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**To Talk of Many Things, Of Stories, Ships and String, of Connections,
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...language is not about inventing words. It is about telling stories in groups.
Languages are invented on the level of narrative, by collectivities of conscious
intellects. (Merlin Donald, 2001)¹

It matters what matters we use to think other matters with; it matters what stories we
tell to tell other stories with; it matters what knots knot knots, what thoughts think
thoughts, what ties tie ties. It matters what stories make worlds, what worlds make
stories. (Donna Haraway, 2011)²

Instead of simply reproducing ourselves, we rather extend ourselves and we construct
new cognitive and material ecologies for growing and instituting our minds. We create
things which in turn create us.

(Lambros Malafouris, 2014)³

All civilisation had its origins in the network of maritime inter-linkages of early

¹ Donald M. (2001) *A Mind So Rare: The Evolution of Human Consciousness*, New York: W.W. Norton, 292.

² Haraway D. (2011) *SF: Science Fiction, Speculative Fabulation, String Figures, So Far*. Available at: <http://people.ucsc.edu/~haraway/Files/PilgrimAcceptanceHaraway.pdf>.

³ Malafouris, Lambros. "On Thinging." In *Torque #1*, edited by Nathan Jones and Sam Skinner, 9-19. (Brescia: Link editions, 2014).

cultures. (Buckminster Fuller, 1981)⁴

How we imagine human capacities and social cooperation in the present is ineluctably shaped by the ways we imagine the evolution of those capacities in the past. The stories we tell ourselves about human cognition, technologies, practices, knowledge production, and their interactions come out of the stories we tell or have been told about the origins and developments of such dynamics. All too frequently such stories are chronologically restricted to the relatively recent past, and technologically restricted to material things.

What I want to tell you is a story of the active coproduction of knowledge and space that focuses on bodily movement and socio-technological practices. By going back to some of the earliest forms of human movement through and in interaction with the environment my story aims to answer to the question of how people were able to move into every econiche on the planet, into territories no one had ever previously encountered. How, in the process of coming to know the landscape, did they shape and conversely, how were they shaped by that landscape and by their social, material, symbolic and economic, technologies of connection and collaboration. One such technology being the practice of story-telling itself, along with string, fire, ochre, kinship and trading networks.

⁴ Fuller B. (1981) *Critical Path*, New York: St Martin's Press, 23.

This is a story about the origins of human cognition. A story that reinforces the recognition common to both science studies my own area, and recent work in archaeology, linguistics and neuroscience, that cognition is not simply an evolved neurological capacity of the brain, but is both embodied and socially distributed. Much has been learned about the coproduction of cognition and language from experimental experience of making hand axes and stone tools and a gradual evolution of language, suggesting ‘simple symbolic communication preceded behavioural modernity by hundreds of thousands of years.’⁵ Furthermore the earliest stone tools are now dated at 3.3mya, half a million years older than previously thought, pushing back yet further the development of the required cognitive capacities and raising the question which hominins made them.⁶ However, extraordinary and aesthetically impressive as hand axes are, prehistory has been far too preoccupied with lithic technology and has not yet sufficiently brought into focus the fundamental importance of early seafaring. The central argument of this paper is that the key socio-cognitive capacities of communication and cooperation were coproduced with the socio-technical capacities for movement by sea. This coproduction began in the Pleistocene more than 150ya and

⁵ Morgan, T. J. H., N. T. Uomini, L. E. Rendell, L. Chouinard-Thuly, S. E. Street, H. M. Lewis, C. P. Cross, R. Kearney C. Evans, I. de la Torre, A. Whiten, and K. N. Laland. "Experimental Evidence for the Co-evolution of Hominin Tool-making Teaching and Language." *Nature Communications* 6 (2015)
Stout, Dietrich. "Tales of a Stone Age Neuroscientist." *Scientific American* 314 (2016): 28-35.

⁶ Harmand, Sonia, Jason E. Lewis, Craig S. Feibel, Christopher J. Lepre, Sandrine Prat, Arnaud Lenoble, Xavier Boës, Rhonda L. Quinn, Michel Brenet, Adrian Arroyo, Nicholas Taylor, Sophie Clément, Guillaume Daver, Jean-Philip Brugal, Louise Leakey, Richard A. Mortlock, James D. Wright, Sammy Lokorodi, Christopher Kirwa, Dennis V. Kent, and Hélène Roche. "3.3-million-year-old stone tools from Lomekwi 3, West Turkana, Kenya." *Nature* 521 (2015).

was the work of early hominins possibly *Homo erectus*.⁷ But, in telling the story in light of new research on the earliest seafarers, the standard 'out of Africa' account and its assumption of the primacy of *Homo sapiens* has to be rethought along with our understandings of the development of human cognition.

Until very recently the established orthodox narrative was, and largely still is, that a small group of *Homo sapiens* possibly as few as 2000 left Africa 60-70kya and spread around the world along mainly terrestrial routes that can now be traced genetically. In the process *Homo sapiens* completely replaced all the other hominid species including Neanderthals and *Homo erectus*.⁸

What has attracted massive media attention recently is that the narrative about Neanderthals has been completely undermined by Svante Paabo's revelations that *Homo sapiens* and Neanderthals interbred and that humans all carry between 1 and 4% Neanderthal genes, or at least those who left Africa do.⁹ The archaeological record is

⁷ Bednarik, Robert. "The Origins of Navigation and Language." *The Artefact* 20 (1997): 16-56.

———. 2002. The Maritime Dispersal of Pleistocene Humans. In, <http://www.ifrao.com/wp-content/uploads/2014/06/dispersal.pdf>. (accessed Feb 22nd, 2016).

———. "Seafaring in the Pleistocene." *Cambridge Archaeological Journal* 13 no. 1 (2003): 41-66.

Bednarik, Robert G. "The Beginnings of Maritime Travel." *Advances in Anthropology* 4 no. 4 (2014).

⁸ See for example Stringer, Chris. *Lone Survivors: How We Humans Became the Only Humans*. (New York: Times Books, 2012).

