Experimental Evaluation of the Levallois "Core Shape Maintenance" Hypothesis

by

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INTRODUCTION

Dennis Sandgathe (2004) has proposed a novel interpretation of preferential, lineal, and recurrent Levallois reduction, namely,

> ...that the removal of the larger central flakes... was predominately a core maintenance technique intended to mitigate the problem of the increasing convexity and central mass of the surface of Levallois (and other types of single-surface cores). Unless this tendency is addressed, it will prevent the maintenance of consistent core morphology throughout the course of reduction. (Sandgathe 2004:147).

He further suggests (p.157) that experimental flintknapping might serve to test the proposition. Here we describe knapped preferential Levallois reductions following his depiction of the proposed sequence (p. 155, Figure 4). We demonstrate that removal of a Levallois flake becomes increasingly difficult as his proposed reduction proceeds. We also show that a knapper can easily maintain consistent morphology of the core without removing any central Levallois flakes. This may be done by carefully managing the bifacial edge of the core.

Following Bradley's (1977) terminology (Figure 1), we define the *ventral face* of a Levallois core as the face from which predetermining flakes are detached, thus we call the predetermining flakes themselves *ventral* flakes. We define the *dorsal face* of the core as the face upon which a knapper creates platforms for the subsequent removal of ventral flakes. Flakes removed from the core's dorsal face are thus called *dorsal* flakes. The ventral and dorsal faces of the Levallois core are also sometimes known as the "upper" and "lower" surfaces, respectively. Following current conventions (Boeda 1995), we refer to the large detached central flake as the *preferential Levallois flake.*

The toolstone used for our Levallois replications is a greensand silicate procured from the Cretaceous cliffs at Seaton on the Devon coast, U.K. Each Levallois reduction was knapped from a large flake blank, which had been previously knapped from even larger blocks collected at the coast. Following current interpretations of Levallois knapping (e.g., Boeda 1995), we applied only direct percussion with hard hammerstones.

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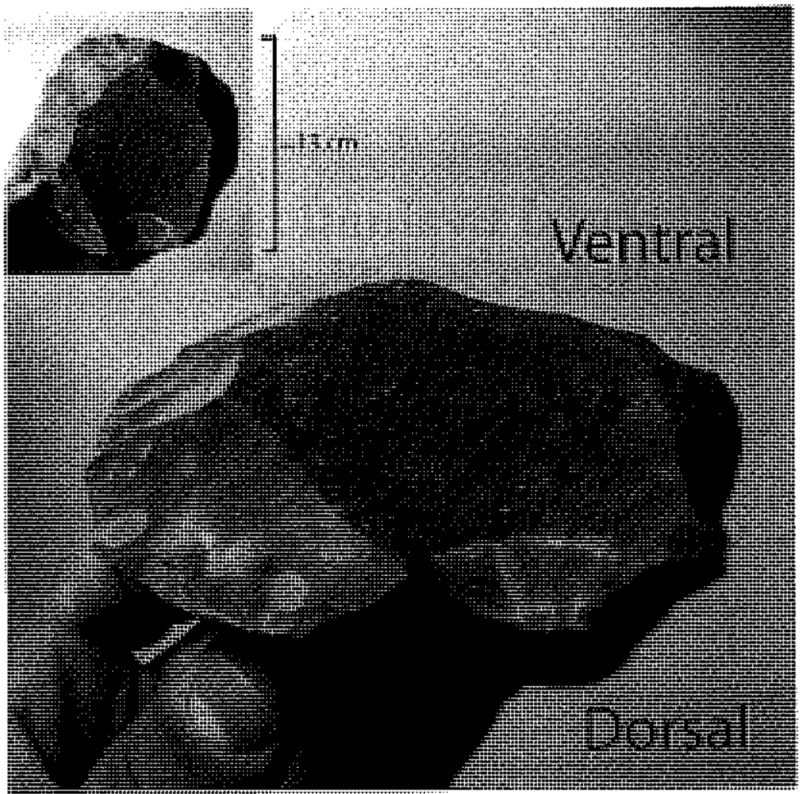

Figure 1. A preferential Levallois core replicated by Eren. The face from which the preferential Levallois flake is detached is called the ventral face. The opposing face is called te dorsal face.

