The Processing of Object Orientation in Tactile and Visual Modalities

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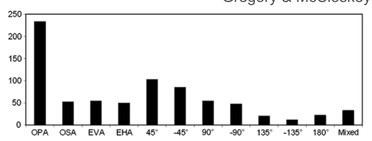
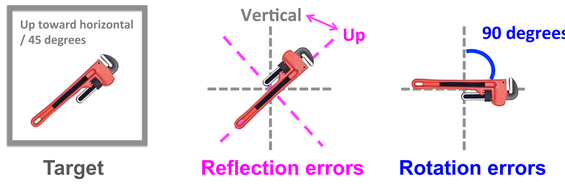
INTRODUCTION

- **How do we represent orientations of objects?**
- **A characteristic pattern of errors is observed in orientation recall tasks with visual stimuli**

Gregory & McCloskey (2010)



- **Compositional representation**



- **Orientation information from touch**
  Crucial for interaction with objects

Research Question

1. ***Do object orientations have the same representation in vision and tactile modality?***
2. ***If not, how differently are the orientations represented?***

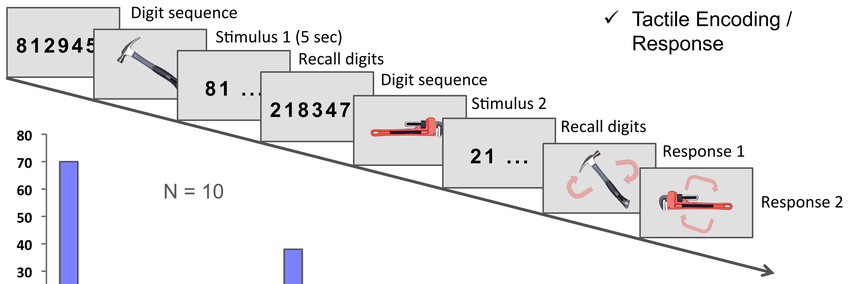
EXPERIMENT SET-UP

- ✓ 8 Objects
- ✓ 16 Orientations
  (45 degree increments x 2 sides)
- ✓ Object fixed to the surface in encoding
- ✓ No visual view of stimuli

EXPERIMENT 1

Procedure & Results

- ✓ 2 Stimuli per trial
- ✓ Tactile Encoding / Response



Frequency of Categorized Error Types

- **Tactile error pattern is very similar to the pattern observed with visual stimuli**
- **Possible interpretations**
  1) Orientations are represented in the **same format** (e.g., amodal or dominant visual) in visual and tactile modalities
  2) Orientations are represented in **modality-specific formats**, but visual and tactile representations have similar structures

If representations of object orientations are different between vision and tactile modalities, there may be 'costs' in crossmodal conditions

EXPERIMENT 2

Experimental Design

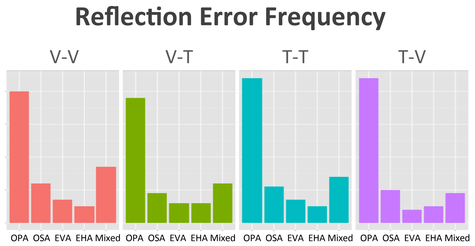
- Encoding (Visual / Tactile) x Response (Visual / Tactile)
- 4 Different Conditions: V-V, V-T, T-T, T-V

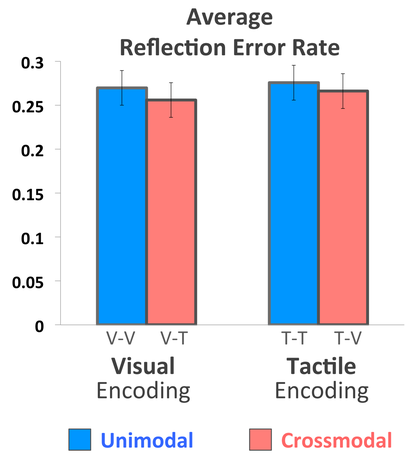
Analysis

- Categorized errors into reflection errors and rotation errors
- Mixed effects logistic regression
  - ✓ Fixed effects of Encoding x Response
  - ✓ Random effects of Subjects and Objects

Reflection errors

- OPA, OSA, EVA, EHA, Mixed
- Similar error patterns across 4 conditions

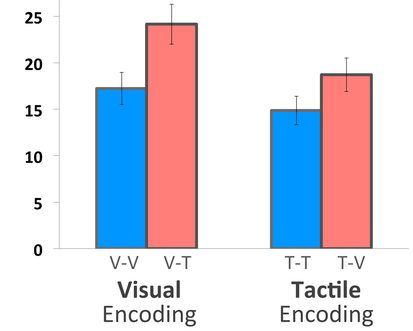




Rotation errors

N = 32

- Absolute values of rotation errors
- Significant Encoding x Response interaction
  → Congruency effect
- Main effect of Encoding
  → Larger mean rotation error in visual encoding conditions



DISCUSSION

- Costs for crossmodal conditions were observed for rotation errors
  - ✓ Suggests that representations of object orientations in visual and tactile modality are not the same
- Different patterns between reflection & rotation errors
  - ✓ No crossmodal cost for reflection errors
  - ✓ Further evidence for compositional representation of object orientations