

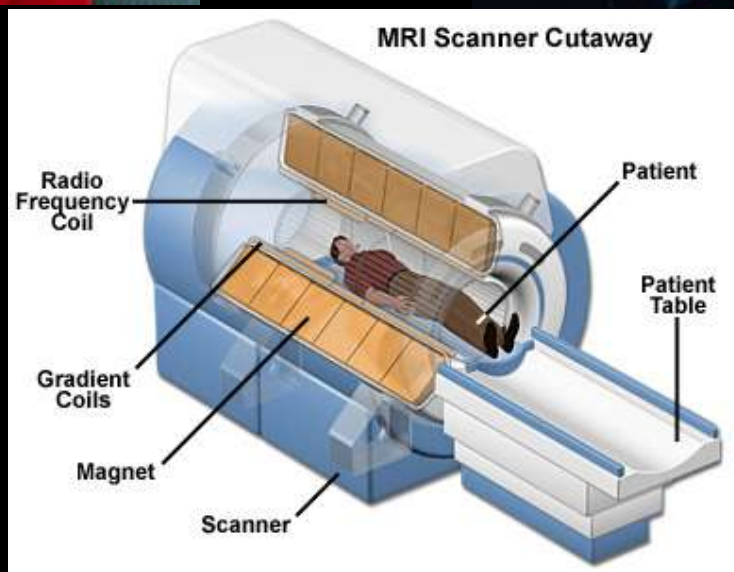
# Neurobiology and Reading Interventions: Possibilities for Guiding Educational Practices?

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***\*Much of what I present today is based on Laura Barquero's  
dissertation!***

