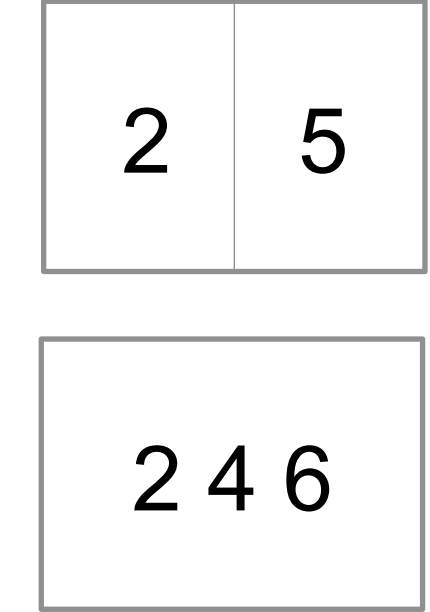


Background

- Children must learn both *symbol-quantity* associations (cardinal properties) and *symbol-symbol* associations (ordinal properties) [1]
- Cardinal tasks have distance effects (DEs) (longer RT for smaller distances between numbers) [2,3]
- Ordinal tasks have reverse distance effects (RDEs) (longer RT for larger distances between numbers) [4,5]
- Cardinal and ordinal tasks may rely on similar [6], or distinct brain regions [5]
- How ordinal processing develops at the behavioural and neural levels is poorly understood

