

*The Imagery-Language Connection: Improving  
Comprehension for Children with ASD*

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Lindamood-Bell Learning Processes  
Be Someone's Missing Piece of the Puzzle!  
Adam Morgan Foundation  
St. Louis, MO  
April 25, 2019

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*Our goal is to help every individual  
reach his or her potential to learn.*

*Our efforts include  
Lindamood-Bell Learning Centers,  
School Partnerships, Professional Development  
Workshops, the Lindamood-Bell Academy, and  
neurological and behavioral research.*

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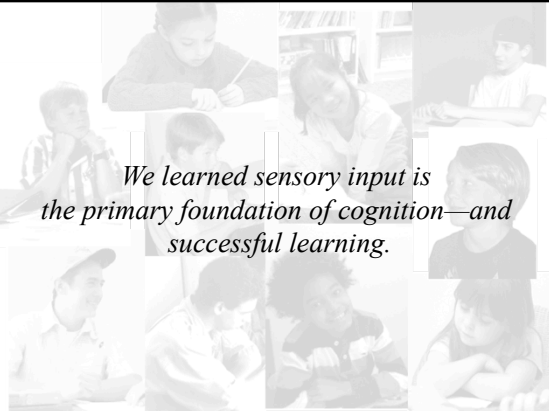
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*We learned sensory input is  
the primary foundation of cognition—and  
successful learning.*

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*After experience and scientific research, we learned that the sensory input of imagery is the primary foundation for cognition and learning.*

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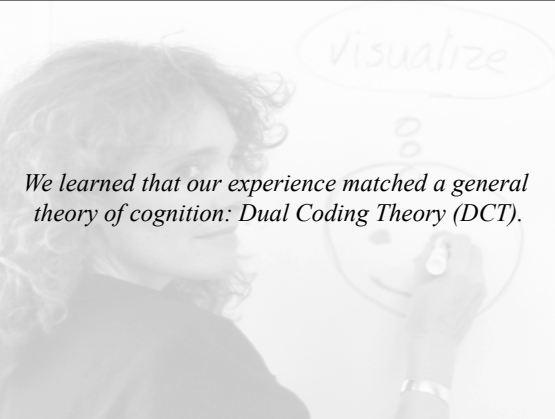
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*We learned that our experience matched a general theory of cognition: Dual Coding Theory (DCT).*

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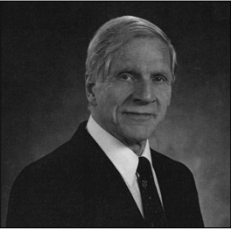
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Allan Paivio and Dual Coding Theory (DCT)



*"Cognition is proportional to the extent that the coding mechanisms of mental representations (imagery) and language are integrated."*

*"Performance is mediated by the joint activity of verbal and nonverbal systems...cognition is always an interplay between the verbal and nonverbal systems."*

*~ Allan Paivio*

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### Dual Coding Theory

#### Imagery and Verbal Processing

Paivio suggested that linguistic competence and performance are based on a substrate of imagery.

*"Performance is mediated by the joint activity of verbal and nonverbal systems...cognition is always an interplay between the verbal and nonverbal systems."*

*"Individuals differ in the extent, manner, and efficiency of employment of each of the systems according to their verbal and nonverbal habits and skills."*

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### 3 Sensory-Cognitive Functions

- *Phoneme Awareness (PA) is the ability to perceive the identity, number, and sequence of sounds within words.*
- *Symbol Imagery (SI) is the ability to create mental imagery for sounds and letters within words.*
- *Concept Imagery (CI) is the ability to create an imaged gestalt (whole) for oral and written language.*

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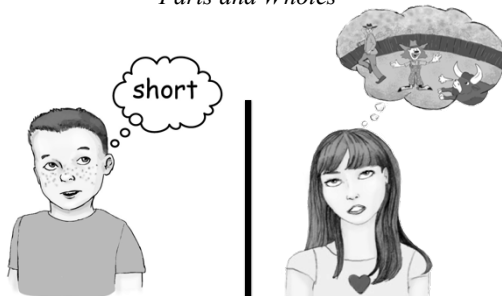
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### Two Types of Imagery

