

# What's Happening in the Reading Brain?



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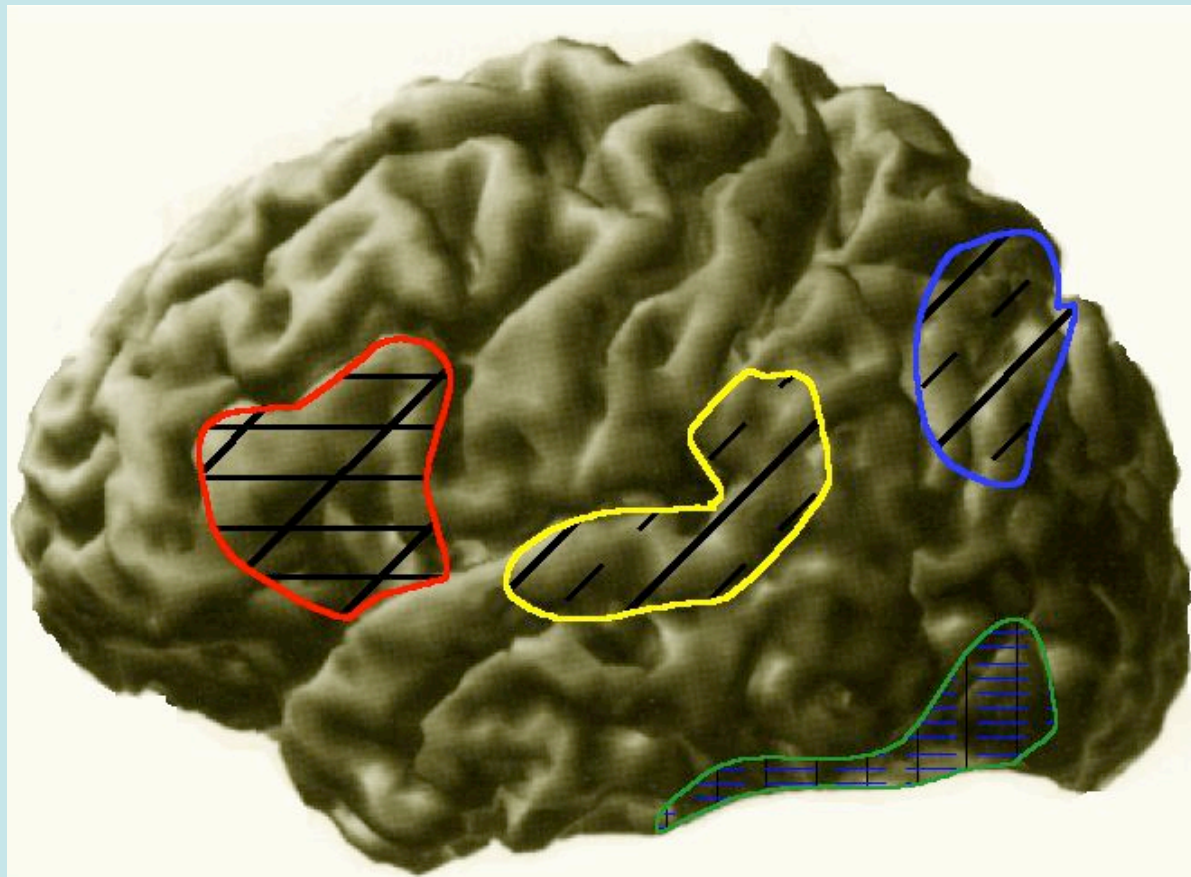
Presented at IDA, Dallas, 2007