⁹ Paabo S. (2014) *Neanderthal Man: In Search of Lost Genomes*, New York: Basic Books.

now being read as showing that there is little to distinguish Neanderthals culturally, technologically or cognitively from *Homo sapiens*.¹⁰

The assumption of human exceptionalism is no longer self-evident. Nothing significant, separates modern humans, *Homo Sapiens sapiens*, from the ‘other’ hominim species against whom their superiority was previously defined. It seems that humans not only interbred with Neanderthals, and hence the claim they are a different species collapses, but that Neanderthals had very much the same range of behaviours humans have. Neanderthals had language and culture, they sang, they danced, they feasted and celebrated. With slightly larger brains, they buried their dead, cared for the old and sick, they created external symbolisation and art.¹¹ They made carefully crafted stone tools that may even have been adopted by *Homo sapiens*.¹² Very significantly it is claimed they made birch bark pitch using controlled burning in the absence of air to produce a technology of connection, if confirmed it would be the first synthetic material made by hominims.¹³

¹⁰ Papagianni, Dimitra. *The Neanderthals Rediscovered: How Modern Science Is Rewriting Their Story*. (London: Thames and Hudson, 2015).

¹¹ Zilhão J, Angelucci DE, Badal-García E, et al. (2010) Symbolic use of marine shells and mineral pigments by Iberian Neandertals. *PNAS* 107: 1023-1028; Callaway E. (2014) Neanderthals Made Some of Europe's Oldest Art. *Nature*.

¹² New evidence debunks ‘stupid’ Neanderthal myth http://www.exeter.ac.uk/news/archive/2008/august/title_1106_en.html

¹³ Koller, Johann, Ursula Baumer, and Dietrich Mania. "High-tech in the Middle Palaeolithic: Neandertal-manufactured Pitch Identified " *European Journal of Archaeology* 4 no. 3 (2001): 385-96.
Grunberg, Judith. "Middle Paleolithic Birch-bark Pitch." *Antiquity* 76 no. 291 (2002): 15-17.

And equally surprisingly, Neanderthals have also been claimed to have built the earliest known hominin structures. 176kya they created oval shaped assemblages of broken stalagmites in a deep and dark cave in the Pyrenees, requiring the controlled use of fire for lighting.¹⁴ These two structures also show signs of blackening of some of the stalagmites, and the discovery of a piece of burnt bone suggestive of heating in small hearths.¹⁵

Suddenly it seems Neanderthals are us. Reports come of new findings come in so fast its hard to keep up. Recently it was announced that the Atapuerca site in Spain, which has produced the richest collection of Neanderthal remains, seems to show that the presumed shared Neanderthal/*Homo sapiens* ancestor may be as old as 400kya.

According to the Australian palaeontologist Darren Curnoe this means *Homo sapiens* may be just as old and could even have evolved in Europe, and possibly migrated back to Africa.¹⁶ The story gets even more complicated. Not only did Humans acquire Neanderthal and Denisovan genes, Neanderthals acquired Human genes, and there

¹⁴ Callaway, Ewen. "Neanderthals Built Cave Structures — and no one knows why." *Nature* (2016).

¹⁵ Soressi, Marie. "Neanderthals Built Underground." *Nature News and Views* (2016).

¹⁶ Gibbons, Ann. "DNA from Neandertal Relative May Shake Up Human Family Tree." *Science* (2015).

Curnoe, Darren. 2015. Did 'Rising Star' Shine Too Bright? In, *The Conversation*, <http://theconversation.com/did-rising-star-shine-too-bright-4...> (accessed Sept 14th, 2015).

have been five or more occasions on which they interbred.¹⁷ Homo sapiens acquired Neanderthal allergies, and may have given them the FOXP2 gene for language, we may also have hastened their demise by giving them our diseases such as herpes, in exchange humans got genital warts.¹⁸

In China fully modern human teeth have been found dated at 120kya, that is around 70ky before modern humans appear in Europe and the Near East, raising the possibility of an 'Out of Asia' migration story.¹⁹ All of which makes the linear, dendritic, 'Out of Africa' replacement model look in need of replacement itself, in favour a much more interactive rhizomatic model along the lines of multi-regionalism.²⁰

¹⁷ <https://www.sciencedaily.com/releases/2016/03/160317150805.htm>

Vernot, Benjamin, Serena Tucci, Janet Kelso, Joshua G. Schraiber, Aaron B. Wolf, Rachel M. Gittelman, Michael Dannemann, Steffi Grote, Rajiv C. McCoy, Heather Norton, Laura B. Scheinfeldt, David A. Merriwether, George Koki, Jonathan S. Friedlaender, Jon Wakefield, Svante Pääbo, and Joshua M. Akey. "Excavating Neandertal and Denisovan DNA from the genomes of Melanesian individuals." *Science* 351 no. March 18 (2016): 1243-58.

¹⁸ Houldcroft, Charlotte J., and Simon J. Underdown. "Neanderthal Genomics Suggests a Pleistocene Time Frame for the First Epidemiologic Transition." *American Journal of Physical Anthropology* 159 no. 4 (2016).

Kuhlwilm, Martin, Ilan Gronau, Melissa J. Hubisz, Cesare de Filippo, Javier Prado-Martinez, Martin Kircher, Qiaomei Fu, Hernán A. Burbano, Carles Lalueza-Fox, Marco de la Rasilla, Antonio Rosas, Pavao Rudan, Dejana Brajkovic, Željko Kucan, Ivan Gušić, Tomas Marques-Bonet, Aida M. Andrés, Bence Viola, Svante Pääbo, Matthias Meyer, Adam Siepel, and Sergi Castellano. "Ancient gene flow from early modern humans into Eastern Neanderthals." *Nature* 530 (2016): 429-33

¹⁹ Liu, Wu, Chang-Zhu Jin, Ying-Qi Zhang, Yan-Jun Cai, Song Xing, Xiu-Jie Wu, Hai Cheng, R. Lawrence Edwards, Wen-Shi Pan, Da-Gong Qin, Zhi-Sheng An, Erik Trinkaus, and Xin-Zhi Wu. "Human Remains from Zhirendong, South China, and Modern Human Emergence in East Asia." *PNAS* 107 no. 45 (2010): 19201-6.