Table 1 presents descriptive data for the three large flake blanks used for each reduction, to be described in the following sections. We stress here that we are evaluating only preferential Levallois reduction against Sandgathe's proposition. Other Levallois reduction sequences may exploit the ventral face of the core differently, though this assertion needs to be experimentally verified.

REPLICATING SANDGATHE'S PREFERENTIAL LEVALLOIS REDUCTION SEQUENCE

If preferential Levallois flake removal does indeed maintain the shape of the core by "mitigating" the increasing central mass, then, as Sandgathe (2004: 155, Figure 4) depicts, there would be no need to manage the bifacial edge by removing dorsal flakes. To test this proposition, one of us (Bradley) prepared a convexity on large flake blank #1 (Figure 2a-b). Next, a preferential Levallois flake was detached. The resulting preferential Levallois flake was not long, wide, nor thick enough to reduce the central mass of the core (Figure 2c). Because of this, another preferential Levallois flake was immediately prepared for the next flake removal, one that adequately removed the central mass of the core (Figure 2d). Then, as Sandgathe's Figure 4 depicts, another core convexity was attempted by removing only ventral flakes (Figure 2e). Because this reduction sequence does not adequately build the correct convexity nor maintain a consistent core shape (in fact, Sandgathe's 2004: 155 Figure 3 resulted), the next preferential Levallois detachment plunged and ruined the core (Figure 2f).

Sandgathe's model was repeated on the large flake blank #2 (again by Bradley, Figure 3a), with the same result. After the initial preferential Levallois flake removal (Figure 3b-c), the core was re-prepared with only ventral flake removals. Once more, the resulting preferential Levallois flake plunged, ruining the core (Figure 3d).

Thus two attempts to follow Sandgathe's model, in which preferential Levallois flakes serve to

Table 1. Dimensions of the large flake blanks before reduction. Length was measured parallel to the axis of percussion. Maximum width was measured perpendicular to the axis of percussion.

Large Blank	Mass (g)	Length mm	Maximum Width (mm)	Maximum Thickness (mm)
1	1194.7	156.5	136.8	41.4
2	1252.9	181.4	123.7	52.0
3	1367.6	189.8	158.9	48.36

reduce the core's central mass, both failed. When ventral face convexity became problematic, proper preferential Levallois flakes could not be removed to address the situation. These results suggest that preferential Levallois flakes cannot be the source for mitigating central core mass in order to maintain core shape.

MAINTAINING CORE SHAPE

Though we understand that Sandgathe uses the term "single-surface" core to suggest that desired products (ventral flakes) only come from one surface of the core, we suggest that the term is misleading. Preferential Levallois reduction is, by definition, a bifacial reduction sequence. For the successful exploitation of a Levallois core, a bifacial strategy is necessary throughout, and not just for initial preparation of the core. It is the management of a Levallois core's bifacial edge that actually maintains a consistent core shape and controls any increase or decrease of central mass.

To demonstrate this point, one of us (Eren) reduced the large flake blank #3, preserving consistent "Levallois shape" throughout reduction by maintaining the "hierarchical" relationship and roles of the ventral and dorsal surfaces (Boeda 1995), without removing a single preferential Levallois flake (Figure 4). In fact, by intention, no ventral flake went beyond the center point of the original large flake blank, so as not to remove the increasing central core mass. This was possible because, when the central mass of the core was in need of flattening, a series of dorsal flakes was removed to adjust the bifacial edge upwards toward the ventral face of the core (Figure 5). That done, ventral flake removal could continue. This process continued until core exhaustion.

CONCLUSIONS

There is no accounting for prehistoric knapping preference, style, or habit. Numerous examples exist in the Paleolithic archaeological record of technological choices that may not make much sense to the archaeologist's 21st century mind. The small flake production of the Middle Paleolithic (Dibble and McPherron 2006), particular Upper Paleolithic blade technologies (Giria and Bradley 1998), or bifacial fluting (Meltzer 2002) are prominent among such unsolved mysteries. The role of the Levallois flake is certainly one such puzzle. In this light, Sandgathe's (2004) attempt to think outside the box and to imagine an unorthodox Levallois reduction pathway is to be commended, but needed to be tested in the real world.

