

The Brain's Role in Dyslexia: A True Story with a Happy Ending

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Educational Psychology
Psychology
Psychology
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Pediatrics
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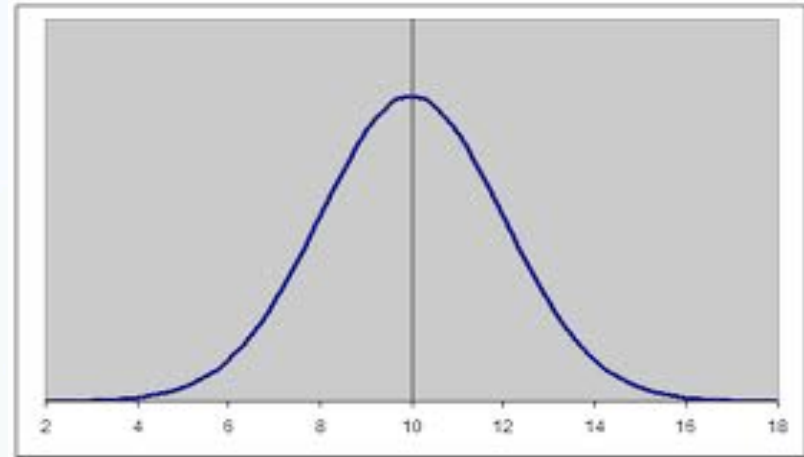
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Dyslexia

What Is It?

Reading skills occur along a continuum, with reading disabilities representing the lower tail of a distribution of reading abilities.



Dyslexia, Reading Disabilities and “poor reading” are labels used to reflect impaired decoding (word reading), fluency (reading speed) and comprehension (understanding)

Dyslexia Definition

National Institute of Neurological Diseases and Stroke

“Dyslexia is a brain-based type of learning disability that specifically impairs a person’s ability to read.

These individuals typically read at levels significantly lower than expected despite having normal intelligence.

Although the disorder varies from person to person, common characteristics...are difficulty with spelling, phonological processing (the sensitivity to and manipulation of speech sounds), and/or rapid visual-verbal responding”

Dyslexia Definition

The result of abnormal learning during the normal course of development despite adequate opportunities for learning, good instruction, and normal intelligence

Note emphasis on **learning opportunities**

Note emphasis on **good instruction – the importance of evidence based instruction**

Note emphasis on **normal intelligence – dyslexia is not all about IQ.**

Dyslexia

What Is It?

"dys" (poor or inadequate) "lexis" (words or language)

A persistent, chronic condition

Not a developmental “lag” (Francis et al, 1996)

Children with dyslexia do not just catch up

Chronic - although children and adults can improve their reading skills

Affects boys and girls equally

It is a myth that boys are affected more than girls (Shaywitz, Shaywitz, Fletcher, & Escobar, 1990); boys may be referred more due to behavior problems

Dyslexia

What Is It?

"dys" (poor or inadequate) "lexis" (words or language)

People with dyslexia can read – up to a point.

Decoding problems are seen when sight words become more complex; simple sight words are “read”

Difficulties in sounding out words (remembering letter-sound associations) makes decoding effortful and spelling difficult

Inaccurate and slow rate of decoding (fluency) are problems for reading comprehension

Dyslexia Misconceptions

Myths about dyslexia

People with dyslexia have visual problems: reversal of letters seen or in written letters; special colored or filtered glasses are needed.

These vision problems are not defining characteristics of dyslexia, nor are they true of all people with dyslexia.

Dyslexia Misconceptions

Myths about dyslexia

Dyslexia is defined by a gap – discrepancy – between IQ and reading achievement.

The focus is on *reading*. If people can not read, they need special instructional supports to enable them to learn to read – regardless of their IQ.

Dyslexia

What Is It?

Studies of dyslexia reveal a heritability factor

Children with one or both parents with dyslexia, or with siblings or close relatives with dyslexia have a higher risk of dyslexia.

Familial Risk

The heritability factor is not 100% - The environment plays an important role in the genetic expression of dyslexia

Dyslexia Risk

"dys" (poor or inadequate) "lexis" (words or language)

Rates of dyslexia

23 - 65% of children who have a parent with dyslexia

40% of siblings of people with dyslexia

27 - 49 % of parents of people with dyslexia

6-15% of people in all countries, regardless of language

non-alphabetic languages – rate is 3-10%

Interesting in light of differences between languages in orthography

Reading Acquisition in English

Learning to read English is hard

Harder than other languages

English has many speech sounds (at least 40 phonemes) with speech sounds represented in different (sometimes inconsistent) ways in print because we only have 26 letters

There are 176 ways different common phonemes are spelled
be, see, sea, scene, key.....

A writing system was *invented* to represent speech sounds as symbols but there are multiple ways to spell the same phonemes and multiple ways to decode letters and letter sequences

Reading Acquisition in Other Languages

Other alphabetic languages (Finnish, French, German, Greek, Italian...) are easier to learn

Have nearly 1 to 1 correspondence between phonemes and the letter or letter pairs used to represent the sound.

Poor readers in these languages can decode and spell words very well, but they have slow reading speed (fluency)

Poor readers in these languages have fluency problems

Dyslexia & Reading Acquisition

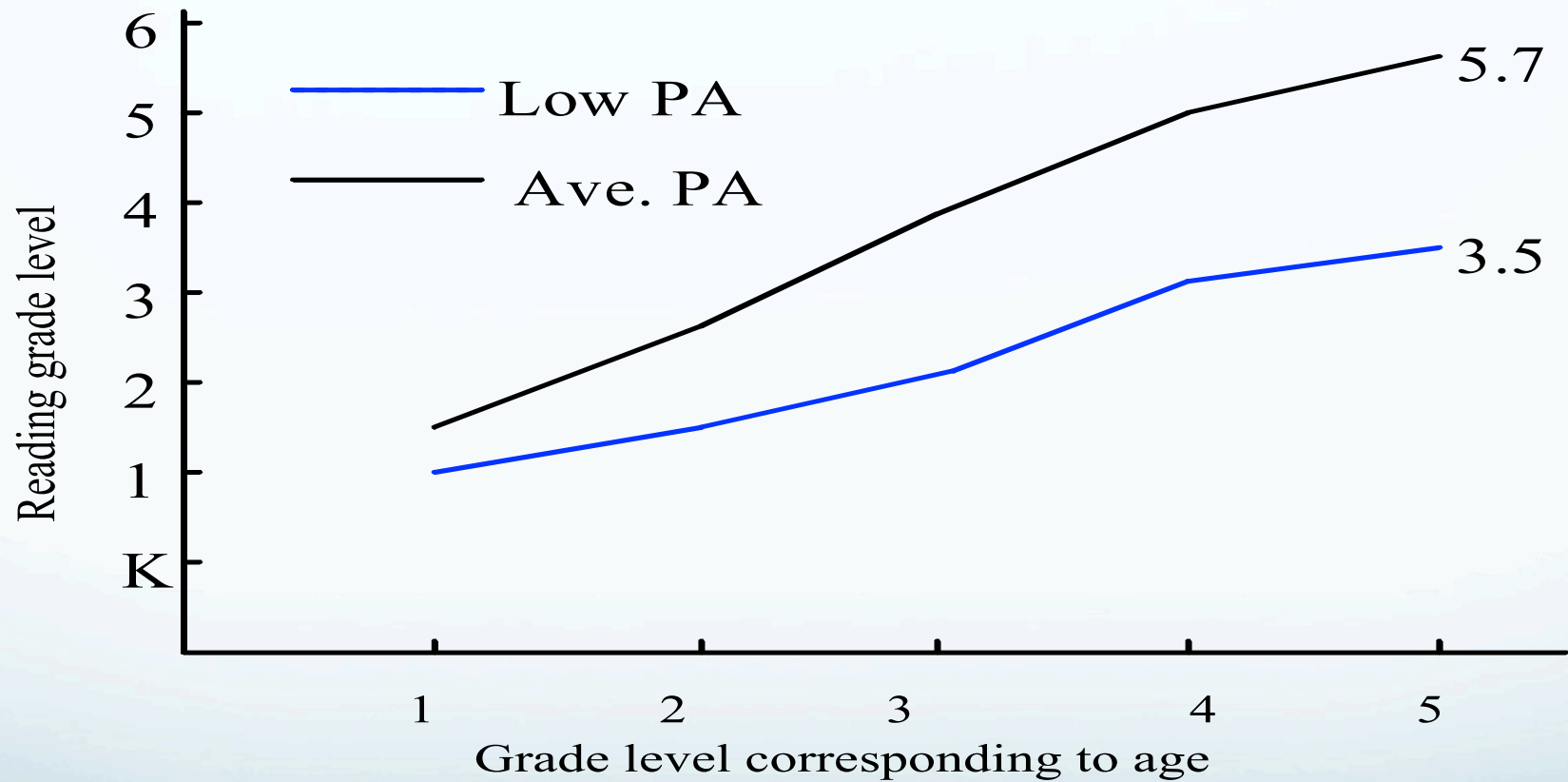
Often, dyslexia or poor reading skills are identified in grade school as reading demands increase

Identification in 3rd or 4th grade is common

But parents, children, and teachers often recognize much earlier when reading skills are not at grade or age level

