

## Hunter-gatherer societies innovate and adapt, they do not accumulate complexity

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Vaesen and Houkes have delivered a timely paper pushing back against the assumption that cumulative culture is pervasive across human societies. There are two problems with the widespread use of the phrase cumulative culture that are contradicted by the Palaeolithic record of deep time cultural change. First is the low bar often set for cumulative culture which simply equates it to high fidelity social transmission; second is the lack of evidence for cumulative culture in multi-millennial records of *Homo sapiens* hunter-gatherer societies.

Cumulative culture is sometimes defined as high fidelity social transmission, such that ever-increasing cultural complexity is an inevitable consequence of reliable transmission, as any innovations are rarely lost. However, Palaeolithic prehistory belies this equation. High fidelity transmission is evident in the Lower Palaeolithic from at least the onset of the Acheulean (Shipton 2010, 2019), if not the preceding Oldowan (Stout et al. 2019); but the growth of technological complexity was slow enough that different hominin species were making the same distinctive complex artefact types across the entire 1.5 million year duration of the Acheulean. While there are occasional incremental improvements in knapping techniques during the Acheulean (Stout et al. 2014), rates of innovation are so low that on timescales of less than hundreds of thousands of years, complexity looks more like random walks than progressive increases (Shipton 2018). One of probably several additional ingredients required for cumulative culture, is an increase in the capacity for innovation (Shipton and Nielsen 2015).

Middle Palaeolithic Levallois technology was an innovation that arose through the generative recombination of concepts used in Acheulean biface knapping (Shipton et al. 2013). The dearth of Levallois technology in East Asia where previously there was a dearth of biface technology (Movius 1949), supports the hypothesis that Levallois builds upon Acheulean technological foundations in a way that might be described as cumulative. However, broader behavioural change at the Lower to Middle Palaeolithic transition (e.g. Brooks et al. 2018) suggests the technological change may reflect a new cognitive mode, rather than cumulative culture. The pioneering modern knappers who were the first to recreate prehistoric technologies, also showed that Levallois technological complexity is not beyond the capacity of a single individual to acquire from scratch. In contrast to the Acheulean to Middle Palaeolithic transition, it is not clear whether Upper Palaeolithic prismatic blade technology directly builds on Middle Palaeolithic Levallois knapping (Kuhn 2003) and it does not appear to be any more complex (Muller, Clarkson, and Shipton 2017).

In addition to the case of Sibudu Cave cited by Vaesen and Houkes, I offer further examples which suggest that the Upper Palaeolithic and Later Stone Age cultural complexity of *Homo sapiens* hunter-gatherers cannot be described as cumulative. Panga ya Saidi on the East African coast preserves a record of repeated *Homo sapiens* hunter-gatherer occupation across the major climatic fluctuations of the last 80,000 years (Shipton et al. 2018). Here, technological innovations such as backing and prismatic blade technology emerge at different points in the sequence as adaptations to particular environmental circumstances. Early backed crescents for example, are associated with drier environments and large bovid remains (Roberts et al. 2020), probably in part because of the role of these armatures in bringing down large prey. However, when bovid prey size decreased, backed crescents were entirely abandoned for tens of thousands of years before being reintroduced in the terminal Pleistocene. Innovation, abandonment, and reinvention also characterizes the use of Levallois and prismatic blade technology at the site. Looking beyond stone tools there are similar stories: carved osseous artefacts and a variety of shell bead types feature at various times, but these come and go rather than accumulate (d'Errico et al. 2020). The site of Madjedbebe in northern Australia presents a parallel case whereby different stone artefact technologies appear and disappear across the 65,000 year sequence; and rather than accumulating complexity, the most complex stone tool type, the groundstone axe, is found from the beginning of the sequence (Clarkson et al. 2017).

