

New Perspectives on Old Stones: Analytical Approaches to Palaeolithic Technologies

Stephen J. Lycett and Parth R. Chauhan (eds.)

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The late Robert Dunnell (1971: 2) wrote in regards to the New Archaeology: "In the rush to become a science and to produce explanation, the route to science has often been forgotten." He continued (*ibid.* 4), "It should be clear from the outset that the problem is not a lack of theory... but rather the lack of its overt expression in the literature of the discipline." Now thanks to Lycett and Chauhan's (2010) *New Perspectives on Old Stones*¹, Dunnell's "route to science" becomes a four-lane super-highway, clear and paved, and I hear street-lamps are being installed next week. No longer will there be any excuse for Paleolithic stone tool analysts to get off track. Make no mistake—as the editors themselves readily admit (pages 1–2, 16)—most of the credit goes to quondam giants, particularly David L. Clarke (1968). But by reminding us of "Clarkeian trends" (see below) and linking them with advancements in, and the application of, digital recording techniques, computer programming and simulation, and flaked stone replication, the volume editors and contributors put an exclamation point on the resurgence of rational, coherent, logical, and truly "analytical" (page 3) approaches to Paleolithic stone tools and detritus.

Lycett and Chauhan launch the volume by reviewing five principle "Clarkeian" themes: (1) hypothesis-testing and formal analysis; (2) quantification and inferential statistical analysis; (3) models; (4) cultural transmission and lineages of artifactual traditions; and, (5) morphometrics. Each theme is illustrated by contributor-written or referenced case-studies that exemplify it, driving home the value, indeed necessity, of each theme. And though "it is probable that disagreements on certain finer points are evident... there is sufficient common ground under the general philosophical approach taken by the contributors that even such disagreements are providing fruitful lines of enquiry rather than descending into irresolvable polemic" (page 18). I suspect it is also that shared scientific focus that unifies this volume into one script, one voice—rare is it that an edited volume is integrated so seamlessly. *New Perspectives* could easily serve as a textbook for advanced undergraduate or graduate archaeology classes (a nice triumvirate for a lithics class might include Patten 2005 and Surovell 2009).

The rest of volume can be divided into three broad sets—those focusing on what artifact form and spatial distribution can tell us about past behavior (Chauhan, Costa, Clarkson, Grove, Lycett, Monnier and McNulty); those focusing on flaked stone reduction and resharpening (Brantingham, Braun et al., Buchanan and Collard, Iovita, Shott);

and, a set of summary papers (Gowlett, O'Brien). Beginning here with the first set of papers, Costa (Chapter 2) and Clarkson (Chapter 3) present papers that ultimately question the primacy of raw material influence over stone tool morphology, something often cited, but rarely examined (Bar-Yosef et al. 2011). Costa presents a 2D geometric morphometric assessment of Acheulean biface outline morphology that compares bifaces knapped on stone versus bone. There was no clear difference, which suggests, at least for 2D plan shape, if a prehistoric craftsman mastered a material medium, they should be able to mold it to his/her will (either through a "mental template" or reduction strategy), rather than succumbing to material "constraints." Costa makes it clear that a 3D assessment eventually needs to be carried out, and that it may yield different results (though it may not). But that is the advantage of a formal analysis—it forces a researcher to explicitly define what is being tested and examined and what is not but eventually should be.

Likewise, by using a microscribe to capture 3D coordinates with which to calculate vectors of core flake scars, which are then (alongside other variables) assessed statistically, Clarkson convincingly shows that "raw material differences would appear to be subservient to other causes of variation in creating differences [of cores] between regions" (page 53). As such, this conclusion nicely compliments Costa's work. Clarkson's analysis certainly sets up exciting future comparisons between cores and specific retouched tools, since the latter is asserted to be "more susceptible to convergence and horizontal transmission than the more elaborate and less easily observed and imitated procedures of core reduction" (page 55). Thus, the two sets of items may eventually reveal different aspects of cultural processes—but the declared dichotomy needs to be assessed first. Tool reduction procedures can certainly be "elaborate" (depending on how one defines the term), and one could easily argue that early reduction stages of tools are just as myopic as those of cores, perhaps more so. After all, there are probably many more core-refit studies than there are tool-refit ones. For this reason I remain optimistic that both retouched tools and cores will in future years yield information on cultural processes.

