

Moira Finnegan, MS, CCC-SLP  
Portland Public Schools

Founding Member,  
Decoding Dyslexia Oregon

## **Dyslexia 101: A Speech-Language Pathologist's Perspective**

- How I became interested in dyslexia
- Neurology of skilled reading
- Definition of dyslexia
- Neurology of dyslexia
- Dyslexia assessment
- Dyslexia intervention
- SLP roles in supporting students with dyslexia

# Can I tell you a secret?

- 4<sup>th</sup> grade boy transferring in to behavior room
- “I can’t read”
- Reading at KG level
- Could decode CVC (e.g., “top”) and clusters (e.g., “st”) but could not blend sounds to decode CCVC (e.g., “stop”)
- Could not write his name without a model
- I was in way over my head!
- Could this be dyslexia?
- Orton-Gillingham training at Blosser Center

# Learning to read isn't automatic

- Reading is not a skill that can be picked up automatically, like spoken language.
- Humans have used spoken language for 50,000-100,000 years.
- Humans have only been reading for about 5,000 years.
- Reading is a multifaceted skill, gradually acquired over years of instruction and practice.

(Wolf, 2008)

# Visual information

See the word  
*cat*

**Auditory (phonological)  
representations**

Activation of  
sounds

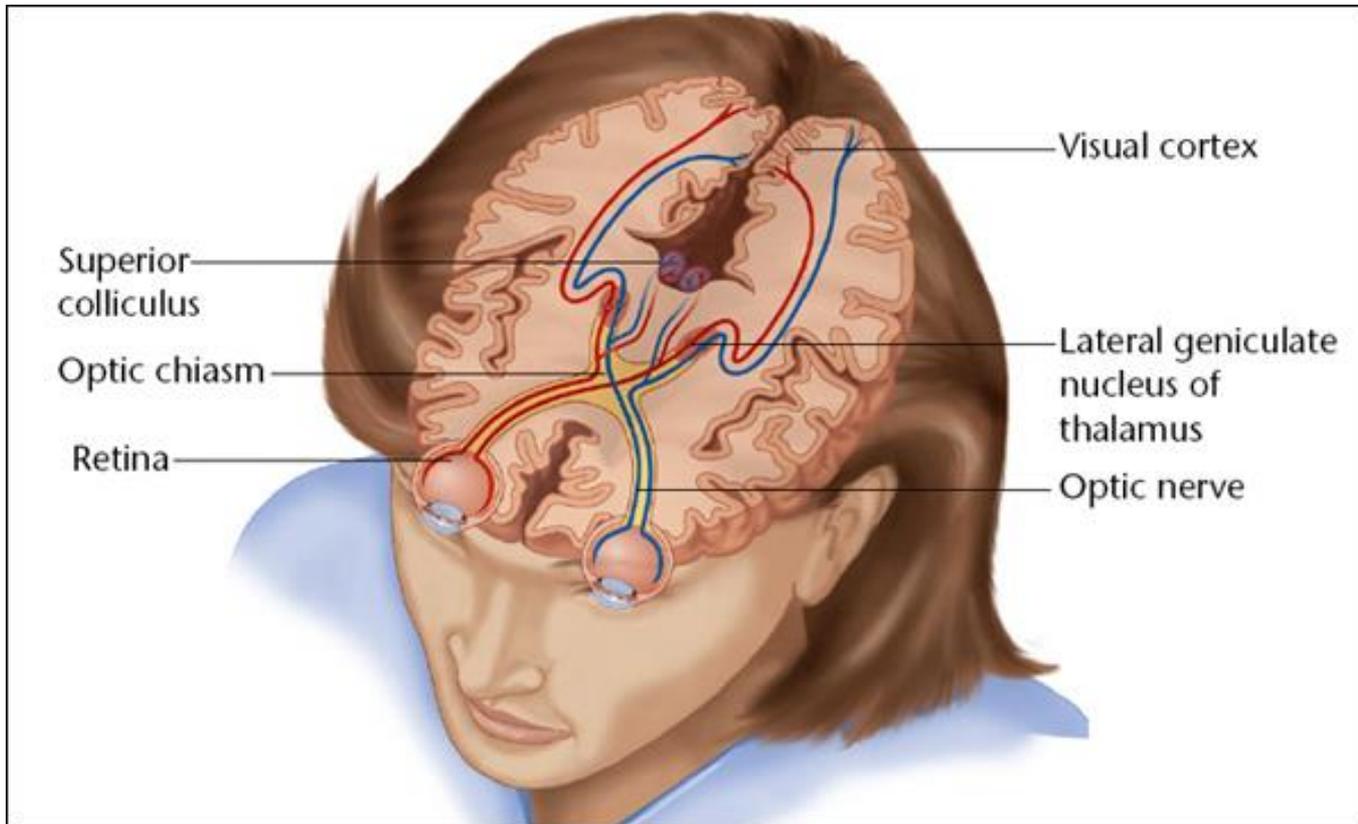
*/kat/*

**Conceptual (semantic)  
representations**

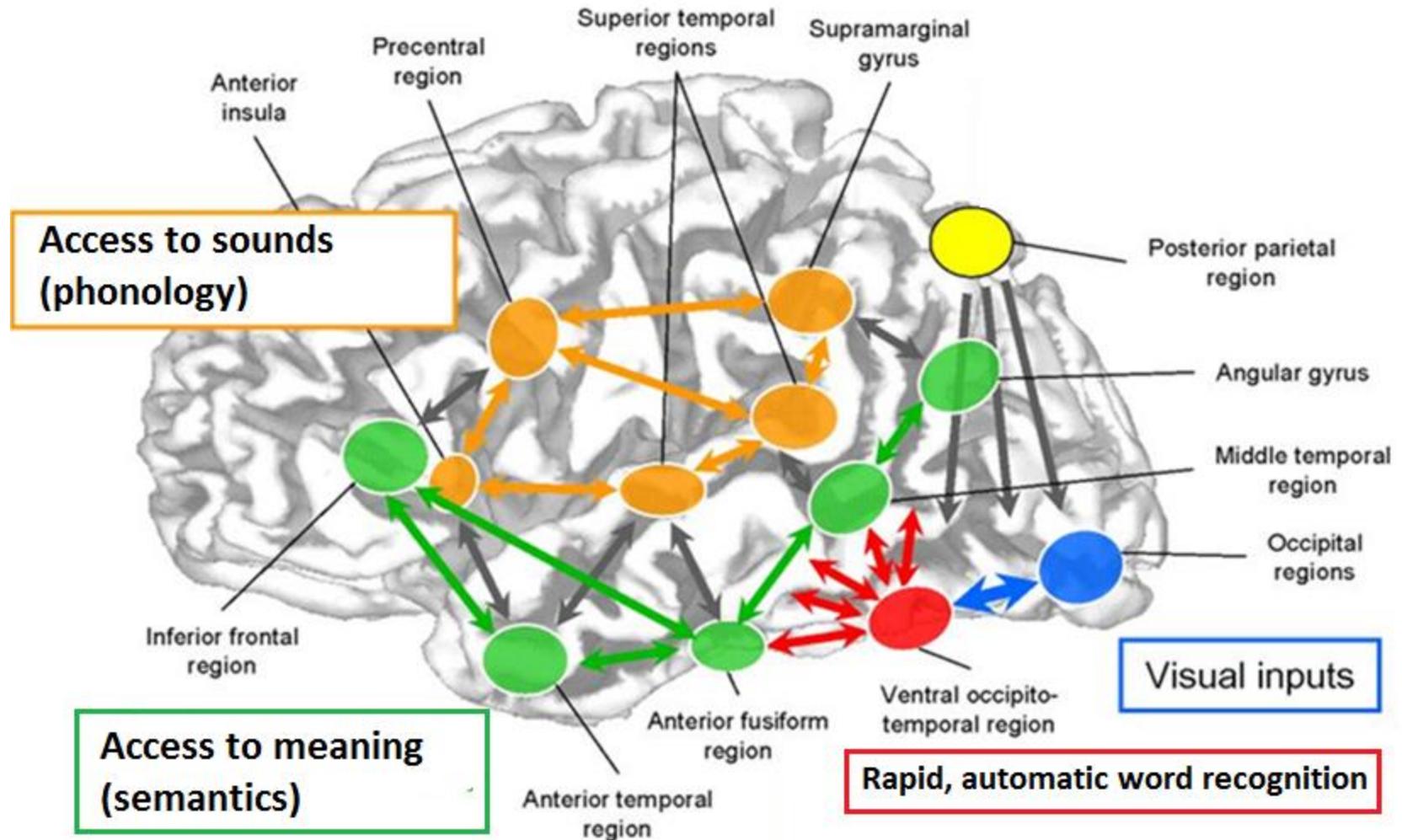
Activation of  
concepts



# Visual Input



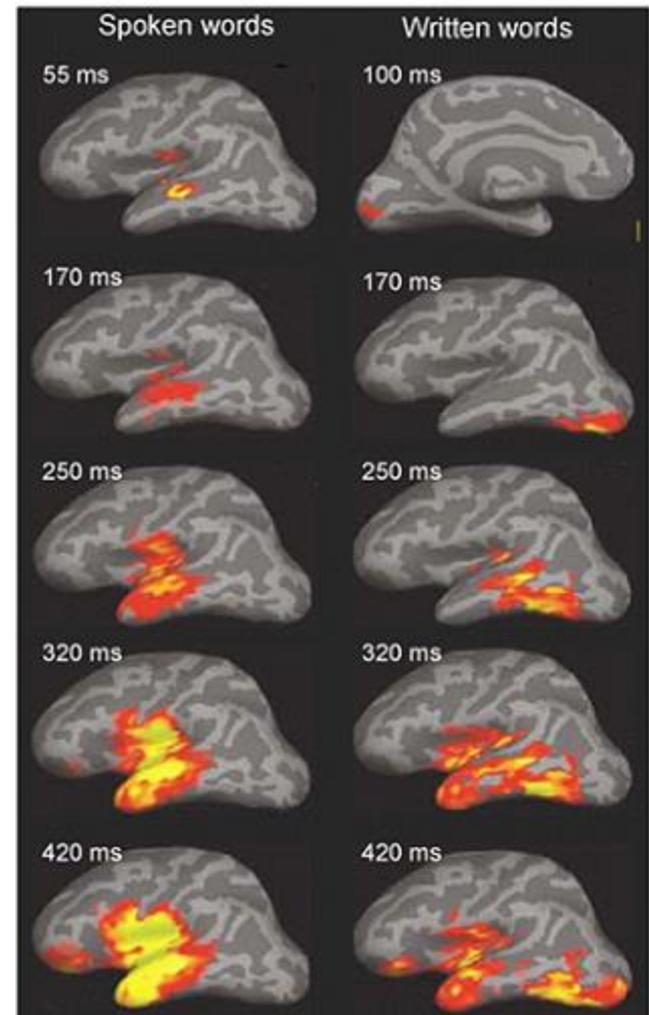
# Reading Networks in the Brain



(based on Dehaene, 2008)

## Shared Neural Pathways for Spoken and Written Language

- Spoken words – initial activation in the temporal lobe
- Written words – initial activation in the occipital lobe