Our experimental flintknapping replications do not support Sandgathe's "core shape maintenance" hypothesis. Preferential Levallois flake removal does not adequately manage the problem of the increasing central core mass, which hinders full exploitation of the parent block. The reason for this is straightforward: after removal of the core's central mass with a preferential Levallois flake, further convexities cannot be built, and thus further Levallois flakes cannot be detached.

Nor does preferential Levallois flake removal help to maintain consistent core morphology. Instead, the bifacial edge of the core must be carefully managed. And lastly, it is the well prepared and *intended* convexities and core shapes that consistently yield preferential Levallois flakes throughout reduction. Default convexities, simply arising from increasing core central mass will not achieve this. Based on our replications, we suggest that preferential Levallois flakes were indeed desired products in their own right, and not simply a means to a technological end.

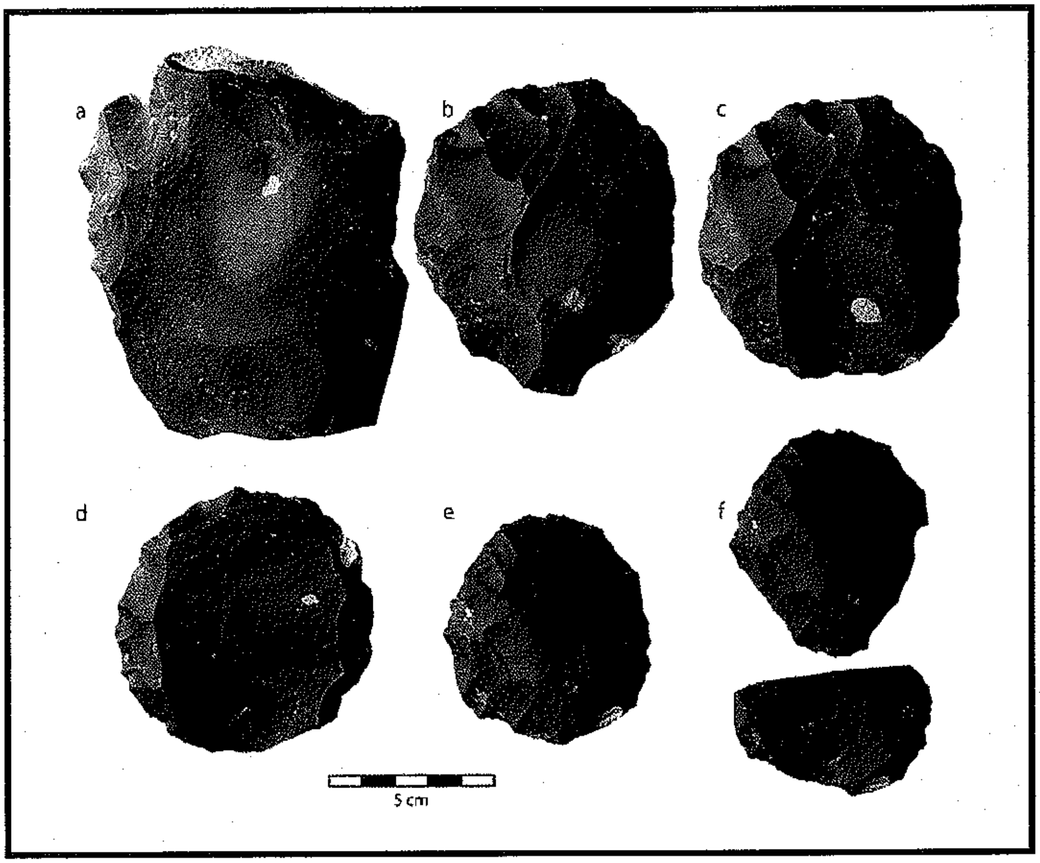

Figure 2. Bradley's first replication of Sandgathe's proposed Levallois reduction. (a) The large flake blank #1; (b) the initial convexity of the ventral face is prepared; (c) the first Levallois flake is detached but fails to remove the core's central mass; (d) another Levallois flake is removed; (e) a new convexity is prepared with only ventral flake removals; (f) due to a lack of dorsal flake removal the next prepared convexity results in a plunging termination that ruins the core.