#### Parts and Wholes



*Symbol Imagery is imagery for sounds and letters within words.*

*Concept Imagery is an imaged whole for oral/written language.*

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Symbol Imagery



*Phonological and orthographic imagery  
for reading and spelling words—orthographic memory.*

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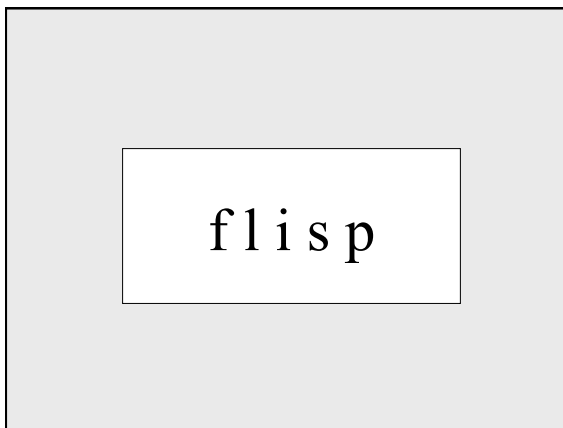
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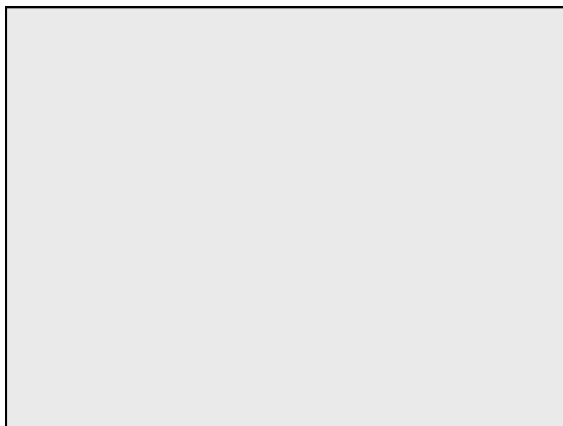
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### Symptoms of Weak Symbol Imagery

*Weakness in:*

- *Word reading skills: word attack and word recognition*
- *Orthographic awareness*
- *Phonological awareness*
- *Memorizing sight words*
- *Fast, accurate decoding*
- *Fast, accurate self-correcting*
- *Contextual reading (guessing rather than rapid accurate decoding)*
- *Orthographic spelling (spelling almost phonetically accurate)*

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### Concept Imagery

*Imaged Whole for Comprehension and Thinking*




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*The big black horse ran across the green field. With his head held high, his hooves pounded the ground and his thick mane blew wildly in the wind.*

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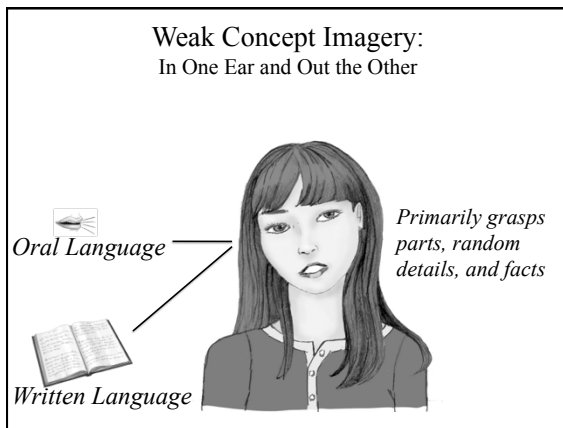
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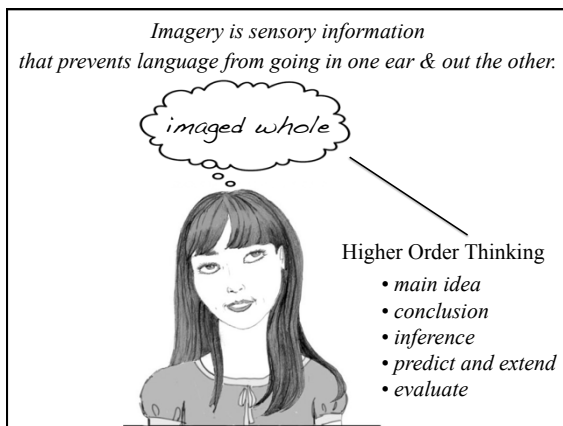
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### Symptoms of Weak Concept Imagery