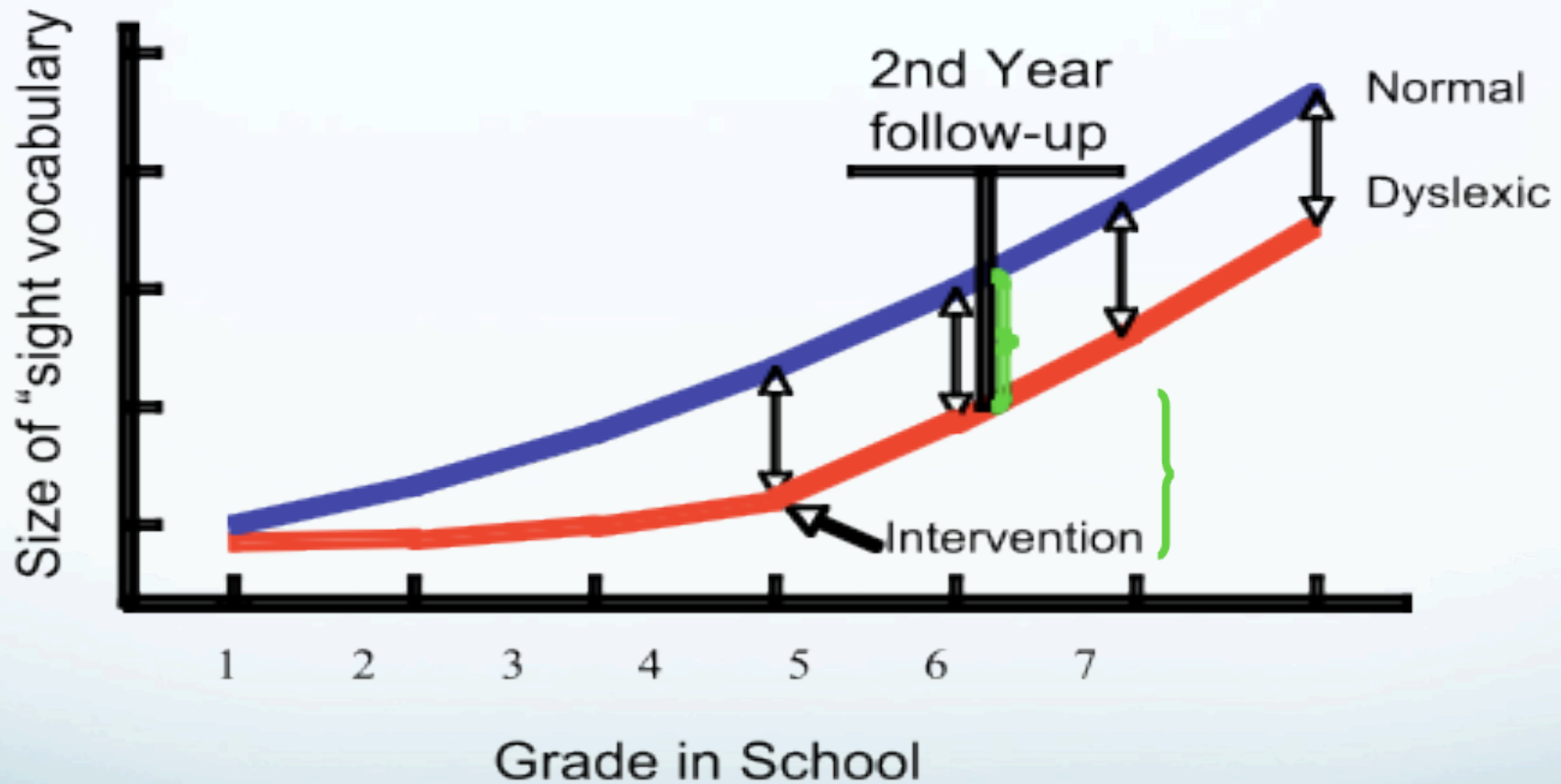
We can see poor reading performance in early grades just by looking at data – we don't even need statistics!

Growth in word reading ability of children who begin first grade in the bottom 20% in Phoneme Awareness and Letter Knowledge (Torgesen & Mathes, 2000)



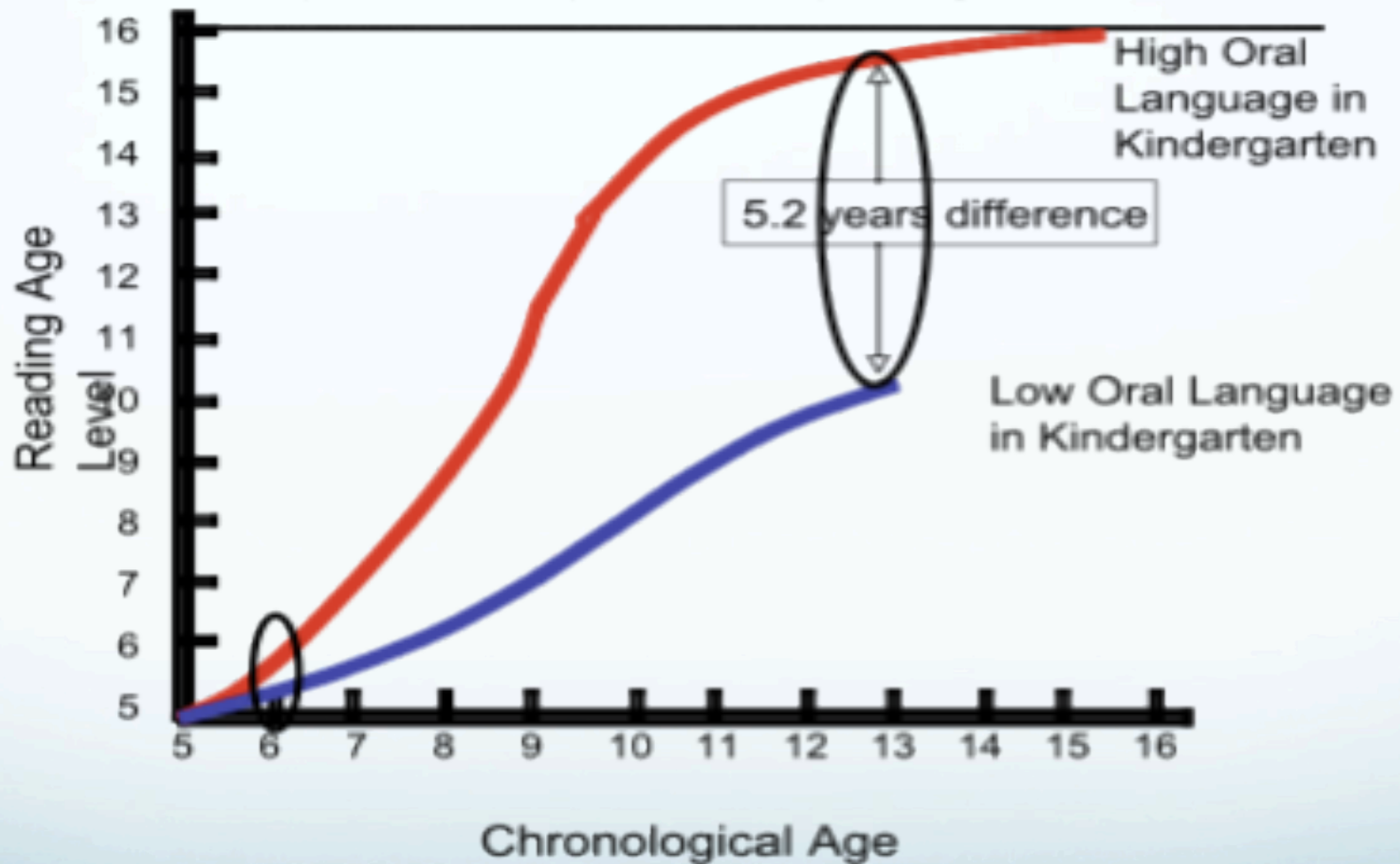
Projected growth in "sight vocabulary" of normal readers and disabled children before and after remediation

From Joseph Torgesen



The Effects of Weaknesses in Oral Language on Reading Growth

(Hirsch, 1996) From Joseph Torgesen



A Story: The Lincoln County Reading Study



School District initiated contact

New reading program was planned

Teachers, families and children with different reading levels wanted to understand how reading skills could be impacted by the new program

Children Participating N = 27

School Identified Reading Groups	Males	Females
Above (2 years +)	4	4
At Grade Level	4	5
Below (2 years -)	5	5

Ages: 9 yrs. 3 mo. - 12 yrs. 1 mo.

Word & Non-word Reading Task

+	BAG	+	?
+	KAT	+	?
+	DAK	+	?