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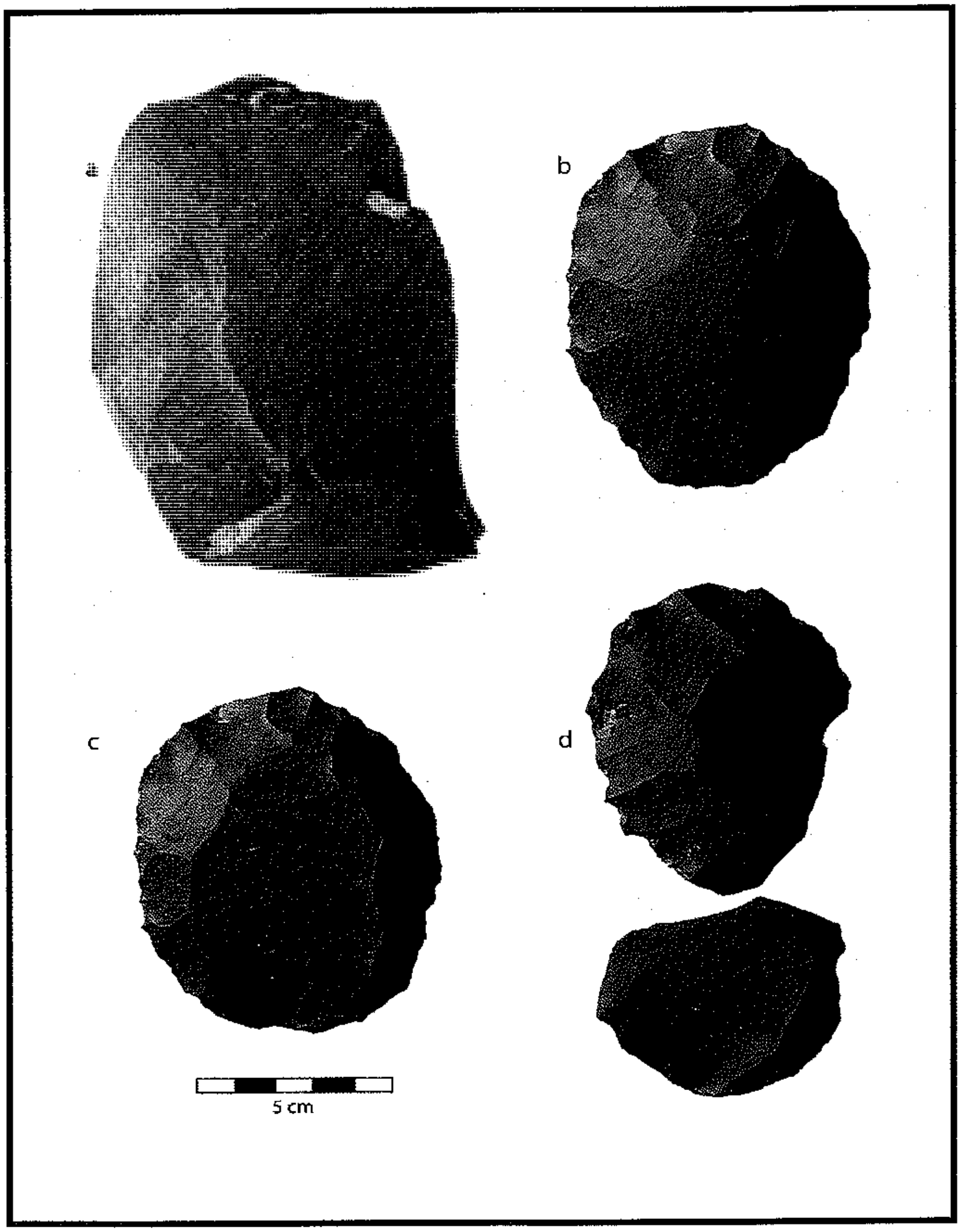

Figure 3. Bradley's second replication of Sandgathe's proposed Levallois reduction. (a) The original large flake blank #2; (b) the initial convexity of the ventral face is prepared; (c) the first Levallois flake detached; (d) again, failure to manage the bifacial edge of the core results in another plunging termination that ruins the core.

