On the road from the City of Skepticism, I had to pass through the Valley of Ambiguity.
Adam Smith (1723-1790)

The Acheulean Handaxe at Boxgrove

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I stepped out of my comfortable arena of New World, Paleoindian archaeology and into the Old World Paleolithic with my first paper on the Acheulean Handaxe in 2006. There I wrote:

> The Lower Paleolithic researchers who believe the Acheulean handaxe was the desired product do not find their justification in its function, since its function is not understood … Instead, they find their justification in its unchanging morphology. For a million plus years, its basic shape remained constant as it spread across three continents.

I further pointed out that this desired-product belief can be traced back to the end of the eighteenth century and John Frere. Then I proposed a different belief, which was the handaxe was actually only the by-product and flakes were the desired-product. The remainder of the paper was then justification for that belief from a morphological perspective.

Since writing that first paper I have had numerous discussions with colleagues about this dichotomy of the desired-product versus by-product. I have discovered that the opinions on the subject are quite strong. Often, it was suggested that I read the Boxgrove literature and this might convince me to change my mind. So I read *Boxgrove: A Middle Pleistocene hominid site at Eartham Quarry, Boxgrove, West Sussex,* which is the monograph of the site at this time. To my surprise, instead of containing evidence to support the desired-product belief, I found that the desired-product belief was the inherent assumption stitched though out the book. But first, why Boxgrove?

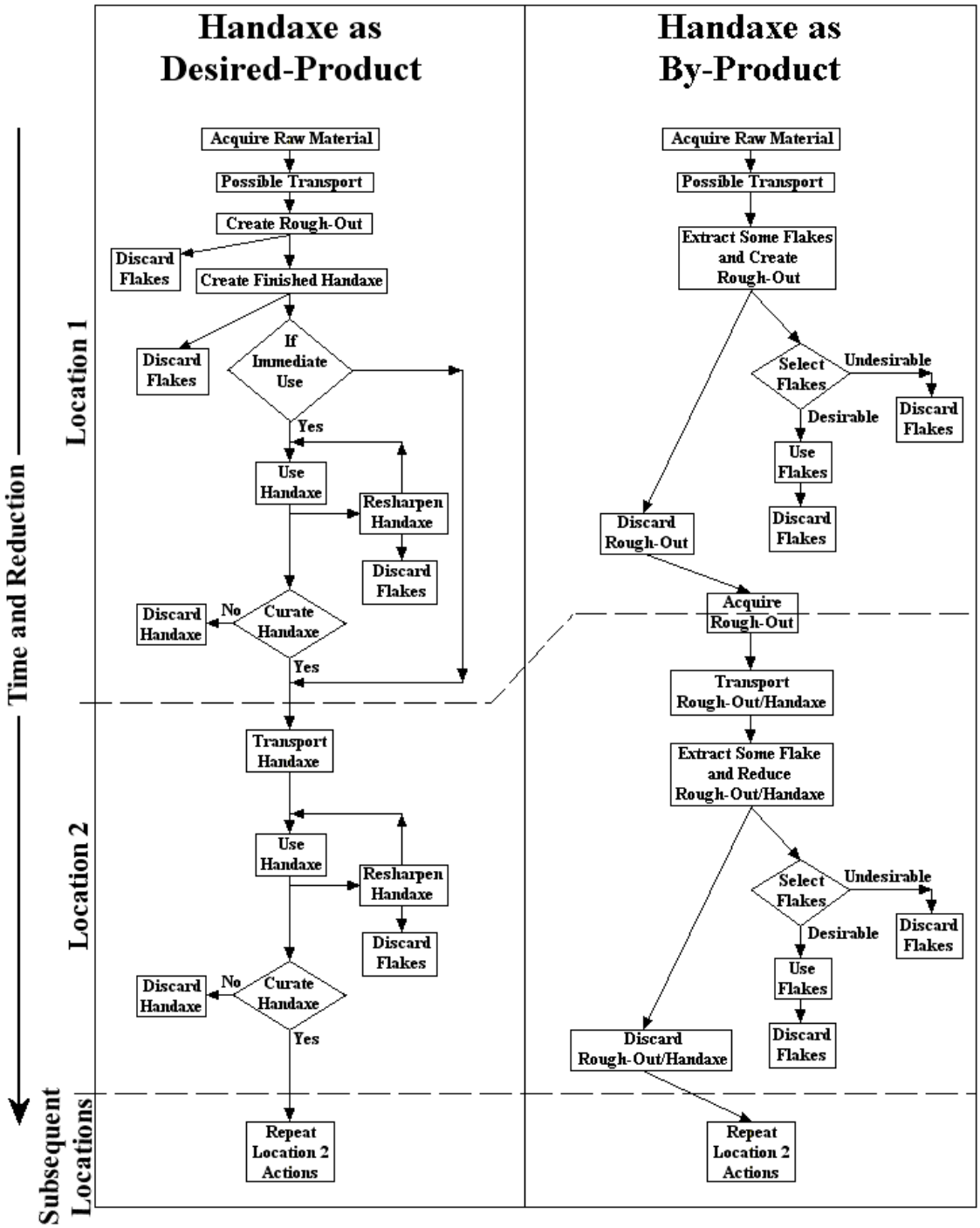
Boxgrove is an archaeological site on the southern coast of England and it is the archaeologist's dream. It is a unique Acheulean site in that it contains "… the presence of *in situ* working floors… " (McNabb 2000:439). It has a date range of between 524 and 420 kyr bp, and "the stone tool assemblage, all of which is made from local flint, is dominated by the production of handaxes" (Roberts and Parfitt 1999:xix). It has even yielded a tibia that "… can only definitely be assigned to Homo sp with possible affinities to either H. heidelbergensis …, H. erectus …, H. neanderthalensis …, or H. sapiens…" (Stringer and Trinkaus 1999:420).

