

Special Issue: Reduction Sequence, *Chaîne Opératoire*, and Other Methods: The Epistemologies of Different Approaches to Lithic Analysis

Introduction

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ABSTRACT

Lithic analysis is an increasingly multinational endeavor conducted by researchers with different cultural and disciplinary backgrounds. The debate between proponents of the reduction sequence and *chaîne opératoire* approaches has shown that there is a mutual lack of understanding on many fronts. Yet lithic analysis cannot be pigeon-holed into these two types alone. This collection of papers was solicited from authors working in different national disciplinary contexts to provide an example and role model for future explicit discussions of epistemologies, goals, and methods of lithic analysis advocated by diverse practitioners. This special issue of *PaleoAnthropology* was designed to help clarify the method, theory, and social context of international lithic analysis, and contains seven contributions:

- Tostevin, G.: Introduction to the Special Issue
- Bleed, P.: Loosening our *Chaînes*: Cognitive insights for the Archaeological Application of Sequence Models
- Carr, P.J., and Bradbury, A.P.: Learning from Lithics: A Perspective on the Foundation and Future of the Organization of Technology
- Shott, M. J., Lindly, J.M., and Clark, G.A.: Continuous Modeling of Core Reduction: Lessons from Refitting Cores from WHS623x, An Upper Paleolithic Site in Jordan
- Soressi, M., and Geneste, J.-M.: The History and Efficacy of the *Chaîne Opératoire* Approach to Lithic Analysis: Studying Techniques to Reveal Past Societies in an Evolutionary Perspective
- Tostevin, G.: Levels of Theory and Social Practice in the Reduction Sequence and *Chaîne Opératoire* Methods of Lithic Analysis
- Tryon, C. and Potts, R.: Approaches for Understanding Flake Production in the African Acheulian

This special issue is guest edited by Gilbert B. Tostevin (Department of Anthropology, University of Minnesota). This is article #1 of 7.

ORIGINS AND AIMS OF THE SPECIAL ISSUE

The increasingly multinational discipline of lithic analysis is currently undergoing a “culture contact” event between competing scientific traditions of studying the evolution of human behavior through the remains of stone tools. This academic culture contact has not been as productive as it should, as researchers advocating an American processual “reduction sequence” approach react with more resistance than informed engagement to the growth in popularity of the French “*chaîne opératoire*” approach among Europeans and other nationalities around the globe. Equally, *chaîne opératoire* advocates have seemingly turned a deaf ear to requests for improvements in the epistemological rigor of their method. The present collection of papers for this special issue (and the SAA symposium which stimulated it¹) was designed to provide a venue and context for improving the nature of the discourse between proponents of both brands of analysis. Such venues offer an opportunity to be explicit about the epistemology for

how and why we investigate the human past through lithic technology.

The study of lithic technology has, in truth, always been international in its scope, since the initial collaborative work between Édouard Lartet, a Frenchman, and Henry Christy, a British scholar (Lartet and Christy 1865–75; see Monnier 2006). The main difference in the 21st century, however, is that lithic analysts are more well versed in the philosophy of science and conscious of epistemological differences than were the founders of our field, particularly because of the important contributions of research agendas such as middle-range theory (*sensu* Binford 1977) and experimental archaeology (e.g., Bordes and Crabtree 1969; Flenniken 1984). Thus, today, method and theory disagreements are both more noticeable and more divisive than they have been in the past. Yet despite all of our modern concern for the method and theory of our science, lithic analysts are still individuals who have experienced this science within the moderately bounded nature of our culturally- and

nationally-defined professional worldviews. At the same time the number of lithic practitioners working only within their own countries has grown in proportion to those analysts who work between national contexts, increasing the variance further. These individualistic as well as more culturally-relative perspectives make a deeper understanding of method and theory differences more difficult to achieve. We need a way to move beyond the conclusion that “You do lithic analysis differently than we do. You do bad work.” In a situation such as this, as when dealing with a difficult and complex subject in the classroom, a conceptual tool to change the perspective of the participants can often produce a breakthrough in understanding.