# A Theoretical Model for the Brain Circuit for Reading (Component Processes)

**Phonological processing:  
correspondence between  
letter and sound**

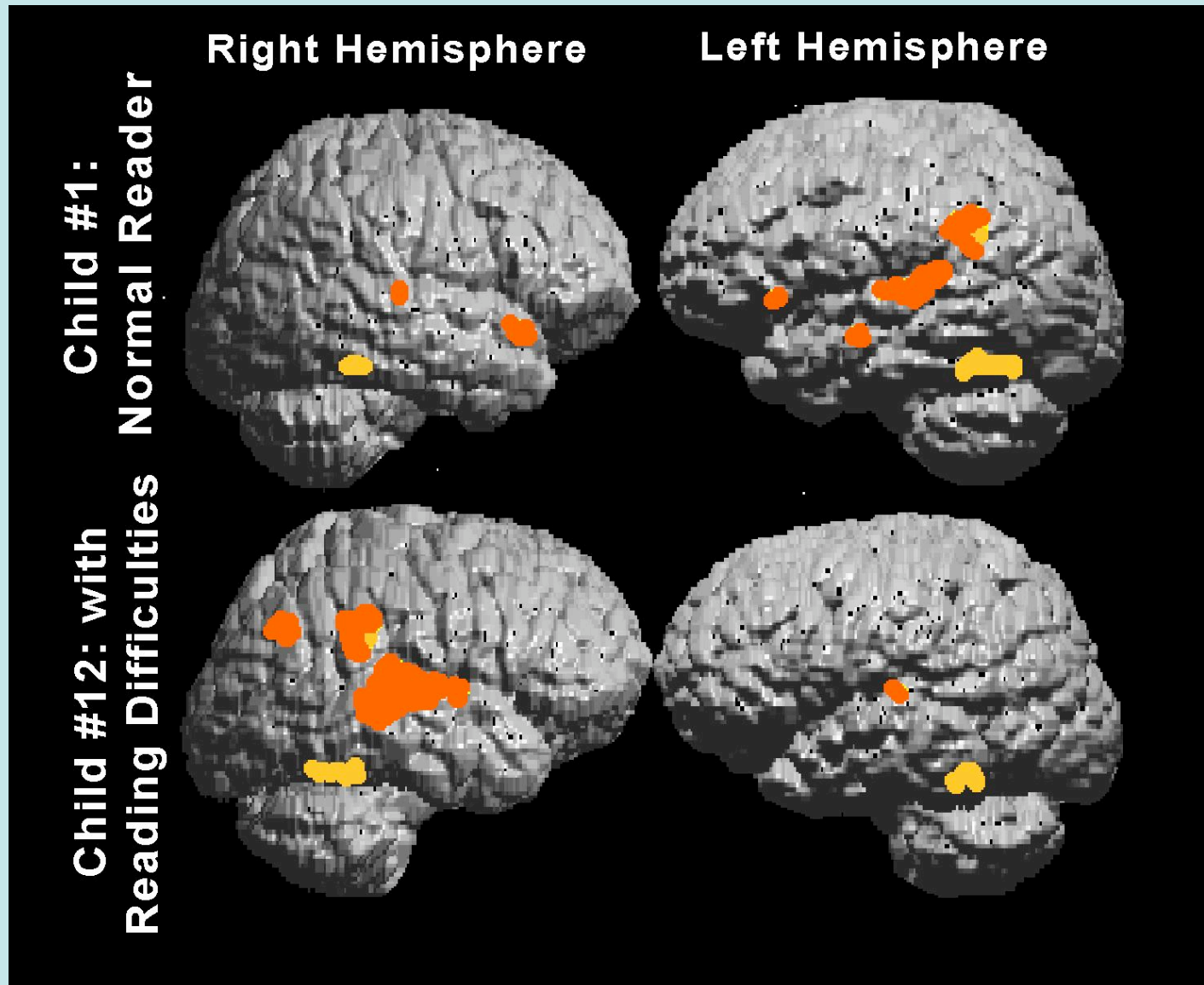
**Relay station;  
Cross-  
modality  
integration**

**Phonological  
processing:  
articulatory  
mapping**



**Graphemic  
analysis**

# Brain Function in Dyslexia



# Neural Response to Intensive Intervention

**Does the pattern of brain activation change in response to intervention?**

8 children with severe dyslexia

8 week intense phonologically- based intervention (2 hours a day= up to 80 hours of instruction)

