



DEPARTMENT OF  
COGNITIVE SCIENCE

*Understanding Your Child's Dysgraphia:  
A Cognitive Science Perspective*

Brenda Rapp & Michael McCloskey  
Johns Hopkins University  
Baltimore, MD

# Dysgraphia

- substantial difficulty with any aspect of writing
  - spelling
  - written composition
  - handwriting
- despite
  - at least average intellectual ability
  - adequate opportunity to learn
  - adequate motor skills for handwriting

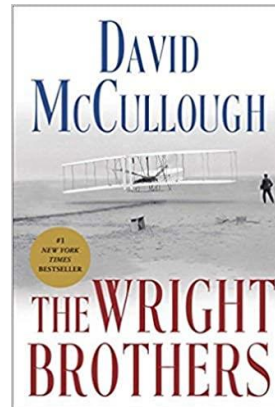
# Our Perspective

- as cognitive scientists, focus on knowledge and mental processes involved in writing
- for a child with dysgraphia, important to ask
  - What knowledge or mental processes have not been adequately learned?
  - What are the reasons for the difficulty in learning?
- answers important for guiding efforts to help children with dysgraphia
- dysgraphia occurs in many forms
  - difficulty with different aspects of the critical knowledge and processing skills
  - no one-size-fits-all answers

# Dysgraphia: Three Brief Examples

# PJ

- 8-year-old boy (completed 2<sup>nd</sup> grade)
- highly intelligent
- excellent spoken language abilities
- excellent reader



# PJ's Writing

8. Name one dangerous liquid and one dangerous solid.

Bleycs

Neyoclr wasd

b) Explain why it is important to keep dangerous solids and liquids in their original containers.

because it coode look layks  
somsing als and smw  
on miyt drinkt / eta

Bleycs

Neyoclr wasd

because it coode look layks  
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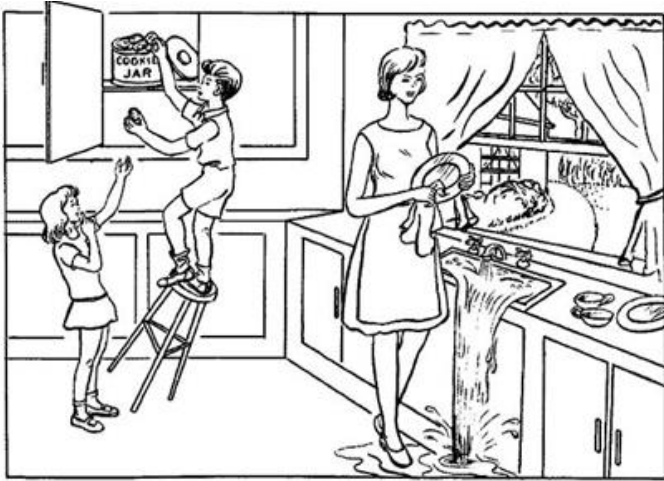
Bleach

Nuclear waste

because it could look like  
something else and some  
one might drink / eat

- difficulty with
  - spelling
  - handwriting

# SRL (10 years old)



- difficulty with
  - spelling
  - handwriting
  - composition

The mom has bad spatial awareness  
and her kid inhibited if the mom can't tell  
that the sink is overflowing and the  
kids ~~can~~ don't see the mom  
and that could not predict what and she does  
was going to happen and the sister doesn't  
not see the boy falling

The mom has bad spatial awareness  
and her kid inhibited if the mom can't tell  
that the sink is overflowing and the  
kids don't see the mom and she does  
and they could not predict what not see the kids  
was going to happen and the sister doesn't  
not see the boy falling

# AKR (10 years old)

## Local restaurant Fails!

The local  
restaurant  
with an  
unflew have  
got a very  
bad review



for day. Well  
try in a to  
accomodate  
customer's  
allergies the  
customer  
was give a  
very bland  
plate. It was  
not enough  
and not real.  
In the end  
words (It) was

more like a large  
shut plate than a  
dinner. The chocolate  
covered bands of  
the end hardly made  
any for it. Plus the  
customer was lanted by  
the smells of the  
one of her  
favorite dishes which she  
can not eat due to  
allergies.

