idea journal

co-constructing body-environments

vol. 17, no. 02

2020

the journal of IDEA: the interior design + interior architecture educators' association

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publishing

ISSN 2208-9217
ISBN 978-3-88778-917-6

Published by Art Architecture Design Research (AADR): aadr.info.
AADR publishes research with an emphasis on the relationship between critical theory and creative practice. AADR Curatorial Editor: Dr Rochus Urban Hinkel, Melbourne.

IDEA (Interior Design/Interior Architecture Educators' Association)
ACN 135 337 236; ABN 56 135 337 236

Registered at the National Library of Australia

idea journal is published by AADR and is distributed through common ebook platforms. Selected articles are available online as open source at time of publication, and the whole issue is made open access on the idea journal website one year after its date of publication.

cover image

Animation by Jo Bailey (2020) of "Giacometti Strata, Bioscleave" (2015). Robert Bowen, Photographer

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co-constructing body-environments: provocation

Presenters at *Body of Knowledge: Art and Embodied Cognition Conference* (*BoK2019* hosted by Deakin University, Melbourne, June 2019) are invited to submit contributions to a special issue of idea journal "Co-Constructing Body-Environments" to be published in December 2020. The aim of the special issue is to extend the current discussions of art as a process of social cognition and to address the gap between descriptions of embodied cognition and the co-construction of lived experience.

We ask for papers, developed from the presentations delivered at the conference, that focus on interdisciplinary connections and on findings arising from intersections across research practices that involve art and theories of cognition. In particular, papers should emphasize how spatial art and design research approaches have enabled the articulation of a complex understanding of environments, spaces and experiences. This could involve the spatial distribution of cultural, organisational and conceptual structures and relationships, as well as the surrounding design features.

Contributions may address the questions raised at the conference and explore:

+ How do art and spatial practices increase the potential for knowledge transfer and celebrate diverse forms of embodied expertise?
+ How the examination of cultures of practice, Indigenous knowledges and cultural practices offer perspectives on inclusion, diversity, neurodiversity, disability and social justice issues?
+ How the art and spatial practices may contribute to research perspectives from contemporary cognitive neuroscience and the philosophy of mind?
+ The dynamic between an organism and its surroundings for example: How does art and design shift the way knowledge and thinking processes are acquired, extended and distributed?
+ How art and design practices demonstrate the ways different forms of acquiring and producing knowledge intersect?

These and other initial provocations for the conference can be found on the conference web-site: https://blogs.deakin.edu.au/bok2019/cfp/.

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in this issue

introduction: unknowingly, a threshold-crossing movement

Julieanna Preston
Executive Editor
idea journal

It is in this special issue that the editorial board holds true to our promise to expand the horizons and readership of *idea journal* while reaching out to associated and adjacent art, design and performance practices and drawing connections to seemingly distant disciplines. The articles in this issue have provenance in a 2019 conference event, Bodies of Knowledge (BOK), which was guided by a similar interdisciplinary ethos. With an emphasis on cultures of practice and communities of practitioners that offer perspectives on inclusion, diversity/neurodiversity and disability, this conference, and this subsequent journal issue, aim to increase knowledge transfer between diverse forms of embodied expertise, in particular, between neuroscience and enactive theories of cognition.

This brief description suggests that there are shared issues, subjects and activities that have the potential of generating new understanding in cross-, inter- and trans-disciplinary affiliations and collaborations. My experience in these modes of inquiry points to the importance of identifying what is shared and what is not amongst vocabulary, concepts, pedagogies and methods. Holding these confluences and diverges without resorting to strict definition, competition or judgement of right and wrong often affords greater understanding and empathy amongst individuals to shape a collective that is diverse in its outlooks, and hopefully, curious as to what it generates together because of that diversity.

cite as:
Preston, Julieanna. 'Introduction: Unknowingly, a threshold-crossing movement,' *idea journal* 17, no. 02 (2020): 08 – 12, https://doi.org/10.37113/ij.v17i02.412.

The breadth of the knowledge bases represented within this issue necessitated that the peer reviewer list expanded once again like the previous issue. It was in the process of identifying reviewers with appropriate expertise that the various synapses between scholarly and artistic practices became evident. It is these synapses that shape sturdy bridges between the journal's existing readership, which is predominantly academics and students in interior design, interior architecture, spatial design and architecture, and the wide range of independent scholars and practitioners, academics, and students attracted to BOK's thematic call for papers, performative lectures and exhibitions. At the risk of being reductive to the complexity and nuances in the research to follow, I suggest that the following terms and concerns are central to this issue, aptly inferred by its title, 'Co-Constructing Body-Environments': spatiality; subjectivity; phenomenology; processual and procedural practice; artistic research; critical reflection; body: experience. All of these are frequent to research and practice specific to interiors. In this issue, however, we find how these terms and concerns are situated and employed in other fields, in other ways and for other purposes.

This is healthy exercise. To stretch one's reach, literally and metaphorically is to travel the distance between the me and the you, to be willingly open to what might eventuate. Imagine shaking the hand of a stranger—a somatic experience known to register peaceful intent, respect, courage, warmth, pressure, humour, nervous energy, and so much more. This threshold-crossing movement is embodied and spatial; it draws on a multitude of small yet complex communication sparks well before verbal impulses ensue. This significant bodily gesture sets the tone for what might or could happen. Based on my understanding of the research presented in 'Co-Constructing Body-Environments,' I propose that this is a procedure in the Gins and Arakawa sense that integrates theory and practice as a hypothesis for 'questioning all possible ways to observe the body-environment in order to transform it.'[01] I call this as *unknowingly*—a process that takes the risk of not knowing, not being able to predict or predetermine, something akin to the spectrum of 'throwing caution to the wind' and 'sailing close to

the wind'. My use of the word 'unknowingly' embraces intuition where direct access to unconscious knowledge and pattern-recognition, unconscious cognition, inner sensing and insight have the ability to understand something without any need for conscious reasoning. Instinct. The word *unknowingly* also affords me to invoke the 'unknowing' element of this interaction—to not know, to not be aware of, to not have all the information (as if that was possible)— an acknowledgement of human humility. I borrow and adapt this facet of unknowingly from twentieth-century British writer Alan Watts:

> This I don't know, is the same thing as, I love. I let go. I don't try to force or control. It's the same thing as humility. If you think that you understand Brahman, you do not understand. And you have yet to be instructed further. If you know that you do not understand, then you truly understand.[02]

Unknowingly also allows me to reference 'un' as a tactic of learning that suspends the engrained additive model of learning. Though I could refer to many other scholarly sources to fuel this concept, here I am indebted to Canadian author Scott H. Young's pithy advice on how to un-learn:

> This is the view that what we think we know about the world is a veneer of sense-making atop a much deeper strangeness. The things we think we know, we often don't. The ideas, philosophies and truths that guide our lives may be convenient approximations, but often the more accurate picture is a lot stranger and more interesting.[03]

In his encouragement to unlearn—dive into strangeness, sacrifice certainty, boldly expose oneself to randomness, mental discomfort, instability, to radically rethink that place/ your place/ our place, suspend aversions to mystery—Young's examples from science remind us that:

Subatomic particles aren't billiard balls, but strange, complex-valued wavefunctions. Bodies aren't vital fluids and animating impulses, but trillions of cells, each more complex than any machine humans have invented. Minds aren't unified loci of consciousness, but the process of countless synapses firing in incredible patterns.[04]

Figure 01:
Meeting the horizon; A still image from Shore Variations, a 2018 film by Claudia Kappenberg that reimagines *Waning*, a 2016 live art performance by Julieanna Preston. https://vimeo.com/user11308386.