²⁰ Curnoe, Darren, and Alan Thorne. "Number of Ancestral Human Species: A Molecular Perspective." *Homo* 53 no. 3 (2003): 201-24.

As I am writing the history of the human lineage is being rewritten, the distinctions and separations between varieties of early humans, that is hominims, are being pushed back in time and becoming very blurred, some would argue Homo *erectus*, Neanderthals and Homo *sapiens* are all one species.²¹ Importantly they do not differ markedly in terms of cranial capacity– Homo *erectus* 850-1250 cc (Avg. 1016 cc), Neanderthals 1100-1700 cc (Avg. 1450 cc), Homo *sapiens* 800-2200 cc (Avg. 1345 cc).²²

For my story what really matters is the recent claim that early hominims made string. Bruce Hardy and his colleagues found what they think is evidence of twisted fibres in the Abri du Maras in the Ardeche that they date at 90kya.²³ String may not seem that much of a cultural achievement by comparison with stone tools and symbolic expression, but I would agree with the archaeologist Elizabeth Barber who makes the case that the invention of string was revolutionary in that it was a key technology enabling people to move into all the continents on Earth except. Antarctica.²⁴

²¹ Curnoe, Darren, and Alan Thorne. "Number of Ancestral Human Species: A Molecular Prespective." *Homo* 53 no. 3 (2003): 201-24.

²² Gauger, Ann, Douglas Axe, and Casey Luskin. *Science and Human Origins*: Discovery Institute Press, 2012).

²³ Hardy BL, Moncel M-H, Daujear C, et al. (2013) Impossible Neanderthals? Making String, Throwing Projectiles and Catching Small Game during Marine Isotope Stage 4 (Abri du Maras, France). *Quaternary Science Reviews* 82: 23-40.
Hardy K. (2008) Prehistoric String Theory. How Twisted Fibres Helped to Shape the World. *Antiquity* 82: 271-280.

²⁴ Barber E. (1994) *Women's Work: The First 20,000 Years*, New York: W.W. Norton & Co, 45. Turnbull D. (2008) String and Stories. In: Selin H (ed) *Encyclopedia of the History of Science, Technology and Medicine in Non-western Cultures*. Berlin: Springer.

Over 20 years ago Barber argued:

We don't know how early to date this discovery— of making string as long and as strong as needed by twisting short filaments together... string can be used simply to tie things up— to catch, to hold, to carry. From these notions come snares and fishlines, tethers and leashes, carrying nets, handles, and packages, not to mention a way of binding objects together to form more complex tools... So powerful in fact is simple string in taming the world to human will and ingenuity that I suspect it to be the unseen weapon that allowed the human race to conquer the earth, that enabled us to move out into every econiche on the globe during the Upper Palaeolithic (50-10kya). We could call it the String Revolution.

String, like all perishable organic material is largely absent in the archaeological record that is inevitably heavily biased towards lithic technologies. String is an under-recognised, seemingly banal, but arguably profoundly important technology of connection essential for both movement and story telling. String or cordage not only allowed early human ancestors to 'catch, hold and carry', but to make watercraft by lashing reeds or logs together. String also played an important role of connection in some of the commonest forms of external symbolisation—necklaces and pendants.

Stringed beads are now known to have been made as much as 200kya.²⁵ Arguably external symbolisation goes hand-in-glove with story telling.²⁶

Narratives of prehistory are in the process of being radically reshaped. It is possible to offer an alternative to the bedtime story for children where all that is civilised and significant happened after 'we' left Africa somewhere around 60kya, spread out across the land, replaced our primitive ancestors, settled down, invented agriculture, and the rest is literally history. It is becoming clear that narrative is entirely too self-serving.

In the emerging narrative early hominims may have done most of the hard yards of earliest migration, and most importantly and surprisingly, by sea as well as by land. However, historical truth does not simply emerge, separate out from narrative and leave it behind. We are inherently and necessarily bound up in story telling. Doubly so. All accounts of the way the world is, scientific or historical, are orderings of events in space and time framed by our ontological and metaphysical assumptions; they are the ways in which we create meaning, significance and value, they are narratives. But narratives are not mere fiction, they too, like string, are essential technologies of connection.

²⁵ Bednarik, Robert G. "The Significance of the Earliest Beads." *Advances in Anthropology* 5 (2015): 51-66.

²⁶ Zilhão J, Angelucci DE, Badal-García E, et al. (2010) Symbolic use of marine shells and mineral pigments by Iberian Neandertals. *PNAS* 107: 1023-1028.

Bednarik R. (1997) The Role of Pleistocene Beads in Documenting Human Cognition. *Rock Art Research* 14: 27-41.

Arsuaga JL. (2002) *The Neanderthal's Necklace: In Search of the First Thinkers*, New York: Four Walls Eight Windows.

<https://stringstoriesstudy.wordpress.com/>

One of the themes I want to follow in this talk is the fundamental role of story telling both in prehistory and in our accounts of prehistory.²⁷ Narratives of prehistory are foundational in establishing what we take ourselves to be. All our notions of identity and difference are articulated in the stories we tell ourselves about where we come from, how we got here and what makes us different from apes and animals. Our origin stories are deeply intertwined with stories we tell about the emergence of modernity, what we mean by modernity and where why and how it was brought about. These stories are complexly interwoven with what we take to be evidence, the nature of knowledge, and how we know. Knowledge has largely been taken to be representational, but the practice-based approach of science studies has opened up the ways in which knowledge is performative, embodied action inseparable from social interaction, material artefacts and movement.²⁸ Knowledge and movement lie at the heart of the stories we tell about ourselves.