One Boy's Insight

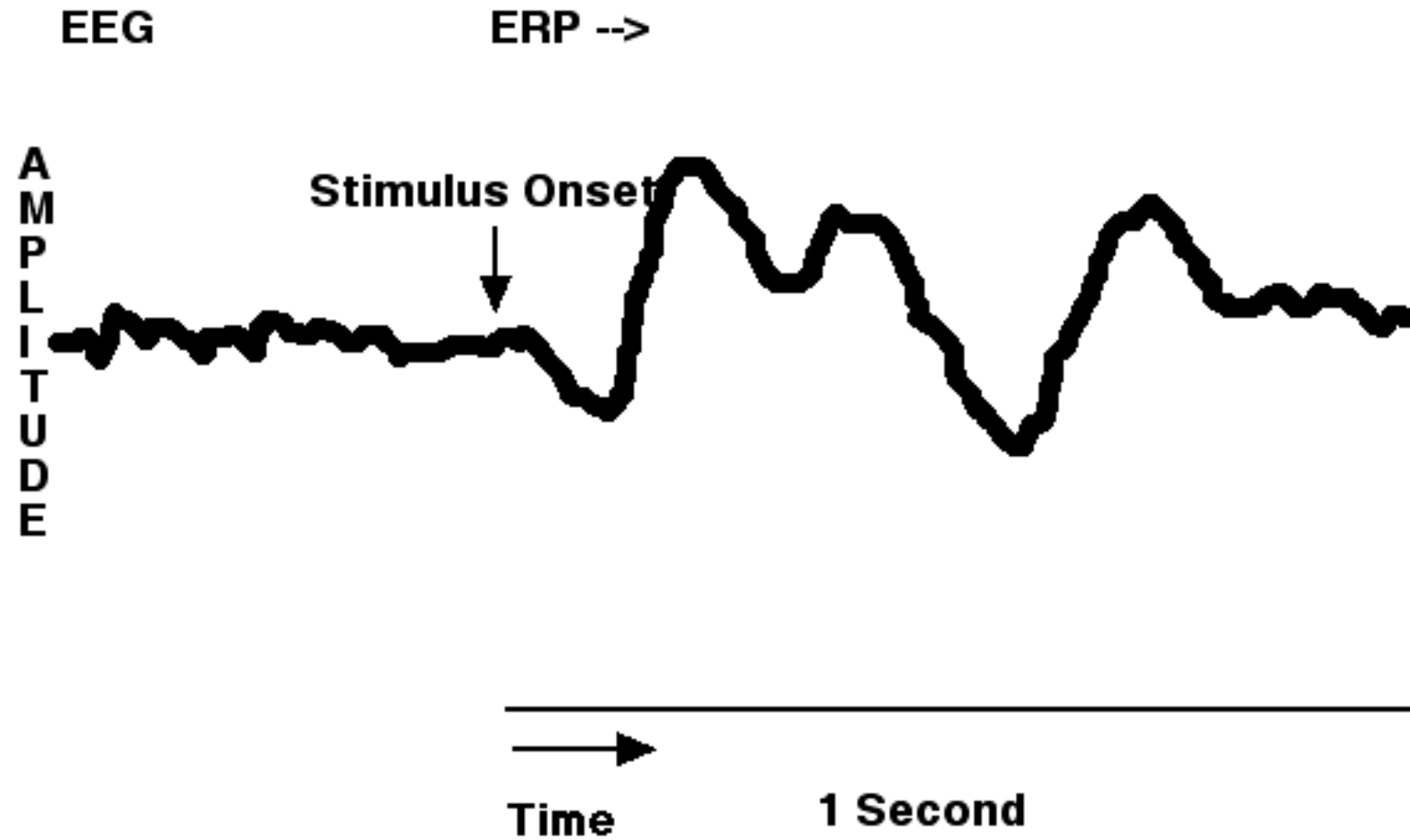
After viewing movies of brain processing during the reading tasks – This child's insight was about his experiences

He was using his whole brain, just like his parents were telling him to.

Using your “whole brain” is not what is needed for reading

So - What Does the Brain
Tell Us About Dyslexia?