- After visual or auditory input is processed, language centers in the left hemisphere are activated for both spoken and written words



(Dehaene, 2008)

# What is dyslexia?

- Dyslexia is a specific learning disability that is neurological in origin.
- It is characterized by difficulties with:
  - accurate and/or fluent word recognition
  - poor spelling
  - poor decoding abilities

(International Dyslexia Association, 2002)

- These difficulties typically result from a deficit in the **phonological component** of language that is often unexpected in relation to other cognitive abilities and the provision of effective classroom instruction.
- Secondary consequences of dyslexia may include problems in reading comprehension and reduced reading experience that can impede growth of vocabulary and background knowledge.

(International Dyslexia Association, 2002)

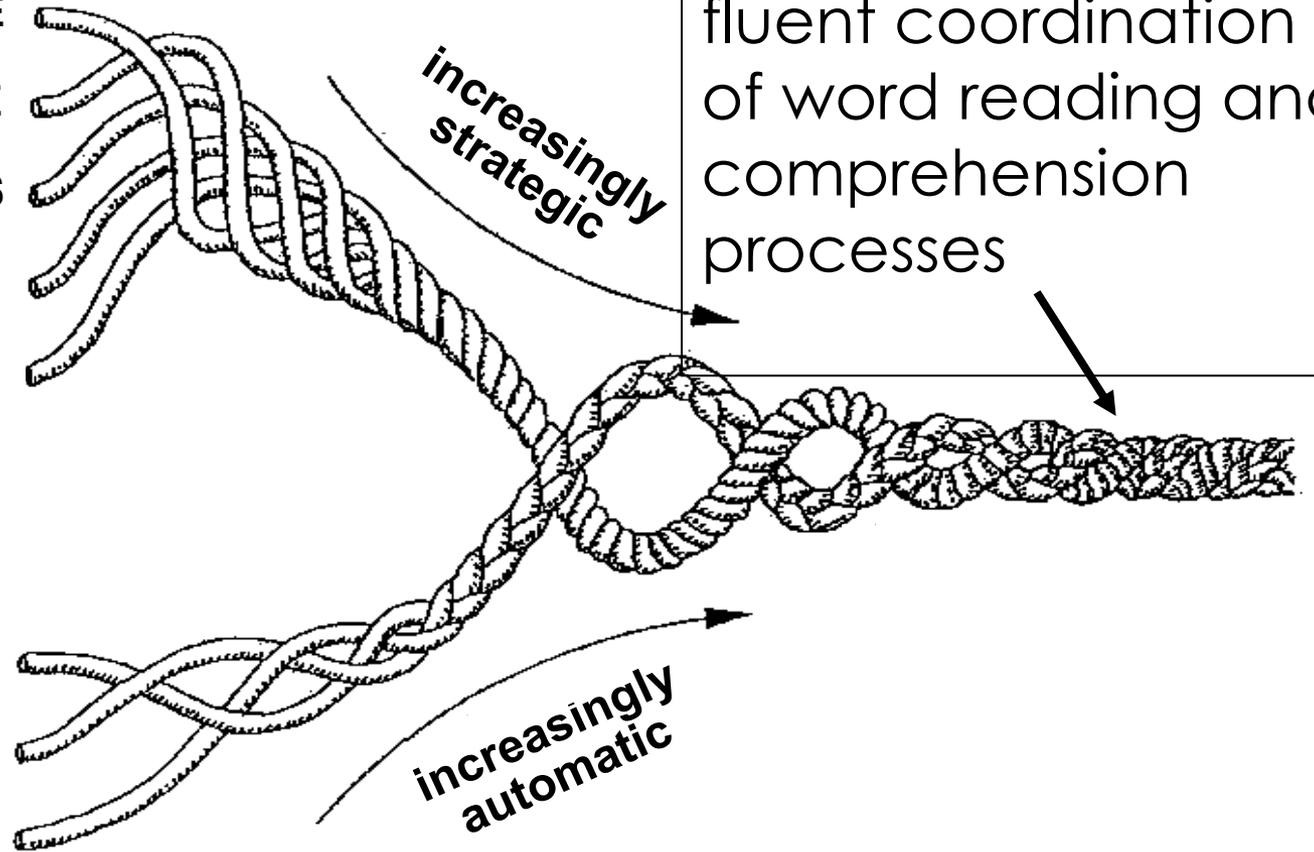
# The Many Strands that are Woven into Skilled Reading (Scarborough, 2001)

## LANGUAGE COMPREHENSION

BACKGROUND KNOWLEDGE  
VOCABULARY KNOWLEDGE  
LANGUAGE STRUCTURES  
VERBAL REASONING  
LITERACY KNOWLEDGE

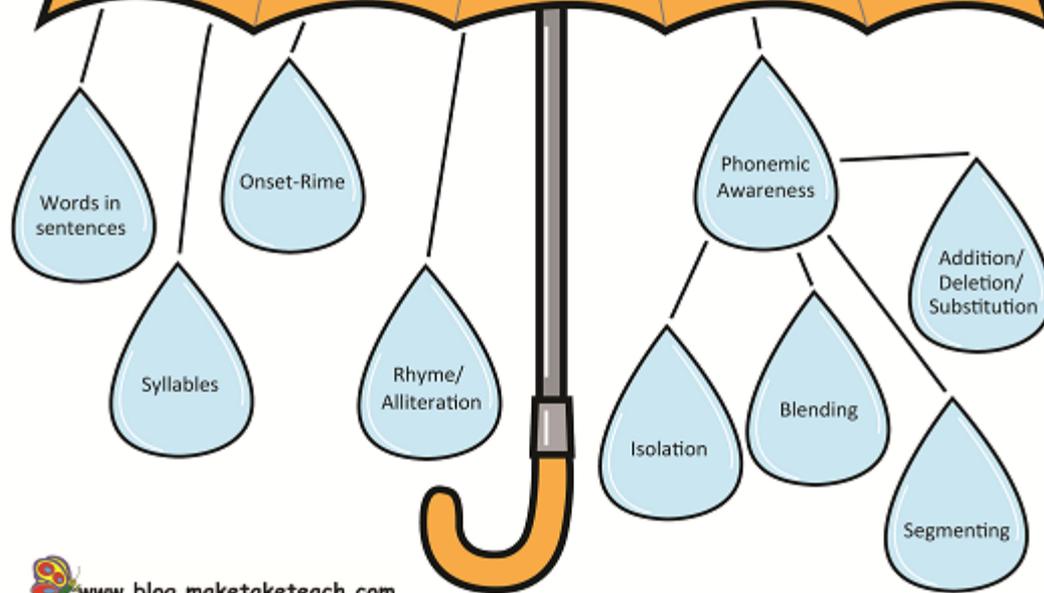
## WORD RECOGNITION

PHON. AWARENESS  
DECODING (and SPELLING)  
SIGHT RECOGNITION



Reading is a multifaceted skill, gradually acquired over years of instruction and practice.

# Phonological Awareness



# Relationship between phonological awareness and reading

- In reading, the “sounds of spoken language [are] mapped onto letters or syllables (graphemes).“
- “Beginning readers must decode print to access the [sound] and meaning of words. They already know the meanings of words in spoken language, but they have to learn to relate [the sounds of spoken] language to print through explicit phonological awareness.”