Monnier and McNulty (Chapter 4) empirically test the link between stone tool "standardization" and "behavioral modernity" (though both concepts have, quite rightly, been critically examined of late, see Kuhn 2010; Shea 2011). Their hypothesis is clear and to the point: "If stone tool standardization is a feature of modern human behavior, one would

expect it to be greater in Neolithic, as well as Upper Paleolithic assemblages than it is in Middle Paleolithic assemblages" (page 66). They used a 2D geometric morphometric approach to quantify tool shape of three type-sets through time: (1) endscrapers; (2) retouched flakes and single-convex sidescrapers; and, (3) retouched blades and backed blades. Neolithic types were significantly *less* standardized than Upper Paleolithic ones, but *not* more standardized than Middle Paleolithic ones (page 77). While Monnier and McNulty's conclusions were cogent, I was less convinced by the claim that their "new measure of artifact shape... is more comprehensive than traditional linear measurements" (page 78). I would instead argue that it is different, rather than "more comprehensive." There is still important information to be gleaned from traditional measurements, namely size, which itself can be the objective of standardization. I thus found their criticism of Wurz's (1999) use of the CV of length for sets of LSA and MSA tools somewhat harsh, especially given their acknowledgement that formal analyses require specificity (see also Lycett and Chauhan Chapter 1: 5; Surovell 2009: 13).

Chauhan (Chapter 6) presents analyses of handaxe variability at sub-continental scales (locality and region). His paper includes an eleven-page (!) table of all handaxe measurements recorded for the study, a significant contribution all on its own. Through univariate and multivariate statistical methods he ultimately shows that (1) early and late Indian Acheulean assemblages overlapped entirely in terms of the five assessed variables; (2) comparison of locally neighboring handaxe assemblages cluster together due to tremendous metrical variation at the locality level; and, (3) inter-*regional* comparison of broad handaxe groups showed statistical differences. But with the last conclusion comes a caveat —there is no geographical patterning. In other words, "at times, there is greater similarity between two groups father apart geographically than between two groups geographically close to each other" (page 160). Of course, this may have to do with nature of the variables assessed or the fact that the data are noisy and require a broader (inter-regional) examination (e.g., Lycett and von Cramon-Taubadel 2008). Size adjustment of the data, such that shape parameters are more explicitly examined, also might reveal more fine-grained patterns.

The two remaining papers dealing with artifact form and spatial distribution touch upon a number of epistemological issues fundamental to the health and "broader impacts" of flaked stone analysis in particular, and Paleolithic archaeology in general. Grove (Chapter 4) presents an overview of techniques for the quantitative analysis of mobility derived from mathematical ecology. He also examines a mobility data set of Dobe !Kung, as well as presents a novel method for applying random walk analyses to archaeological datasets. Though this new method confronts a number of challenges (e.g., establishing contemporaneity of sites), duly acknowledged by Grove, it certainly still can be used to understand "average" mobility adaptations over a swath of time, which of course is archaeology's chief strength. Lycett's research (Chapter 9) drives this very point home and

takes full advantage of Paleolithic data's coarse resolution to empirically focus on big questions involving cultural transmission, population genetic models, and Paleolithic artifact variability. Indeed, a large block of Lycett's research over the last five years is synthesized in the chapter, and in condensed form underlines the elegance and exciting potential of his nascent neo-processual school.

The five papers on stone tool reduction and/or reshaping are methodologically diverse, and are a testament to the vitality and untapped potential of this narrow sub-field of flaked stone analysis. First, Braun et al. (Chapter 7) has taken up the challenge of calculating original flake size from platform attributes, a concept introduced by Dibble (1987) and advocated by others (Braun et al. 2008; Eren and Sampson 2009; Shott 2000). Instead of simply equating platform area with platform width times platform height, Braun et al. created a 3D platform "topography" using GIS software that more precisely and accurately captured true platform area. Though the method showed only minimal improvement over digital methods of capturing platform area, the results were still promising ($r^2=0.87$) (and happily, Braun et al.'s 3D approach has recently inspired follow-up work by other researchers, see Clarkson and Hiscock 2011). By reconstructing Oldowan flake size, the authors were able to statistically test hypotheses involving reduction intensity and artifact transport and curation. They persuasively conclude, based on their analysis, that "...Oldowan technology may represent an understanding of the landscape-scale distribution of resources that is not usually associated with these early tool-makers" (page 179).

