The role of the *lexicon* in early identification and intervention for language and reading disabilities

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Research Goal

- Elucidate causal mechanisms underpinning language and reading disabilities
- Improve early identification and intervention for children at risk for language and reading disabilities

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- Elucidate causal mechanisms underpinning language and reading disabilities
- Improve early identification and intervention for children at risk for language and reading disabilities
- The lexicon

Big Issue #1

- Poor readers are not identified until they begin learning how to read


I CAN'T
READ.

Big Issue #1

- Poor readers are not identified until they begin learning how to read
  - Reading tests don't identify poor readers until 1st grade and beyond
- Solution: Measure precursors to reading

Big Issue #2

- Precursors to reading
  - Phonological awareness & vocabulary
    - Good sensitivity
    - **Poor** specificity (Heath & Hogben, 2004)
- Solution:
  - Use theory and data to create better tests of precursors

Simple View of Reading

Framework for understanding components of reading

The Simple View of Reading

(Catts, Hogan, & Adlof, 2005; Gough & Tunmer, 1986; Hoover & Gough, 1990)

Reading Comprehension

The Simple View of Reading

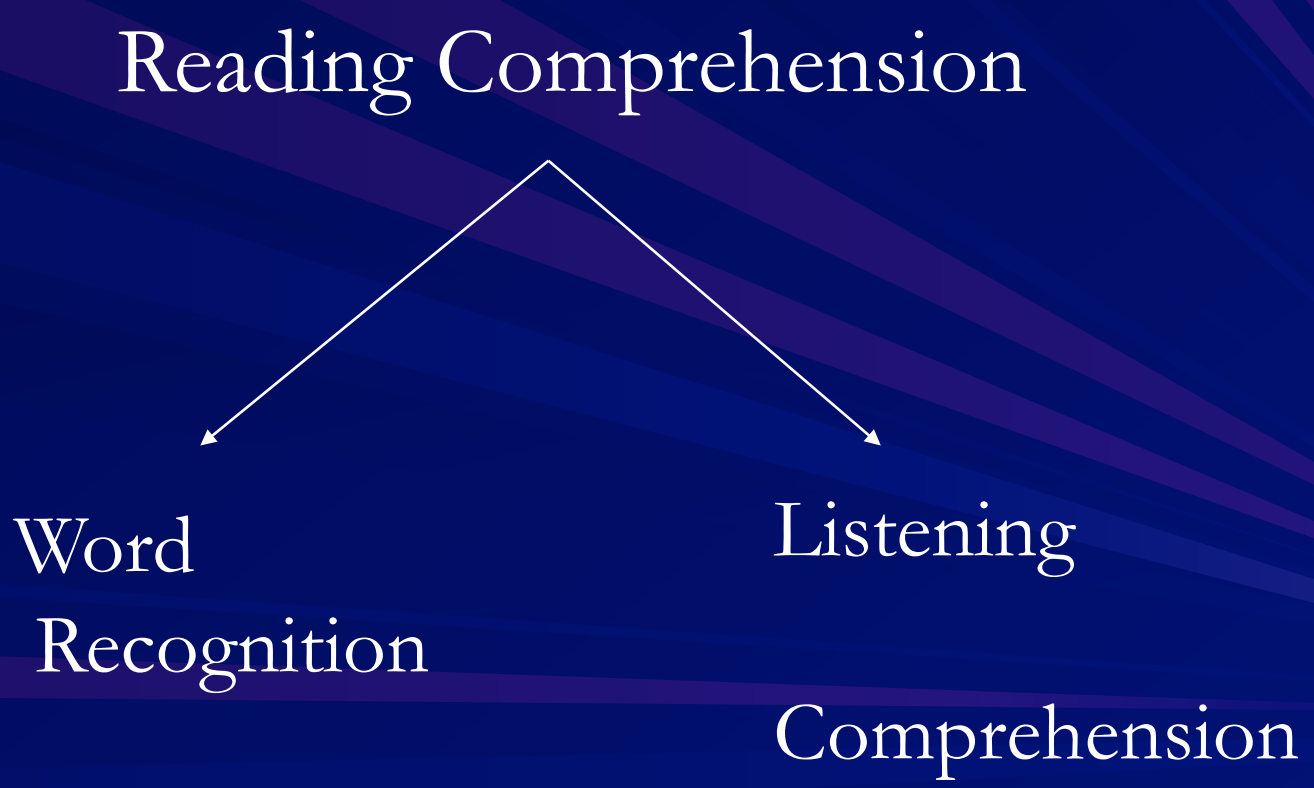
(Catts, Hogan, & Adlof, 2005; Gough & Tunmer, 1986; Hoover & Gough, 1990)

Reading Comprehension

Word Recognition

The Simple View of Reading

(Catts, Hogan, & Adlof, 2005; Gough & Tunmer, 1986; Hoover & Gough, 1990)