# Can We Use Neurobiology to Get At The Underlying Causes and Help Refine Treatment?



*Why might this be important?*

*An Important Principle:*

**GROWTH IN BRAIN AND IN EDUCATION  
ARE DYNAMIC AND INTERACTIVE  
PROCESSES**



# Growth in Brain and In Education Are Dynamic and Interactive Processes

*So...*

**THE BRAIN IS NECESSARY TO LEARN, BUT  
EDUCATION ALSO CHANGES THE BRAIN**

*An Example of How Education  
Could Potentially Be Guided By  
Neurobiology*

# Pressing Educational Issues

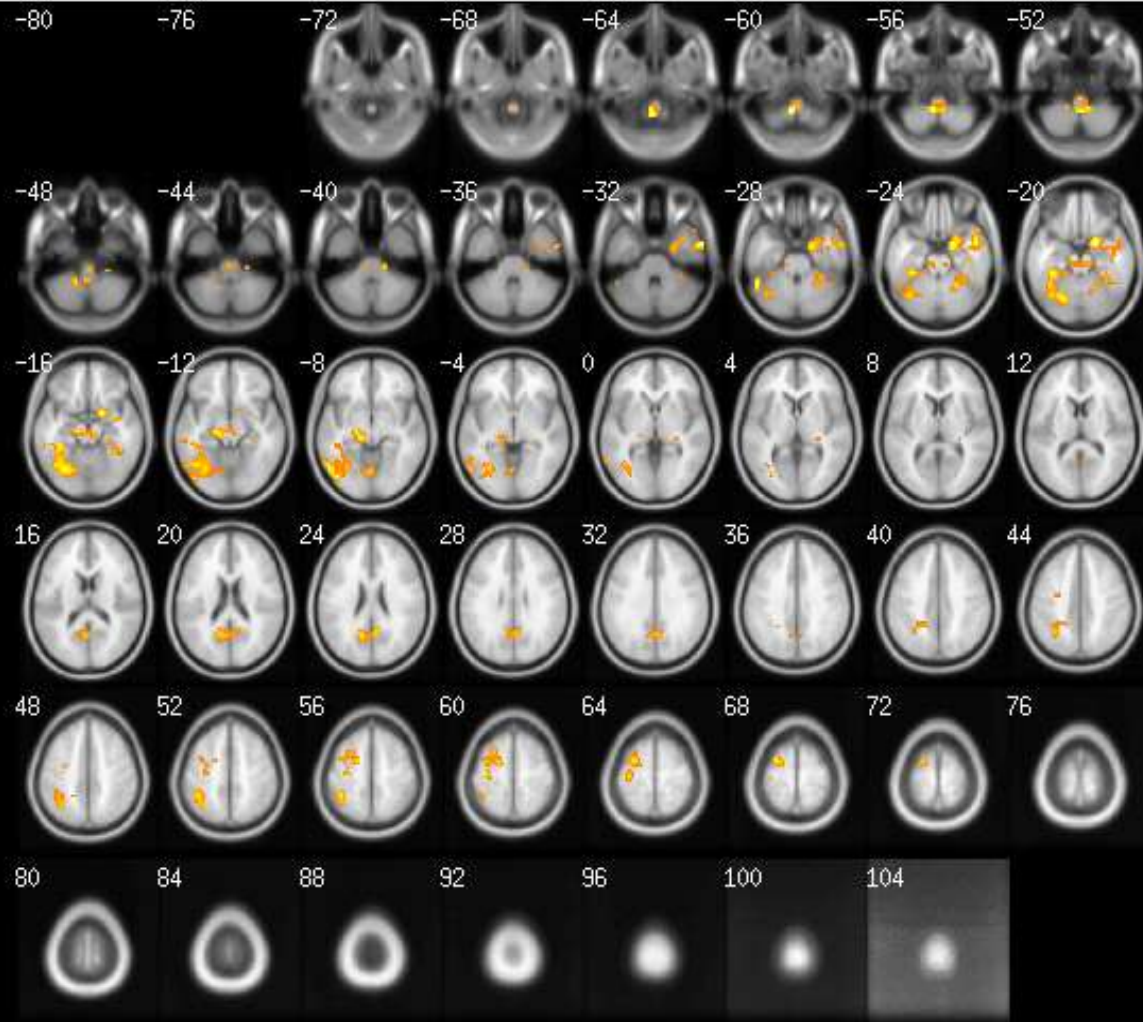
- Many children struggle to learn to read – at least 10%.
- Why do some kids have difficulty learning to read, while for others the process seems almost effortless?
- Why do some kids respond well to intervention and some kids respond very poorly?