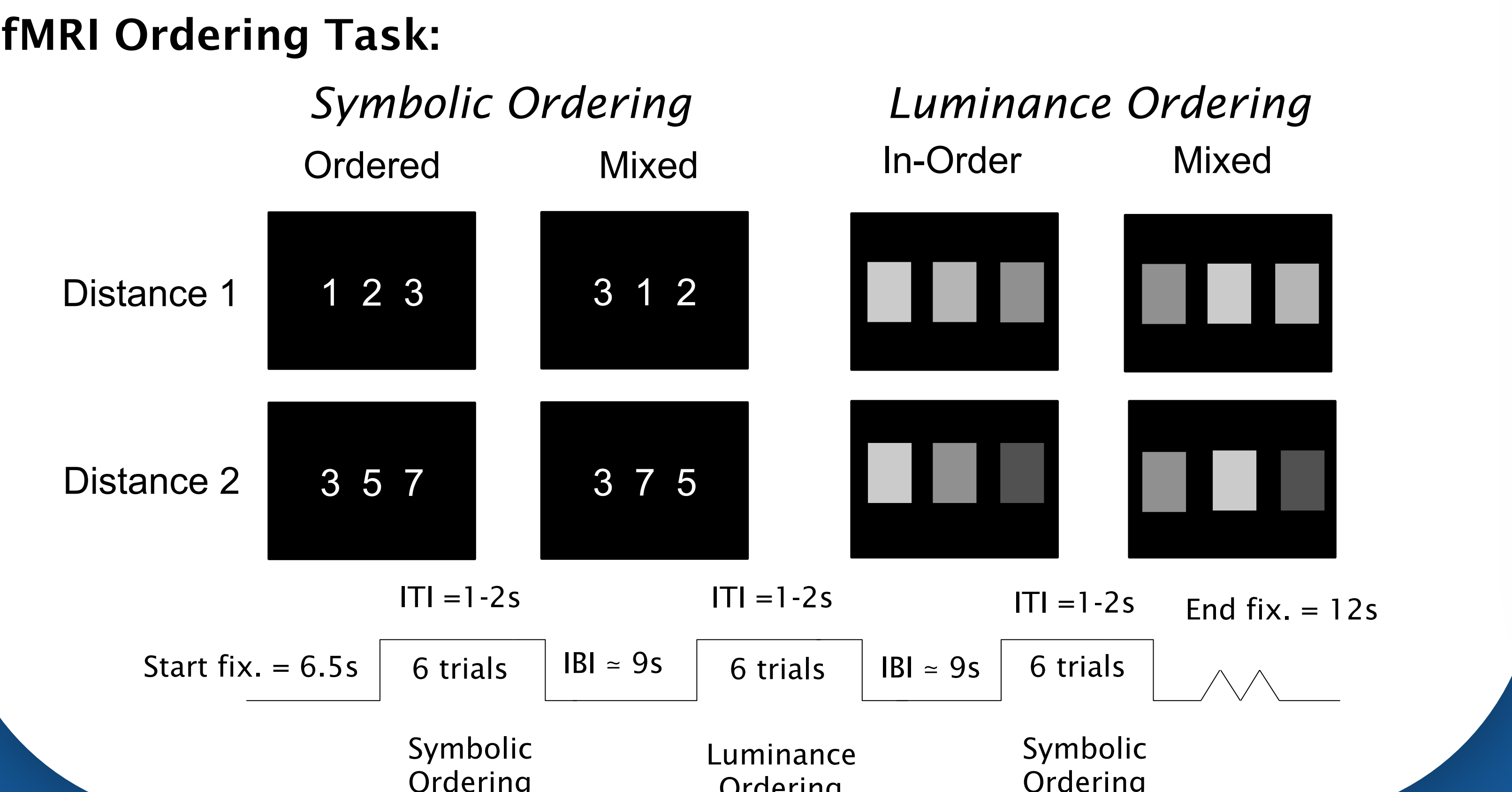


- ### Objectives
- Which brain regions support ordinal (and cardinal) processing?
 - Are there age-related changes in the neural correlates of ordinal processing?

