

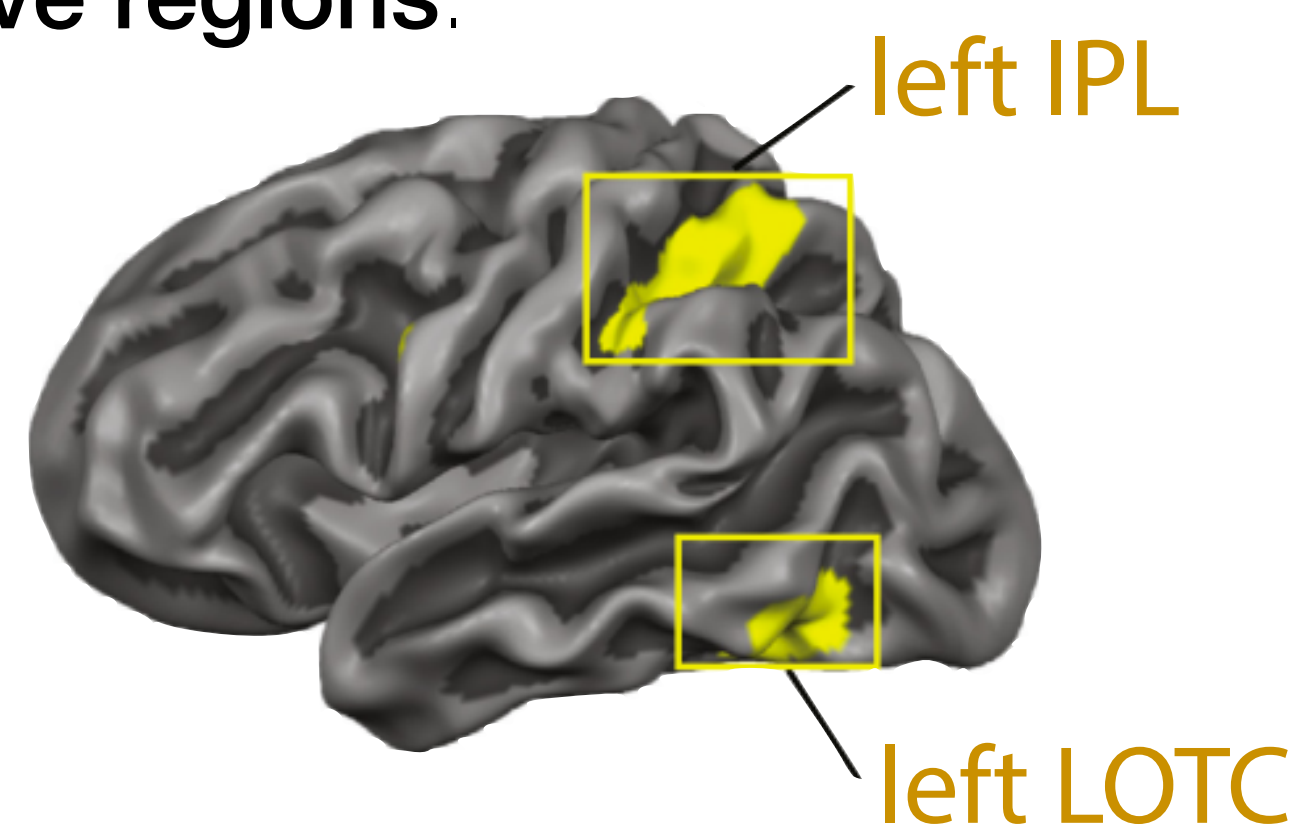
Tool-selective lateral temporal cortex is sensitive to event relations