In like manner to the *BOK2019* conference which was staged as a temporally infused knowledge-transfer event across several days, venues, geographies and disciplines, I too, ingested the materials submitted for this issue in this spirit of unknowingly. The process was creative, critical, intuitive, generative and reflective—all those buzz words of contemporary research—yet charged with substantial respect and curiosity for whatever unfolded, even if it went against the grain of what I had learned previously. For artists, designers, architects, musicians, and performers reading this journal issue, especially academics and students, this territory of inquiry may feel familiar to the creative experience and the increasing demands (and desires) to account for how one knows what one knows in the institutional setting. 'Explain yourself,' as the review or assessment criteria often states. If you are faced having to annotate your creative practice or to critically reflect on aspects that are so embedded in your making that you are unaware of them, I encourage you to look amongst the pages of this journal issue for examples of how others have grappled with that task such that the process is a space of coming to unknow and know, unknowingly.

There are a few people I would like to acknowledge before you read further. First, huge gratitude to the generosity of the peer reviewers, for the time and creative energy of guest editors Jondi Keane, Rea Dennis and Meghan Kelly (who have made the process so enjoyable and professional), for the expertise of the journal's copy editor Christina Houen and Graphic Designer Jo Bailey, and to AADR for helping to expand the journal's horizons.

Okay, readers, shake hands, consider yourself introduced, welcome into the *idea journal* house, and let's share a very scrumptious meal.

acknowledgements
I am forever grateful for what life in Aotearoa/ New Zealand brings. With roots stretching across the oceans to North America, Sweden, Wales and Croatia, I make my home between Kāpiti Island and the Tararua Ranges, and in Te Whanganui-A-Tara/ Wellington. I acknowledge the privilege that comes with being educated, employed, female and Pākehā, and the prejudices and injustices that colonialism has and continues to weigh on this land and its indigenous people. I am committed to on-going learning and practicing of Kaupapa Māori.

notes

01 Jondi Keane, 'An Arakawa and Gins Experimental Teaching Space; A Feasibilty Study,' *INFLeXions* 6 (2012), accessed 29 October 2020, http://www.inflexions.org/n6_keane.html.

02 Alan Watts, *Creating Who You Are* (Video) (n.d.), accessed 29 October 2020, https://vimeo.com/76888920.

03 Scott H. Young, 'The Art of Unlearning' (2018), accessed 29 October 2020, https://www.scotthyoung.com/blog/2018/04/12/the-art-of-unlearning/.

04 Young, 'The Art of Unlearning.'

movement, narrative and multiplicity in embodied orientation and collaboration from prehistory to the present

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abstract

The term 'body of knowledge' has a double meaning, implying a unified assemblage of knowledge as well as embodied cognition. But knowledge is not naturally unified, as was apparent in the first *Body of Knowledge Conference*, where the internalist neurosciences presenting themselves as universalist and objective were clearly divided from the externalist performing arts with their more experiential and practice-based character. Assemblage across such divides takes embodied, collaborative, social and technological action. I suggest that bridging of the divides from both sides is now starting to emerge through an augmentation of the dimensions of what Ed Hutchins has called a 'cognitive ecosystem' to include a complex multiplicity of culture, history, and exchange. A socio-historical cognitive ecosystem that emphasises the central importance of narrative, collaboration and movement, multiplicity, and orientation in embodied cognitive practises.

Building on the talk I gave at the 2016 *Body of Knowledge Conference*,[01] this paper aims to explore the roles of movement, narrative, and multiplicity in embodied orientation and collaboration, from prehistory to the present. Disparate narratives of movement, multiplicity, collaboration, and cognition that are emerging in a variety of seemingly unrelated disciplines are woven together in three parts: 1) recent neuro-scientific research on the 'cognitive map' in the brain; 2) recent reticulated accounts of how hominims moved out of Africa; and 3) how differing knowledge traditions and ontologies can be seen to work together in the case of the chart drawn for Captain Cook by Tupaia, the great Polynesian navigator.

cite as:
Turnbull, David. 'Movement, Narrative and Multiplicity in Embodied Orientation and Collaboration from Prehistory to the Present,' *idea journal* 17, no. 02 (2020): 69–86, https://doi.org/10.37113/ij.v17i02.307.

keywords:
embodied cognition, wayfinding, narratives of prehistory, African Multiregionalism, Tupaia's Chart

introduction

The overarching proposition linking these narrative strands is the recognition that cognition and navigation, thinking and moving are intertwined. Thought is 'embedded within and richly structured by space,'[02] but navigation, like cognition is deeply embedded in forms of life, in differing ways of knowing and being in the world and has its origins in our prehistoric past.

The disciplines of neuroscience, prehistory, and anthropology are reaching some common ground in the recognition that knowledge is profoundly embodied and spatial, precisely because it is generated in bodily activity and movement.[03] But as Alexander Mawyer and Richard Feinberg, two Polynesian navigation researchers, point out:

> While space is an integral part of the underlying cognitive and logical foundation upon which all humans depend and on which all human experience rests. At the same time, it is profoundly variable, an integral facet of the specific, localised, particular features of unique subjective and culture-specific inter-subjective human experiences.[04]

Hence, the dimensions that, I argue, help to bridge the apparent divides both within western knowledge traditions and between all knowledge traditions, indigenous and western, including orientation, social collaboration, and most importantly, narrative and complex interactivity, are multiplicitous, culture-specific, and variable.

narratives, multiplicity and complex interactivity in cognitive neuroscience

The reductionist, computational thinking of the neurosciences has led to the apparent dominance of a disembodied understanding of human cognition, courtesy of the advances in fMRI imaging, brain mapping, robotics, artificial intelligence, and deep learning. For example, in 2014, the Nobel prize for physiology or medicine was awarded for the discovery of 'place' and 'grid' cells in the brain, excitedly described as the 'GPS system' of the brain, or, as O'Keefe, one of the medallists, following Tolman's original speculation, called it, a 'cognitive map.'[05] Another example was the announcement, in January 2019, accompanied with the now normal fanfare for such pronouncements, that 'deep learning' has revealed a hitherto unknown human species.[06] (An indication of the new normal is that archaeological discoveries regularly get a large column in the UK *Daily Mail*.)[07]

There are deeply problematic epistemological issues embedded in the claim that artificial intelligence (AI) in the form of 'deep learning' modelled on human neural networks can generate knowledge of human speciation and cognition, utilising algorithms to discern hidden patterns in the supposedly pure data. Paradoxically, processes like this are so abstracted that humans do not properly understand them.[08]

However, it is not all algorithmic gloom; it is possible to discern a change in direction across the physical and biological sciences as well as the social sciences. A trajectory that, following Hutchins, could be called ecological,

but in general is an ontological change — non-linear, interactive, enactive and embodied. A turn that is non-deterministic, embraces sociality, culture, and complex multiplicity. Talk of turns has become all too clichéd, but there is a discernible shift to a 'reticulated', 'relational' perspective.[09]

Such a shift is apparent in cognitive neuroscience, and in archaeology and the human origins 'Out of Africa' story. In the case of cognitive neuroscience, the shift has emerged in research on the brain area known as the hippocampus and the closely associated entorhinal cells. Previously, the research tradition I have mentioned above shows the hippocampus to be the site where the 'cognitive map' is located, 'a system dedicated to calculating routes through space.'[10] But another tradition finds it to be the site of episodic, working or declarative memory, 'our capacity to recall facts and events.'[11] These seemingly separate functions, it is now suggested, are linked first of all through the recognition that navigation has to be understood as an integration of the two frames of reference—allocentric, meaning survey knowledge based on a fixed spatial reference frame, GPS style, and egocentric, based on the way finder's knowledge of landmarks and paths.[12] The NYU cognitive neuroscientist Andre Fenton's work suggests that the internally organised GPS style sense of direction has to be registered against landmarks in the environment, very much in the manner of Polynesian navigation.[13] This egocentric, landmark- and path-following mode of navigation does, however, require that memory of events, people, practises, and places be ordered in space and time. Working memory is obviously necessary for this, but it also requires story telling for communication and sense making between and within social groups.[14] The Doeller Lab group working on Navigating Cognition finds that:

> Our brains, and more specifically the hippocampus, represents memories as networks of inter-related events with prominent spatial and non-spatial event elements, such as spatial locations and people, as nodes of these memory networks. We think these memory networks are the neural basis of navigation through space, but also through the landscape of our memories.[15]

M.R. O'Connor, in her recent brilliant book on human navigation, suggests that Shaw-Williams's 'social trackways reading hypothesis' is a way to understand human navigation.