Simos et al., *Neurology*, 2002

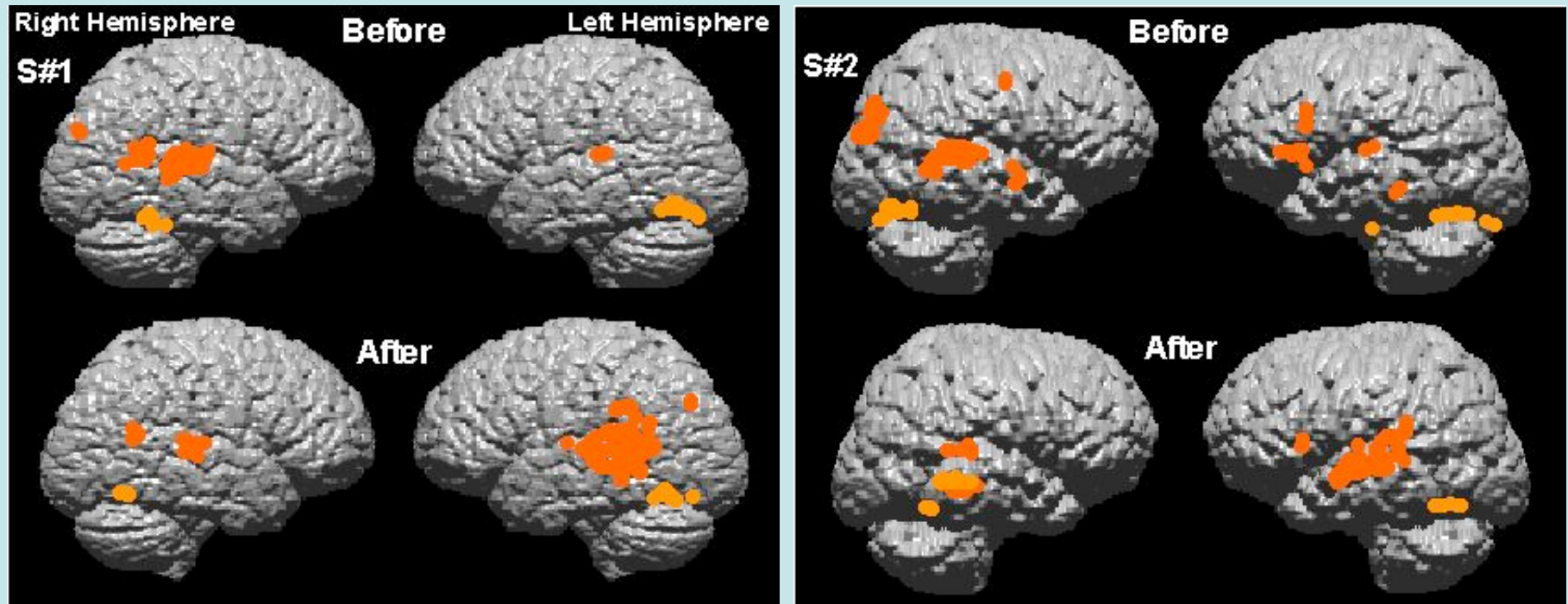
# Demographic Information

Child	Gender	Age (years/mo)	WJ-III pre (%)	WJ-III post (%)	IQ	Medication
1	M	15	13	55	103	Adderal
2	M	10	2	59	95	Ritalin
3	M	10	2	38	110	Ritalin
4	F	8	3	55	105	Ritalin
5	F	7	2	50	110	Ritalin
6	M	7	18	60	101	—
7	M	11	1	38	98	Ritalin
8	M	17	1	45	102	—

# Interventions

- One of two intense phonologically- based interventions delivered 1:1, 2 hours a day, 8 weeks (Very intense tertiary interventions)
- Selected by a reading clinic based on considerations about the level of the child's phonological awareness and word reading skills
- Pilot study for larger-scale studies

# The Brain on Reading!



Blachman, Schatschneider, Fletcher,  
Shaywitz, Shaywitz- J Ed Psych, 2004

## **Purpose**

**Evaluate the effects of an intensive reading intervention emphasizing phonologic and orthographic connections on the functional organization of the brain in Grade 2/3 children with RD randomly assigned to intervention or standard practice**



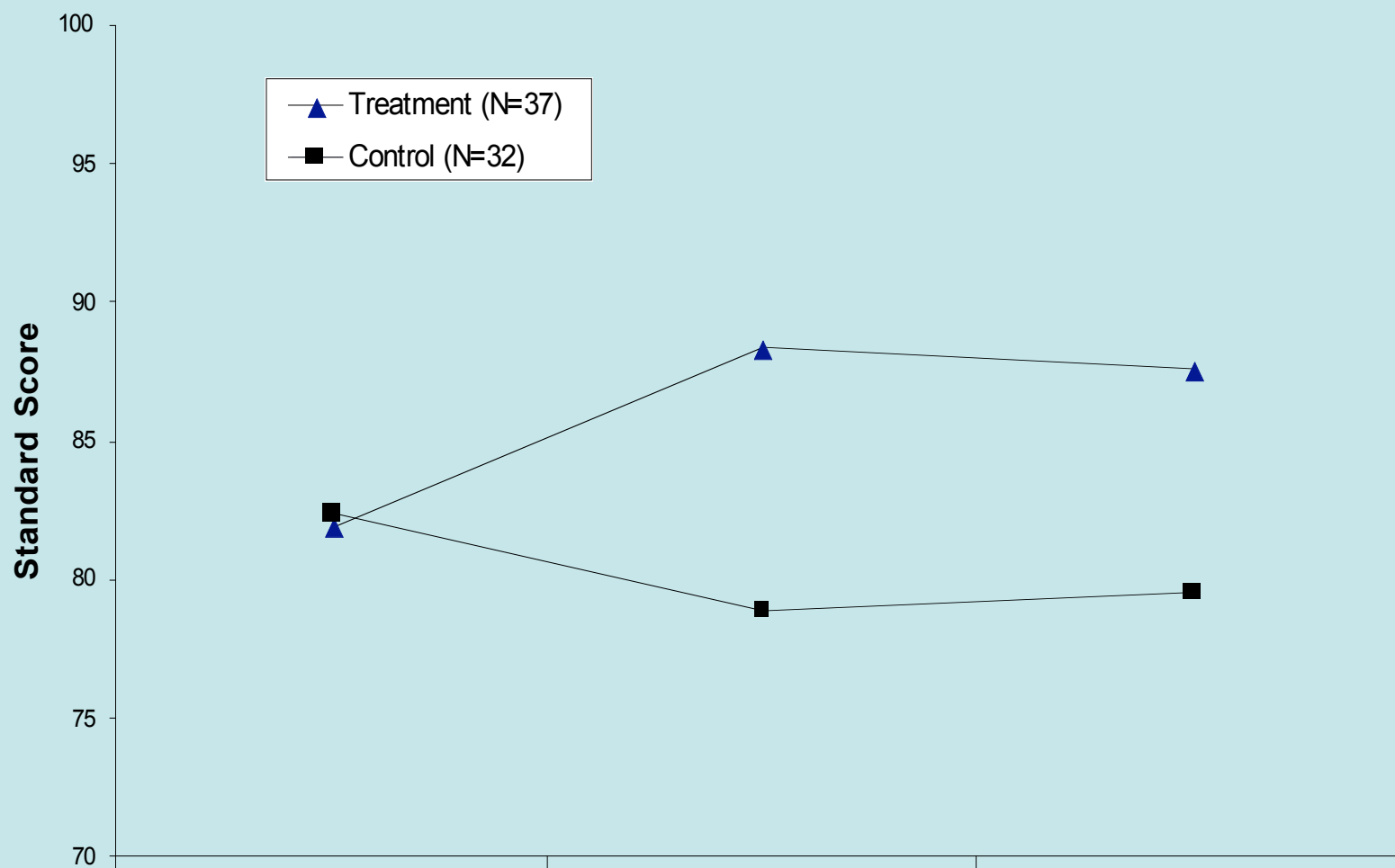
# INTERVENTION

Each lesson is built around a 5-step core that includes:

