedman, L.P., I.M. Cockburn and T.S. Simcoe, 2015. The Economics of Reproducibility in Preclinical Research. *PLOS Biology* 13 (6): e1002165.

Freeman, J. and J.M. Anderies, 2015. The socioecology of hunter–gatherer territory size. *Journal of Anthropological Archaeology* 39: 110-123.

Froehle, A.W. and S.E. Churchill, 2009. Energetic competition between Neandertals and Anatomically Modern Humans. *PaleoAnthropology* 2009: 96-116.

Gamble, C., 1993. *Timewalkers:The Prehistory of Global Colonization*. Cambridge: Harvard University Press.

Gamble, C.S. and J. Steele, 1999. Hominid ranging patterns and dietary strategies. In *Hominid evolution. Lifestyles and survival strategies*, edited by H. Ullrich. Berlin: Edition Archaea, 396-409.

Gaona, P., P. Ferreras and M. Delibes, 1998. Dynamics and viability of a metapopulation of the endangered Iberian lynx (Lynx pardinus). *Ecological monographs* 68 (3): 349-370.

Gibbard, P.L., 1988. The history of the great northwest European rivers during the past three million years. *Philosophical Transactions of the Royal Society of London* Series 318: 559-602.

Gilbert, N., 2008. *Agent-based models*, *Quantitative Applications in the Social Sciences*. Thousand Oaks, California (USA): Sage Publications.

Gilbert, N. and P. Ahrweiler, 2009. The Epistemologies of Social Simulation Research. In *Epistemological Aspects of Computer Simulation in the Social Sciences: Second International Workshop, EPOS 2006, Brescia, Italy, October 5-6, 2006, Revised Selected and Invited Papers*, edited by F. Squazzoni. Berlin, Heidelberg: Springer Berlin Heidelberg, 12-28.

Gilbert, N. and S. Bankes, 2002. Platforms and methods for agent-based modeling. *Proceedings of the National Academy of Sciences of the United States of America* 99 (Suppl 3): 7197-7198.

Gilmour, M., A. Currant, R. Jacobi and C. Stringer, 2007. Recent TIMS dating results from British Late Pleistocene vertebrate faunal localities: context and interpretation. *Journal of Quaternary Science* 22 (8): 793-800.

Gilpin, W., M.W. Feldman and K. Aoki, 2016. An ecocultural model predicts Neanderthal extinction through competition with modern humans. *Proceedings of the National Academy of Sciences*.

Goldberg, D.E., 1989. *Genetic algorithms in search, optimization, and machine learning*. Vol. 1989: Addison-wesley Publishing Company, inc.

Gosling, J., D.C. Holmes and K. Arnold, 2005. *The Java programming language*: Addison Wesley Professional.

Gosling, J. and H. McGilton, 1996. The java language environment, a white paper. *Sun Developer Network White Paper.* .

Goval, E., 2008. *Définitions, analyses et caractérisations des territoires des Néandertaliens au Weichsélien ancien en France septentrionale (Approches technologiques et spatiales, élargissement au Nord-Ouest de l'Europe)*, Préhistoire, Université des sciences et technologies de Lille, Lille.

Grant, K., E. Rohling, M. Bar-Matthews, A. Ayalon, M. Medina-Elizalde, C.B. Ramsey, C. Satow and A. Roberts, 2012. Rapid coupling between ice volume and polar temperature over the past 150,000 [thinsp] years. *Nature* 491 (7426): 744-747.

Green, R.E., J. Krause, A.W. Briggs, T. Maricic, U. Stenzel, M. Kircher, N. Patterson, H. Li, W. Zhai, M.H.-Y. Fritz, N.F. Hansen, E.Y. Durand, A.-S. Malaspinas, J.D. Jensen, T. Marques-Bonet, C. Alkan, K. Prüfer, M. Meyer, H.A. Burbano, J.M. Good, R. Schultz, A. Aximu-Petri, A. Butthof, B. Höber, B. Höffner, M. Siegemund, A. Weihmann, C. Nusbaum, E.S. Lander, C. Russ, N. Novod, J. Affourtit, M. Egholm, C. Verna, P. Rudan, D. Brajkovic, Ž. Kucan, I. Gušic, V.B. Doronichev, L.V. Golovanova, C. Lalueza-Fox, M. de la Rasilla, J. Fortea, A. Rosas, R.W. Schmitz, P.L.F. Johnson, E.E. Eichler, D. Falush, E. Birney, J.C. Mullikin, M. Slatkin, R. Nielsen, J. Kelso, M. Lachmann, D. Reich and S. Pääbo, 2010. A Draft Sequence of the Neandertal Genome. *Science* 328 (5979): 710-722.

Grimm, V., 1994. Mathematical models and understanding in ecology. *Ecological modelling* 75: 641-651.

Grimm, V., U. Berger, F. Bastiansen, S. Eliassen, V. Ginot, J. Giske, J. Goss-Custard, T. Grand, S.K. Heinz and G. Huse, 2006. A standard protocol for describing individual-based and agent-based models. *Ecological modelling* 198 (1): 115-126.

Grimm, V., K. Frank, F. Jeltsch, R. Brandl, J. Uchmański and C. Wissel, 1996. Pattern-oriented modelling in population ecology. *Science of the Total Environment* 183 (1-2): 151-166.

Grimm, V. and S.F. Railsback, 2005. Individual-based Modeling and Ecology:(Princeton Series in Theoretical and Computational Biology).

Grimm, V., E. Revilla, U. Berger, F. Jeltsch, W.M. Mooij, S.F. Railsback, H.H. Thulke, J. Weiner, T. Wiegand and D.L. DeAngelis, 2005. Pattern-oriented modeling of agent-based complex systems: lessons from ecology. *Science* 310 (5750): 987-91.

Grøn, O., 2018. Some problems with modelling the positions of prehistoric hunter-gatherer settlements on the basis of landscape topography. *Journal of Archaeological Science: Reports* 20: 192-199.

Groß, D., A. Zander, A. Boethius, S. Dreibrodt, O. Grøn, A. Hansson, C. Jessen, S. Koivisto, L. Larsson, H. Lübke and B. Nilsson, 2018. People, lakes and seashores: Studies from the Baltic Sea basin and adjacent areas in the early and Mid-Holocene. *Quaternary Science Reviews* 185: 27-40.

Groucutt, H.S., M.D. Petraglia, G. Bailey, E.M. Scerri, A. Parton, L. Clark-Balzan, R.P. Jennings, L. Lewis, J. Blinkhorn and N.A. Drake, 2015. Rethinking the dispersal of Homo sapiens out of Africa. *Evolutionary Anthropology: Issues, News, and Reviews* 24 (4): 149-164.

Guha, A.H. and G.J. Assaf, 2018. Representing Collected Road Condition Data with Chernoff Faces for Evaluation of Pavement Conditions. Civil Infrastructures Confronting Severe Weathers and Climate Changes Conference.

Guibert, P., F. Bechtel, L. Bourguignon, M. Brenet, I. Couchoud, A. Delagnes, F. Delpech, L. Detrain, M. Duttine, M. Folgado, J. Jaubert, C. Lahaye, M. Lenoir, B. Maureille, J.-P. Texier, A. Turq, E. Vieillevigne and G. Villeneuve, 2008. Une base de données pour la chronologie du Paléolithique moyen dans le Sud-Ouest de la France. In *Les sociétés du Paléolithique dans un Grand Sud-ouest de la France: nouveaux gisements, nouveaux résultats, nouvelles méthodes*, edited by J. Jaubert, J.-G. Bordes and I. Ortega: CNRS, 19-40.

Guiot, J., A. Pons, J.L. de Beaulieu and M. Reille, 1989. A 140,000-year continental climate reconstruction from two European pollen records. *Nature* 338: 309-313.

Guisan, A. and N.E. Zimmermann, 2000. Predictive habitat distribution models in ecology. *Ecological Modelling* 135 (2): 147-186.

Gunz, P., S. Neubauer, B. Maureille and J.-J. Hublin, 2010. Brain development after birth differs between Neanderthals and modern humans. *Current Biology* 20 (21): R921-R922.

Gupta, S., J.S. Collier, A. Palmer-Felgate and G. Potter, 2007. Catastrophic flooding origin of shelf valley systems in the English Channel. *Nature* 448 (7151): 342-5.

Gurven, M. and H. Kaplan, 2007. Hunter-gatherer longevity: cross-cultural perspectives. *Population and development review* 33: 321-365.

Guthrie, R.D., 1982. Mammals of the mammoth steppe as palaeoenvironmental indicators. In *Palaeoecology of Beringia*, edited by D. M. Hopkins, J. V. Matthews, C. E. Schweger and S. B. Young. New York: Academic Press, 307-26.

Guthrie, R.D., 1990. *Frozen Fauna of the Mammoth Steppe: the story of Blue Babe*. Chicago: Chicago University Press.

Hajdinjak, M., Q. Fu, A. Hübner, M. Petr, F. Mafessoni, S. Grote, P. Skoglund, V. Narasimham, H. Rougier, I. Crevecoeur, P. Semal, M. Soressi, S. Talamo, J.-J. Hublin, I. Gušić, Ž. Kućan, P. Rudan, L.V. Golovanova, V.B. Doronichev, C. Posth, J. Krause, P. Korlević, S. Nagel, B. Nickel, M. Slatkin, N. Patterson, D. Reich, K. Prüfer, M. Meyer, S. Pääbo and J. Kelso, 2018. Reconstructing the genetic history of late Neanderthals. *Nature* 555: 652.

Hamilton, K., 2007. Analyses of IPCC Climate Model Data at IPRC. *IPRC Climate*. Newsletter. Internation Pacific Research Center.

Hamilton, M.J., B.T. Milne, R.S. Walker and J.H. Brown, 2007. Nonlinear scaling of space use in human hunter-gatherers. *Proceedings of the National Academy of Sciences* 104 (11): 4765-4769.

Hansson, L., L. Fahrig and G. Merriam, 1995. *Mosaic landscapes and ecological processes*. The Netherlands: Springer Science & Business Media.

Hardy, K., J. Brand-Miller, K.D. Brown, M.G. Thomas and L. Copeland, 2015. The Importance of Dietary Carbohydrate in Human Evolution. *The Quarterly Review of Biology* 90 (3): 251-268.

Harrison, S.P. and I.C. Prentice, 2003. Climate and CO_2 controls on global vegetation distribution at the last glacial maximum: analysis based on palaeovegetation data, biome modelling and palaeoclimate simulations. *Global Change Biology* 9 (7): 983-1004.

Hartmann, S., 1996. The World as a Process. In *Modelling and Simulation in the Social Sciences from the Philosophy of Science Point of View*, edited by R. Hegselmann, U. Mueller and K. Troitzsch: Springer Netherlands, 77-100.

Hasumi, H. and S. Emori, 2004. *K-1 coupled GCM (MIROC) description*. Center for Climate System Research, University of Tokyo, Tokyo.

Hawe, G.I., G. Coates, D.T. Wilson and R.S. Crouch, 2012. Agent-based simulation for large-scale emergency response: A survey of usage and implementation. *ACM Computing Surveys (CSUR)* 45 (1): 8.

Hawkins, B.A., R. Field, H.V. Cornell, D.J. Currie, J.-F. Guégan, D.M. Kaufman, J.T. Kerr, G.G. Mittelbach, T. Oberdorff, E.M. O'Brien, E.E. Porter and J.R.G. Turner, 2003. Energy, water, and broad-scale geographic patterns of species richness. *Ecology* 84 (12): 3105-3117.

Haxeltine, A. and I.C. Prentice, 1996. BIOME3: An equilibrium terrestrial biosphere model based on ecophysiological constraints, resource availability, and competition among plant functional types. *Global Biogeochemical Cycles* 10 (4): 693-709.

Hays, J.D., J. Imbrie and N.J. Shackleton, 1976. Variations in the Earth's Orbit: Pacemaker of the Ice Ages. *Science* 194 (4270): 1121-1132.

Henry, A.G., A.S. Brooks and D.R. Piperno, 2011. Microfossils in calculus demonstrate consumption of plants and cooked foods in Neanderthal diets (Shanidar III, Iraq; Spy I and II, Belgium). *Proceedings of the National Academy of Sciences* 108 (2): 486-491.

Herrera, F., M. Lozano and J.L. Verdegay, 1998. Tackling Real-Coded Genetic Algorithms: Operators and Tools for Behavioural Analysis. *Artificial Intelligence Review* 12 (4): 265-319.

Hewitt, G.M., 1996. Some genetic consequences of ice ages, and their role in divergence and speciation. *Biological Journal of the Linnean Society* 58: 247-276.

Hewlett, B.S., 1991. Demography and childcare in preindustrial societies. *Journal of Anthropological Research* 47: 1-47.

Heyes, P. and K. MacDonald, 2015. Neandertal energetics: Uncertainty in body mass estimation limits comparisons with Homo sapiens. *Journal of Human Evolution* 85: 193-197.

Higham, T., T. Compton, C. Stringer, R. Jacobi, B. Shapiro, E. Trinkaus, B. Chandler, F. Groning, C. Collins, S. Hillson, P. O'Higgins, C. FitzGerald and M. Fagan, 2011. The earliest evidence for anatomically modern humans in northwestern Europe. *Nature* 479(7374), 521.

