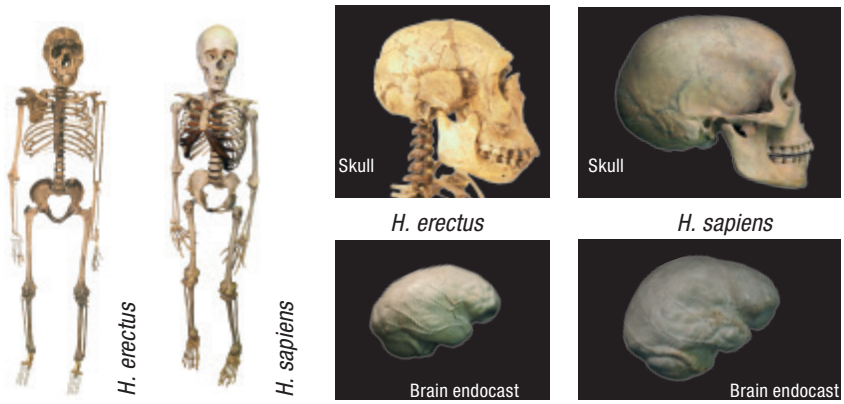
4 Out of an unsettled world

Out of life's school of war: What does not destroy me, makes me stronger.
Friedrich Nietzsche, *Twilight of the Idols*

Climate plays an important part in determining the average numbers of a species and periodical seasons of extreme cold or drought, I believe to be the most effective of all checks.

… each at some period of its life, during some season of the year, during each generation or at intervals, has to struggle for life, and to suffer great destruction. When we reflect on this struggle, we may console ourselves with the full belief, that the war of nature is not incessant, that no fear is felt, that death is generally prompt, and that the vigorous, the healthy and the happy survive and multiply.
Charles Darwin, *Origin of Species*

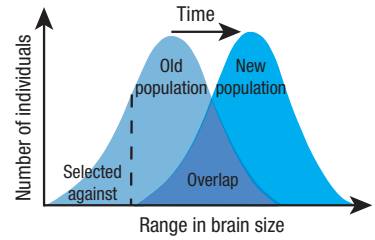
Homo erectus was a highly successful species that lived for one and a half million years. They were the first of our ancestors whom we would readily acknowledge as one of our own. Although their bodies displayed a fair amount of variation, they were a more or less robust, smaller-brained version of us. Living in cooperative groups in control of fire and sharing a diverse array of foods that included meat, *H. erectus* was the first to expand beyond Africa. The symmetrical beauty of some of their stone tools suggests an appreciation for form as well as function – the initial expression of abstract, symbolic thought. And yet they appear to have been firmly set in their ways, as reflected in the 'variable sameness' of their Early Acheulean stone tools. Their brain appears to have been far less capable than ours at imagining doing things differently. But if their conservative way of doing things had served them so well for over a million years, why change? And yet, considering in hindsight all the advantages we enjoy by having a large brain, you might ask: why not change?



The skeleton of *H. erectus* is similar to ours but the skull is notably different – especially in terms of brain size shown by the respective brain endocasts