Anna Leshinskaya*, Mira Bajaj & Sharon L. Thompson-Schill

University of Pennsylvania

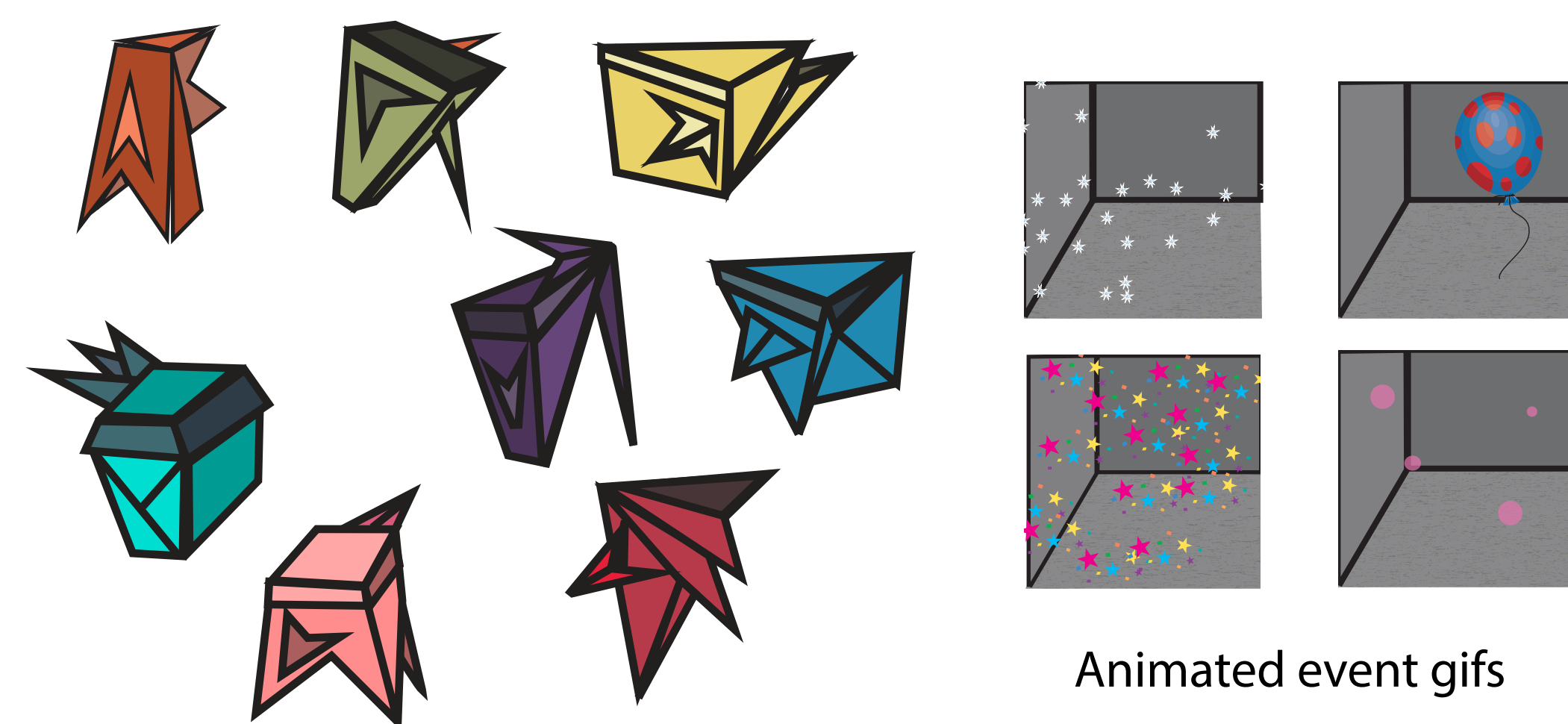
*alesh@sas.upenn.edu

left inferior parietal lobule (IPL) and lateral occipito-temporal cortex (LOTC) respond preferentially to images and names of tools relative to other categories of objects. Action-related knowledge is thought to explain these responses (Peelen et al 2011; Bracci et al 2017; Perini et al 2014; Valyear et al 2007; Mahon et al 2007). A less-explored but more specific property of tools is their ability to exert changes on the environment (i.e., a causal event relation). **We cued causal event relations with event order using novel objects and events, and examined the responses of tool-selective regions.**



Garcea, F.E., & Mahon, B. Z. (2014). Parcellation of left parietal tool representations by functional connectivity. *Neuropsychologia*, 60, 131–43.

novel objects & events



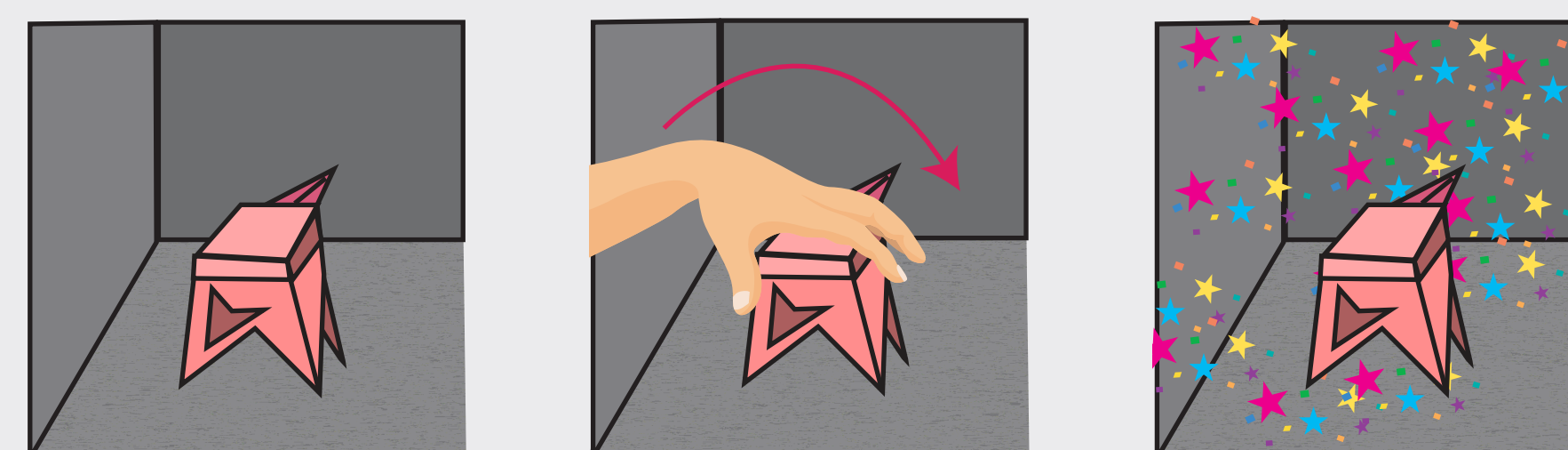
Shapes assigned in counterbalanced fashion to conditions; 2 objects/condition with one of two ambient events