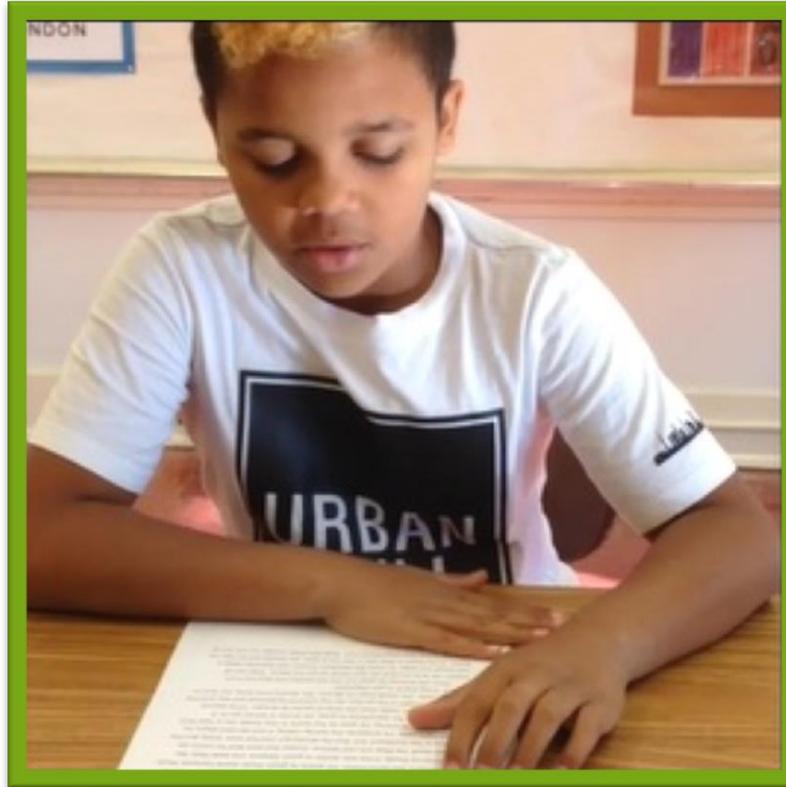
(Gabrielli 2009)

# Phonological awareness impairments in dyslexia

- “Children with dyslexia frequently exhibit poor phonological awareness, **initially for spoken words and subsequently for printed words.**”
- “These children have difficulty performing oral language tasks that depend on phonological awareness,” such as:
  - Deciding which words start with the same sound
  - Segmenting words into parts
  - Blending sounds to create a word
  - Deleting a sound within a word, saying what’s left

(Gabrielli 2009)

Harry



**Decoding Errors and Impaired Fluency in Moderate Dyslexia**

# Spelling errors in dyslexia

## Harry's Spellings

fan	frite
pet	chooing
dig	crall
rob	whishis
hope	thorn
whate	showtid
gum	spoyled
sled	grawl
stick	thereed
shighn	campd
drem	chrise
blade	claping
coche	rideing

## Correct Spellings

fan	fright
pet	chewed
dig	crawl
rob	wishes
hope	thorn
wait	shouted
gum	spoil
sled	growl
stick	third
shine	camped
dream	tries
blade	clapping
coach	riding

**Sally**



**Decoding Errors in Mild Dyslexia**

# Spelling errors in dyslexia

## Sally's Spellings

switch	visable
smudge	curcumphrance
traped	civilisation
scrape	monarchy
knotted	dominance
shaving	corrispon
squirt	iliterate
pounce	emphisise
scraches	opsition
crater	clorrine
salor	commotion
village	madissinal
disloyal	irisponsable
tunnel	sicseshon
humor	
confedence	
fortunate	

## Correct Spellings

switch	visible
smudge	circumferen
trapped	ce
scrape	civilization
knotted	monarchy
shaving	dominance
squirt	correspond
pounce	illiterate
scratches	emphasize
crater	opposition
sailor	chlorine
village	commotion
disloyal	medicinal
tunnel	irresponsible
humor	secession
confidence	
fortunate	

# Speech problems that may signal poor phonological awareness

- Persistence of normal developmental speech errors beyond the ages at which they would normally disappear. For example:
  - Voicing errors (big/pig) – gone by age 3
  - Final consonant deletion (coe/comb) – gone by age 3;3
  - Fronting (tar/car) – gone by age 3;6
  - Weak syllable deletion (tato/potato) – gone by age 4
  - Cluster reduction (poon/spoon) – gone by age 4
  - Gliding (wike/like) – gone by age 5

(Bowen, 2012)

# Speech problems that may signal poor phonological awareness

- Presence of unusual speech errors (not seen in typical speech development):
  - Initial consonant deletion (og for dog)
  - Backing (moving front sounds like /t/ and /d/ to the back of the mouth like /k/ and /g/)
  - Glottal replacement (ha er for hammer)
  - Fricatives replacing stops (sop for top)
  - Stopping of glides (darn for yarn)
  - Vowel error patterns

(Paul, 2007)

## Additional symptoms of poor phonological awareness

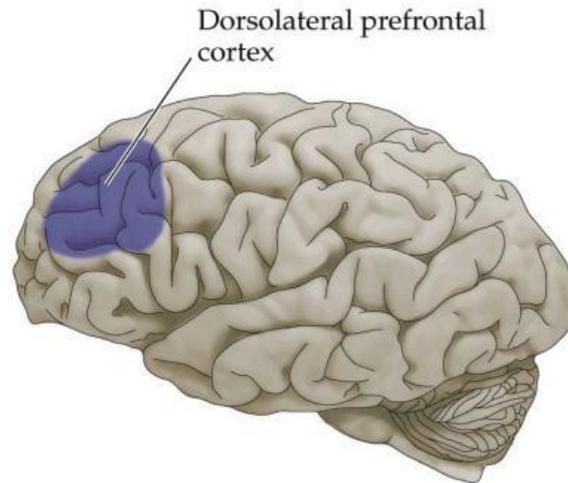
- Errors in sequencing sounds in spoken language (aminal / animal)
- Trouble remembering sound-symbol relationships (e.g., the sound /bl/ is made with the letters b and l)
- Overreliance on whole-word and context cues when reading
- Difficulty sounding out unfamiliar words
- Slow reading rate
- Difficulty sequencing sounds in words when spelling
- Confusions between similar-sounding sounds (e.g., the short vowel sounds /e/ and /I/ )

(Mather & Wendling, 2012)

## Quick word for SLPs on treating phonologically-based speech sound disorders

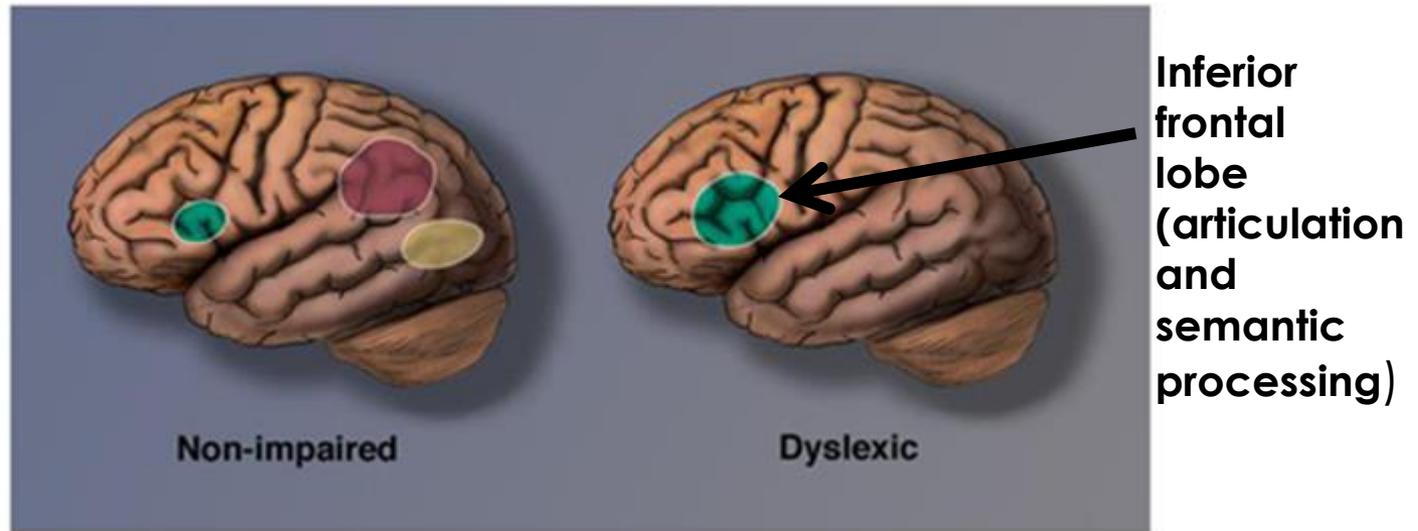
- Don't use traditional articulation therapy
- Use a phonological approach to intervention, such as:
  - Cycles Therapy
  - Metaphon Therapy
  - Minimal Pair Therapy
  - Phoneme Awareness Therapy
- You are working on correcting the child's spoken language system, not their articulation skills

# Phonological Processing of Spoken Language



- Typical readers show activation in the left dorsolateral prefrontal cortex when performing phonological analysis of **spoken language**
- Dyslexic readers do not show activation in this region

# Phonological Processing of Written Language

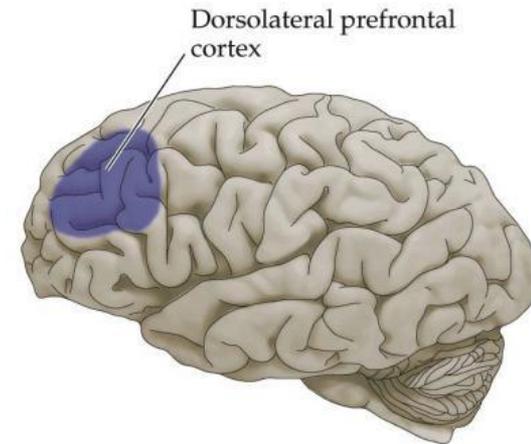


(Shaywitz, 2003)