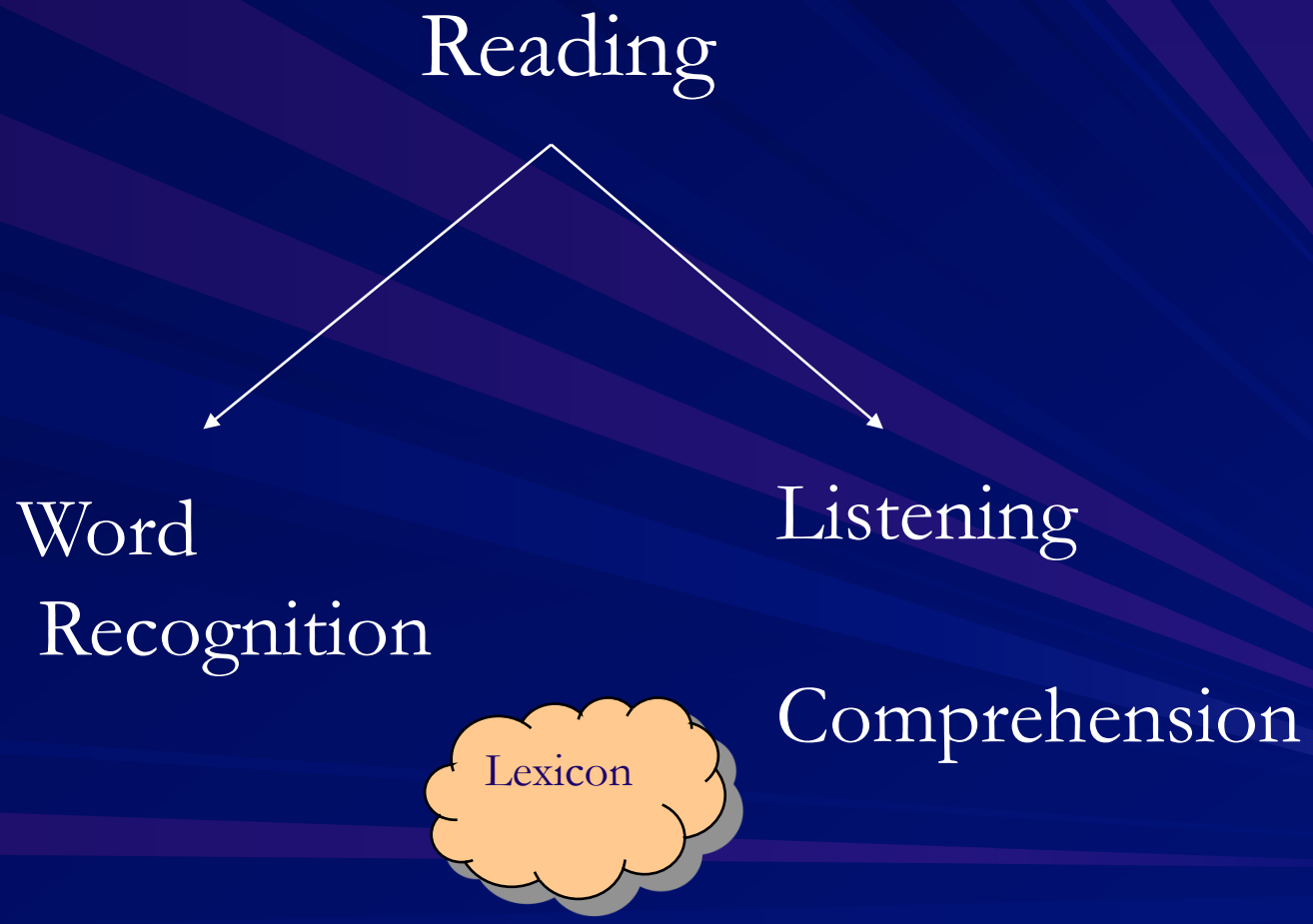


Research Goal

- To improve early identification of reading impairment…
- Need to examine precursors to
  - Word recognition
  - Listening Comprehension
- Use theory to create better tests of these precursors
  - Good sensitivity and good specificity

Could the *lexicon* be the key to early identification and intervention for all poor readers?

