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From side to side: Symmetry in handaxes in the British Lower and Middle Palaeolithic

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ABSTRACT

The Acheulean is defined by its iconic tool type, the handaxe, and a suite of other large cutting tools (LCTs). These tools retain information on technical and procedural practices concerned with the manufacture of these butchery tools and carcass processing knives. The Acheulean straddles the period in which more ancient hominin species (*H. erectus* and *H. heidelbergensis*) give way to archaic *H. sapiens* (*sensu lato*) amongst whom the ancestor of modern humans may be found. The roots of modern behaviour may be present in these handaxe making hominin species, and the handaxes themselves, through proxy data such as bilateral symmetry, may chart hominin cognitive evolution as researchers such as T. Wynn and F. Coolidge (2016), amongst others, have argued. But the search for the earliest consistent application of symmetry, and its persistence thereafter has been hampered by the lack of large datasets, spanning the temporal extent of the Acheulean, and analysed through a single consistent methodology.

Our paper has two aims. The first, and in the absence of a large comparative data set of earlier Acheulean handaxes, is to assess the degree to which symmetry is consistently applied to the making of handaxes in the later Acheulean (≤ 0.5 Mya), a time when bilateral planform symmetry should already be an integral component in handaxe making. The dataset we select is the British Acheulean from MIS 13 – MIS 3/4. To the best of our knowledge this is the first time handaxe symmetry has been assessed on a large body of British Acheulean handaxes. Our second aim is to present a relatively simple and low tech methodology for the analysis of handaxes and their symmetry that is widely available and does not require expensive equipment or specialist software/technical knowledge. It works from orthogonal handaxe photographs which many researchers will already have. From such data it may be possible to begin to construct the larger datasets necessary to answer symmetry related questions regarding cognitive evolution. This offers us the opportunity to raise a number of key methodological questions which we believe ought to be debated by researchers before the generation of appropriate datasets begins.

1. Introduction

The Acheulean is the name given to a stone tool assemblage type recognised by the presence of its iconic tool – the handaxe, one of a suite of large cutting tools (LCTs) which also includes cleavers, picks, trihedrals and unifaces (Clark, 1994; Wymer, 1968). However, the Acheulean is also defined by technological practices associated with the manufacture of LCTs, such as the making of large flake blanks often from cores with a prepared surface (Sharon, 2007), and marginal thinning, commonly with a soft hammer or billet to impose deliberate shape on the LCT (Newcomer, 1971). Good introductions to handaxes are present in a number of references (de la Torre, 2016; Emery, 2010; Goren-Inbar and Sharon, 2006; Machin, 2009; Newcomer, 1971).

The oldest Acheulean yet discovered is at Konso in Ethiopia and Kokiselei 4, West Turkana, Kenya, both of which date to 1.75 Mya (Beyene et al., 2013; Lepre, 2011). From this point onwards, handaxes become the defining artefact of the Acheulean found across the Old World from Spain to China, and from South Africa to the English Midlands. The appearance of *Homo ergaster* in Africa, (Lepre and Kent, 2015) at about c. 1.9 Mya (KNM-ER 2598), and its more widespread presence after c. 1.6 Mya (KNM-ER 3733; Lepre and Kent, 2015) is suggestive of a link between this new hominin and the Acheulean

Abbreviations: Mya, Millions of years ago; my, Million years; kya, Hundred thousand years ago; ky, hundred thousand years; MIS, Marine isotope stage

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'package' - a new tool technology to meet the needs of new behavioural adaptations. The emergence of the Acheulean may help fill the fossil gap which currently exists for the erectines between KNM-ER 2598 and 3733 (Lepre and Kent, 2015).

Traditionally, handaxes are thought to have been made in Africa by two hominin species, *H. ergaster/erectus* and *H. heidelbergensis* (= *H. rhodesiensis*). In Europe handaxes were made by *H. heidelbergensis* (Manzi, 2016; Profico et al., 2016), although the chronology of the Heidelbergs in Europe may be subject to change given recent palaeogenetic advances (Meyer et al., 2016, 2014). *H. neanderthalensis* is also a European handaxe maker (Ruebens, 2014; Ruebens et al., 2013), but new cultural labels are applied to the Late Pleistocene Neanderthal handaxes (e.g. Mousterian of Acheulean Tradition rather than Acheulean). Anatomically modern humans may continue to make handaxes once they emerge in Africa (Clark et al., 2003), a pattern possibly seen elsewhere (Shipton et al., 2013).

This hominin evolutionary trajectory is often portrayed as a single upward cline, a slope of gradual development as for example in the iconic Social Brain graph (Dunbar et al., 2014; Gowlett et al., 2012), although a more punctuated interpretation is possible (McNabb and Cole, 2015; Shultz et al., 2012).

In these interpretations the Acheulean (here broadly defined as handaxe making by hominins other than Neanderthals and anatomically modern humans) is often seen as an evolving material culture accompaniment to biological development. Early handaxes are described as crude and poorly shaped, lacking much - if any - sense of symmetry in their planform (Hodgson, 2010, 2015; Wynn, 2002). Later Acheulean handaxes, appearing toward the end of the Acheulean, supposedly show much higher degrees of symmetry accompanying regularity in planform outline (Clark, 1994, 2001; Wynn and Coolidge, 2016). Potentially, these later Acheulean handaxes may reflect the increasing capacity of material culture to carry symbolic meaning (Lycett, 2008).