Higham, T., K. Douka, R. Wood, C.B. Ramsey, F. Brock, L. Basell, M. Camps, A. Arrizabalaga, J. Baena, C. Barroso-Ruiz, C. Bergman, C. Boitard, P. Boscato, M. Caparros, N.J. Conard, C. Draily, A. Froment, B. Galvan, P. Gambassini, A. Garcia-Moreno, S. Grimaldi, P. Haesaerts, B. Holt, M.-J. Iriarte-Chiapusso, A. Jelinek, J.F. Jorda Pardo, J.-M. Maillo-Fernandez, A. Marom, J. Maroto, M. Menendez, L. Metz, E. Morin, A. Moroni, F. Negrino, E. Panagopoulou, M. Peresani, S. Pirson, M. de la Rasilla, J. Riel-Salvatore, A. Ronchitelli, D. Santamaria, P. Semal, L. Slimak, J. Soler, N. Soler, A. Villaluenga, R. Pinhasi and R. Jacobi, 2014. The timing and spatiotemporal patterning of Neanderthal disappearance. *Nature* 512 (7514): 306-309.

Hijmans, R.J., S.E. Cameron, J.L. Parra, P.G. Jones and A. Jarvis, 2005. Very high resolution interpolated climate surfaces for global land areas. *International Journal of Climatology* 25 (15): 1965-1978.

Hill, K., A.M. Hurtado and R.S. Walker, 2007. High adult mortality among Hiwi hunter-gatherers: Implications for human evolution. *Journal of Human Evolution* 52: 443-454.

Hill, R.A. and R.I.M. Dunbar, 2003. Social Network Size in Humans. *Human Nature* 14(1): 53-72.

Hobbs, N.T., 1996. Modification of Ecosystems by Ungulates. *The Journal of Wildlife Management* 60 (4): 695-713.

Hodgkins, J., C.W. Marean, A. Turq, D. Sandgathe, S.J.P. McPherron and H. Dibble, 2016. Climate-mediated shifts in Neandertal subsistence behaviors at Pech de l'Azé IV and Roc de Marsal (Dordogne Valley, France). *Journal of Human Evolution* 96: 1-18.

Hofer, H. and M.L. East, 1993. The commuting system of Serengeti spotted hyaenas: how a predator copes with migratory prey. II. Intrusion pressure and commuters' space use. *Animal Behaviour* 46 (3): 559-574.

Hoffecker, J.F. and N. Cleghorn, 2000. Mousterian hunting patterns in the northwestern Caucasus and the ecology of the Neanderthals. *International Journal of Osteoarchaeology* 10 (5): 368-378.

Hoffmann, D.L., C.D. Standish, M. García-Diez, P.B. Pettitt, J.A. Milton, J. Zilhão, J.J. Alcolea-González, P. Cantalejo-Duarte, H. Collado, R. de Balbín, M. Lorblanchet, J. Ramos-Muñoz, G.-C. Weniger and A.W.G. Pike, 2018. U-Th dating of carbonate crusts reveals Neandertal origin of Iberian cave art. *Science* 359 (6378): 912-915.

Holland, D. and N. Quinn, 1987. *Cultural models in language and thought*: Cambridge University Press.

Holland, J.H., 1975. *Adaptation in natural and artificial systems: an introductory analysis with applications to biology, control, and artificial intelligence*: The University of Michigan Press, Ann Arbor, MI.

Hollander, M. and D.A. Wolfe, 1973. *Nonparametric statistical methods*, *Wiley Series in Probability and Statistics*. New York: John Wiley & Sons, inc.

Holliday, T.W. and A.B. Falsetti, 1995. Lower limb length of European early modern humans in relation to mobility and climate. *Journal of Human Evolution* 29 (2): 141-153.

Holmes, K.M., 2007. Using Pliocene palaeoclimatic data to postulate dispersal pathways of early hominins. *Palaeogeography, Palaeoclimatology, Palaeoecology* 248: 96-108.

Hoogakker, B.A., R.S. Smith, J.S. Singarayer, R. Marchant, I.C. Prentice, J.R. Allen, R.S. Anderson, S.A. Bhagwat, H. Behling and O. Borisova, 2016. Terrestrial biosphere changes over the last 120 kyr. *Climate of the Past* 12 (1): 51-73.

Horan, R.D., E. Bulte and J.F. Shogren, 2005. How trade saved humanity from biological exclusion: an economic theory of Neanderthal extinction. *Journal of Economic Behavior & Organization* 58 (1): 1-29.

Hublin, J.-J., 2000. Modern-Nonmodern Hominid Interactions: A Mediterranean Perspective. In *The Geography of Neandertals and Modern Humans in Europe and the Greater Mediterranean*, edited by O. Bar-Yosef and D. Pilbeam. Cambridge: Peabody Museum of Archaeology and Ethnology, Harvard University, 157-182.

Hublin, J.-J., 2009. The Origin of Neandertals. *Proceedings of the National Academy of Sciences* 106 (38): 16022-16027.

Hublin, J.-J., 2015. The modern human colonization of western Eurasia: when and where? *Quaternary Science Reviews* 118: 194-210.

Hublin, J.-J., 2017. The last Neanderthal. *Proceedings of the National Academy of Sciences*.

Hublin, J.-J., A. Ben-Ncer, S.E. Bailey, S.E. Freidline, S. Neubauer, M.M. Skinner, I. Bergmann, A. Le Cabec, S. Benazzi, K. Harvati and P. Gunz, 2017. New fossils from Jebel Irhoud, Morocco and the pan-African origin of Homo sapiens. *Nature* 546: 289.

Hublin, J.-J. and W. Roebroeks, 2009. Ebb and flow or regional extinctions? On the character of Neandertal occupation of northern environments. *Comptes Rendus Palevol* 8 (5): 503-509.

Hublin, J.-J., S. Talamo, M. Julien, F. David, N. Connet, P. Bodu, B. Vandermeersch and M.P. Richards, 2012. Radiocarbon dates from the Grotte du Renne and Saint-Césaire support a Neandertal origin for the Châtelperronian. *Proceedings of the National Academy of Sciences* 109: 18743–18748.

Huntley, B. and T. Webb III, 1989. Migration: species' response to climatic variations caused by changes in the earth's orbit. *Journal of Biogeography*: 5-19.

IBM Corp., 2015. IBM SPSS Statistics for Windows. *Version 23.0.0.3* 64-bit.

Iman, R.L. and W. Conover, 1980. Small sample sensitivity analysis techniques for computer models. with an application to risk assessment. *Communications in statistics-theory and methods* 9 (17): 1749-1842.

Imbrie, J., J.D. Hays, D.G. Martinson, A. McIntyre, A.C. Mix, J.J. Morley, N.G. Pisias, W.L. Prell and N.J. Shackleton, 1984. The orbital theory of Pleistocene climate: Support from a revised chronology of the marine delta ^{18}O record. In *Milankovitch and climate: Understanding the response to astronomical forcing*, edited by A. I. Berget et al., D. Reidel Publishing company.

Isaac, G.L., 1968. Traces of Pleistocene Hunters: An East African Example. In *Man the Hunter*, edited by R. B. Lee and I. DeVore: Aldine Publishing Company, Chicago, 253-361.

Isarin, R.F. and S.J. Bohncke, 1999. Mean July temperatures during the Younger Dryas in northwestern and central Europe as inferred from climate indicator plant species. *Quaternary Research* 51 (2): 158-173.

Ives, A.R. and S.R. Carpenter, 2007. Stability and Diversity of Ecosystems. *Science* 317 (5834): 58.

Janis, C.M., J. Damuth and J.M. Theodor, 2000. Miocene ungulates and terrestrial primary productivity: Where have all the browsers gone? *Proceedings of the National Academy of Sciences* 97 (14): 7899-7904.

Janssen, M.A., 2009. Understanding artificial anasazi. *Journal of Artificial Societies and Social Simulation* 12 (4): 13.

Janssen, M.A., L.N.i. Alessa, M. Barton, S. Bergin and A. Lee, 2008. Towards a community framework for agent-based modelling. *Journal of Artificial Societies and Social Simulation* 11 (2): 6.

Jennings, R., C. Finlayson, D. Fa and G. Finlayson, 2011. Southern Iberia as a refuge for the last Neanderthal populations. *Journal of Biogeography* 38 (10): 1873-1885.

Jiménez-Valverde, A. and J.M. Lobo, 2007. Threshold criteria for conversion of probability of species presence to either–or presence–absence. *Acta Oecologica* 31 (3): 361-369.

Johnson, J.W., 2000. A Heuristic Method for Estimating the Relative Weight of Predictor Variables in Multiple Regression. *Multivariate Behavioral Research* 35 (1): 1-19.

Johnston, A.S.A., M.E. Hodson, P. Thorbek, T. Alvarez and R.M. Sibly, 2014. An energy budget agent-based model of earthworm populations and its application to study the effects of pesticides. *Ecological Modelling* 280: 5-17.

Joordens, J.C.A., F. d/'Errico, F.P. Wesselingh, S. Munro, J. de Vos, J. Wallinga, C. Ankjaergaard, T. Reimann, J.R. Wijbrans, K.F. Kuiper, H.J. Mucher, H. Coqueugniot, V. Prie, I. Joosten, B. van Os, A.S. Schulp, M. Panuel, V. van der Haas, W. Lustenhouwer, J.J.G. Reijmer and W. Roebroeks, 2015. Homo erectus at Trinil on Java used shells for tool production and engraving. *Nature* 518 (7538): 228-231.

Joussaume, S. and K.E. Taylor, 1995. Status of the Paleoclimate Modeling Intercomparison Project (PMIP). Proceedings of the first international AMIP scientific conference. WCRP Report.

Kageyama, M., P. Braconnot, L. Bopp, V. Mariotti, T. Roy, M.-N. Woillez, A. Caubel, M.-A. Foujols, E. Guilyardi, M. Khodri, J. Lloyd, F. Lombard and O. Marti, 2013. Mid-Holocene and last glacial maximum climate simulations with the IPSL model: part II: model-data comparisons. *Climate Dynamics* 40 (9-10): 2469-2495.

Kaplan, H.S., K. Hill, J. Lancaster and A.M. Hurtado, 2000. A theory of human life history evolution: diet, intelligence and longevity. *Evolutionary Anthropology* 9 (4): 156-185.

Kay, D. and M. van Harmelen, 2012. Analytics for the whole institution; balancing strategy and tactics. *CETIS Analytics Series* 1 (2): 1067598-1.

Keeley, L.H., 1988. Hunter-gatherer economic complexity and "population pressure": A cross-cultural analysis. *Journal of Anthropological Archaeology* 7 (4): 373-411.

Kelly, R.L., 1983. Hunter-gatherer mobility strategies. *Journal of Anthropological Research* 39: 277-306.

Kelly, R.L., 1995. *The Foraging Spectrum. Diversity in Hunter-Gatherer Lifeways*. Washington, D.C.: Smithsonian Institution Press.

Kelly, R.L., 2003. Colonization of new land by hunter-gatherers. Expectations and implications based on ethnographic data. In *Colonization of Unfamiliar Landscapes: The archaeology of adaptation.*, edited by M. Rockman and J. Steele. London/New York: Routledge, 44-58.

Kemerer, C.F. and M.C. Paulk, 2009. The impact of design and code reviews on software quality: An empirical study based on psp data. *IEEE transactions on software engineering* 35 (4): 534-550.

Klein, R.G., 2008. Out of Africa and the Evolution of Human Behavior. *Evolutionary Anthropology* 17: 267-281.

Klein, R.G., 2009a. Darwin and the recent African origin of modern humans. *Proceedings of the National Academy of Sciences* 106 (38): 16007-16009.

Klein, R.G., 2009b. *The Human Career: Human Biological and Cultural Evolution*. Third Edition : University of Chicago Press, Chicago.

Klein, R.G. and T.E. Steele, 2013. Archaeological shellfish size and later human evolution in Africa *PNAS* 110 (27): 10910-10915.

Kohler, T.A., 2012. Complex systems and archaeology. *Archaeological theory today*: 93-123.

Kohler, T.A. and S.E. Van der Leeuw, 2007. Introduction. Historical Socionatural Systems and Models. In *The model-based archaeology of socionatural systems*, edited by T. A. Kohler and S. E. Van der Leeuw. Santa Fe, New Mexico: School for Advanced Research Press, 1-12.

Kolodny, O. and M.W. Feldman, 2017. A parsimonious neutral model suggests Neanderthal replacement was determined by migration and random species drift. *Nature Communications* 8 (1): 1040.

Kondo, Y., K. Sano, T. Omori, A. Abe-Ouchi, W.-L. Chan, S. Kadowaki, M. Naganuma, R. O'ishi, T. Oguchi, Y. Nishiaki and M. Yoneda, 2018. Ecological Niche and Least-Cost Path Analyses to Estimate Optimal Migration Routes of Initial Upper Palaeolithic Populations to Eurasia. In *The Middle and Upper Paleolithic Archeology of the Levant and Beyond*, edited by Y. Nishiaki and T. Akazawa. Singapore: Springer Singapore, 199-212.

Konigsberg, L.W. and S.R. Frankenberg, 2013. Demography. In *Research Methods in Human Skeletal Biology*, edited by E. A. diGangi and M. K. Moore. New York City (USA): ElsevierAcademic Press, 293-322.

Kowarik, K., H. Reschreiter and G.P.X. Wurzer, 2012. Modelling Prehistoric Mining. *IFAC Proceedings Volumes* 45 (2): 17-29.

Kremer, M., 1993. Population growth and technological change: one million BC to 1990. *The Quarterly Journal of Economics* 108 (3): 681-716.

Krohne, D., 2001. *General ecology*, 2nd edn. Pacific Grove, CA: Brooks/Cole.

