Conclusion

The flake and core assemblages found at Globe Pit, Grays previously described by Wymer as Clactonian, contains a small number of non-classic bifaces and biface thinning flakes which appear to form an integral part of the assemblage. Can this site still be regarded as Clactonian?

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A REEXAMINATION OF THE BRITISH BIFACE DATA

Shannon McPherron
Department of Anthropology, Bishop Museum, 1525 Bernice Street, Honolulu, HI 96817

Introduction

During the 1960s, Roe (1964, 1968) both defined a new way of measuring biface morphology and, as a result, our current understanding of morphological variability in Lower Paleolithic bifaces of Great Britain. Roe's empirical method resulted in the discovery of a bimodal distribution, at the assemblage level, in one aspect of biface shape. Roe then organized the British assemblages into the Ovate and Pointed Traditions based on this bimodal patterning. The pattern itself has since been verified by others with more powerful statistical techniques (Doran and Hodson 1975, Callow 1976). Its meaning, however, has remained unclear. At the time, Roe thought that it might reflect chronological change in preferred biface shapes. The lack of well dated sites made this hypothesis difficult to test, though the site of Swanscombe provided some stratigraphic support. Better dates now exist, and it has become clear that the chronological hypothesis is unsupportable (cf. Ashton et al. 1992). Roe (1981) has also suggested that there are possible functional differences between the two groups though this hypothesis remains untested.

New studies have explicitly de-emphasized the importance of traditional stylistic and functional modes of explanation and instead focused on the role of raw materials (Ashton and McNabb 1994; White 1995) and intensity of bifacial reduction (McPherron 1994) in structuring these assemblages. Ashton and McNabb (1994) argue that the shape of the nodule or flake blank has an important and previously understated role in determining biface shape. Thick, long, and narrow nodules, for instance, lend themselves more easily to pointed forms than rounded forms. On the other hand, in instances where the raw material is judged to be more neutral, lending itself equally to an ovate or pointed form, ovates seem to have been manufactured. As a result, both Ashton and McNabb (1994) and White (1994) argue that ovate bifaces were the preferred shape presumable because they maximized the functional utility of the piece.

This paper emphasizes the complimentary role of reduction intensity in structuring the variability documented by Roe. It will be argued that this variability is in very large part due to differences in the intensity of bifacial reduction at these sites. This hypothesis is based on studies of Acheulian assemblages in northern France that show a strong relationship between all measures of shape and a single measure of biface size, namely tip length, where tip length is defined as the distance from the point of maximum width to the tip (McPherron 1994). While the upper limit on tip length is constrained in large part by raw material size, variability in tip length is attributable to the intensity of bifacial reduction. The same patterns are demonstrable at the assemblage level in the British data, and in this regard, the British biface assemblages fit a pattern documented for biface assemblages throughout the Old World (McPherron 1994).

Though Roe did not divide biface variability into a large series of types, as did Bordes (1961), the fundamental framework underlying Roe's analysis is still essentially typological in its emphasis on two presumably preferred forms: pointed and ovate. As we will see, while a great deal of variability is evident early in Roe's description and analysis, it is eventually lost as the numbers are boiled down to these two types. One is left with the distinct impression that British assemblages consist of varying proportions of pointed and ovate bifaces and that these were the preferred or intended forms. If so, then the key to understanding British biface variability would be in explaining why pointed bifaces were preferred in some instances over ovate bifaces and in other instances were not. Roe, however, never demonstrated the presence of two biface types in Britain. Rather, he demonstrated the presence of two assemblage types based directly on the relative location of the maximum width and only indirectly on the edge shape. When we look at edge shape variability within an assemblage the picture that emerges is one of continuous variability, and despite the bimodality at the assemblage level, the continuity and overlap between assemblages is remarkable.

Roe's methodology

To better understand these points it is worth revisiting Roe's method and data. Roe divided morphological variability along three separate axes using shape ratios computed from caliper measurements. Besides the standard length, width and thickness measurements, Roe added a number of other measurements (Figure 1). First, Roe measured the distance from the base to the point of maximum width, which will be referred to here as the base length. Next, Roe measured both the width and thickness at the tip. At the tip, in this case, is defined as back one-fifth the length of the biface away from the tip. These measures will be referred to as tip width and thickness. Lastly, Roe also measured the width and thickness at the base. Again, at the base is defined as back one-fifth the length away from the base.

