Stone Tools and the Evolution of Human Cognition

April Nowell and Iain Davidson (eds.)

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Prehistoric hominids' cognitive and language abilities have been the subject of conjecture for as long as the fields of paleoanthropology and paleolithic archaeology have been in existence. Indeed, in the late 19th century even Worthington G. Smith (1894: 3) was not beyond such fancy, penning, "It is clear that man must have existed for thousands of years as a being incapable of designing and making stone weapons and tools of geometrically correct form." Since then, tying supposition like this to the archaeological record, the actual dirt-covered field-collected data, has been no easy task. Evidence-focused researchers often shrug off discussions of prehistoric cognition as little more than untestable conjecture, incapable of either verification or falsification. Such is the difficulty of linking abstract to artifact that some have probably given up, branding the endeavor impossible. But after reading *Stone Tools and the Evolution of Human Cognition* any pessimist can certainly be more sanguine about the prospects of an empirical, truly data-based examination of prehistoric cognition. Those already optimistic about such prospects can relish reading ten uniformly strong chapters that should certainly motivate further multidisciplinary exploration and archaeological experimentation of the subject.

The editors, Nowell and Davidson, open the volume with a short, but dense, chapter that expounds upon recent advances in inferring prehistoric cognition from stone tools. Throughout their discussion they manage to seamlessly introduce all of the subsequent chapters, while touching upon a number of pertinent topics involving language, typology, and the history of "paleopsychology."

Moore contributes a paper that should be thoughtfully read and considered by all lithic analysts, especially those working in the Lower Paleolithic. Utilizing Greenfield's ontogenetic model, Moore suggests that "changes in early stone flaking should reflect the evolutionary development of an action grammar through subassemblies and combinations of subassemblies of ever-increasing complexity" (page 17). By utilizing both basic and elaborate "flake units" he is able to show that cognitively simple flaking can actually appear to be complex (known as the "spandrel" effect). The implications of this research are vast, and may lead to reinterpretations of "complex" flaking at the earliest East African localities (e.g., Gona, Lokalalei), and perhaps even of Levallois reduction sequences (but see Sandgathe 2004 versus Eren and Bradley 2009). We can all look forward to future results from Moore's research program which promises to stimulate discussion both methodologically and theoretically.

De la Torre's paper deals with the nature of the earliest tool use among hominids and primates. After an in depth discussion of chimpanzee hammer-and-anvil percussion versus hominid flaked stone reduction, he comes to the correct, yet often overlooked, conclusion that straight comparisons of the products from each process may be pointless, if not misleading. This is because there is no homology or functional equivalence of those products (page 51). He thus advocates comparisons of technological skills and inferred behavior over static artifacts. While the question of how those comparisons should be made, beyond qualitative description, is left to the reader, de la Torre certainly has done the field a service by bringing this methodological issue to the fore. Similarly to de la Torre's chapter, Nowell and White's paper is a review-length discussion, but this time dealing with Acheulean technological systems. They posit whether demographic and social factors, or even hominid life history, might explain the apparent stagnancy of Middle Pleistocene technology. These are all concepts that are potentially testable with the archaeological record, and hearteningly, some are starting to be taken seriously (Lycett 2007; Lycett and Norton 2010).

Wynn and Coolidge's contribution, on "how Levallois is or is not like chess," is absorbing. The authors identify factors that constitute expert performance, and discuss aspects of cognitive organization. They then demonstrate (through refitted examples) how Levallois reduction (Majorie's core from Maastricht-Belvedere) and biface production (from Boxgrove) does or does not exemplify these concepts. After this they offer two central, but tentative, concluding inferences. First, they argue that both are examples of craft production expertise, but since expert performance is "based on the ability to rapidly access well-learned patterns, knowledge, and procedures" (page 101) that have been stored in long-term memory, language may not be necessary for the actual performance. They do admit however that verbal instruction may "streamline learning" how to flintknap, an interesting observation in need of empirical proof, but possibly tenable with experimental testing. The second inference is that Levallois reduction requires more complex and flexible "retrieval structures" (a comprehensive set of cues an expert learns and embeds in long-term memory, page 87) than biface knapping. While I can corroborate from personal experience their assertion that mas-

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tery of Levallois reduction does take years of practice, I am unconvinced that "Levallois is perhaps the best example of expert performance in all of lithic reduction" (page 89). I would maintain, based on Wynn and Coolidge's arguments, that late Pleistocene advanced bifacial reduction sequences (e.g., Solutrean, Folsom) would have certainly required even more complex retrieval structures than Levallois. But at this point my contention is nothing more than speculation, which I hope may inspire examination. Given the large number of refitted late Pleistocene bifacial reduction sequences (e.g., Aubry et al. 2008), a comparison with Levallois certainly appears feasible.