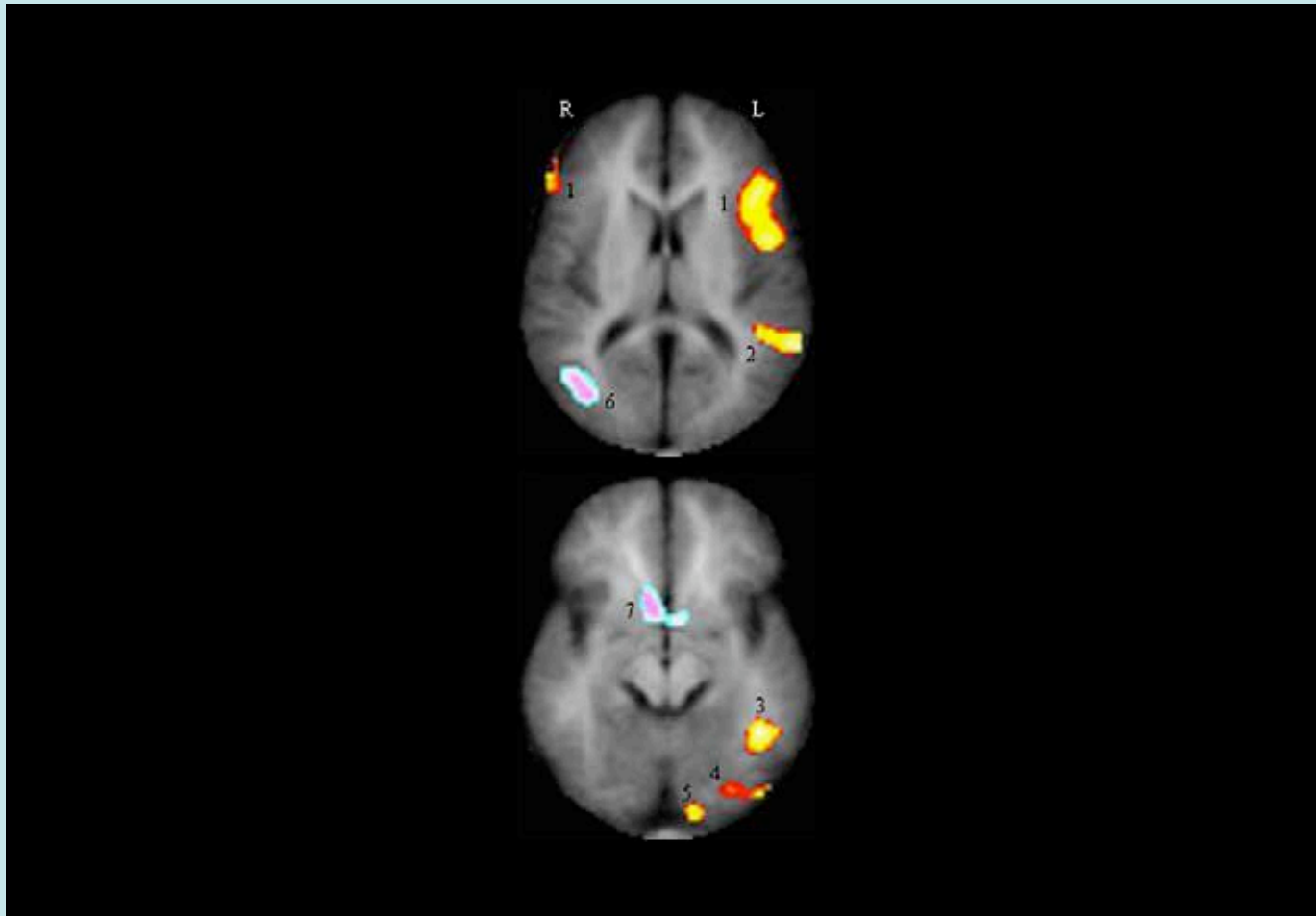
- (1) Review of sound-symbol associations
- (2) Practice making words to develop a new decoding skill (e.g., work on building words with the final “e” pattern)
- (3) Review of previously learned phonetically regular words and high frequency sight words
- (4) Oral reading of stories
- (5) Writing to dictation words and sentences from earlier steps in the lesson

Each lesson also includes “extended activities,” such as additional reading of both narrative and expository texts to enhance fluency, comprehension, and a sense of enjoyment, as well as additional writing activities and

## Pretest, Posttest, and Follow-Up for the Woodcock Reading Basic Skills Cluster by Group



# Shaywitz et al., 2004- Biological Psychiatry



# Early Development of Reading Skills: A Cognitive Neuroscience Approach

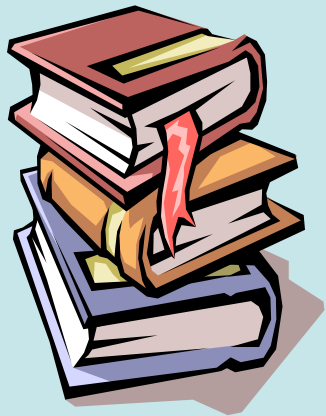
(Jack M. Fletcher – PI)