Five of these eight measurements are used to calculate three ratios describing biface shape. The first of these describes the relative location of the maximum width and is calculated as the ratio of the base length to the total length. Roe's second ratio expresses the edge shape or pointedness as the ratio of the tip width to the base width. Lastly, Roe measured elongation as the ratio of the width to the length. Rather than using these three ratios to establish biface types (Bordes 1961), Roe preferred a graphical approach to describing variability in biface shape. Given the difficulty of presenting the three shape ratios in a single graph, Roe set arbitrary intervals of the relative location of the maximum width to create three separate graphs of edge shape to elongation

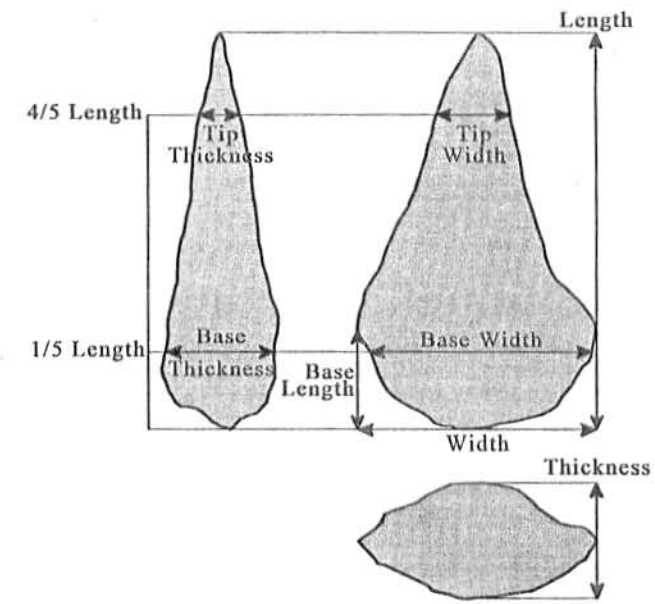

Fig. 1. Roe's measurement system for bifaces.

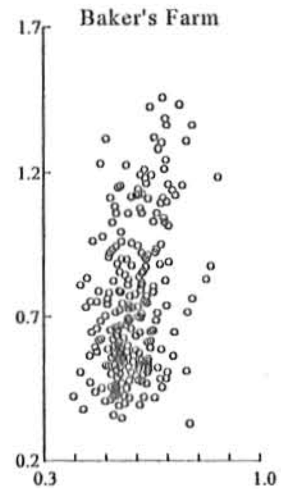

Fig. 2. Baker's Farm bifaces graphed using Roe's tripartite system.

(Figure 2). Roe called this a tripartite system of representation.

In each of these three graphs, relatively narrow bifaces group to the left while broader ones group to the right. Bifaces with broad tips and narrow bases cluster towards the top of each graph, while those with narrow tips and broad bases cluster towards the bottom. The graph to the left includes only bifaces where the relative location of the width exceeds 0.550. Next, the middle graph includes bifaces with a relative location of the width in excess of 0.350 but still less than 0.550. Lastly, the graph to the right includes all remaining bifaces where the relative location of the width is close to the base.

When 38 British biface assemblages (see Roe 1968) were presented in this way, Roe noted a recurrent pattern in the three graphs. In each assemblage, points on the right hand graph tend to cluster lower than points on the middle graph which in turn tend to cluster lower than points on the left hand graph. In other words, the edge shape ratio and the relative location of the maximum width are directly related. When the maximum width occurs near the base, the biface tends to be pointed. When it falls closer to the middle the biface tends to be more rounded. And when it is closer to the tip than the base, the biface is more likely to be classified as a cleaver. Hence, Roe labeled bifaces on the right graph as pointed types, bifaces on the middle graph as ovate types, and bifaces on the left graph as cleaver types.