However, I would argue that it is the slowly emerging recognition of the role of seafaring in hominin occupation of the world that offers the most profound challenge to the prevailing prehistoric narrative and incidentally brings to the fore the importance

²⁷ Turnbull D. (2004) Narrative Traditions of Space, Time and Trust in Court: *Terra Nullius*, 'wandering', The *Yorta Yorta* Native Title Claim, and The Hindmarsh Island Bridge Controversy. In: Edmond G (ed) *Expertise in Regulation and Law*. Aldershot: Ashgate, 166-183.

²⁸ Latour, Bruno and Steve Woolgar. *Laboratory Life; The Social Construction of Scientific Facts*. 2nd ed. (Beverly Hills: Sage, 1979).
Pickering, Andrew, ed. *Science as Practice and Culture*. (Chicago: University of Chicago Press, 1992).
Malafouris, Lambros. *How Things Shape the Mind: A Theory of Material Engagement*. (Cambridge: MIT Press, 2013).

of story telling. Though somewhat less dramatic, the augmentation of terrestrial prehistory with a maritime dimension has been much less readily accepted than the revelation of our intimacy with Neanderthals. This, despite the long recognised reality that somehow Australia was occupied by humans around 60kya, and that that movement of people involved at least three sea journeys, one of which was minimally 90 km across fast flowing turbulent waters.²⁹

This reluctance to acknowledge deliberate seafaring is arguably in part due to what Tim Cresswell calls a 'sedentarist metaphysics'. There are, he claims, two profoundly differing ways of understanding the world in terms of mobility, spatial order and place.³⁰ One sees social order in terms of rootedness and place, and hence mobility is suspect, the other celebrates the fluidity and dynamism of mobility. Sedentarist metaphysics underpins much of contemporary western understandings of the state, modernity, civilisation and rationality, and consequently infuses prehistory, privileging territorial over maritime mobility. This reflects the important distinction that Tim Ingold makes between the ways in which knowledge and movement are conceived in mapping, and in wayfaring. In mapping knowing is a matter of static calculation in place; in wayfaring knowledge is based in movement along paths. In a kinetic,

²⁹ Allen J and O'Connell J. (2009) Getting from Sunda to Sahul. In: Clark G, Leach F and O'Connor S (eds) *Islands of Inquiry: Colonisation, Seafaring and the Archaeology of Maritime Landscapes. terra australis* 29. Canberra: ANU epress, 31-46. O'Connor S, Ono R and Clarkson C. (2011) Pelagic Fishing at 42,000 Years Before the Present and the Maritime Skills of Modern Humans. *Science* 334: 1117-1121.

³⁰ Cresswell T. (2006) *On The Move: Mobility in the Modern Western World*, New York: Routledge, 26-7. Malkki L. (1992) National Geographic: The Rooting of Peoples and the Territorialization of National Identity among Scholars and Refugees *Cultural Anthropology* 7: 24-44.

performative practice based perspective ‘We know as we go’ as Ingold succinctly puts it.³¹ Another component in the resistance to the idea of early seafaring lies in the assumption that it requires the transmission of knowledge and practices that would have been beyond the cognitive capacity of early hominims before the emergence of behaviourally modern humans around 40-50kya.

Nonetheless a small but growing school of maritime prehistorians, are focused not just on whether early hominims could have been seafarers, but on how they could have made sea voyages, given that there is now emerging evidence of Pleistocene seafaring beyond the examples of Australia and Flores. Early voyaging in the Mediterranean by hominims has started to shift the balance somewhat, coming as it does from an intersection of archaeology and genetics on Cyprus and Crete.

A few years ago the archaeologist Thomas Strasser found stone tools on Crete seemingly reliably dated as at least 140kya.³² This is pretty radical, it puts the dating of seafaring in the Mediterranean back by a massive 100ky. Similar discoveries on Cyprus and the Ionian islands suggest that these early substantial sea voyages predate

³¹ Turnbull D. (2007) Maps, Narratives and Trails: Performativity, Hodology, Distributed Knowledge in Complex Adaptive Systems– An Approach to Emergent Mapping. *Geographical Research* 45: 140-149.

Ingold T. (2000) *The Perception of the Environment: Essays in Livelihood, Dwelling and Skill*, London: Routledge.

Ingold T. (2011) *Being Alive: Essays on Movement, Knowledge and Description*, London Routledge.

³² Strasser, T, E Panagopoulou, et al. (2010) Stone Age Seafaring in the Mediterranean: Evidence from the Plakias Region for Lower Palaeolithic and Mesolithic Crete, *Hesperia*, **79**(2): 145-90.

behaviourally modern humans.³³ These discoveries obviously open up the question of how early seafaring could have been achieved, but I think the issue becomes much more profound when the flurry of recent discoveries requiring rethinking the foundational narrative of ‘the Neolithic Revolution’ are added to the mix.

I only want to briefly mention two of them here. Klaus Schmidt, who tragically died in 2014, spent 25 years excavating the most important pre-Neolithic site in the world at Gobekli Tepe in Eastern Turkey. This complex of elaborately carved, massive stone structures is dated at 12kya, meaning it was built by hunter-gatherers, since it was before the domestication of plant and animals, before agriculture, before sedentarisation, before that which has been taken to be the necessary conditions for the possibility of civilisation.³⁴ In other words we need a new narrative explaining how humans were able to work collaboratively without being fixed in place.

In addition, two recent genetic studies appear to show that following the development of agriculture in the Near East, it did not first spread into Europe by the obvious

³³ Simmons A. (2012) Mediterranean Island Voyages. *Science* 338: 895-897.; Simmons A. (2014) *Stone Age Sailors: Paleolithic Seafaring in the Mediterranean*, Walnut Creek: Left Coast Press.

Bednarik R. (2003) Seafaring in the Pleistocene. *Cambridge Archaeological Journal* 13: 41-66.

Ferentinos G, Gkioni M, Geraga M, et al. (2012) Early Seafaring Activity in the Southern Ionian Islands, Mediterranean Sea. *Journal of Archaeological Science* 39: 2167-2176.