*Weakness in:*

- *Written language comprehension*
- *Oral language comprehension*
- *Critical and logical thinking, and problem solving*
- *Following directions*
- *Expressing language orally*
- *Expressing language in writing*
- *Grasping humor*
- *Interpreting social situations*
- *Understanding cause and effect*
- *Mental mapping*
- *Responding to a communicating world*

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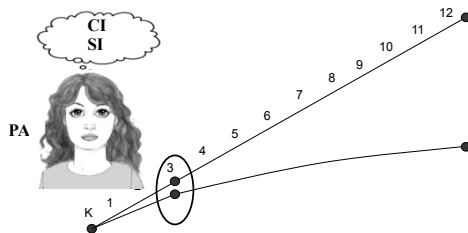
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### Cause: Weak Sensory-Cognitive Functions

*Weakness in sensory-cognitive functions is the primary cause of weakness in reading words and comprehending language.*




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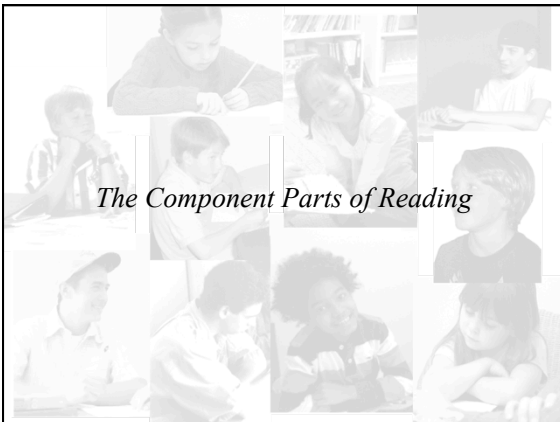
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### The Component Parts of Reading




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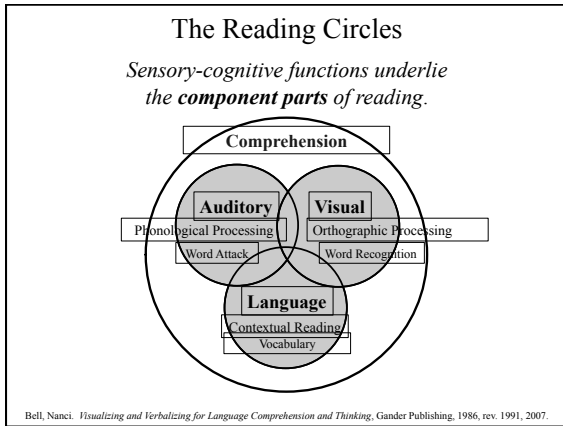
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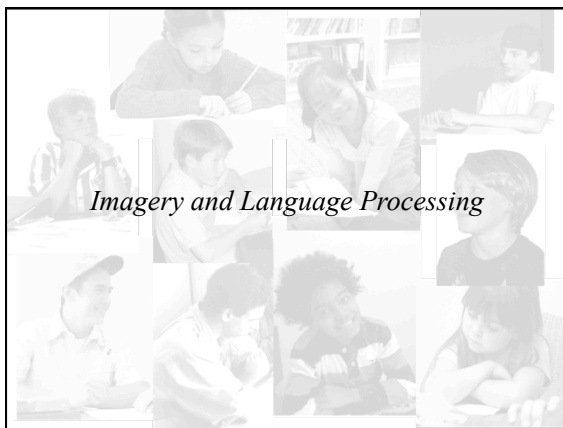
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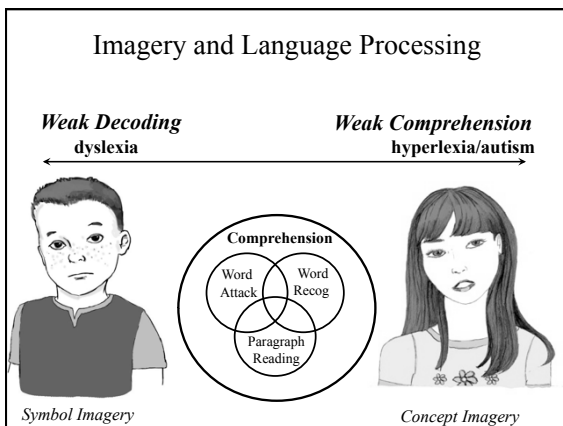
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### Natalie