- Typical readers show activation in the left occipito-temporal and left temporo-parietal regions when performing phonological analysis of **written language**
- Dyslexic readers show little or no activation in these regions

# Phonological Memory Deficits in Dyslexia

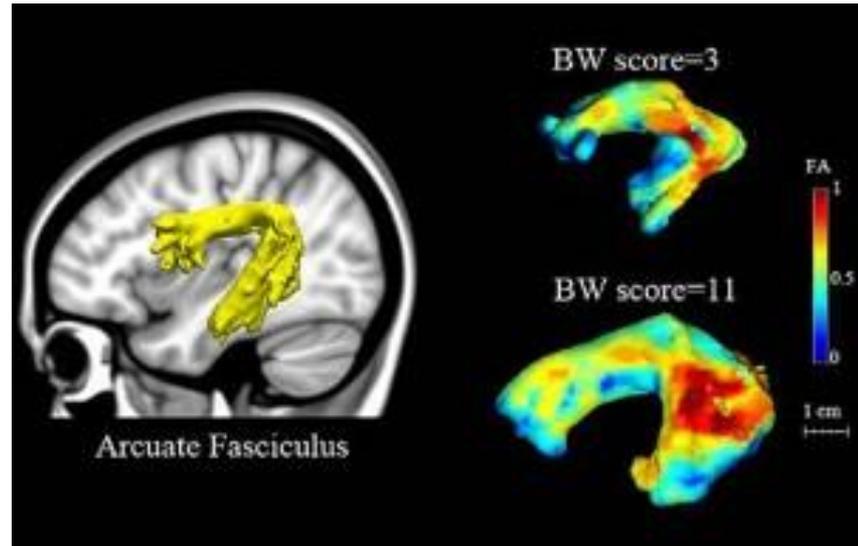
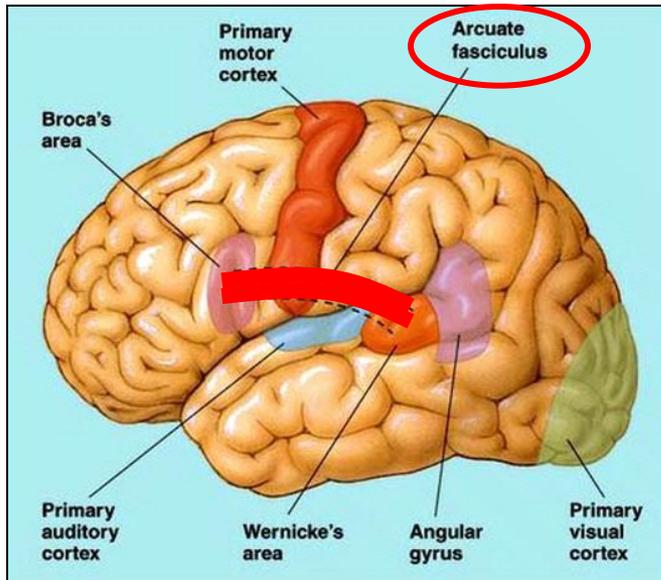
- “The primary memory deficit in children with dyslexia is poor phonological short-term memory.” (Kibby, 2009)
- “Children with dyslexia may have trouble operating upon or working with phonological units of language, rather than perceiving or forming phonological representations.” (Ramus and Szenkovits, 2008)
- Semantic short-term memory is not affected
- Long-term memory is not affected



# Is the problem representation of sounds, or access to/manipulation of sounds?

- Boets et al. determined that the neural quality of phonetic representations was intact in the auditory cortices of dyslexic adults.
- However, functional and structural connections between auditory cortices and the left inferior frontal gyrus was “significantly hampered in dyslexics, **suggesting deficient access to otherwise intact phonetic representations.**”

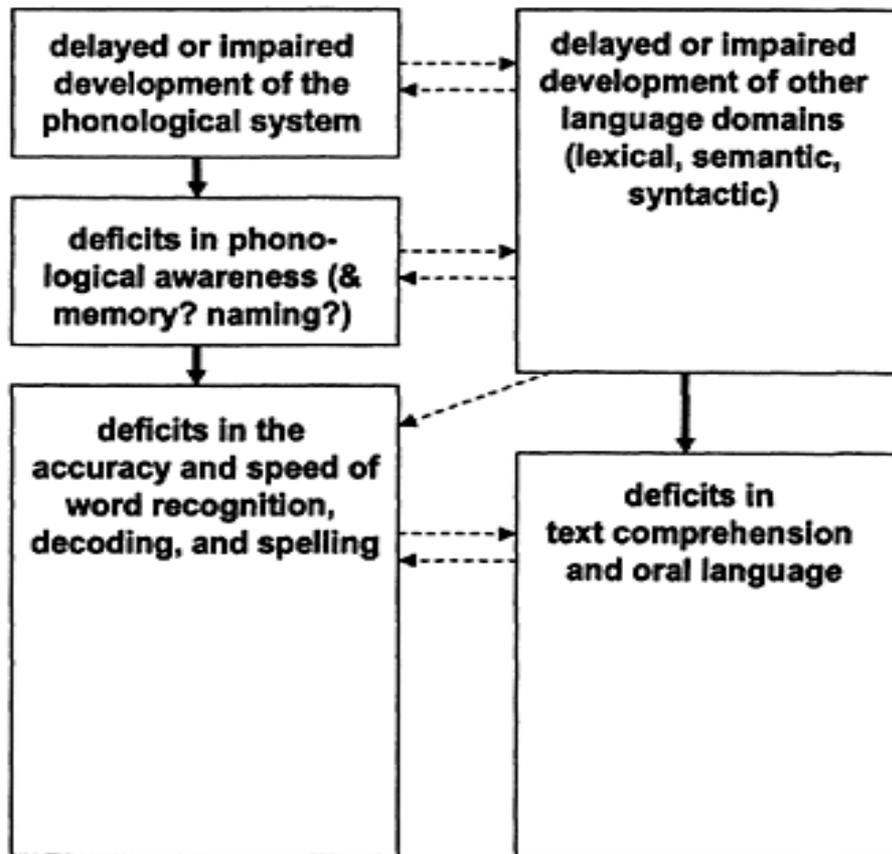
# Arcuate Fasciculus



Saygin et al., 2013

- “Researchers found that kindergarten children with strong [phonological awareness] skills have a bigger, more robust and well-organized arcuate fasciculus (bottom right) while children with very weak PA skills have a small and not particularly well-organized arcuate fasciculus (top right).” (<http://ww2.kqed.org/mindshift>)

# Other Language Domains May Also Be Affected



- Morphology
- Syntax
- Semantics
- Comprehension

(Scarborough, 2005)

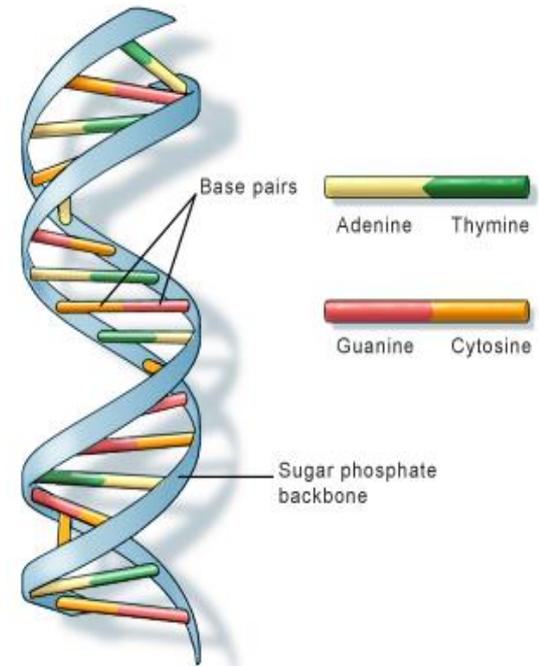
# Dyslexia Not Caused by Vision Problems

- Joint policy statement (2009) from American Academy of Pediatrics and American Academy of Ophthalmology
- “While vision problems can interfere with the process of learning, vision problems are not the cause of dyslexia or learning disabilities. Dyslexia is a language-based disorder.”
- “There is no scientific evidence to support the use of eye exercises, vision therapy, tinted lenses or filters to directly or indirectly treat learning disabilities, and such therapies are not recommended or endorsed.”

# Genetic Influences

- Dyslexia is strongly (54% to 75%) heritable
- Occurs in up to 68% of identical twins
- 50% of individuals who have a parent or sibling with dyslexia will also have dyslexia

(Gabrieli, 2009)



U.S. National Library of Medicine

# Prevalence of Dyslexia

- “Depending on the definition chosen, the prevalence of reading disability is approximately 5% to 20% of school-aged children in the United States.”
- “Approximately 80% of people with learning disabilities have dyslexia, which makes it the most common learning disability.”