Next, Roe noted the percentage of bifaces falling into each of these three categories. Interestingly, the distribution of ovate and pointed types formed a bimodal distribution across Roe's 38 assemblages. In other words, there is a fairly clear distinction between assemblages dominated by ovate types on the one hand, and assemblages dominated by pointed types on the other, with only a few assemblages falling between the two. Roe settled on 60 percent as the threshold for determining whether an assemblage should be assigned to either the Ovate or Pointed Tradition. Assemblages in which neither the pointed or ovate types dominate were considered Intermediate. While the tripartite system left open the theoretical possibility of an assemblage dominated by cleavers, no such assemblage existed in Roe's data set.

Roe's traditions, however, despite their names, are not based on edge shape. Rather, they are based directly on the location of the maximum width relative to the length, which is another way of saying the base or tip length relative to the length since the location of the maximum width separates the base from the tip. The extent to which the bifaces of each tradition do maintain a particular edge shape is entirely dependent on a correlation between edge shape and the relative location of the maximum width. Regression analysis shows that, in fact, these two variables are highly correlated ($R=0.913$, $R^2=0.833$, $N=38$) (Figure 3). Likewise, within each assemblage, when the edge shape ratio is compared between the ovate, pointed and cleaver types (Table 1), in all but two instances, there is a significant difference in the edge shape of each type. Bifaces with a low relative location of the maximum width are statistically more likely to be pointed as measured by the tip width relative to the base width.

An important point to note is that while Roe's data suggest a bimodal distribution in edge shape between assemblages, there is no indication that this pattern is replicated within an assemblage. In other words, while a line can be drawn between pointed assemblages and ovate assemblages in this sample of 38, there is no evidence that within an assemblage a line can be drawn between pointed and ovate bifaces. Demonstrating the absence of a pattern in 38 assemblages is not altogether straightforward. One possible approach, however, is to collapse the three graphs into a single graph (Figures 4 through 10, cf. Bar-Yosef and Goren-Inbar 1993). Symbols are not used to distinguish the three biface types to emphasize the point that when these three graphs are combined into one the distribution of the pointed, ovate and cleaver types merge into one large scatter of points. In other words, Roe's division of the base length to total length ratio into three groups does not appear to match any patterning in the data themselves at the assemblage level. Sites differ from one another on average, but biface types blend into one another. While an argument can be made for distinct assemblage types, the data do not indicate that these assemblage types correspond to distinct biface types. There are simply no data to support the notion that ovate and pointed shapes are distinct biface types. Rather, in each assemblage, there is modal shape with continuous variability to either side.

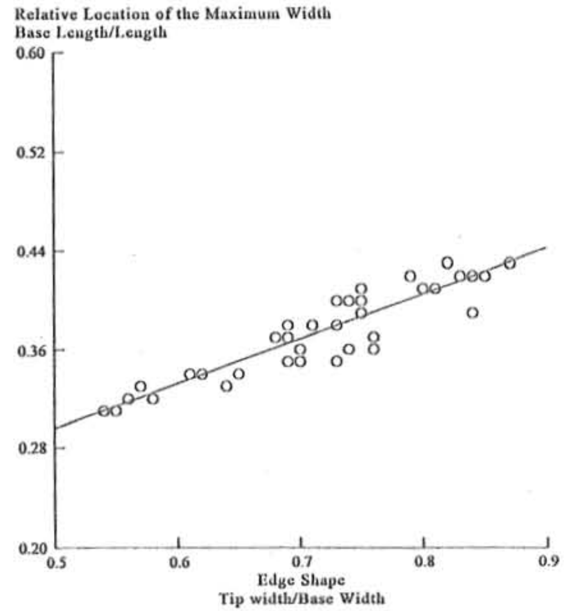

Fig. 3. Average edge shape to relative location of the maximum width in Roe's 38 assemblages ($R=0.913$, $R^2=0.833$).