Event-Related Potential - ERP



Event-Related Potential - ERP

**Rapid Temporal Information
(1/1000 Second)**

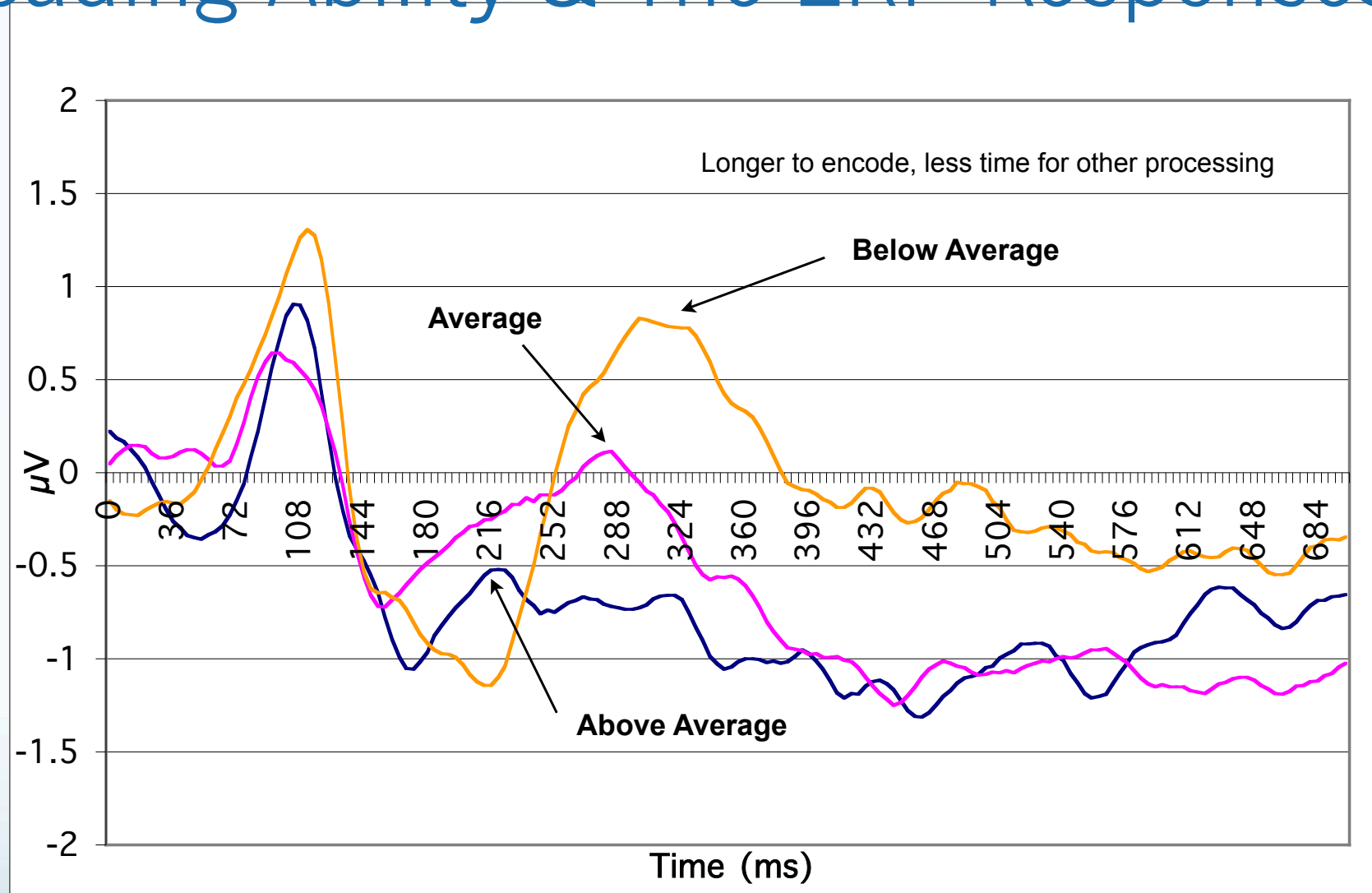
Sensitive to Developmental Changes

Correlates with Cognitive Abilities

Predictor of Later Development

Correlates with Intervention success

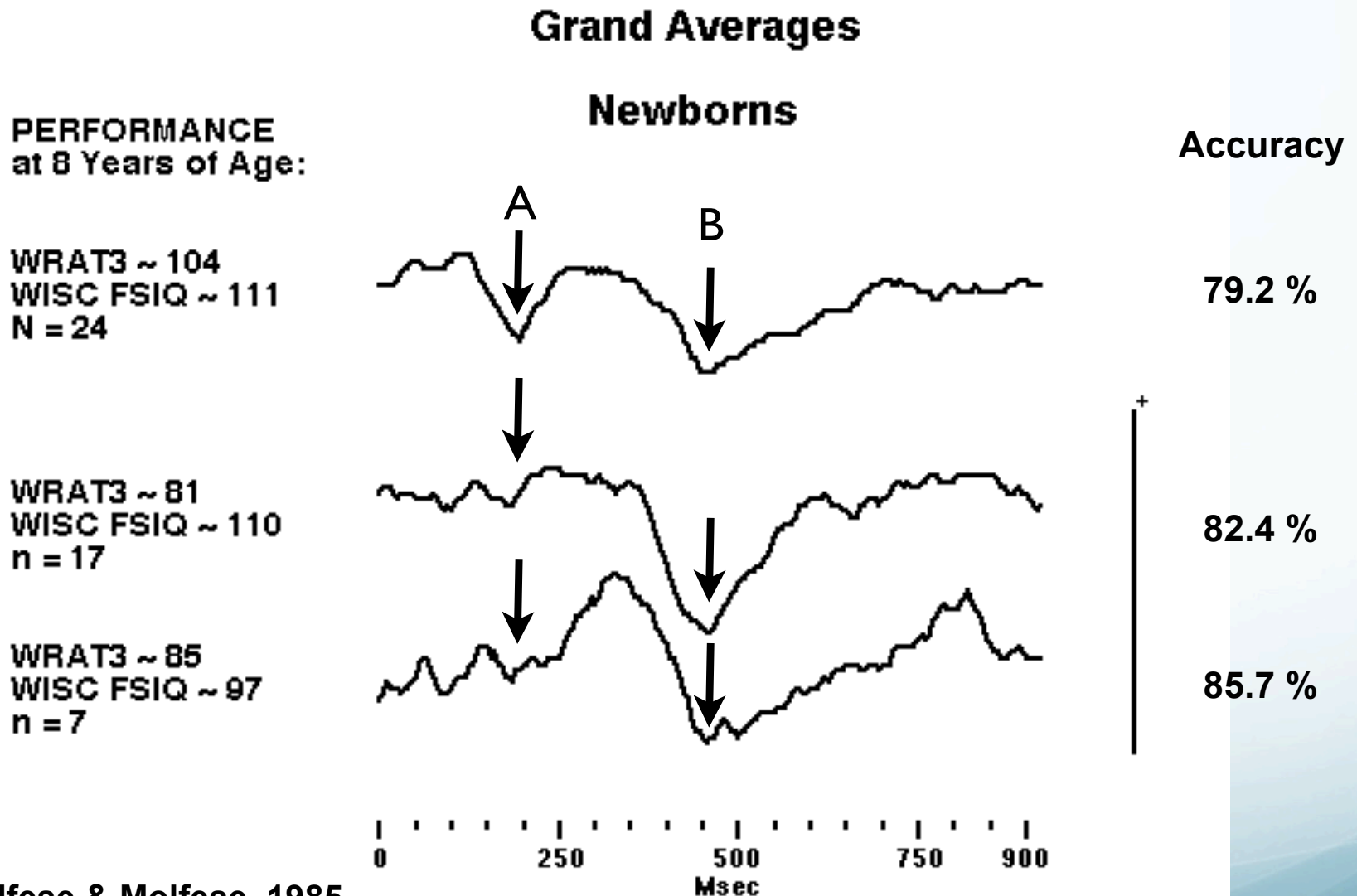
Reading Ability & The ERP Responses



Children: Ages 9 - 12 years (n=27)

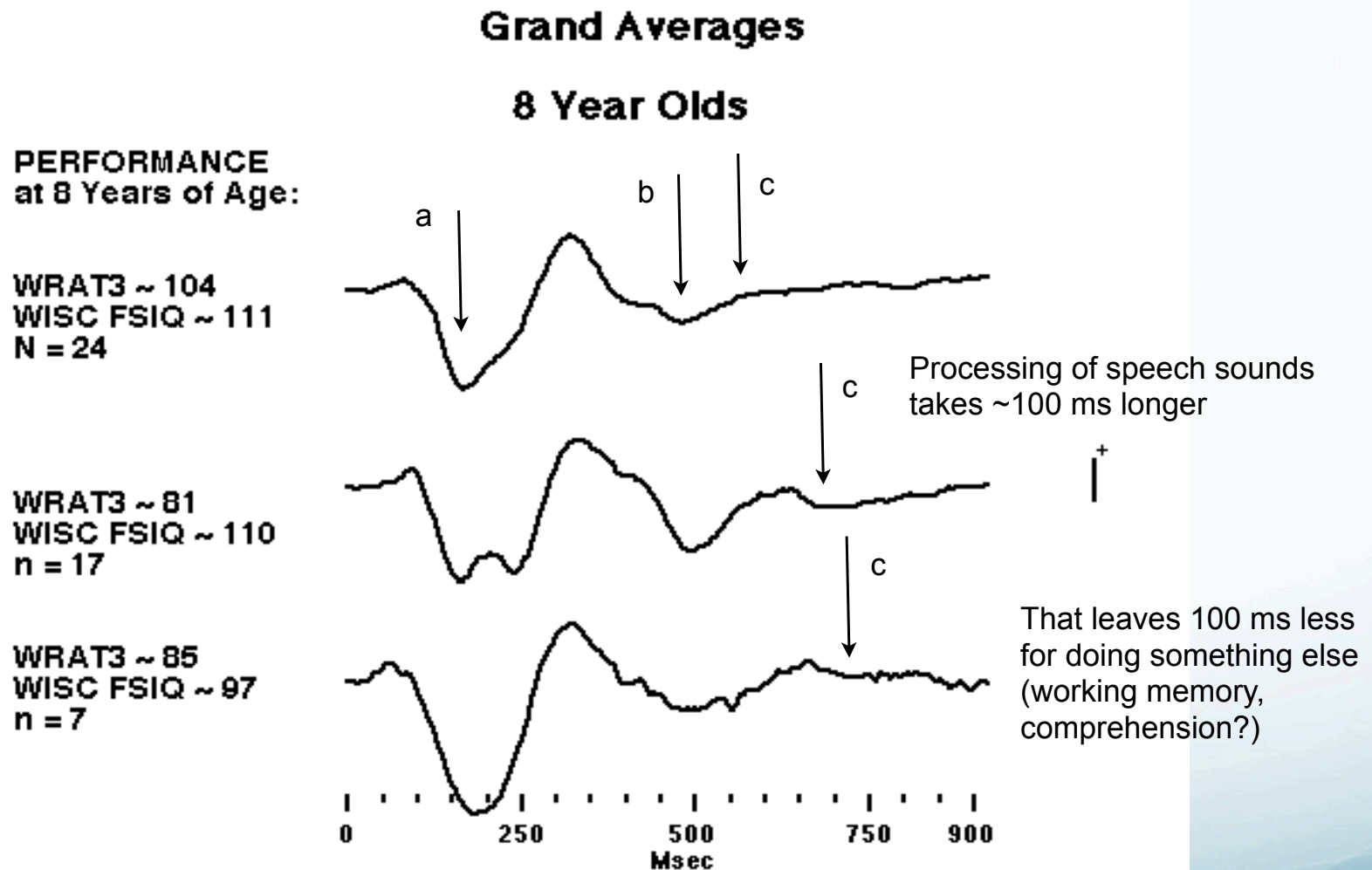
$F(2, 42) = 4.56, p < .016, \text{power} = .744$; $t(26) = 3.143, p < .004$, and $t(26) = 3.422, p < .002$

Newborn Responses to Speech Predict Later Reading Skills



Molfese & Molfese, 1985
Molfese & Molfese, 1997
Molfese, 2000

8-Year Olds' Responses to Speech & Later Reading Skills



Intervention

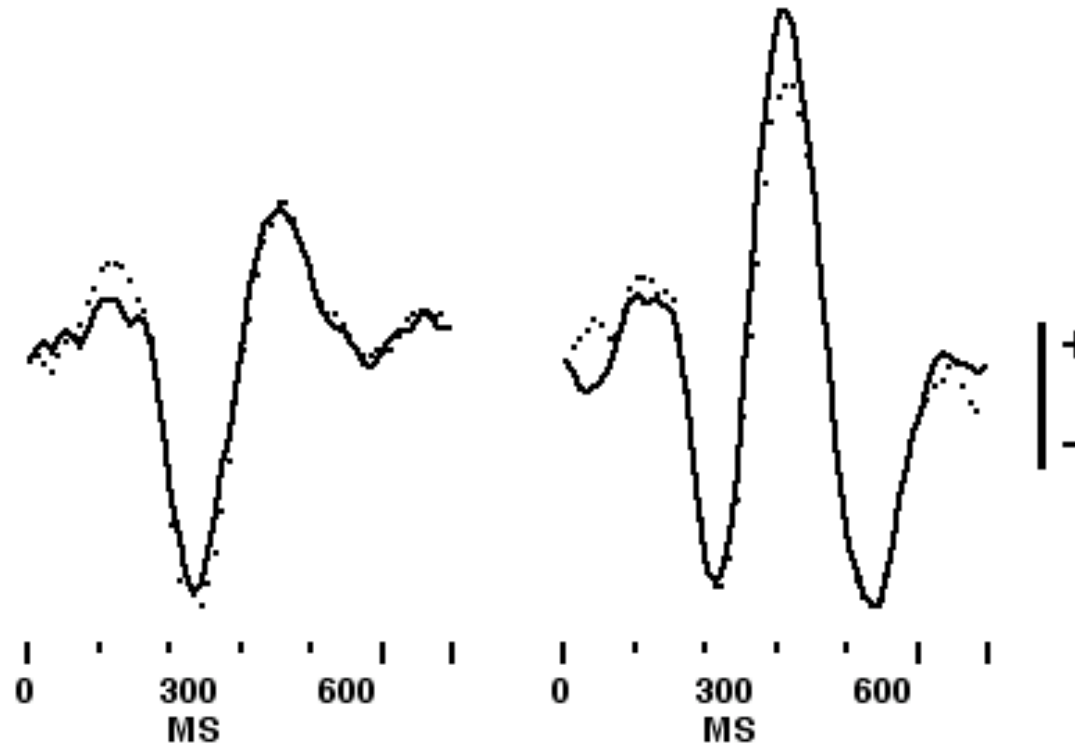
Begin Intervention And Track Effectiveness of The Intervention



14-Month-Old Infants
(n=14)