conditions

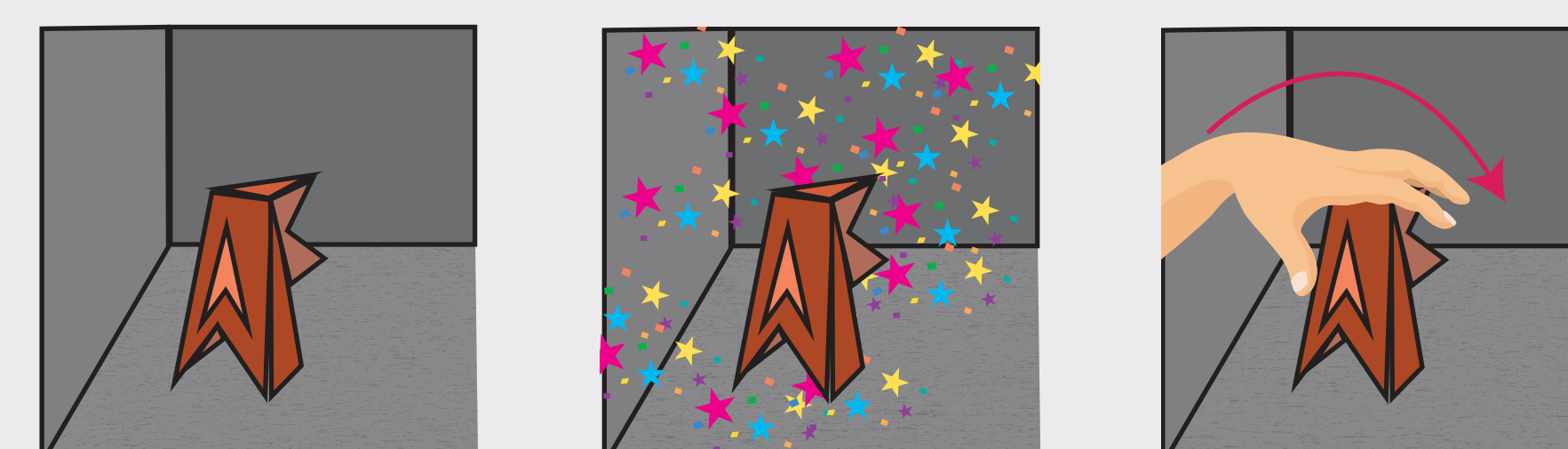
Movement Type: Hand-generated vs Self-generated