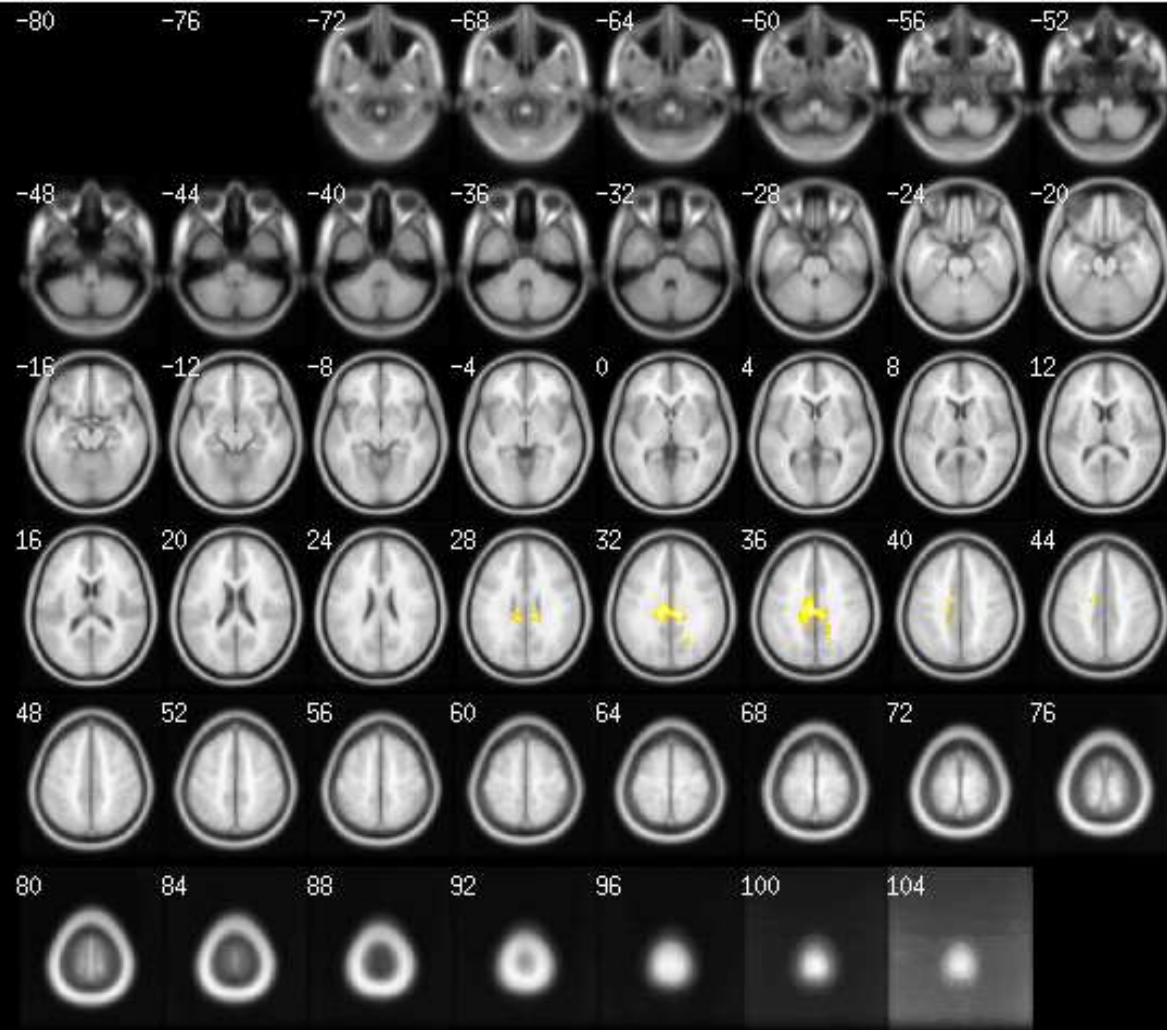
# Can We Predict Who Will Have a Better Response to Reading Intervention Based on Initial Brain Activity?

- fMRI scans on 38 children age 8-14yrs, including Typically Developing (n=15) and RD (n=23)
- Single word reading task
- 15 hr reading intervention
- Compare Responders (n=13) and Non-responders (n=10) using whole brain and Region of Interest (ROI) analyses
- Behavioral results from the larger study showed significant gains for intervention group compared to no treatment and typically developing (Barquero, Sefcik, Cutting, & Rimrodt, *submitted*)