	Edge Shape		
	Statistic	P	N
Gaddesden Row	*t*=-2.089	0.043	45
High Lodge	*t*=-3.434	0.001	66
Warren Hill Fresh	F=68.299	0.000	627
Highlands Farm	F=32.991	0.000	194
Croxley	*t*=3.002	0.005	37
Caddington	*t*=4.609	0.000	33
Corfe Mullen	*t*=-3.009	0.004	43
Holybourne	n.d.		
Warren Hill Worn	F=26.419	0.000	114
Allington	*t*=5.307	0.000	54
Bowman's Lodge	*t*=1.280	0.212	28
Tilehurst	*t*=4.230	0.000	91
Elevden	*t*=5.210	0.000	71
Farnham Terrace A	*t*=-3.765	0.001	39
Round Green	n.d.		
Oldbury	*t*=1.003	0.324	30
Caversham	*t*=8.144	0.000	149
Swanscombe U.L.	*t*=4.014	0.001	18
Knowle Farm	F=66.149	0.000	448
Broom	F=74.329	0.000	171
Santon Downham	t=7.933	0.000	99
Barton Cliff	*t*=9.169	0.000	108
Fordwich	F=74.580	0.000	192
Stoke Newington	*t*=6.941	0.000	59
Baker's Farm	F=175.389	0.000	234

Table 1. cont. on next page.

	Edge Shape		
	Statistic	P	N
Great Pan Farm Pit	*t*=5.379	0.000	44
Wallingford	*t*=7.544	0.000	99
Foxhall Road	*t*=8.644	0.000	74
Twydall	*t*=5.224	0.000	53
Cuxton	F=53.987	0.000	160
Whitlingham	F=111.927	0.000	142
Hitchen	*t*=8.385	0.000	79
Dovercourt	*t*=8.122	0.000	164
Fruze Platt	F=290.791	0.000	460
Hoxne	t=7.322	0.000	109
Chadwell St. Mary	*t*=7.686	0.000	98
Swanscombe M.G.	*t*=9.163	0.000	157
Wolvercote	*t*=3.888	0.000	46

Table 1. By assemblage, statistical comparison of edge shape between cleaver, ovate and pointed biface types as defined by relative location of the maximum width.

Reducing variability in biface shape to a single percentage has the effect of hiding variability. While the average value of the relative location of the width ratio does show a bimodal distribution, when these same data are presented along with their standard deviations (Figure 5), it is clear that there is considerable overlap between assemblages when variability within each assemblage is acknowledged. In this figure, only the Swanscombe Middle Gravels stand apart from the rest. The bimodality, in other words, is a result of slightly more assemblages falling at either end and not in the middle and not a result of an actual gap in the numbers. As the figure clearly demonstrates, there are assemblages of every type between the extremes of Gaddesden Row and the Swanscombe Middle Gravels. While it is possible to draw a line between assemblages dominated by pointed bifaces and assemblages dominated by ovate bifaces, at the interface between the two traditions, the assemblages of each type are hardly distinguishable.

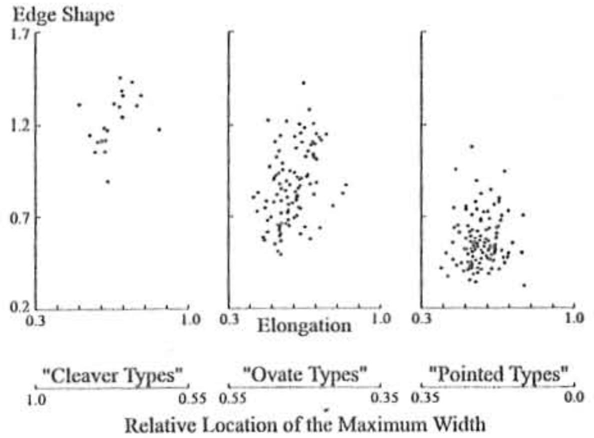

Fig.4. Tripartite diagram for Baker's Hole showing the cleaver pointed and ovate biface types combined on a single graph.