The Simple View of Reading



Lexical Entry

Lexical Entry

Lexical Entry

Form representation

Lexical Entry

Form representation

/p/ /l/ /e/ /n/

Lexical Entry

Form representation

↓

/p/ /l/ /e/ /n/

↓

/plen/

Lexical Entry

Form representation

Semantic representation

/p/ /l/ /e/ /n/

/plen/

Lexical Entry

Form representation

/p/ /l/ /e/ /n/

/plen/

Semantic representation

Flying object

Carries people and cargo

Lexical Entry

Form representation

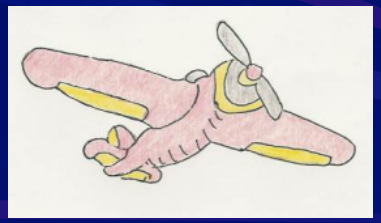
/p/ /l/ /e/ /n/

/plen/

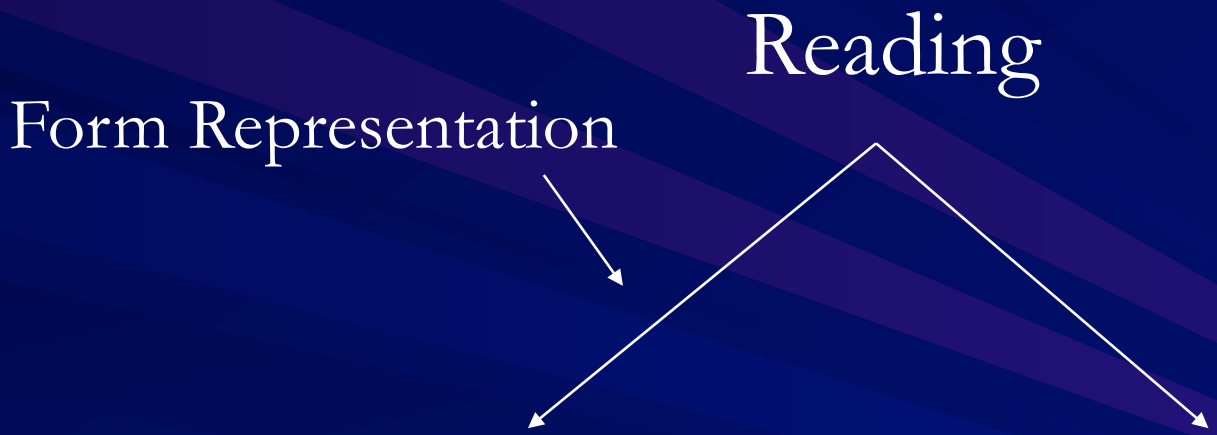
Semantic representation

Flying object

Carries people and cargo



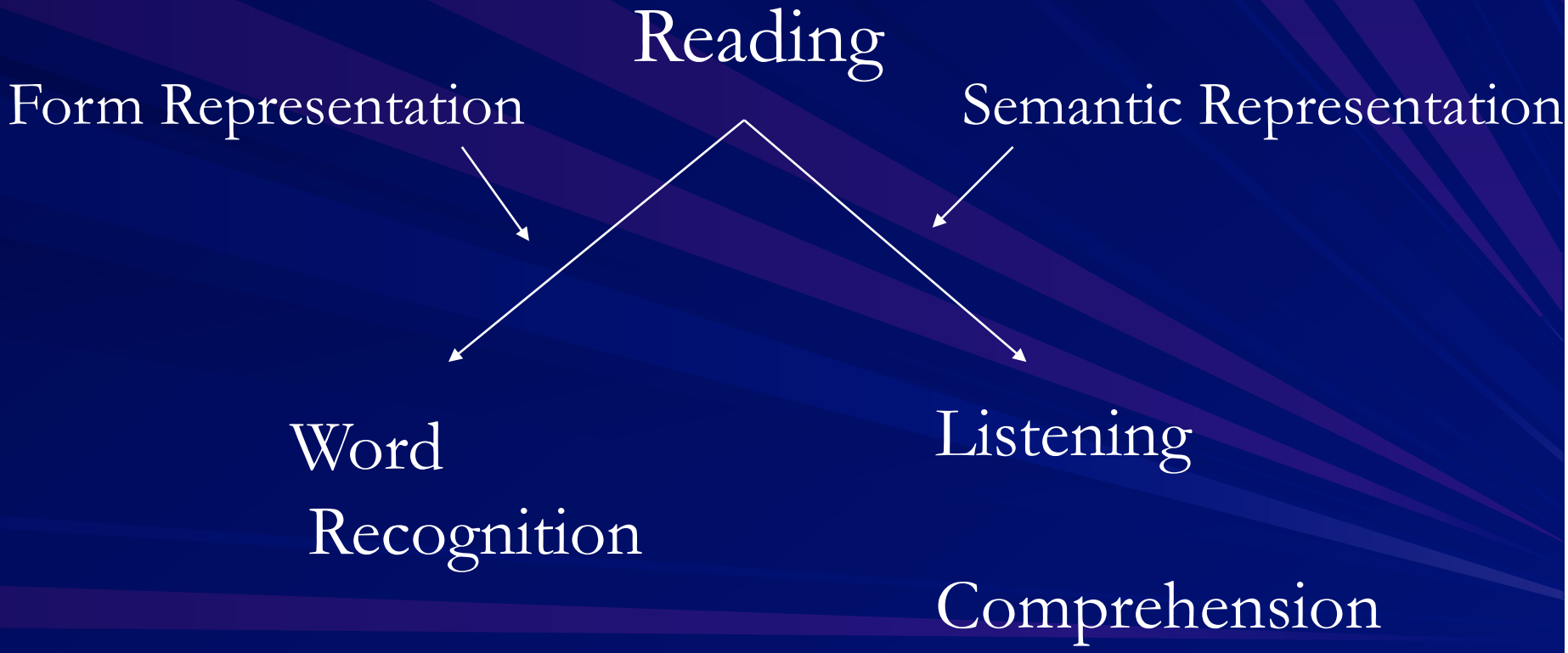
The Simple View of Reading & the Lexicon



Word Recognition

Listening Comprehension

The Simple View of Reading & the Lexicon



Advantages to the Lexicon and Early ID

The lexicon

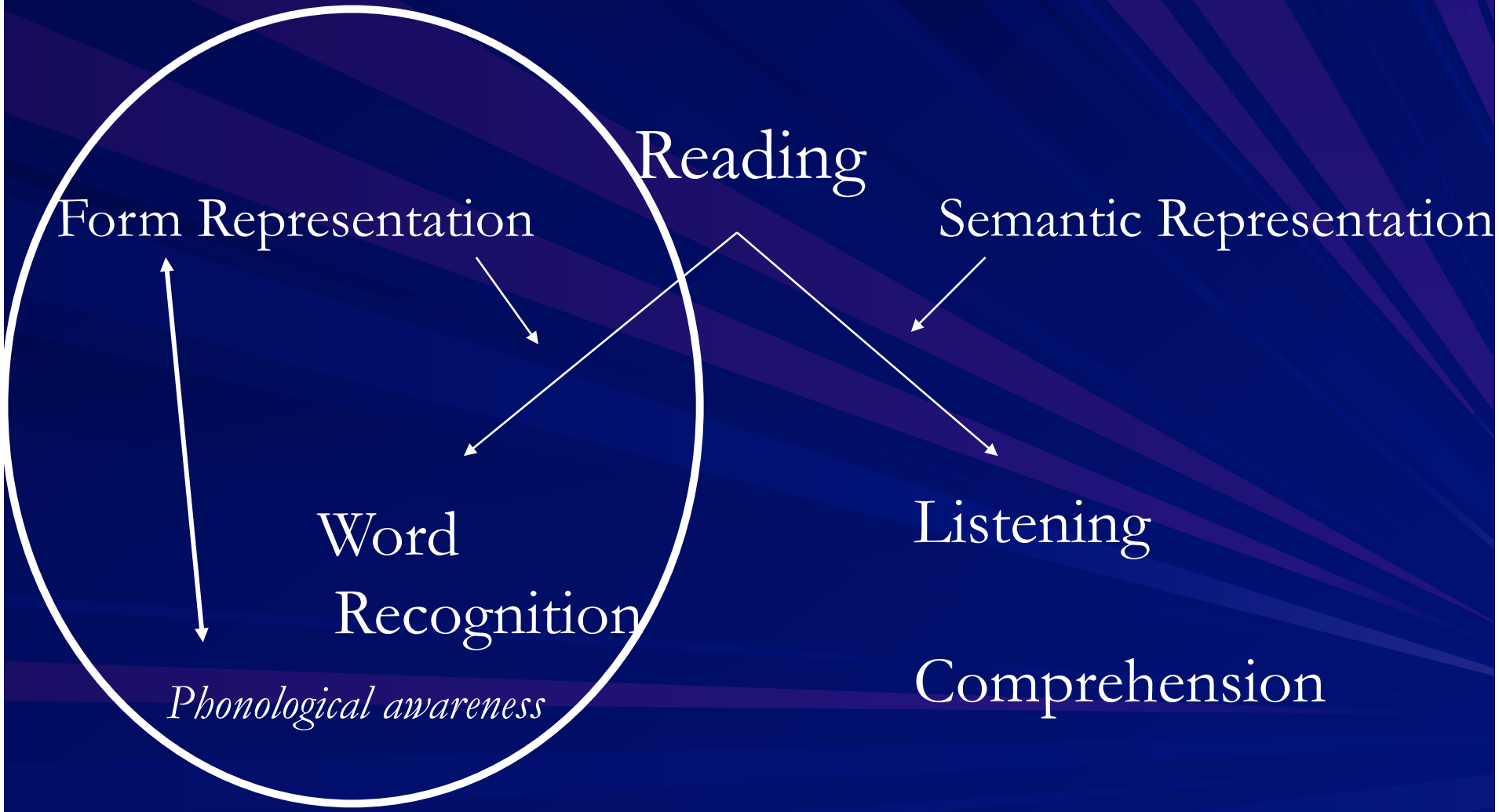
- Maps to Simple View components
- Develops early and is easy to measure