Kuhn, S.L., D.A. Raichlen and A.E. Clark, 2016. What moves us? How mobility and movement are at the center of human evolution. *Evolutionary Anthropology: Issues, News, and Reviews* 25 (3): 86-97.

Kuhn, S.L. and M.C. Stiner, 2006. What's a Mother to Do? The Division of Labor among Neandertals and Modern Humans in Eurasia. *Current Anthropology* 47 (6): 953-980.

Kyriacou, K., J.E. Parkington, A.D. Marais and D.R. Braun, 2014. Nutrition, modernity and the archaeological record: Coastal resources and nutrition among Middle Stone Age hunter-gatherers on the western Cape coast of South Africa. *Journal of Human Evolution* 77 (Supplement C): 64-73.

Lake, M.W., 2000. MAGICAL computer simulation of Mesolithic foraging. *Dynamics in Human and Primate Societies: agent-based modelling of social and spatial processes*: 107-143.

Lake, M.W., 2014. Trends in Archaeological Simulation. *Journal of Archaeological Method and Theory* 21 (2): 258-287.

Lalueza-Fox, C., A. Rosas, A. Estalrrich, E. Gigli, P.F. Campos, A. García-Tabernero, S. García-Vargas, F. Sánchez-Quinto, O. Ramírez, S. Civit, M. Bastir, R. Huguet, D. Santamaría, M.T.P. Gilbert, E. Willerslev and M. de la Rasilla, 2011. Genetic evidence for patrilocal mating behavior among Neandertal groups. *Proceedings of the National Academy of Sciences* 108 (1): 250-253.

Lambeck, K. and J. Chappell, 2001. Sea level change through the last glacial cycle. *Science* 292: 679-685.

Law, A.M. and M.G. McComas, 1991. Secrets of successful simulation studies. *Proceedings of the 1991 Winter Conference on Simulation* (23rd).

Lawing, A.M. and P.D. Polly, 2011. Pleistocene Climate, Phylogeny, and Climate Envelope Models: An Integrative Approach to Better Understand Species' Response to Climate Change. *PLoS ONE* 6 (12): e28554.

Layton, R. and S. O'Hara, 2010. Human Social Evolution: A Comparison of Hunter-gatherer and Chimpanzee Social Organization. Proceedings of the British Academy.

Lee, J.-S., T. Filatova, A. Ligmann-Zielinska, B. Hassani-Mahmooei, F. Stonedahl, I. Lorscheid, A. Voinov, J.G. Polhill, Z. Sun and D.C. Parker, 2015. The Complexities of Agent-Based Modeling Output Analysis. *Journal of Artificial Societies and Social Simulation* 18 (4).

Lee, R.B., 1968. What hunters do for a living, or, how to make out on scarce resources. In *Man the Hunter*, edited by R. B. Lee and I. DeVore. New York: Aldine Publishing Company, 30-48.

Lee, R.B. and I. DeVore, 1968. Preface. In *Man the Hunter*, edited by R. B. Lee and I. DeVore. New York: Aldine Publishing Company, vii-ix.

Lehmann, J., A.H. Korstjens and R.I.M. Dunbar, 2007. Fission–fusion social systems as a strategy for coping with ecological constraints: a primate case. *Evolutionary Ecology* 21 (5): 613-634.

Leppard, T.P., 2015. Passive Dispersal versus Strategic Dispersal in Island Colonization by Hominins. *Current Anthropology* 56 (4): 7.

Leppard, T.P. and C. Runnels, 2017. Maritime hominin dispersals in the Pleistocene: advancing the debate. *antiquity* 91 (356): 510-519.

Levins, R., 1966. The strategy of model building in population biology. *American Scientist* 54 (4): 421-431.

Lewis, S.G., N.M. Ashton and R. Jacobi, 2011. Testing Human Presence During the Last Interglacial (MIS 5e): A Review of the British Evidence. In *The Ancient Human Occupation of Britain*, edited by N. M. Ashton, S. G. Lewis and C. B. Stringer. Amsterdam: Elsevier, 125-164.

Li, J., Y. Cui, J. Liu, W. Shi and Y. Qin, 2013. Estimation and analysis of net primary productivity by integrating MODIS remote sensing data with a light use efficiency model. *Ecological Modelling* 252 (0): 3-10.

Lieberman, D.E., 2002. Neandertal and Early Modern Human Mobility Patterns. In *Neandertals and Modern Humans in Western Asia*, edited by T. Akazawa, K. Aoki and O. Bar-Yosef: Springer US, 263-275.

Liefvendahl, M. and R. Stocki, 2006. A study on algorithms for optimization of Latin hypercubes. *Journal of Statistical Planning and Inference* 136 (9): 3231-3247.

Lieth, H., 1973. Primary production: Terrestrial ecosystems. *Human Ecology* 1 (4): 303-332.

Ligmann-Zielinska, A., D.B. Kramer, K. Spence Cheruvelil and P.A. Soranno, 2014. Using Uncertainty and Sensitivity Analyses in Socioecological Agent-Based Models to Improve Their Analytical Performance and Policy Relevance. *PLoS ONE* 9 (10): e109779.

Linge, N. and A. Sutton, 2015. *30 Years of Mobile Phones in the UK*: Amberley Publishing Limited.

Lisiecki, L.E. and M.E. Raymo, 2005. A Pliocene-Pleistocene stack of 57 globally distributed benthic d18O records. *Paleoceanography* 20: PA1003.

Locht, J.-L., É. Goval and P. Antoine, 2010. Reconstructing Middle Palaeolithic hominid behaviour during OIS 5 in northern France. In *Settlement Dynamics of the Middle Paleolithic and Middle Stone Age: Volume III*, edited by N. J. Conard and A. Delagnes: Kerns Verlag, Tübingen, 329-356.

López-García, J.M., H.-A. Blain, I. Lozano-Fernández, E. Luzi and A. Folie, 2017. Environmental and climatic reconstruction of MIS 3 in northwestern Europe using the small-mammal assemblage from Caverne Marie-Jeanne (Hastière-Lavaux, Belgium). *Palaeogeography, Palaeoclimatology, Palaeoecology* 485: 622-631.

Lowe, J.J. and M.J. Walker, 2014. *Reconstructing quaternary environments*: Routledge.

Lyman, R.L., 1979. Available meat from faunal remains: A consideration of techniques. *American Antiquity*: 536-546.

Macal, C.M. and M.J. North, 2005. Tutorial on agent-based modeling and simulation. Proceedings of the 37th conference on Winter simulation.

Macal, C.M. and M.J. North, 2009. Agent-based modeling and simulation. In *Winter Simulation Conference*. Austin, Texas: Winter Simulation Conference.

MacDonald, K., 2007. Cross-cultural Comparison of Learning in Human Hunting. Implications for Life History Evolution. *Human Nature* 18 (4): 386-402.

MacDonald, K., M. Martinón-Torres, R.W. Dennell and J.M. Bermúdez de Castro, 2012. Discontinuity in the record for hominin occupation in south-western Europe: Implications for occupation of the middle latitudes of Europe. *Quaternary International* 271: 84-97.

MacDonald, K., W. Roebroeks and A. Verpoorte, 2009. An energetics perspective on the Neandertal record. In *The evolution of hominin diets: Integrating approaches to the study of Palaeolithic subsistence.*, edited by J.-J. Hublin and M. P. Richards. Leipzig: Springer, 211-220.

MacDonell, G., 1995. Environmental resources and range size: a study of modern and ancients hunter gathers. *Nebraska Anthropologist* 12.

Malleson, N., 2006. An agent-based model of burglary in Leeds, School of Geography, Uniersity of Leeds, Leeds.

Mäntylä, M.V. and C. Lassenius, 2009. What Types of Defects Are Really Discovered in Code Reviews? *IEEE Transactions on Software Engineering* 35 (3): 430-448.

Marc, P., 2001. Digital Natives, Digital Immigrants Part 2: Do They Really Think Differently? *On the Horizon* 9 (6): 1-6.

Marean, C.W. and S.Y. Kim, 1998. Mousterian large-mammal remains from Kobeh Cave: Behavioural implications for Neanderthals and early modern humans. *Current Anthropology* 39 (Suppl. 3): S79-S113.

Maria, B. and S. Udo, 2017. Why input matters: Selection of climate data sets for modelling the potential distribution of a treeline species in the Himalayan region. *Ecological Modelling* 359: 92-102.

Marín, J., P. Saladié, A. Rodríguez-Hidalgo and E. Carbonell, 2017. Neanderthal hunting strategies inferred from mortality profiles within the Abric Romaní sequence. *PLoS ONE* 12 (11): e0186970.

Maris, M.N.A., B. de Boer and J. Oerlemans, 2012. A climate model intercomparison for the Antarctic region: present and past. *Climate of the Past* 8: 803-814.

Marks, J., 2012. My ancestors, myself. Fossil genomics is opening new windows to the past. But the view through them isn't as clear as we like to think. . In *Aeon 12*.

Martelle Hayter, H., 2011. Hunter-gatherers and the Ethnographic Analogy: Theoretical Perspectives. *Totem: The University of Western Ontario Journal of Anthropology* 1 (1): 8.

Marwick, B., 2017. Computational Reproducibility in Archaeological Research: Basic Principles and a Case Study of Their Implementation. *Journal of Archaeological Method and Theory* 24 (2): 424-450.

Mateos, A., I. Goikoetxea, W.R. Leonard, J.Á. Martín-González, G. Rodríguez-Gómez and J. Rodríguez, 2014. Neandertal growth: What are the costs? *Journal of Human Evolution* 77: 167-178.

Mathur, P., 2007. Agent-based Modeling of Urban Phenomena in GIS. In *Urban Spatial Analytics, Capstone Project*: University of Pennsylvania.

Mayr, E., 1950. Taxonomic categories in fossil homnids. *Cold Spring Harbor Symposium on Quantitative Biology* 15: 108-118.

McGlade, J., 2014. Simulation as narrative: contingency, dialogics, and the modeling conundrum. *Journal of Archaeological Method and Theory* 21 (2): 288-305.

McNaughton, S.J., M. Oesterheld, D.A. Frank and K.J. Williams, 1989. Ecosystem-level patterns of primary productivity and herbivory in terrestrial habitats. *Nature* 341 (6238): 142-144.

Medina-Elizalde, M., 2013. A global compilation of coral sea-level benchmarks: Implications and new challenges. *Earth and Planetary Science Letters* 362 (0): 310-318.

Melchionna, M., M. Di Febbraro, F. Carotenuto, L. Rook, A. Mondanaro, S. Castiglione, C. Serio, V.A. Vero, G. Tesone, M. Piccolo, J.A.F. Diniz-Filho and P. Raia, 2018. Fragmentation of Neanderthals' pre-extinction distribution by climate change. *Palaeogeography, Palaeoclimatology, Palaeoecology* 496: 146-154.

Melis, A.P. and M. Tomasello, 2013. Chimpanzees' (Pan troglodytes) strategic helping in a collaborative task. *Biology Letters* 9 (2).

Mellars, P.A., 1992. Archaeology and the population-dispersal hypothesis of modern human origins in Europe. *Philosophical Transactions of the Royal Society of London* 337: 225-234.

Meyer, M., J.-L. Arsuaga, C. de Filippo, S. Nagel, A. Aximu-Petri, B. Nickel, I. Martínez, A. Gracia, J.M.B. de Castro, E. Carbonell, B. Viola, J. Kelso, K. Prüfer and S. Pääbo, 2016. Nuclear DNA sequences from the Middle Pleistocene Sima de los Huesos hominins. *Nature* 531: 504.

Michalewicz, Z., 1992. *Genetic algorithms + data structures = evolution programs*: Springer-Verlag.

Miller, B.L. and D.E. Goldberg, 1995. Genetic algorithms, tournament selection, and the effects of noise. *Complex systems* 9 (3): 193-212.

Miller, J.H. and S.E. Page, 2007a. *Complex Adaptive Systems: An introduction to computational models of social life.*: Princeton, NJ: Princeton University Press.

Miller, J.H. and S.E. Page, 2007b. Social Science in Between, from Complex Adaptive Systems: *An Introduction to Computational Models of Social Life*. Introductory Chapters.

Mithen, S. and M. Reed, 2002. Stepping out: a computer simulation of hominid dispersal from Africa. *Journal of Human Evolution* 43 (4): 433-462.

Monserud, R.A. and R. Leemans, 1992. Comparing global vegetation maps with the Kappa statistic. *Ecological Modelling* 62 (4): 275-293.

Montuire, S. and E. Desclaux, 1997. Palaeoecological analysis of mammalian faunas and environmental evolution in the South of France during the Pleistocene. *Boreas* 26 (4): 355-365.

Moore, G., 1965. Moore’s law. *Electronics Magazine* 38 (8): 114.

Mosbrugger, V., T. Utescher and D.L. Dilcher, 2005. Cenozoic continental climatic evolution of Central Europe. *Proceedings of the National Academy of Sciences of the United States of America* 102 (42): 14964-14969.

Moum, J.N., A. Perlin, J.D. Nash and M.J. McPhaden, 2013. Seasonal sea surface cooling in the equatorial Pacific cold tongue controlled by ocean mixing. *Nature* 500 (7460): 64-67.

Mulder, V., V. Heri and T. Wickham, 2000. Traditional honey and wax collection with Apis dorsata in the upper Kapuas Lake region, West Kalimantan. In *Borneo Research Bulletin* edited by C. Sather: Borneo Research Council, 246-260.

