Examining the Levallois Reduction Strategy From a Design Theory Point of View

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The Levallois reduction strategy has long been considered a hallmark of the Middle Paleolithic of Western Eurasia (Bordes 1953) and the Middle Stone Age of Africa (Goodwin 1929). However, both the definition of the technique and its possible significance remain controversial paleoanthropological issues (see papers in Dibble and Bar-Yosef 1995). Sandgathe's volume, based on his doctoral thesis, represents a recent contribution to the ongoing Levallois discussion.

This study attempts to elucidate the potential advantages of employing the Levallois reduction strategy, which contributed to its widespread geographic distribution and temporal endurance. Constructed around design theory, the study develops a generalized model of Middle Paleolithic lifeways and attempts to identify those factors that would have most significantly constrained the design of lithic technologies. These constraints take on two forms—functional constraints on the flaking products (blanks and tools) and those imposed on the reduction sequence. Five morphological aspects of blanks are hypothesized to more or less dictate performance—flake size, length of cutting edge, angle of cutting edge, ventral curvature, and overall robusticity. Raw material economy and technological knowledge are proposed as the primary constraints influencing the choice of reduction strategy. Based on these constraints, several hypotheses are developed that are argued to potentially explain the advantages of employing a Levallois reduction strategy and the circumstances under which these operate.

These hypotheses are tested through the analysis of blank selection patterns for tool-making at three French Middle Paleolithic sites in the Southwest (Pech de L'Azé IV, le Moustier, and Combe Capelle Bas) and one in the Southeast (Jiboui). The analysis begins by comparing the attributes thought to control performance in the morphologies of used vs. unused flakes. Sandgathe concludes that selection, in fact, does appear to have been based on all of the hypothesized attributes except ventral curvature. In addition, the selection of specific attributes varied depending on the conditions of the site.

The analysis then considers how blanks produced by various reduction strategies from each of the assemblages might satisfy the selection criteria that appear to have been in place. The four classes of blanks considered include central Levallois flakes, peripheral Levallois flakes, *éclats débordants*, and amorphous flakes. By comparing the characteristics of the technological products to the characteristics of those blanks chosen for use, Sandgathe concludes that Levallois products, as well as the products of similar reduction approaches, possess functionally advantageous morphologies. The most significant attributes appear to be greater average size, a high number of usable edges per flake, and decreased robusticity. A more general conclusion of the study is that Levallois technologies would offer important advantages under conditions of restricted access to raw material.

The basic questions explored in this study are rooted in evolutionary ecology in that they seek to investigate the ways in which the adoption of the Levallois technique can be considered an adaptive strategy pursued by Middle Paleolithic humans. In this sense, the research employs high-level theory that is closely aligned with an Americanist approach to lithic technology. Likewise, one of the great strengths of the work that Sandgathe presents in this book and elsewhere (Sandgathe 2004) is that it approaches Middle Paleolithic core reduction strategies from the perspective of the overall organization of technology (*sensu* Nelson 1991). Specifically, this is achieved by expanding the focus of investigation beyond classic Levallois products (*sensu* Bordes 1961) to include the significance of products such as *éclats débordants*. In fact, this book may represent the most thorough investigation of the functionality of *éclats débordants* yet published.

Most of the problems from which this study suffers, however, relate to the precision with which types of flaking products (i.e., blanks) are defined and the degree to which they can be assigned accurately to specific reduction strategies—issues that have been the focus of considerable archaeological debate (e.g., Boëda 1994: 262-265; Dibble 1989; Marks and Volkman 1983). Because blanks are the study's primary unit of analysis, these obstacles could present significant challenges to the conclusions. Two of the four blank types considered by Sandgathe are particularly problematical and deserve some discussion. These are "*éclats débordants*" and "peripheral Levallois flakes."

Throughout the book, Sandgathe maintains that *éclats débordants* are widely recognized as a product of discoidal technologies. However, many key studies of Levallois technology describe *éclats débordants* as a far more general class of blanks which can be produced by both discoidal and Levallois techniques (Boëda 1988, 1993, 1994; Boëda et al. 1990; Debénath and Dibble 1994; Meignen 1995). A simple definition of these artifacts could be "flakes whose lateral margin removes an edge of the core." Because a technological understanding of this blank type is necessary to follow the logic of several of the arguments being presented throughout the book, it would have been better if Sandgathe had made more explicit his reasoning for associating

éclat débordants with a discoidal reduction system. A diagram (Figure 2.4) tries to clarify this somewhat, but it is not effective. Illustrations of the artifacts that were classified as *éclats débordants* following standard conventions (*sensu* Addington 1986) might have helped clarify this issue, but only undiagnostic photographs are provided (Plates 1-3).

