Stone Age humans needed more brain power to make big leap in tool design (w/ Video)

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A variety of stone tools. Image: Wikipedia.

Stone Age humans were only able to develop relatively advanced tools after their brains evolved a greater capacity for complex thought, according to a new study that investigates why it took early humans almost two million years to move from razor-sharp stones to a hand-held stone axe.

Researchers used computer modelling and tiny sensors embedded in gloves to assess the complex hand skills that early humans needed in order to make two types of tools during the Lower Palaeolithic period, which began around 2.5 million years ago. The cross-disciplinary team, involving researchers from Imperial College London, employed a craftsperson called a flintnapper to faithfully replicate ancient tool-making techniques.

The team say that comparing the manufacturing techniques used for both Stone Age tools provides evidence of how the human brain and human behaviour evolved during the Lower Palaeolithic period.

Neuroscientist Dr Aldo Faisal, the lead author of the study from the Departments of Bioengineering and Computing at Imperial College London, says: "The advance from crude stone tools to elegant hand-held axes was a massive technological leap for our early human ancestors. Hand-held axes were a more useful tool for defence, hunting and routine work. Interestingly, our study reinforces the idea that tool making and language evolved together as both required more complex thought, making the end of the Lower Palaeolithic a pivotal time in our history. After this period, early humans left Africa and began to colonise other parts of the world."

Prior to today's study, researchers have had different theories about why it took early humans more than 2 million years to develop stone axes. Some have suggested that early humans may have had underdeveloped motor skills or abilities, while others have suggested that it took human brains this time to develop more complex thoughts, in order to dream up better tool designs or think about better manufacturing techniques.

The researchers behind today's study say that their evidence, from studying both tool-making techniques, confirms that the evolution of the early human brain was behind the development of the hand-held axe. Furthermore, the team suggest that the advancement of hand-held axe production may have also coincided with the development of language, as these functions overlap in the same regions of the modern and early human brains.

The flintnapper who participated in today's study created two types tools including the razor-sharp flakes and hand-held axes. He wore a data glove with sensors enmeshed into its fabric to record hand and arm

movements during the production of these tools.

After analysing this data, the researchers discovered that both flake and hand-held axe manufacturing techniques were equally complex, requiring the same kind of hand and arm dexterity. This enabled the scientists to rule out motor skills as the principal factor for holding up stone tool development.

The team deduced from their results that the axe-tool required a high level of brain processing in overlapping areas of the brain that are responsible for a range of different functions including vocal cords and complex hand gestures.

This is the first time that neuroscientists, archaeologists, anthropologists and flintnappers have teamed together, using cutting edge technology including data glove sensors and advanced modelling, to develop a deeper understanding of early human evolution.

In the future, the team plan to use their technology to compare tools made by Neanderthals, an extinct ancestor of humans, to glean insights into their brain development.

More information: "The manipulative complexity of Lower Palaeolithic stone tool making" *PLoS One* journal, Wednesday 3 November 2010.

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