Müller, B., S. Balbi, C.M. Buchmann, L. de Sousa, G. Dressler, J. Groeneveld, C.J. Klassert, Q.B. Le, J.D.A. Millington, H. Nolzen, D.C. Parker, J.G. Polhill, M. Schlüter, J. Schulze, N. Schwarz, Z. Sun, P. Taillandier and H. Weise, 2014. Standardised and transparent model descriptions for agent-based models: Current status and prospects. *Environmental Modelling & Software* 55 (0): 156-163.

Müller, U.C., J.ö. Pross and E. Bibus, 2003. Vegetation response to rapid climate change in central europe during the past 140,000 yr based on evidence from the Füramoos pollen record. *Quaternary Research* 59 (2): 235-245.

Murdock, G.P., 1967. *Ethnographic Atlas: a Summary*. Pittsburgh: University of Pittsburgh Press.

Muttoni, G., G. Scardia and D.V. Kent, 2018. Early hominins in Europe: The Galerian migration hypothesis. *Quaternary Science Reviews* 180: 1-29.

Nabel, J.E., N. Zurbriggen and H. Lischke, 2013. Interannual climate variability and population density thresholds can have a substantial impact on simulated tree species' migration. *Ecological Modelling* 257: 88-100.

Nakazawa, Y. and C.J. Bae, 2017. Quaternary paleoenvironmental variation and its impact on initial human dispersals into the Japanese Archipelago. *Palaeogeography, Palaeoclimatology, Palaeoecology*.

Niazi, M.A. and A. Temkin, 2017. Why teach modeling & simulation in schools? *Complex Adaptive Systems Modeling* 5 (1): 7.

Nichols, J.D., 2001. Using models in the conduct of science and management of natural resources. In *Modeling in natural resource management: development, interpretation, and application*, edited by T. M. Shenk and A. B. Franklin. Washington, DC: Island Press.

Nikolai, C. and G. Madey, 2009. Tools of the trade: A survey of various agent based modeling platforms. *Journal of Artificial Societies and Social Simulation* 12 (2): 2.

North, M.J., N.T. Collier, J. Ozik, E.R. Tatara, C.M. Macal, M. Bragen and P. Sydelko, 2013. Complex adaptive systems modeling with Repast Simphony. *Complex Adaptive Systems Modeling* 1 (1): 1-26.

North, M.J., N.T. Collier and J.R. Vos, 2006. Experiences creating three implementations of the repast agent modeling toolkit. *ACM Transactions on Modeling and Computer Simulation (TOMACS)* 16 (1): 1-25.

North, M.J., T.R. Howe, N.T. Collier and J.R. Vos, 2005. The repast simphony runtime system. Agent 2005 Conference on Generative Social Processes, Models, and Mechanisms, at Argonne National Laboratory, Argonne, IL USA.

Nuzzo, R., 2014. Scientific method: statistical errors. *Nature News* 506 (7487): 150.

O'Connell, J.F., 2006. How did modern humans displace Neanderthals? Insights from hunter-gatherer ethnography and archaeology. *When Neanderthals and modern humans met*: 43-64.

O'Connor, S., J. Louys, S. Kealy and S.C.S. Carro, 2017. Hominin Dispersal and Settlement East of Huxley's Line: The Role of Sea Level Changes, Island Size, and Subsistence Behavior. *Current Anthropology* 58(S17), S567-S582.

Oesterheld, M., O.E. Sala and S.J. McNaughton, 1992. Effect of animal husbandry on herbivore-carrying capacity at a regional scale. *Nature* 356 (6366): 234-236.

Olfert, O., R.M. Weiss and D. Kriticos, 2011. Application of General Circulation Models to Assess the Potential Impact of Climate Change on Potential Distribution and Relative Abundance of Melanoplus sanguinipes (Fabricius) (Orthoptera: Acrididae) in North America. *Psyche: A Journal of Entomology* 2011: 9.

Otto-Bliesner, B.L., E.C. Brady, G. Clauzet, R. Tomas, S. Levis and Z. Kothavala, 2006. Last Glacial Maximum and Holocene Climate in CCSM3. *Journal of Climate* 19 (11): 2526-2544.

Otto-Bliesner, B.L., C.D. Hewitt, T.M. Marchitto, E. Brady, A. Abe-Ouchi, M. Crucifix, S. Murakami and S.L. Weber, 2007. Last Glacial Maximum ocean thermohaline circulation: PMIP2 model intercomparisons and data constraints. *Geophysical Research Letters* 34 (12): L12706.

Pais, C.M., M.G. Colazo, M. Fernandez, S. Bulatovich and H. Fernandez, 2017. Dengue Agent-Based Model in South American Temperate Zone. In *Bioinformatics and Biomedical Engineering: 5th International Work-Conference, IWBBIO 2017, Granada, Spain, April 26–28, 2017*, edited by I. Rojas and F. Ortuño. Granada, Spain: Springer International Publishing.

Pearson, R.G., W. Thuiller, M.B. Araújo, E. Martinez-Meyer, L. Brotons, C. McClean, L. Miles, P. Segurado, T.P. Dawson and D.C. Lees, 2006. Model-based uncertainty in species range prediction. *Journal of Biogeography* 33 (10): 1704-1711.

Peeters, H. and J.-W. Romeijn, 2016. Epistemic considerations about uncertainty and model selection in computational archaeology: a case study on exploratory modeling. In *Uncertainty and Sensitivity Analysis in Archaeological Computational Modeling*: Springer, 37-58.

Peng, R.D., 2011. Reproducible Research in Computational Science. *Science* 334 (6060): 1226.

Pennington, 2001. Hunter-gatherer demography. In *Hunter-gatherers: an interdisciplinary perspective*, edited by C. Panter-Brick, R. H. Layton and P. Rowley-Conwy. Cambridge: Cambridge University Press.

Pereda, M., D. Zurro, J.I. Santos, I. Briz i Godino, M. Álvarez, J. Caro and J.M. Galán, 2017. Emergence and Evolution of Cooperation Under Resource Pressure. *Scientific Reports* 7: 45574.

Pfeifer, B., K. Kugler, M.M. Tejada, C. Baumgartner, M. Seger, M. Osl, M. Netzer, M. Handler, A. Dander and M. Wurz, 2008. A cellular automaton framework for infectious disease spread simulation. *The open medical informatics journal* 2: 70.

Phillips, B.L., G.P. Brown, J.K. Webb and R. Shine, 2006. Invasion and the evolution of speed in toads. *Nature* 439 (7078): 803-803.

Phillips, S.J., R.P. Anderson and R.E. Schapire, 2006. Maximum entropy modeling of species geographic distributions. *Ecological Modelling* 190 (3–4): 231-259.

Pitt, W.C., P.W. Box and F.F. Knowlton, 2003. An individual-based model of canid populations: modelling territoriality and social structure. *Ecological Modelling* 166 (1): 109-121.

Polack, F.A., P.S. Andrews, T. Ghetiu, M. Read, S. Stepney, J. Timmis and A.T. Sampson, 2010. *Reflections on the simulation of complex systems for science*. 15th IEEE International Conference on Engineering of Complex Computer Systems (ICECCS).

Power, R., D. Salazar-García, D. A, M. Rubini, K. Harvati, W. M.J, H. J.J and H. A, 2018. Dental calculus indicates widespread plant use within the stable Neanderthal dietary niche. *Journal of Human Evolution,* 119, 27-41.

Premo, L., J. Murphy, J. Scholnick, B. Gabler and J. Beaver, 2005. Making a case for agent-based modeling. *Society for Archaeological Sciences Bulletin* 28 (3): 11-13.

Prentice, I.C., W. Cramer, S.P. Harrison, R. Leemans, R.A. Monserud and A.M. Solomon, 1992. Special paper: a global biome model based on plant physiology and dominance, soil properties and climate. *Journal of biogeography*: 117-134.

Prentice, I.C., D. Jolly and B. participants, 2000. Mid-Holocene and glacial-maximum vegetation geography of the northern continents and Africa. *Journal of Biogeography* 27 (3): 507-519.

Pryor, A., A. Pullen, D. Beresford-Jones, J. Svoboda and C. Gamble, 2016. Reflections on Gravettian firewood procurement near the Pavlov Hills, Czech Republic. *Journal of Anthropological Archaeology* 43: 1-12.

Pulliam, H.R., 1988. Sources, sinks, and population regulation. *The American Naturalist* 132 (5): 652-661.

Pulliam, H.R., 1996. Sources and sinks: empirical evidence and population consequences. In *Population dynamics in ecological space and time*, edited by O. E. J. Rhodes, R. K. Chester and M. H. Smith. Chicago: University of Chicago Press, Illinois, USA, 45-69.

R Core Team, 2017. *R: A language and environment for statistical computing. R Foundation for Statistical Computing*, Vienna, Austria.

Radloff, F.G.T. and J.T. Du Toit, 2004. Large predators and their prey in a southern African savanna: a predator's size determines its prey size range. *Journal of Animal Ecology* 73 (3): 410-423.

Railsback, S.F., S.L. Lytinen and S.K. Jackson, 2006. Agent-based simulation platforms: Review and development recommendations. *Simulation* 82 (9): 609-623.

Rangel, T.F.L., J.A.F. Diniz-Filho and L.M. Bini, 2006. Towards an integrated computational tool for spatial analysis in macroecology and biogeography. *Global ecology and biogeography* 15 (4): 321-327.

Rangel, T.F.L., J.A.F. Diniz Filho and L.M. Bini, 2010. SAM: a comprehensive application for spatial analysis in macroecology. *Ecography* 33 (1): 46-50.

Rasmussen, S.O., M. Bigler, S.P. Blockley, T. Blunier, S.L. Buchardt, H.B. Clausen, I. Cvijanovic, D. Dahl-Jensen, S.J. Johnsen, H. Fischer, V. Gkinis, M. Guillevic, W.Z. Hoek, J.J. Lowe, J.B. Pedro, T. Popp, I.K. Seierstad, J.P. Steffensen, A.M. Svensson, P. Vallelonga, B.M. Vinther, M.J.C. Walker, J.J. Wheatley and M. Winstrup, 2014. A stratigraphic framework for abrupt climatic changes during the Last Glacial period based on three synchronized Greenland ice-core records: refining and extending the INTIMATE event stratigraphy. *Quaternary Science Reviews* 106: 14-28.

Revay, P. and C. Cioffi-Revilla, 2018. Survey of evolutionary computation methods in social agent-based modeling studies. *Journal of Computational Social Science* 1 (1): 115-146.

Reyes-Centeno, H., S. Ghirotto, F. Détroit, D. Grimaud-Hervé, G. Barbujani and K. Harvati, 2014. Genomic and cranial phenotype data support multiple modern human dispersals from Africa and a southern route into Asia. *Proceedings of the National Academy of Sciences* 111 (20): 7248-7253.

Richards, M., K. Harvati, V. Grimes, C. Smith, T. Smith, J.-J. Hublin, P. Karkanas and E. Panagopoulou, 2008. Strontium isotope evidence of Neanderthal mobility at the site of Lakonis, Greece using laser-ablation PIMMS. *Journal of Archaeological Science* 35 (5): 1251-1256.

Richards, M.P., P.B. Pettitt, E. Trinkaus, F.H. Smith, M. Paunović and I. Karavanić, 2000. Neanderthal diet at Vindija and Neanderthal predation: The evidence from stable isotopes. *Proceedings of the National Academy of Sciences* 97 (13): 7663-7666.

Richards, M.P. and E. Trinkaus, 2009. Isotopic evidence for the diets of European Neanderthals and early modern humans. *Proceedings of the National Academy of Sciences* 106 (38): 16034-16039.

Richter, D., H. Dibble, P. Goldberg, S.P. McPherron, L. Niven, D. Sandgathe, S. Talamo and A. Turq, 2013. The late Middle Palaeolithic in Southwest France: New TL dates for the sequence of Pech de l'Azé IV. *Quaternary International* 294: 160-167.

Riede, F. and J.B. Pedersen, 2018. Late Glacial Human Dispersals in Northern Europe and Disequilibrium Dynamics. *Human Ecology*.

Rigby, P.C. and M.-A. Storey, 2011. Understanding broadcast based peer review on open source software projects. *Proceedings of the 33rd International Conference on Software Engineering*. IEEE.

Roebroeks, W., 2006. The human colonisation of Europe: where are we? *Journal of Quaternary Science* 21 (5): 425-435.

Roebroeks, W., 2010. *The Neandertal Experiment*. Amsterdam: Stichting Nederlands Museum voor Anthropologie en Praehistorie.

Roebroeks, W., N.J. Conard and T. van Kolfschoten, 1992. Dense forests, cold steppes and the Palaeolithic settlement of Northern Europe. *Current Anthropology* 33 (5): 551-586.

Roebroeks, W., J.J. Hublin and K. MacDonald, eds, 2011. *Continuities and Discontinuities in Neandertal Presence: A Closer look at Northwestern Europe*. Edited by N. M. Ashton, S. G. Lewis and C. B. Stringer. The Ancient Human Occupation Of Britain ed. Vol. 14, *Developments in Quaternary Science*. Amsterdam: Elsevier.

Roebroeks, W. and M. Soressi, 2016. Neandertals revised. *Proceedings of the National Academy of Sciences* 113 (23): 6372-6379.

Rogers, J.D. and W.H. Cegielski, 2017. Opinion: Building a better past with the help of agent-based modeling. *Proceedings of the National Academy of Sciences* 114 (49): 12841-12844.