I found Brantingham's contribution (Chapter 8), "The Mathematics of Chaines Operatoires," to be one of the most gripping papers in the volume—I strongly encourage flaked stone analysts to carefully digest its contents. He seeks a formalization of the processes leading to variability in core reduction intensity and core design (page 183), and develops three mathematical models of core reduction (Bernoulli, Markov, and Price Core Technologies) that allow powerful predictions and inferences into core knapping decisions. By comparing the predictions of the formalized core-reductions to archaeological case studies, he can support or reject hypotheses involving economic productivity and remnant core use-life. I can only hope this paper becomes as influential and widely-cited as a notable predecessor (Kuhn 1994). Of course, I wonder about the Price model assumptions involving the influence of raw material. In my experience mediocre knappers produce mediocre work, regardless of how good the raw material is (cf. page 201); and, on the whole, experienced knappers face little trouble in the face of "poor" toolstones. But assumptions (of Brantingham) and perceptions (of my own) need to be experimentally tested, and if found lacking can be easily removed from the mathematical models (like *E*, page 200), or replaced with other constraining parameters. Indeed, since the "Price Core Technology" model suggests that knapper choice may outweigh the effect of raw material quality (page 203), actualistically-based probabilities of how often knappers of different experience make, and

successfully carry out, correct choices may be an profitable avenue of inquiry. Nevertheless, the take-home point, so elegantly illustrated by Brantingham's paper, is that "models are not by themselves statements about reality; rather they are formalized means of laying down explicit parameters in order that we can ask *how much does reality match this pattern?*" (Lycett and Chauhan Chapter 1, page 12, emphasis original).

Rather than attempting to document the extent of tool resharpening, Iovita (Chapter 10) targets its patterning (something Mary Prendergast and I called, tongue-in-cheek, a "retouch-tion sequence" Eren and Prendergast 2008: 79–82). Using Elliptical Fourier methods, a type of outline analysis, and statistically evaluating them, Iovita shows the importance of resharpening trajectories as an indicator of both tool function and economic behavior (page 248). But I suspect that the implications may be even greater, which is why in my discussion of Clarkson's paper above, I suggested that retouched tools might yield information about cultural, rather than just functional, behaviors. By analyzing Iovita's resharpening trajectories in conjunction with use-wear and tool-performance studies, it should be possible to test whether function or economy is driving particular resharpening "types" (page 237), or whether multiple types are functionally or economically equivalent. The latter would suggest that adopted resharpening patterns are the result of social transmission processes (see also Clarkson's discussion on page 55). Regardless of what sorts of information Iovita's approach ultimately yields, it certainly has promise and we can look forward to its application in future years.

Buchanan and Collard's contribution (Chapter 11) nicely demonstrates that stone tool resharpening does not always result in allometry, and instead stone tool shape can be maintained (isometry). By analyzing a robust sample of Late Pleistocene projectile-points from the North American Southern Plains with 2D geometric morphometric techniques, the authors arrive at two solid conclusions. First, blade shape is a good variable for distinguishing multiple point types (in this case Clovis, Folsom, and Plainview). Second, by using size as a proxy for resharpening extent (smaller = more resharpening), they statistically confirm that resharpening does not alter blade shape such that one might be prone to making misclassifications of point type. It would be interesting to independently confirm that point size is indeed a good proxy for resharpening, perhaps through correlation of size with width to thickness ratios (smaller ratios = more resharpening) or some version of Clarkson's (2002) or Andrefsky's (2006) invasiveness indices. But Buchanan and Collard's results should make skeptics think-twice before criticizing projectile-point cladistic analyses (e.g. O'Brien and Lyman 2003)—the input data may not be as messy or confounded by resharpening processes as some might like to think.