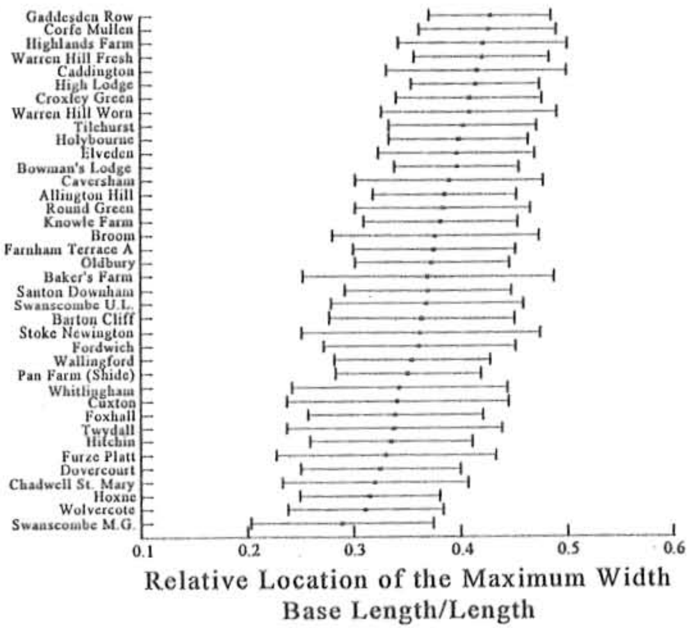

Fig. 5. Relative location of maximum width with one standard deviation error bars for Roe's 38 assemblages.

A reduction model

Given these patterns, it is clear that an explanation of variability in British bifaces must emphasize factors which will result in a continuity of form rather than distinct biface types. Such an explanation is possible when we consider the relationship between size and shape in the bifacial reduction strategy. Repeatedly resharpening a biface edge or repeatedly removing flake blanks from a biface will obviously diminish its size. However, depending on the goals of the reduction strategy, measures of size such as length, width and thickness may be affected differentially resulting in a change of shape. If maintaining a consistent shape is important then care must be given to reducing length, width, thickness and the relative size of the tip and the base at a constant rate. On the other hand, if factors such as the length of the bifacial edge and the edge angle are important, then these measures may decrease at very different rates. As a result, shape will gradually change as a function of reduction intensity.

The relationship between size and shape, however, is unclear. In nearly all studies of biface shape, whether it is explicitly acknowledged or not, size is generally viewed as a variable which must be controlled for or removed from analysis (cf. Wynn and Tierson 1990). Roe, like nearly everyone else who has looked at biface variability, focused on relationships between various measures of shape. By converting his measures of size into shape ratios, Roe removed the effect of biface size from his analysis. For instance, rather than comparing the average biface width between two assemblages, the width is first divided by the length to create an elongation ratio which has the effect of scaling the width relative to a standardized length. In this way it can be determined whether the large bifaces of one assemblage are, relatively speaking, broader than the smaller bifaces of another assemblage.

When variability in size is attributed solely to variability in locally available raw materials, its behavioral importance is minimized. Size, however, is affected not only by available raw materials but by the intensity of bifacial reduction. The importance of this latter factor in structuring assemblage variability has only recently been acknowledged in Old World lithic studies (Dibble 1984, 1987a, 1987b; Baumler 1988; Cahen et al. 1979; Holdaway 1991) though it has been discussed in New World lithics for some time (Frison 1968). A number of studies on New World bifaces, for instance, have shown a relationship between reduction intensity, as measured by size, and morphology (Bradley 1974; Goodyear 1974; Hoffman 1985). In many cases, biface types which were previously assumed to be quite distinct were shown to be stages in the reduction of a single biface type.

Since overall biface size is affected by both raw material size and reduction intensity, it makes it difficult to judge the relative contribution of each. One approach to this problem is to make a rather radical simplifying assumption that all nodules or flake blanks worked into bifaces were of identical size. If this were true, then the standard measures of size, such as length, should reflect the intensity of bifacial reduction. The extent to which this assumption is violated makes it more difficult to show a relationship between size and shape. Another, less radical, approach to separating the double contribution of raw material size and reduction intensity to biface size is to focus on a more narrowly defined aspect of biface size with a larger behavioral component. The reduction model presented here looks at the tip, defined as the portion of the biface above the location of the maximum width, since it is this portion of the biface that seems to be the focus of bifacial reduction. Bifacial reduction certainly begins with the tip, almost by definition, and nearly all bifaces, with the exception of cleaver types not considered here, have a tip clearly identifiable by its reduced width and/or thickness. The distinction between the tip and the base is more difficult on some perfectly ovate bifaces where the location of the maximum width is at the midpoint of the biface, but even in these instances the reduction of the base does not exceed the tip otherwise the base would almost certainly become the tip. With the focus of bifacial reduction on the tip, the size or length of the tip will be a good reflection of the intensity of reduction, as it does with New World bifaces (Bradley 1974). In other words, given two bifaces made from similar raw materials, the biface with the shorter tip length is said to be more reduced. Clearly, the maximum tip length is limited by raw material size, but within this constraint it is free to vary.