The local restaurant with a name that got a very bad review today. While trying to accommodate a customer with allergies the chef gave a very bland plate. The chef was not very professional. The most colorful words I heard were "it was not like a snake plate, it was more like a chocolate covered banana in the end." The chef had covered the plate with chocolate and it was not for the taste of a spite of offering to filter the food by the dishes which she cannot eat due to allergies.

- difficulty with
  - spelling
- adequate handwriting
- good composition



# Dysgraphia

- Dysgraphia may involve difficulty with any combination of
  - handwriting
  - spelling
  - composition
- Dysgraphia occurs in children with average or above-average
  - intelligence
  - spoken language abilities
  - reading ability
- Dysgraphia *may* be accompanied by other cognitive difficulties, such as
  - spoken language difficulties
  - reading difficulties (dyslexia)
  - attention-deficit disorder

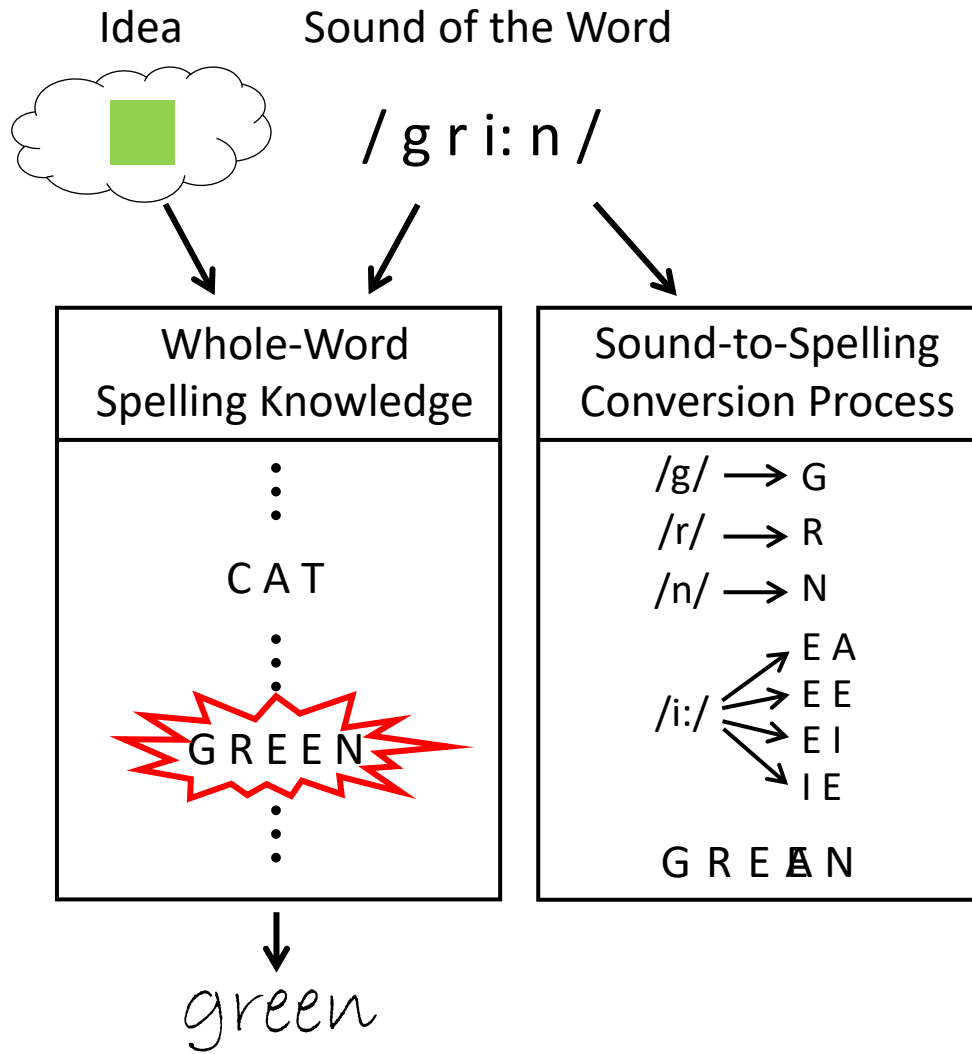
# Obstacles in Getting Help

- dysgraphia not widely recognized or well-understood
- difficulties with writing often viewed as an aspect of dyslexia
- writing not always considered important, so dysgraphia may not be considered a significant problem