(American Academy of Pediatrics, 2011)

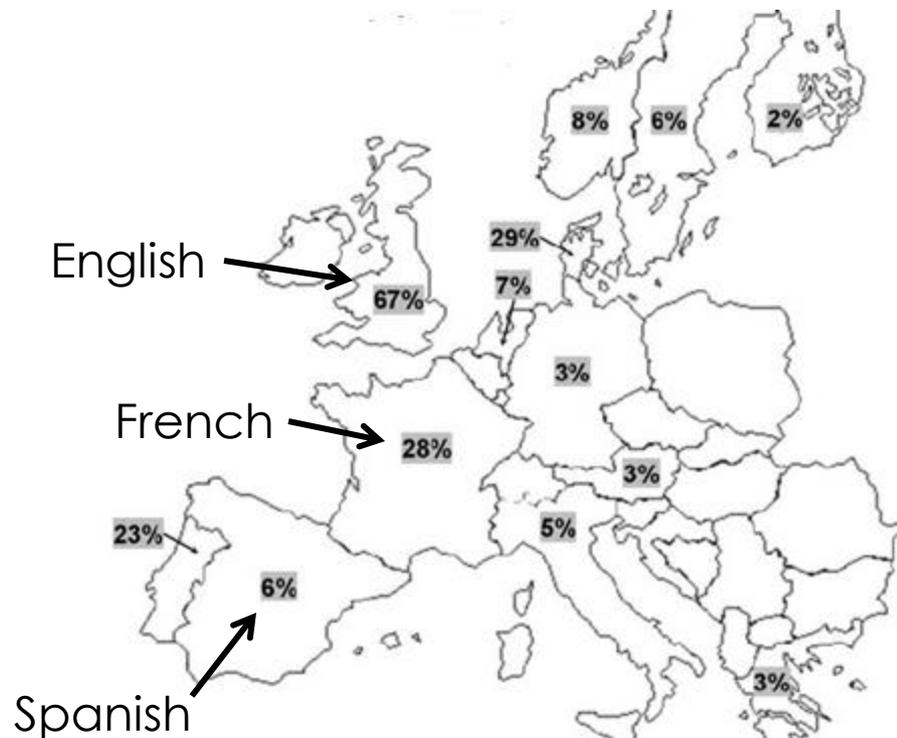
# Does Dyslexia Occur in Other Languages?

- Yes, but...
- “The expression of phonological difficulty in dyslexia varies as a consequence of differences in orthographies.” (Gabrieli, 2009)
- In alphabetic languages, orthography refers mainly to spelling – how sounds are represented by written symbols (letters)
- “Alphabetic languages vary in their regularity – how consistently letters or letter clusters relate to one speech sound” (Gabrieli, 2009)

# Does Dyslexia Occur in Other Languages?

- Spanish and Italian are languages with more regular/transparent/shallow orthographies
- English is a language with more irregular/opaque/deep orthography
- “Cross-cultural studies have shown that learning to read single words (graphing-phoneme decoding) takes longer in less consistent orthographies.” (Gabrieli, 2009)

# Errors in word reading among European languages at the end of first grade



(Dehaene, 2008)

# Degrees of Dyslexia

- “Dyslexia is not an all-or-none phenomenon, but like hypertension, occurs in degrees.” (Shaywitz, 1992)
- “Dyslexia is a life-long condition that varies in degrees of severity. Most children with reading disabilities have relatively mild reading disabilities, and a smaller number of them have more severe reading disabilities.”

(American Academy of Pediatrics, 2011)

# Dyslexia Persists Over Time

- “Dyslexia occurs at all levels of intelligence and is a persistent problem that does not represent a transient developmental lag.”  
(American Academy of Pediatrics, 2011)
- “Dyslexia is persistent: A student who fails to read adequately in 1st grade has a 90% probability of reading poorly in 4th grade and a 75% probability of reading poorly in high school.” (Gabrieli, 2009)

# Psychological and social implications



- Students with dyslexia may be perceived as less intelligent or not trying hard enough
- Decreased self-esteem is often a result (Riddick et al., 1999)
- Negative experiences leave students vulnerable to feelings of failure, anxiety, shame, helplessness, depression (Valas, 1999)
- Students with poor reading skills are less likely to finish high school, and more likely to enter the juvenile justice system (Quinn, 2001; Wagner 1993)

# Psychological and social implications

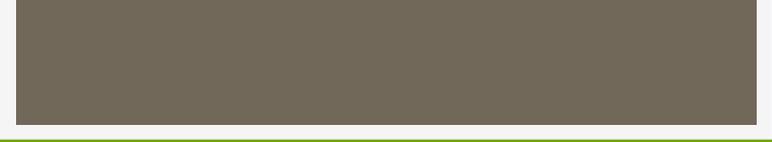


- “Oh, I used to just like mumble over the word or say it really quietly — and pretend like I said it.”
- “I would be chased down the hallway... it was mostly just one boy, and he’d be yelling at me, chasing me, and the teachers would just watch, and he’s like ‘You can’t read, like you should know how to read by now, you’re in seventh grade,’ but so, yeah, it was not very fun to go to school.”
- “I remember that I used to pretend to be sick every day...and it was like most people say, ‘Oh, eighth grade, seventh grade, sixth grade, best years of your life.’ Not really. Like for some — a lot of dyslexic kids...it was torture.”

- “For starters, let me tell you that when it comes to dyslexia, most people focus on reading or spelling. They should instead focus on shame.”
- “If you’re terrible at a thing you’re asked to do every day—in my case as a kid, reading—you begin to assume that *you* must be the problem, and you try to hide it. That is shame.”

- Ben Foss, inventor of Intel Reader
- MBA and law degree, Stanford University
- Proud “ear reader”





(International Dyslexia Association, 2008)

# Co-Occurrence of ADHD

- It is estimated that 30% of those with dyslexia have coexisting ADHD (inattention, variable attention, distractibility, impulsivity, hyperactivity)
- The dyslexic person's reading is typically dysfluent, with major problems with accuracy, misreading both large and small words.
- The person with ADHD may also be a dysfluent reader, but his or her reading is not characterized by misreading words.

# Dyslexia Assessment

- “There is no single standardized test used to make the diagnosis of dyslexia.”
- “A comprehensive evaluation is necessary.”
- “The testing can be conducted by trained school [specialists] or outside specialists.”
- “Dyslexia is not ...determined solely by medical screening or psychological/IQ testing alone.”

(American Academy of Pediatrics, 2011)

# Dyslexia Assessment – Language skills

- Phonological awareness
  - Comprehensive Test of Phonological Processing
  - Lindamood Auditory Conceptualization Test
  - Phonological Awareness Skills Test (informal)
- Reading (decoding, fluency, comprehension)
  - Kaufman Test of Educational Achievement
  - Process Assessment of the Learner: Diagnostics for Reading and Writing
  - Test of Word Reading Efficiency
  - Grade Oral Reading Test
  - Qualitative Reading Inventory

# Dyslexia Assessment – Language skills

- Orthographic awareness (spelling)
  - Test of Orthographic Competence
  - SPELL-2: Spelling Performance Evaluation for Language and Literacy
  - Words Their Way
- Morphology skills
  - Clinical Evaluation of Language Fundamentals (CELF-5)
  - Comprehensive Assessment of Spoken Language (CASL)

# Dyslexia Assessment – Language skills

- Rapid automatized naming
  - Comprehensive Test of Phonological Processing
  - Dyslexia Early Screening Test
  - Naming of colors, objects, letters

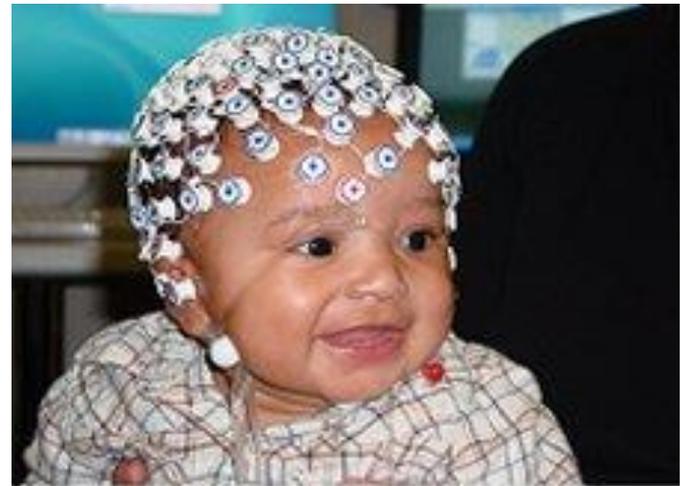
# Dyslexia Assessment – Cognitive skills

- Working memory
  - Woodcock-Johnson III Tests of Cognitive Abilities
  - Informal tasks (repeat series of numbers backwards, recall last words in a series of sentences)
- Processing speed
  - Woodcock-Johnson III Tests of Cognitive Abilities
  - Wechsler Intelligence Scale for Children
  - Differential Ability Scales

# The Future of Early Identification?



Newborn Hearing Screening



Newborn Language Screening

# Treatment for Dyslexia

- While dyslexia is a neurologically based condition, the treatment is not medical but educational.
- “Most children with dyslexia need help from a teacher, tutor, or therapist who has been specially trained in using a multisensory, structured language approach. “
- “It is important for these children to be taught by a sequenced, systematic and explicit method that involves several senses (hearing, seeing, touching) at the same time.”
- “Remedial programs should include specific instruction in decoding, fluency training, vocabulary, and comprehension.”

