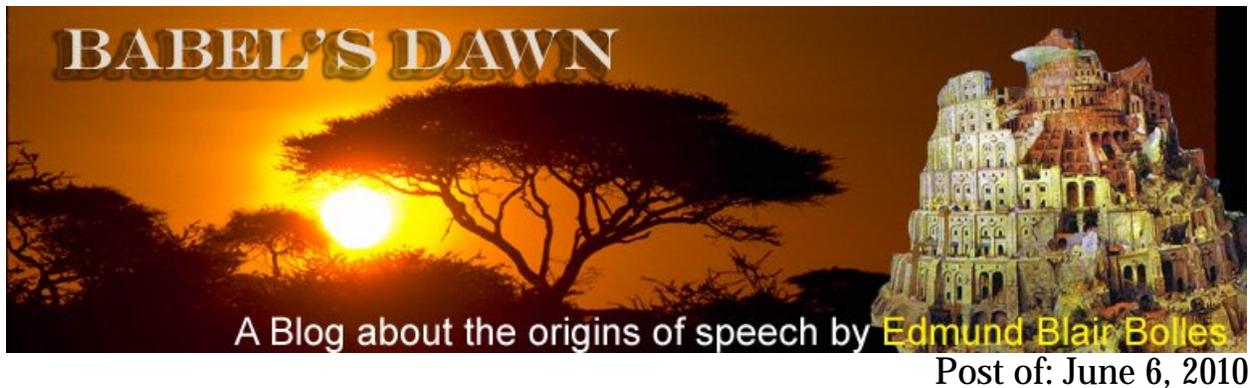+

Post of: June 6, 2010

Linking Tool Use and Language

More than two million years after *Homo habilis* began using tools
to make tools, Neanderthals made these Mousterian points. How far
along do you suppose their language had come?

During the evolution of Homo four things seem to have been going on at the same time: (1) the rise of syntactical speech; (2) the formation of cooperative communities; (3) the use of tool to make other tools; and (4) the growth of the brain. Two other processes appear to have started before these four and ended while the four continued onward, but there was probably some overlap: (a) the shaping of the hand for precise grip and action and (b) modification of the leg for running.

We won't really know how speech began until we understand the full interaction of these simultaneous processes. The previous two posts looked at the relation between speech and brain. A Portuguese scholar, Antonio Vieira, has just published an ambition paper in *Theory Bioscience* titled, "Grammatical Equivalents of Paleolithic Tools" (abstract here). Its thesis is that "the grammatical equivalents inherent to stone tool work guide the evolution of language."

Surely the most valuable part of the paper is its listing of the different tool-making phases of the stone age.

- Oldowan (starting about 2.5 million years ago, lasting over a million years). Used a hammerstone to break off cutting flakes. The stone that provided the flakes (called the core) also became a sharp tool as a result of the operation. Primarily associated with *Homo habilis*.
- Acheulean (starting about 1.6 million years ago and lasting over a million years). They are much larger than Oldowan tools and may have begun as modified Oldowan cores, although, as Vieira says, they seem to reflect a quantum leap in technology. Their most obvious difference from earlier technology is that the cutting edge is two sided and of both sides of the tool match. Their double-sided quality is why they are called technically 'bifaces' and many people call them hand axes, although they may never have been used like a modern axe. Primarily associated with *Homo erectus*.
- Levallois (starting about 300 thousand years ago). The core was more extensively prepared and a large, double-sided, pointing flake was outlined in the core and chipped off. A series of matching points could be produced. If you are feeling enthusiastic, you can point to this action as the introduction of mass production. Primarily associated with *Homo heidelbergensis*.
- Mousterian (dates from about the same time as the Levallois) and is a particularly fine example of Levallois points. It is at this stage that handles were first attached to stone tools. Primarily associated with *Homo neanderthalensis*.
- Leptolithic (dates from the end of Neanderthal times) replaces flakes with blades and begins producing a range of specialized tools. Primarily associated with *Homo sapiens*.

Linking these stages to syntax would be a great tour de force. What is the syntactical equivalent of an axe handle? It didn't seem to me that Vieira was quite up to his chosen task. He argues more from analogy and metaphor than from fundamentals; e.g., "To intervene in the environment with a tool… means to create a dialogue with the surrounding world." [page references will have to come later] Hmm. That metaphor is not going to work on this blog which defines dialog in terms of the speech triangle.

> Each tool kit is like a lexicon, the descriptive logic of its effects looks like a grammar, and the global consequences of its actions sounds like a kind of semantics. … All the grammatical structure is foreshadowed in the preparation and use of lithic implements: the tools and time and mode of their use indicate the adverb functions; the objects created by their action are like nouns… []

I don't believe this kind of argument is going to force a skeptic to rethink. And yet I am in agreement with the author that there is a rough harmony between tool making and language ability; however, I suspect that it is at a much higher level of abstraction. I also agree with the author that the first use of speech, presumably single words, began with *Homo habilis*.

Apes have been making tools for a long time. The difference between a chimpanzee using a stone to smash open a nut and a human using a stone to skin an antelope is not just the sophistication of the task, but the fact that a the skinning stone was made with another tool. This action is recursion at its most basic level. Recursion can be defined formally as using a procedure (P) to produce a result (r) and then seeding the next occurrence of P with r to produce a second result. In this case the procedure is to select or even shape a hammer stone and then using the hammer to break off a cutting edge from a second stone. The idea behind the chimpanzee's nut cracker is to make a hammer to get food. The cutting flake depends on an intermediary idea. Make a hammer to make a flake to get food.

Now consider the difference between communication that uses gestural pairing and communication that uses a speech triangle. A pairing familiar in the ape world is the use of a begging gesture to ask for food. A speech triangle has an intermediary idea, the topic. Sticking with gestures,

we can imagine Homo habilis pointing to a Thompson's gazelle. The expectation is that the other habilis will see the Tommy and join number one in trying to bring it down. The ape makes a signal to get food. The Homo makes a signal to identify a topic to get food.

Both the tool-made tool and the topic-based signal depend on an intermediary idea. So at least at the beginning of Homo there could have been an intellectual connection between language and tools.

How about further along? Can we make another linkage? The next high level linguistic breakthrough that I see is the introduction of a gestalt so that two foci of attention (the subject and the predicate) are understood as a whole. How close is that to seeing two sides of a core stone as one whole? Making an Acheulean axe does require focusing attention on one face of the stone and then on the other face. So maybe that analogy works too, suggesting a date for the transition from words to sentences. At any rate, this level of abstraction strikes me as more likely for a linkage between tool and language use.

Links:

Antonio Vieira:
http://cfcul.fc.ul.pt/equipa/3_cfcul_elegiveis/bracinha%20vieira/bracinhavieira.htm
Abstract: http://highwire.stanford.edu/cgi/medline/pmid;20502979