9. Neanderthal hands in their proper perspective

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Abstract

Neanderthal hand remains are usually compared to those of recent humans because recent human samples are readily available. These comparisons demonstrate that Neanderthal hand morphologies are at or beyond the range of recent human samples for traits such as: expanded distal tuberosities, rugose musculotendinous attachment sites, dorsopalmarly flat metacarpal 1 bases, relatively short thumb proximal phalanges, more parasagittally oriented capitate metacarpal 2 facets, reduced metacarpal 3 styloid processes, radioulnarly flat metacarpal 5 bases, and large, projecting carpal tubercles. Functional interpretations suggest that Neanderthal hands are adapted primarily for power during manipulation.

Neanderthal hands are rarely systematically compared to those of other Late Pleistocene humans. Metric and three-dimensional geometric morphometric analyses and qualitative observations demonstrate that Early and Late Upper Paleolithic hand remains are more similar to recent human hands than to Neanderthal hands and that the Skhūl/Qafzeh sample is similar to the Upper Paleolithic samples. However, Early and Late Upper Paleolithic hand remains are not indistinguishable from those of modern humans. Evident in the Early Upper Paleolithic sample are features reminiscent of Neanderthals, such as the presence (on some specimens) of significant muscle crests on metacarpals 1 and 5 as well as a Neanderthal-like metacarpal 1 base shape. Additionally, both the Early and Late Upper Paleolithic samples have intermediate metacarpal 2 and 3 base morphologies relative to Neanderthal and recent human samples. There are indications of increased stabilization of the mid-carpometacarpal region, the enhancement of first finger precision movements, and reductions in mechanical advantages in the Early and Late Upper Paleolithic specimens. Some features found in the Upper Paleolithic samples are likely related to increases in the frequency and sophistication of hafted tools, while functional adaptations related to more frequent precision grip usage are argued to be associated with fine finger movements.

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Introduction

The fossil record indicates that anatomically modern human cranio-facial and postcranial morphologies evolved in the Old World during the Late Pleistocene. Traditionally, analyses of the cranio-facial region have been the main focus of phylogenetic debates, especially regarding the "fate" of the Neanderthals. The primary concern of these debates has been whether, and to what extent, they contributed to the recent human gene pool (Stringer & Andrews, 1988; Wolpoff, 1989a, b, 1992; Bräuer, 1992; Stringer, 1992, 1994; also see contributions to this volume).

Sometimes lost in the emphasis on phylogeny are issues of human behavioral evolution, usually the subject of archaeological analyses. In general, Late Pleistocene archaeological remains indicate substantial changes in subsistence strategies, the pace of technological innovation and the spatial organization of sites, which may be indicative of an adaptive shift towards ethnohistorically documented hunting and gathering behavioral pattern (Mellars, 1994). Some paleoanthropologists have put aside the issues of phylogeny in favor of quantifying correlated shifts in postcranial morphology within the framework of the hypothesis that archaic human behavior was not simply a technologically limited version of recent hunter-gatherer behavior (see Trinkaus [1992b] for a historical perspective).

Central to this intellectual and methodological framework is the integration of Paleolithic archaeology with functional analyses of the appendicular skeleton (Trinkaus, 1976, 1977, 1978, 1983a, b, 1986a, b, 1989b, 1992a, b; Lovejoy & Trinkaus, 1980; Riley & Trinkaus, 1989; Churchill & Trinkaus, 1990; Trinkaus & Villemeur, 1991; Churchill, 1994; Niewoehner et al., 1997b; Niewoehner, 2000, 2001). These analyses indicate that Neanderthals, as the most numerous and best preserved examples of Late Pleistocene humans, are morphologically and functionally distinct from more recent humans in many developmentally plastic regions of the skeleton, including the hand. The habitual use of contrasting manipulative postures changes the positions in which articulations are peak loaded and alters the vectors of the principal joint reaction forces. Between-sample contrasts in articular facet orientation could therefore be indicative of contrasting patterns of habitual force transmission. This is a reasonable position because animal experiments demonstrate that subchondral bone has the ability to dynamically model to restore effective load transmission when load patterns are altered during growth (Frost, 1987, 1990, 1999; Llinas et al., 1993; Frost et al., 1998; Plochocki & Organ, 2003). However, the mechanisms of ontogenetic responses to loading on cortical bone and subchondral bone are complex and not well understood and it appears that the majority of skeletal responses to altered load patterns in cortical bone (and perhaps subchondral bone) occur before sexual maturity (Pearson & Lieberman, 2004). Thus, the behavioral interpretations presented later should be considered working hypotheses that, if correct, reflect sub-adult behaviors that presumably are carried into adulthood.

Why study hands? The evolution of hominid manipulative behaviors continues to generate considerable interest in paleoanthropology, given the primacy of technology in the human adaptive complex. Central to the elucidation of fossil hominid manipulative capabilities and habitual behaviors is the examination of fossil hand remains within a comparative framework. Early Pliocene hominid hands display a mosaic of ape-like and human-like traits, being separated from recent humans by a considerable morphological gap, and they appear to have not yet achieved fully human manipulative capabilities (Lewis, 1977; Susman & Creel, 1979; Marzke, 1983, 1997; McHenry, 1983; Marzke & Marzke, 1987; Marzke &