As stated above, I found the desired-product belief to be an assumption in the Boxgrove monograph. For example, consider again from the above paragraph, "the stone tool assemblage … is dominated by the production of handaxes." This comes from the summary at the beginning of the monograph. Though out the discussion of the lithics and their relationship to the archaeological record, flakes are referred to as waste flakes as in the following: "It (assemblage) comprised in the main waste flakes from the production of handaxes and five finished bifacial tools" (Austin, L. A. et al 1999:315). Or, "The debitage from areas Q1/A and Q1/B is the waste from handaxe production" (Austin, L. A. et al 1999:341). In the concluding remarks to the archaeology chapter, which is also the end of the monograph, one finds:

> It has been argued that as the lithic assemblages of the earliest occupants of northern France and the United Kingdom are dominated by handaxes, then the source area for the European hominids was from the Levant and Africa, where handaxes were in use from c 1.5myr bp, more so as handaxes appear later in the archaeological record of Asia and central and eastern Europe. Whilst this hypothesis is persuasive, it must be remembered that handaxe manufacture is very much determined by raw material sources … and caution must be exercised in using tool types as sources fossils. (Roberts 1999:423)

As there was no attempt to test the desired-product belief against the Boxgrove archaeological record in the monograph, I have attempted to do it here. Simultaneously, I tested my by-product belief in a similar manner. Since I have never been to the site and have only seen the artifacts at the British Museum, the monograph is my view of the Boxgrove's archaeological record. The following is a discussion and results of that testing.

Flow Chart 1


Handaxe as Desired-Product
Handaxe as By-Product
Time and Reduction
Location 1
Location 2
Subsequent Locations
Acquire Raw Material
Possible Transport
Create Rough-Out
Discard Flakes
Create Finished Handaxe
Discard Flakes
If Immediate Use
Yes
Use Handaxe
Resharpen Handaxe
Discard Flakes
Discard Handaxe
No
Curate Handaxe
Yes
Transport Handaxe
Use Handaxe
Resharpen Handaxe
Discard Flakes
Discard Handaxe
No
Curate Handaxe
Yes
Repeat Location 2 Actions
Acquire Raw Material
Possible Transport
Extract Some Flakes and Create Rough-Out
Select Flakes
Undesirable
Discard Flakes
Desirable
Use Flakes
Discard Flakes
Discard Rough-Out
Acquire Rough-Out
Transport Rough-Out/Handaxe
Extract Some Flake and Reduce Rough-Out/Handaxe
Select Flakes
Undesirable
Discard Flakes
Desirable
Use Flakes
Discard Flakes
Discard Rough-Out/Handaxe
Repeat Location 2 Actions

Theories and Models

I have taken the position in this paper that the *handaxe was the desired-product* is a theory. I know that many researchers would argue that it is more than just a theory, and instead, that it is a fact. However, I have seen no evidence or read anything to date that makes it a given for me. In my mind it is only a theory that needs to be tested, as is the competing theory that the *handaxe was the by-product*. One way to test these theories is to make predictions from them and then compare the predictions against the archaeological record.