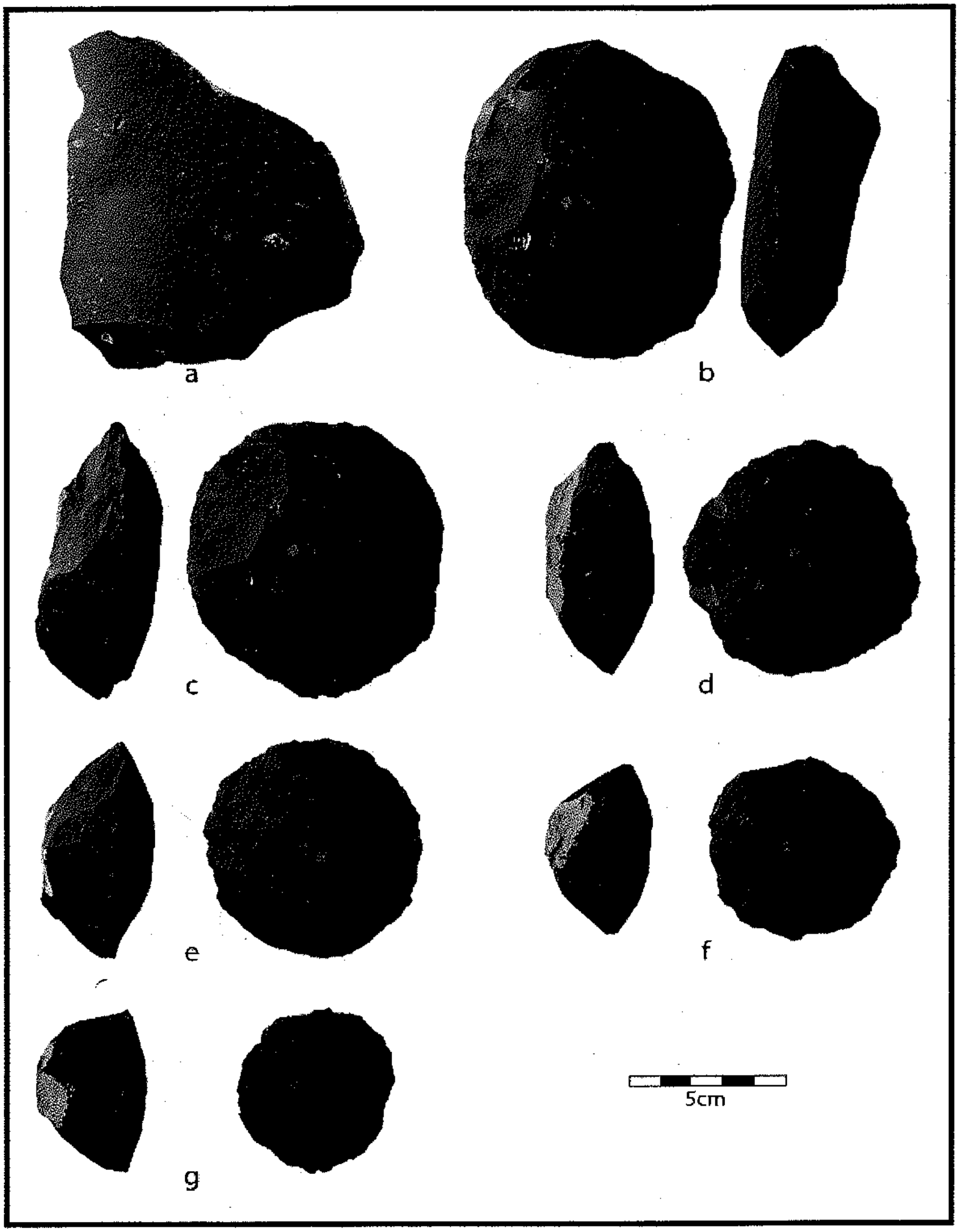

Figure 4. Eren's replication showing full control of core shape, ventral face convexity, and central core mass without recourse to preferential Levallois flake. (a) The large flake blank #3; (b-g) the core's shape is maintained by carefully managing the bifacial edge until core exhaustion. After each set of ventral flake removals, which lowers the bifacial edge and increases the core's central mass, there follow a set of dorsal flake removals, which raises the bifacial edge and decreases the core's central mass. Core shape remains consistent and the hierarchical relationship between the ventral and dorsal surface remains intact, despite that fact that no flake travels past the core's central area. Here, the original core surface survives each reduction stage.