PRETEST

POSTTEST



— Match
..... Mismatch



Rhyming Task

+

cat

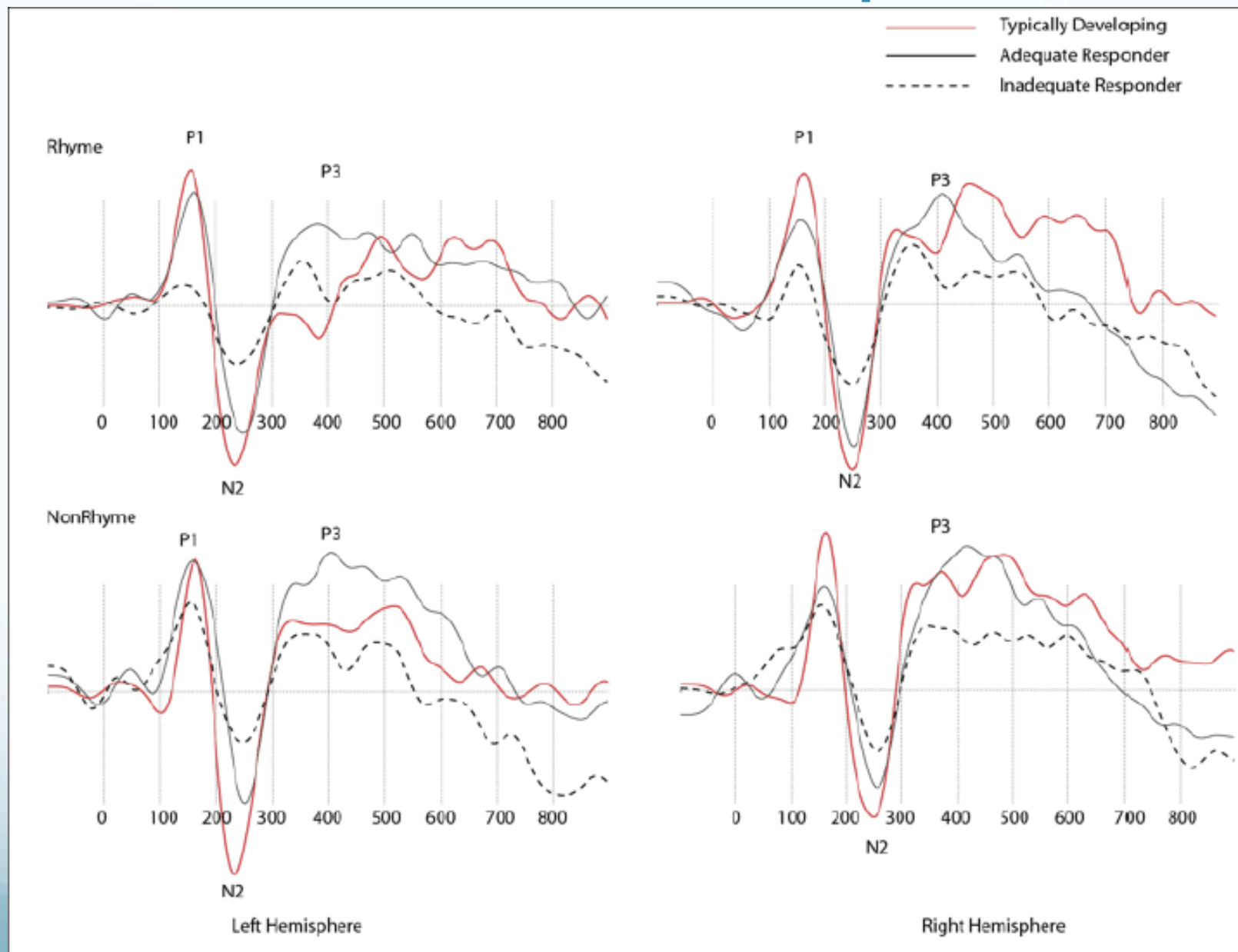
+

hat

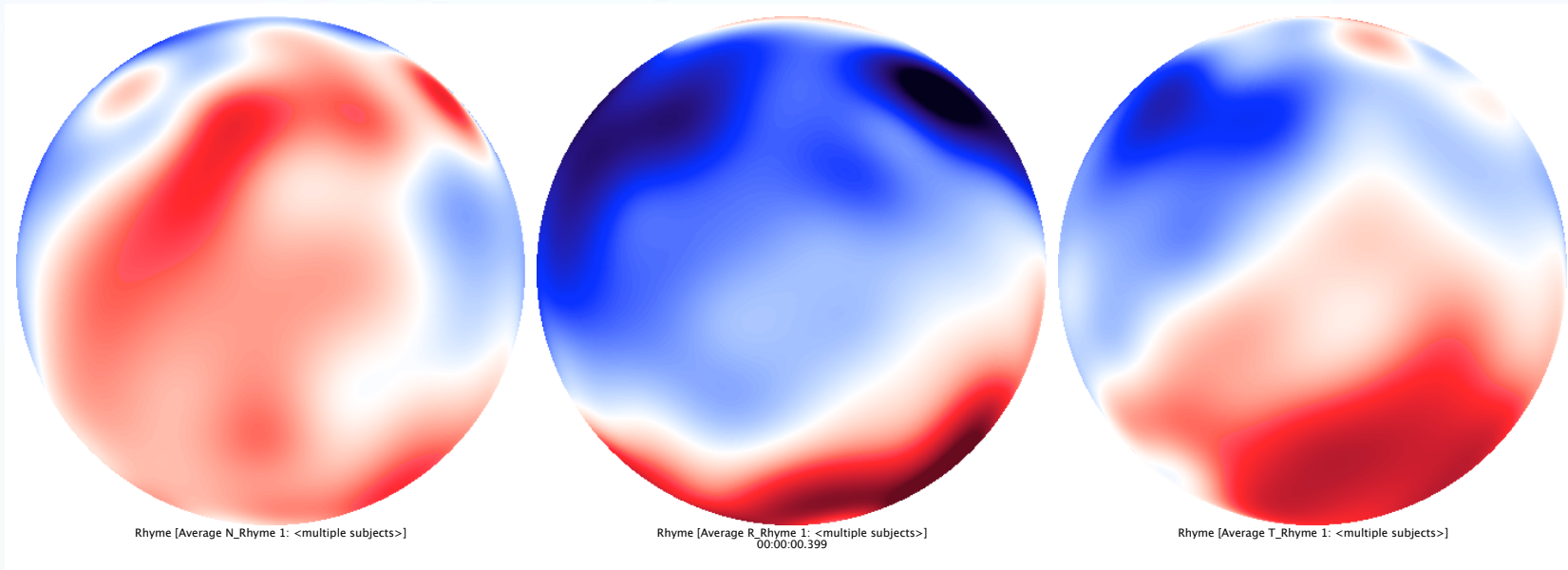
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ERPs for Typical Readers, Responders to Intervention & Non-Responders