(American Academy of Pediatrics, 2011)

# National Reading Panel

## “The Big 5”

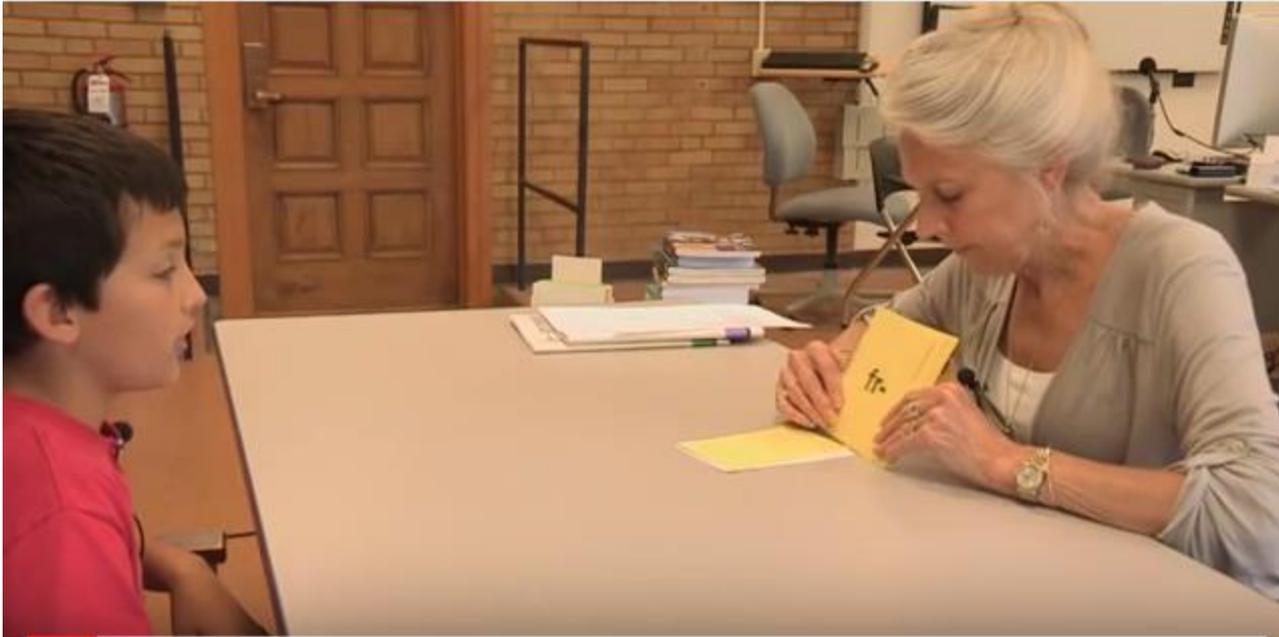
- Phonemic awareness
- Alphabetic principal (phonics)
- Fluency
- Vocabulary
- Comprehension

# Some effective interventions from my personal experience

- Orton-Gillingham method
  - Originally developed in the 1920s and 1930s by Samuel T. Orton, MD (pioneer in study of learning disabilities) and Anna Gillingham (educator and psychologist)
  - I've used this intervention 1:1 and in small groups
- Early Reading Intervention
  - Curriculum published by Scott Foresman
  - Used with kindergarten students at my school
  - Appears to include many elements that are part of Orton-Gillingham method

# Orton-Gillingham 1:1 tutoring

- [Dr. Susan Nolan, Ohio University](#)



# Orton-Gillingham small group intervention

- Cheri Brubaker, preschool teacher,  
Norwood City Schools, Norwood, Ohio



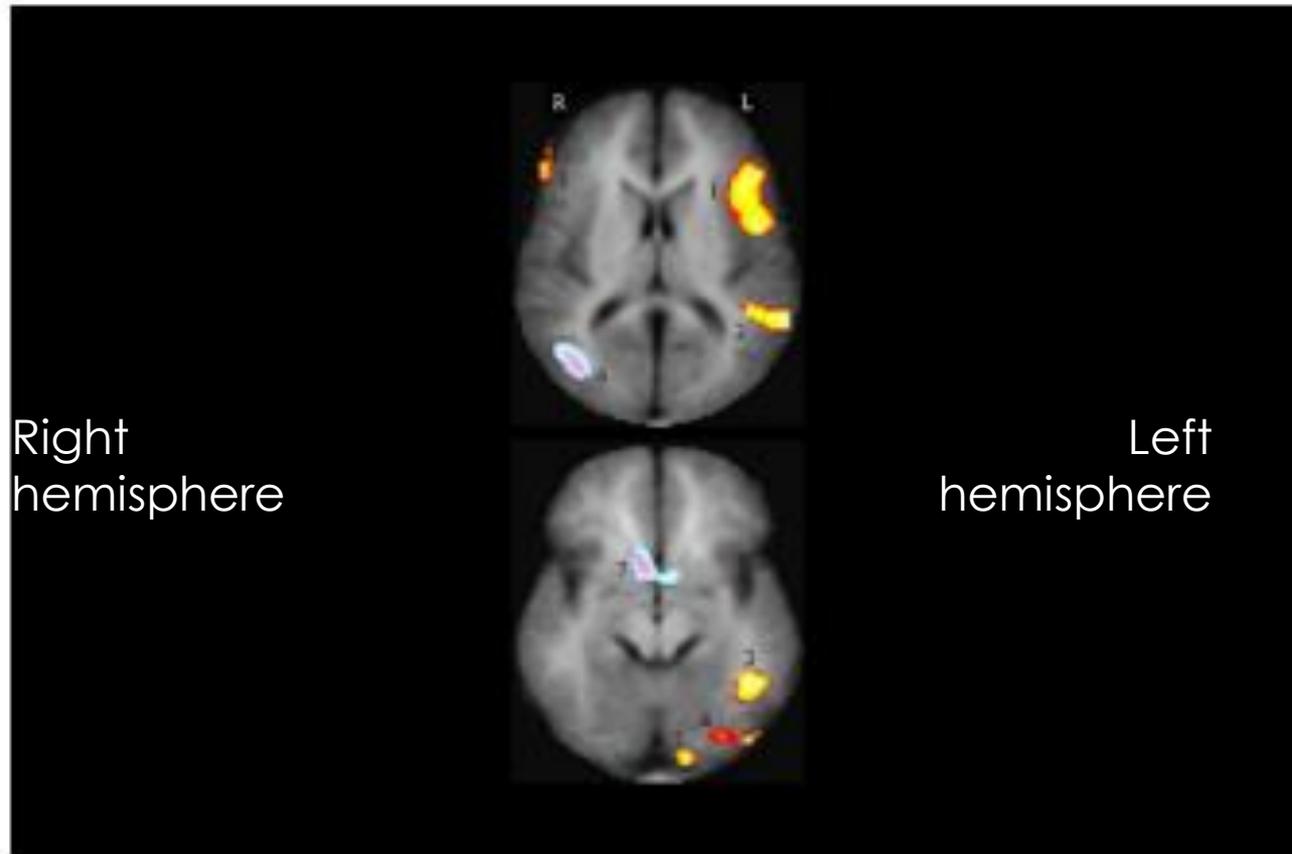
# Early Reading Intervention

- First grade small group instruction using Scott Foresman Early Reading Intervention curriculum
- <http://www.teachertube.com/video/early-reading-intervention-214868>

# Orton-Gillingham-Based Reading Instruction Programs

- Classic Orton-Gillingham
- Wilson Reading System
- Project Read
- Alphabetic Phonics
- Language!
- Slingerland Approach
- Lindamood-Bell Learning Processes

# Effective Intervention Changes Brain Function



**Blue:** brain regions more active before intervention

**Red-yellow:** brain regions more active after intervention

(Shaywitz et al., 2004)

## Treatment outcomes: prevention vs. remediation

- “With appropriate instruction, at-risk readers can become both accurate and fluent readers.
- In contrast, although intensive, evidence-based remedial interventions can markedly improve reading accuracy in older, reading-disabled children, they have been significantly less effective in closing the fluency gap.”

(Alexander & Slinger-Constant, 2004)

# Benefits of Early Intervention

- “Prevention and early phonologic awareness intervention programs in kindergarten through 2nd grade can increase reading skills in many poor readers to average reading levels.”
- “Torgesen reviewed many studies on early intervention and found that **when intervention began in the 1st grade, the expected incidence of reading disability of 12% -18% was reduced substantially to 1.6% -6%.**”

(American Academy of Pediatrics, 2011)

# Risks of Waiting

- “Children identified as reading disabled after 2nd grade rarely catch up to their peers.”
- “Results of longitudinal studies have shown that when intervention is delayed until 3<sup>rd</sup> grade or 9 years of age (the average age at which these children receive services), approximately 74% of these children will continue to have difficulties learning to read through high school.”

(American Academy of Pediatrics, 2011)

## Roles and Responsibilities of Speech-Language Pathologists With Respect to Reading and Writing in Children and Adolescents (2001)

- It is the position of the American Speech-Language-Hearing Association (ASHA) that speech-language pathologists (SLPs) play a **critical and direct role in the development of literacy** for children and adolescents with communication disorders.

- The connections between spoken and written language are well established:
  - Spoken language provides the foundation for the development of reading and writing
  - Spoken and written language have a reciprocal relationship, such that each builds on the other to result in general language and literacy competence

- SLPs' knowledge of normal and disordered language acquisition, and their clinical experience in developing individualized programs for children and adolescents, prepare them to assume a variety of roles related to the development of reading and writing.

## **Appropriate roles and responsibilities for SLPs include, but are not limited to:**

- Preventing written language problems by fostering language acquisition and emergent literacy
- Identifying children at risk for reading and writing problems
- Assessing reading and writing
- Providing intervention and documenting outcomes for reading and writing
- Assuming other roles, such as providing assistance to general education teachers, parents, and students; advocating for effective literacy practices; and advancing the knowledge base

## SLP role: early Identification

- Catts et al. recommend:
  - “All children who enter kindergarten **with known histories** of speech and/or language problems should be screened”
  - "Their history of speech-language problems places [these students] at risk for reading difficulties that are 4 to 5 times greater than those of children from the general population.”