> …once tracks became a much-used strategy for navigation, foraging, finding water, remembering routes, and hunting for animals, it led to humans creating rich mental maps of territories and routes based on narrative memory of previous experience and the experiences of others. Our memory capacities grew, and we amassed more natural history information— the changing seasons, migration patterns of animals, breeding cycles, habitats… Out of this process emerged a creature that could begin to organise its experiences

in space and time, to navigate farther, to build complex maps and sequences in the brain and, eventually, once they harnessed symbolic communication and language, to communicate these geographic and biographical narratives to themselves.[16]

Kim Shaw-Williams concludes:

> The human mind just is a uniquely self-projecting, wayfinding mind—and socially we view our whole lives, our communities, our everyday routines, and our conversations as overtly explorative and cooperative *what if* narrative journeys through space and time.[17]

This describes a different kind of space from the disembodied, abstract space of western science, a space that, like Maria Russo, professor of moral philosophy at Rome University, I would call a 'hodological space', a lived, embodied, space of action.[18] But it is a space that has not only to be recognised as profoundly cultural, and hence, multiplicitous, diverse and variable, but it is also social; cognition, as Shaun Gallagher, Ed Hutchins and others have forcefully pointed out, is not located in a single mind, it is distributed.[19]

One of the great limitations of much neuro-scientific research on cognition and navigation is that it has, until recently, been done on single brains in isolation. Now, Thea Wheatley and her group at Dartmouth College have been able to observe multiple brains in interaction by linking fMRIs through 'hyperscanning.' For Wheatley, 'social brains interact like a dance, where partners take their own steps but move in concert, continuously adjusting and adapting.'[20]

Uri Hasson, a neuropsychologist at Princeton, has similarly found through, linked fMRIs, that 'Brains don't work in isolation they are built to communicate to tell and hear stories and join with other brains linked through synchronisation.'[21] Sociality through story telling has now been made visible.

Jonathon Delafield-Butt, developmental neurobiologist and developmental psychologist at the University of Edinburgh, finds that the intimate entwinement of narrative and movement is so basic, its development can be discerned in the foetus in the womb. His research group 'identify the origins of narrative in the innate sensorimotor intelligence of a hypermobile human body and trace the ontogenesis of narrative form from its earliest expression in movement.'[22]

Narrative consciousness, with its cognitive content, rather than being conceived as a product of conceptual verbal thinking, can be defined as the organising life principle of human cognition, animated by a primary emotional consciousness in social events of meaning-making. It is by making and telling affected stories that we represent the importance to ourselves of other persons' presence and actions, the properties of objects, how persons and objects relate to each other, and to one's own well-being in awareness of activity. The assumptions, understandings, and knowledge of science, law, politics, history, and religion all depend on the developmental construction, co-

construction, and re-telling of narratives, with or without words.[23]

Once we approach the question of human navigation within an expanded framework of embodied cognition that includes the social and the cultural, navigation becomes a question of orientation—of knowing who we are, as much as where we are. The two are 'fundamental aspects of our physical and mental experience.'[24]

a revised out of africa story

Knowing who we are and where we are is also intimately bound up with the stories we tell ourselves about our prehistoric development, the origins of human cognition, and how humans got to occupy all the econiches on the planet.

In a 2017 conference paper, I argued that 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 60-70 thousand years ago 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 hominim species, including Neanderthals and *Homo erectus*.[25]

But, this linear, dendritic, Out of Africa replacement model now looks set to be replaced itself in favour of a much more interactive, rhizomatic, model along the lines of multi-regionalism. We now know that *Homo sapiens* interbred with other varieties of Homo including Neanderthals and Denisovans. Furthermore, *Homo sapiens* is not exceptionally sapiens; Neanderthals were fully culturally modern well before *Homo sapiens.*

Neanderthals had language and culture; they sang, they made music and danced, they feasted and celebrated, they probably told stories.[26] With slightly larger brains than ours, they buried their dead, cared for the old and sick, they created external symbolisation and art. They made string for bead and bone necklaces, and needles to sew their clothes. They ground ochre to paint their bodies and to make images. They made carefully crafted and hafted stone tools that may even have been adopted by *Homo sapiens*.[27]

Equally surprisingly, Neanderthals are also thought to have built the earliest known hominim structures. Nearly two hundred thousand years ago, 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.[28] These two structures also show signs of blackening of some of the stalagmites, along with a piece of burnt bone suggesting heating in small hearths.[29] There was no 'cognitive revolution'[30] or 'Neolithic revolution';[31] hominim cognitive capacities have been in continuous development over several million years, and much of the cultural dimension of that development was not created by *Homo sapiens*, but other hominims, especially Erectus and Neanderthals.

In that presentation, I went on to argue that it is the slowly emerging recognition of the role of seafaring in hominim occupation of the

world that offers the most profound challenge to the prevailing prehistoric narrative and the origins of cognition. I will come back to this in the next section.

Since then, two radical new models of human origins have been published, that pick up on the reticulated, multiregional model I wrote of three years ago. Notice the term model, used to describe a theory or hypothesis that is based on seemingly plausible assumptions; in other words, a narrative that orders events in space and time. Sometimes, the assumptions are explicit and testable; sometimes, they are taken for granted sometimes, they are simply not acknowledged. One way to make the assumptions apparent is to contrast the new multiregional models with a new single region model that has attracted international attention and a lot of airtime in Australia in 2019—Lewis Dartnell's *Origins: How The Earth Made Us*. Dartnell tells a bold and persuasive, geologically determinist story, very much in the manner of *Guns Germs and Steel*, Jared Diamond's explanation of European supremacy.

In Dartnell's model, the development of human cognition, complex social interaction, language, and tool use, evolved in response to the uniquely fluctuating environment of the East African rift valley, where, he claims, the ephemeral lakes acted as 'cultural amplifiers.' The drivers of human cognitive development in his adaptationist account are genes and the geo-physical environment.

The emergence of our large brains millions of years ago [are an example of the way the earth has shaped us]. These supercharged organs require a lot of resources and energy, and so would have needed a very good reason to emerge. Their development would have been driven by necessity, probably as a response to complex and rapidly changing surroundings that required high intelligence and adaptability to survive.[32]

Dartnell's model of the Out of Africa story is a linear dendritic one following pretty much the standard story:

The first of our ancestors' big migrations began nearly two million years ago, when *Homo erectus* spread across Asia, reaching as far as China and Indonesia. There they gave rise to at least two other hominim species — the Neanderthals in Europe and the Denisovans in central Asia. Anatomically modern humans left Africa around 65,000 years ago, spreading up into Europe and along the southern margin of Eurasia to today's India and South-East Asia.[33]

This standard account became known as the replacement model, because, while acknowledging *Homo sapiens* interbred with Neanderthals and Denisovans and any other hominim species they encountered, *Homo sapiens* replaced them all; whether through cognitive superiority, absorption, higher fertility, or ethnocide, remains unclear.