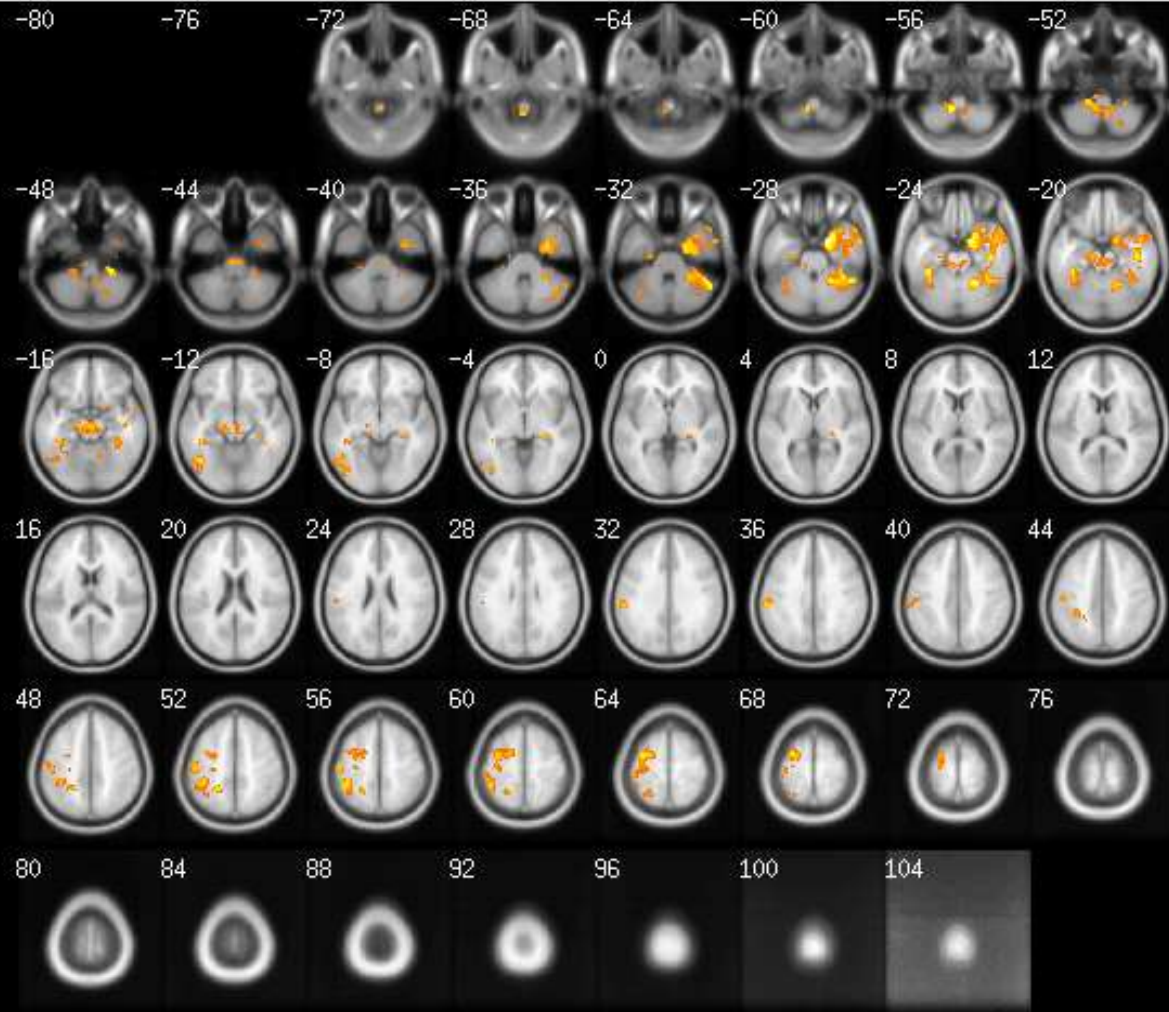
# Typically Developing versus Non-responders