Grade I Multi-tiered Intervention

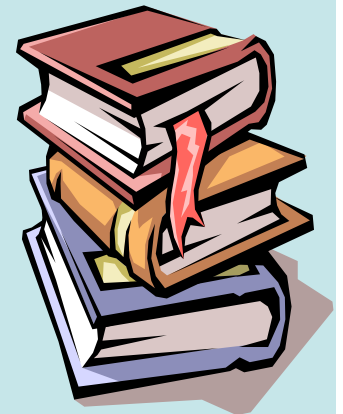
Patricia Mathes and Carolyn Denton -

**P1: Early Reading Intervention**

**(Mathes et al., RRQ, 2005)\***



Andrew Papanicolaou - **P2: Brain Activation Patterns (Simos et al., Neuropsychology, 2005; JLD, in press)**



**\*Albert J. Harris award, IRA, 2006**

# ***The Core Sample***

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**Children** – sampled across 2 years (2001- 2002)

- 300 At-Risk Readers - assigned randomly to intervention in Grade 1
- 100 Low Risk Readers

## **Teachers**

- 6 Intervention teachers (tier 2)
- 30 General Education 1<sup>st</sup>-grade Teachers (tier 2)

## **Schools**

- 6 elementary schools in a large urban school district
  - (91% minority; 82% low socioeconomic status)

# *The Interventions*

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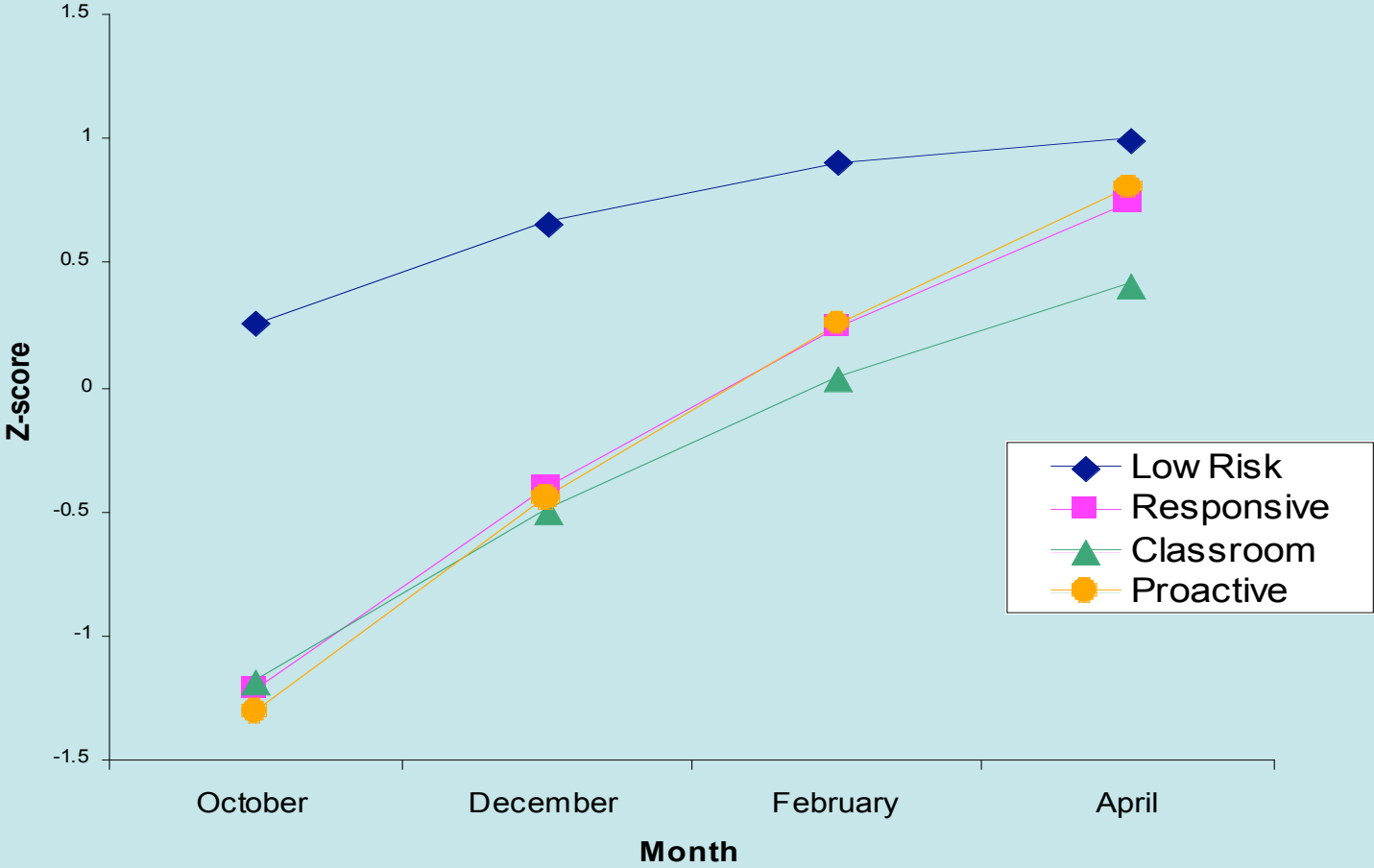
## **Enhanced Classroom Instruction**

