To See Behind Walls; Contrast-Enhanced Micro-CT 3D Reconstructions of Morphological Adaptations in the Fourth Digit of a Human for Tool-usage

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The human hand is a pillar of the species' distinction, a crucial orchestrator of the technological and cognitive adaptive niche that has shaped the modern world. Artifacts of morphological adaptations guiding transitions in early hominin evolution are present in the hand. As early hominins shifted from suspensory arboreal regimes to bipedalism, and from occasional tool-using to tool-making, the human hand adapted morphologically, leading to its current form. Conversely, the chimpanzee hand evolved within a primarily arboreal locomotive niche at the expense of optimization for tool-usage. Comparative studies can elucidate functional relationships that have shaped these changes. In this study, we aim to visualize the morphological adaptations present in the human hand in a non-destructive manner that can be applied to rare and valuable chimpanzee specimens. Using DragonFly software, we present a 3D reconstruction of an entire human hand, contrast-enhanced with phosphotungstic-acid. Additionally, we identified and segmented four unique morphological adaptations present in the human finger for advanced manual handling ability. These include the unique morphology of the distal phalanx, a strengthened flexor digitorum profundus insertion, increased neural innervation in the distal tip, and a compartmentalized digital pulp. This study precedes our upcoming application of the above on a chimpanzee fourth digit, and a future report of comparative sensory neural innervation, which is involved in sensorimotor feedback during tool-usage in both species but may be specialised in *Homo sapiens*.