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Hand morphometrics, electrodermal activity, and stone tools haptic perception

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Abstract

Objectives: Tool use requires integration among sensorial, biomechanical, and cognitive factors. Taking into account the importance of tool use in human evolution, changes associated with the genus *Homo* are to be expected in all these three aspects. Haptics is based on both tactile and proprioceptive feedbacks, and it is associated with emotional reactions. Previous analyses have suggested a difference between males and females, and during haptic exploration of different typologies of stone tools. Here, we analyze the correlation between electrodermal reactions during stone tool handling and hand morphology to provide evidence of possible allometric factors shared by males and females.

Methods: Electrodermal analysis was used to investigate some specific parameters involved in these reactions, such as changes in the level of attention and arousal. We analyzed the responses of 46 right-handed adults to 20 distinct stone tools while blindfolded.

Results: Females have smaller hands and a wider range of electrodermal reactions. Within males and females, hand diameters and general hand size do not correlate with the degree of electrodermal level and response.

Conclusions: Sex differences in electrodemal reaction during stone tool handling are apparently not due to the effect of hand size or proportions. Differences between males and females are better interpreted as real sex differences, either due to a biological or cultural influences. Hand size does not influence the degree of arousal or attention during tool exploration, suggesting that other factors trigger individual reactions. These results add to a general cognitive approach on hand-tool evolution and tool sensing.

1 | INTRODUCTION

In the human genus, tool use and tool making represented a crucial shift toward a new ecological and dietary niche (Key & Lycett, 2016; Williams-Hatala et al., 2018). Accordingly, hand structure and function underwent relevant evolutionary specializations in the bones and muscles (Almécija, Smaers, & Jungers, 2015; Diogo, Richmond, & Wood, 2012; Tocheri, Orr, Jacofsky, & Marzke, 2008). This was possible through the coevolution with those parietal cortical regions involved in reaching, grasping, and object exploration (Goldring & Krubitzer, 2017). Body-tool relationship is based on both tactile and proprioceptive information (Tunik, Rice, Hamilton, & Grafton, 2007; Turvey & Carello, 2011), and this haptic experience finally leads to an integration of the tool within the body scheme of the brain (Iriki, 2006), through a remapping process bridging biomechanics with cognition (Heed, Buchholz, Engel, &

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