# Spelling Difficulties

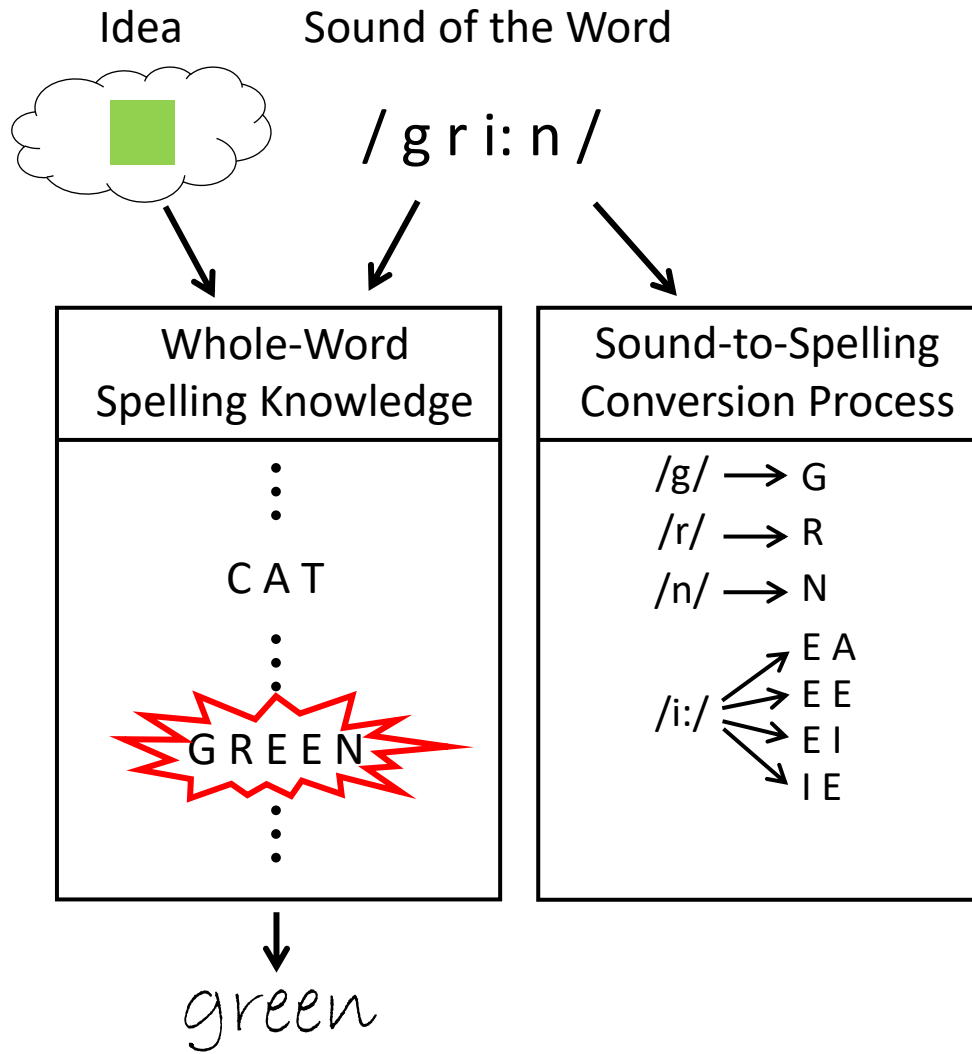
- Knowledge & Processes in Spelling
- Types of Spelling Difficulty
- Diagnosing Spelling Difficulties
- Causes of Difficulty In Learning to Spell
- Helping a Child with Dysgraphia

