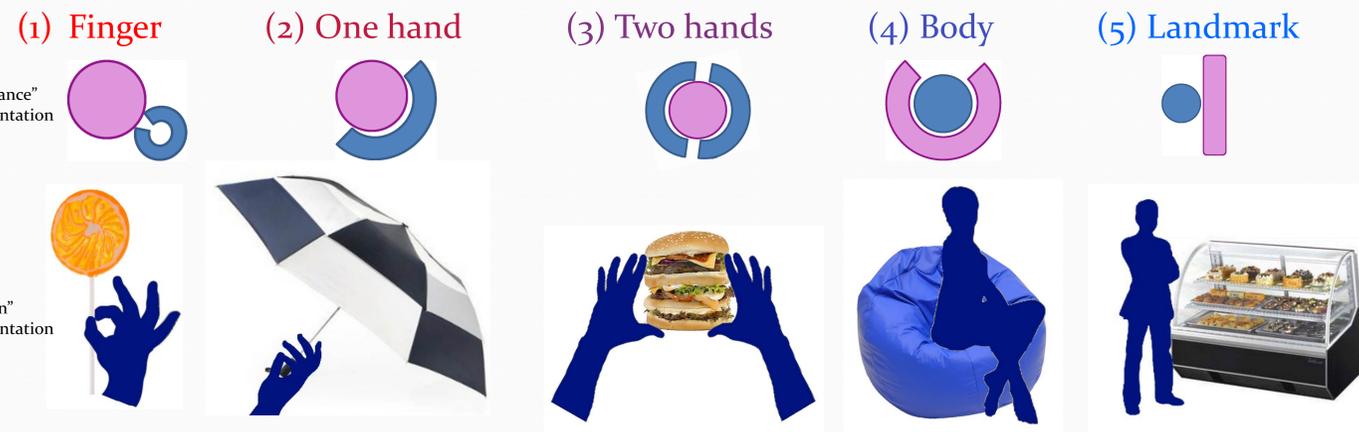


## MOTIVATIONS:

- Little is known about human mental representations of the interaction space of objects
  - Debate 1:** Action-perception dissociation (Goldenberg & Kanarh, 2006) OR integration (Grèzes et al, 2003)?
  - Debate 2:** Categorical representation (hand vs body) OR gradient representation?
- Application:** Robotics uses different, categorical systems for body navigation and hand-object manipulation. *Is this the right way to do it?*
- Several cortical regions are sensitive to object function (Mahon et al, 2007), shape (Grill-Spector et al, 1999), and size (Konkle & Oliva, 2012)
- Metrics of distance and layout have been found in space regions (Morgan et al, 2011)
- In this preliminary study, we look at brain activity upon passive viewing of objects of different interaction spaces.

## STIMULI:

- 5 categories of object interaction type with 120 images each = 600 images total:



- Power spectra and mean luminance were examined amongst each category, no significant correlation was found with V1 activity

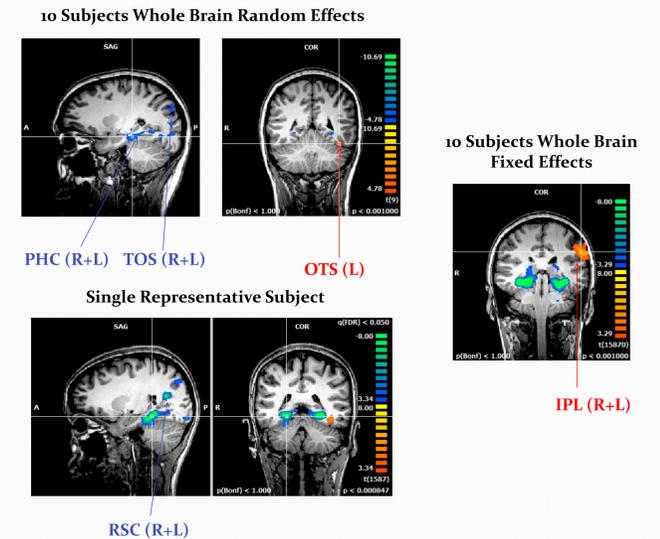
## IMAGING METHODOLOGY:

- 32-channel 3T fMRI study of 10 right-handed human participants
- 3-mm voxels, 33 slices, TR = 2
- 10 participants performed a 1-back task while viewing blocks of object images against a white background, at the same retinal size
- Participants were asked to think of how they interact with each object

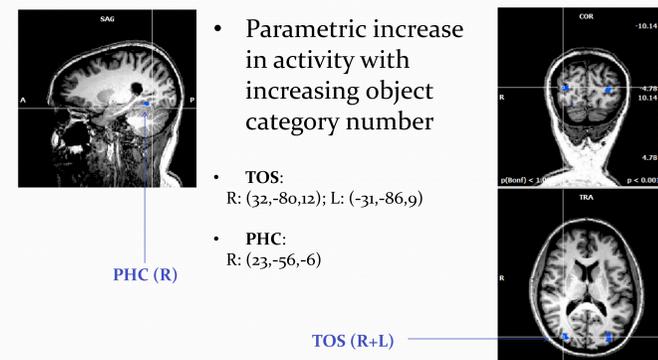
## RESULTS:

### WHOLE BRAIN RANDOM EFFECTS ANALYSIS:

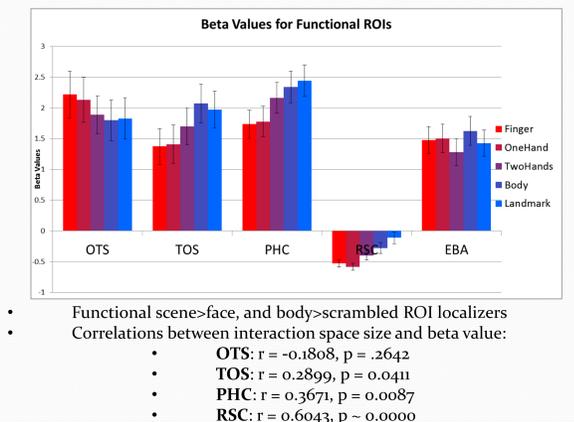
- Categories 4 + 5 > Categories 1 + 2
- PHC = Parahippocampal cortex (10/10 subjects)  
Peak voxel - R: (20,-29,-18); L: (-31,-41,-9)
  - RSC = Retrosplenial cortex (9/10 subjects)  
Peak voxel - R: (17,-59,15); L: (-19,-62,12) \*
  - TOS = transverse occipital sulcus (10/10 subjects)  
Peak voxel - R: (20,-71,-12); L: (-34,-83,12)
- Categories 1 + 2 > Categories 4 + 5
- OTS = occipito-temporal sulcus (10/10 subjects)  
Peak voxel - L: (-40,-47,-24)
  - IPL = inferior parietal lobule (7/10 subjects)  
Peak voxel - R: (65,-26,30); L: (-64,-23,39) \*



### WHOLE BRAIN PARAMETRIC ANALYSIS:



### ROI ANALYSIS:



## CONCLUSIONS & FUTURE DIRECTIONS:

- Cortical regions are differentially selective to different interaction spaces, there may be a parametric relationship
- Future studies to separate object interaction space from object size
- High resolution scanning of relevant cortical regions
- Examine human analogs of important topics in robot body & arm trajectory planning:
  - Points of grasp and aperture
  - Homotopic classes of trajectory
  - Coarse versus fine movement

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