INTRODUCTION

• 4 constituents of numerical processing
  - Represented in distinct regions of the brain
    - Precentral Gyrus
    - Intraparietal Sulcus (IPS)
    - Insula
    - Angular Gyrus
    - Inferior Frontal Gyrus (IFG)
    - Fusiform Gyrus

• How do underlying representations differ across formats within regions involved in numerical processing?

METHODS

Participants: 18 adults (M age = 22 years; 12 females, 6 males)
Procedure: Interleaved design: 5 runs of novel paradigm; 4 runs of traditional paradigm
fMRI data collection and preprocessing
  - Data collected on Siemens 3 T head-only Allegra
  - Anatomical regions of interest defined using FreeSurfer (Fischl et al., 2002, 2004)
  - Multi-voxel Pattern Analyses (MVPA)
    - Gaussian Naive Bayes classifier was trained and tested for 4-way classification
    - Support Vector Machine classifier was trained and tested for binary classification

Traditional paradigm (Emerson & Cantlon, 2015)

Numbers + 2
Words + one
Shapes + a + a

“Same or different?”

RESULTS

MVPA Decoding: 4-way Classification

Novel paradigm

- Numerical: Is the quantity greater than 3?
- Phonological: Does the quantity’s name contain a long vowel sound?

Traditional paradigm

- Numerical > Phonological
- Phonological > Numerical

Generalization

“Yes or no?”

DISCUSSION

• Underlying numerical representations can generalize across task and across stimuli in regions implicated in processing numerical information
• Our novel paradigm identifies a broader range of regions involved in all 4 constituents, compared to a traditional paradigm
• Next, investigate how these representations are integrated across the regions
• Compare representations in developing children
• Relate to behavioral measures of math ability

REFERENCES

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