Response to Intervention



Non-Responder

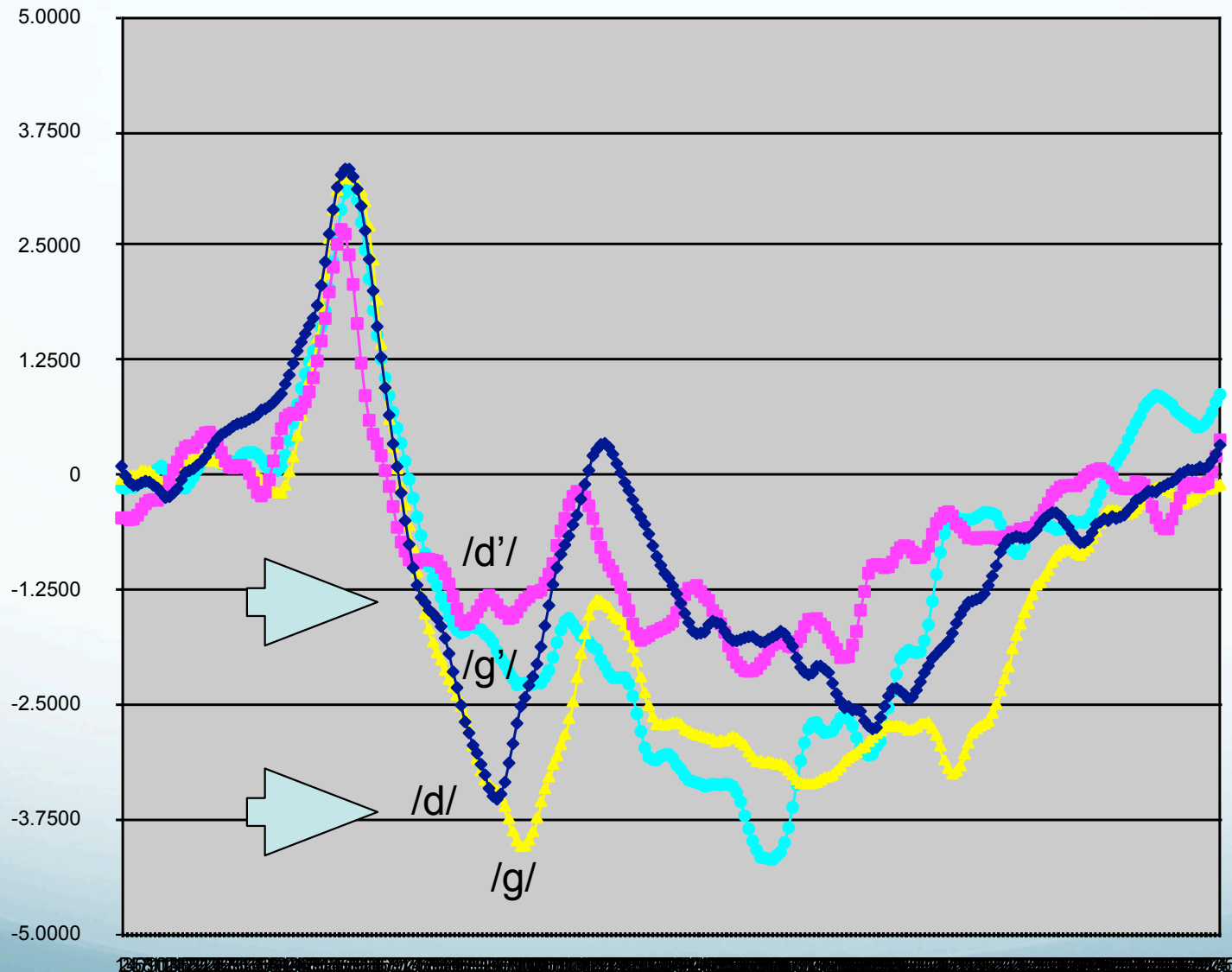
Responder

Typical Developing

Response to Rhyming Stimuli
Differentiates between all three groups

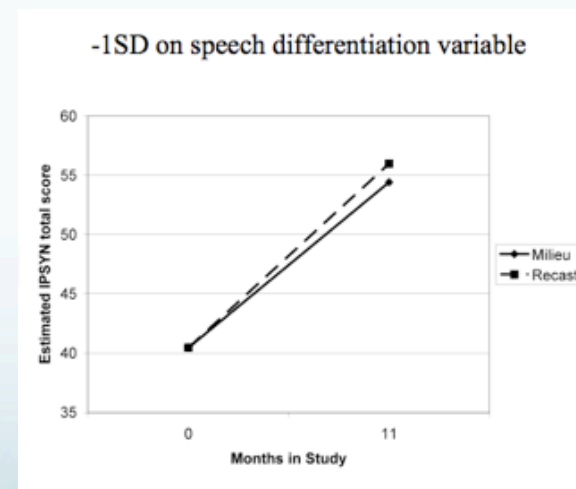
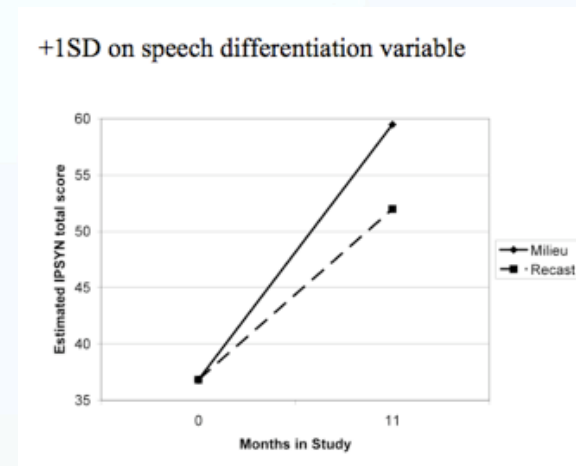
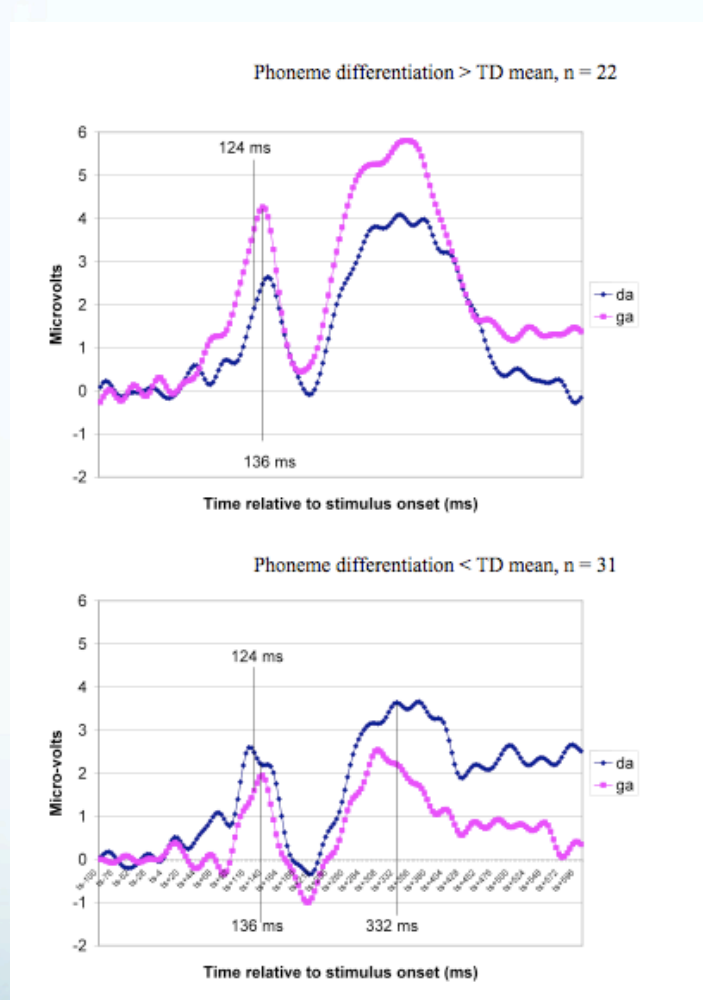
STUDY 1

ERPs in 5-Year-Old Preschool SLI Children Predict Subsequent Language Gains Following 6-Week Intervention



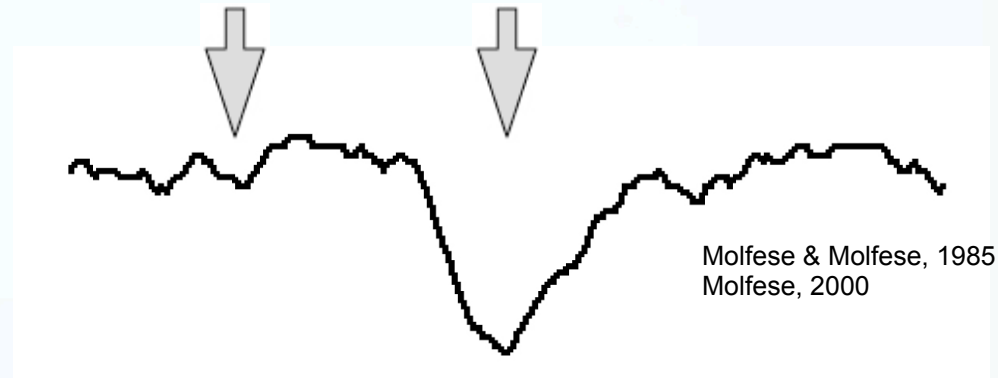
ERPs in 2 to 4-Year-Old Preschool SLI Children Predict Subsequent Language Gains Following 4 Month Intervention

Ability to discriminate /da/ from /ga/

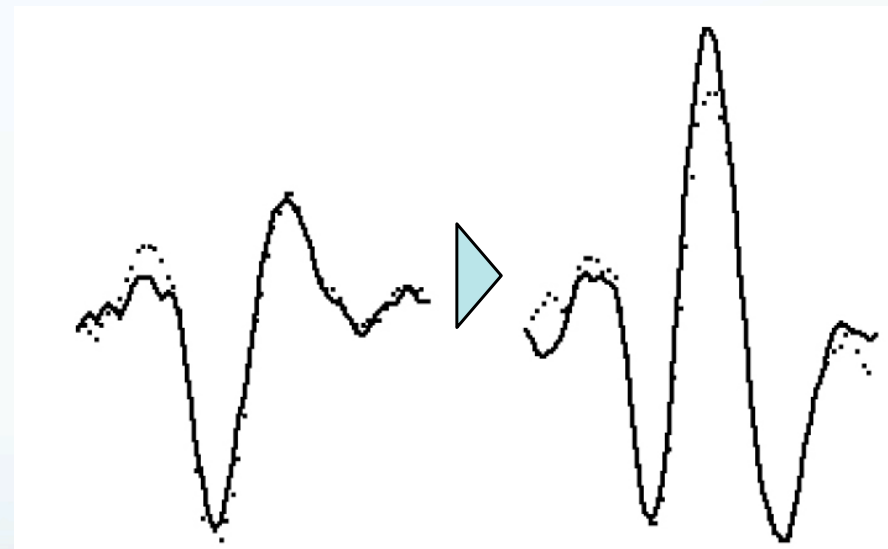


Model For Intervention That Incorporates Early Identification

1. Identify Risk At Birth/Infancy



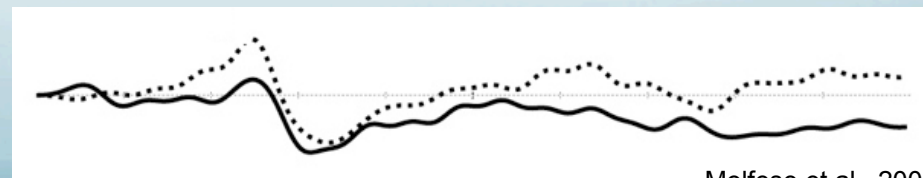
2. Choose & Monitor Effectiveness of Early Intervention