# Typically Developing versus Responders



# Responders versus Nonresponders

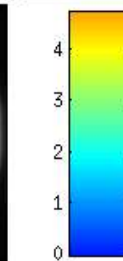
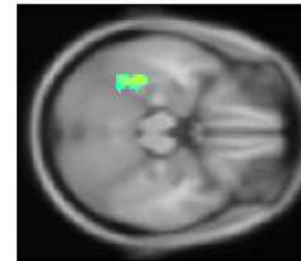
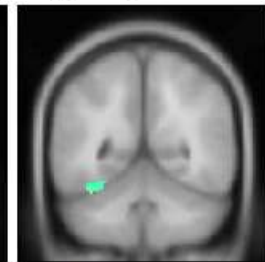
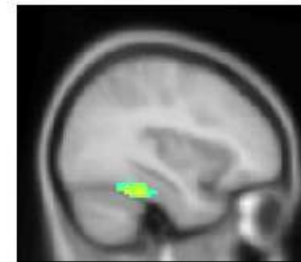
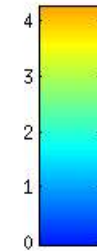
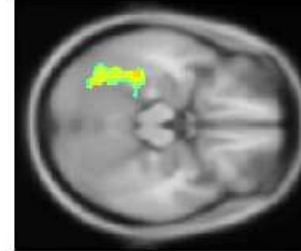
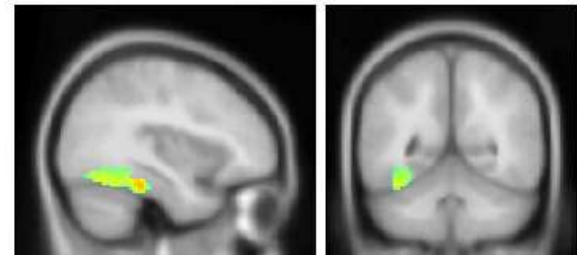
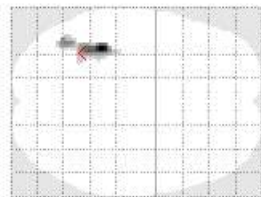
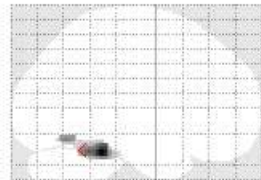
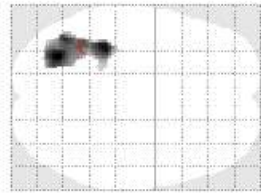
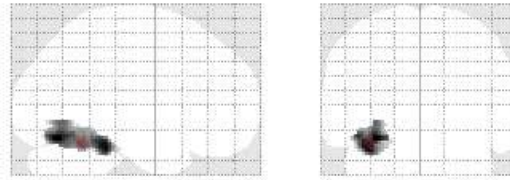


# Region of Interest Analysis

- Based on previous literature:
  - R Inferior frontal gyrus (Hoeft et al., 2011)
  - L/R MTG (Rezaie et al., 2011a, 2011b)
  - L/R STG (Rezaie et al., 2011a, 2011b)
  - L Angular gyrus (Rezaie et al., 2011b)
  - L SMG (Rezaie et al., 2011b)
  - L fusiform (Rezaie et al., 2011a)
  - L VWFA located within the fusiform gyrus (Bach et al., 2011)

# Left fusiform gyrus ROI Analysis

Typically Developing  
v Nonresponders

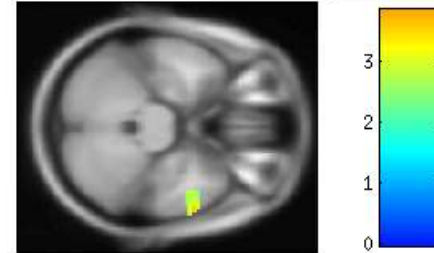
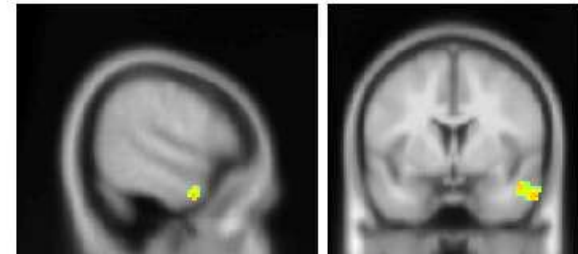
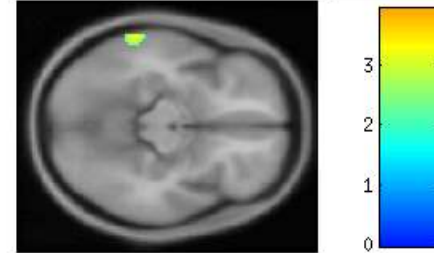
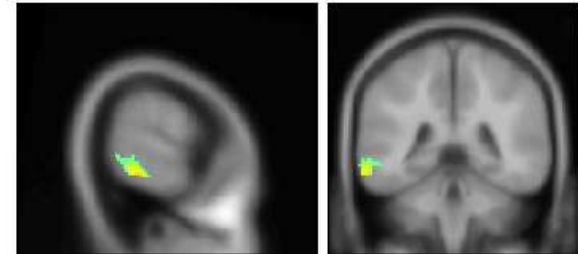
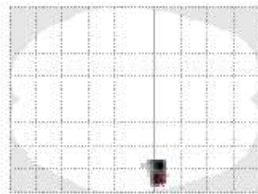
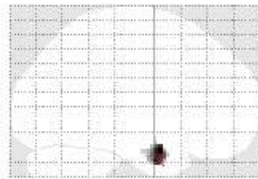
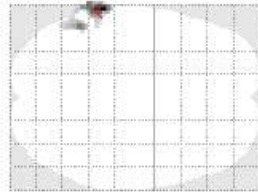
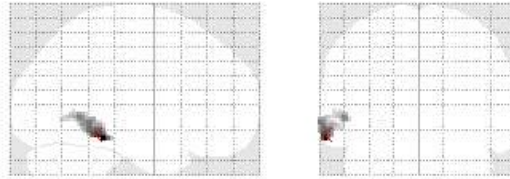