- Natalie is a quiet, shy, 11-year-old in sixth grade.
- She performs at a high school level in word attack, word recognition, and spelling.
- Her oral vocabulary is above the normal range and her paragraph reading is at the 91<sup>st</sup> percentile.
- Natalie's reading comprehension and ability to follow directions are below her potential.




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### Natalie

- By third grade, Natalie's parents were told she wasn't "attending" and she wasn't completing assignments.
- By fifth grade, the same complaints continued but they added that Natalie wasn't "motivated."
- By sixth grade, Natalie began to complain of stomach aches prior to going to school.
- She told her parents she was dumb.




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### Natalie

CA: 11-10 Grade: 7.0



*Though Natalie had easily learned to read words in her early grades, by 4<sup>th</sup> grade she was sick before going to school and moving her to the front of the classroom didn't help her performance.*

Peabody Picture Vocabulary Test.....	86th Percentile
Woodcock Word Attack.....	86th Percentile
Wide Range Achievement Test	
Word Recognition.....	87th Percentile
Gray Oral Reading Test-3	
Rate.....	84th Percentile
Accuracy.....	95th Percentile
Fluency.....	91st Percentile
Comprehension.....	2nd Percentile

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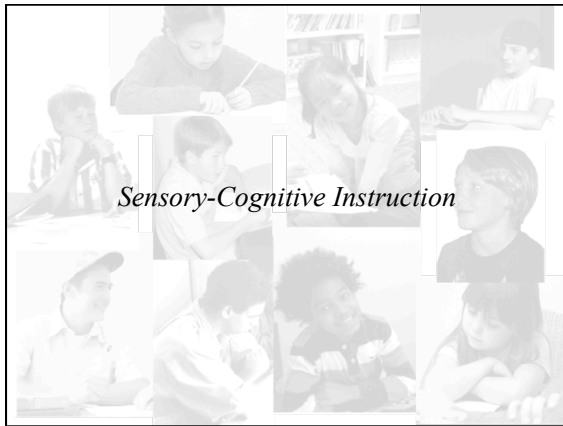
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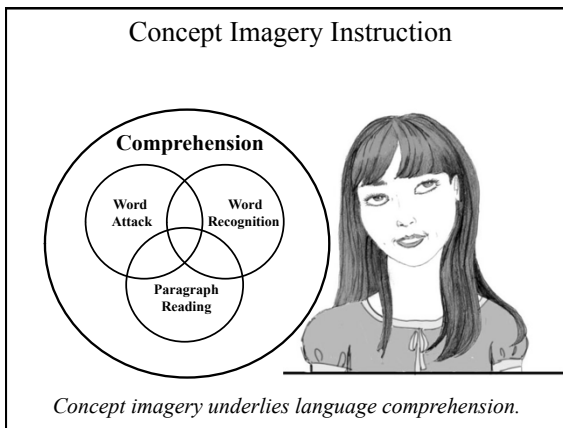
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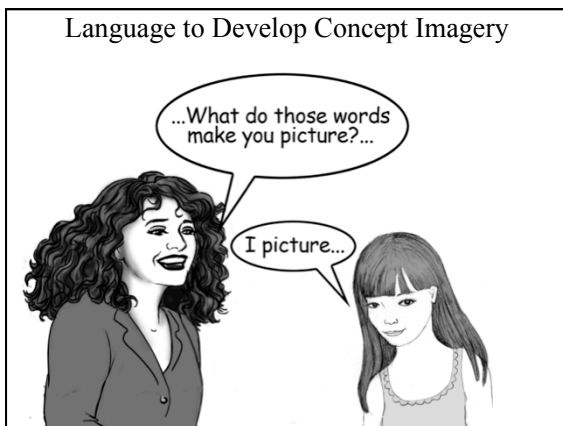
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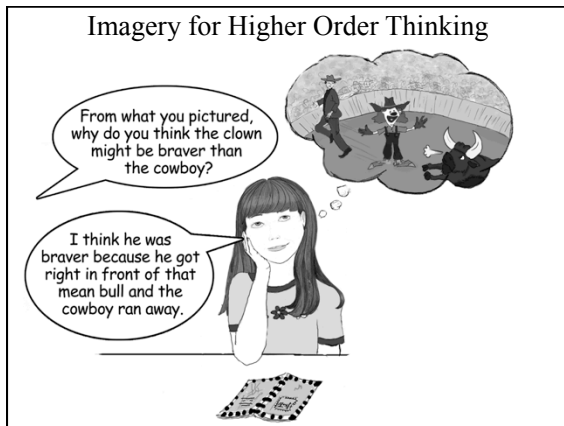
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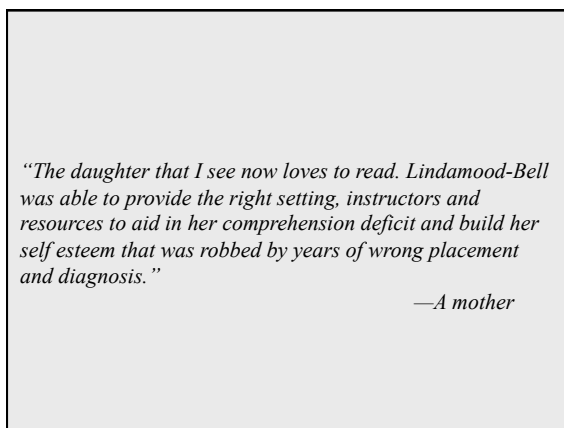