Romanowska, I., C. Gamble, S. Bullock and F. Sturt, 2017. Dispersal and the Movius line: testing the effect of dispersal on population density through simulation. *Quaternary International* 431: 53-63.

Roussel, M., M. Soressi and J.-J. Hublin, 2016. The Châtelperronian conundrum: blade and bladelet lithic technologies from Quinçay, France. *Journal of Human Evolution* 95: 13-32.

RStudio: Integrated development environment for R 1.0.153, Boston, MA.

Ruebens, K., S.J.P. McPherron and J.-J. Hublin, 2015. On the local Mousterian origin of the Châtelperronian: Integrating typo-technological, chronostratigraphic and contextual data. *Journal of Human Evolution* 86: 55-91.

Rufà, A., R. Blasco, F. Rivals and J. Rosell, 2015. Who eats whom? Taphonomic analysis of the avian record from the Middle Paleolithic site of Teixoneres Cave (Moià, Barcelona, Spain). *Quaternary International*, 421, 103-115.

Salazar-García, D.C., R.C. Power, A. Sanchis Serra, V. Villaverde, M.J. Walker and A.G. Henry, 2013. Neanderthal diets in central and southeastern Mediterranean Iberia. *Quaternary International,* 318, 3-18.

Sanchez Goñi, M.F. and S.P. Harrison, 2010. Millennial-scale climate variability and vegetation changes during the Last Glacial: Concepts and terminology. *Quaternary Science Reviews* 29 (21-22): 2823-2827.

Sanchez Goñi, M.F., A. Landais, W.J. Fletcher, F. Naughton, S. Desprat and J. Duprat, 2008. Contrasting impacts of Dansgaard–Oeschger events over a western European latitudinal transect modulated by orbital parameters. *Quaternary Science Reviews* 27 (11): 1136-1151.

Sandve, G.K., A. Nekrutenko, J. Taylor and E. Hovig, 2013. Ten Simple Rules for Reproducible Computational Research. *PLOS Computational Biology* 9 (10): e1003285.

Schelling, T.C., 1978. *Micromotives and Macrobehavior,* Fels lectures on public policy analysis. New York: WW Norton.

Scherjon, F., 2011. SteppingIn – Modelling and Simulating Modern Humans moving into Palaeolithic Europe, Faculty of archaeology, University/College of Higher Education: University of Leiden, Leiden, The Netherlands.

Scherjon, F., 2012. SteppingIn – Modern humans moving into Europe – Implementation. In *CAA 2012 International Conference*, edited by D. Whitelock, W. Warburton, G. Wills and L. Gilbert. University of Southampton.

Scherjon, F., 2015a. *HomininSpace, modelling and simulating hominins moving through time and real geographic space* (thesis), Human Origins, Faculty of Archaeology, Leiden University, Leiden, The Netherlands.

Scherjon, F., 2015b. Large scale population modelling in the deep past. Issues and concerns. HomininSpace, a case study in points. In *Computer Applications and Quantitative Methods in Archaeology (CAA)*. Siena, Spain.

Scherjon, F., 2015c. Neanderthals on the move. Or not. Poster presentation. In *European Society for the Study of Human Evolution (ESHE)*. London, UK.

Scherjon, F., 2016. Evolving hominins in HomininSpace—Genetic algorithms and the search for the 'perfect'Neanderthal. *Proceedings Computer Applications & Quantitative Methods in Archaeology*, at Oslo.

Scherjon, F., C. Bakels, K. MacDonald and W. Roebroeks, 2015. Burning the Land: An Ethnographic Study of Off-Site Fire Use by Current and Historically Documented Foragers and Implications for the Interpretation of Past Fire Practices in the Landscape. *Current Anthropology* 56 (3): 299-326.

Schiffer, M.B., 1985. Is There a "Pompeii Premise" in Archaeology? *Journal of Anthropological Research* 41: 18-41.

Schmitt, T. and Z. Varga, 2012. Extra-Mediterranean refugia: The rule and not the exception? *Frontiers in zoology* 9 (1): 1-12.

Schmitz, H., 2018. Schnek: A C++ library for the development of parallel simulation codes on regular grids. *Computer Physics Communications*.

Scott, B. and N.M. Ashton, 2011. The Early Middle Palaeolithic: The European Context. In *The Ancient Human Occupation of Britain*, edited by N. M. Ashton, S. G. Lewis and C. B. Stringer. Amsterdam: Elsevier, 91-112.

Shaman, J., S. Solomon, R.R. Colwell and C.B. Field, 2013. Fostering advances in interdisciplinary climate science. *Proceedings of the National Academy of Sciences* 110 (Supplement 1): 3653-3656.

Shaw, C.N. and J.T. Stock, 2013. Extreme mobility in the Late Pleistocene? Comparing limb biomechanics among fossil< i> Homo</i>, varsity athletes and Holocene foragers. *Journal of human evolution*.

Shea, John J., 1998. Neandertal and Early Modern Human Behavioral Variability A Regional-Scale Approach to Lithic Evidence for Hunting in the Levantine Mousterian. *Current Anthropology* 39 (s1): S45-S78.

Shen, C.-C., T. Lee, K.-K. Liu, H.-H. Hsu, R.L. Edwards, C.-H. Wang, M.-Y. Lee, Y.-G. Chen, H.-J. Lee and H.-T. Sun, 2005. An evaluation of quantitative reconstruction of past precipitation records using coral skeletal Sr/Ca and δ18O data. *Earth and Planetary Science Letters* 237 (3–4): 370-386.

Short, R., 1987. The biological basis for the contraceptive effects of breast feeding. *International Journal of Gynecology & Obstetrics* 25: 207-217.

Shultz, S., C. Opie and Q.D. Atkinson, 2011. Stepwise evolution of stable sociality in primates. *Nature* 479 (7372): 219-222.

Sibly, R.M., V. Grimm, B.T. Martin, A.S. Johnston, K. Kułakowska, C.J. Topping, P. Calow, J. Nabe-Nielsen, P. Thorbek and D.L. DeAngelis, 2013. Representing the acquisition and use of energy by individuals in agent-based models of animal populations. *Methods in Ecology and Evolution* 4 (2): 151-161.

Sier, M.J., J.M. Parés, P. Antoine, J.-L. Locht, M.J. Dekkers, N. Limondin-Lozouet and W. Roebroeks, 2015. Evidence for the Blake Event recorded at the Eemian archaeological site of Caours, France. *Quaternary International* 357: 149-157.

Sier, M.J., W. Roebroeks, C.C. Bakels, M.J. Dekkers, E. Brühl, D. De Loecker, S. Gaudzinski-Windheuser, N. Hesse, A. Jagich, L. Kindler, W.J. Kuijper, T. Laurat, H.J. Mücher, K.E.H. Penkman, D. Richter and D.J.J. van Hinsbergen, 2011. Direct terrestrial-marine correlation demonstrates surprisingly late onset of the last interglacial in central Europe. *Quaternary Research* 75 (1): 213-218.

Silva, M., M. Brimacombe and J.A. Downing, 2001. Effects of body mass, climate, geography, and census area on population density of terrestrial mammals. *Global Ecology and Biogeography* 10 (5): 469-485.

Skinner, M., 1997. Dental wear in immature Late Pleistocene European hominines. *Journal of archaeological science* 24 (8): 677-700.

Slimak, L. and Y. Giraud, 2007. Circulations sur plusieurs centaines de kilomètres durant le Paléolithique moyen. Contribution à la connaissance des sociétés néandertaliennes. *Comptes Rendus Palevol* 6 (5): 359-368.

Smith, T.M., P. Tafforeau, D.J. Reid, R. Grün, S. Eggins, M. Boutakiout and J.-J. Hublin, 2007. Earliest evidence of modern human life history in North African early *Homo sapiens*. *Proceedings of the National Academy of Sciences* 104 (15): 6128-6133.

Smith, T.M., P. Tafforeau, D.J. Reid, J. Pouech, V. Lazzari, J.P. Zermeno, D. Guatelli-Steinberg, A.J. Olejniczak, A. Hoffman, J. Radovcic, M. Makaremi, M. Toussaint, C. Stringer and J.-J. Hublin, 2010. Dental evidence for ontogenetic differences between modern humans and Neanderthals. *Proceedings of the National Academy of Sciences,* 107(49), 20923-20928.

Smith, W.H.F. and D.T. Sandwell, 1997. Global Sea Floor Topography from Satellite Altimetry and Ship Depth Soundings. *Science* 277 (5334): 1956-1962.

Sneyers, R., 1991. *On the statistical analysis of series of observations*. Technical Note - World Meteorological Organization 143.

Snodgrass, J.J. and W.R. Leonard, 2009. Neandertal energetics revisited: Insights into population dynamics and life history evolution. *PaleoAnthropology*: 220-237.

Soltis, J., R. Boyd and P.J. Richerson, 1995. Can Group-Functional Behaviors Evolve by Cultural Group Selection?: An Empirical Test. *Current Anthropology* 36 (3).

Sørensen, B., 2009. Energy use by Eem Neanderthals. *Journal of Archaeological Science* 36 (10): 2201-2205.

Sørensen, B., 2011. Demography and the extinction of European Neanderthals. *Journal of Anthropological Archaeology* 30: 17-29.

Sorensen, M.V. and W.R. Leonard, 2001. Neandertal energetics and foraging efficiency. *Journal of Human Evolution* 40 (6): 483-95.

Soressi, M., 2016. Archaeology: Neanderthals built underground. *Nature* 534 (7605): 43-44.

Soressi, M. and M.A. Hays, 2003. Manufacture, Transport, and use of Mousterian Biface. In *Multiple Approaches to the Study of Bifacial Technologies*, edited by M. Soressi and H. L. Dibble. Philadelphia: University of Pennsylvania Press.

Speth, J.D., 2010. *The Paleoanthropology and Archaeology of Big-game Hunting: Protein, Fat, Or Politics?*, *Interdisciplinary Contributions to Archaeology*. New York, NY: Springer Science+Business Media, LLC.

Speth, J.D., 2013. Thoughts about hunting: Some things we know and some things we don't know. *Quaternary International* 297: 176-185.

Steegmann, T.A., F.J. Cerny and T.W. Holliday, 2002. Neandertal cold adaptation: Physiological and energetic factors. *American Journal of Human Biology* 14 (5): 566-583.

Steele, J., J. Adams and T. Sluckin, 1998. Modelling Paleoindian Dispersals. *World Archaeology* 30 (2): 286-305.

Steinmetz, R., W. Chutipong, N. Seuaturien, E. Chirngsaard and M. Khaengkhetkarn, 2010. Population recovery patterns of Southeast Asian ungulates after poaching. *Biological Conservation* 143 (1): 42-51.

Stewart, F.L. and P.W. Stahl, 1977. Cautionary note on edible meat poundage figures. *American Antiquity*: 267-270.

Stewart, J.R., 2007. Neanderthal extinction as part of the faunal change in Europe during Oxygen Isotope Stage 3. *Acta Zoologica Cracoviensia-Series A: Vertebrata* 50 (1-2): 93-124.

Stewart, J.R. and A.M. Lister, 2001. Cryptic northern refugia and the origins of the modern biota. *Trends in Ecology and Evolution* 16(11): 608-613.

Stewart, J.R., A.M. Lister, I. Barnes and L. Dalén, 2010. Refugia revisited: individualistic responses of species in space and time. *Proceedings of the Royal Society B: Biological Sciences* 277 (1682): 661-671.

Stiegelmeyer, S.M. and M.C. Giddings, 2013. Agent-based modeling of competence phenotype switching in Bacillus subtilis. *Theoretical Biology and Medical Modelling* 10 (1): 23.

Strasser, T.F., E. Panagopoulou, C.N. Runnels, P.M. Murray, N. Thompson, P. Karkanas, F.W. McCoy and K.W. Wegmann, 2010. Stone Age seafaring in the Mediterranean: evidence from the Plakias region for Lower Palaeolithic and Mesolithic habitation of Crete. *Hesperia*: 145-190.

Straus, L.G., 2001. Africa and Iberia in the Pleistocene. *Quaternary International* 75 (1): 91-102.

Stringer, C., 2003. Human evolution: Out of Ethiopia. *Nature* 423 (6941): 692-695.

Stringer, C., 2016. The origin and evolution of Homo sapiens. *Phil. Trans. R. Soc. B* 371 (1698): 20150237.

Surovell, T.A., 2003. Simulating Coastal Migration in New World Colonization. *Current Anthropology* 44 (4): 580-591.

Surovell, T.A. and P.J. Brantingham, 2007. A note on the use of temporal frequency distributions in studies of prehistoric demography. *Journal of Archaeological Science* 34 (11): 1868-1877.

Surovell, T.A., J. Byrd Finley, G.M. Smith, P.J. Brantingham and R. Kelly, 2009. Correcting temporal frequency distributions for taphonomic bias. *Journal of Archaeological Science* 36 (8): 1715-1724.

Syswerda, G., 1989. Uniform Crossover in Genetic Algorithms. In *Proceedings of the 3rd International Conference on Genetic Algorithms*: Morgan Kaufmann Publishers Inc.

Tafelmaier, Y., A. Pastoors and G.-C. Weniger, 2017. Cultural contact over the Strait of Gibraltar during the Middle Palaeolithic? Evaluating the visibility of cultural exchange. *Munibe Antropologia-Arkeologia* (68).

Tatara, E., M. North, T. Howe, N. Collier and J. Vos, 2006. An indroduction to repast simphony modeling using a simple predator-prey example. Proceedings of the Agent 2006 Conference on Social Agents: Results and Prospects.