Responders v  
Nonresponders

All significant differences were positive  
No difference for TD v Responder

# MTG ROI Analysis

Typically  
Developing v  
Nonresponders



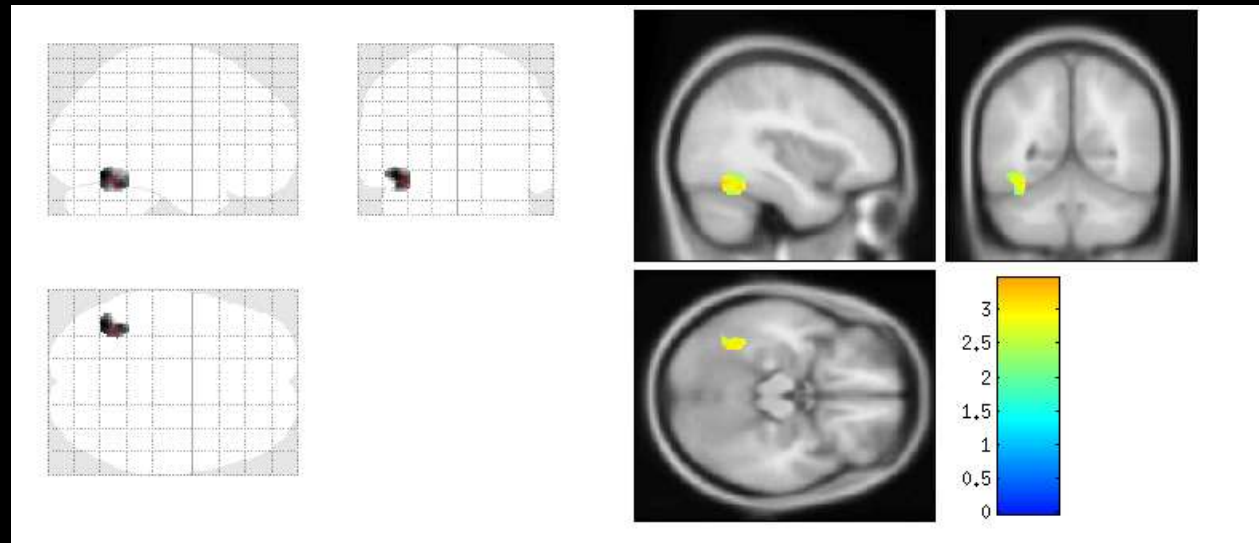
Responders v  
Nonresponders

All significant differences were positive  
No difference for TD v Responder

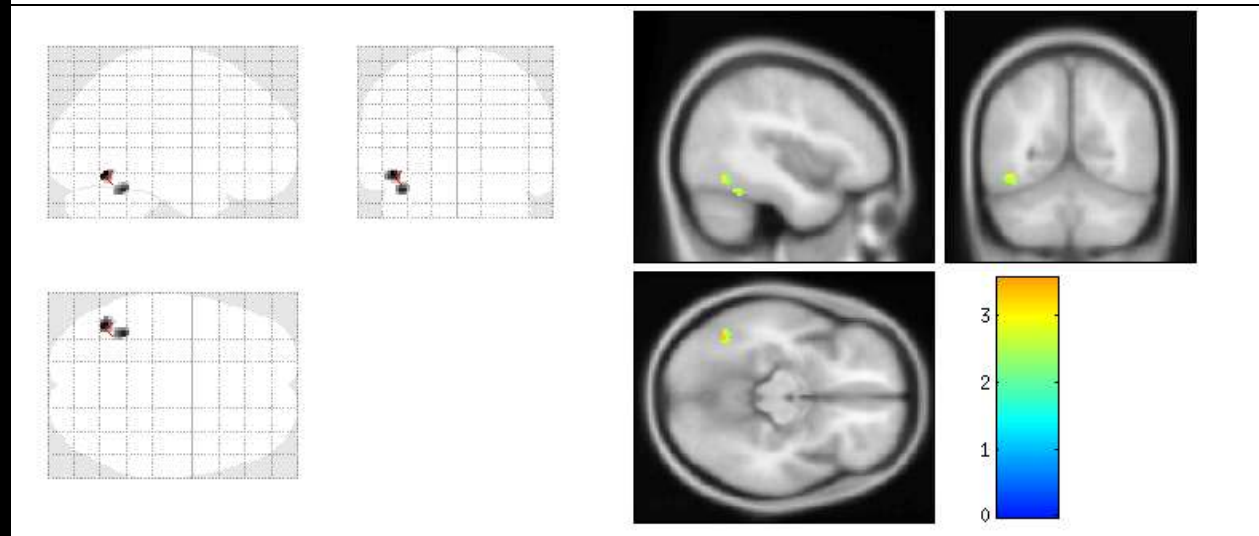