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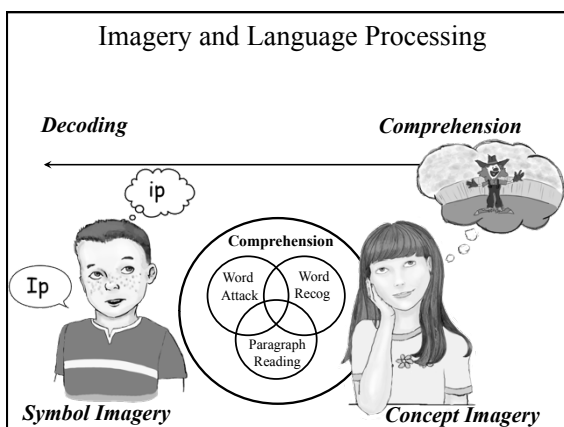
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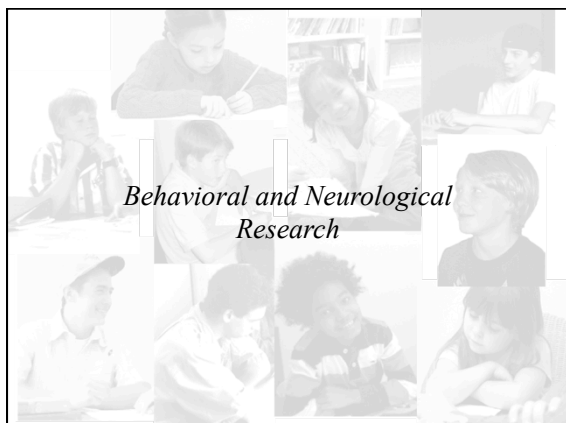
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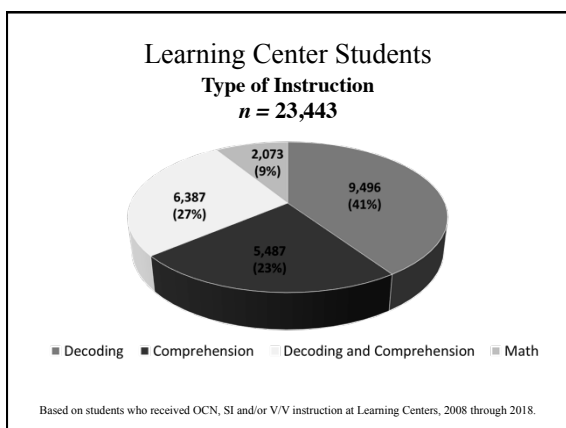
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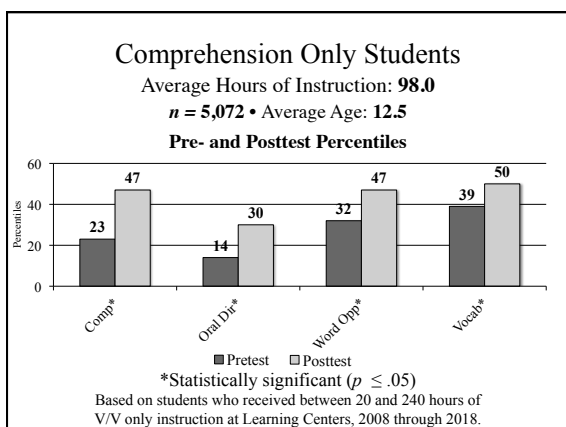
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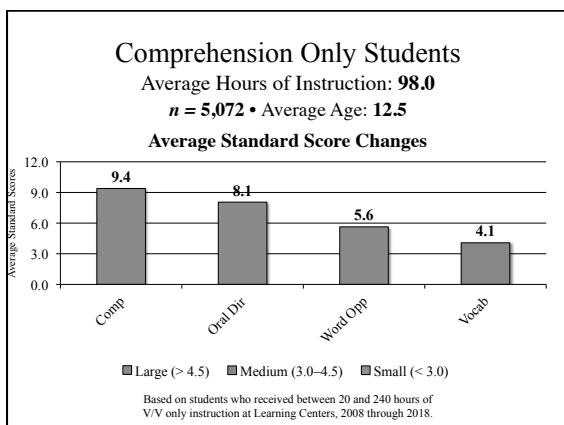
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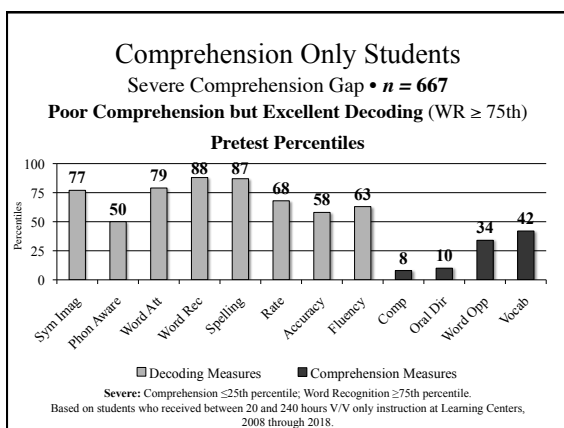
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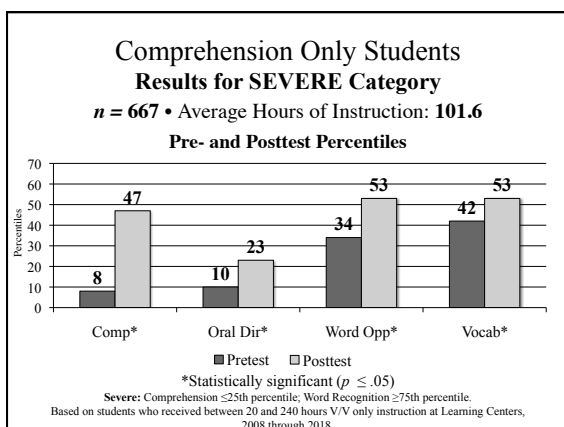
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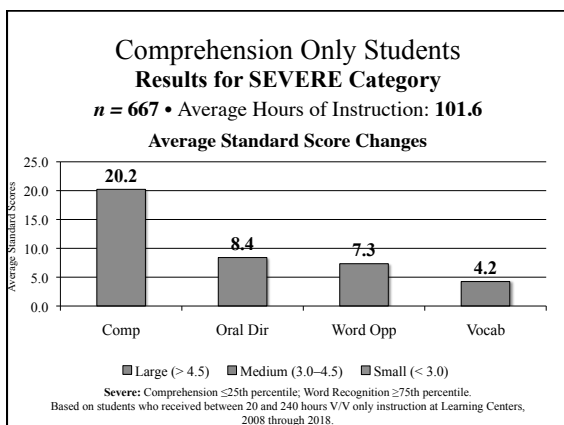
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**UAB Neuroimaging Research  
Interconnectivity and Reading Comprehension**