Hunter-gatherer occupation records spanning ~45 to 5 thousand years ago occur on both the tropical islands of Sri Lanka and Timor at the sites of Fa Hien Lena and Asitau Kuru, respectively. Throughout these sequences there is consistency in faunal exploitation patterns, with monkeys and squirrels favoured at Fa Hien Lena (Wedage, Amano, et al. 2019), and fish and shellfish at Asitau Kuru (O'Connor, Ono, and Clarkson 2011). Likewise, there is strong continuity in stone tool making traditions at both sites with, for example, bipolar knapping of quartz to produce backed crescents throughout the Fa Hien Lena sequence (Wedage, Picin, et al. 2019), and large chert flakes used as discoidal cores to produce small flakes with prepared platforms throughout the Asitau Kuru sequence (Shipton et al. 2019). In neither case does prolonged continuity of traditions appear to have given rise to a progressive increase in complexity. Aside from the lithic technology, elaborate carved bone arrowheads and shell beads are found from the beginning of occupation at Fa Hien Lena (Langley et al. 2020), and shell beads and red pigment crayons occur in the early occupation phases at Asitau Kuru (Langley and O'Connor 2016, Langley and O'Connor 2018).

Cumulative culture is not an inevitable consequence of high fidelity transmission: Deep-time records of hunter-gatherer material cultures do not show progressive increases in complexity. Instead hunter-gatherers persist with the same effective cultural adaptations for tens of thousands of years. Innovations occur in response to external factors such as environmental change, but these do not typically lead to an increase in complexity, with technologies likely to be abandoned and replaced when circumstances change again. A case might be made for Epipalaeolithic and Neolithic societies having cumulative culture, but there we are generally talking about expanding populations and the growth in complexity is

a function of the size of the society. It may not be until the invention of writing that human cultures can be said to be truly cumulative.

## References

- Brooks, Alison S, John E Yellen, Richard Potts, Anna K Behrensmeyer, Alan L Deino, David E Leslie, Stanley H Ambrose, Jeffrey R Ferguson, Francesco d'Errico, and Andrew M Zipkin. 2018. "Long-distance stone transport and pigment use in the earliest Middle Stone Age." *Science* 360 (6384):90-94.
- Clarkson, Chris, Zenobia Jacobs, Ben Marwick, Richard Fullagar, Lynley Wallis, Mike Smith, Richard G Roberts, Elspeth Hayes, Kelsey Lowe, and Xavier Carah. 2017. "Human occupation of northern Australia by 65,000 years ago." *Nature* 547 (7663):306-310.
- d'Errico, F, Africa Pitarch Marti, Ceri Shipton, E Le Vraux, E Ndiema, S Goldstein, MD Petraglia, and N Boivin. 2020. "Trajectories of Middle to Later Stone Age cultural innovation in eastern Africa: personal ornaments, bone artifacts and ocher from Panga ya Saidi, Kenya." *Journal of Human Evolution* 141:102737.
- Kuhn, Steven L. 2003. "In what sense is the Levantine Initial Upper Paleolithic a "transitional" industry." In *The chronology of the Aurignacian and of the transitional technocomplexes. Dating, stratigraphies, cultural implications*, 61-70. Lisbon: Instituto Português de Arqueologia.
- Langley, Michelle C, and Sue O'Connor. 2018. "40,000 Years of Ochre Utilisation in Timor-Leste: Powders, Prehensile Traces, and Body Painting." *Paleoanthropology*.
- Langley, Michelle C, and Susan O'Connor. 2016. "An enduring shell artefact tradition from Timor-Leste: Oliva bead production from the Pleistocene to Late Holocene at Jerimalai, Lene Hara, and Matja Kuru 1 and 2." *PLOS One* 11 (8):e0161071.
- Movius, Hallam L. 1949. "Lower Paleolithic archaeology in southern Asia and the Far East." In *Early Man in the Far East*, edited by WW Howells, 17-82. Detroit: American Association of Physical Anthropologists.
- Muller, A, C Clarkson, and C Shipton. 2017. "Measuring behavioural and cognitive complexity in lithic technology throughout human evolution." *Journal of Anthropological Archaeology* 48:166-180.
- O'Connor, Sue, Rintaro Ono, and Chris Clarkson. 2011. "Pelagic fishing at 42,000 years before the present and the maritime skills of modern humans." *Science* 334 (6059):1117-1121.
- Roberts, Patrick, Mary Prendergast, Anneke Janzen, Ceri Shipton, James Blinkhorn, Jan Zech, Alison Crowther, Elizabeth Sawchuk, Emmanuel Ndiema, Michael Petraglia, and Nicole Boivin. 2020. "Late Pleistocene to Holocene human palaeoecology in the tropical environments of coastal eastern Africa." *Paleogeography, Paleoclimatology, Paleoecology* 537:109438.
- Shipton, Ceri. 2010. "Imitation and shared intentionality in the Acheulean." *Cambridge Archaeological Journal* 20 (02):197-210.
- Shipton, Ceri. 2018. "Biface knapping skill in the East African Acheulean: progressive trends and random walks." *African Archaeological Review* 35:107-131.
- Shipton, Ceri. 2019. "The evolution of social transmission in the Acheulean." In *Squeezing Minds from Stones*, edited by K Overmann and Frederick L Coolidge, 332-354. Oxford: Oxford University Press.
- Shipton, Ceri, Chris Clarkson, Jaganath N Pal, Sacha C Jones, Richard G Roberts, Clair Harris, MC Gupta, Peter W Ditchfield, and Michael D Petraglia. 2013. "Generativity, hierarchical action and recursion in the technology of the Acheulean to Middle Palaeolithic transition: A perspective from Patpara, the Son Valley, India." *Journal of Human Evolution* 65:93-108.
- Shipton, Ceri, and Mark Nielsen. 2015. "Before Cumulative Culture." *Human Nature* 26 (3):331-345.