# Visual Word Form Area ROI Analysis

MNI -42, -54, -17, 10mm sphere

Typically  
Developing v  
Nonresponders



Responders v  
Nonresponders

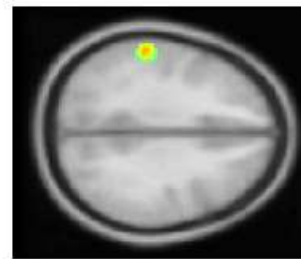
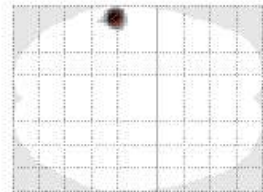
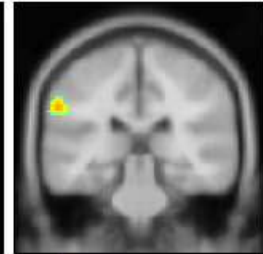
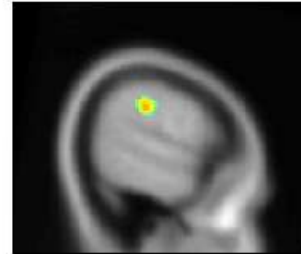
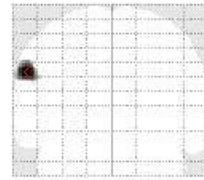
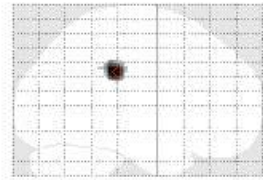