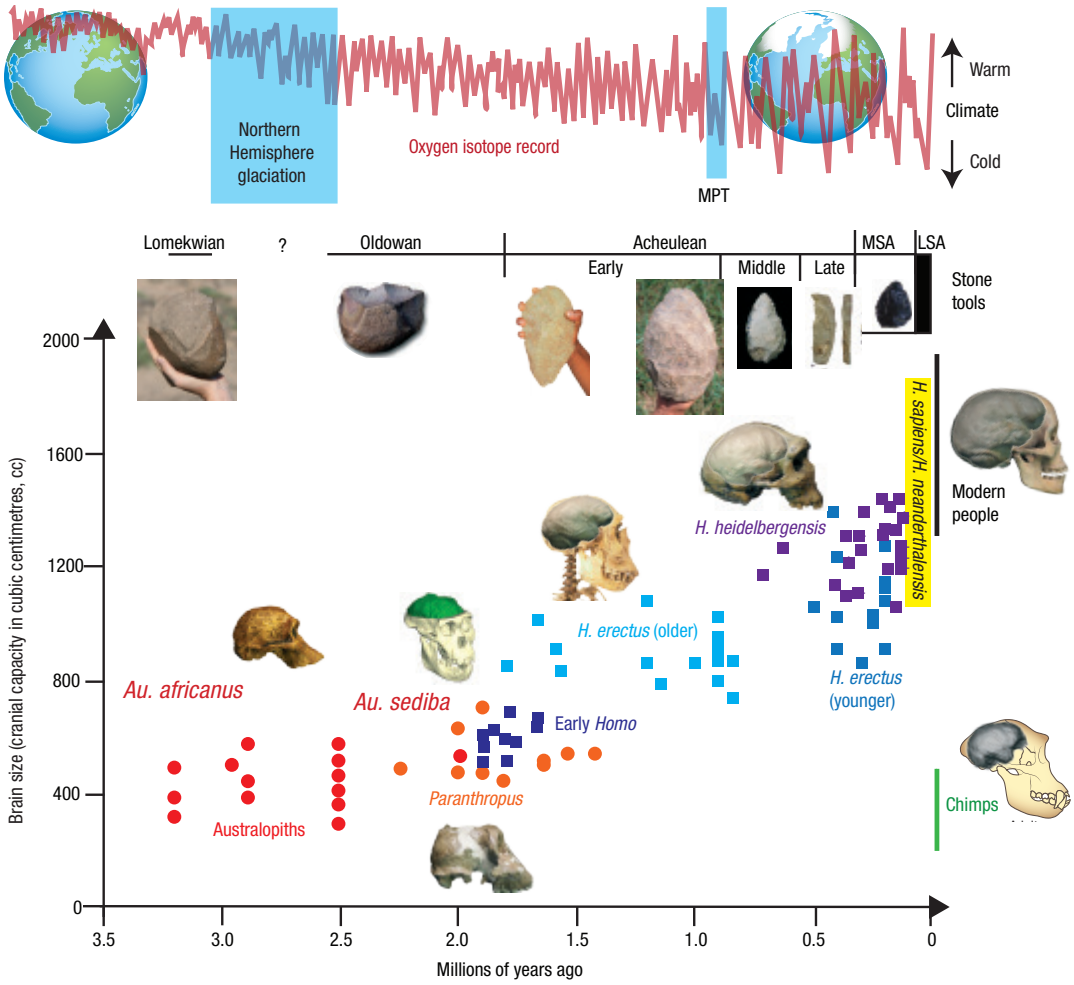
Evolution cannot anticipate potential future advantages; it can only select for those advantages that enhance the immediate survival and reproductive success of individuals or a group of individuals. As long as *H. erectus* continued to do well, evolution wasn't going to fix something that wasn't broken. Besides, a bigger brain comes with costs as well as benefits. It requires a high-calorie diet and a prolonged dependency of children while they grow a bigger brain. Some among *H. erectus* had brains approaching the minimum brain size of people living today (1100 cc). But it was only when having a bigger brain tipped the balance in favour of the benefits compared to the costs that a bigger brain started to be consistently selected for.

From 1.8 to 0.9 million years ago, it was the highly successful, conservative world of *H. erectus*, maker of the Early Acheulean brand typified by the conventional hand axe. But from around 0.9 million years ago, the staid Early Acheulean brand started to change and was joined by a succession of new stone-tool cultures that corresponds at least broadly to the evolution of a bigger brain. A bigger brain started to matter and became worth the costs. The result is an example of what is termed directional selection, in which the mean brain size increased over time as those who had a bigger brain tended to be selected over those who did not. Like most evolutionary changes, growing a big brain was associated with many other changes, but among all of these a big brain, and the cultural evolution that went along with it, would define the arrival of our species *Homo sapiens*.