# Knowledge & Processes in Spelling



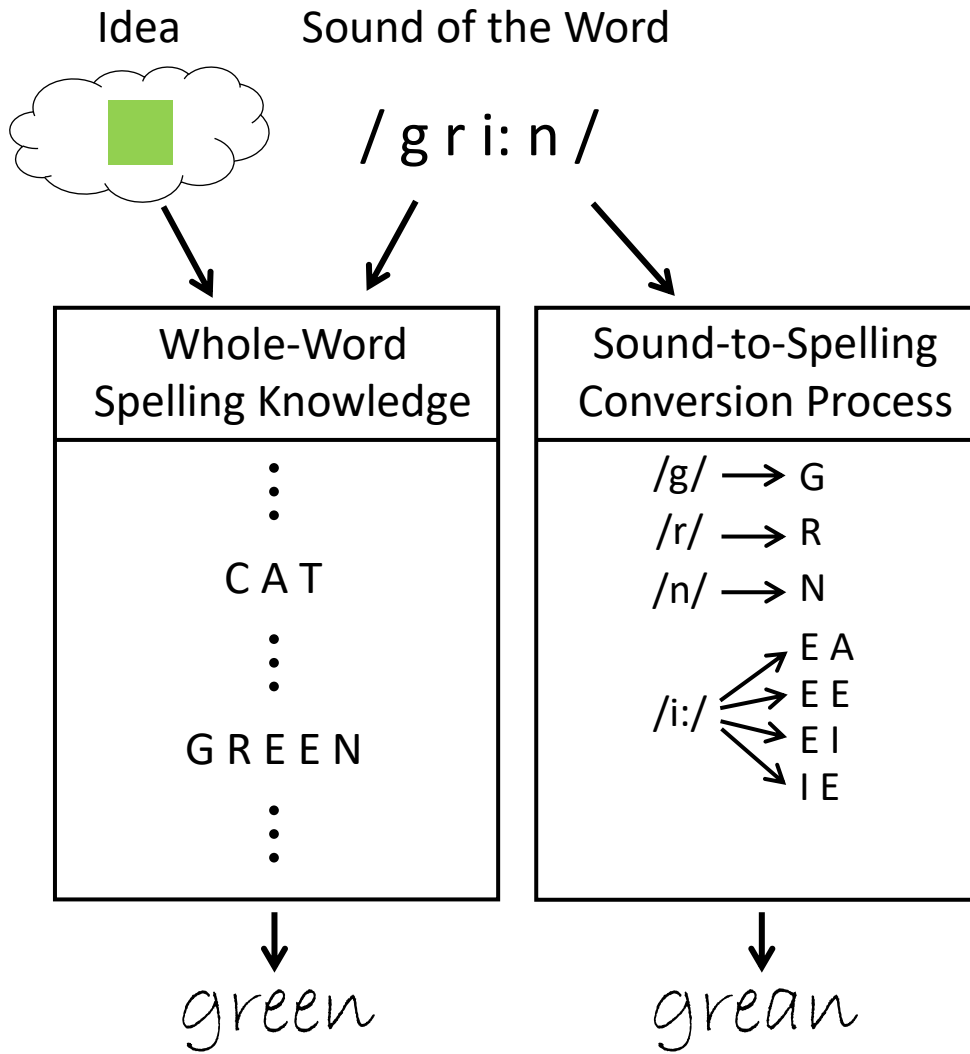
- good spelling requires both
  - whole-word spelling knowledge to ensure correct spellings for words
  - sound-to-spelling conversion process to produce plausible spellings (phonetic spellings) for unfamiliar words