³⁴ What may have been part of the inspiration for building Gobekli Tepe may have been beer and feasting, social gathering and connecting. Dietrich O, Heun M, Notroff J, et al. (2012) The Role of Cult and Feasting in the Emergence of Neolithic communities. New Evidence from Göbekli Tepe, South-eastern Turkey. *Antiquity* 86: 674-695.

terrestrial route through Anatolia, but by sea through Cyprus, Crete and Aeolian islands.³⁵

But, despite the growing body of archaeological evidence there are archaeologists who claim, in a re-emergence of a version of the out-dated arguments against the possibility of deliberate Polynesian voyaging, that either the dating is incorrect, or the artefacts are a result of accidental dispersal or drift voyages. A claim based on the assertion that it was cognitively impossible for anyone to make deliberate sea voyages prior to the arrival of BMH ie that now rather elusive category behaviourally modern humans. By contrast there are those who argue that the evidence shows that early seafaring must indeed have been practicable and the question is how was it achieved. I suggest these two positions result from differing narrative modes—the representational and the performative— modes with differing ontologies, ways of being and knowing with differing ways of ordering events and actions in space and time.

In representationalist mode the argument against early seafaring is articulated by the archaeologist Thomas Leppard. He claims as a matter of self-evident analysis of human cognition that seafaring requires planning, fully syntactical language,

³⁵ Balter M. (2014) *First Farmers Were Also Sailors*. Available at: <http://news.sciencemag.org/archaeology/2014/06/first-farmers-were-also-sailors>.
Paschou P, Drineas P, Yannaki E, et al. (2014) Maritime Route of Colonization of Europe. *Proceedings of the National Academy of Sciences*; Fernández E, Pérez-Pérez A, Gamba C, et al. (2014) Ancient DNA Analysis of 8000 B.C. Near Eastern Farmers Supports an Early Neolithic Pioneer Maritime Colonization of Mainland Europe through Cyprus and the Aegean Islands. *PloS Genetics*; (it should be noted that the sea was a barrier between Northern Mediterranean island and N Africa, but was a bridge between the islands.) Vigne J-D, Briois Fo, Zazzo A, et al. (2012) First Wave of Cultivators Spread to Cyprus at Least 10,600 y ago. *PNAS* 109: 8445-8449.

abstraction and a fully working memory.³⁶ None of this does he derive from a consideration of the practices of seafaring. Indeed he goes so far as to deny that anything can be learned from experimental or replica voyaging. In his view demonstrating that it can be done tells you nothing about how it was done.³⁷

Helen Farr by contrast in performative mode argues seafaring is crucially based in social action and situated knowledge.

Her account of what is actually involved in making an experimental sea journey across the Adriatic from Greece to Italy in the Neolithic period rightly shows seafaring is a profoundly social activity based in the collaboration, communication of practical mastery and complex knowledges of seascapes and landscapes with varying spatialities and temporalities.

Seafaring is a skill which requires knowledge on a number of different levels. What may be referred to as ‘world’ knowledge involves spatial and temporal awareness and an understanding of land and seascape and a perception of surroundings, whilst ‘local’ knowledge involves navigational lore, local weather and current conditions, location of resources and other social groups...

³⁶ Leppard, Thomas P., "The Evolution of Modern Behaviour and its Implications for Maritime Dispersal during the Palaeolithic", *Cambridge Archaeological Journal* 26 no. 1 (2015): 1-18.

³⁷ Leppard, Thomas P., and John Cherry. "Experimental Archaeology and the Earliest Seagoing: The Limitations of Inference " *World Archaeology* 47 no. 5 (2015): 1-16.

In summary, Farr claims a general knowledge base, and a local knowledge base would have been necessary for seafaring. This knowledge would have been maintained and disseminated through oral traditions, in which stories, songs or poetry, recounted trips, celebrated deeds and transmitted cautionary advice.³⁸

If we look more closely at the earlier seafaring of early hominims, its apparent that Farr's notion of knowledge transmission through practice, cognitive mapping and oral tradition needs augmentation and elaboration. Early in hominim evolutionary history, collaboration, journeying and oral traditions would presumably have been in the process of being developed, along with language itself. In contrast to an account that presupposes the existence of language, treats knowledge as information and invokes cognitive maps, I want to postulate a process of co-production and connection.

What is in development is collaboration and the 'ability to extend social relations across space and time.'³⁹ That extension is more likely to be basically performative, and to be based in bodily movement. It is our bodies as much as our minds that give us our location, our spatial and temporal orientation in the world. In the process of making connections cognitively, socially, and linguistically, we come to know the world and to alter it.⁴⁰ We also deploy tools, materials, artifacts, and knowledge in

³⁸ Farr 2006, 96.

³⁹ Clive Gamble claims "what characterizes social life in humans rather than hominids is our ability to extend social relations across space and time."Gamble, C (2007) *Origins and Revolutions: Human Identity in Earliest Prehistory*, Cambridge, Cambridge University Press, 8-39. Obviously we now have to modify this to include hominims.

⁴⁰ Turnbull, 2007.

complex systems of trade and exchange, thus proliferating “chains of connection” in strategically structured social networks.⁴¹ In addition to a finely adapted tool kit and a profound capacity for absorbing detailed knowledge of the weather, the seasons and the behaviour of plants and animals; a key component on which all forms of movement depend is a social technology of kinship—a network of relatedness, bonding, and obligations across generations through a classification of friends, enemies, and strangers. ‘The constitution of persons and of places are mutually entailed aspects of the same process. In this sense kinship is geography, or landscape.’⁴²

There is emerging evidence that early hominins around 1.2mya started to form groups larger than the extended family, groups of around 150 people. At the same time they started to extend their resource base beyond the immediate home place with a radius of around 13km. They began travelling over 100km to collect materials and to make compound tools.⁴³ All these social extensions in space required collaboration and synchronisation, social capacities that could only have evolved out of pre-existing capacities. The model that currently seems most plausible, does not require the sudden

⁴¹ Mulvaney, DJ (1976) 'The Chain of Connection': The Material Evidence, *Tribes and Boundaries in Australia*, N. Peterson (Ed. Canberra, Australian Institute of Aboriginal Studies: 72-95. Keen, I (1994) *Knowledge and Secrecy in an Aboriginal Religion*, Oxford, Clarendon Press, 16.