- Theories related to the lexicon and…
  - Word recognition
    - Phonological awareness
  - Listening comprehension
    - Vocabulary knowledge

Form representations and phonological awareness performance

Funded by the International Dyslexia Association
(General Grant; PI: Hogan)

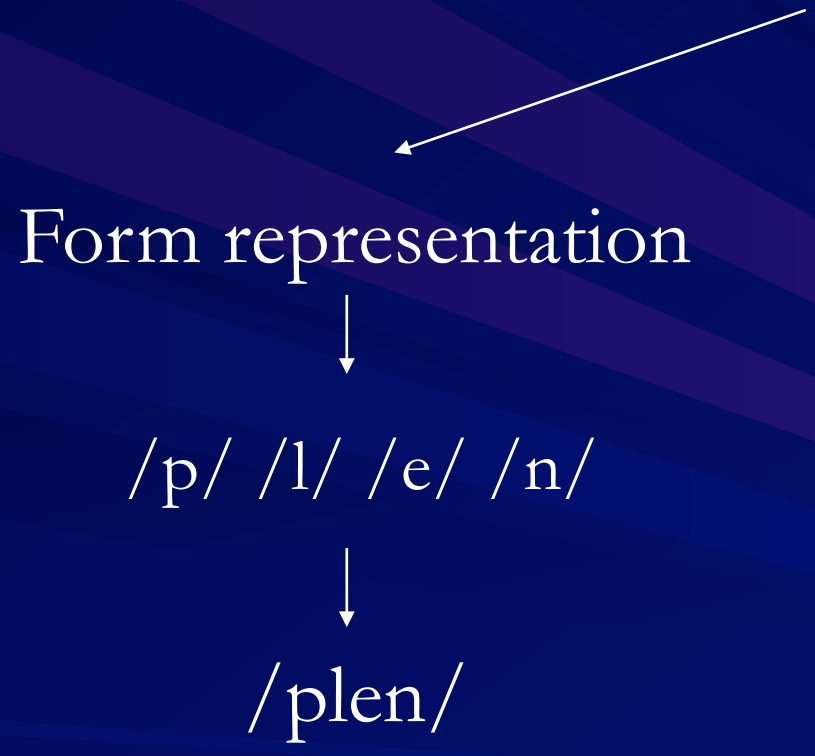
The Simple View of Reading & the Lexicon



Tests of Phonological Awareness

- Tests of phonological awareness have been used to identify children who will be at risk for reading impairment
  - Example test: phoneme deletion
- Over-identify good readers as having poor phonological awareness (Heath & Hogben, 2004)
  - Poor specificity
- Using data-driven, theory-based selection of phonological awareness test words is likely to improve early detection of reading impairment

Lexical Entry



Sound-to-be-deleted

Neighborhood density

Sound Sonority

- Sonority: resonant property that somewhat corresponds to its degree of constriction during production (Chin, 1996)

- Highly sonorous: more vowel-like
- Least sonorous: less vowel-like

Sonority Hierarchy

- Least sonorous
  - voiceless stops/affricates /p/
  - voiced stops/affricates /d/
  - voiceless fricatives /f/
  - voiced fricatives /v/
  - Nasal /m/
  - Liquids /l/
  - Glides /w/
  - Vowels /a/
- Most sonorous