Directional selection of a bigger brain

The trend toward a bigger brain is difficult to establish in detail owing to the few fossil skulls available; the overlap in the large range of brain sizes that exist within a population at any given time; the difficulties in measuring the braincase volume of partial or deformed fossil skulls; and little or no information about the size of the body that went with the skull. But a big brain does not evolve on its own; it evolves

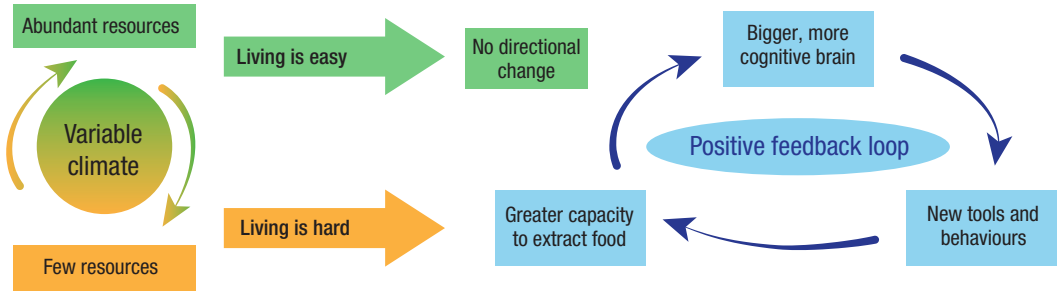


along with other anatomical features and cultural artefacts. Populations having a bigger mean brain size are more likely to make more innovative things, and some of these cultural items – with a strong bias to those made from hard stones – may end up preserved in the archaeological record. Recent research has shed new insight on the critical question of how stone tools were used, and the equally important question of when they were made. Together, these insights provide a chronology of not only when the brain may have become larger but when it became smarter. Because more than just size, what we ultimately want to know is: what was the brain that was once housed inside the skull capable of doing?

Given that *H. erectus* was so set in their ways and successful for the first nearly one million years of their existence, what was it that initiated the directional selection for a bigger brain? In a word, it was climate. As observed by Darwin, extreme cold

Trend toward a bigger brain in our lineage corresponds to changes in stone tools and increasing climate variability

or drought could wipe out large numbers of individuals and act as a strong selective force. Climate had always been variable, but from 0.9 million years ago climate fluctuations suddenly intensified, with the onset of unprecedented periodic swings between warm and cold. These major changes in climate forced our ancestors to contend with stressful periods when resources suddenly became scarce. The pressures associated with abrupt changes in habitat imposed on those living in this unsettled world are argued here to have ultimately driven the selection for a bigger brain in our lineage. Technology as reflected in the tools is linked to a larger brain by a positive feedback loop in which the use of novel tools or the adaptation of new behaviours to extract more food enabled growing a larger brain, which in turn was better able to make and use tools or work cooperatively in groups to extract more food. Prior to large variations in climate, a big brain would have been superfluous, with the extra energy required to run it an unwarranted disadvantage. However, once an unsettled world set in, a big brain able to figure out how to adapt to change became advantageous. How did global climate vary in the past and how did it influence our evolution?



An unsettled world

The world initially became less settled with the onset of Northern Hemisphere glaciation 3 to 2.5 million years ago. This initial change in climate coincided with, and was argued in the previous chapter to have possibly played an important role, in the evolution of our genus *Homo* and the emergence of *H. erectus*. Climate alternated between glacial periods (g), when cooler conditions resulted in the building up of ice and the lowering of global sea level by between 20 and 75 metres, and interglacial periods (ig), when warmer conditions melted the same ice and global sea level rose to return to levels similar to today. *H. erectus* had become well adapted to these relatively moderate glacial to interglacial cycles (indicated by g/ig). The steady rhythm

Variable climate selected for a larger brain