At the same time as Dartnell was writing *Origins,* twenty-two of the leading proponents of the standard Out of Africa account, including, most significantly, archaeologists, geneticists and climatologists, issued what

amounts to a joint manifesto, arguing that their standard account had been built on false assumptions, simplistic models, and had failed to accommodate accumulating contradictory archaeological evidence.[34] Their key proposal is an alternative narrative, one that, tellingly, they label 'African multiregionalism.' Multiregionalism was the much-derided model proposed by Alan Thorne and Milford Wolpoff, who argued that all the variants of Homo were not distinct species, but just one—*Homo sapiens*, which was geographically but not genetically separated. On occasions the varieties interbred, the consequent gene flow leading to the variations of human populations we have today. Thorne and Wolpoff saw this scenario as playing out in the world beyond Africa.[35] Eleanor Scerri and her fellow African multi-regionalists see it playing out in Africa before humans started voyaging to the wider world. This is an especially interesting change of a core assumption by Chris Stringer, one of the co-authors, who has been the chief proponent of the replacement theory, and a most strident critic of multiregionalism.[36]

The point about multiregionalism is that it differs fundamentally in its spatiotemporal assumptions from the standard model; it is non-linear and interactive. That means the dynamics of the development of human cognition can be completely different from that in which genetic neurological changes are assumed to precede cultural changes. In effect, it allows for emergent effects and a co-productive understanding of genes, culture, and environment.[37]

This switch to an interactive model is most apparent in the adoption of 'mosaicism.' Technically, mosaicism is the seemingly dull name for 'the concept that evolutionary change takes place in some body parts or systems without simultaneous changes in other parts.'[38] As articulated by the African Multiregionalists, its ontological and epistemological implications are much more profound.

Specifically, the model Scerri and co. are arguing for is a bio-ecological-cultural one, which recognises that about two million years ago, the African climate switched from having been predominantly hot, wet, and tropical for millions of years, to one of continuous violent changes from hot and wet to extreme droughts and back again. These climatic reversals led to partly isolated pockets of varieties of hominims adapting differently in differing times and differing places. Early varieties of humans have now been found all over Africa, not just in the Rift Valley, but also in Morocco, at Jebel Irhoud, and in South Africa. In effect, mosaicism is a form of distributed evolution; instead of a single group and a single place of origin, human socio-cultural cognitive capacities developed as an ad hoc assemblage from multiple sites.

However, these populations of hominims were not permanently isolated. On occasion, they met and interacted, sharing and exchanging genes and practises, resulting in the multifaceted varieties of *Homo sapiens* who first left Africa as early as two million years ago. But, most significantly, African multiregionalists do not restrict the

dimensions of their model of change to climate and genetic factors; most explicitly, they include social and material culture in the mosaic. In particular, they include the social dimension of connectivity; that is, how people and practises move and interact.

Two of the authors, archaeologists Alison Brooks and Francesco d'Errico, have been working in the Olorgesailie Basin in Southern Kenya, and their discoveries radically change previous assumptions about the supposed cognitive capacities of *Homo sapiens*.[39] They have found evidence that around 320 thousand years ago, that is, 100 thousand years earlier than *Homo sapiens* had previously been thought to have emerged, major social and material cultural changes occurred across Africa. These hominims:

> abandoned simple hand axes in favour of smaller and more advanced blades made from obsidian and other materials obtained from distant sources. That shift suggests the early people living there had developed a trade network—evidence of growing sophistication in behaviour. The researchers also found gouges and striations on black and red rocks and minerals, which indicate that early Olorgesailie residents used those materials to create pigments and possibly communicate ideas.[40]

What makes this mosaic narrative fundamentally different from the linear chronology of the standard Out of Africa story is spatial and temporal multiplicity along with the inclusion of very early capacities for movement and assemblage of people and ideas. In turn, this opens up the possibility of seeing the interacting dimensions as co-productions with emergent effects. Even more powerfully, D'Errico goes on to argue that it is not genes but culture that is the driver of human cognitive development.[41]

What now has to be added to African mosaicist multiregionalism and the driver of culture in understanding 'who and where we are' is the complexity of recent and still contentious findings of ancient humans and stone tools in China and India. Back in 2010, fully modern human teeth were found in Zhirendong, South China, dated at 120 thousand years ago; that is, around 70 thousand years before modern humans appeared in Europe and the Near East. This discovery reignited the possibility of an 'Out of Asia' migration story.[42]

But the China story has become way more complicated. Just this year, remains of 2.1 million-year-old hominims were found in North West China, which alone adds 400,000 years to prehistory in China.[43] Moreover, two caches of stone tools have been found; the first at Shangchen in central China, dated at between and 1.2 and 2.1 million years ago.[44] The second of the more sophisticated Lavallois type, dated at around 178-180 thousand years ago, were found in the Guanyindong Cave in southwest China.[45]

Chris Stringer concedes, 'Asia has been a forgotten continent. Its role in human evolution may have been largely under-appreciated.'[46] What is now up for debate is,

how to explain the presence of really ancient hominims and tools in China. Did all varieties of human originate in Africa? Did they take their tool making practises with them, or were they produced locally? Or did *Homo erectus* originate in China and travel to Africa? 'Some say Asia should have equal billing as the birthplace of our species.'[47] Clearly, there has been interaction of some kind, from a very much earlier date than previously assumed, and quite plausibly, it could have been the culturally driven, mosaic, kind, now suggested in the African multiregionalist model.

A possible example of such Asian-African social relational heterogeneity is the 260,000-year-old 'Dali Skull' found in Dali County, Shaanxi Province in Central China. The skull has a complex mosaic mix of ancient and modern human traits.[48] Sheela Athreya at Texas A&M University and Xinzhi Wu at Beijing have found morphological similarities between the Dali skull and the one found in in Morocco at Jebel Irhoud, which so strongly undermined the single origin hypothesis in the Out of Africa model.[49] This suggests that at least some of the DNA in living humans might have come from Asian H*omo erectus*. John Hawks at the University of Wisconsin-Madison suggests 'In a real sense we are talking about a multiregional population, connected recurrently by migration and genetic exchanges.'[50]

While the interpretation of the Dali skull remains contentious, it clearly shows that there is an awful lot to learn about human origins, and that the narrative has been strongly Afro and Eurocentric. But if Athreya and Wu's analysis is confirmed by further research, it speaks very powerfully to the idea that human cognition is thoroughly and deeply embodied. It is embodied in the most ancient of human capacities for movement and social connection and communication.

Finally, I can't resist mentioning the most entertaining example of early embodied cognition emerging from the development of modern human skull shape. It has been suggested that the reduction of the brow ridge, the heightening of the forehead and reduction of face size has led to greater prominence and mobility of the eyebrows. 'Over time, the face became more gracile, potentially gaining an ability to generate more diverse facial expressions that likely enhanced non-verbal communication.'[51] Eyebrow wiggling, the driver of human social relations, who knew? (Could this have been a co-productive interaction with dogs, since they have developed muscles for moving their eyebrows, something that endears them to us and differentiates them from wolves?)

reading tupaia's chart

The argument, to this point, has been that embodied cognition is intertwined with the human capacity to move, navigate and orient in space, but is also a thoroughly social capacity dependent not simply on brain function, but also on the social and bodily interactions of people. It is all too easy to assume, following the cognitive map approach, that it is a human universal, or one very close to a western cartographic understanding of how to know where and who you are. (In part this quasi-natural

assumption has been a consequence of the institutionalised authority of the map).[52] But, precisely because cognition is both embodied and social, it is also cultural. And precisely because it's cultural, it's variable. Being aware of the diversity of ways of being and knowing is vital in an age in which we are heading into a doomed monoculture.

A salient reminder of the significance of navigational and orientational diversity is apparent in a new reading of one of the most important ethnographic documents recording a collaborative cartographic encounter between different navigational traditions—Tupaia's chart.