- Shipton, Ceri, S O'Connor, N Jankowski, J O'Connor-Veth, T Maloney, S Kealy, and C Boulanger. 2019. "A new 44,000-year sequence from Asitau Kuru (Jerimalai), Timor-Leste, indicates long-term continuity in human behaviour." *Archaeological and Anthropological Sciences* 11:5717-5741.
- Shipton, Ceri, Patrick Roberts, Will Archer, Simon J Armitage, Caesar Bitu, James Blinkhorn, Colin Courtney-Mustaphi, Alison Crowther, Richard Curtis, Francesco d'Errico, Katerina Douka, Patrick Faulkner, Huw S Groucutt, Richard Helm, Andy IR Herries, Severinus Jembe, Nikos Kourampas, Julia Lee-Thorp, Robert Marchant, Julio Mercader, Africa Pitarch Marti, Mary E Prendergast, Ben Rowson, Amini Tengeza, Ruth Tibesasa, Tom S White, Michael D Petraglia, and Nicole Boivin. 2018. "78,000-year-old record of Middle and Later Stone Age innovation in an East African tropical forest." *Nature Communications* 9 (1):1832.
- Stout, Dietrich, Jan Apel, Julia Commander, and Mark Roberts. 2014. "Late Acheulean technology and cognition at Boxgrove, UK." *Journal of Archaeological Science* 41:576-590.
- Stout, Dietrich, Michael J Rogers, Adrian V Jaeggi, and Sileshi Semaw. 2019. "Archaeology and the Origins of Human Cumulative Culture: A Case Study from the Earliest Oldowan at Gona, Ethiopia." *Current Anthropology*:309-340.
- Wedage, Oshan, Noel Amano, Michelle C Langley, Katerina Douka, James Blinkhorn, Alison Crowther, Siran Deraniyagala, Nikos Kourampas, Ian Simpson, and Nimal Perera. 2019. "Specialized rainforest hunting by Homo sapiens~ 45,000 years ago." *Nature communications* 10 (1):1-8.
- Wedage, Oshan, Andrea Picin, James Blinkhorn, Katerina Douka, Siran Deraniyagala, Nikos Kourampas, Nimal Perera, Ian Simpson, Nicole Boivin, and Michael Petraglia. 2019. "Microliths in the South Asian rainforest~ 45-4 ka: New insights from Fa-Hien Lena Cave, Sri Lanka." *PLOS One* 14:e0222606.