# Types of Spelling Difficulty



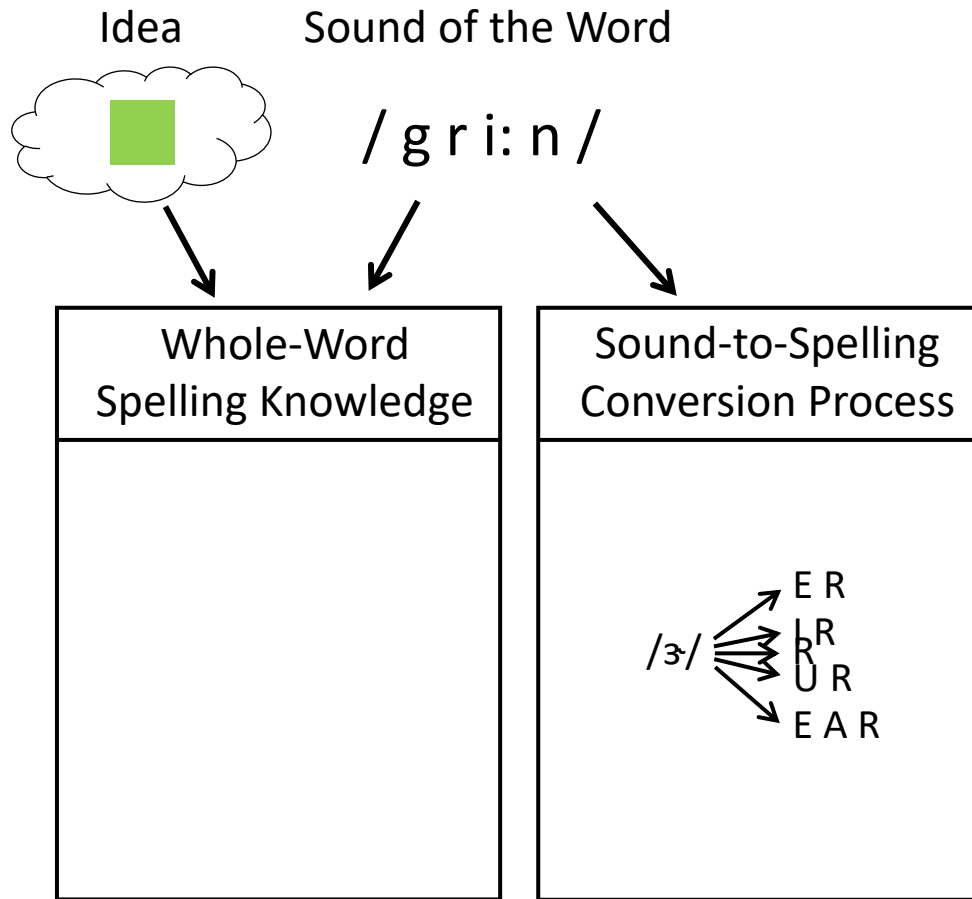
- possible causes of spelling difficulty
  - inadequate learning of whole-word spellings
  - inadequate learning of sound-to-spelling conversion processes

# Poor Whole-Word Spelling Knowledge




- fewer whole-word spellings learned than expected for age/grade level
- words must be spelled through sound-spelling conversion
- good spelling for 'regular' words
  - plant
  - sound-spelling conversion usually generates the correct spelling
  - plant → PLANT
- poor spelling for 'irregular' words
  - giant
  - sound-spelling conversion generates spellings that are plausible but often incorrect
  - giant → JIENT

# Poor Sound-Spelling Conversion



- incomplete or incorrect knowledge of sound-spelling correspondences
- example
  - GERM
  - BIRD
- incorrect rule causes errors
  - bird → BRD
  - work → WRK