Teyssandier, N., 2008. Revolution or evolution: the emergence of the Upper Paleolithic in Europe. *World Archaeology* 40 (4): 493-519.

Thackeray, J.F., 2013. Human evolution from an African perspective. With reference to Charles Darwin palaeoclimate and the problem of defining a species. In *35ste Kroon-voordracht.* . Stichting Nederlands museum voor Anthropologie en Praehistorie.

Thomas, C.D., A. Cameron, R.E. Green, M. Bakkenes, L.J. Beaumont, Y.C. Collingham, B.F. Erasmus, M.F. De Siqueira, A. Grainger and L. Hannah, 2004. Extinction risk from climate change. *Nature* 427 (6970): 145-148.

Timm, I.J., F. Lorig, E. Holzchen and C. Hertler, 2014. Multi-scale agent-based simulation of long-term dispersal processes. Social Simulation Conference.

Tobias, R. and C. Hofmann, 2004. Evaluation of free Java-libraries for social-scientific agent based simulation. *Journal of Artificial Societies and Social Simulation* 7 (1).

Trinkaus, E., 1986. The Neandertals and Modern Human Origins. *Annual Review of Anthropology* 15: 193-218.

Trinkaus, E., 2011. Late Pleistocene adult mortality patterns and modern human establishment. *Proceedings of the National Academy of Sciences* 108 (4): 1267-1271.

Tsanova, T., 2006. Les débuts du Paléolithique supérieur dans l'Est des Balkans. Réflexion à partir de l'étude taphonomique et techno-économique des ensembles lithiques des sites de Bacho Kiro (couche 11), Temnata (couches VI et 4) et Kozarnika (niveau VII), Sciences du Vivant, Géoscience, Sciences de l'environnement, Université Bordeaux 1.

Turing, A.M., 1948. *Intelligent Machinery, report for the National Physical Laboratory*: The Turing Archive for the History of Computing (www.AlanTuring.net/intelligent_machinery, verified 9 April 2019).

Turing, A.M., 1954. Solvable and unsolvable problems. *Science News-ens. fr* 39.

Usman, F., K. Murakami, A. Dwi Wicaksono and E. Setiawan, 2017. Application of Agent-Based Model Simulation for Tsunami Evacuation in Pacitan, Indonesia. *MATEC Web Conf.* 97: 01064.

Valeggia, C. and P.T. Ellison, 2009. Interactions between metabolic and reproductive functions in the resumption of postpartum fecundity. *American Journal of Human Biology* 21 (4): 559-566.

van Andel, T.H., 2002. The Climate and Landscape of the Middle Part of the Weichselian Glaciation in Europe: The Stage 3 Project. *Quaternary Research* 57: 2-8.

van Andel, T.H. and W. Davies, eds, 2003. *Neanderthals and modern humans in the European landscape during the last glaciation: archaeological results of the Stage 3 Project*. Cambridge: The McDonald Institute for Archaeological Research.

van Gijssel, K., 2006. A continent-wide framework for local and regional stratigraphies: application of genetic sequence and event stratigraphy to the Middle Pleistocene terrestrial succession of Northwest and Central Europe. Ph.D. thesis, Faculty of Archaeology, Leiden University, Leiden.

Vandermeer, J., 2006. Oscillating Populations and Biodiversity Maintenance. *BioScience* 56 (12): 967-975.

Vaquero, M., J. Maroto, A. Arrizabalga, J. Baena, E. Baquedano, E. Carrión, J.F. Jordà, M. Martinón, M. Menéndez, R. Montes and J. Rosell, 2006. The Neandertal-Modern Human Meeting in Iberia: A Critical View of the Cultural, Geographical and Chronological Data. In *When Neanderthals and Modern Humans Met*, edited by N. J. Conard. Tübingen: Kerns Verlag, 419-439.

Verpoorte, A., 2006. Neanderthal energetics and spatial behaviour. *Before Farming* 2006/3: 1-6.

Verpoorte, A., 2009. Limiting factors on early modern human dispersals: The human biogeography of late Pleniglacial Europe. *Quaternary International* 201: 77-85.

Vieillevigne, E., L. Bourguignon, I. Ortega and P. Guibert, 2008. Analyse croisée des données chronologiques et des industries lithiques dans le grand sud-ouest de la France (OIS 10 à 3) *PALEO* 20.

Villa, P. and W. Roebroeks, 2014. Neandertal Demise: An Archaeological Analysis of the Modern Human Superiority Complex. *PLoS ONE* 9: e96424.

Waelbroeck, C., L. Labeyrie, E. Michel, J.C. Duplessy, J.F. McManus, K. Lambeck, E. Balbon and M. Labracherie, 2002. Sea-level and deep water temperature changes derived from benthic foraminifera isotopic records. *Quaternary Science Reviews* 21 (1–3): 295-305.

Wagenmakers, E.-J., 2003. How many parameters does it take to fit an elephant? *Journal of Mathematical Psychology* 47 (5): 580-586.

Wall-Scheffler, C.M. and M.J. Myers, 2013. Reproductive costs for everyone: How female loads impact human mobility strategies. *Journal of Human Evolution* 64 (5): 448-456.
Waltari, E., R.J. Hijmans, A.T. Peterson, Á.S. Nyári, S.L. Perkins and R.P. Guralnick, 2007. Locating Pleistocene refugia: comparing phylogeographic and ecological niche model predictions. *PLoS ONE* 2 (7).
Weaver, T.D., H. Coqueugniot, L.V. Golovanova, V.B. Doronichev, B. Maureille and J.-J. Hublin, 2016. Neonatal postcrania from Mezmaiskaya, Russia, and Le Moustier, France, and the development of Neandertal body form. *Proceedings of the National Academy of Sciences*.
Weaver, T.D. and J.-J. Hublin, 2009. Neandertal birth canal shape and the evolution of human childbirth. *Proceedings of the National Academy of Sciences* 106 (20): 8151-8156.
Weaver, T.D. and K.L. Steudel-Numbers, 2005. Does climate or mobility explain the differences in body proportions between Neandertals and their Upper Palaeolithic successors? *Evolutionary Anthropology* 14 (6): 218-223.
Webb III, T., 1986. Is vegetation in equilibrium with climate? How to interpret late-Quaternary pollen data. *Vegetatio* 67 (2): 75-91.
Welker, F., M. Hajdinjak, S. Talamo, K. Jaouen, M. Dannemann, F. David, M. Julien, M. Meyer, J. Kelso, I. Barnes, S. Brace, P. Kamminga, R. Fischer, B.M. Kessler, J.R. Stewart, S. Pääbo, M.J. Collins and J.-J. Hublin, 2016. Palaeoproteomic evidence identifies archaic hominins associated with the Châtelperronian at the Grotte du Renne. *Proceedings of the National Academy of Sciences* 113 (40): 11162.
Wenban-Smith, F.F., M.R. Bates and J.-L. Schwenninger, 2010. Early Devensian (MIS 5d-5b) occupation at Dartford, southeast England. *Journal of Quaternary Science* 25 (8): 1193-1199.
Wenban-Smith, F., 2010. M25 roadworks reveal earliest UK Neanderthal occupation at Dartford. *Geology Today* 26 (5): 175-179.
Wheatley, D., 2004. Making space for an archaeology of place. *Internet archaeology* 15.
White, A.A., 2012. The socal networks of early hunter-gatherers in midcontinental North America, The University of Michigan.
White, A.A., 2013. Subsistence economics, family size, and the emergence of social complexity in hunter–gatherer systems in eastern North America. *Journal of Anthropological Archaeology* 32 (1): 122-163.
White, M., P. Pettitt and D. Schreve, 2016. Shoot first, ask questions later: Interpretative narratives of Neanderthal hunting. *Quaternary Science Reviews* 140 (Supplement C): 1-20.
White, M.J., 2006. Things to do in Doggerland when you're dead: surviving OIS3 at the northwestern-most fringe of Middle Palaeolithic Europe. *World Archaeology* 38 (4): 547-575.
White, M.J. and P.B. Pettitt, 2011. The British Late Middle Palaeolithic: An Interpretative Synthesis of Neanderthal Occupation at the Northwestern Edge of the Pleistocene World. *Journal of World Prehistory* 24: 25-97.
White, T.E., 1953. A method of calculating the dietary percentage of various food animals utilized by aboriginal peoples. *American Antiquity* 18 (4): 396-398.
Whitner, R.B. and O. Balci, 1989. Guidelines for selecting and using simulation model verification techniques. Proceedings of the 21st conference on Winter simulation, at Washington, D.C., USA.
Wiegand, T., F. Knauer, P. Kaczensky and J. Naves, 2004. Expansion of Brown Bears (Ursus arctos) into the Eastern Alps: A Spatially Explicit Population Model. *Biodiversity & Conservation* 13 (1): 79-114.
Will, O., 2009. Resolving a replication that failed: news on the Macy & Sato model. *Journal of Artificial Societies and Social Simulation* 12 (4): 11.
Williams, A.N., S. Ulm, A.R. Cook, M.C. Langley and M. Collard, 2013. Human refugia in Australia during the Last Glacial Maximum and Terminal Pleistocene: A geospatial analysis of the 25-12ka Australian archaeological record. *Journal of Archaeological Science,* 40(12), 4612-4625.
Wilson, G., D.A. Aruliah, C.T. Brown, N.P.C. Hong, M. Davis, R.T. Guy, S.H. Haddock, K.D. Huff, I.M. Mitchell and M.D. Plumbley, 2014. Best practices for scientific computing. *PLoS biology* 12 (1): e1001745.

Wimsatt, W.C., 1987. False models as means to truer theories. In *Neutral models in biology*, edited by M. N. a. A. Hoffman. London: Oxford University Press, 23-55.
Wisiol, K., 1984. Estimating Grazingland Yield from Commonly Available Data. *Journal of Range Management* 37 (5): 471-475.
Wobst, H.M., 1974. Boundary Conditions for Paleolithic Social Systems: A Simulation Approach. *American Antiquity* 39 (2): 147-178.
Wolfram, S., 1983. Statistical mechanics of cellular automata. *Reviews of modern physics* 55 (3): 601.
Wood, B. and B.G. Richmond, 2000. Human evolution: taxonomy and paleobiology. *Journal of anatomy* 196: 19-60.
Wragg Sykes, R., 2010. Neanderthals in Britain: Late Mousterian Archaeology in Landscape Context, University of Sheffield, Department of Archaeology.
Wragg Sykes, R.M., 2017. Neanderthals in the Outermost West: Technological adaptation in the Late Middle Palaeolithic (re)-colonization of Britain, Marine Isotope Stage 4/3. *Quaternary International* 433: 4-32.
Wylie, A., 2002. *Thinking from Things: Essays in the Philosophy of Archaeology*: University of California Press.
Yao, X., 1993. An empirical study of genetic operators in genetic algorithms. *Microprocessing and Microprogramming* 38 (1): 707-714.
Yellen, J.E., 1977. *Archaeological approaches to the present: models for reconstructing the past*. Vol. 1: Academic Press New York.
Yeniay, Ö., 2005. Penalty function methods for constrained optimization with genetic algorithms. *Mathematical and computational Applications* 10 (1): 45-56.
Yokoyama, Y., K. Lambeck, P. De Deckker, P. Johnston and L.K. Fifield, 2000. Timing of the Last Glacial Maximum from observed sea-level minima. *Nature* 406 (6797): 713-716.
Young, D.A., 2002. A New Space-Time Computer Simulation Method for Human Migration. *American Anthropologist* 104 (1): 138-158.
Zhou, W.-X., D. Sornette, R.A. Hill and R.I. Dunbar, 2005. Discrete hierarchical organization of social group sizes. *Proceedings of the Royal Society B: Biological Sciences* 272 (1561): 439-444.
Zilhão, J., 2000. The Ebro frontier: a model for the late extinction of Iberian Neanderthals. In *Neanderthals on the edge: 150th anniversary conference of the Forbes' Quarry discovery, Gibraltar*, edited by C. Stringer, R. N. E. Barton and C. Finlayson. Oxford: Oxbow Books, 111-121.
Zimov, S., N.S. Zimov and F.S. Chapin, III, 2012. The Past and Future of the Mammoth Steppe Ecosystem. In *Paleontology in Ecology and Conservation*, edited by J. Louys: Springer Berlin Heidelberg, 193-225.
Zimov, S.A., 2005. Pleistocene Park: Return of the Mammoth's Ecosystem. *Science* 308 (5723): 796-798.
Zobler, L., 1986. *A world soil file for global climate modeling*: National Aeronautics and Space Administration, Goddard Space Flight Center, Institute for Space Studies.
Zubrow, E., 1989. The demographic modelling of Neanderthal extinction. In *The Human Revolution. Behavioural and Biological Perspectives on the Origins of Modern Humans*, edited by P. Mellars and C. B. Stringer. Edinburgh: Edinburgh University Press, 212-231.
Zuk, M., 2013. *Paleofantasy: What Evolution Really Tells Us about Sex, Diet, and How We Live*: WW Norton & Company.