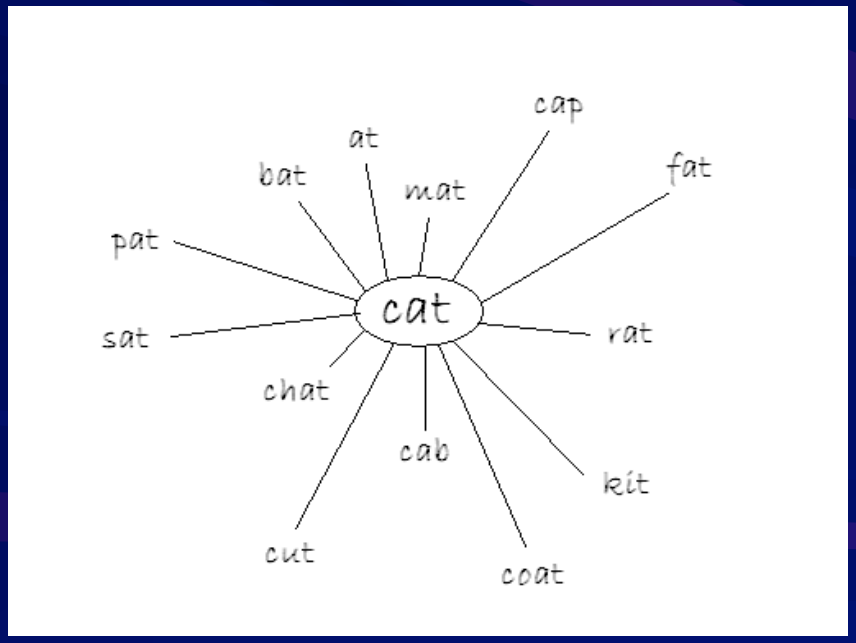
Sonority and Phonological Awareness

- The higher the sonority of the sound, the more difficult it is to delete that sound from a word during a phonological awareness task (Yavas & Gogate, 1999)
- Example: wall vs. call
- Focus on individual sounds is in line with the phonological deficit hypothesis (Catts 1986, 1989; Elbro, 1996)

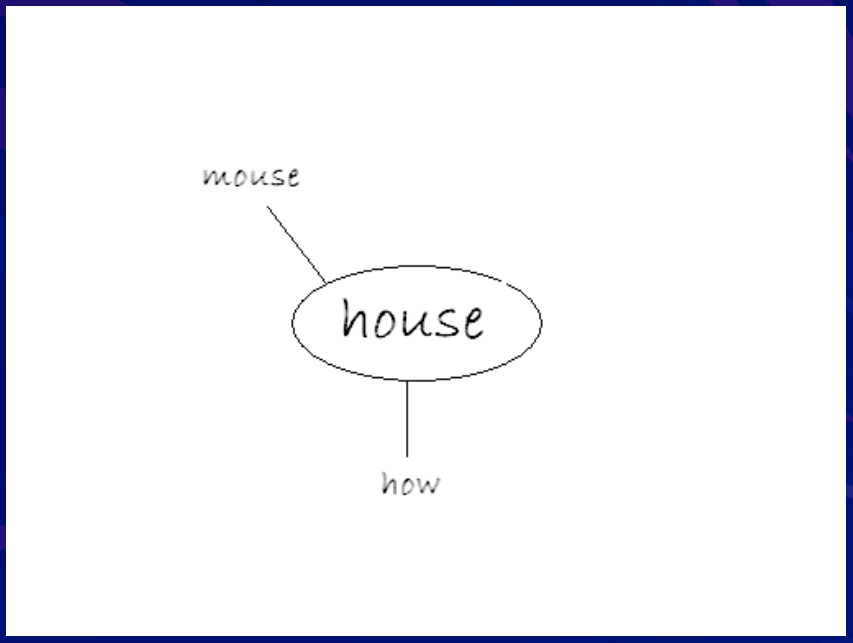
Neighborhood Density

- Neighbors differ by the subtraction, addition, or substitution of 1 phoneme

Dense



Sparse



Neighborhood Density and Phonological Awareness

- Because words from dense neighborhoods have many neighbors, they contain more phonemic detail in order to differentiate one from another Example
- Deleting a sound from a word is easier when the word contains more phonemic detail
  (Hogan, Bowles, Catts, Storkel, 2010; Metsala, 1999)
- Focus on word as integrated whole is in line with the Lexical Restructuring Model (Metsala & Walley, 1998)

This study examined the impact of the sound-to-be-deleted and neighborhood density *simultaneously*

Research Questions

1: Do phonological awareness deletion test words differing in the sonority of the sound-to-be-deleted differ in accuracy?

Prediction:

Yes, words with *low sonority sounds-to-be-deleted* will be more accurate compared to words with high sonority sounds-to-be deleted.

Research Questions

2: Do phonological awareness deletion test words differing in neighborhood density differ in accuracy?

Prediction:

Yes, words from dense neighborhoods will be more accuracy compared to words from sparse neighborhoods

Research Questions

3: Are their interactions between the sonority of the sound-to-be-deleted and neighborhood density?

Prediction:

Yes

words from dense neighborhoods will be most accurate regardless of the sonority of the sound-to-be-deleted

words from sparse neighborhoods with low sonority sounds-to-be-deleted will be more accurate than words from sparse neighborhoods with high sonority sounds-to-be-deleted

Methods

Participants

- Typically developing 5- & 6-year-olds (*n* = 13)
- Enrolled in kindergarten (*M* = 70 months, SD = 5)
- Middle to high socioeconomic status
- English only speakers
- No history of speech and/or language impairment
- Normal language skills
  - Expressive vocabulary (*M*=109, *SD*=16)
  - Receptive vocabulary (*M*=110,*SD*=14)
  - Nonverbal IQ (*M*=118, *SD*=17)
  - Phonological awareness (*M*=107, *SD*=16)
  - Literacy knowledge (*M*=111, *SD*=8)

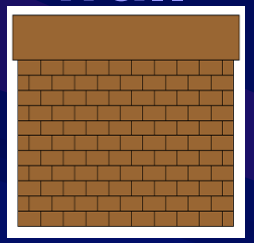
Task

- Phoneme Awareness Deletion Task
  - CVC words initial sound deletion
    - Remaining sounds created a VC real word
  - Presented via computer
  - Picture support
- Why Phoneme Deletion Task?
  - Consistently best phonological awareness predictor of reading (e.g., Torgesen, Wagner, & Rashotte, 1994)
  - Neighborhood density is phoneme-based metric