Taking a quantitative approach, Kuhn vividly illustrates how flaked stone products may appear to be standardized in design, when in actuality the mechanical constraints of flintknapping produce a substantial amount of involuntary "morphological redundancy" (page 110). Presenting metric data and comparative statistical examinations of flaked stone products from four sites (Riparo Mochi, Italy; Grotta di Sant' Agostino, Italy; Tabun Cave, Israel; Yarimburgaz Cave, Turkey) Kuhn is able to demonstrate that to get at the concept of "standardization" lithic analysts should probably look towards reduction sequences and tool life-histories instead of static products. Refreshingly, he suggests possible avenues for doing just that (pages 125–128). Like Kuhn, the use of quantitative assessment by Wurz not only gives her conclusions empirical validity, but also the chance to be properly retested in the future. She presents the MSA 1, MSA 11, and Howiesons Poort techno-complexes from Klasies River Main Site and discusses them in terms of their relevance to the evolution of hominid symbolic capacity. Ultimately from her comparisons she suggests that the Howiesons Poort should not be seen as a dramatic reorganization of technology.

The individual contributions of Stout and Davidson each present extended summaries of different aspects regarding the inference of language and cognition from stone tools. The former focuses his discussion on neurology, and is an accessible examination of the recent literature for scholars not at the front lines of that sort of research (like this reviewer). After exploring chimpanzee and early hominin tool use, the latter presents hypothetical "tool phases" analogous to Jackendoff's (2002) "language phases." To conclude the volume the reader is treated to a thoughtful discussion of all the chapters by the experimental psychologist Philip J. Barnard of the MRC Cognition and Brain Sciences Unit at the University of Cambridge. Barnard's candid, but courteous, commentary does more than regurgitate the volume's content—it adds an exclamation point to an already strong volume by constructively critiquing each paper while pointing out several avenues of research to be pursued further.

Overall, *Stone Tools* nicely balances the old with the new by supplying the reader with several review papers and data chapters alike. The tables and figures are clear, and even the occasional schematic of stone tool reduction, which in many other volumes can be painfully inadequate, is well done here. Thankfully, the references cited within each chapter are located at each chapter's end, and not misplaced at the end of the volume.

One final note: it seems most of the contributors recognize that the study of prehistoric cognition (and perhaps, more broadly, the fields of paleoanthropology and paleolithic archaeology) is in desperate need of a quantified, symbolic shorthand to both represent and compare flaked stone reduction sequences. I ardently concur. It may take a number of restarts until the task is accomplished, but achieving a quantified, symbolic shorthand of stone tool reduction sequences will ultimately be worth the effort.

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I conclude that stone tools can be interpreted to give strong evidence about the evolution of cognition, but the outcomes depend on careful assessment of the theoretical basis for the argument. Relating Cognitive Abilities to the Production of Stone Tools My present approach to stone tools and cognition was developed in 2003 during a research project titled Precursors to Culture at the Collegium Budapest led by Richard Byrne. Byrne has recorded the sequence of actions routinely engaged 185 I a i n D a v id s o n in, in the wild, by a gorilla he called Flossie to avoid the painful sting of nett...Â When we analyzed the evidence in a number of characteris- 186 Stone Tools and the Evolution of Hominin and Human Cognition Table 9.1. The stone tools that have survived in the archaeological record can tell us something about the intelligence of the people who made them. Even our earliest human ancestors were no dummies; there is evidence for stone tools as early as 3.3 million years ago, though they were probably making tools from perishable items even earlier. As early as 2.6 million years ago, some small-bodied and small-brained human ancestors chipped small flakes off of larger stones to use their sharp cutting edges. These types of stone tools belong to what is known as the Oldowan industry, named after Olduvai Gorge in