The last paper to systematically investigate reduction and resharpening is by Shott (Chapter 12), who starts with a terse, reasoned review of "The Reduction Thesis" and measures of tool reduction. He is spot on with this: "Advo-

cacy of particular methods is salutary to the limits of their validity and reach, but we must avoid tiresome arguments about the general superiority of particular measures in order to appreciate that the manifest diversity of reduction trajectories and effects requires comparable diversity in reduction measures" (page 278). He goes on to construct "survivorship" demographic distribution curves of Late Pleistocene bifaces from the North American Midwest. As in Brantingham's paper, model curves with known implications also are constructed and then compared to the archaeological case study. Because the frequency of artifact abundance does not reflect popularity or frequency of use so much as low curation (page 283), Shott concludes that the greater abundance of discarded fluted points in the Midwest is not due to relatively higher populations of Paleoindians in the Midwest than Western North America (as is sometimes argued), but due to Paleoindians discarding their tools at faster rates.

I will leave Gowlett's and O'Brien's thoughtful and balanced discussant papers to the reader of this review to ponder. I do this not out of laziness, but in the hopes of sparking curiosity. They carefully outline a number of important issues and future research avenues that should not be summarized, but absorbed in full. In following, it should certainly help "to put the fun back into Archaeology" (Gowlett, page 304).

The overall contents of the volume lead this reviewer to a number of thoughts:

1. The volume's diversity of methods and measurements epitomizes a basic scientific reality—it is the question that dictates the analytical variables a researcher records. Thus, any calls for the standardization of stone tool measurements are entirely misguided. Measuring a lithic blank's "length" one way may yield information about one aspect of prehistoric culture or behavior, while measuring "length" another way may be relevant to a different question entirely. If we were to suddenly to impose a single "length" measurement on the discipline, analytical innovation, as well as the number and type of research questions, would be limited severely. Collectively, the papers therefore demonstrate that *we do not need more methodological and measurement standardization, we need more methodological and measurement definition, explicitness, and justification that recorded variables are actually appropriate for the question being asked.* This also means that as we explore and utilize the plethora of new methods available to us, we should not forget that there are important answers still to be found in "old fashioned" and "basic" variables (e.g., length, width, thickness)—to reiterate, it all depends on the question being asked.
2. O'Brien (page 328) states: "We might ask ourselves if it wouldn't be better to rely on some of the quantitative methods discussed here rather than on experience and intuition." The answer

to that question is a resounding “yes.” No longer should lithic analysts or flintknappers (this reviewer included) rely on, or make appeals to, qualitative assessments of “the technology,” but instead aim to demonstrate it empirically and quantitatively (for a discussion of the use of the term “technology” in flaked stone analysis, see Eren 2011: 7–11). This is not to say that cultural or behavioral inferences cannot be made from descriptions or observations, only that inferences from quantitative analyses are stronger due to their independence. Thus, if a tool’s flaking pattern is described as “bolder” than another’s, the mandatory next step should be to mathematically define “boldness” and test that impression. Imagine how silly it would be if radiocarbon specialists simply gave their impressions of how old a piece of charcoal was. The reason this situation does not exist is because radiocarbon methods are explicitly defined, tested, and made clear to the rest of the discipline as a whole—there is no appeal to authority. Positively, and as *New Perspectives* makes crystal clear, it seems like flaked stone analysis is finally, and permanently, slouching away from its intuitive traditions.

3. It should be noted that while there is much to learn from reduction sequences, as a number of contributors demonstrate there are still large amounts of information to be gleaned from discarded tools themselves (e.g., handaxes).

To those who have ever said “I do not need statistics to tell me about stone tools;” to those who shrug off hypothesis-testing and quantitative assessment; and, to those who rely upon authority and experience over evidence and verification, be warned: *New Perspectives* is a game-changer. It is a tome that its proponents will rally behind. The papers within not only make flaked stone analysis relevant to the rest of paleoanthropology and biology via the scientific method, but epitomize productive, reality-based, and in these times of economic woe, cost-effective research. And at the end of the day, to justify stone tool analysis and its relevance to human origins research, as well as to the public that funds it, lithic analysts must produce empirically-based, applicable results. *New Perspectives* captains what is shaping up to be a renaissance of flaked stone research that does exactly that.

ENDNOTE

¹Partly derived from a symposium at the 2008 meeting of the Society for American Archaeology, in Vancouver, Canada.

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