Deletion Task

- 20 high frequency test words:
  - Varied by 1) sound sonority
    2) neighborhood density
    - **Most** sonorous - **Dense** neighborhood density
    - **Least** sonorous - **Dense** neighborhood density
    - **Most** sonorous - **Sparse** neighborhood density
    - **Least** sonorous - **Sparse** neighborhood density

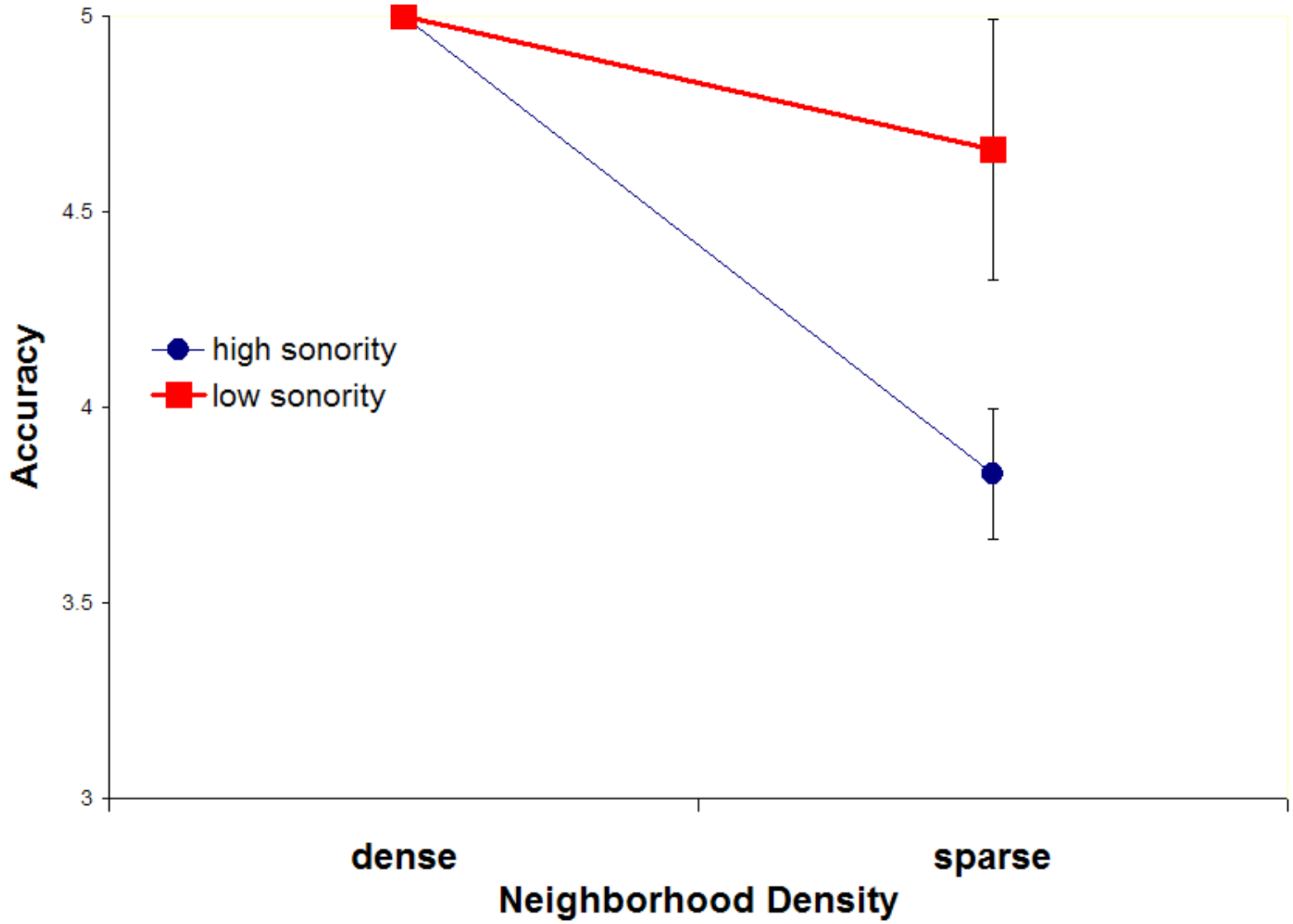
Initial Deletion Task

High sonority – Dense	High sonority – Sparse
wall 	**wheel** 
Low sonority - Dense	Low sonority – Sparse
cat 	**coat** 

Phoneme Deletion Video

Results

Results


5
4.5
4
3.5
3
Accuracy
high sonority
low sonority
dense
sparse
Neighborhood Density

Implications for Findings

- Supports both neighborhood density and sonority of sound-to-be-deleted as metrics for test word difficulty

Future Directions

- Just the beginning….
  - Big question for future work: Can these item characteristics be used to construct more sensitive tests of phoneme awareness for the detection of reading risk?
  - Can phonological and lexical knowledge be changed to result in better phoneme awareness and, in turn, reading abilities?

Future Directions

- Collecting more data to confirm trends and examine other influences on performance
  - Picture vs. no picture support
  - Real vs. nonwords
  - Initial vs. final sound deletion
  - Influence of letter knowledge
  - Task: Phoneme deletion vs. odd-one-out

Future Directions

- Examining the impact of form representations on phonological awareness performance
  - Across development

    (NIH/NIDCD 9667; PI: Hogan)