Event Relation: movement precedes (Causes) or follows (Reacts to) other events

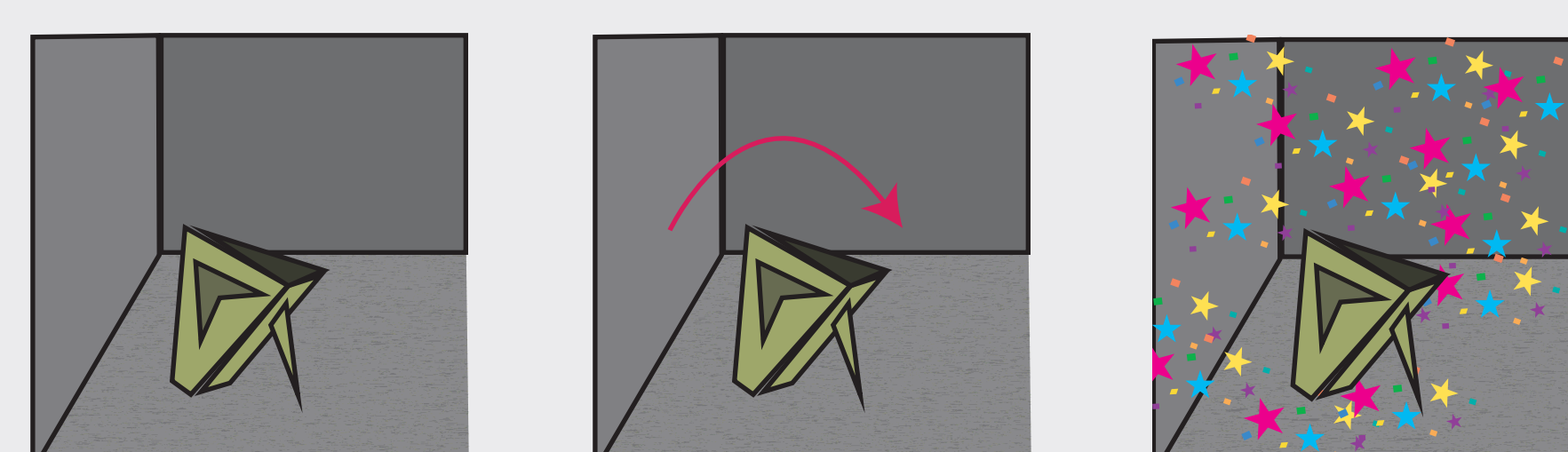
Hand-Causer



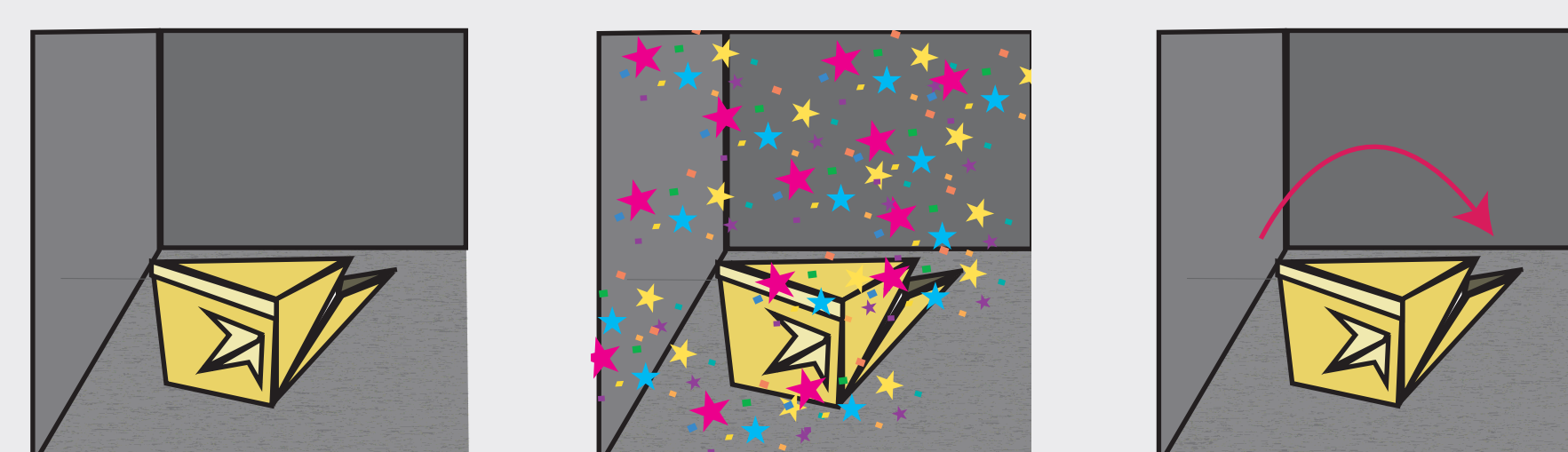
Hand-Reactor



Self-Causer



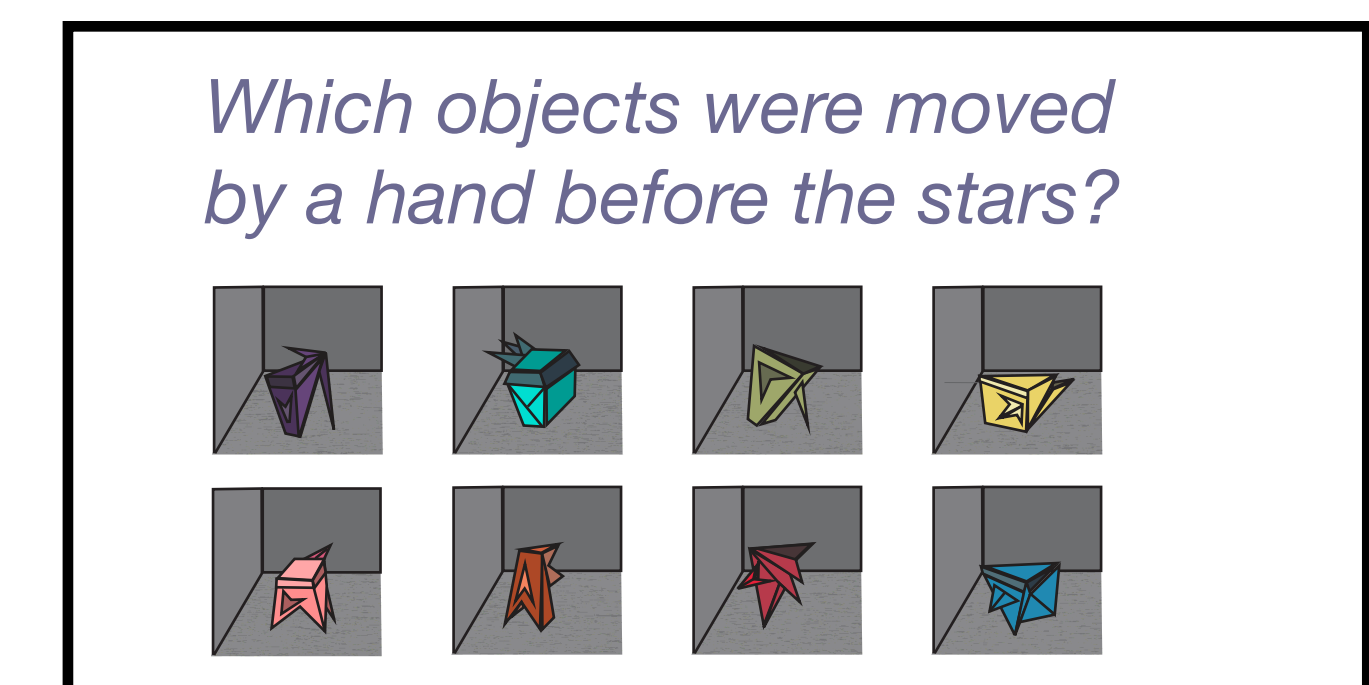