Tupaia was the leading Pacific navigator of the 18th century, working in an indigenous tradition that enabled the greatest feat of colonisation in the history of mankind—the discovery and occupation of the islands of the Pacific.

This month is the 250th anniversary of Captain James Cook's famous voyage to Tahiti in 1769 on HMB *Endeavour* to measure the transit of Venus, where he met Tupaia and took him on board for the rest of the Pacific voyage. Until recently, this has often been framed as a fortuitous encounter between a universalised scientific western knowledge tradition and an indigenous local tradition, divided by the much-debated distinction in practises of orientation between mapping

Figure 01:
Tupaia's Chart of the Pacific drawn on board HMB *Endeavour,* 1769.

and wayfinding.[53] That narrative now stands in need of correction. It was indeed a fortuitous encounter, one that may be unique, certainly rare, and as luck would have it, extremely productive. The world's two greatest navigators at the peak of their powers met and spent enough time closely engaged in navigational practice to appreciate each other's capacities, but clearly their capacities and fundamentally different traditions were in flux and development.

In the case of Cook, this was especially true, because the British Admiralty sent him to Tahiti to try and solve the last two missing pieces of the great western navigational puzzle— how to measure the distance of the earth from the sun, and how to accurately calculate longitude. Both these problems were believed to be solvable by observing the transit of Venus across the face of the sun during a solar eclipse. The Astronomer Royal determined an ideal spot for such observations was Tahiti. Fortuitously, Tahiti had just been geo-located on Western maps courtesy of its 'discovery' two years earlier by Captain Wallis on HMS *Dolphin.* Cook was selected for the task of setting up an observatory on Tahiti because he was the leading western navigator and cartographer of the day. By complete and very unlikely chance, he met Tupaia, the leading Polynesian navigator of the day.

Though Cook became a supreme mapmaker, he was not initially trained in a map-based tradition. As a teenager he joined the merchant navy and learned his sailing and navigational skills working on colliers (the same kind of lumbering coal carrier as the *Endeavour*) in the North Sea, where local knowledge of tides, winds, landmarks, fogs, and shifting sandbanks were the key to survival in a complex and ever changing environment. At age 27, when the Seven Years War against the French began, he joined the Royal Navy, which led to him mapping the approaches to the St Lawrence River, enabling the defeat of the French and the capture of Quebec. He went on to map Newfoundland, where, in another chance encounter; he met Samuel Holland, a Dutch engineer, from whom he learnt the art of coastal surveying using a plane table. Cook's skills as a marine cartographer and surveyor, drawing maps of Newfoundland and New Zealand that have stayed in use until close to the present day, made him not only the leading cartographer of the 18th century, but also a claimant to being a 'father of modernity.' A father in the sense that his voyages and maps completed the great panoptic dream of knowing the whole world. An achievement that helped maps and mapping become the epitome of abstract objective scientific knowledge, but notably one that was profoundly based in local, practical experience, and wayfinding as well as abstract calculation. The western navigational tradition was not completed until Cook's second voyage, where the accurate timekeeping of Harrison's watch solved the problem of longitude.

Tupaia, by contrast, was raised in a completely different tradition. He was trained as a master navigator entirely without charts or instruments, and had vast practical experience, having sailed to or had knowledge

of 74 Pacific islands. He was also a priest and member of a special society of travelling performers—the *arioi*. As a *tahu'a* he was a 'master of knowledge' charged with the preservation of Tahitian narrative and voyaging traditions. But as performers, the *arioi* were also renowned for their satire and trickery.[54] This background meant Tupaia was uniquely suited to the role of 'cultural go-between and mediator between knowledges.'[55]

The really astonishing and unlikely dimension of the encounter between these two master navigators from differing cultural traditions is that they spent sufficient time together on a ship to work together and observe each other's maritime and navigational practises. As Harriet Parsons[56] and Lars Eckstein and Anja Schwarz amply illustrate, the ultimate location of the encounter is the close intimacy of the worktable in the great cabin on the *Endeavour*.

At any one time there could have been as many as eleven people of all classes and rankings at the table working on their special tasks, drying, dissecting, drawing specimens, charting and illustrating. The Royal Navy men involved in the collaborative drawing of the chart included the captain, master, mate, and a seaman, all personnel of differing ranks with a wide range of capacities in navigation, calculation, map making, drawing and ship handling. The civilians from the Royal Society included two naturalists, three artists and an astronomer. Together with Tupaia, they worked in a heterotopic knowledge space, drawing a chart of the Pacific that combined differing spatialities and temporalities, and differing ways of treating movement. For Foucault 'The ship is the heterotopia par excellence,' 'the greatest reserve of the imagination,' a place without a place, where spatialities are mixed and new spatialities are created.[57]

It was on the great cabin table that, at Cook's request, Tupaia drew the chart showing all the islands he knew in the Pacific. There has, however, always been a problem about reading it. It appears to show many islands in the wrong place, and some are shown twice. Varieties of explanation of these apparent disparities and inconsistencies have been offered over time, including the suggestion that drawing such maps was beyond the capacity of an indigenous person from an oral culture. As argued, for example, in the case of the map of New Zealand map drawn by Tuki for Governor Philip King. 'A non-literate man was fundamentally incapable of projecting his geographical knowledge on a flat piece of paper.'[58] Despite evidence from around the world that indigenous people were readily able to draw maps of their territory,[59] that easy denial of indigenous cartographic capacity spoke directly to Andrew Sparke's argument that Polynesian voyagers could not have 'discovered' any Pacific islands, they could only have accidentally drifted to them.[60] The ethnographic evidence of indigenous cartographic capacity now overwhelms such assertions.[61] The replica voyages of the Hawaiian canoe *Hōkūle'a* confirm that non-instrumental voyaging is entirely feasible.[62]

So how is Tupaia's chart to be read? There are currently two closely related readings. Two French oceanists, Anne di Piazza and

Eric Pearthree, argue that Tupaia's Chart, while having the appearance of a map, is in fact a 'mosaic of sailing directions or plotting diagrams drawn on paper.' They conclude that their unravelling of the Chart:

> highlights the difficulties of understanding or sharing knowledge on both sides. Cook, in his own words, believed Tupaia was drawing a map. Tupaia seems indeed to have tried to include distance in his plotting diagrams, thereby going beyond the traditional system of representation. Cook clearly remained fixed in his Cartesian world, adding cardinal points to Tupaia's Chart. But both could look at the manuscript and see their own system represented: Cook reading islands on a grid and Tupaia reading islands radiating out from different centers.[63]

In other words, Cook and Tupaia worked with differing epistemological and ontological assumptions about space and time, and how they can be represented; assumptions that were incommensurable and mutually unrecognised. They both thought they were drawing a map but did not realise they had no common agreement about what maps are or how they record and enable movement. Though they each had an effective system of navigation, they were operating within completely different socio-technical-religious networks. For Cook and his fellow enlightenment European navigators and explorers, the system was one of calculation and long-distance control central to the establishment of empire. For Tupaia and his fellow Polynesian navigators, the system was one of exploration and settlement by kin-based replication.[64]

A more complex reading is offered by Lars Eckstein and Anja Schwarz. They agree with di Piazza and Pearthree that the chart was the product of the melding of two incommensurable navigating traditions. They argue that Cook and fellow crew members set up the basic framework of the chart and, having asked Tupaia for a list of the islands he knew, invited him to position them on the chart. On their account, Tupaia transposed his narrative-based path, following knowledge of sailing directions and practises, into a cartographic form that melded with Cook's geo-locational, allocentric form of cartography. In Tupaia's egocentric system, he sees the canoe as stationary and the world of sea and islands as moving towards him. To translate and meld his knowledge with Cook's ontology, Tupaia imagines his moving world of islands is rotating around a polar axis marked by the position of the sun at midday, something he observes Cook and his crew measure with great precision every noon in order to calculate their position. Tupaia put North at the centre of his chart, where Cook's cardinal axes cross marking the position of his polar axis with the imaginary island *Avatea.*

While I favour the Eckstein and Schwarz reading because it reconciles many of the anomalies on the chart, the important point is that both readings support the idea that Tupaia had a cognitive map in mind that enabled him to translate between the two

differing and incommensurable traditions, while he also worked within a deep socio-cultural tradition that enabled knowledge to be shared and continuously renewed.