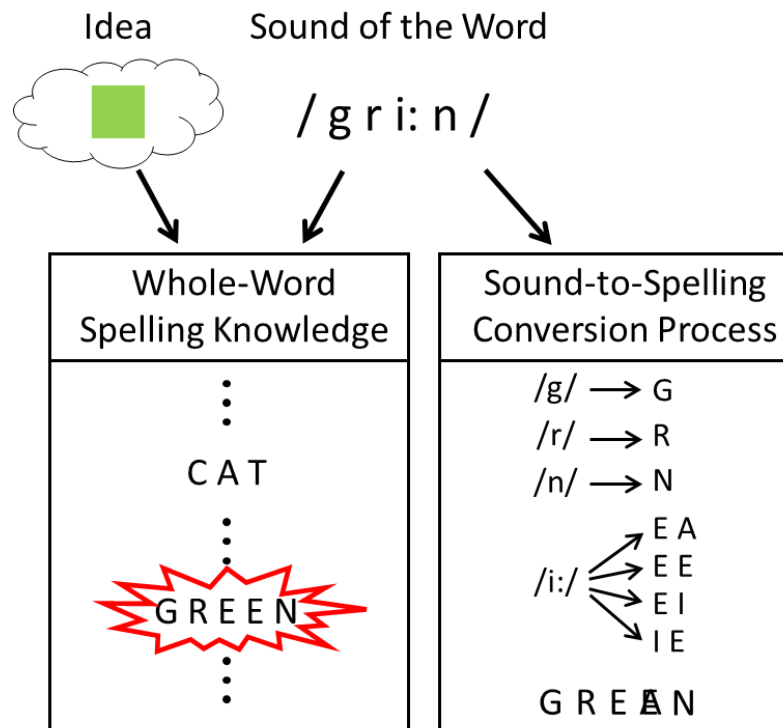
# Spelling & Spelling Difficulties

- Knowledge & Processes in Spelling
- Types of Spelling Difficulty
-  • Diagnosing Spelling Difficulties
- Causes of Difficulty In Learning to Spell
- Helping a Child with Dysgraphia



# Diagnosing Spelling Difficulties

- Guided by our understanding of the cognitive processes of spelling
- **Accuracy levels** and **error types** are very useful



# Diagnosing Spelling Difficulties: Accuracy

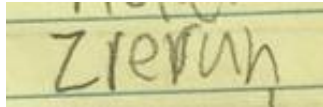
## Difficulties:

- Sound-to-Spelling Conversion
  - **low accuracy with new or made-up words**
    - Made-up words
    - “flope”, “daff”, “zern”
- Whole-Word Spelling Knowledge
  - **low accuracy with words that don't have fully predictable spellings (irregular words) compared to words that do (regular words)**
    - Irregular: COME, LAUGH, HEART, WAS, HAVE, SAID
    - Regular: PLANT, MIST, MARSH

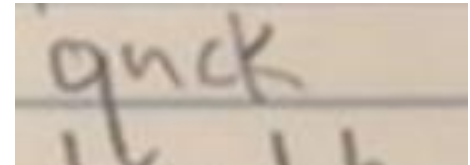
# Diagnosing Spelling Difficulties: Error Types

- Sound-to-spelling conversion?
  - implausible spellings for new or made-up words

“zirn” →

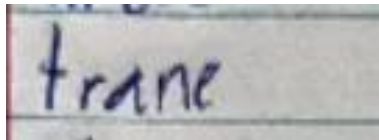


“quoik” →

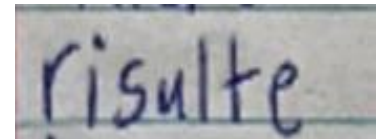


- Whole word spelling knowledge?
  - Plausible (phonetic) spellings for irregular words

“train” →

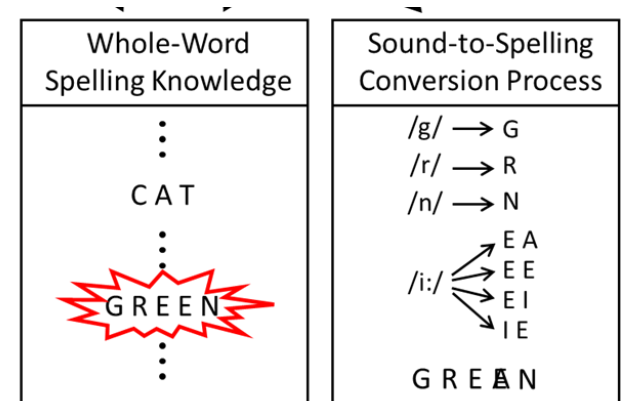


“result” →



# Summary: Signs of Different Difficulties

- Sound-to-spelling conversion
  - **Accuracy:** Low accuracy in spelling “new words”
  - **Errors:** Non-phonetic spellings
- Whole-word spelling knowledge
  - **Accuracy:** Low accuracy for irregular words compared to regular words
  - **Errors:** Phonetic spellings for irregular words
- **NOTE:** there can be weakness in both