Self-Reactor



procedure

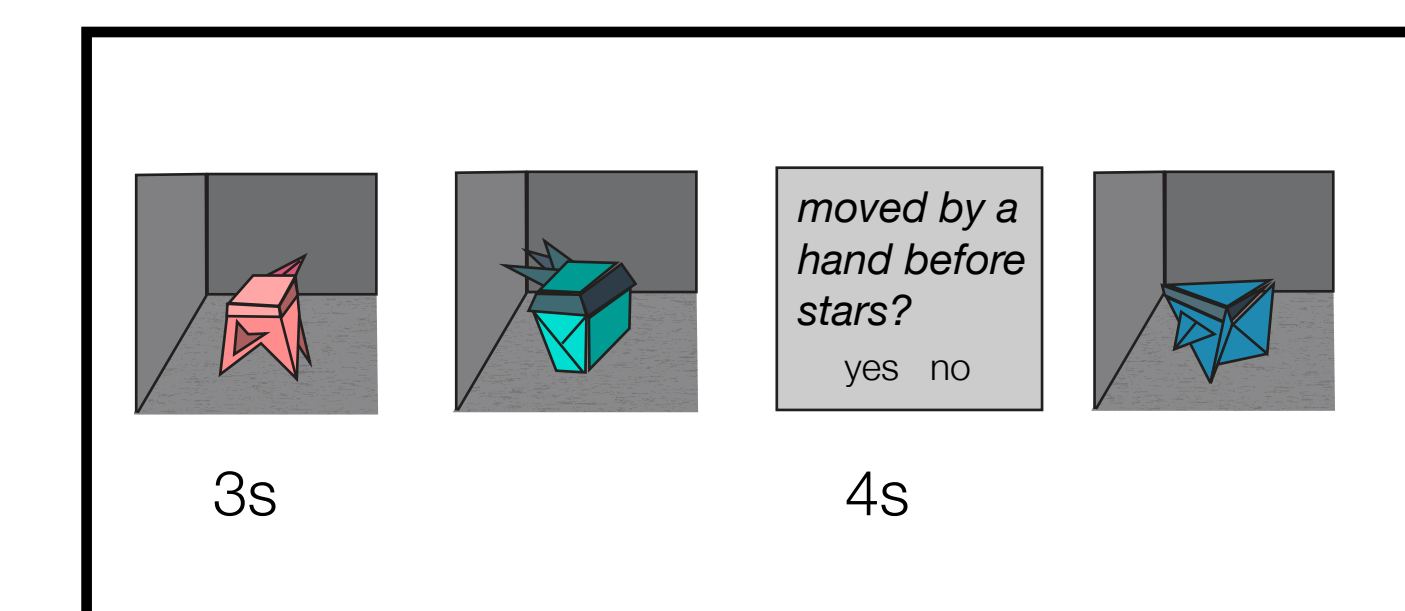
Training

Each animation (2/condition) shown 45 times over 5 blocks
Knowledge tested after each block with 12 questions probing event knowledge
Participants are at ceiling prior to scan