Catts et al. (2001)

## SLP role: early identification

- For children who enter kindergarten **without known histories** of speech and/or language problems, teachers should “make liberal referrals to the SLP for screening” if characteristics such as the following are observed:
  - Child appears to be behind in their familiarity with books
  - Teacher has concerns about speech and/or oral language development
  - Child has difficulty with phonological awareness tasks that are part of the kindergarten curriculum

## SLP role: teaming with teacher

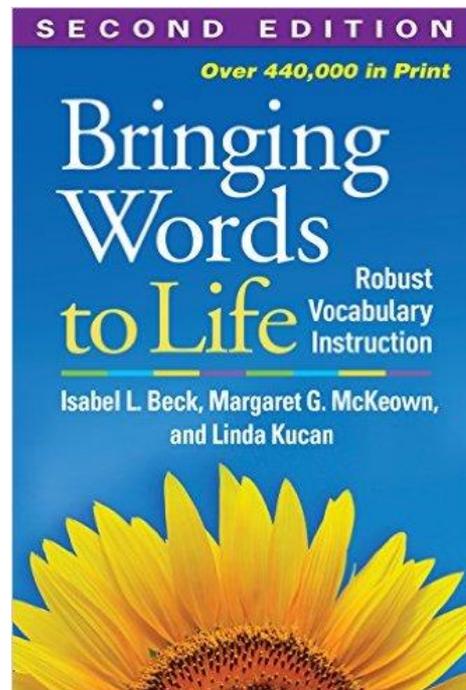
- "Classroom reading activity should be intensified by increasing the time of instruction and/or reducing teacher-to-student ratios"
- SLP works with classroom teacher in planning and conducting intensified instruction on phonological awareness and sound-letter correspondences

# Phonological/phonemic awareness and sound-symbol treatment activities

- “Facilitating Phoneme Awareness Development in 3-and 4-Year-Old Children with Speech Impairment” (Gillon 2005)
- Phonemic Awareness in Young Children: A Classroom Curriculum (Adams et al., 1997)
- “How Now Brown Cow: Phoneme Awareness Activities” <http://www.readingrockets.org/>

# Vocabulary

- Bringing Words to Life, Beck et al. (2013)



# Spelling treatment activities

- Words Their Way

<https://www.pearsonhighered.com/educator/series/Words-Their-Way-Series/10888.page>

- SPELL-Links to Reading and Writing

<http://www.learningbydesign.com/>

# Assistive technology tools

- Learning Ally (audio books)
- Livescribe Smartpen (record lectures)
- CoWriter (word prediction)
- Inspiration Maps (graphic organizers)
- Voice Dream (text to speech)
- Dragon Dictation (speech to text)
- Notability (note taking)
- Snap Type (take a photo of worksheet, add text)



## **DECODING DYSLEXIA OREGON**

Educate. Advocate. Legislate.

- A grassroots movement driven by Oregon families and educators who recognized the need for conversations with our school districts and policy makers regarding dyslexia.
- Strives to raise dyslexia awareness, empower families to support their children, and improve resources for students with dyslexia in Oregon public schools.

# Parent Advocates



# New Dyslexia Laws in Oregon

- HB 2412 – Changes TSPC standards for educator preparation programs
  - Educator preparation programs for early childhood education, elementary education, special education or reading must provide instruction on dyslexia
  - The instruction must be consistent with the knowledge and practice standards of an international organization on dyslexia.
  - Educator preparation programs must demonstrate compliance with the standards no later than December 31, 2016.

# New Dyslexia Laws in Oregon

- SB 612
  - Creates new Dyslexia Specialist position at Oregon Dept. of Education, to provide school districts with support and resources that are necessary to assist students with dyslexia and their families
  - ODE is also directed to work with experts on dyslexia to develop a plan to screen for risk factors of dyslexia
  - Beginning January 1, 2018 districts are required to ensure that at least one kindergarten through grade five teacher, in each kindergarten through grade five school, has received training related to dyslexia.
  - Training must be consistent with the knowledge and practice standards of an international organization on dyslexia.

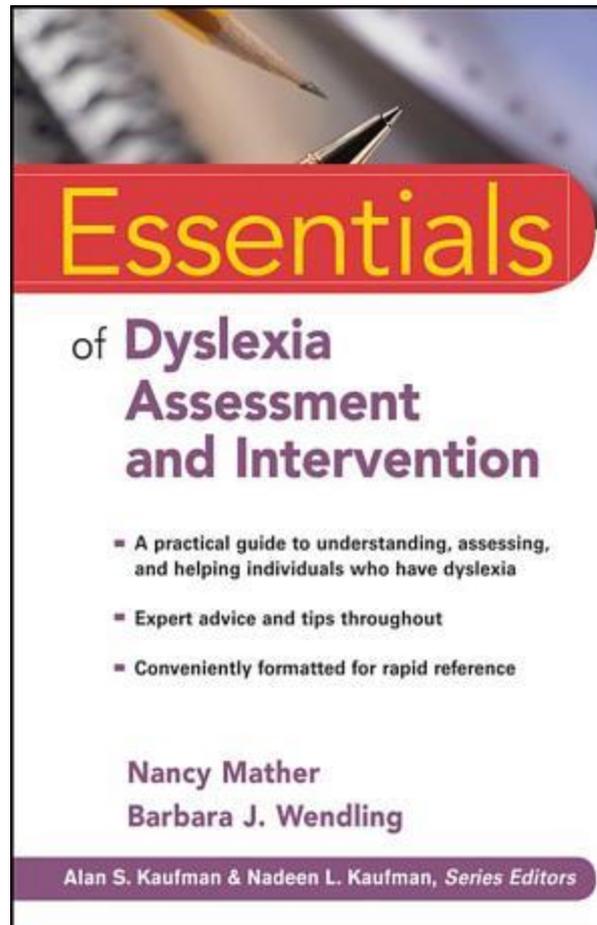
# Student Advocates!

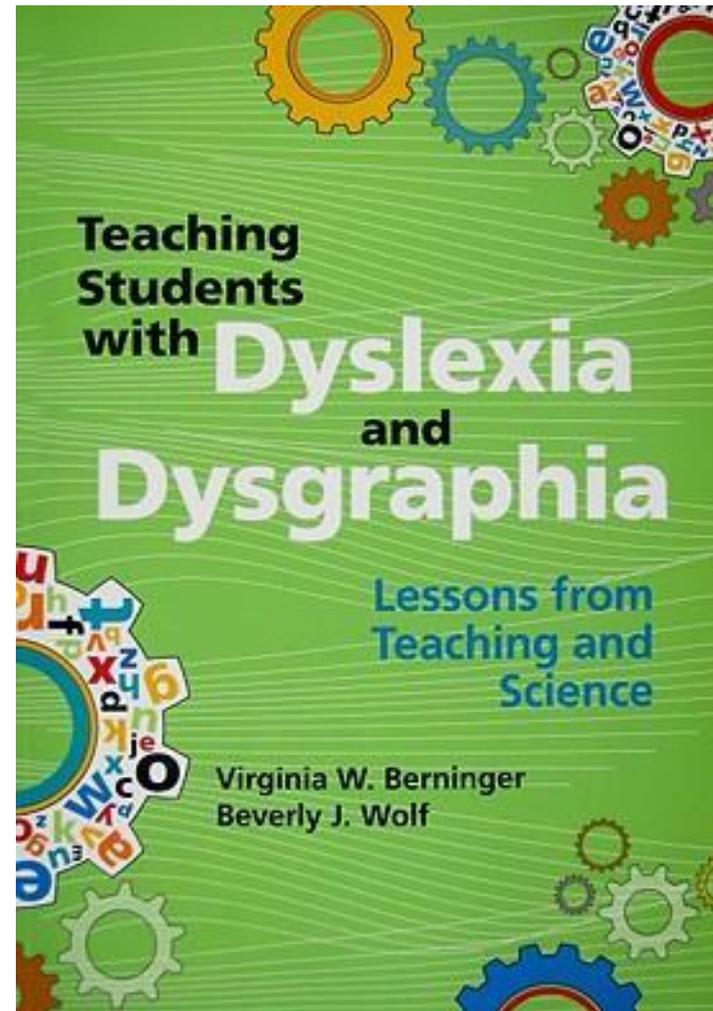


## Good sources of information/support

- International Dyslexia Association (IDA)  
<https://eida.org/>
- University of Michigan  
<http://dyslexiahelp.umich.edu/>
- Decoding Dyslexia Oregon  
<http://www.decodingdyslexiaor.org/>
- Oregon Branch of IDA  
<http://www.orbida.org/home.asp>
- Understood.org  
<https://www.understood.org/en>

