Word Count: 620 **Tiya Chokhani**

Tool usage as an adaptive strategy in human development dates back at least 3.3 million years when stone tools were discovered at prehistoric sites in Africa (Toth and Schick, 2015). The archaeological record reveals a significant period of reliance on stone tools, documented by a series of ancestor species and a steadily rising rate of technical development.

The earliest stone tools are called “Oldowan” and have been dated back to 2.3mya. Experiments have shown that these tools were made by removing flakes from stone cores and that they could have been used as ‘cutting tools’(Toth, 1985). Early hominins could have used these flakes as knives to hunt small animals, scavenge carcasses, or even make spears and sticks from branches. According to the "expensive tissue theory," being able to acquire and add meat to their diets may have played a critical role in enabling the evolution and development of the human brain, thus changing their biology(Aiello and Wheeler, 1995). It can be seen that hominins started transporting stones across the terrain by comparing the geological source of the rock against the sites where they were found. There’s evidence of selectivity and choice in the selection of stones used. Hence, it’s clear that hominins did not use a random selection of locally available stones. This shows a significant change and growth in cognition as they weren't just using the tools by accident but were planning and actively thinking about their use (Toth and Schick, 2015).

Beginning at 1.8mya, hominins created more advanced stone tools known as Acheulean technology, which marked a substantial change from Oldowan toolmaking. The large cores needed to make Acheulean tools fanned larger distances than those needed for Oldowan tools. Since these cores were more likely to be found in more upstream areas, the emergence of this technology can act as proof that hominins were utilizing more upstream regions of the environment (Toth and Schick, 2015). The process of making these tools was more elaborate and time-consuming. Moreover, Acheulean tools production required more than 4 times the cognitive effort needed to make Oldowan tools (Toth and Schick, 2015). Therefore, it can be seen how the level of cognition is increasing alongside the amount of cognitive effort being applied. These tools are extremely useful in hunting large animals which could point towards a shift to meat in hominin's diet and as mentioned earlier, this could have helped expand their brain tissue allowing for more enhanced tool-related behavior and cognitive processes.

The Middle Palaeolithic stage started about 300kya. The main technology used in this era was flake tools that were built using specific types of cores. These tools usually had some sort of *standardization* and their production followed a set process. Compared to prior technologies, these "prepared core" technologies imply stronger cognitive abilities and predetermination (Toth and Schick, 2015). Microscopic use-wear analysis suggested that these tools could have been used in “composite tools” like a shaft in a throwing spear. This shows how hominins are not only using tools for multiple things but are now putting them together to try and create more complex technologies which help improve their standard of living. During this time, evidence of fire at habitation sites also becomes considerably more frequent(Toth and Schick, 2015). The use of fire in everyday life necessitates a detailed understanding of the mechanical processes of production as well as the other materials needed. Controlling fire creation and utilization would increase their capacity to compete against predators on the terrain, as well as broaden their access to food supplies and nutritional value allowing for better biological brain and body development.

While human fossils can tell us a lot about previous hominin species they can tell us, even more, when studied alongside archaeological evidence. Finding fossils can be extremely difficult as we have to locate the geological surfaces of interest and the locations of ecological zones that are suitable. Even when fossils are found they still can't tell us about the activities and behaviors of the species, so we need archeological evidence to provide context for the behavior surrounding the fossils. For example, when fossils are found in pits with animal carcasses and tools that can tell us that these species were either hunting animals or scavaging for their meat, but if only the fossils were found then we would just be able to tell the species resided here at one point.

Improved adaptation through intelligent, inventive tool use may also have selected for enlarged brains, and the use of these tools to procure ani- mal resources may have set the stage and allowed the rapid brain expansion that ensued. Of course, a circular feedback mechanism likely ensued, with the brain expan- sion also supporting enhanced tool-related behaviors and tool evolution, which would have been enhanced by fur- ther brain expansion, and so on.

Prehistoric evidence for tool use as an adaptive strategy in human evolution extends back at least 3.3 million years, when stone tools began to be found at prehistoric sites in Africa in regions containing fossils of early bipedal ancestors. Archaeological research documents a long period of dependence on stone tools through a succession of ancestral species and a gradually accelerating pace of technological change, with emergence of large complex societies and rapid technological proliferation only within the past 10,000 years.