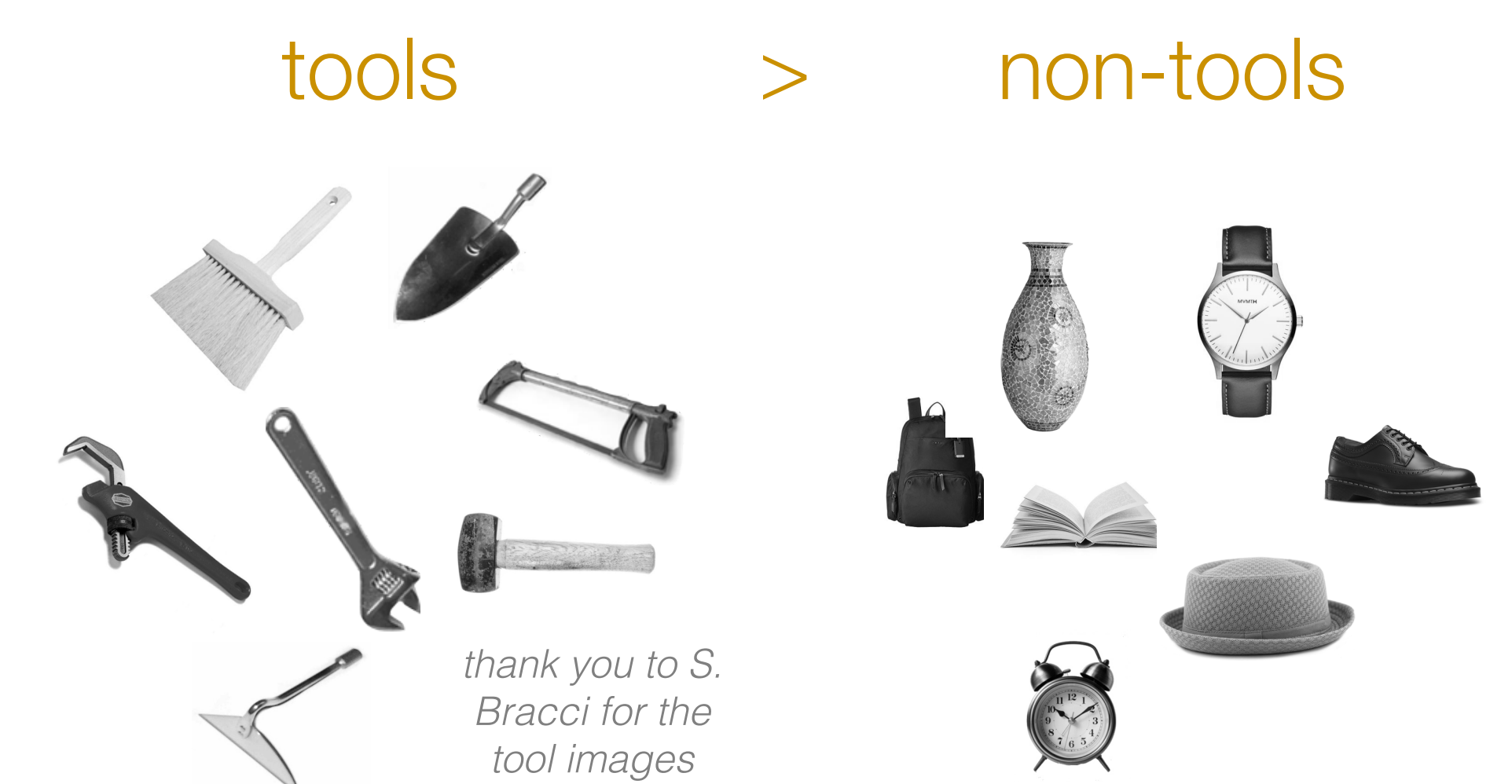
In-Scan Retrieval Task

Each object shown as static image 72 times over 8 runs
16/72 trials followed by a question probing specific and general aspects of associated event animations



Tool Localizer

800 ms presentation + 200 ms fixation / trail; blocked design with 8 trials/-block; 1-back repetition detection task; also included animals and hands