- District provided extensive professional development and new materials
- All children identified as at-risk for principal, teachers, and parents
- Progress monitored with feedback to principal, teachers, and parents

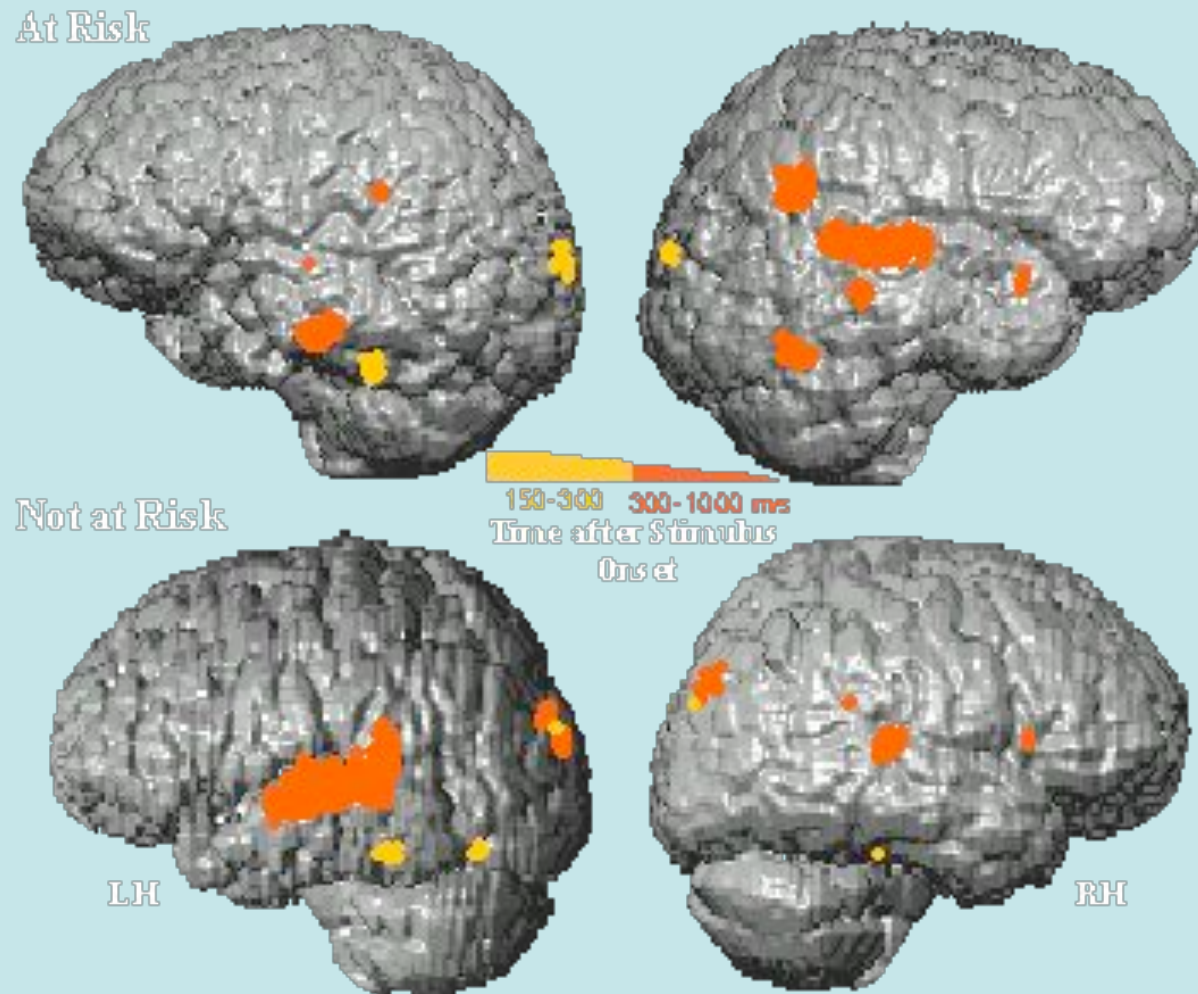
## **Supplemental Instruction**

- Some children also received an additional 40' of daily small group instruction for 30 weeks using one of two comprehensive reading programs constructed using different philosophies