Method

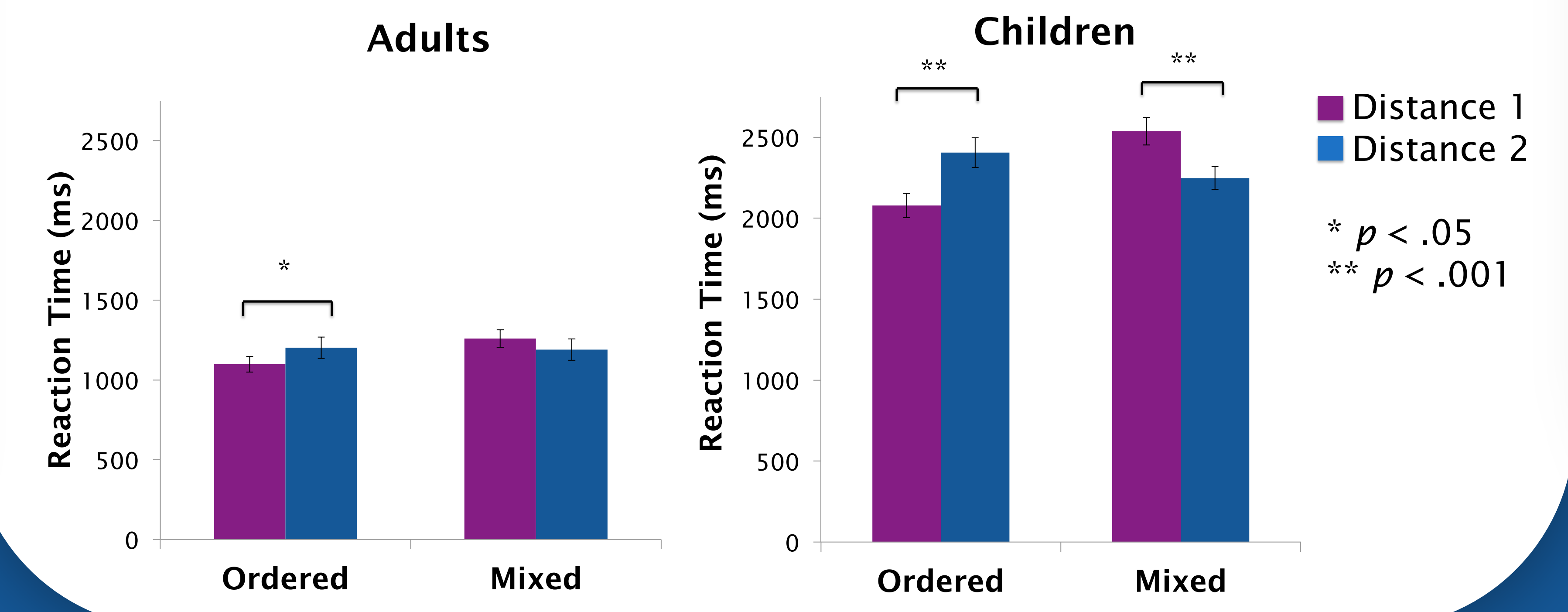
- ### Participants
- 50 Children
 - Age: M = 9.1, SD = 0.9
 - 23 female, 3 left-handed
 - 26 Adults
 - Age: M = 22.1, SD = 2.1
 - 12 female, all right-handed