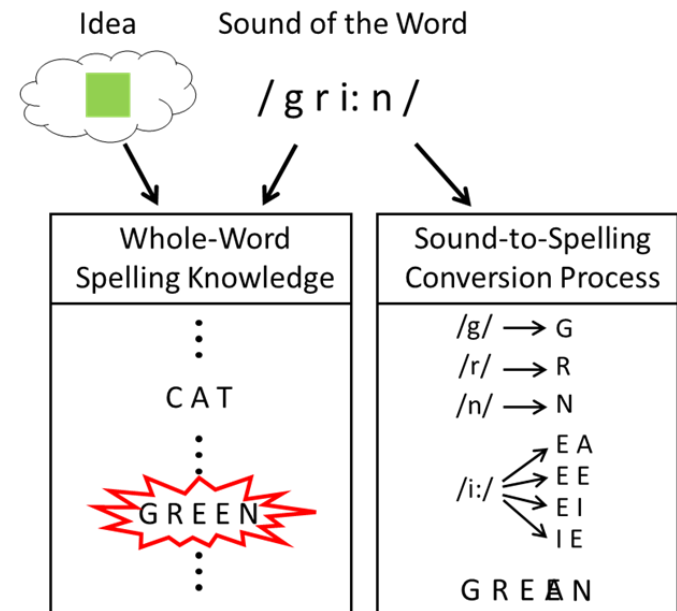


# AKR (fifth grade)

**Reading:** superior

## Spelling

- New/made-up words: 46<sup>th</sup> percentile
- Irregular words: 14<sup>th</sup> percentile
  - “which” → WICH
  - “snack” → SNAK
  - “purchase” → PURCHES



# Diagnosing Spelling Difficulties

## Key points:

- Assess spelling with different types of words
  - words (regular and irregular words)
  - new words (made-up words)
- Difficulties with specific spelling processes produce characteristic patterns of **accuracy and error types**

# Possible Underlying Causes of Difficulties in Learning to Spell

- What skills are needed to “build” the spelling system?
  - MANY have been proposed: spoken vocabulary, phonological awareness, visual and phonological working memory, visual and phonological long-term memory, visual-motor integration, etc.
- Why does it matter?
  - If weakness in underlying skills contributes to spelling difficulties, then this knowledge may guide interventions
- Challenge: We don't know with certainty which skills are critical for learning to spell

# Spoken Vocabulary

- Spoken vocabulary may help children build and expand their written vocabulary as they learn the spellings of new words
- ❖ Many children with dysgraphia may have normal to superior spoken vocabulary knowledge



# Phonological Awareness

- Awareness of the units of speech: that words are made up of strings of individual sounds and that these can map onto individual letters or letter groups
- Weakness in phonological awareness is the most commonly proposed underlying cause of developmental dyslexia/dysgraphia
- ❖ NOT necessarily deficient
  - AKR and PJT: 79<sup>th</sup> and 63<sup>rd</sup> percentile in phonological awareness score (CTOPP)

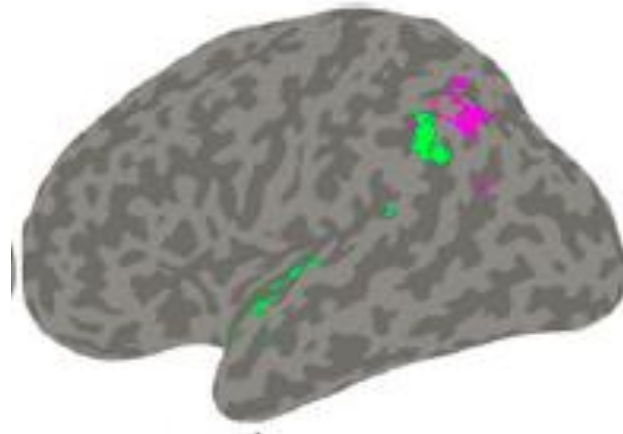
# Working Memory

- Systems used to maintain information for a short period of time (seconds to minutes) – a mental workspace
- Spelling: WM systems may be used to hold letter and sound strings while learning to map one to other, or while waiting to produce one letter at a time
- ❖ Research shows that they may be specialized for different types of info: visual, spatial, spoken sounds, letter strings