Molfese, Morse & Peters, 1990



3. Normal Development

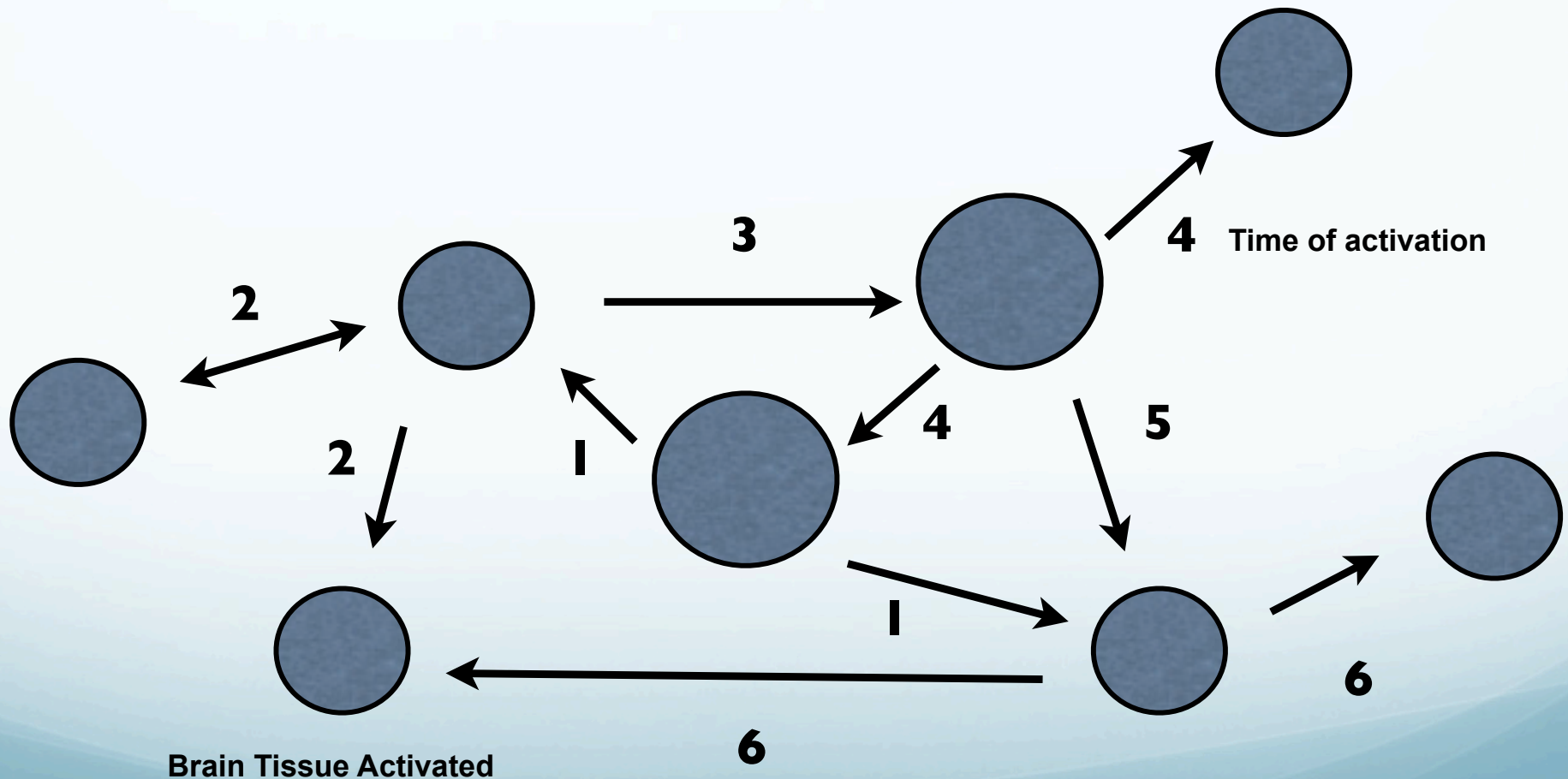


Molfese et al., 2008

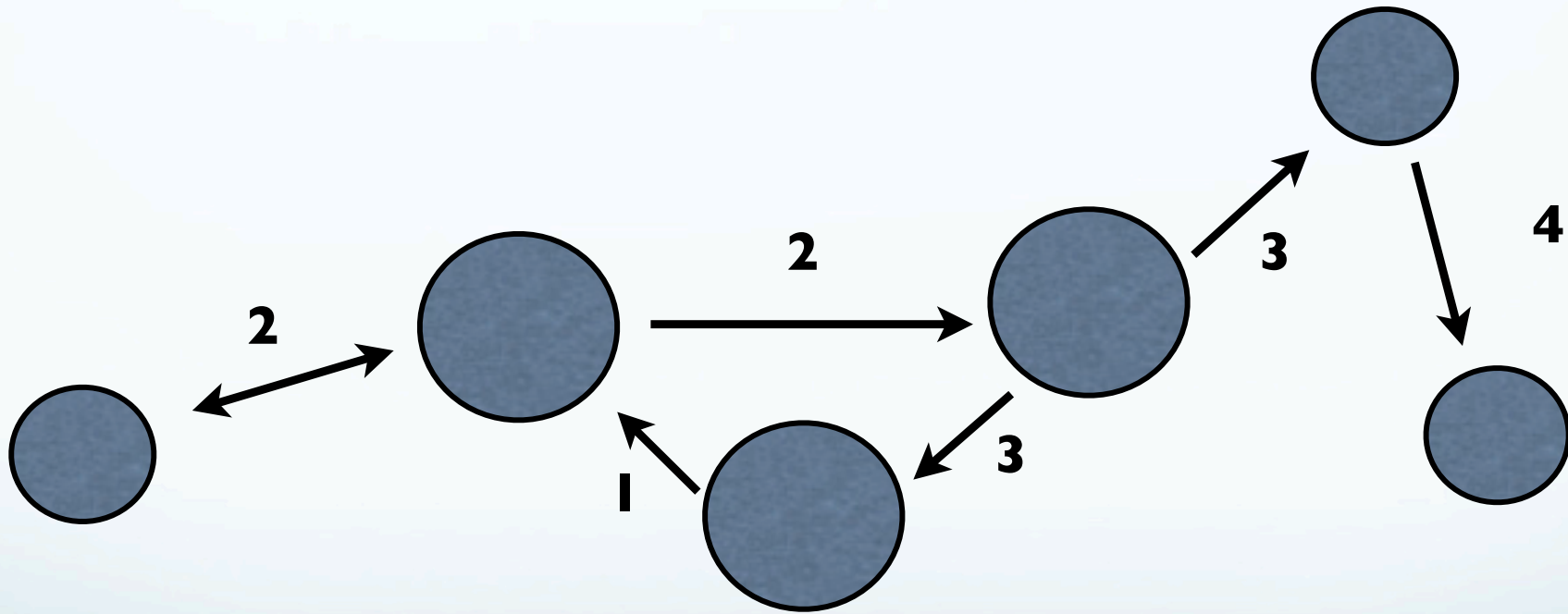
Model For Acquisition

Normal Learning Development

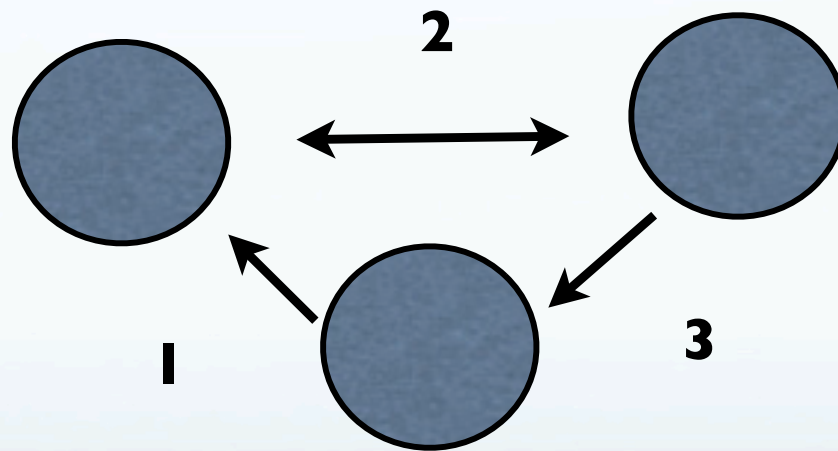
Normal: Time I



Normal: Time 2

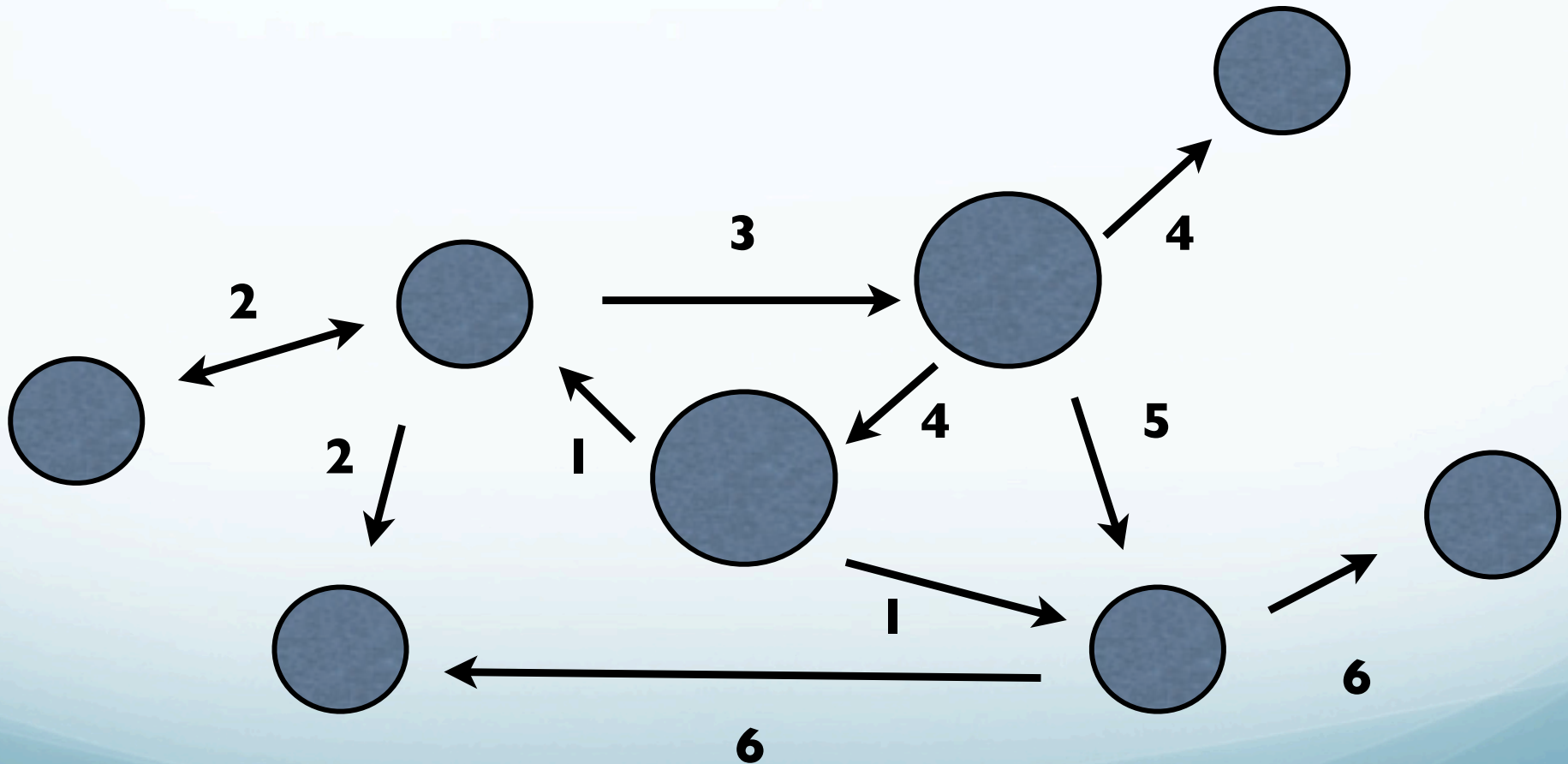


Normal: Time 3

