

Author's Accepted Manuscript

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Austin Rallis, Kelene A. Fercho, Taylor J. Bosch, Lee A. Baugh



PII: S0028-3932(17)30488-8
DOI: <https://doi.org/10.1016/j.neuropsychologia.2017.12.023>
Reference: NSY6614

To appear in: *Neuropsychologia*

Received date: 2 August 2017
Revised date: 14 November 2017
Accepted date: 12 December 2017

Cite this article as: Austin Rallis, Kelene A. Fercho, Taylor J. Bosch and Lee A. Baugh, Getting a handle on virtual tools: An examination of the neuronal activity associated with virtual tool use, *Neuropsychologia*, <https://doi.org/10.1016/j.neuropsychologia.2017.12.023>

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Title: Getting a handle on virtual tools: An examination of the neuronal activity associated with virtual tool use.

Austin Rallis^{a,b}, Kelene A. Fercho^{a,b}, Taylor J. Bosch^{a,b}, Lee A. Baugh^{a,b*}

^aBasic Biomedical Sciences, University of South Dakota, 414 E Clark St, Vermillion, SD 57069, USA.

^bCenter for Brain and Behavior Research, University of South Dakota, 414 E Clark St, Vermillion, SD 57069, USA.

*Correspondence to: Lee.Baugh@usd.edu

Abstract

Tool use is associated with three visual streams—dorso-dorsal, ventro-dorsal, and ventral visual streams. These streams are involved in processing online motor planning, action semantics, and tool semantics features, respectively. Little is known about the way in which the brain represents virtual tools. To directly assess this question, a virtual tool paradigm was created that provided the ability to manipulate tool components in isolation of one another. During functional magnetic resonance imaging (fMRI), adult participants performed a series of virtual tool manipulation tasks in which vision and movement kinematics of the tool were manipulated. Reaction time and hand movement direction were monitored while the tasks were performed. Functional imaging revealed that activity within all three visual streams was present, in a similar pattern to what would be expected with physical tool use. However, a previously unreported network of right-hemisphere activity was found including right inferior parietal lobule, middle and superior temporal gyri and supramarginal gyrus – regions well known to be associated with tool processing within the left hemisphere. These results provide evidence that both virtual and physical tools are processed within the same brain regions, though virtual tools recruit bilateral tool processing regions to a greater extent than physical tools.

Keywords: Tool use, Virtual tools, fMRI, Sensorimotor control, Visual streams, Tool lateralization

1. Introduction

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