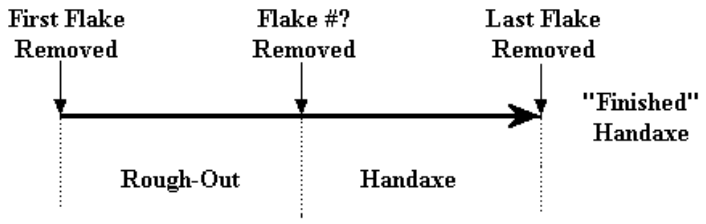
A theory is similar to the title of a book; it contains no details. "The devil is in the details" as the old saying goes. So, I created the details, which I call a life history model. The detailed life history models for the two theories are depicted in Flow Chart 1. From these models, I formulated my predictions to compare against the archaeological record, which in this case is the archaeological record at Boxgrove.

Important points I want the reader to note about the models in Flow Chart 1 are that first, each represents the life history of a single chunk of rock, from the time it is first selected until its final discard into the archaeological record. Next, the locations marked on the left side are different locations on the landscape. However, unlike stratigraphy where moving down is moving back into time, moving down in these models is moving forward in time. Thirdly, from this follows that the chunk of rock is getting smaller (more reduced) as it moves downward in the Model.

The dotted lines that separate the locations do not represent the same point in time in the two models. For example, the Desired-Product Model (DPM) assumes a single individual or immediate group associated with the life history of the handaxe. So, at a maximum the handaxe would have a life history equal to that of the remainder of its creator's life. In contrast, the By-Product Model (BPM) does not assume a single individual. So the rough-out can lie at Location 1 for hundreds of years before it is again acquired at the beginning of Location 2. Its life history can be hundreds or even thousands of years long. It is even possible that it could have been acquired from an eroded surface many thousands of years older than the surface of its final discard.

The concept of the rough-out, handaxe, and finished handaxe needs some elaboration. As I understand the DPM, it consists of two stages of reduction. The first stage of flake removal is from a core that the archaeologists would identify as a rough-out. The second stage of reduction is from a core that the archaeologist would identify as a handaxe. At the end of the second stage of reduction the handaxe is "finished" and ready for use. Schematically, this looks like Flow Chart 2.

Flow Chart 2



I have not found a definitive definition for the transition from rough-out to handaxe. This same statement applies to the transition from handaxe to "finished" handaxe. I suspect there are no definitions and, therefore, these transitions vary from archaeologist to archaeologist. However, for my purposes I have retained these concepts of rough-out, handaxe, and finished handaxe.

The concept of the rough-out must also exist in the BPM. Since there is no definition for the rough-out/handaxe transition, I have assumed it occurs at some location beyond Location 1. I made this assumption because this model assumes that flakes are the desired products, and I believe sufficient flakes would have been extracted and the core discarded at Location 1 before the rough-out/handaxe transition was crossed.

I have tried to create the DPM and BPM as polar or diametric as possible, because I wanted to avoid ambiguous results. In different words, I wanted to be able to see differences in the archaeological record that would favor one of the two models. For example, if I had created a DPM with the roughing-out of the handaxe occurring at a separate location from that of the finishing the handaxe, then this model would have been closer to the BPM, which would have increased the chances of ambiguity. Ambiguous results favor neither model.

A Few Definitions

I have included this short section because I want the reader to fully understand the way I am using some terms.

In this paper I recognize three types of core artifacts:

Rough-out – a core in the early stages of reduction and on a trajectory to becoming a handaxe.
Handaxe – a core that has ceased being a rough-out and now is on a trajectory to becoming a finished handaxe.
Finished handaxe – a tool ready for use.

I also recognize two types of flakes:

Roughing-out flake – a flake that is removed from a rough-out. Newcomer has defined them as tending "… to be thick, and have varying amounts of cortex on their dorsal surfaces. Butts are usually wide and plain (or cortex) and bulbs and cones of percussion and undulations on the ventral surface are well developed" (1971:88).