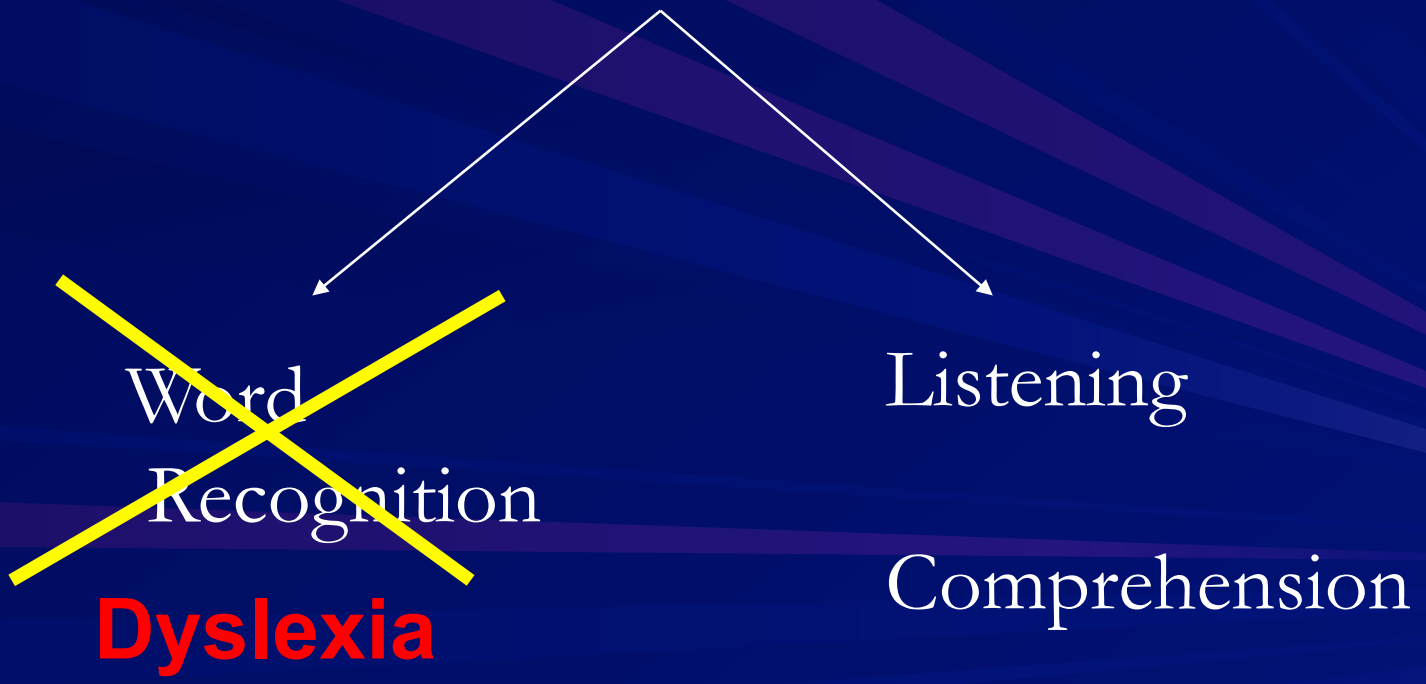
Future Directions

- Determine the utility of lexicon-based processing measures for *aligning with* and *predicting* reading component dissociations in poor reader subgroups
  - Examine word learning in subgroups

    (NIH NICDC 9667; PI: Hogan)