⁴² Sahlins, M (2013) *What Kinship Is— And Is Not*, Chicago, Chicago University Press, 7.

⁴³ Marwick B. (2006) The Interpersonal Origins of Language: Social and Linguistic Implications of an Archaeological Approach to Language Evolution. *Linguistics and the Human Sciences* 1: 197-224.
Ambrose S. (2001) Paleolithic Technology and Human Evolution. *Science* 291: 1748.
Dunbar R, Gamble C and Gowlett J. (2010) The Social Brain and the Distributed Mind. In: Dunbar R, Gamble C and Gowlett J (eds) *Social Brain and the Distributed Mind*. Oxford: Oxford University Press, 3-13.

development of language or a cognitive map, rather it suggests that music, song, dance and storytelling developed with the formation of larger social of social groups, cooperative complex activity and extended travelling.⁴⁴ Arguably cooperation is based in 'shared intentionality' the ability to create with others joint intentions and joint commitments in cooperative endeavours.⁴⁵ That shared intentionality is coproduced with turn taking,⁴⁶ synchrony and gesture that becomes developed in music in singing,

⁴⁴ Mithen S. (2005) *The Singing Neanderthals: The Origins of Music. Language, and Body*, London: Phoenix.

Garfinkel Y. (2003) *Dancing at the Dawn of Agriculture*, Austin: University of Texas.

Dietrich O, Heun M, Notroff J, et al. (2012) The Role of Cult and Feasting in the Emergence of Neolithic communities. New Evidence from Göbekli Tepe, South-eastern Turkey. *Antiquity* 86: 674-695.

Brown S. (2000) The 'Musilanguage' Model of Music. In: Wallin N, Merker B and Brown S (eds) *The Origins of Music*. Cambridge: MIT Press, 271-300.

Morley I. (2013) *The Prehistory of Music: Human Evolution, Archaeology, and the Origins of Musicality*, Oxford: Oxford University Press.

Terrell J. (1990) Storytelling and Prehistory. *Archaeological Method and Theory* 2: 1-29.

McNeill W. (1995) *Keeping Together in Time: Dance and Drill in Human Communication*, Cambridge: Harvard University Press.

Wiessner PW. (2014) Embers of Society: Firelight Talk Among the Ju/'hoansi Bushmen. *PNAS*.

Tomasello M, Carpenter M, Call J, et al. (2005) Understanding and Sharing intentions: The Origins of Cultural Cognition. *Behavioral and Brain Sciences* 28

Harari YN. (2014) *Sapiens: A Brief History of Humankind*, London: Harvill Secker

⁴⁵ Tomasello, Michael, Malinda Carpenter, Josep Call, Tanya Behne, and Henrike Moll. "Understanding and Sharing intentions: The Origins of Cultural Cognition." *Behavioral and Brain Sciences* 28 (2005), xiii

⁴⁶ Levinson, Stephen C. "Turn-taking in Human Communication – Origins and Implications for Language Processing." *Trends in Cognitive Sciences* 20 no. 1 (2016): 6-14.

and dancing, and performative story-telling.⁴⁷ Language, like memory, arises performatively in movement, spatiality, synchronised interconnection, and in practical activities. From an evolutionary perspective it could have emerged in the co-production of thinking and acting.⁴⁸

The development of complex forms of social cognition, of cooperation and collaboration are fundamental to the extension of relationships in space and time. As the anthropologist Clive Gamble puts it ‘to get to Australia, kinship was needed just as much as boats’.⁴⁹ So I suggest that the standard story that culturally and cognitively complex behaviour only developed in the human revolution with modern *Homo sapiens*, after they left Africa, has to be replaced with a non-revolutionary story. A story of developing ‘socio-cognitive niches’, or as I prefer ‘knowledge spaces’, or co-adaptations of ourselves and our environment as we moved through it. As the

⁴⁷ Sterelny, Kim. "Language, Gesture, Skill: The Co-evolutionary Foundations of Language." *Philosophical Transactions B* 367 no. 1599 (2012): 2141–51.

Schulkin, Jay, and Greta B. Raglan. "The Evolution of Music and Human Social Capability." *Frontiers in Neuroscience* (2014).

Tarr, Bronwyn, Jacques Launay, and Robin I. M. Dunbar. "Music and Social Bonding: “Self-other” Merging and Neurohormonal Mechanisms." *Frontiers in Psychology* 5 (2014).

⁴⁸ Stutz, Aaron J. "Embodied Niche Construction in the Hominin Lineage: Semiotic Structure and Sustained Attention in Human Embodied Cognition." *Frontiers in Psychology* (2014)

Cowley, S.J. "Linguistic Embodiment and Verbal Constraints: Human Cognition and the Scales of Time." *Frontiers in Psychology* (2014)

⁴⁹ Gamble, C (2008) Kinship and Material Culture: Archaeological Implications of the Human Diaspora, *Early Human Kinship: From Sex to Social Reproduction*, N. Allen, H. Callan, R. Dunbar and W. James Eds). Oxford, Blackwell: 27-40.

biologists Maturana and Varela have argued, life and cognition are processes of connection literally joining and co-producing bodies, things and ideas.⁵⁰

I would like to leave you with an hypothesis or a narrative sketch of how knowledge spaces were created that enabled hominims to become the great colonisers and survivors in every available territory on the planet– how they transformed themselves and their environment in the process– how their development of fire, ochre, string, stories, boats, kinship and exchange were based in recursion, seafood and symbolisation- how they connected people, practices and places in the process of moving.