I have found the method and theory differences across international lithic analysis to be far more understandable when viewed through David Hurst Thomas’ discussion (1998: 66–94) of archaeological method and theory as manifested at three levels of operation—low-level, middle-level, and high-level theory. Low-level theories include observations obtained in archaeological fieldwork, what are usually termed “data.” These include the products of measurement techniques, inferences from qualitative examination of artifacts, statistical representations of counts and attributes, and published artifact illustrations. Low-level theory is thus the beginning of archaeological method. Middle-level (or middle-range, *sensu* Binford 1977) theories connect these observations of the archaeological record to patterns of human behavior through experimental archaeology, ethnoarchaeology, and other types of research designed to recognize causal relationships between the processes of human behavior and their resultant effect on the formation of the archaeological record. High-level theories provide the reasons or intellectual goals for asking certain questions of the archaeological record, usually from a specific orientation to explaining the past. Thomas’ three-level distinction in method and theory offers the advantage of understanding a particular example of lithic analysis as the articulation of intellectual activity at each of these levels rather than a monolithic task. The three-level distinction allows one to understand how low- and middle-level theories need to be shaped in a particular way in order to achieve the goals of high-level theory. At the same time, it is thus possible to see how a slight change in high-level theory objectives, which are often more sensitive to the cultural background of the researcher, can necessitate a logical succession of changes in middle- and low-level theories. Given this observation, it is beneficial for lithic analysts to evaluate the method and theory of others’ work in a holistic manner from low- to high-level theory. This is frequently not possible, however, because there is a great diversity in how analysts explicitly describe their low-, middle-, and high-level theory goals. Explicit statements of how high-level theory goals shape the method in the other levels of theory are particularly rare.

Providing a venue for explicit statements of the epistemology of lithic analysis from different intellectual traditions, in order to partly fill this gap, was my goal in organizing the Society for American Archaeology electronic

symposium that led to the writing, several years later, of the papers collected in this special issue. Venues such as this offer an opportunity to be explicit about the epistemology of our low-level and middle-level theory and forthright about our analytical goals as reflected in the use of high-level theory. In particular, it is an apt time to discuss how these differences may relate to the institutional structures in which lithic analysts are trained and work, be they cultural resource management corporations, university teaching positions with research responsibilities, or the research-driven *Centre National de Recherche Scientifique*. Equally important is the necessity to prevent the current nature of the reduction sequence vs. *chaîne opératoire* debate, as summarized in my article contribution to the special issue, from polarizing the discipline into only two ways of conducting lithic analysis. Lithic analysis cannot be pigeon-holed into these two types alone. That being said, lithic analysts are participants in roughly the same scientific enterprise regardless of nationality and so need to agree on what constitutes replicable low-level theory, i.e., data gathering techniques and documentation in published research, as well as sound epistemology in middle-level theory. Yet lithic analysts also need to be flexible in accepting the use of observations of lithic data in the pursuit of different high-level theory goals, i.e., how archaeologists’ observations of the archaeological record are shaped by their overall research aims. In this, lithic analysis as a discipline can benefit from the theoretical diversity of its participants as a whole.

The present collection of papers was solicited from lithic analysts working in different national disciplinary contexts to help remedy this situation. Apart from this introduction, the collection includes six papers, written by eleven authors, employed in three different countries, working in six different regional or prehistoric contexts (four continents), and each representing a unique way to approach lithic analysis. The authors were asked to provide an explicit discussion of their own epistemology, goals, and methods of lithic analysis applied in one or two prehistoric case studies.

By assembling this diversity of approaches in the form of explicit epistemological statements (some from traditions which have habitually avoided explicit epistemological discussions), the collection serves the field of Paleoanthropology in multiple ways. First, the collection will hopefully serve as a useful resource for scholars from one perspective looking for an explicit and authoritative statement from another perspective. For instance, Marie Soressi and Jean-Michelle Geneste’s paper on the history and epistemology of the *chaîne opératoire* approach to lithics, in the opinion of one of the peer-reviewers, is the best description of this approach in English and so will be vital reading for non-francophones needing to learn from this school of thought. Explicit epistemological statements from practitioners of the *chaîne opératoire* approach are rare enough, as it is, that this paper alone will greatly benefit international understanding among lithic analysts. Equally, a prehistorian outside of North America could look to this issue to read Phil Carr and Andrew Bradbury’s presentation of what in America

has come to be called the “Organization of Technology” approach to lithic analysis. Given the length of time since Nelson’s (1991) frequently cited synthesis of research in this area, or even since Carr’s (1994) edited monograph, the field has long been in need of an explicit discussion of the epistemology of this approach. In presenting their personal perspective on this type of research, Carr and Bradbury fulfill the goals of the special issue in allowing a multi-level understanding, as discussed above, of their approach. Each of the six papers in fact has an audience in analysts from other contexts.