By way of conclusion, I want to look at the implications for embodied cognition and the possible solutions for bridging the divides by looking at the Australian art historian Harriet Parsons' suggestions about the role of collaborative drawing in enabling the differing traditions to work together.[65] Parson's approach has been to see the drawing practises of Cook, Banks and the naturalists and the artists on board the *Endeavour* as the beginning of an empirical objectivist tradition using drawing as creative problem solving. Tupaia was encouraged to draw, sketch and paint by the two artists Richard Pickersgill and Sydney Parkinson, and a portfolio of drawings in the Bank's archive have now been attributed to him.[66] Parsons' detailed analysis of The Society Islands Chart published as being drawn by Cook shows that:

> This chart does for Cook what he was doing in his book for the captains of Newfoundland: it tells the way through unknown waters. It describes the complex discussion that Cook and Tupaia were able to carry out with limited vocabulary because they shared the common language of pilots. Much emphasis is placed upon Cook's skill in mathematical calculations, but in this chart, we see him using a narrative tradition in which British and Polynesian concepts of space, distance and orientation converge.[67]

For Parsons, 'the Society Islands chart makes the first successful attempt to transform a list transcribed from a chanted recitation into a recognisable, European-style chart.'[68]

But of course, Tupaia's chart was unrecognisable as an accurate European style chart until, courtesy of Eckstein and Schwartz, we were able to read it as a divide-breaking, heterotopic hybrid, only really possible in practice through the performative and embodied act of collaborative drawing, gesturing and narrating, creating an hodological space. A space in which connections and narrative journeys across divides can be made, practically and cognitively.[69]

Establishing such knowledge spaces where knowledge traditions could work together would not only allow indigenous knowledges an active voice but would also allow for a creative tension between the sciences and the arts.

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notes

01 David Turnbull, 'To Talk of Many Things, of Stories, Ships and String, of Connections, Collaborations, Knowledges and Kin: Prehistoric Seafaring and Embodied Cognition,' in *A Body of Knowledge - Embodied Cognition and the Arts Conference*, University of California, Irvine, 2016, 1-27, accessed 30 June 2020, https://escholarship.org/uc/item/8680g0t.

02 Jodie M. Plumert and John P. Spencer, *The Emerging Spatial Mind*: Oxford Scholarship Online 2007, accessed 30 June 2020, https://www.oxfordscholarship.com/view/10.1093/acprof:oso/9780195189223.001.0001/acprof-9780195189223.

03 Shaun Gallagher, 'How Moving is Sometimes Thinking,' *Body of Knowledge 2: Art and Embodied Cognition Conference*, Deakin University, Australia, 2019, accessed 1 July 2020, https://blogs.deakin.edu.au/bok2019/keynotes/.

04 Alexander Mawyer and Richard Feinberg, 'Senses of Space: Multiplying Models of Spatial Cognition in Oceania,' *Ethos* 42, no. 3 (2014): 243-52, https://doi.org/10.1111/etho.12058.

05 May-Britt Moser and Edvard Moser, 'Where Am I? Where Am I Going?' *Scientific American* 314, no. 1 (2015): 26-33. doi: 10.1038/scientificamerican0116-26; Brad E. Pfeiffer and David J. Foster, 'Discovering the Brain's Cognitive Map,' *JAMA Neurol* 72, no. 3 (2015): 257-258. https:/doi.org/10.1001/jamaneurol.2014.4141.

06 Center for Genomic Regulation, 'Artificial Intelligence Applied to the Genome Identifies an Unknown Human Ancestor,' ScienceDaily. 16 January 2019, accessed 30 June 2020, www.sciencedaily.com/releases/2019/01/190116122650.htm; Mondal Mayukh, Jaume Bertranpetit and Oscar Lao, 'Approximate Bayesian Computation with Deep Learning Supports a Third Archaic Introgression in Asia and Oceania,' *Nature Communications* 10, no. 1 (2019). https://doi.org/10.1038/s41467-018-08089-7.

07 Cheyenne MacDonald, 'Has AI Found a New Human Ancestor? Footprint of Extinct Hominid Spotted by an Algorithm Suggests Neanderthals Commonly Bred with Other Species,' *Daily Mail*, Jan 17 2019, accessed 30 June 2020, https://www.dailymail.co.uk/sciencetech/article-6600209/Has-AI-new-human-ancestor-Evidence-extinct-hominid-spotted-algorithm.html.

08 James Bridle, *New Dark Age: Technology and the End of the Future* (London: Verso, 2018), *passim*.

09 Donna Haraway, 'Symbiogenesis, Sympoesis, and Art Science Activisms for Staying with the Trouble,' in *Arts of Living on an Damaged Planet*, eds. Anna Tsing, Heather Swanson, Elaine Gan and Nils Bubandt (Minneapolis: University of Minnesota Press, 2017), M25-50.

10 Howard Eichenbaum and Neal J. Cohen, 'Can We Reconcile the Declarative Memory and Spatial Navigation Views on Hippocampal Function?' *Neuron* 83 (2014): 764, https://doi.org/10.1016/j.neuron.2014.07.032.

11 Eichenbaum and Cohen, 'Can We Reconcile the Declarative Memory and Spatial Navigation Views on Hippocampal Function?' 764.

12 Wen, Wen, Toru Ishikawa and Takao Sato, 'Individual Differences in the Encoding Processes of Egocentric and Allocentric Survey Knowledge,' *Cognitive Science* 37, no. 1 (2013): 176, https://doi.org/10.1111/cogs.12005.

13 Eun Hye Park, Stephen Keeley, Cristina Savin, Jr. James B. Ranck and André A. Fenton, 'How the Internally Organized Direction Sense Is Used to Navigate,' *Neuron* 101 (2019): 1-9, https://doi.org/10.1016/j.neuron.2018.11.019.

14 Elizabeth Marozzi, and Kathryn J. Jeffery, 'Place, Space and Memory Cells,' *Current Biology* 22 (2012): R939-R942; Lucas M. Bietti, Ottilie Tilston and Adrian Bangerter, 'Storytelling as Adaptive Collective Sensemaking,' *Topics in Cognitive Science* (2019): 710-32, https://doi-org.ezp.lib.unimelb.edu.au/10.1111/tops.12358.

15 Doeller Lab, 'Hippocampus as the storyteller: New study reveals how the brain makes sense of movies,' Dec 4 (2016), accessed 30.6.20 https://doellerlab.com/storyteller/.

16 M. R. O'Connor, *Wayfinding: The Science and Mystery of How Humans Navigate the World*. (Melbourne: Affirm Press, 2019), 107, citing Kim Shaw-Williams, 'The Social Trackways Theory of the Evolution of Human Cognition,' *Biological Theory* 9 (2014): 16-26.

17 Kim Shaw-Williams, 'The Social Trackways Theory of the Evolution of Language,' *Biological Theory* 12, no. 4 (2017): 209, https://doi.org/10.1007/s13752-017-0278-2.