Such a schema or story could perhaps be titled– ‘The human species made themselves and their environment: the birth of the Anthropocene’. (The Anthropocene is the proposed new name for the period in which we all now live, where our actions can be shown to affect the environment.) My candidate for its start is the controlled and habitual use of fire, and the attendant development of an early social connection space– the camp fire.

The reasons for picking on fire as the human invention that marked the onset of the Anthropocene are that it is a hominim-created technological practice that radically altered both the physiology of its creators and their social life. It began a process of

⁵⁰ Maturana, Humberto, and Francisco Varela. *The Tree of Knowledge: The Biological Roots of Human Understanding*. (Boston: New Science Library, 1987).

coproduction whereby hominim technological practices shaped the landscape and all subsequent hominims and their interactions. Fire-cooked food requires far less digestive processing, fire thus allowed the development of a radically shortened human gut relative to primates, thereby freeing energy for the development of a larger brain.⁵¹ The evidence for the earliest hearths comes from the delightfully named Wonderwerk Cave in South Africa, and has set a minimum date of around 1mya and incidentally shows evidence of ochre use from the same period.⁵²

Red ochre has played a fundamental role in hominim prehistory, marking as it does the earliest evidence of symbolisation and cognition at two sites in Africa, one at GnJh-03 in the Kapthurin formation of Kenya dated at 285mya and another at Twin Rivers in

⁵¹ Wrangham R. (2009) *Catching Fire: How Cooking Made Us Human*, New York: Basic Books. Berna F, Goldberg P, Horwitz LK, et al. (2012) Microstratigraphic Evidence of In Situ Fire in the Acheulean Strata of Wonderwerk Cave, Northern Cape Province, South Africa. *PNAS* 19: E1215-1220.

⁵² Berna, Francesco, Paul Goldberg, Liora Kolska Horwitz, James Brink, Sharon Holt, Marion Bamford, and Michael Chazan. "Microstratigraphic Evidence of In Situ Fire in the Acheulean Strata of Wonderwerk Cave, Northern Cape Province, South Africa." *PNAS* 19 no. 20 (2012): E1215-20.

Chazan, Michael, and Liora Kolska Horwitz. "Milestones in the Development of Symbolic Behaviour: A Case Study from Wonderwerk Cave, South Africa." *World Archaeology* 41 no. 4 (2009): 521-39.

Beaumont, Peter B., and John C. Vogel. "On a Timescale for the Past Million Years of Human History in Central South Africa." *South African Journal of Science* 102 (2006): 217-28.

Zimbabwe dated at 230kya.⁵³ Ochre is so important in the origins of embodied cognition it deserves book length treatment, unfortunately there is only room here for a brief side bar. Ochre naturally occurs as forms of haematite (iron oxide) in many colours red, white, and yellow. The painters workshop and tool kit found at Blombos cave in South Africa dated at 100kya shows the profound sophistication of its preparation. Ochre was heat treated to produce differing colours, it was ground to aspecific granularity for differing purposes using carefully selected grinding stones and it was mixed with a variety of binders depending again on its use.⁵⁴ Ochre was a jointly social and material technology of connection, that as a prized medium of symbolic expression in rock art, jewellery and ritual, was used to join ideas together; and like string it was also a material technology of connection used in hafting and joining things together.⁵⁵

⁵³ Hansen, Ine Askevold. "The Role of Ochre in the Middle Stone Age." MA Thesis, (University of Oslo, 2011)

Rosso, D.E., Martí A. Pitarch, and F. d'Errico. "Middle Stone Age Ochre Processing and Behavioural Complexity in the Horn of Africa: Evidence from Porc-Epic Cave, Dire Dawa, Ethiopia." *PLoS One* 11 no. 11 (2016).

Watts, Ian. "The Red Thread: Pigment Use and the Evolution of Collective Ritual." In *The Social Origins of Language*, edited by Daniel Dor, Chris Knight and Jerome Lewis, 208-27. (Oxford: Oxford University Press, 2014).

Wadley, Lyn. "Compound-Adhesive Manufacture as a Behavioral Proxy for Complex Cognition in the Middle Stone Age." *Current Anthropology* 51 no. S1 (2010).

⁵⁴ Henshilwood, Christopher S., Francesco d'Errico, Karen L. van Niekerk, Yvan Coquinot, Zenobia Jacobs, Stein-Erik Lauritzen, Michel Menu, and Renata García-Moreno. "A 100,000-Year-Old Ochre-Processing Workshop at Blombos Cave, South Africa." *Science* 334 (2011): 219-22.

⁵⁵ Jones P. (2007) *Ochre and Rust: Artefacts and Encounters on Australian Frontiers*, Kent Town SA: Wakefield Press, 348, citing Wreschner EE. (1980) Red Ochre and Human Evolution: A Case for Discussion. *Current Anthropology* 21: 631-644

Watts, Ian. "The Red Thread: Pigment Use and the Evolution of Collective Ritual." In *The Social Origins of Language*, edited by Daniel Dor, Chris Knight and Jerome Lewis, 208-27. (Oxford: Oxford University Press, 2014).

But back to fire. The anthropologist Richard Wrangham has argued that the large brain and relatively delicate jaw of *Homo erectus* is evidence for their adaptation to the use of fire for cooking, and that it points to the use of fire around 1.8mya. It has been argued that for fire to have had an evolutionary and cultural impact it would have to have been habitual rather than opportunistic. In opposition to Wrangham's hypothesis, investigations in the Near East suggest that such habitual use of fire as evidenced by hearths did not develop until around 350kya.⁵⁶ However, recent research on African paleoclimates shows that 2 to 3 million years ago the tropical African environment started to become progressively fire-prone which has led to the 'Pyrophilic Primate Hypothesis' in which it is suggested that Hominims became fire adapted very early.⁵⁷ While there is now evidence of the controlled use of fire at around 1mya at a cave site in Spain,⁵⁸ the dating of early fire use is far from settled, and is likely to remain controversial for some time. However, there is another set of complex co-adaptations and transformations that are directly linked to fire, where hominim socio-technical

⁵⁶ Shimelmitz R, Kuhn SL, Jelinek AJ, et al. (2014) Fire at Will: The Emergence of Habitual Fire Use 350,000 years ago. *Journal of Human Evolution* 77: 196-203.