The Acheulean then, in its broadest definition, is a key period in human evolution as it sees the emergence of some of the cognitive faculties that will later contribute to the 'modernity' of *Homo sapiens*. Wynn has explicitly linked what he sees as stages in handaxe development to evolving hominin cognition and spatial awareness, connected with more sophisticated hunting (Wynn, 2002), and evolving hominin neural architecture (Wynn and Coolidge, 2016). He argues that a threshold was crossed at c. 1.8 Mya with the deliberate imposition of shape on raw material. Whereas the preceding Oldowan tools *acquired* form fortuitously through the production of flakes, the earliest Acheulean handaxes had clear form deliberately *imposed* upon them. This imposition of shape in its earlier stages was an 'attention to shape' (Wynn, 2004), through an awareness of the balance of surface area either side of a mid-line. By 1.0 Mya attendance to shape was becoming more prevalent. A second major threshold had been crossed by $\geq$ 0.5 Mya when that awareness of symmetrical balance reflects congruence, an exact mirroring of opposing edges. Wynn posits that from this point on bilateral planform symmetry is commonly accompanied by cross-sectional symmetry in long profile and across the width too (looking from the tip down). With a three dimensional concept of symmetry now present, knappers were even able to produce deliberately asymmetric LCTs on occasion – broken symmetry.

Persistent bilateral symmetry in planform down the long axis of a handaxe is then one of the hall-marks of cognitive evolution.

In light of the above, there are a number of research questions that could be asked of the Acheulean which would focus on temporal changes in its character over the 1.5 + Mya lifespan of this phenomenon. However, two of us (JM and JC) have elsewhere noted the difficulties in finding appropriate data in which to study long-term changes in handaxe symmetry over time (McNabb and Cole, 2015). Ideally, long sequences with large assemblages from single sites are necessary, and lots of them; but they are scarce. Currently some of the best are in the Awash Valley, Ethiopia, Melka Kunture, Ethiopia, and Oldupai Gorge, Tanzania (Beyene et al., 2013; Clark et al., 2003; de la Torre and Mora, 2005, 2014; Gallotti and Mussi, 2017; Leakey and Roe, 1994; Schick and Clark, 2003).

2. The research question

As the data to meaningfully compare earlier and later Acheulean handaxes with each other does not yet exist, what other questions may be addressed with the data that is available to us? The question we chose to ask was:

Is bilateral planform symmetry consistently applied in the British Acheulean?

Why is this question important?

Firstly, the time period covered here is nearly 0.35 my (MIS 13–7), and longer if the Late Pleistocene Neanderthal site of Lynford is included (nearly 0.5 Mya). It may cover one emerging hominin lineage (*H. neanderthalensis*), or two partially contemporary ones with an ancestor descendent relationship (*H. heidelbergensis – H. neanderthalensis*). The mean brain size of *H. heidelbergensis* is c. 1256.6 cm^3 and that of Neanderthals c. 1421.23 cm^3 (Dunbar et al., 2014). If handaxe planform symmetry is a viable proxy for cognitive evolution – then changes in handaxe manufacture should reveal evidence of progressive development even in this later segment of the Acheulean's history, in effect, the tail end of the evolutionary trajectory. Our research question therefore asks whether we should expect relatively high levels of symmetry, consistently present, at this later stage of the trajectory? The difficulty of poor comparative data is fully acknowledged here.

If we do see greater evidence of symmetry and congruence in later Acheulean assemblages, then we need data to support this, but to the best of our knowledge this does not yet exist. The identification of a consistent presence of higher degrees of symmetry across the British Acheulean will help in highlighting any earlier vs later Acheulean contrasts when those data become available.

There is an alternative perspective that may be taken into account. The European Middle Pleistocene hominin lineage(s) do not directly contribute to the evolution of modern humans – this occurs in Africa (Hublin et al., 2017; Stringer, 2011; Stringer and Galway-Witham, 2017). However, in focusing on a region away from the direct line of *sapiens* evolution we will provide important comparative data for the character of material culture of our actual ancestor when that lineage becomes clearer. The last common ancestor of Neanderthals, modern humans and their putative Heidelberg ancestor predates 600 kya (Viola and Pääbo, 2013). Did a capacity for symmetry occur independently in two diverging branches, or did a common heritage express itself in similar patterns of diachronic development? Our research question will not answer these directly, but we hope it will provide data that will help define and address the issues as research continues. As such focusing on symmetry in the later British Acheulean will help clarify the character of an evolutionary trend within the Acheulean of the Old World.

Ultimately, behavioural and cognitive studies of any hominin lineage, whether extinct cousin or direct ancestor, remain interesting in their own right.

3. The study of handaxe symmetry in the Acheulean

There have been a number of attempts over recent years to quantify and interpret the presence of symmetry on Acheulean assemblages. Methodologically, one of the most successful has been the flip test developed by Hardaker and Dunn (Hardaker and Dunn, 2005), which has seen usage in a number of different contexts (Shipton and Clarkson, 2015; Underhill, 2007), and other techniques have also been promoted (Lycett, 2008). In addition, there have been a number of theoretical stances that have sought to extract behavioural meaning from Acheulean handaxes. We will give a brief summary for some of the main positions here, but recently Hodgson (2015) and McNabb and Cole (2015) provide useful additional references and critiques.