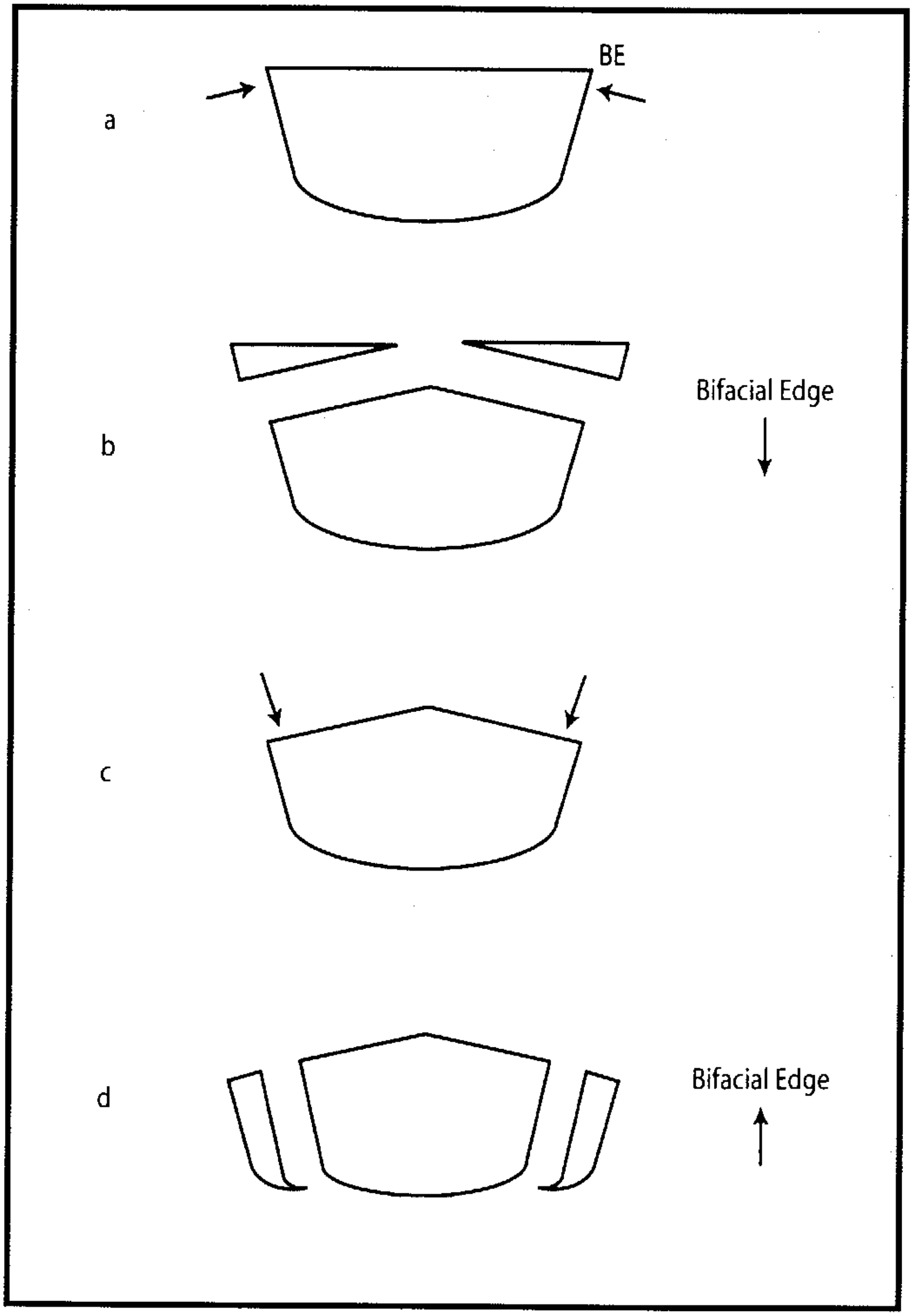

Figure 5. Diagram of core shape maintenance during Levallois reduction by managing the bifacial edge of two hierarchically related surfaces. (a) A set of ventral flakes is removed; (b) this lowers the bifacial edge in relation to the core's center, in turn increasing the core's central mass; (c) a set of dorsal flakes is removed; (d) this raises the bifacial edge in relation to the core's center, in turn flattening the core's central mass and maintaining core shape throughout reduction.