doi 10.4436/jass.93014

JASs *forum*
Journal of Anthropological Sciences
Vol. 93 (2015), pp. 181-183

# The hand of the Neandertals: dexterous or handicapped?

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The hand is a fundamental part of the body. In fact, it links us to the environment and helps in the creative expression of the brain. The human hand participates in numerous activities and in a multitude of ways, including prehension, grasping, grooming, gesture and communication. As a consequence, the human hand has been studied from many different angles, focusing on its structure, function, evolution or development during the lifespan (Tubiana, 1981; Napier, 1993).

In evolutionary studies, the hand has long been the object of attention. Even before the theory of evolution was accepted, in 1834 the Scottish surgeon, Sir Charles Bell, dedicated a book to this organ (Bell, 1834). Bell considered the hand not as a product of evolution, concluding that its perfect adaptation was evidence of design in creation. On the contrary, Darwin observed that different organisms with hands could use them in different ways but their structures were similar. Thus, he maintained that all the animals inherited them from a common ancestor.

Versatility is the hallmark of the primate hand, with a thumb that is functionally differentiated from the rest of the fingers (Marzke, 1996). Anthropological studies have explored the anatomy of the hand in closely related primates in order to establish which traits could be related to functions and manipulative behavior. This knowledge gained of the hand morphology in humans, apes and monkeys has helped us better understand which traits identified in the different paleoanthropological remains could be interpreted functionally.

The discovery of a set of hand bones in 1960 at Olduvai Gorge together with some primitive stone tools, which led to the definition of the new species, named *Homo habilis* ("handy man"), included the view that the hand was capable of making the associated tools (Leakey *et al.,* 1964). The Olduvai hand bones, although they were very similar to humans, show some ape-like traits. Since the first description by Napier (1962), their anatomy, their taxonomic attribution and the functional interpretation of their morphology have been a matter of debate (Moya-Sola *et al.,* 2008 and reference therein). Napier started a discussion which influenced paleoanthropological research because he linked some anatomical features to technological capabilities. Other hand fossils have been discovered since then and new techniques have made it possible to analyze the hand morphology of other hominids, including different species of *Australopithecus*, *Paranthropus* or *Homo*. However, since Napier, the question has remained the same: can we infer manipulative behavior from a particular hand anatomy? Do we agree about which traits are necessary for an efficient manufacture and use of tools? The anatomy of the Neanderthal hand is very close to ours but, at the same time, there are some distinctive features. Therefore, studies on Neanderthal hand anatomy cannot avoid these issues and the functional inferences proposed according to their morphological differences are currently under scrutiny.

Bruner & Lozano (JASs *forum* 2014, vol. 92: 273) initiated an in depth and provocative debate using an approach that links biological

and cultural information. They propose that the mouth was an additional interface in the Neanderthal lineage because they present an inefficient visuo-spatial integration system. Immediately, we must face the question regarding the Neanderthal hand and whether or not the anatomical differences of this lineage could have produced distinctions at functional level.

Very few hand remains have been recovered for Early *Homo* species, neither for the first representatives of the first Europeans lineage nor for the attributed last common ancestor between Neandertals and modern humans (Lorenzo *et al.,* 1999, 2015). On the contrary, there is a lot of material regarding the hand of the populations that are closely related to Neandertals due to the extraordinary record from Sima de los Huesos Middle Pleistocene site (Lorenzo, 2007). The Neanderthal custom of burying the dead has provided us with plenty of postcranial remains, including fairly complete hands. Thanks to this extraordinary record, many authors have tried to infer manual capabilities from the anatomy of the Neanderthal hand. In literature, we find two extreme positions: the defenders of the theory that there are no functional differences between Neandertals and the researchers that sustain different capabilities (usually indicating there is a lower level of capability the Neanderthal group).

The hands of the Neandertals were broad in general dimensions, the joints relatively large, the muscle insertions well-developed, especially the thenar (thumb region) and the interosseus muscles, the finger-tips large and broad. Remarkably, the Neanderthal thumbs have a total length which, relative to the rest of the finger, is equal to modern humans while the internal proportions were different. In fact, the proximal phalanx of the Neanderthal thumb was relatively shorter and the distal phalanx was relatively longer. Concerning function, the evidence suggests that the precision grip of Neandertals was powerful and well developed, the opposability of the thumb was equal to modern humans and there is no doubt that Neandertals were able to approximate their thumb to the other finger tips in the same way as modern humans (Napier, 1993).

Due to differences in carpal and metacarpal joint surfaces, some authors (i.e. Niewoehner, 2001) argue that important manipulative differences existed between Neandertals and modern humans, not in dexterity but in grip strength and the ability to resist forces in particular grip positions (Churchill, 2001). However, could we really unequivocally link a trait or a set of traits to the real use of the hand? The variability in the use of hands by different people with identical morphologies invalidates this deterministic approach. Versatility of the human hand could be illustrated by the different hand uses in modern humans. Furthermore, humans with strong disabilities and physical or mental handicaps have demonstrated that their biological system is able to overcome these difficulties. People are capable of learning how to use prostheses or even to use the feet as substitutes of the hand in amazing ways. What makes it possible to overcome these obstacles goes well beyond the hand anatomy. Probably it is linked to psicomotricity, including motor coordination of the musculoskeletal system, processing of the propioceptive information by the brain and the nervous system and execution of body movements.

The subtle differences in the Neanderthal hand makes it difficult to attribute any different forms of manipulative behavior. Moreover, the use of the mouth as a third hand by the Neandertals was not due to limitations in their hand anatomy. We cannot separate the hand from the rest of the integrative system which includes biological and cultural information and if we want to expand the statement of Bruner & Lozano (2014), any integrative approach must consider the information from hand anatomy.

## Acknowledgements

*I'm deeply grateful to Emiliano Bruner and Marina Lozano for inviting me to participate in this JASs Forum. Gala Gómez-Merino provided helpful comments on the manuscript. This paper is supported by Ministerio de Economía y Competitividad, Spain (CGL2012-38434-C03-01/03) and AGAUR 2014 SGR 899.*

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