Working Memory

Spelling 

Speech 



# Learning and (Long-Term) Retention

- Systems that learn and store information for days, weeks and years
- Spelling: learning and long-term retention of sound-to-spelling mappings and whole word forms
- ❖ Research shows that these systems may be specialized for different types of information (visual, faces, objects, spoken and written words, etc.)

# Learning and Retention: Spoken and Written Words

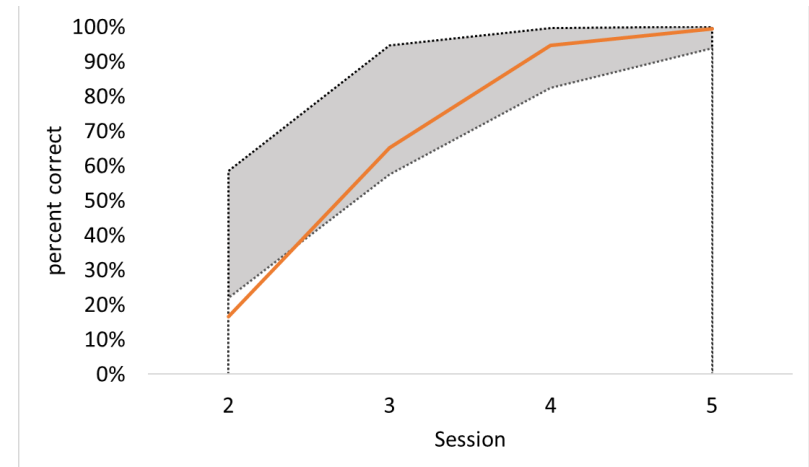
Evaluation: learning and long-term retention of new spoken and written words



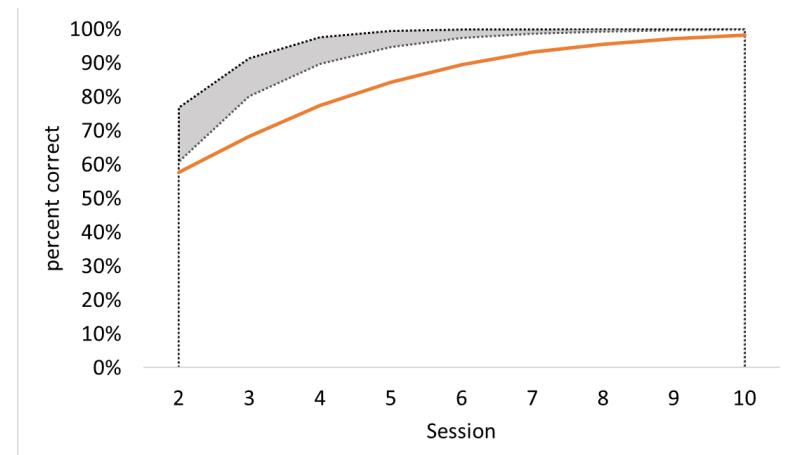
“neelent”  
NEELENT

Findings: In some children, spoken word learning is within normal range, while written word learning is not

SRL: Spoken Words



SRL: Written Words



# Possible Underlying Causes

## Key points:

- Learning to spell requires the coordination of many underlying skills
- Unfortunately, there is still considerable uncertainty about which are critical
- ❖ We should not assume that all individuals with dysgraphia have the same underlying difficulties

# Helping a Child or Adult with Dysgraphia

1. Help child understand they are not stupid/lazy
2. Advocate for child in school and other settings
3. Identifying the specific aspects of writing that are affected is critical for focusing remediation
4. Remediation approaches
  - Strengthen affected processes
  - Use strengths to develop workarounds (typing, spell checker, scribe or speech to text)

Thank you for your interest in  
dysgraphia!