Peripheral Levallois is a second tenuous class of blanks considered in the study. Sandgathe defines these in the following way:

> If its shape and dorsal scar configuration indicate that it comes from the periphery of the face of the core and it includes a significant portion of the peripheral edge of sub-circular shaped, single-surface core then it is considered a centripetal or peripheral Levallois flake (see Van Peer 1992) or potentially a more generic disc core flake (p. 83).

Here again, as was the case with the *éclats débordants* class, this type potentially includes both Levallois and discoidal products. As well, this class would seem to include several forms of *éclats débordants*.

These techno-typological issues limit the study in that they prohibit the examination of Levallois core reduction as a discrete phenomenon, which is a stated objective of the study. Instead, what is actually being examined is a greater class of blanks which includes the products of all variants of Levallois and discoidal technologies. While there may be some evidence that these technologies are related (Baumler 1988; Lenoir and Turq 1995), many researchers believe that they are technologically divergent enough to warrant individual consideration. This is not only because they are organized differently volumetrically (Boëda 1993), but also because they represent different levels of curation and are likely to have different costs and benefits (Brantingham and Kuhn 2001; Dibble 1997). Regardless of what position one takes on the relatedness of Levallois and discoidal technologies, the system employed to type blanks in this study clearly masks potentially significant technological variability. Moreover, while one of the primary conclusions of the book is that several of the advantageous morphological aspects of Levallois products are found in similar technologies, this seems to be more of an assumption inherent in the system used to type blanks than it is an actual finding.

Other problems arise from the basic methodology of design theory itself. First, the identification of possible constraints on lithic technologies, which serve as the foundation for the hypotheses tested in the study, is a function of what is known about Middle Paleolithic human adaptations. Likewise, Sandgathe's predictions about optimal tool design rely almost entirely on taphonomically complicated use-wear data which indicate that stone tools were primarily used in the Middle Paleolithic for woodworking and butchery. However, these are the same conclusions reached by use-wear studies of Lower Paleolithic assemblages where Levallois was not common (Shea 2006). Therefore, these use-wear data do not inform on how Levallois products can be considered *uniquely* designed for these purposes.

Second, even if it were possible to unequivocally assign a flake exhibiting use-wear to a certain technology, this does not mean that they were actually *designed* for that purpose. This would seem to be supported by the fact that among each of the blank classes analyzed by Sandgathe, the overall frequency of used and/or retouched "amorphous" blanks was higher than any other blank class (pp.126–130). Importantly, selection of a flake for retouch or use can take place long after a flake was produced, to judge from the not infrequent occurrence of retouch scars bearing younger patination than the remainder of the flake. Therefore, while one of the primary goals of the study is to evaluate the adaptive significance of the Levallois reduction strategy, the behavior being examined is simply blank selection patterns. To consider this aspect of behavior indicative of the entire flintknapping strategy is to reify the existence of a "desired end-product," which may or may not be an emic goal regardless of any etic validity (i.e., the Ford (1952) vs. Spaulding (1953) debate).

Third, in assessing the role of sociality in Levallois technological knowledge, Sandgathe seems to discount the role of social learning. This conclusion runs counter to an enormous body of ethnographic data on how individuals acquire technical skills (e.g., Wiessner 1983, 1984; see also references in Shennan and Steele 1999) and even studies of modern flintknappers (Whittaker 2004) suggesting that complex tasks (such as the production of Levallois flakes) are most effectively transmitted in social contexts.

There are also issues with the overall production quality of the book. The bibliography could have been more thorough, particularly for work done by French technologists. Specifically, strategic placement of such citations may have helped clarify the source of Sandgathe's understanding of *éclats débordants*. As well, while the book contains numerous graphs and tables which are all very clear and rich with data, schematic representations of reduction sequences and the photographs of the artifacts are unclear. And as previously mentioned, the book also might have benefited from the inclusion of artifact illustrations. Typographical errors exist, but none compromise the readability.

Despite these criticisms, readers interested in Levallois technology are likely to find many of the ideas presented by Sandgathe to be insightful and thought-provoking. Because none of the assemblages considered in the study have any significant Levallois point component, it is uncertain if the findings would be germane to work being done in regions such as the Levant where there are higher frequencies of such artifacts during the Middle Paleolithic than there are in Western Europe. The book additionally will be of interest to those researchers more generally studying Middle Paleolithic stone tool technology.

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