Second, the collection’s breadth demonstrates that it is unwise to conceive of lithic analysis as being anything but combinations of unique approaches that have different degrees of similarity and contrast. One can gauge this diversity by noting the different perspectives taken at all levels of operation of the archaeological endeavor, i.e., low-middle-, and high-level theory. This is clear from Christian Tryon and Richard Potts’ paper addressing the thorny issue of how to study an African Acheulian assemblage without privileging the bifaces to the detriment of the flake subassemblage. By comparing descriptive and explanatory methods of lithic analysis, they present an ‘industry-free,’ attribute-based analysis for the study of raw material economy that they hold to be complementary to the more descriptive results of both *chaîne opératoire* and reduction sequence research. The quantitative low- and middle-level theories exemplified by Tryon and Potts’ paper have much in common with the quantification of attributes in Michael Shott, John Lindly, and Geoffrey Clark’s paper on using continuous modeling of refit data to characterize an assemblage’s reduction strategy. Yet, whereas Tryon and Potts’ quantification is designed to address lithic technology within the context of the high-level theory of evolutionary ecology (seeing stone tool assemblages reflecting “solutions to given problems within a broader foraging context as hominins pursued subsistence needs” p. 381), Shott et al. use quantification for different high-level theory goals. Shott et al. pursue pure sequence study research to demonstrate that how we understand lithic reduction influences how we interpret it. They contrast stage reduction models with models of reduction continua using regression and principle component analyses, testing their approach against refit data from a Near Eastern Upper Paleolithic site. Their results, showing that some aspects of lithic reduction are best modeled as continua, while others are better modeled as discrete, take us one step closer to understanding the boundary conditions for when it is best to apply one type of modeling of reduction versus another. While they are not immediately testing a “big question” in human evolution, i.e., their aim is not to answer a specific high-level theory question, they are in fact improving and redefining low-level theory through the identification of “data” itself by means of the experimental archaeological use of refits to isolate the causal links between artifact morphology and the artifact’s place in the reduction sequence. This is important, for, as they point out, understanding boundary conditions helps “establish what constitutes data, how hy-

potheses are formulated, how test implications are generated from them, and what criteria should be used to evaluate them” (Shott et al. this issue, p. 331).

Readers of Soressi and Geneste’s contribution also can see the action of research across the three-level distinction as Soressi and Geneste takes pains to explain the movement of the *chaîne opératoire* practitioner back and forth between low-level theory observations and middle-level theory connections between reduction behaviors and the morphological variants produced by them. As noted above, this is one of the best examples of a “this is how you do it” description of any type of lithic analysis to date. Carr and Bradbury’s contribution, while not a step-by-step manual for the Organization of Technology approach (or the “TO” approach following Cobb 2000), also illustrates why they make their choices at all three levels of archaeological theory. Their presentation of how individual publications by North American lithic analysts directly impacted the development of their personal approach highlights the diversity possible within an approach to lithic analysis which an outsider may see as homogenous and yet from within shows variation even at the resolution of low-level theory. This is particularly clear in the disagreements within the TO approach over the efficacy of aggregate analysis versus a traditional piece by piece reduction sequence analysis.