- ### MRI Data Acquisition & fMRI Task
- MRI data acquisition:**
- 3T Whole-body MRI scanner (Siemens Prisma)
 - TR = 2000ms
 - Voxel size = 3mm x 3mm x 3mm



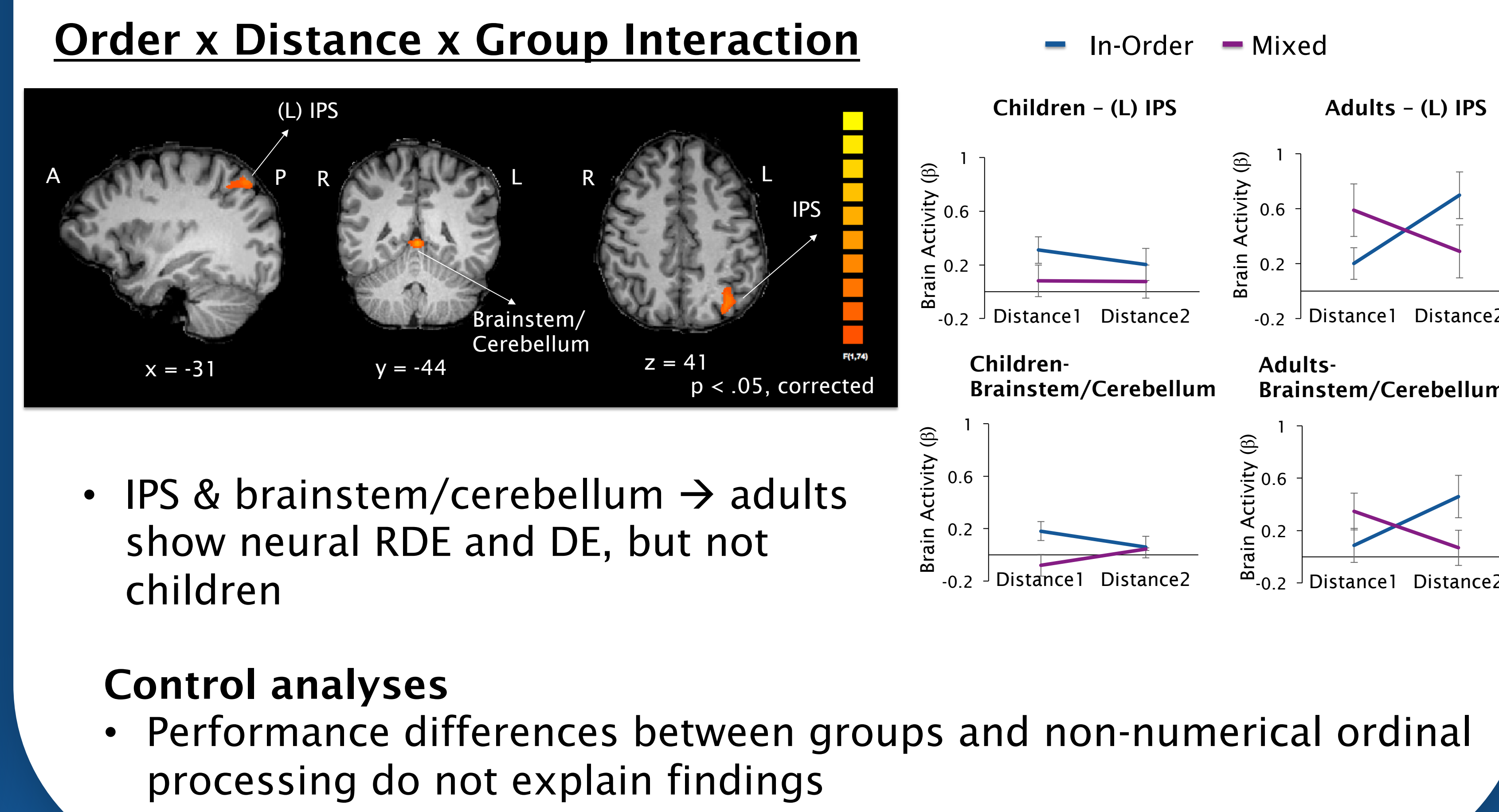
Behavioural Results

- ### Order X Distance x Group ANOVA
- Main effect of order ($p < .01$) & group ($p < .001$)
 - Order x distance interaction, ($p < .001$)
 - RDE for in-order trials and a DE for mixed-order trials
 - Order x distance x group interaction, ($p < .01$)
 - For in-order trials adults and children show RDE
 - For mixed-order trials children show DE; DE only marginal in adults ($p = .08$)
 - Note: Magnitude of RDE larger in children than in adults ($p = .01$)