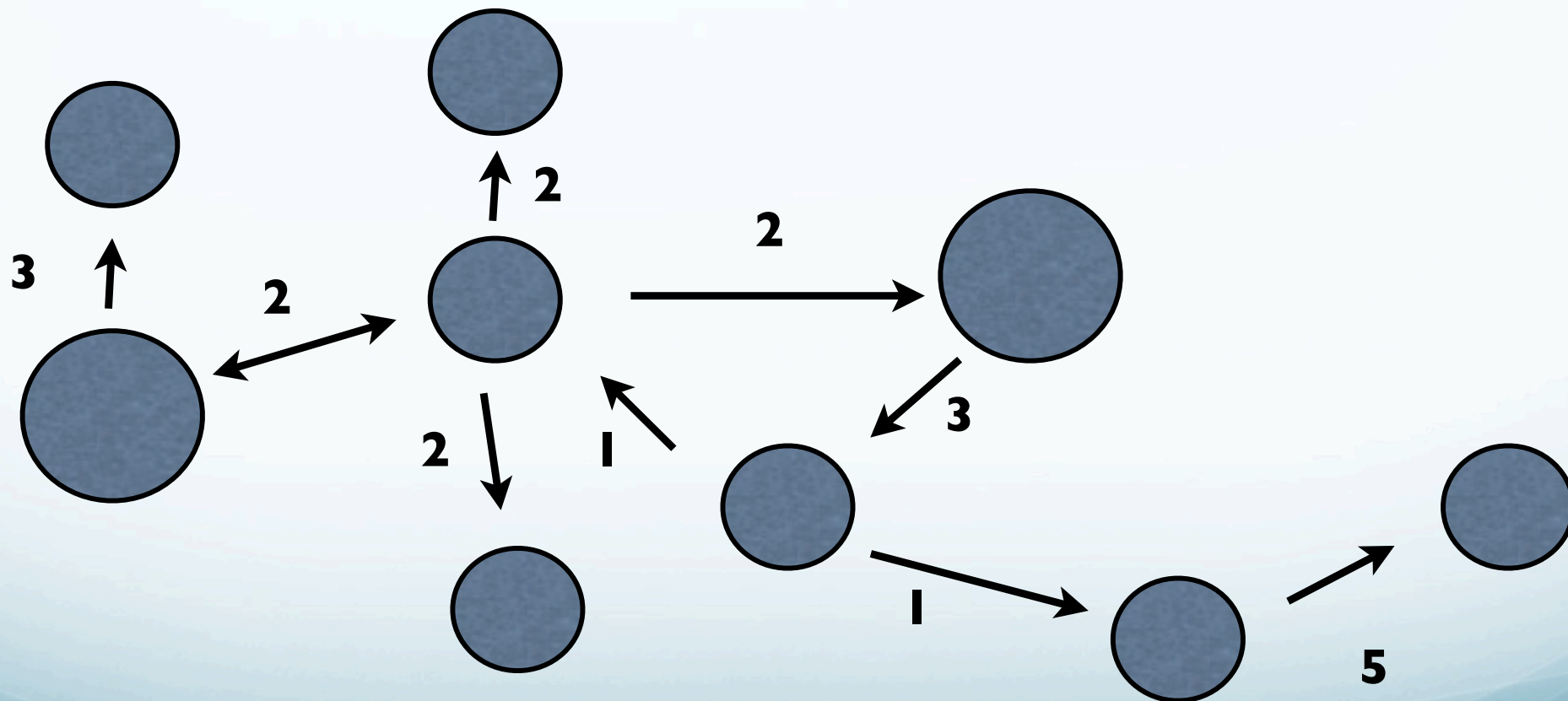


At-Risk Learning Development

Impaired: Time I

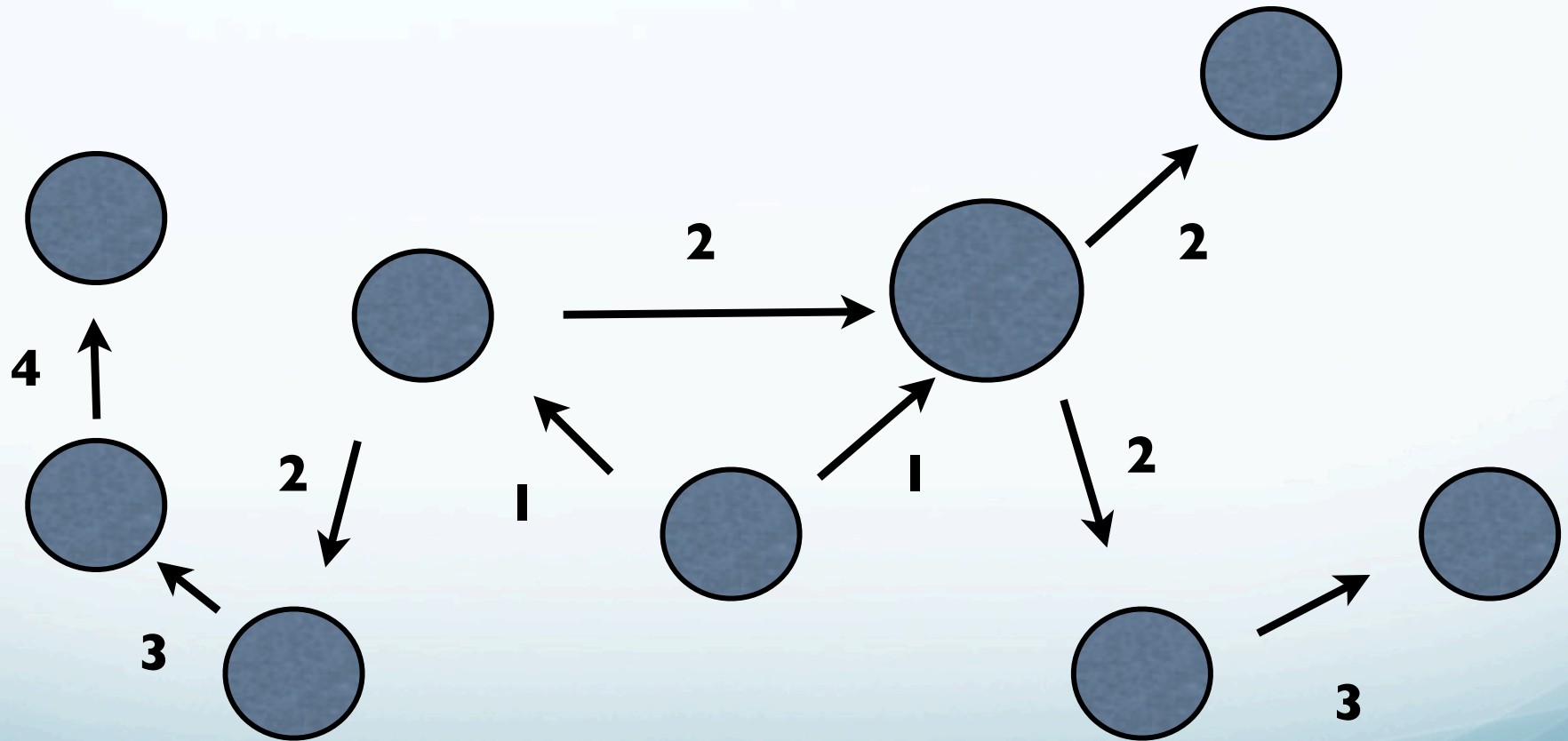


Impaired: Time 2



1. Slow or No Transition to Fewer Areas.
2. Areas Activated Change From Trial-to-Trial.
3. Unstable Temporal Links Between Areas.

Impaired: Time 3



QUESTIONS ???

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