APPENDIX 1: ABBREVIATIONS

Abbreviations

Abbreviation	Meaning
ABMS	Agent-Based Modelling and Simulation
ABM	Agent-Based Model(ling), can also be found under the terms Agent-Based Computational Modelling, Agent-Based Social Simulation, Multi-Agent systems, Distributed Artificial Intelligence, and Swarm Intelligence.
ABS	Agent-Based System.
AMH	Anatomically Modern Human(s).
BP	Before Present, where present is defined as 1950.
CLIMAP	Climate Map.
FR	Foraging range: The total area of land over which a hominin group moves and from which resource materials are taken in one year. This is equal to the *annual range*, the area that is covered for subsistence purposes in a complete year (MacDonell 1995).
GARP	Genetic Algorithm for Rule-Set Prediction.
HS	HomininSpace: The *Hominini* tribal level is today the scientific identification of humans and their ancestors as separated from the great apes, with which they form the family taxonomic unit of *Hominidae* (Wood and Richmond 2000). In popular language this is anglicized to hominins. Space is the natural living dimension for individuals. Both the simulation research methods as well as archaeological excavations add their own temporal dimension to the usage of space. The generalized nature of the implementation of the system (without the specialized datasets that mark the case study for Neanderthals) suggests the name HomininSpace (no italics) for a simulation system that models hominin behaviour in the landscape and that is validated against archaeological data concerning hominin presence and absence. HomininSpace is the designation for the complete modelling and simulation system with associated documentation that has been developed in the context of the study described in this thesis.
IBM	Individual-Based Modelling.
ka	Kilo-Annum (thousand years) ago.
kya	Kilo (thousand) years ago.
LP	Late Pleistocene (versus Middle Palaeolithic). The Late Pleistocene is defined as the period from 126 ka up to 11.7 ka. It starts with the Eemian (MIS 5e) and ends with the Holocene (http://quaternary.stratigraphy.org/majordivisions/, http://www.stratigraphy.org/index.php/ics-chart-timescale, accessed 15 January 2018). Since the simulations in this study all end at 50 ka, the final part of the Late Pleistocene is not included in this research.
MAS	Multi-Agent Systems.
MAXENT	Maximum Entropy.
MH	Mid-Holocene point in time (~6 ka), reconstructed as very warm compared to current day temperatures.
My	Million Years.
Mya	Million Years Ago.
LGM	Last Glacial Maximum (~21 ka).
LMP	Late Middle Palaeolithic.
LUP	Late Upper Palaeolithic.
PMIP	Paleoclimate Modeling Intercomparison Project.
SAM	Spatial Analysis in Macroecology.

Bioclimatic parameters

Bioclimatic parameters	BIO1 = Annual Mean Temperature BIO2 = Mean Diurnal Range (Mean of monthly (max temp - min temp)) BIO3 = Isothermality (BIO2/BIO7) (* 100) BIO4 = Temperature Seasonality (standard deviation *100) BIO5 = Max Temperature of Warmest Month BIO6 = Min Temperature of Coldest Month BIO7 = Temperature Annual Range (BIO5-BIO6) BIO8 = Mean Temperature of Wettest Quarter BIO9 = Mean Temperature of Driest Quarter BIO10 = Mean Temperature of Warmest Quarter BIO11 = Mean Temperature of Coldest Quarter BIO12 = Annual Precipitation BIO13 = Precipitation of Wettest Month BIO14 = Precipitation of Driest Month BIO15 = Precipitation Seasonality (Coefficient of Variation) BIO16 = Precipitation of Wettest Quarter BIO17 = Precipitation of Driest Quarter BIO18 = Precipitation of Warmest Quarter BIO19 = Precipitation of Coldest Quarter

Biome (Mega) classifications

Original biome classification	Mega-biome classification
Tropical evergreen broadleaf forest Tropical semi-evergreen broadleaf forest Tropical deciduous broadleaf forest and woodland	Tropical forest
Warm-temperate evergreen broadleaf and mixed forest Warm-temperate evergreen broadleaf forest Warm-temperate rainforest Wet sclerophyll forest	Warm-temperate forest
Cool evergreen needle leaf forest Cool mixed forest Cool-temperate rainforest Cool-temperate evergreen needle leaf and mixed forest Temperate evergreen needle leaf forest Temperate deciduous broadleaf forest	Temperate forest
Cold deciduous forest Cold evergreen needle leaf forest	Boreal forest
Temperate sclerophyll woodland and scrubland Temperate evergreen needle leaf open woodland Tropical savanna Temperate deciduous broadleaf savanna	Savanna and dry woodland
Tropical xerophytic scrubland Temperate xerophytic scrubland Tropical grassland Temperate grassland Steppe Xerophytic woods/scrub Temperate grassland and xerophytic scrubland	Grassland and dry scrubland
Desert	Desert
Graminoid and forb tundra	Dry tundra
Cushion-forb tundra (cushion forb, lichen and moss tundra) Erect dwarf-shrub tundra	Tundra

Low and high shrub tundra Prostrate dwarf-shrub tundra Tundra Alpine grassland	

(taken from http://pmip2.lsce.ipsl.fr/, accessed 24 May 2013 (Harrison and Prentice 2003)).

APPENDIX 2: SUPPLEMENTARY MATERIALS

HomininSpace consist of a computer application, associated input files, simulation results and documentation. This thesis describes the study in which the HomininSpace simulation system was developed and with this thesis come Supplementary Materials, both in the appendices and in separate files collected on a single DVD disk. The content of this DVD is listed in Table 56. Furthermore this appendix contains the posters that were presented at conferences and which are referred to in this work. Such materials are normally not easily accessible and therefore included here. All materials available on the DVD are also accessible online, via a service made available by the Data Archiving and Networked Services (DANS): https://doi.org/10.17026/dans-28h-bysx. Data has been submitted using the online archiving system EASY, upon which data is archived according to the guidelines of the international Data Seal of Approval, the ICSU-WDS, and the NESTOR seal for Trustworthy Digital Archives. Moreover, the metadata fields in EASY comply with the guidelines of the Dublin Core standard[49] ensuring future availability.

Contents of the HomininSpace data disk

The Table 56 lists the items on the disk that accompanies this study. Bold face headers are the names of directories on the disk, starting at the root. The actual filenames as included on the disk are given in italics.

Table 56: Contents of the HomininSpace disk.

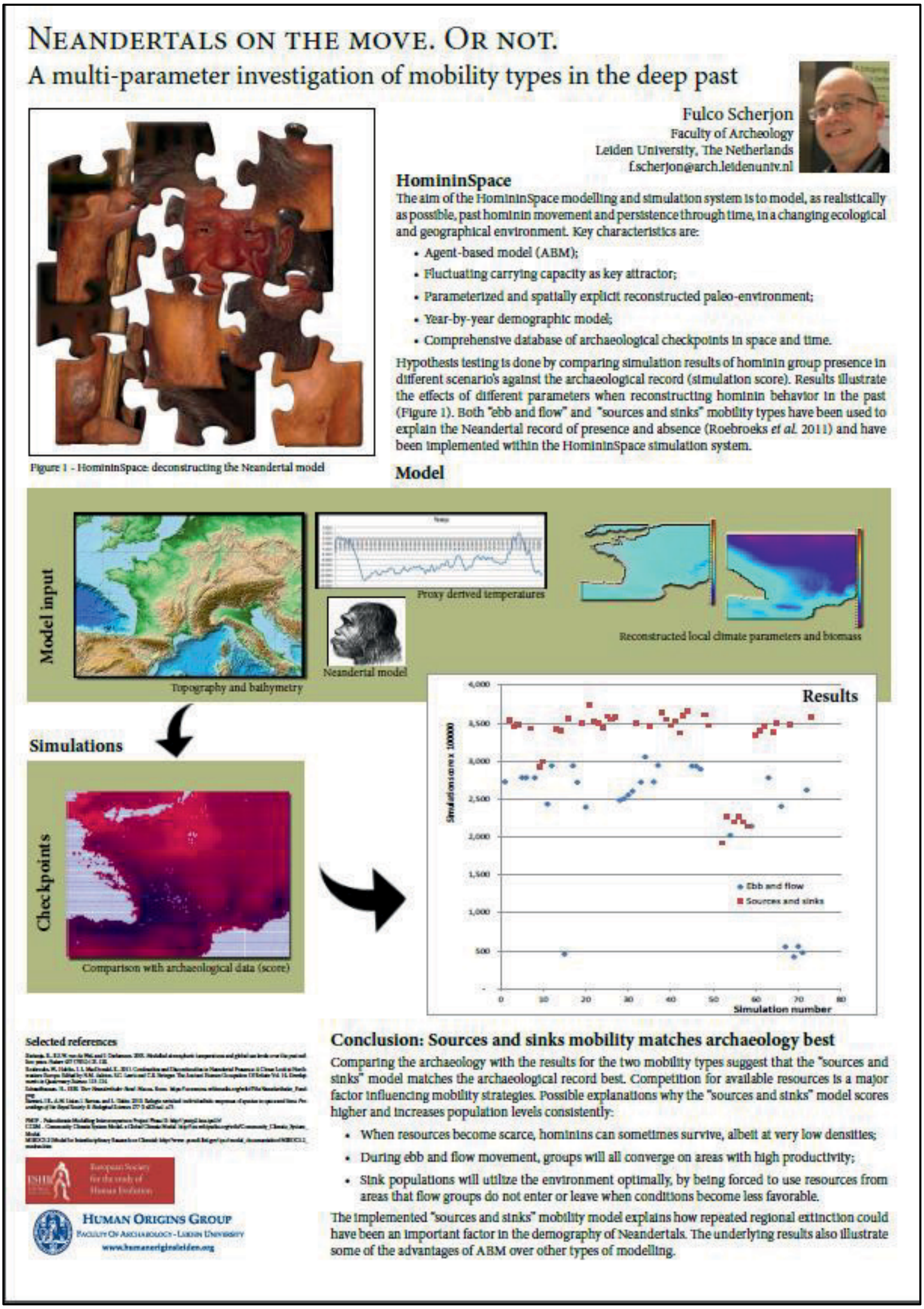
\Documentation		
	HomininSpace ODD.docx / .pdf	The Overview, Design and Details document for the HomininSpace model and simulation system.
	HomininSpace – checkpoint database.docx	Document describing the construction of the checkpoint database. Provides also reasons to include or exclude individual sites.
	HomininSpace – thesis.docx / .pdf	This thesis.
	Climate reconstruction - Fulco Scherjon - labreport.docx	Documentation on the use of SAM and related files.
	HomininSpace_GE.kmz	Google Earth input file with all checkpoints.
	HomininSpace - user manual 1.6.docx / .pdf	User manual describing the most common actions within the simulation system, including input and output data formats.
\Analysis		
	Analysis results plots [scenario].pdf	Graphical output of the statistical analysis, including correlation figures. For each scenario.

[49] See http://easy.dans.knaw.nl/doc/pdf/DEP_All other disciplinesUK.pdf, verified 26 March 2018.

	AllData.csv	File with all simulations from all scenarios.
	Batchresults_[scenario].txt	Results for all simulations from a scenario. One file for each scenario.
	[Correlation output]	For each scenario files with correlation data for the Standard set, the Evolved set and the combined set with all simulations.
	Top10 parametervalues.csv	Overview of the best 10 simulations for each scenario.
\Model Data		
	Neandertal sites – north west Europe.xlsx	All checkpoints with associated intervals. Database with dating information for Neandertal sites for the simulation area. Also includes a list of MIS 6 sites (used for starting populations) and pure information points (that just register presence, but since no exact dating information is known, these are not used in validation of the results). Contains all checkpoints, monitoring checkpoints and starting locations of initial population groups.
	SAM Grid a_1_12.txt	Input grid cells.
	Bintanja2008.txt	Reconstructed temperature and sea level values.
	HomininSpace Climate Grid.txt	Climate data per grid cell.
	HomininSpace Checkpoint List.txt	The actual input file with the checkpoint information. Derived from the Neandertal sites Excel file.
	SAM input files	
	Etopo1_bedrock.zip	Bedrock height values for selected area, XYZ format input file.
	alt_2-5m_bil.zip	Worldclim.org input files, ecological data for current and past climates in high resolution (2.5 arc minutes).
	bio_2-5m_bil.zip	
	wc_2_5m_CCSM_21k_bio.zip	
	wc_2_5m_MIROC3.2_21k_bio.zip	
\Source code		
	Workspace\HomininSpace	Source Code which provides the Java source code of the HomininSpace modelling framework. This is a Repast workspace and contains next to the source also administrative files.
\Scripts for statistical analysis		
	Batch analysis HS results.R	R script for statistical analysis of the combined simulation result files.
	Batch print HS results.R	R script to generate images that are used in the statistical analysis.
	Analysis draw faces.R	R script to generate the Chernoff faces of the top 10 scoring individuals.

	Climate calculations.xlsx	Example calculations of secondary biomass.
	HomininSpace Population Calculator.xlsx.	Interactive tool to see the effect on population structure of different parameters.
\Output data Files with batch simulation results		
	Summed data only.xlsx	Excel sheet containing the summed results for all output variables for all relevant simulations for all scenarios.
	HS Logfile 2018-11-29 0045.txt	Example log file.
Movies with screen captures of running simulations		
	1.888.579.450 8-10-2013 50.avi	
	1.888.579.450 9-10-2013 50.avi	
	1.888.579.450 22-10-2013 50.avi	
	1.888.579.450 23-10-2013 50.avi	
\Review by Iza Romanowska		
	HomininSpaceComments.docx	Word document with the source code review results.
	Re HomininSpace et al (email 2016-12-11).txt	Verbatim email text with the overall impression and review results.
	Earlier emails.txt	Email exchange about the review.
\Applications Tools used in the framework or during development		
	Quickview	Installation file for Quickview (needed to capture and view simulation movies).
	Repast	Installation files for Repast 2.2.
	SAM	Installation files for SAM 4.0 + documentation.