**Predicted Growth in Word Reading by Group - Year 1 & 2**



# Early Detection of Aberrant Brain Activation Profiles for Reading (end K)

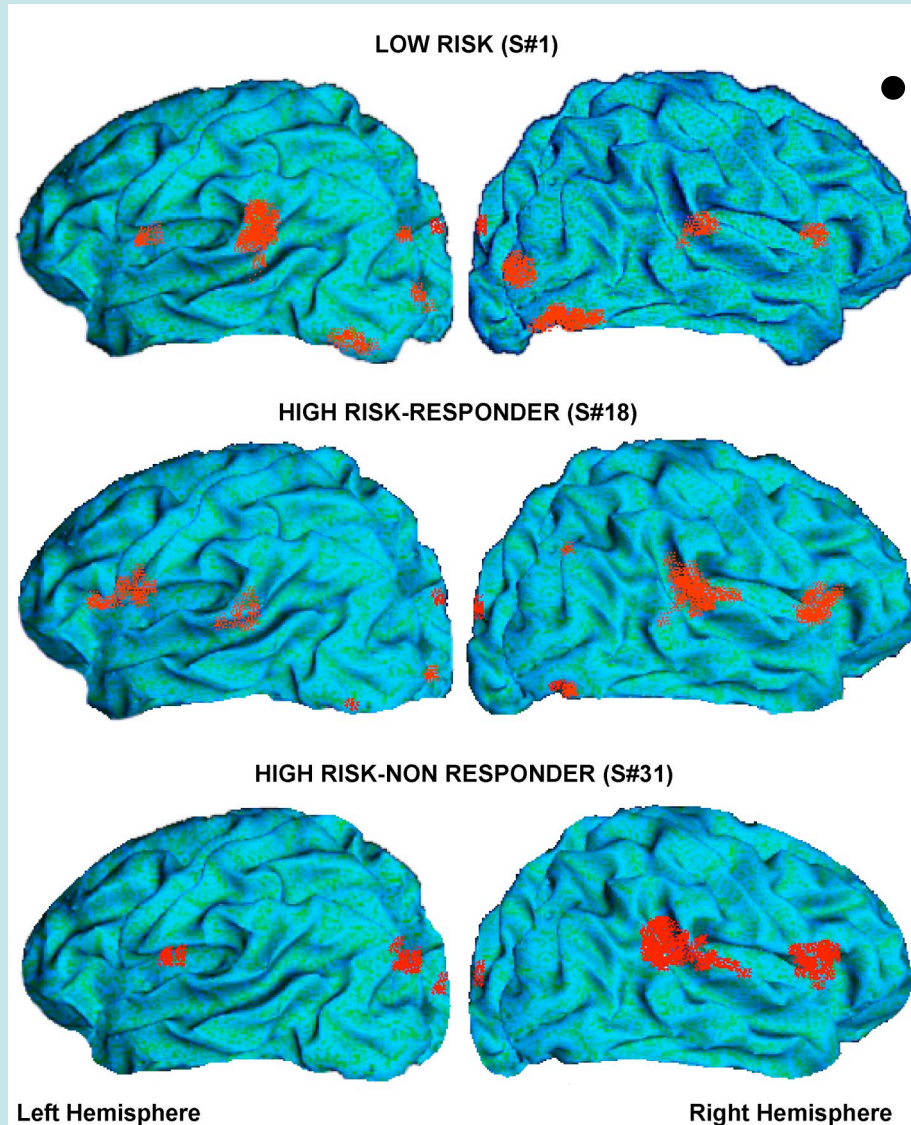


*N= 45 children 6 yrs old*

*Simos et al., J Child Neurol, 2002*



# Grade 1 Intervention



- Simos et al (Neuropsychology, 2006)- after Grade 1 intervention in Mathes et al. (RRQ, 2005)

# What percentage of children don't respond adequately to quality intervention?

Primary only:  $15/92 = 16\%$  (3.2% of school population)

Primary + Secondary:

- $7/163 = 4\%$  (<1% of school population)

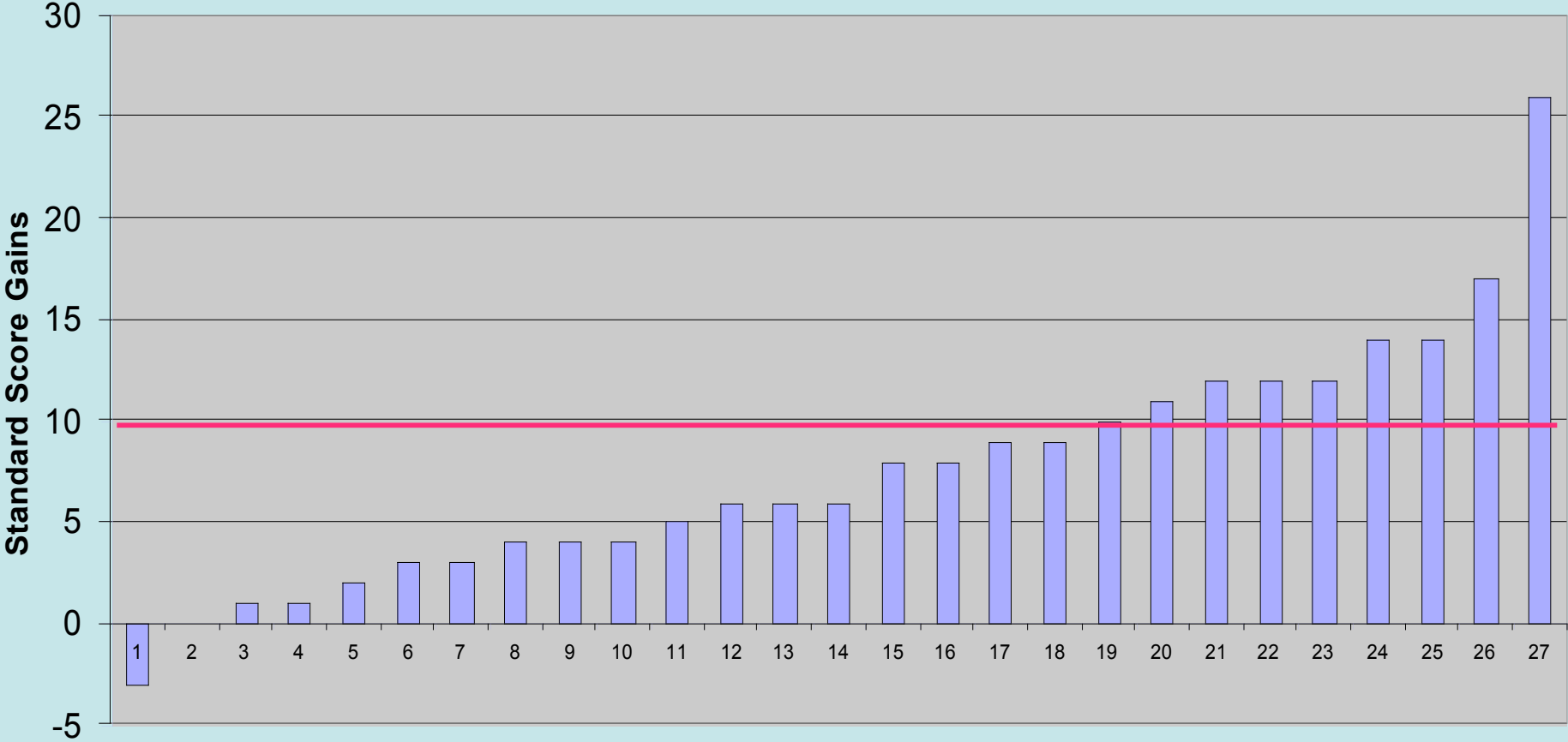
(Woodcock Basic Reading < 30<sup>th</sup> percentile)