The implications of the reduction model for biface variability are quite clear. If biface shape is a byproduct of bifacial reduction rather than the intended product, then we should expect to see shape vary with reduction intensity. If, on the other hand, maintaining a particular biface shape is important, then we should expect to see shape remain constant despite variation in the reduction intensity. Given that tip length is a measure of reduction intensity, the reduction model predicts that shape will vary along with tip length. As tip length decreases the shape will change in a predictable way. The extent to which is does not will invalidate the reduction model. It is very important to note in this context, that large variations in nodule size will make it more difficult to show a pattern between shape and reduction intensity as measured by any aspect of size. Short tip lengths in one assemblage where large raw materials were available may indicate substantial reduction while in another assemblage where smaller raw materials were available it may indicate very little reduction. In this regard, it is better to test the reduction model within an assemblage or a small region where the range in raw material sizes will be less.

The reduction model is not affected by the debate over whether bifaces were tools, cores or both. If they were tools, then we can argue that their edges would dull from use and need to be resharpened periodically. It is far more efficient to resharpen an existing bifacial edge than it is to fabricate a new one. However, at some point the biface would be cast aside in favor of another with edges more easily resharpened. On the other hand, if bifaces served as cores, then we would certainly expect them to be reused until they no longer provided suitable flakes. The factors influencing its eventual discard in this case probably

have to do with the size of the flakes being removed and the difficultly of achieving a proper platform for new removals. The important point is that the focus of bifacial reduction strategy was on achieving a bifacial edge, not a biface of a particular shape (Hayden 1989; Ashton and McNabb 1994; White 1995). Once a bifacial edge was achieved, expedience and efficiency in the bifacial reduction strategy (Ashton and McNabb 1994; White 1995) would mean that the edge could be reused and reworked repeatedly before the biface was finally abandoned (Austin 1994).

Results

Fortunately, testing the reduction model is quite easy since Roe's standard suite of measurements included the base length. Tip length, the variable used in this analysis, is simply calculated as the length minus the base length. For this examination of the relationship between reduction intensity and biface morphology, it is worth updating Roe's data set to reflect more current work with these assemblages. For this we turn to Callow (1976) who reexamined Roe's assemblages as well as several others from Britain and a great many from the Continent. Callow's British data set differs from Roe's in several ways. To Roe's original sample, Callow added one more Pointed assemblage (Keswick) and several more Ovate assemblages (Rickson's Pit, Corfe Mullen - Sleight Pit, Ballist Pit rolled, and Ballist Pit fresh). Callow also broke some of Roe's original assemblages into several assemblages based on whether the bifaces were fresh or rolled (Highlands Farm, Corfe Mullen - Cogdean Pit, Furze Platt). Lastly, Callow dropped Oldbury and Shide from the list of Acheulian assemblages and dropped the Caversham Ancient Channel assemblage entirely because it probably represents a mixture of several assemblages. As a result, there are 43 assemblages in Callow's data set which have been classified as belonging to either the Ovate or Pointed tradition as defined by Roe.

	R	P	N
Edge Shape to Tip Length	-0.393	0.009	43
Elongation to Tip Length	0.758	0.000	43
Relative Location of the Max. Width to Tip Length	-0.542	0.000	43
Refinement to Tip Length	-0.490	0.001	43

Table 2. Regression of tip length to Roe's shape ratios using Callow's (1976) British Acheulian assemblages.