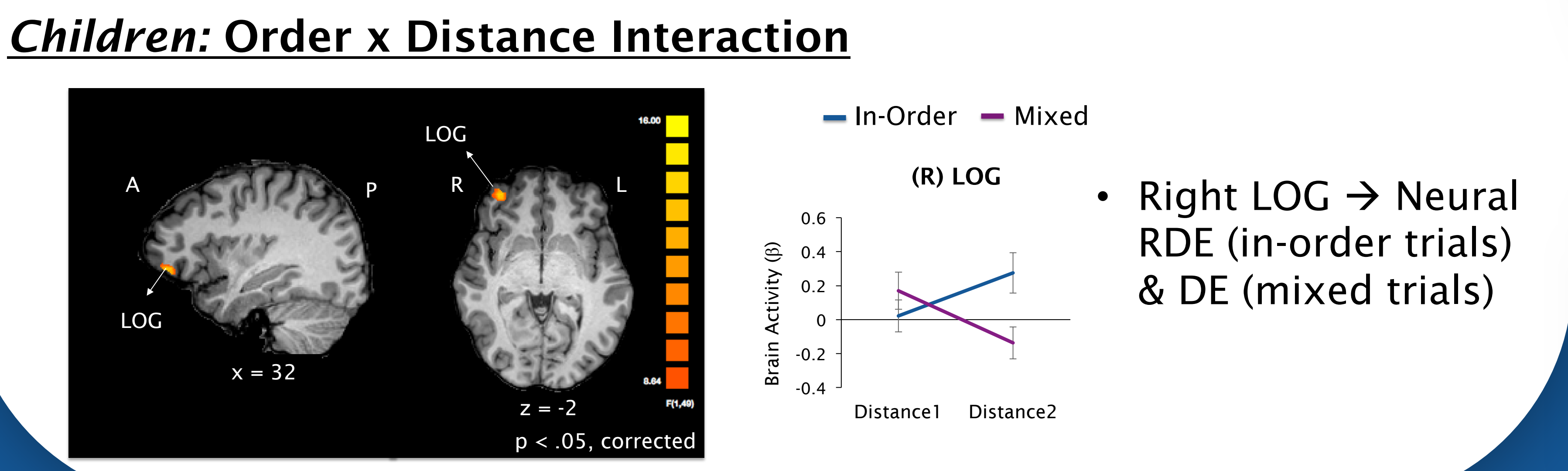
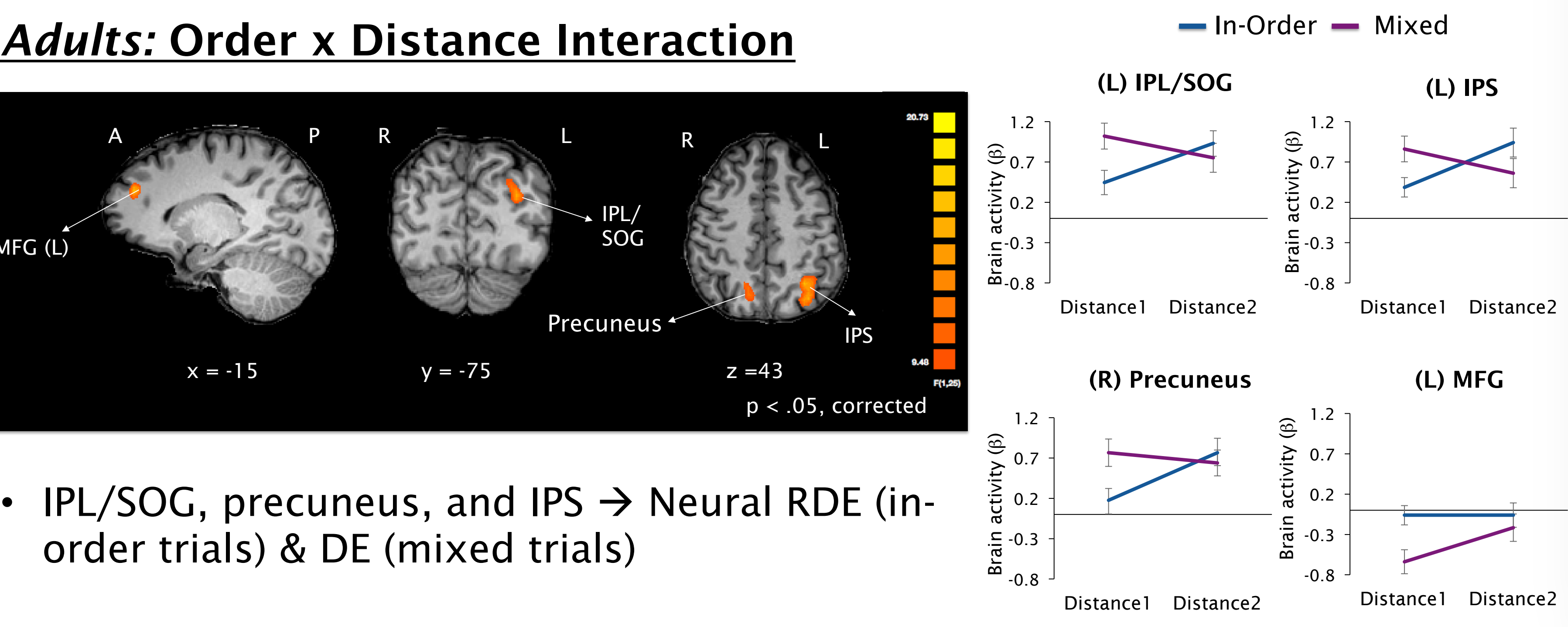
fMRI results

Are there age-related changes in the neural correlates for ordinal and cardinal processing?



fMRI Results

Which brain regions do adults and children recruit for ordinal and cardinal processing?



Discussion

- Children rely on inferior frontal brain regions for cardinal and ordinal processing
- Adults recruit the left inferior parietal and right superior parietal brain regions for cardinal and ordinal processing
- Fronto-Parietal Shift? → Inferior parietal cortex may become increasingly specialized for both cardinal and ordinal processing over development [7]
- Findings likely specific to symbolic ordering, rather than more general ordinal processing (e.g. luminance)
- Shared neural substrates for cardinal and ordinal processing do not necessarily indicate common neural processes
- Cardinal and ordinal representations may follow similar trajectories of cortical specialization

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