# Resources



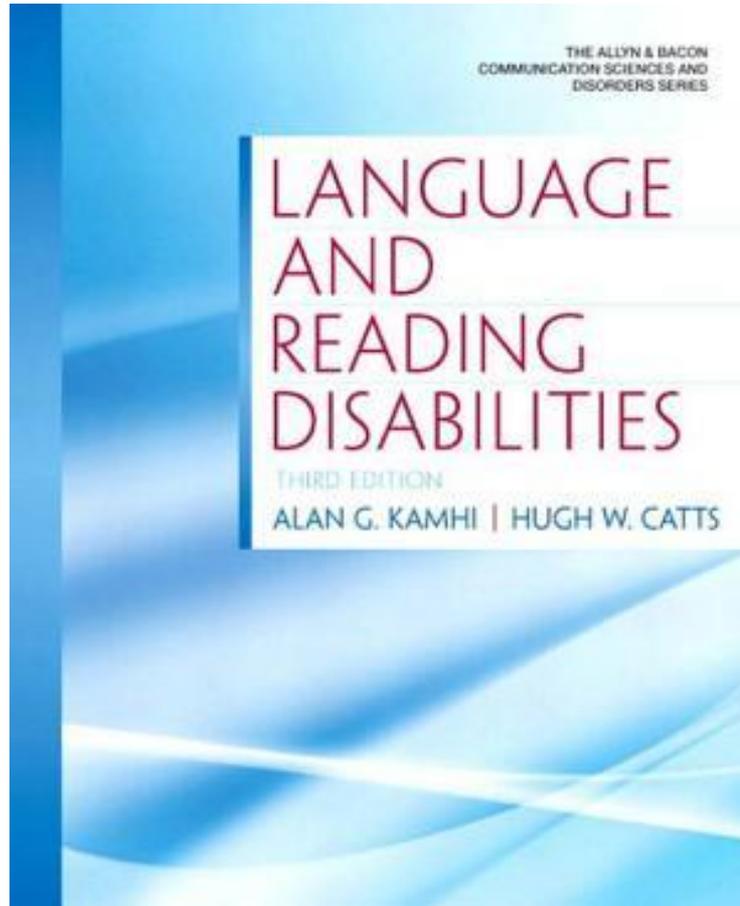


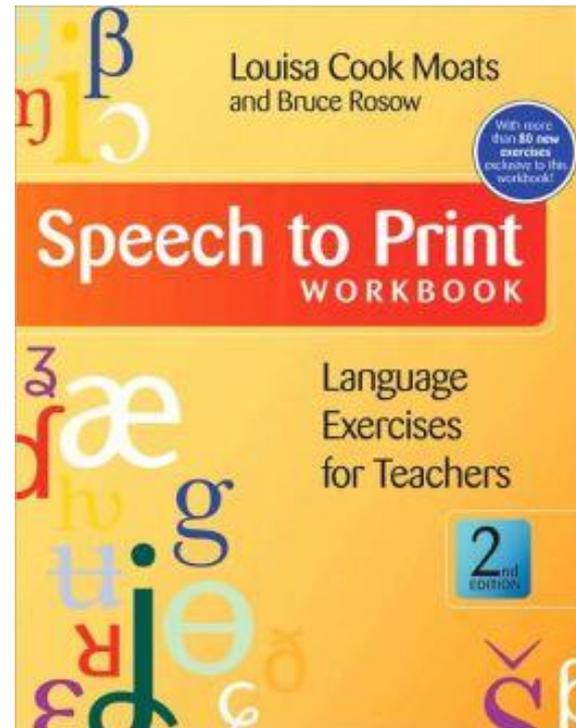
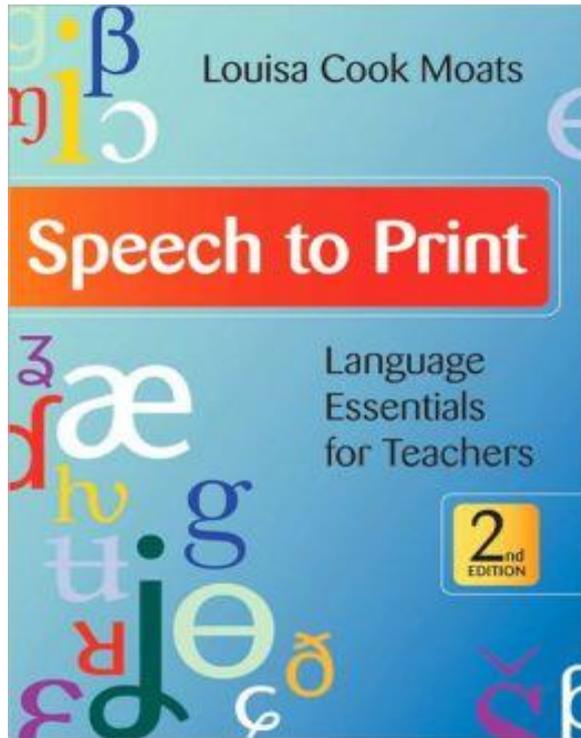
THE ALYN & BACON  
COMMUNICATION SCIENCES AND  
DISORDERS SERIES

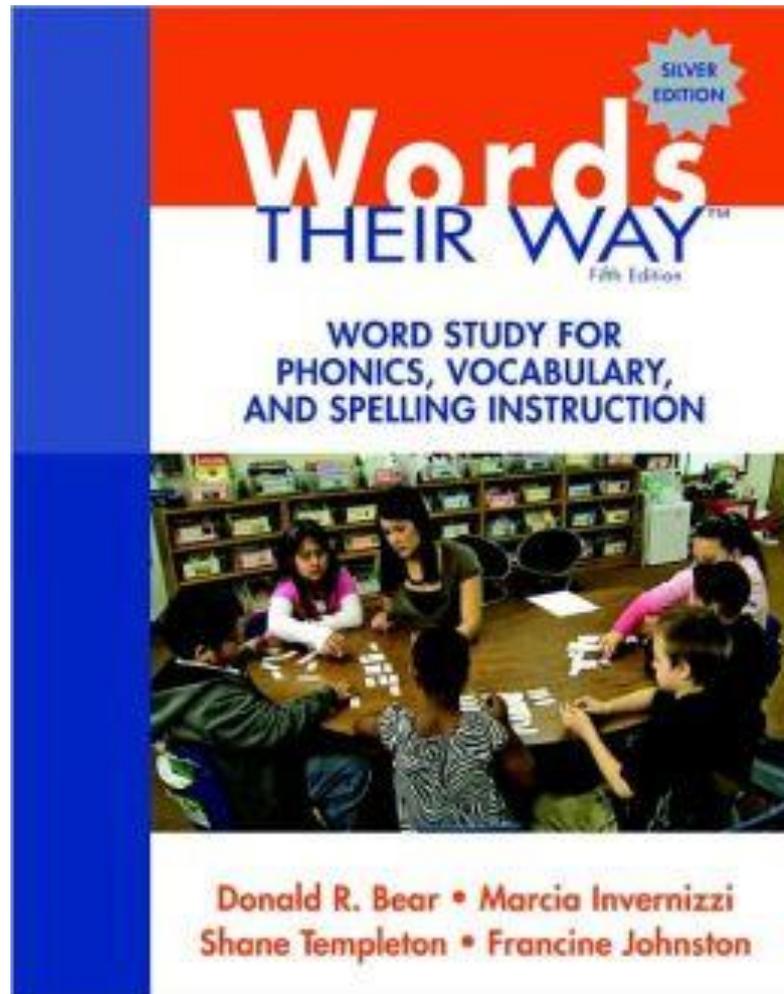
# LANGUAGE AND READING DISABILITIES

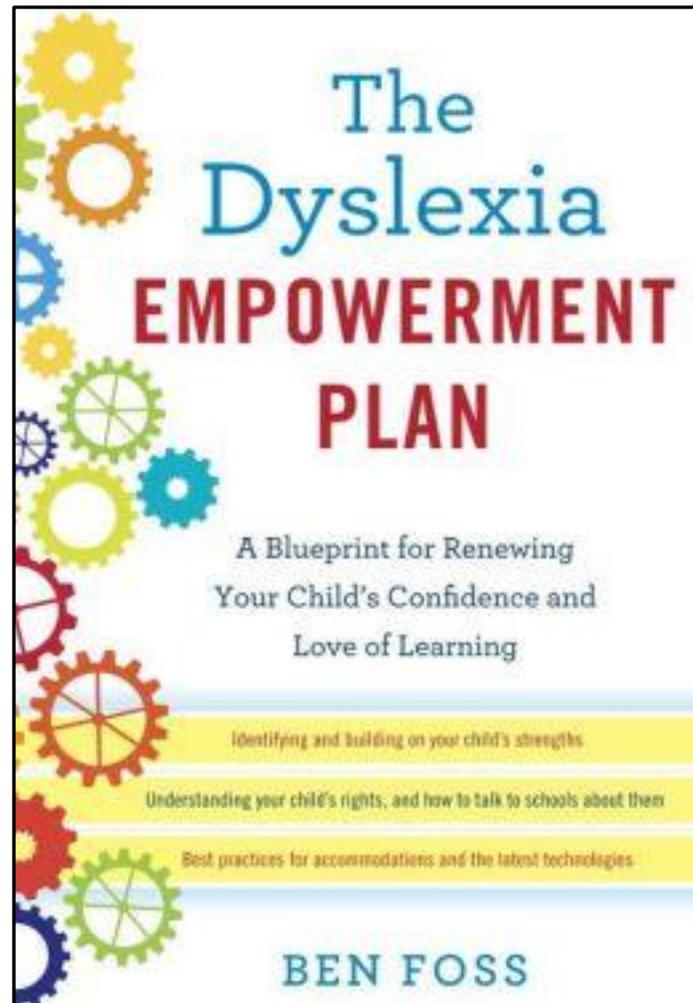
THIRD EDITION

ALAN G. KAMHI | HUGH W. CATTs









# READING IN THE BRAIN

THE NEW SCIENCE  
OF HOW WE READ



STANISLAS DEHAENE

A WASHINGTON POST BEST SCIENCE BOOK OF THE YEAR



# References

- Please email me at [mfinnega@pps.net](mailto:mfinnega@pps.net) if you would like more information about sources referenced in my presentation.