The most straightforward way to test for a relationship between tip length and shape is with regression analysis. The reduction model predicts that there will be a relationship between shape and reduction intensity as measured by tip length, whereas in the traditional model shape will be independent of tip length. When tip length is regressed against Roe's three principle axes of morphological variability plus refinement (maximum width/maximum thickness), the results are clear (Table 2). In each case, shape is highly correlated with tip length. The direction of these correlations is such that assemblages with long tip lengths are characterized by elongated, thick, pointed bifaces, and assemblages with short tip lengths are characterized by broad, thin, rounded bifaces.

	Tip Length	Edge Shape	Refinement	Elongation
Ovate Tradition (N=24)	67.065 (12.235)	0.771 (0.061)	2.200 (0.322)	1.595 (0.164)
Pointed Tradition (N=15)	78.907 (10.235)	0.648 (0.080)	2.039 (0.166)	1.655 (0.077)
t statistic	-3.257	5.069	2.050	-1.552
Probability	0.003	0.000	0.048	0.130

Table 3. Tip length, edge shape, refinement, and elongation between the Ovate and Pointed Traditions.

Since Roe's traditions are based on the relative location of the maximum width and since this ratio varies with tip length, it follows that tip length should also vary significantly between traditions. A Student's *t*-test shows that in fact tip length is significantly different between the two traditions (Table 3). Assemblages of the Ovate Tradition have on average shorter tips than assemblages of the Pointed Tradition. It is no surprise that edge shape also varies significantly between the traditions since it is the focus of Roe's work, but Roe's approach makes no predictions about any correlation between the traditions and either elongation or refinement. It follows from the data presented here, however, that the traditions should also differ in terms of elongation and refinement. In the case of refinement, there is a significant difference between the two (Table 3). On average, assemblages of the Ovate Tradition are more refined than assemblages of the Pointed Tradition. The data for elongation also show a difference in the expected direction, though in this case the difference is not statistically significant. Ovate assemblages are characterized by broader bifaces than Pointed ones.

Another way to look at these patterns is to reorganize the British

assemblages arbitrarily into two groups based not on shape, as Roe has done, but on the median tip size. When this is done (Table 4), all of the basic measures of size and shape are statistically different between these two groups. While it is not surprising that bifaces with long tips are overall longer than bifaces with short tips, a priori there is no reason why bifaces with longer tips must be wider, thicker, more elongated, less refined and more pointed than bifaces with shorter tips. The fact that the British biface assemblages do follow this common pattern speaks to a common biface reduction strategy. The important point of this analysis is that when the British assemblages are organized along the axis of tip length a model based on raw materials and reduction intensity can explain differences in shape.

	Long Tip Bifaces N=22	Short Tip Bifaces N=21	*t* statistic	Probability
Length	127.355 (13.640)	102.195 (8.241)	7.358	0.000
Width	75.695 (5.577)	67.105 (5.545)	5.064	0.000
Thickness	41.023 (5.711)	32.419 (3.978)	5.753	0.000
Elongation	1.685 (0.133)	1.531 (0.087)	4.490	0.000
Relative Location of the Maximum Width	0.360 (0.026)	0.395 (0.034)	-3.805	0.001
Edge Shape	0.688 (0.066)	0.758 (0.093)	-2.829	0.008
Refinement	2.053 (0.259)	2.266 (0.255)	-2.717	0.010

Table 4. A comparison of size and shape measures between two groups of British assemblages based on median tip length.

Discussion

This analysis has shown that morphological variability in Roe's biface assemblages can be fairly neatly organized along one axis, namely tip length.

Assemblages with shorter tip lengths tend to have more rounded, less elongated and more refined bifaces than assemblages with longer tip lengths. If we can attribute variability in tip length to variability in raw materials and the intensity with which they are reduced, then we have explained in large part variability in biface shape. In this perspective, Roe's Ovate Tradition assemblages differ from the Pointed Tradition assemblages primarily because the bifaces of the former were more intensely reduced.