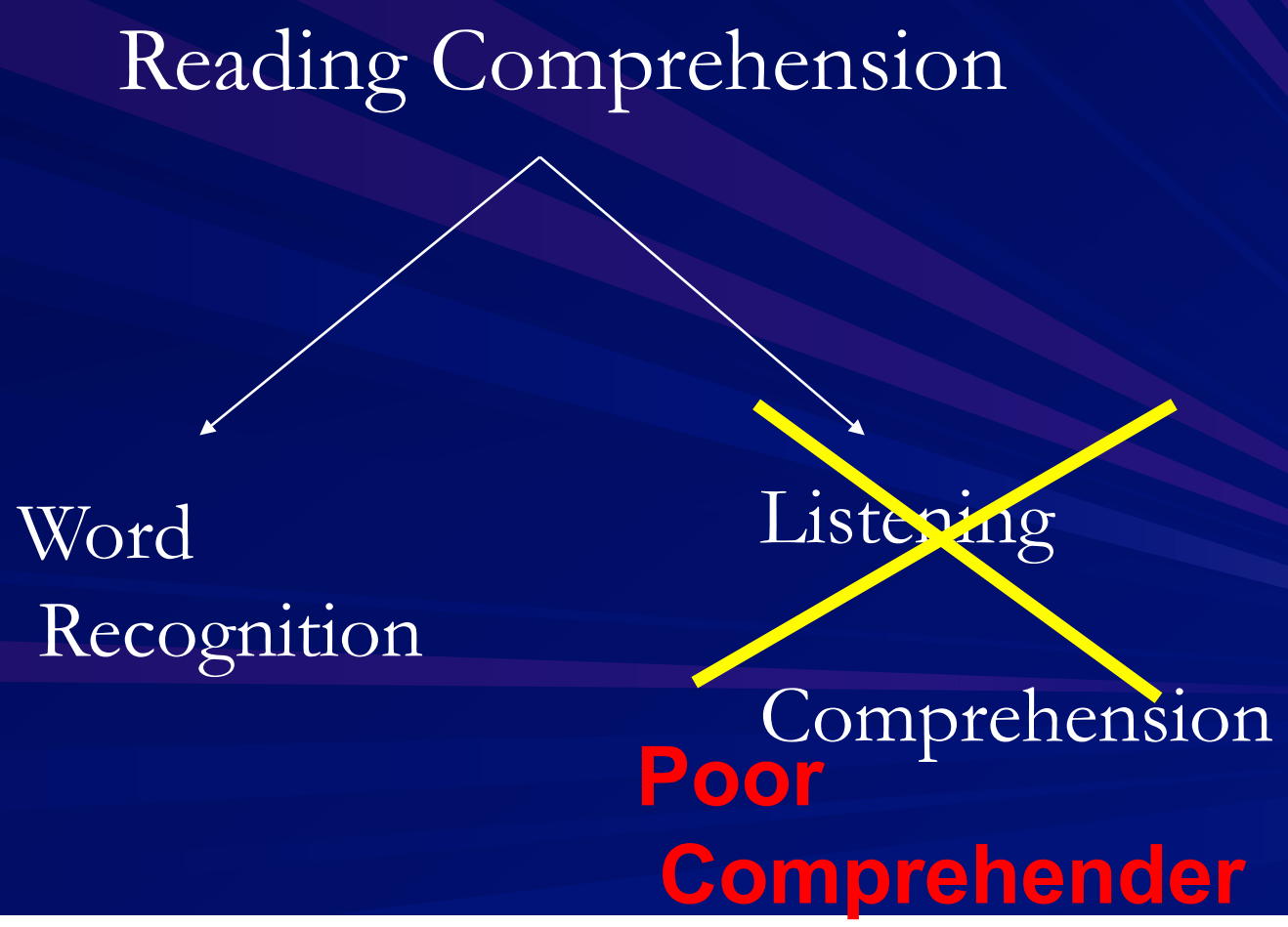
Poor Reader Subgroups

(Catts, Hogan, & Fey, 2003)

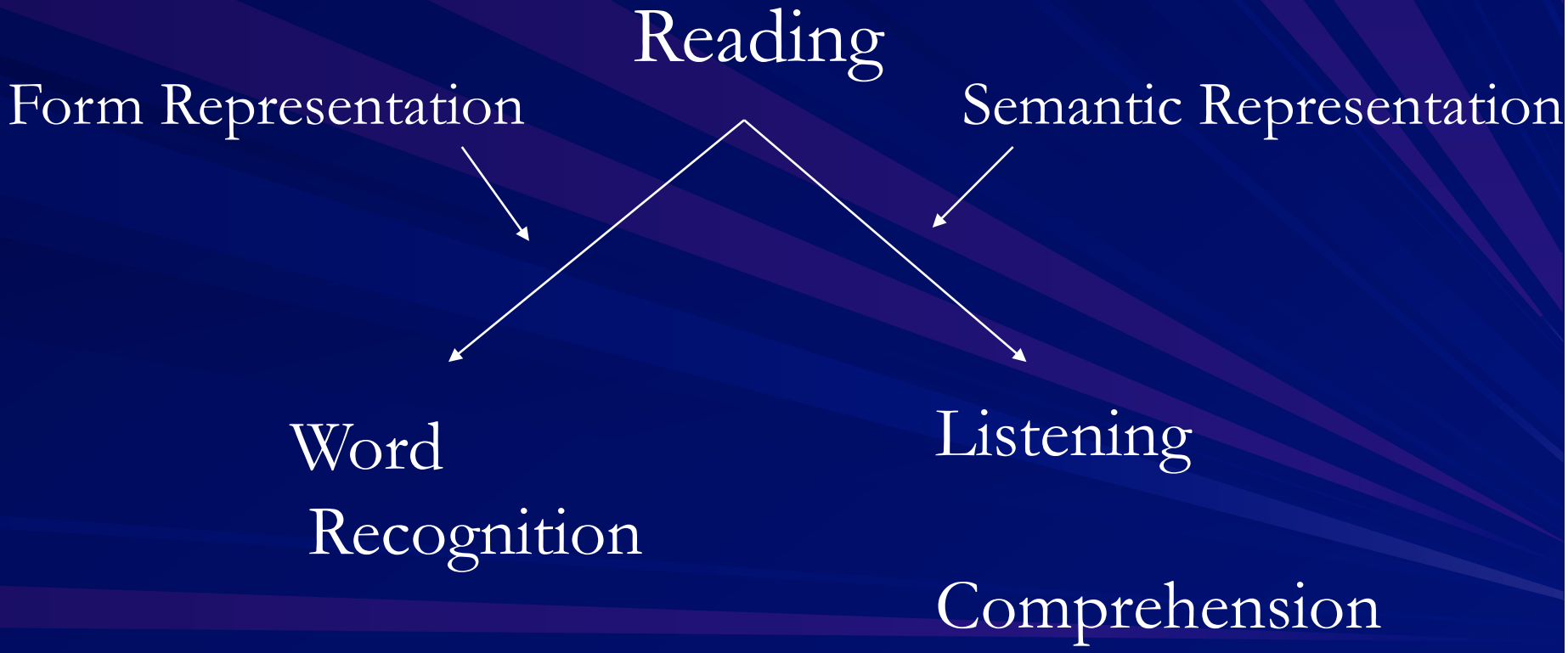


Poor Reader Subgroups

(Catts, Hogan, & Fey, 2003)



The Simple View of Reading & the Lexicon



Overall Summary

- Study of the lexicon and its representations allows data-driven, theory-based inspection of reading component *precursors*

- Ultimate result:

  improvement of early identification and intervention for those at risk for reading disabilities

Other projects related to the lexicon & language and reading disabilities

- Word learning differences in poor reader subgroups (Gray, Hogan, Alt, Cowan, & Green, 2010)
  - Impact of working memory and bilingualism
- Orthographic influences on phonologically-based tasks (Hogan & Suddarth, 2010; Hogan, 2008)

Acknowledgements

Lab Members:

Link *N* Literacy Lab: Linking Language and Literacy
University of Nebraska -Lincoln

*L*4 Lab: *L*anguage, *L*earning, *L*iteracy, *L*exicon
University of Arizona

Collaborators:

Hugh Catts, Holly Storkel
University of Kansas

Funding Sources:

National Institutes of Health
(DC 06749; DC 09667, PI: Hogan),

International Dyslexia Association (PI: Hogan),

Thank You

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bat

stop – vowel - stop

stop – vowel - stop

stop – vowel - stop

stop – vowel - stop

↓

voiced stop – vowel - stop

stop – vowel - stop

stop – vowel - stop

↓

voiced stop – vowel - stop

stop – vowel - stop

↓

unvoiced stop – vowel - stop

voiced stop – vowel - stop

unvoiced stop – vowel - stop

Back