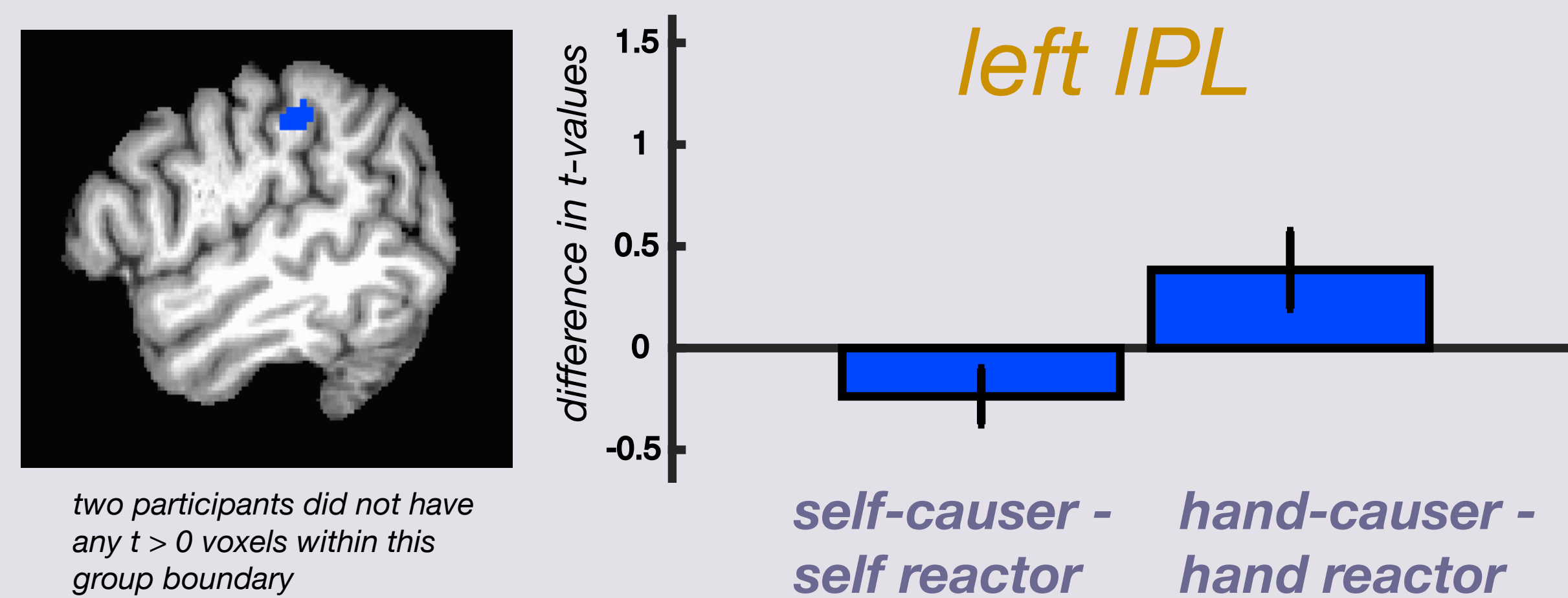
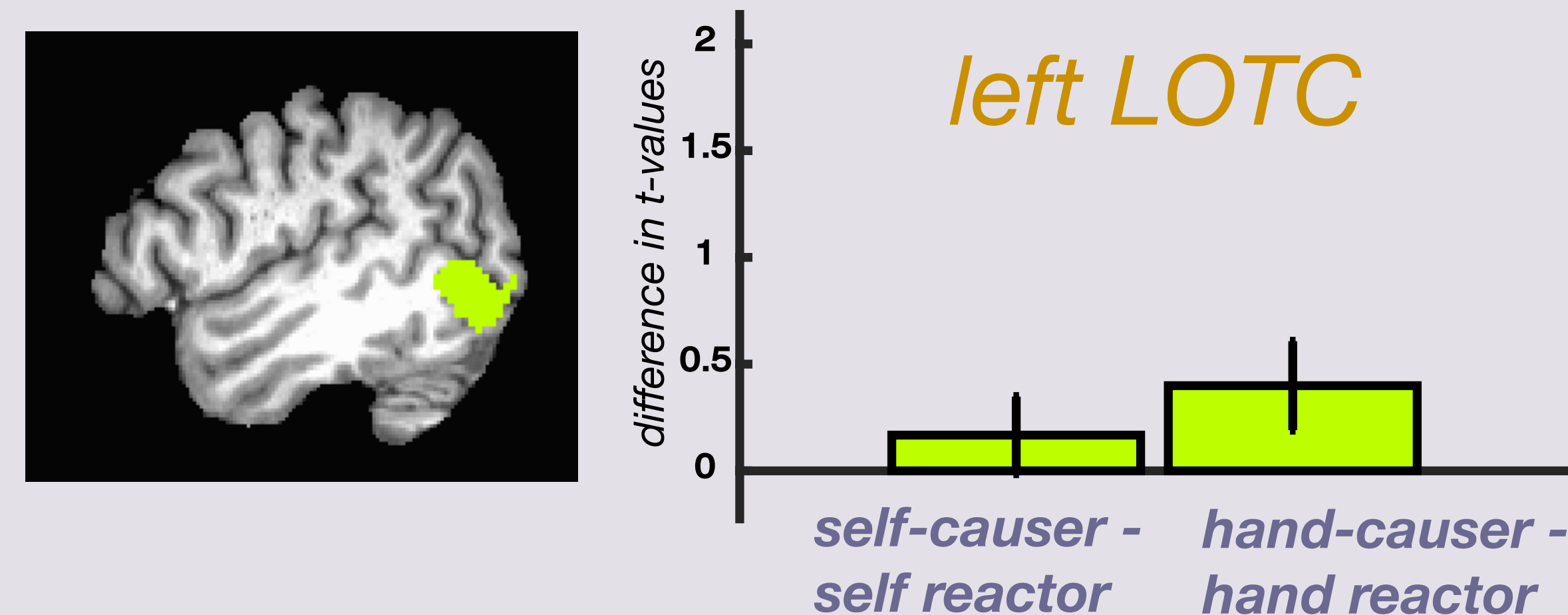


results

Are tool-selective areas sensitive to event relations?