The coevolution of technology and human biology has been an important focus of palaeoanthropology. This process has been dubbed the “biocultural feedback system” by noted anthropologist Sherwood Washburn (1960), “gene–culture coevolution” by sociobiologists Alan Lumsden and E.O Wilson (1983), and “techno-organic evolution” by the authors of this chapter (Schick and Toth, 1993).

stone tool sites continue on in time after their extinction and become even more numerous and widespread, as do evolving species of Homo. Thus, it is certain that the adaptation of Homo had incorporated a technological adaptation into its evolutionary strategy, and it would appear likely that Homo species were largely responsible for early stone tool industries.

In the past million years, *Homo* has undergone fairly rapid and dramatic evolutionary changes along with an accelerating pace of technological change. Between 1 mya and a few hundred thousand years ago,

This later evolution of the genus *Homo* witnessed the technological transition from the later Acheulean to the Middle Paleolithic (Middle Stone Age in sub-Saharan Africa) and then the Upper Paleolithic

Early *H. sapiens* were generally associated with Middle Palaeolithic and Middle Stone Age technologies.

The emergence of food production, metalworking, complex societies, and escalating technological change are recent phenomena in our evolution ([Scarre, 2013](https://www.sciencedirect.com/science/article/pii/B9780128026526000141?via%3Dihub#bib54)), all produced by modern *H. sapiens* since the end of the last Ice Age 10,000 to 12,000 years ago.

In primates, however, many instances of tool-related behaviors have been documented in a number of species that show good evidence of having been learned rather that innate and to be shared through learning within the primate group.

As our closest living relatives, the chimpanzees, show a diversity of tool-using and even sometimes toolmaking behaviors in the wild, it might be considered very likely that early hominin ancestors also utilized a variety of other materials before the prehistoric inception of stone tool manufacture and use. … Thus, the beginning of a verified, documented record of tool use in the human lineage begins with the invention of flaked and battered stone tools.

The earliest known stone tools are found from sites in the Great Rift Valley of East Africa.

At present, the earliest probable claim for stone artifacts is at Lomekwi 3, West Turkana, Kenya

The earliest stone tools are categorized as the “Oldowan,” Starting approximately 2.3 mya, Oldowan sites become more numerous and widespread on the African continent,

**Oldowan Tools**

• First stone tools ~ 3 mya

• Gona, Ethiopia 2.6-2.4 mya

• Oldovai Gorge 2.0-1.6 mya

Oldowan Tool Use

• Simple, expedient technology

• Raw materials transported 10-15 km

• Occurs in areas with both Homo & Australopithecus/Paranthropus fossils

• Multiple uses based on analyses of wear patterns derived from experimental archaeology

The Next Step - Homo erectus/ergaster

• 1.8 to 0.6 mya in Africa

• Skull with ancient traits

• Brain size 600-910 cc

Associated with 1st Acheulean stone tool technology?

**Acheulean Industry**

• 1.6 - 0.25 mya

• More sophisticated flaking technology

• Core prep

• Soft hammer after 0.6 mya

• However, little change or variation across time and space

Late Acheulean tech in west

Schöningen Spears ~300 kya

• Wood spears associated with hunted and butchered horses in central Germany

**Mousterian Technology**

• Middle Stone Age/Paleolithic

• 300 - 32 kya

• Levallois technique widespread

• Greater standardization & use of hafted tools

• Few significant differences in assemblages assigned to AMH or Neanderthals

• Prior to writing, archaeology must focus on symbolism to track emergence of language/symbolic capacity

The Earliest Known Stone Tools

The Oldowan (Earlier Lower Paleolithic/Early Stone Age)

The Acheulean and Contemporaneous Industries (Later Lower Paleolithic)

The Middle Paleolithic/Middle Stone Age

The Upper Paleolithic/Late Stone Age

We can figure out what the geological source of the rock is and find out if they're getting transported, that's already a change in cognition. We find fragments of fossils sometimes with stone tools with pieces of us to show. We find tools together with animal carcass and bones due to erosion doesn't mean they were all used together, but the bias is our ancestors went out and stalked and hunted animals there's nothing in the archaeological record that shows that. Could just be scavenging the carcass cause the animal died.