All significant differences were positive  
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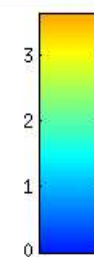
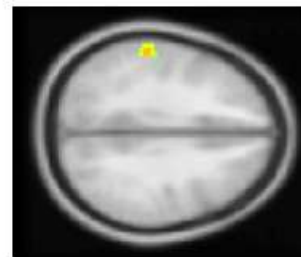
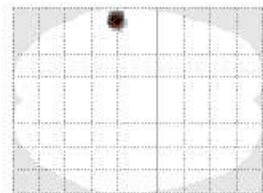
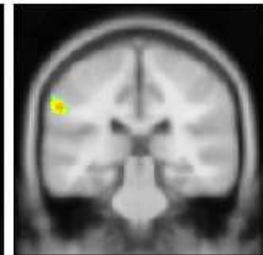
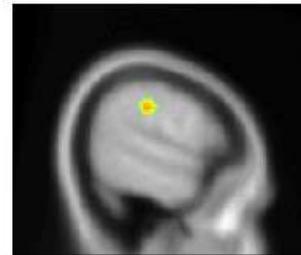
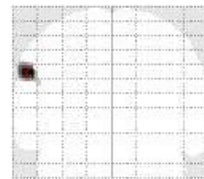
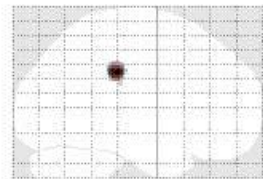


# Left Supramarginal Gyrus ROI Analysis

Typically  
Developing v  
Nonresponders



Responders v  
Nonresponders



All significant differences were positive  
No difference for TD v Responder

## Predicting Responsiveness: Summary

- Whole brain profiles differed between responders, non-responders, and typically developing
- The greatest differences were between typically developing and non-responders, and the least differences were between typically developing and responders
- ROI analyses had similar results: L fusiform and L SMG did not differ for typically developing and responders, but did differ for typically developing > non-responders and responders > non-responders

# Possibilities for Guiding Educational Practices?

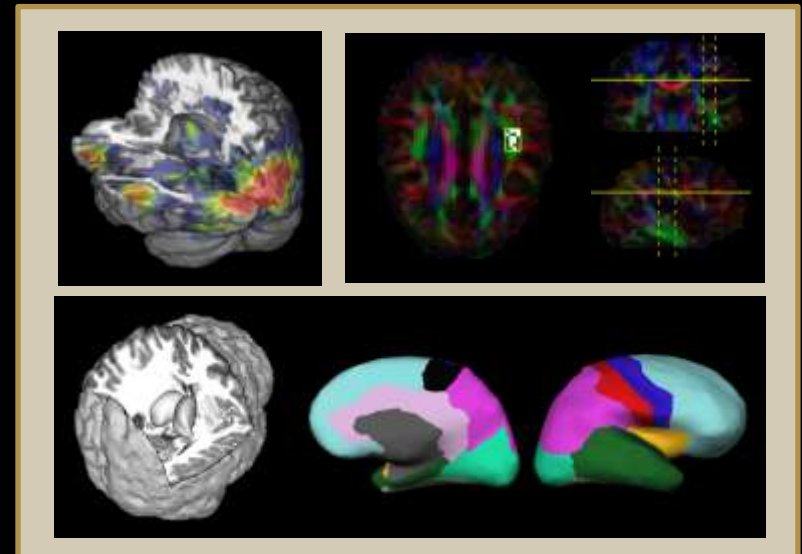
- Still in its youth, but many possibilities
- How well can neurobiology predict response?
  - Is it better than behavior? Should we focus on this?
- Can we actually define the boundaries of developmental disorders?
  - better diagnosis = better treatment
- Can we personalize education the way we want to personalize medicine?

# Acknowledgements

# *Education and Brain Sciences Research Lab*

## Multi-Faceted Approach

- Multiple patterns of reading problems
  - Difficulty acquiring early and/or basic reading skills
  - Reading comprehension
  - Later emerging reading difficulties
- Multiple complementary techniques
  - Experimental and “paper-pencil” tasks
  - fMRI, DTI, structural MRI



# Funding Sources

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**Thank you!**

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