18 Maria Teresa Russo, 'The Human Hand as a Microcosm. A Philosophical Overview on the Hand and Its Role in the Processes of Perception, Action, and Cognition,' in *The Hand. Perception, Cognition, and Action*, eds. M. Bertolaso and N. Di Stefano, (Dordrecht, Springer, 2017), 99-113; Turnbull, David. 'Maps, Narratives and Trails: Performativity, Hodology, Distributed Knowledge in Complex Adaptive Systems– An Approach to Emergent Mapping,' *Geographical Research* 45, no. 2 (2007): 140-149, https://doi.org/10.1111/j.1745-5871.2007.00447.x.

19 Hutchins, Edwin, *Cognition in the Wild*, (Cambridge, MIT Press, 1996); Shaun Gallagher, 'The Socially Extended Mind,' *Cognitive Systems Research* 25-6 (2013): 4-12, https://doi.org/10.1016/j.cogsys.2013.03.008; Robin Dunbar, Clive Gamble, and John Gowlett, 'The Social Brain and the Distributed Mind,' in *Social Brain and the Distributed Mind*, eds. Robin Dunbar, Clive Gamble and John Gowlett (Oxford: Oxford University Press, 2010); Robert Boyd, Peter J. Richerson and Joseph Henrich, 'The Cultural Niche: Why Social Learning is Essential for Human Adaptation,' *PNAS* 108, no. 2 (2011): 10918–10925, https://doi.org/10.1073/pnas.1100290108.

20 Cognitive Neuroscience Society, 'Mind Melding: Understanding the Connected, Social Brain,' ScienceDaily, 26 March 2019, accessed 30 June 2020, www.sciencedaily.com/releases/2019/03/190326132708.htm; Laura Sanders, 'Our Brains Sculpt Each Other. So Why Do We Study Them in Isolation?' *Science News* (2019), accessed 30 June 2020, https://www.sciencenews.org/article/brains-sculpt-each-other-social-interactions.

21 Uri Hasson, 'This is Your Brain on Communication,' TED talk, accessed 30 June 2020, https://www.ted.com/talks/uri_hasson_this_is_your_brain_on_communication.

22 Jonathan Delafield-Butt and Colwyn Trevarthen, 'The Ontogenesis of Narrative: From Moving to Meaning,' *Frontiers in Psychology* 6 (2015), https://doi.org/10.3389/fpsyg.2015.01157.

23 Delafield-Butt and Trevarthenm, (2015); see also Jonathan Delafield-Butt and Jillian Adie, 'The Embodied Narrative Nature of Learning: Nurture in School,' *Mind, Brain, and Education* 10, no. 2 (2016) :117-31.

24 Michael J. Proulx, Orlin S. Todorov, Amanda Taylor Aiken and Alexandra A. de Sousa 'Where am I? Who am I? The Relation Between Spatial Cognition, Social Cognition and Individual Differences in the Built Environment,' *Frontiers in Psychology* 7 (2016), https://doi.org/10.3389/fpsyg.2016.00064; David Turnbull, 'How Did People Move in Completely New and Unfamiliar Environments?– A Performative and Hodological Approach to Orientation, Spatiality and Temporality,' unpublished paper at Local Intermediaries in International Exploration Conference, Canberra, July 2013.

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

26 Dimitra Papagianni, *The Neanderthals Rediscovered: How Modern Science Is Rewriting Their Story* (London: Thames and Hudson, 2015); J. Zilhão, Angelucci DE, Badal-García E, et al., 'Symbolic Use of Marine Shells and Mineral Pigments by Iberian Neandertals,' *PNAS* 107 (2010), https://doi.org/10.1073/pnas.0914088107: 1023-1028; E. Callaway, 'Neanderthals Made Some of Europe's Oldest Art,' *Nature* (2014), accessed 20 October 2020, https://www.nature.com/news/neanderthals-made-some-of-europe-s-oldest-art-1.15805.

27 Anon, "New Evidence Debunks 'Stupid' Neanderthal Myth," ScienceDaily (Aug 26, 2018), accessed 20 October 2020. http://www.exeter.ac.uk/news/archive/2008/august/title_1106_en.html.

28 Ewen Callaway, 'Neanderthals Built Cave Structures— And No One Knows Why,' *Nature* (2016), https://doi.org/10.1038/nature.2016.19975.

29 Marie Soressi, 'Neanderthals Built Underground,' *Nature News and Views* 534 (2016): 43-4, https://doi.org/10.1038/nature18440.

30 As claimed for example by Yuval Noah Harari, *Sapiens: A Brief History of Humankind* (London: Harvill Secker, 2014); See also Clive Finlayson, *The Smart Neanderthal: Cave Art, Bird Catching, and the Cognitive Revolution* (Oxford: Oxford University Press, 2019).

31 Sally McBrearty and Alison Brooks, 'The Revolution That Wasn't: A New Interpretation of the Origin of Modern Human Behaviour,' *Journal of Human Evolution* 39 (2000): 453-63, https://doi.org/10.1006/jhev.2000.0435.

32 Lewis Dartnell, 'How Earth Shaped Us,' *New Scientist* 242 (3226) (2019): 35, accessed 20 October 2020, https://live.newscientist.com/2019-speaker-programme/origins-how-the-earth-made-us#/.

33 Dartnell, 'How Earth Shaped Us,' 36.

34 Eleanor M. L. Scerri, Mark G. Thomas, Andrea Manica, et al., 'Did Our Species Evolve in Subdivided Populations across Africa, and Why Does It Matter?' *Trends in Ecology and Evolution* 33, no. 8 (2018): 582-94, https://www.cell.com/trends/ecology-evolution/fulltext/S0169-5347(18)30117-4; Ed Yong, 'The New Story of Humanity's Origins in Africa,' *The Atlantic*, July 11 (2018), accessed 20 October 2020, https://www.theatlantic.com/science/archive/2018/07/the-new-story-of-humanitys-origins/564779/.

35 Alan Thorne and Milford Wolpoff, 'The Multiregional Evolution of Humans,' *Scientific American* April (1992): 76-83; Alan Thorne and M.H. Wolpoff, 'Regional Continuity in Australasian Pleistocene Hominids,' *American Journal of Physical Anthropology* 55 (1981): 337-49, https://doi.org/10.1002/ajpa.1330550308; M.H. Wolpoff, Wu X. Z., and Thorne A.G., 'Modern Homo Sapiens Origins: A General Theory of Human Evolution Involving the Fossil Evidence from East Asia,' in *The Origins of Modern Humans: A World Survey of the Fossil Evidence*, eds. F. H. Smith and F. Spencer (New York: Alan R. Liss, 1984), 411-83.

36 Chris Stringer, 'Why We Are Not All Multiregionalists Now' *Trends in Ecology and Evolution* 29, no. 5 (2014): 248-51, https://doi.org/10.1016/j.tree.2014.03.001.

37 Ivan Colagè and Francesco d'Errico, 'Culture: The Driving Force of Human Cognition,' *Topics in Cognitive Science* (2018): https://doi-org.ezp.lib.unimelb.edu.au/10.1111/tops.12372.

38 Wikipedia, 'Mosaic Evolution' citing King, R.C.; Stansfield, W.D.; Mulligan, P.K. 2006. *A Dictionary of Genetics*. 7th ed, Oxford University Press, 286; Robert A. Foley, 'Mosaic Evolution and the Pattern of Transitions in the Hominin Lineage,' *Phil Trans B* 371, no. 1698 (2016), https://doi.org/10.1098/rstb.2015.0244.

39 Alison S. Brooks, John E. Yellen, Richard Potts, et al., 'Long-distance Stone Transport and Pigment Use in the Earliest Middle Stone Age,' *Science* 360 (2018): 90–94, https://doi.org/10.1126/science.aao2646.