# Denton et al., JLD, 2006

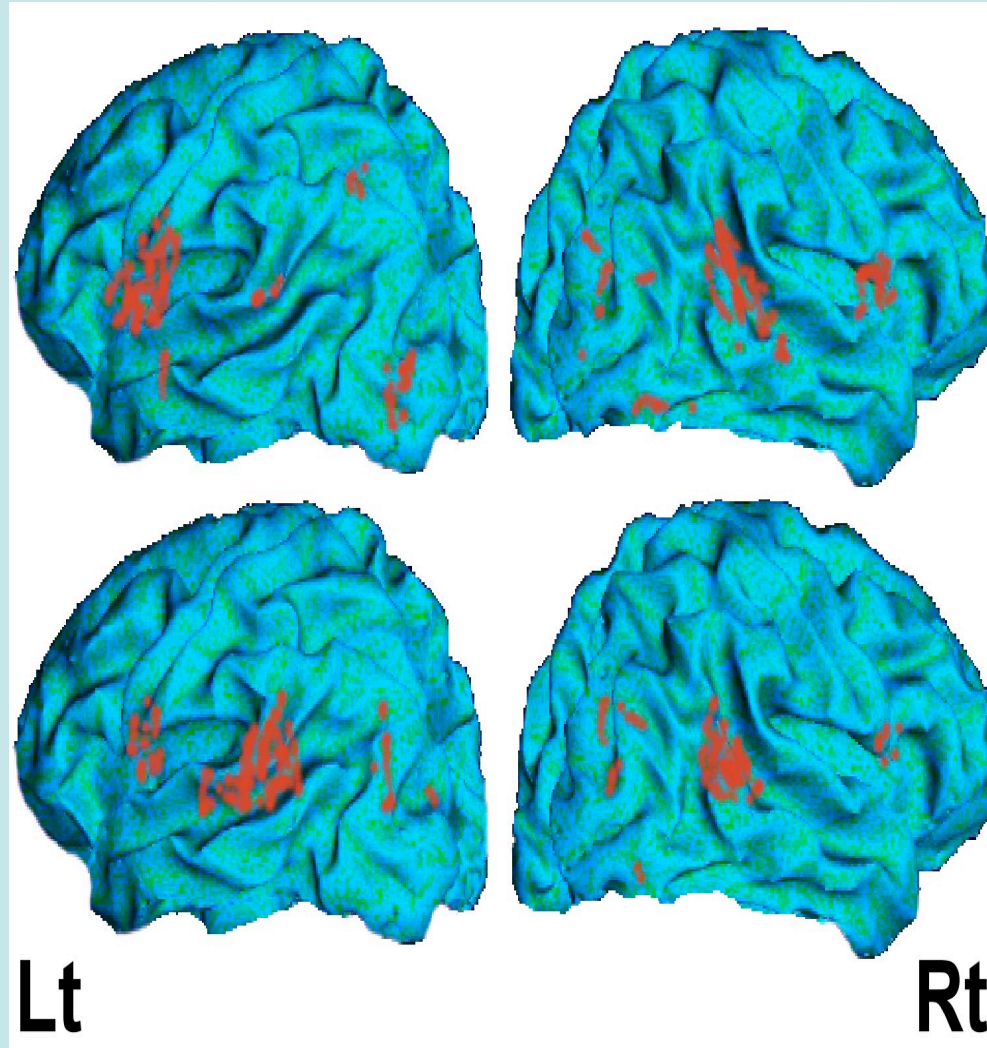
16 week intervention

- 8 week phonological decoding program 2 hours per day
- 8 week fluency program 1 hour per day
- All taught in groups of 2:1

# Gains in Basic Skills Standard Score Points During 16-Week Intervention



# Response to Tertiary Instruction



# Conclusions

- Development of reading skills dependent on establishment of LH neural network
- Network can be established through instruction, but is interplay of brain and experience
- Network may be malleable, but not all brains (or instruction) are the same

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