Preliminary data with $n = 15$; pre-registered target sample size = 32

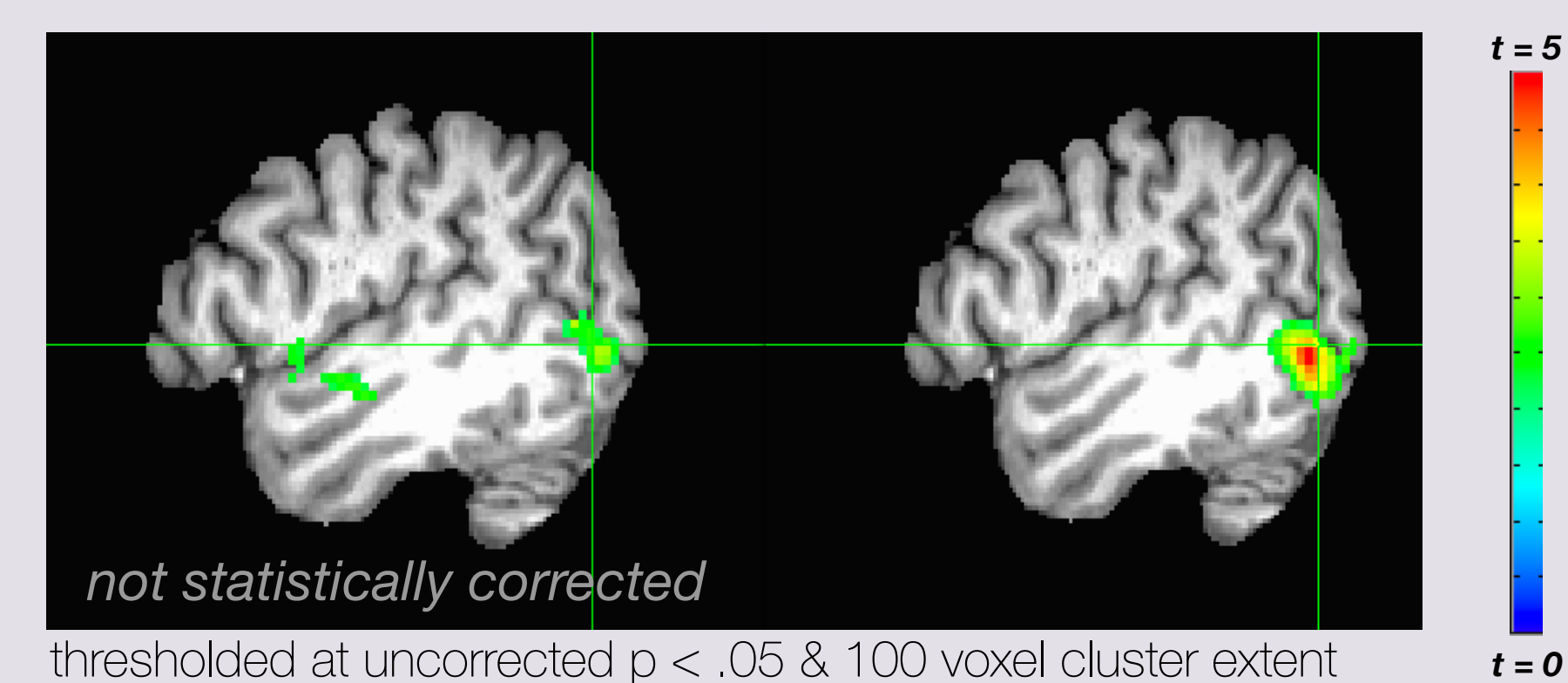
ROIs defined with tools > non-tools contrast, using intersection of group cluster, thresholded at $p < .05$ uncorrected and each individual's data (up to 300 maximally responsive & contiguous voxels, thresholded at $t > 0$)



Main effect of event relation: $M = 0.28$, $t(14) = 2.12$, $p = 0.05$

Interaction between event relation and movement type: $M = 0.62$, $t(12) = 2.53$, $p = 0.03$

causers > reactors tools > non-tools



LOTC responded more to objects which affected the environment than to those which reacted to it, consistent with preference to objects that have causal event relations. IPL showed an interaction: it responded most to objects which affected the environment after having been moved by a hand. Thus, both areas are sensitive to event relations, but IPL's response is additionally modulated by involvement of hand events.

online materials

<https://osf.io/wzvn2/>

This work was supported by NIH grant R01DC009209 to S.L.T.S.

pdf of this poster

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Mahon, B. Z., Milleville, S. C., Negri, G. a L., Rumati, R. I., Caramazza, A., & Martin, A. (2007). Action-related properties shape object representations in the ventral stream. *Neuron*, 55(3), 507–20.

Peelen, M. V., Bracci, S., Lu, X., He, C., Caramazza, A., & Bi, Y. (2013). Tool selectivity in left occipitotemporal cortex develops without vision, 1–10

Perini, F., Caramazza, A., & Peelen, M. V. (2014). Left occipitotemporal cortex contributes to the discrimination of tool-associated hand actions: fMRI and TMS evidence. *Frontiers in Human Neuroscience*, 8(August), 1–10.

Valyear, K. F., Cavina-Pratesi, C., Stiglick, A. J., & Culham, J. C. (2007). Does tool-related fMRI activity within the intraparietal sulcus reflect the plan to grasp? *NeuroImage*, 36 Suppl 2, T94–T108.