40 Jeff Tollefson, 'Advances in Human Behaviour Came Surprisingly Early in Stone Age,' *Nature* 555 (2018): 424-425.

41 Colagè and d'Errico, 'Culture: The Driving Force of Human Cognition.'

42 Wu Liu, Chang-Zhu Jin, Ying-Qi Zhang, Yan-Jun Cai, et al., 'Human Remains from Zhirendong, South China and Modern Human Emergence in East Asia,' *PNAS* 107, no. 45 (2010): 19201-6, https://doi.org/10.1073/pnas.1014386107.

43 Zhaoyu Zhu, Robin Dennell, Weiwen Huang, et al., 'Hominin Occupation of the Chinese Loess Plateau Since about 2.1 million years ago,' *Nature* 559 (2018): 608-12, https://doi.org/1038/s41586-018-0299-4.

44 Colin Barras, 'Tools from China are oldest hint of human lineage outside Africa,' *Nature* July 11 (2018), https://doi.org/10.1038/d41586-018-05696-8.

45 Yue Hu, Ben Marwick, Jia-Fu Zhang, et al., 'Late Middle Pleistocene Levallois Stone-tool Technology in Southwest China,' *Nature* 565 (2019): 82–85, https://doi.org/10.1038/s41586-018-0710-1; Ben Marwick, Bo Li, and Hu Yue, 'New Dates for Ancient Stone Tools in China Point to Local Invention of Complex Technology,' *The Conversation* Nov 20 (2018); https://theconversation.com/new-dates-for-ancient-stone-tools-in-china-point-to-local-invention-of-complex-technology-106914.

46 Jane Qiu, 'How China is Rewriting the Book on Human Origins,' *Nature* 535 (2016): 22-25, https://doi.org/10.1038/535218a.

47 Kate Douglas, 'Asia's Mysterious Role in the Early Origins of Humanity,' *New Scientist* (July 4 2018); https://www.newscientist.com/article/mg23931850-200-asias-mysterious-role-in-the-early-origins-of-humanity/.

48 Xiu-Jie Wu, Shu-Wen Pei, Yan-Jun Cai, et al., 'Archaic Human Remains from Hualongdong, China, and Middle Pleistocene Human Continuity and Variation,' *PNAS* 116, no. 20 (2019): 9820-9824, https://doi.org/10.1073/pnas.1902396116.

49 Sheela Athreya and Xinzhi Wu, 'A Multivariate Assessment of the Dali Hominin Cranium from China: Morphological Affinities and Implications for Pleistocene Evolution in East Asia,' *American Journal of Physical Anthropology* 164, no. 4 (2017); https://doi.org.ezp.lib.unimelb.edu.au/10.1002/ajpa.23305.

50 Colin Barras, 'Ancient Skull from China May Rewrite the Origins of Our Species,' *New Scientist* (Nov 14, 2017): https://www.newscientist.com/article/2153242-ancient-skull-from-china-may-rewrite-the-origins-of-our-species/.

51 Rodrigo S. Lacruz, Chris B. Stringer, William H. Kimbel, et al., 'The Evolutionary History of the Human Face,' *Nature, Ecology and Evolution* 3 (2019): 726-36, https://doi.org/10.1038/s41559-019-0865-7.

52 David Turnbull, *Maps Are Territories; Science is an Atlas* (Chicago: Chicago University Press, 1993).

53 Kirill V. Istomin and Mark J. Dwyer, 'Finding the Way: A Critical Discussion of Anthropological Theories of Human Spatial Orientation with Reference to Reindeer Herders of Northeastern Europe and Western Siberia,' *Current Anthropology* 50, no. 1 (2009): 29-49, https://doi.org/:10.1086/595624; Tim Ingold, *The Perception of the Environment: Essays in Livelihood, Dwelling and Skill* (London: Routledge, 2000).

54 Anne Salmond, *Aphrodite's Island: The European Discovery of Tahiti* (Berkeley: University of California Press, 2009); Anne Salmond, 'Tupaia The Priest-Navigator,' in *Tangata o le Moana: The Story of Pacific People in New Zealand* eds. Sean Mallon, Kolokesa Māhina-Tuaiand and Damon Salesa (Wellington: Te Papa Press, 2012).

55 Lars Eckstein and Anja Schwarz, 'The Making of Tupaia's Map: A Story of the Extent and Mastery of Polynesian Navigation, Competing Systems of Wayfinding on James Cook's Endeavour, and the Invention of an Ingenious Cartographic System,' *Journal of the Polynesian Society* 54, no. 1 (2018): 2, https://doi.org/10.1080/00223344.2018.1512369; David Turnbull, 'Boundary-Crossings, Cultural Encounters and Knowledge Spaces in Early Australia,' in *The Brokered World: Go-Betweens and Global Intelligence 1770-1820*, eds. Simon Schaffer, Lissa Roberts, Kapil Raj and James Delbourgo (Sagamore Beach: Science History Publications, 2009.

56 Harriet Parsons, 'British–Tahitian Collaborative Drawing Strategies on Cook's Endeavour Voyage,' in *Indigenous Intermediaries: New Perspectives on Exploration Archives*, eds. Shino Konishi, Maria Nugent and Tiffany Shellam (Canberra: ANU Press, 2015).

57 Michel Foucault, 'Of Other Spaces,' *Diacritics* 16 (Spring) (1986): 27, https://doi.org/10.2307/464648.

58 G. S. Parsonson, 'Review of Milligan R.R.D. The Map Drawn by the Chief Tuki-Tahua in 1793,' *Journal of the Polynesian Society* 74 (1965): 128.

59 David Turnbull, 'Mapping Encounters and (En)countering Maps: A Critical Examination of Cartographic Resistance,' in *Research in Science and Technology Studies: Knowledge Systems. Knowledge and Society*, ed. Shirley Gorenstein (Stanford Connecticut: JAI Press, 1998).

60 Andrew Sharp, *Ancient Voyagers in Polynesia* (Sydney: Angus and Robertson, 1963).

61 David Woodward and G. Malcom Lewis, eds. *The History of Cartography, Vol 2, Book 3: Cartography in the Traditional African, American, Arctic, Australian, and Pacific Societies* (Chicago: University of Chicago Press, 1998).

62 Ben Finney, *Voyage of Rediscovery: A Cultural Odyssey Through Polynesia* (Berkeley: University of California Press, 1994).

63 Anne Di Piazza and Erik Pearthree, 'A New Reading of Tupaia's Chart,' *The Journal of the Polynesian Society* 116, no. 3 (2007): 336.

64 David Turnbull, 'Trails and Tales: Multiple Stories of Human Movement and Modernity,' in *Arctic Geopolitics and Autonomy, Arctic Perspective Cahier Series No. 2*, eds. M. T. Bravo and N. Triscott (Ostfildern: Hatje Cantz, 2010).

65 Harriet Parsons, 'Collaborative Drawing on Captain Cook's Endeavour Voyage, 1768-1771: An Intellectual History of Artistic Practice,' PhD, School of Culture and Communication, University of Melbourne, (2018).

66 Keith Smith, 'Tupaia's Sketchbook,' *eBLJ British Library Journal online*, (2005), https://www.bl.uk/eblj/2005articles/article10.html

67 Parsons, 162.

68 Parsons, 164.

69 Elinor Ochs, Sally Jacoby and Patrick Gonzales, 'Interpretive Journeys: How Physicists Talk and Travel Through Graphic Space,' *Configurations* 2, no. 1 (1994): 151-71, https://doi:10.1353/con.1994.0003; Patricia Cain, 'How Do I Know What I think Until I See What I Say? (The otherwise invisible into visibility),' *Body of Knowledge: Art and Embodied Cognition Conference* (2019), Deakin University, accessed 1 July 2020, https://blogs.deakin.edu.au/bok2019/keynotes/.