This conclusion is supported by the recent work of White (1994) on some of these same assemblages. White finds that ovate bifaces are generally made from larger, more regularly shaped nodules from chalk deposits while pointed bifaces are more likely to be made from smaller, more irregularly shaped nodules found in gravel terraces. In his analysis, White finds an inverse correlation between the percentage of cortex and the frequency of ovate bifaces which he interprets as "support [for] the contention that many ovate bifaces were intensively reduced from larger nodules." A correlation between the percentage cortex, any measure of size, tip length and shape has also been demonstrated at Cagny-la-Garenne (McPherron 1994). The principal drawback to using cortex as a measure of reduction intensity, however, is that it stops being a discriminating measure once the piece is completely decortified, whereas tip length measures reduction intensity throughout.

There are good indications in White's data for a correlation between the distance to raw material sources and shape. Sites located on gravel terraces seem to be dominated by pointed forms, while sites without an apparent immediately available raw material source tend to be dominated by more ovate forms. Furthermore, his analysis indicates that often where ovate bifaces are found in association with pointed bifaces made from terrace gravels, the ovates have been transported into the site. The same general pattern is true of northern France where sites such as Gouzeaucourt (Tuffreau and Bouchet 1985; Tuffreau 1987:323-330; Marcy 1989; Lamotte 1992) and Longavesnes (Ameloot-Van der Heijden 1991) located on high plateaus away from river gravel deposits are characterized by highly reduced ovates whereas sites such as Cagny-la-Garenne and Cagny-l'Epinette (Tuffreau 1978, 1987; Tuffreau et al. 1982) located in the Somme Valley on river terraces rich in immediately available raw materials are characterized by lightly reduced pointed forms (McPherron 1994). Better raw material studies, however, are still needed on the assemblages from northern France before they can be integrated with White's results.

While the reduction model can explain the range of edge shapes in the British biface assemblages, it does not explain why there is a bimodal distribution in edge shape. One possibility comes from Ashton and McNabb's (1994) raw material studies. They argue that in some instances the shape of the raw material lent itself easily to a pointed biface but virtually prevented the manufacture of an ovate biface. In other words, the shape or size of the nodule halted the reduction process at an early stage preventing a gradual move from pointed to ovate forms as the reduction intensity increased. Without this

constraint, average edge shape might be normally distributed across Roe's assemblages, but with this constraint, a second peak is added to the curve where raw materials prohibit further reduction. It is puzzling, however, that this pattern is apparently not visible at the assemblage level. In an assemblage with a mix of both pointed and ovate forms, one would expect to see a similar bimodality. There is currently absolutely no evidence in support of such.

On the other hand, it has been emphasized here and elsewhere (Ashton and McNabb 1994) that despite the small discontinuity in the distribution of the relative location of the maximum width ratio, the overall picture is one of extreme continuity with a great deal of overlap between assemblages. It seems quite possible that the bimodality that Roe observed is simply an artifact of the British data set. It would be very interesting to have more assemblages from immediately adjacent areas of the Continent typed using Roe's approach (cf. Callow 1976, 1986). In all likelihood the bimodality would disappear in much the same way as Bordes' Mousterian facies started to blur into one another once more assemblages were typed using his method (Dibble and Rolland 1992). It is already clear, that the patterns of variability documented here for the British data set are the same ones found throughout the Old World (McPherron 1994).

Conclusions

In the three decades since Roe's original publications outlining the nature of morphological variability in the Acheulian of Britain, the data have remained essentially the same and the level of explanation has not advanced beyond the traditional areas of style and function. Recently, however, methodological advances in other areas of Paleolithic research have spilled over into this area and resulted in a number of new studies. These studies have focused on the role of raw materials (Ashton and McNabb 1994; White 1994) and reduction intensity (McPherron 1994) in structuring the variability that Roe outlined. While we weigh the relative contributions of these variables, one conclusion is clear. Acheulian variability cannot be addressed by simply comparing average biface morphology between sites. Since shape is a function of the raw materials and the intensity of reduction, we must compare reduction strategies instead. In other words, to answer the larger questions about Acheulian variability, we must look for similarities and dissimilarities in process and not in final form. We need to focus more on the way bifaces were made and less on the particulars of which bifaces were actually made.

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