Another example of an approach that can be seen to be unique when situated against the backdrop of contrasting approaches to sequence studies is Peter Bleed’s contribution. Bleed discusses the cognitive approaches to studying variation in reduction sequences in the context of Japanese refit data dating to the terminal Pleistocene. The reader may see Bleed’s knowledge of cognitive sciences giving him a different angle on middle-level theory than other examples of sequence studies. For instance, by pointing out how cognitive sciences have identified patterns in the performance of modern sequential tasks equivalent to stone knapping, he is able to suggest that there are aspects of reduction sequence data that many approaches are currently missing. How sequential tasks are learned, cognitively managed, rehearsed, internally explained, and elaborated or ritualized are all aspects of a cognitive approach to sequence studies that promise a different view of the traditional archaeological reconstruction of step-by-step technological procedures. I found Bleed’s paper to be particularly stimulating when read in tandem with a flintknapper’s argument against considering the technology as a simple step-by-step procedure, namely Jacques Pelegrin’s (1990) paper on the logic of his approach to *chaîne opératoire*.

My own paper compares the reduction sequence approach to the *chaîne opératoire* approach according to the contrasts in low-level theory resulting from different questions asked within high-level theory. By espousing a behavioral approach that is neither reduction sequence nor *chaîne opératoire*, my paper provides an example of how to solve some of the epistemological problems common to both. This approach is applied to the Upper Paleolithic sequence at Kebara Cave, Israel, to show how new variation can be recognized between assemblages which under in-

dustrial type definitions were viewed as the same.

The collection will provide a third service to the field of Paleoanthropology in providing an example of a publication effort designed to improve international comprehension of how disciplinary training shapes research design, even at the level of what constitutes data in a publication. Classic volumes such as Dibble and Bar-Yosef's (1995) *The Definition and Interpretation of Levallois Variability* and Clark's (1991) *Perspectives on the Past* have made great efforts in this direction but require repeating every decade at least to have the desired benefit.

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ENDNOTES

¹ Electronic Symposium "Core Reduction, *Chaîne Opératoire*, and Other Methods: the Epistemologies of Different Approaches to Lithic Analysis," organized by G. Tostevin, at the 71st Annual Meeting of the Society for American Archaeology, Saturday, April 29, 2006, San Juan, Puerto Rico.

REFERENCES

- Binford, Lewis R. 1977. General Introduction. In *For Theory Building in Archaeology: Essays on Faunal Remains, Aquatic Resources, Spatial Analysis and Systematic Modeling*, L. Binford (ed.), pp. 1–10. Academic Press, New York.
- Bordes, François and Donald E. Crabtree. 1969. The Corbiac Blade Technique and Other Experiments. *Tebivwa* 12 (2): 1–21.
- Carr, Philip J. (ed.). 1994. *The Organization of North American Prehistoric Chipped Stone Tool Technologies*. International Monographs in Prehistory, Ann Arbor, Michigan.
- Clark, Geoffrey A. (ed.). 1991. *Perspectives on the Past: Theoretical Biases in Mediterranean Hunter-Gatherer Research*. University of Pennsylvania Press, Philadelphia.
- Cobb, Charles R. 2000. *From Quarry to Cornfield: The Political Economy of Mississippian Hoe Production*. The University of Alabama Press, Tuscaloosa.
- Dibble, Harold L. and Ofer Bar-Yosef (eds.). 1995. *The Definition and Interpretation of Levallois Variability*. Prehistory Press, Madison.
- Flenniken, J. Jeffrey. 1984. The Past, Present, and Future of Flintknapping: An Anthropological Perspective. *Annual Review of Anthropology* 13: 187–203.
- Lartet, Edouard and Henry Christy. 1865–75. *Reliquiae Aquitanicae, being Contributions to the Archaeology and Palaeontology of Périgord and the Adjoining Provinces of Southern France*. Williams and Norgate, London.
- Monnier, Gilliane F. 2006. The Lower/Middle Paleolithic Periodization in Western Europe: An Evaluation. *Current Anthropology* 47(5): 709–744.
- Nelson, Margaret. 1991. The Study of Technological Organization. In *Archaeological Method & Theory Vol. 3*, M. Schiffer (ed.), pp. 57–100. University of Arizona Press, Tucson.
- Pelegrin, Jacques. 1990. Prehistoric Lithic Technology: Some Aspects of Research. *Archaeological Review from Cambridge* 9(1): 116–125.
- Thomas, David Hurst. 1998. *Archaeology*. Third Edition. Harcourt College Publishers, Fort Worth.