Poster: ***Neandertals on the move. Or not.*** **– ESHE 2015**



Poster: *How (not) to model Neandertal extinction*. –ESHE 2016

How (not) to model Neandertal extinction

Fulco Scherjon
Faculty of Archeology
Leiden University, The Netherlands
f.scherjon@arch.leidenuniv.nl

Krist Vaesen
Faculty of Archeology
Leiden University, The Netherlands
Eindhoven University of Technology
k.vaesen@tue.nl

Alexander Verpoorte
Faculty of Archeology
Leiden University, The Netherlands
a.verpoorte@arch.leidenuniv.nl

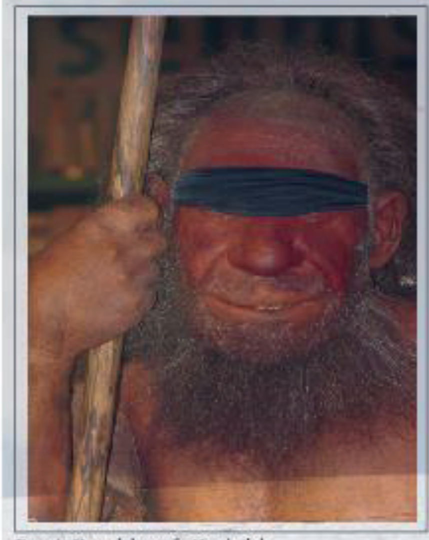


Figure 1 - Unequal chances for Neanderthals.

If you handicap the competition, do not be surprised to win...

We analysed existing simulation models for Neanderthal demise. Each of the models assumes a large difference between Neanderthals and AMH (Fig. 1). Evidently, under such conditions the replacement of Neanderthals by AMH is inevitable (Fig. 2). Each model we looked at implements an unsubstantiated (relative) handicap for Neanderthals:

- increasing mortality rates for Neanderthals [6], and decreasing rates for AMH [1];
- decreasing growth rates for Neanderthals, but increasing rates for AMH (due to differences in technological development [3,4, 5, 7] or in social organization [2]).

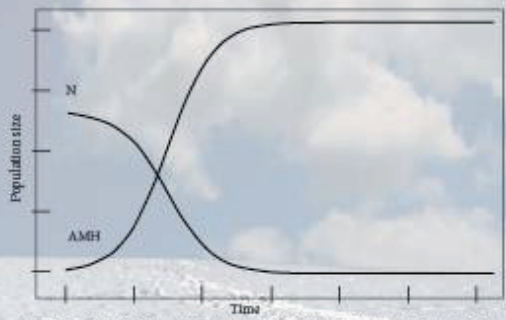


Figure 2 - The inevitable result: replacement of N by AMH (figure adapted from [7]).

Reference	Handicap (assumptions)	Results	Model type
Zubrow 1989 [1]	Seemingly small but effectively large demographic differences, with lower birthrate for N.	Large discrepancies in mortality and life expectancy, with an increment in N mortality of 1–2 % leading to extinction within as little as 30 generations.	population model
Horan et al. 2005 [2]	Increasing social organisation for AMH.	Unavoidable replacement of N by AMH after varying amount of years.	mathematical
Flores 2011 [3] Flores 1998 [7] Murray 2004 [5]	Higher mortality rate for N.	N are replaced by AMH (model implemented by Murray 2004). Flores 2011 uses the computed similitude from [7] to calculate diffusion coefficients.	nonlinear mathematical model
Gilpin et al. 2016 [4]	Lower cultural level interacting with population size.	Replacement of larger N population by AMH.	mathematical
Sorensen 2011 [6]	1% reduction in death during childbirth and in death by hunting incidences between AMH and N.	Population growth amongst AMH despite adverse climatic conditions ~45 kya.	mathematical

Conclusion: How to model Neanderthals?

We introduce a conservative model which assumes no difference between N and AMH and uses only population size. This null model suggests that stochasticity and allee effects (i.e., populations at low numbers are affected by decreasing growth rates) might have been sufficient for the Neanderthals to have gone extinct (Fig. 3).

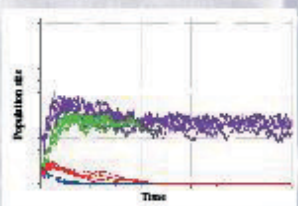


Figure 3 - Preliminary results for different population sizes of N, including allee effects. Green and Blue illustrate critical population sizes, where Purple represents survival and Red extinction levels.

References

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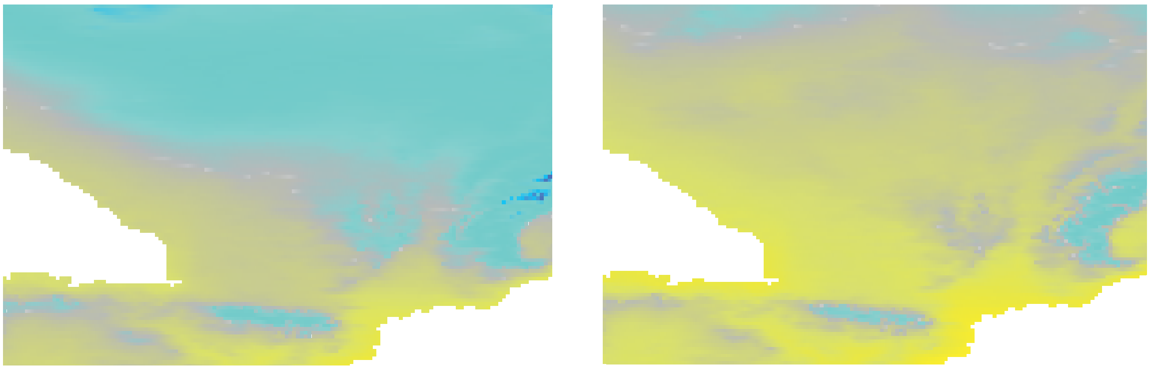
Comparing past climate models: CCSM versus MIROC

The LGM period is part of the focus of the Paleoclimate Modeling Intercomparison Project (PMIP, Joussaume and Taylor 1995) which is an international effort to evaluate models using widely varying climate conditions. Climate for this defining period in the past has been extensively documented using a diverse array of paleo-climate proxy data sets and is used to calibrate (new) climate models. The LGM climate differs significantly from today and can be interpreted as an extreme climate anomaly for which there is no present day analogue and which is difficult to reconstruct in simulations, but for which the major forcing factors are relatively well known. The LGM is a severe glacial period with changes in greenhouse gases, sea level and ice sheets. As such, climate parameters can be used to model extreme climate changes (Prentice *et al.* 2000). Due to the fact that conditions for the LGM are well studied, results from simulations including this period can be compared against other modelling results (Otto-Bliesner *et al.* 2006) and thus the dataset as a whole gains in confidence.

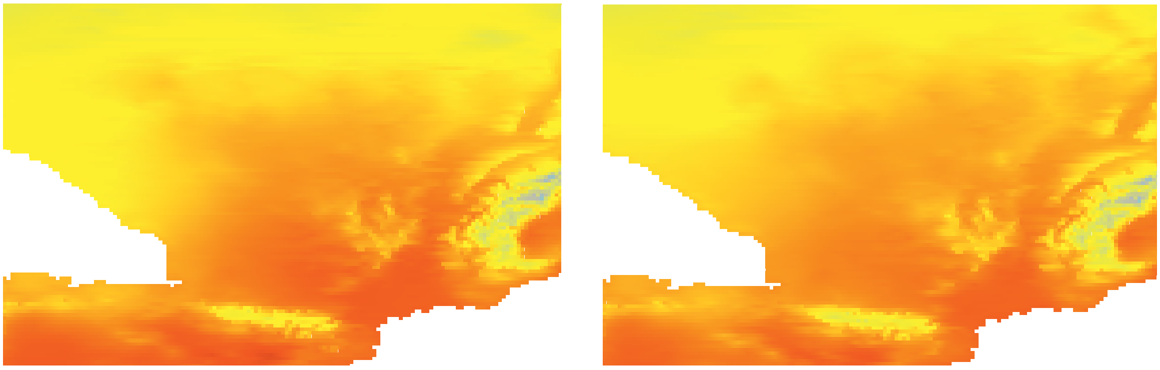
WorldClim provides two sets of data for the Last Glacial Maximum (LGM, around 21ka): the Community Climate System Model (CCSM) and the Model for Interdisciplinary Research On Climate (MIROC). Both are coupled general circulation models, with MIROC developed at the Center for Climate System Research (CCSR) at the University of Tokyo (Hasumi and Emori 2004) and CCSM designed at the University Corporation for Atmospheric Research (UCAR) (Collins *et al.* 2006). MIROC couples models for atmosphere, land, river, sea ice and ocean where CCSM couples models for land, sea-ice, ocean and atmosphere. MIROC is available upon request for collaborative researchers (http://ccsr.aori.u-tokyo.ac.jp/~yangpeng/source_center.htm, accessed 25 July 2013), where CCSM is actively developed into a successor named Community Earth System Model (CESM, http://www2.cesm.ucar.edu/, accessed 25 July 2013). Both are used primarily for future climate predictions, for instance by the Intergovernmental Panel on Climate Change (IPCC) (Hamilton 2007).

The reconstructed LGM environments from CCSM and MIROC are different. See Figure 94 for a visual comparison of the most relevant datasets. Especially temperatures as simulated by CCSM are generally lower than those from MIROC, but precipitation levels are also lower. These differences are likely to influence simulation results (Olfert *et al.* 2011). Both models are however among the best for modelling LGM circumstances (Maris *et al.* 2012; Otto-Bliesner *et al.* 2007). Instead of averaging the results of the two models as done by Waltari *et al.* (2007), the underlying research uses one single model. CCSM has been selected due to the fact that the available data from MIROC were created using version 3.2 which contains an error in the land surface scheme. Correcting this error, as has been done in 3.2.2, would lower the temperature values (Maris *et al.* 2012, 804).

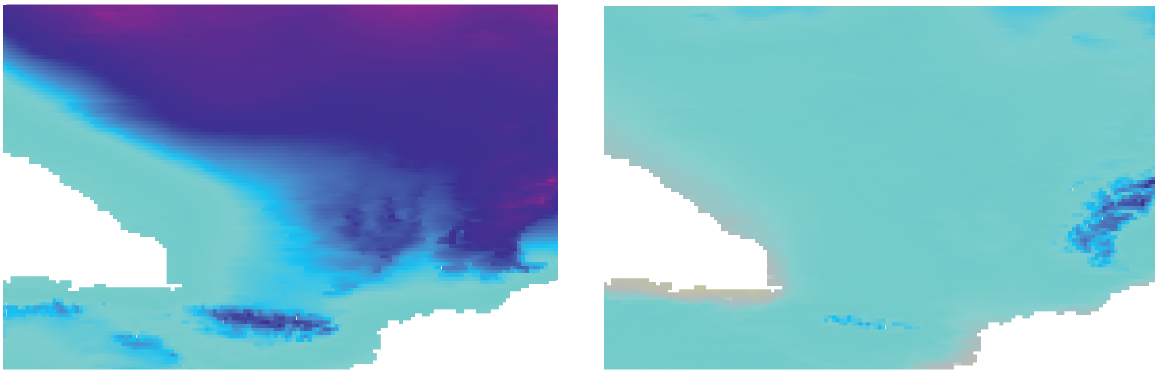
The chosen colour scheme for the temperature maps (values in Table 3) is constructed based on the colours used by The Weather Network (example in http://scsjournal.files.wordpress.com/2011/11/the-weather-network.jpg, accessed 21 July 2013). The colour scheme for the precipitation values is inspired by the Canadian weather reports (http://scsjournal.wordpress.com/, accessed 21 July 2013). Note that the temperature values in the WorldClim database must be divided by 10 to get degrees Celsius.



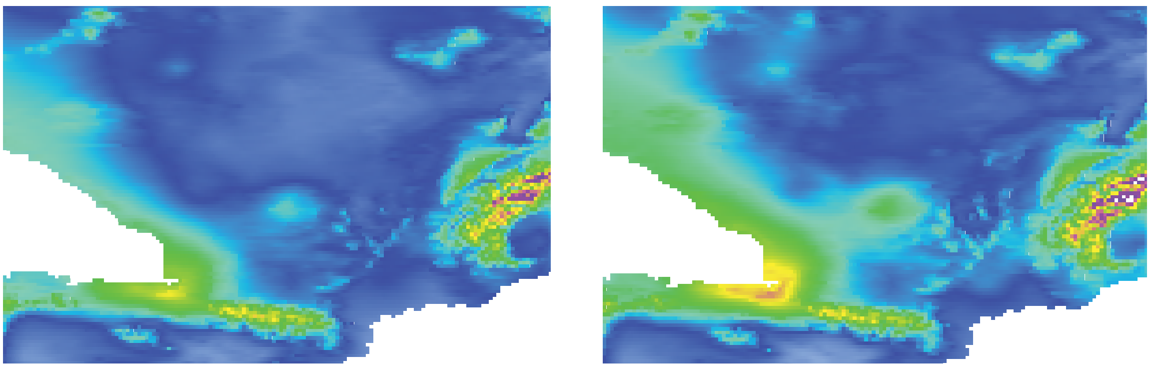
BIO1 = Annual mean temperature



BIO5 = Max temperature of the warmest month



BIO6 = Min temperature of the coldest month



BIO12 = Annual precipitation

Figure 94: Overview of the results for the main biological values for CCSM (left) and MIROC climate models with unified colour coding schemes.