⁵⁷ Parker, Christopher H. , Earl Keefe, Nicole Herzog, James F. O'Connell, and Kristen Hawkes. "The Pyrophilic Primate Hypothesis." *Evolutionary Anthropology* 25 (2016): 54-63. Burton, Frances. *Fire: The Spark That Ignited Human Evolution*. (Albuquerque: University of New Mexico Press, 2009).

⁵⁸ Walker, M.J., D. Anesin, D.E. Angelucci, A. Aviles-Fernandez, F. Berna, A.T. Buitrago-Lopez, Y. Fernandez-Jalvo, M. Haber-Uriarte, A. Lopez-Jimenez, M. Lopez-Martinez, I. Martin-Lerma, J. Ortega-Rodriganez, J.-L. Polo-Camacho, S.E. Rhodes, D. Richter, T. Rodriguez-Estrella, J.-L. Schwenninger, and A.R. Skinner. "Combustion at the late Early Pleistocene Site of Cueva Negra del Estrecho del Rio Quipar (Murcia, Spain)." *Antiquity* 90 no. 351 (2016): 571-89.

innovations/inventions have shaped their evolutionary history.⁵⁹ The development of habitual use of hearths and campfires transformed identity and community, spatiality and temporality. Fires enabled the development of primary ‘technologies of connection and cooperation’ – language and stories. Fires were a fundamental dimension in the transformation in the way people moved, interacted, cooperated and assembled cultural knowledge practices. Fires were central to the development of community, and the so-called recursive ‘theory of mind’ – the recognition that other people have minds, thoughts just like our own that enabled group identity and story telling that preceded language.⁶⁰

This is of course a partly speculative argument, one triggered by the publication in 2014 of what may become a landmark article by Polly Wiessner. Her article analyses campfire talk of the !Kung Bushmen also known as Ju/'hoansi or Khoisan people of the Kalahari desert, the oldest continuous culture on Earth (despite Australian Aboriginal claims to the contrary), and the most genetically diverse group, who can claim to be ancestral to all of us. Wiessner accepts Wrangham’s ‘cooking hypothesis’ and argues

⁵⁹ Gowlett JAJ and Wrangham RW. (2013) Earliest Fire in Africa: Towards the Convergence of Archaeological Evidence and the Cooking Hypothesis. *Azania: Archaeological Research in Africa* 48: 5-30.

⁶⁰ Gowlett argues that ‘Above all, there is a vital social and ideational side to fire: not only did it do much to fuel the social brain, it served as a focus for bringing together insights and ideas, eventually in a strong context of language. Through the Pleistocene, probably from beginning to end, it has played a major part in linking the social and technical, firing the brain and also its imagination.’ Gowlett, John. "Firing Up The Social Brain." In *Social Brain and the Distributed Mind*, edited by Robin Dunbar, Clive Gamble and John Gowlett, 341-65. (Oxford: Oxford University Press, 2010).
Everett D. (2012) *Language: The Cultural Tool*, New York: Pantheon Books.
Corballis MC. (2011) *The Recursive Mind: The Origins of Human Language, Thought, and Civilization*, Princeton: Princeton University Press

that habitually having campfire alters circadian rhythms and radically extends the day
'creating effective time for social activities that did not conflict with productive time
for subsistence activities'.

Her analysis of !Kung conversation, gossip, and talk shows that it changed markedly
between day and night.

The nitty-gritty of egalitarianism, food sharing, kinship dues, and land tenure were
... regulated by day; night talk was critical for transmitting the big picture of the
workings of marriage, kinship, xhara exchange, and cosmology/trance healing.⁶¹

Putting Wiessner together with the suggestive work of Ambrose on compound tools,
Dunbar on the social brain, Marwick on networks and language development,
Bednarik on seafaring, Parkington and Erlandson on aquatic diets and brain growth,
and the recent spectacular discovery of *Homo erectus* engraved shells in Indonesia,
along with the central role of red ochre, gives a radically new picture of how early

⁶¹ Wiessner PW. (2014) Embers of Society: Firelight Talk Among the Ju/'hoansi
Bushmen. *PNAS*.

humans moved and shaped themselves culturally.⁶² A picture in which somewhere around 1+mya Homo *erectus* made camp fires and cooked food, developed language, stories and symbolic expression, along with string and ochre– technologies of connection and cooperation that allowed for extended travel and seafaring, capacities coproduced with brain growth, symbolisation, and social networks.

In differing periods of migration and seafaring early hominims– Homo erectus, Neanderthals and Homo sapiens, sang, danced and storied their way out of Africa, by land and by sea, interbreeding, swapping technologies and extending social relations, as they encountered each other. A new story of prehistory is being composed, its stories all the way down.

⁶² Ambrose S. (2001) Paleolithic Technology and Human Evolution. *Science* 291: 1748.

Bednarik R. (2003) Seafaring in the Pleistocene. *Cambridge Archaeological Journal* 13: 41-66.

Marwick B. (2006) The Interpersonal Origins of Language: Social and Linguistic Implications of an Archaeological Approach to Language Evolution. *Linguistics and the Human Sciences* 1: 197-224.

Erlandson J. (2010) Food for Thought: The Role of Coastlines and Aquatic Resources in Human Evolution. In: Cunnane S and Stewart K (eds) *Human Brain Evolution: The Influence of Freshwater and Marine Food Resources*. Hoboken: Wiley-Blackwell, 125-136.

Parkington J. (2010) Coastal Diet, Encephalization, and Innovative Behaviours in the Late Middle Stone Age of Southern Africa. In: Cunnane S and Stewart K (eds) *Human Brain Evolution: The Influence of Freshwater and Marine Food Resources*. Hoboken: Wiley-Blackwell, 189-202.

Dunbar RIM. (2014) How Conversations Around Campfires Came To Be. *PNAS* 111: 14013-14014.