University of Alabama at Birmingham  
*Donna Murdaugh, Rajesh Kana, et al*





**Cognition, Brain, and Autism Laboratory**

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**UAB Neuroimaging Research**

*This study researched the impact of concept imagery stimulation (Visualizing and Verbalizing® Program) on brain circuitry and connectivity in children with autism spectrum disorders (ASD).*

*Neuroscientific findings suggest that the neural basis of altered cognition in autism entails a lower degree of integration of information across certain cortical areas resulting from reduced intra-cortical connectivity. This research supports a new theory of cortical underconnectivity in autism, which posits a deficit in the integration of information at the neural and cognitive levels, such as in language comprehension.*

*There have been five papers published on the study.*

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### UAB Neuroimaging Research

- 31 children with autism were randomly assigned to experimental (V/V<sup>®</sup>) and control (no V/V) conditions.

Characteristic	Experimental (n = 16)	Control (n = 15)
Age	10.3	11.0
Gender	12 M, 4 F	12 M, 3 F
WASI FSIQ	94.7	97.2
GORT-Comprehension	76.7	84.2
SORT	107.5	105.5

Groups were similar on all variables.

<sup>†</sup>Murdaugh, D. L., J. O. Maximo, and R. K. Kana. 2015. "Changes in intrinsic connectivity of the brain's reading network following intervention in children with autism." *Human Brain Mapping*. doi: 10.1002/hbm.22821.

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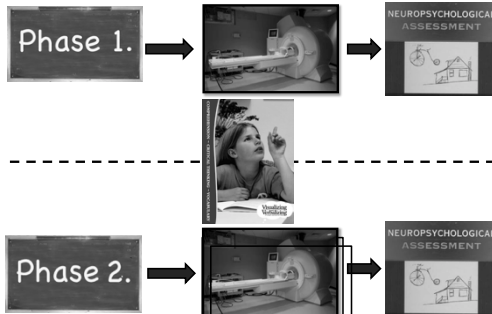
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### Neuroimaging Research (UAB)<sup>†</sup>



<sup>†</sup>Murdaugh, D. L., J. O. Maximo, and R. K. Kana. 2015. "Changes in intrinsic connectivity of the brain's reading network following intervention in children with autism." *Human Brain Mapping*. doi: 10.1002/hbm.22821.

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### UAB Neuroimaging Research

- Children received brain scans (fMRI) and were administered the GORT-comprehension 10 weeks apart.
- Experimental children received 4 hours of V/V a day, 5 days a week for 10 weeks.
- Pre- to posttest brain and GORT-comprehension changes favored the experimental group.

<sup>†</sup>Murdaugh, D. L., J. O. Maximo, and R. K. Kana. 2015. "Changes in intrinsic connectivity of the brain's reading network following intervention in children with autism." *Human Brain Mapping*. doi: 10.1002/hbm.22821.

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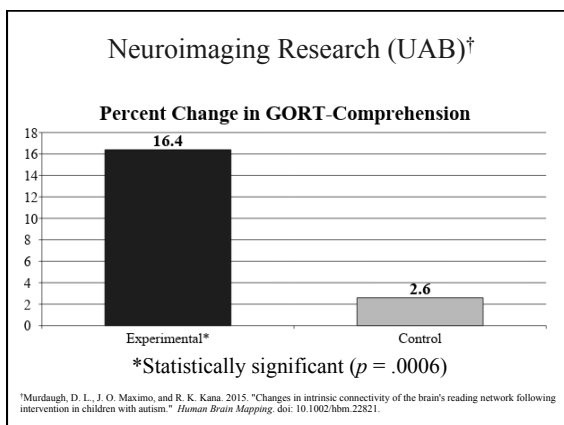
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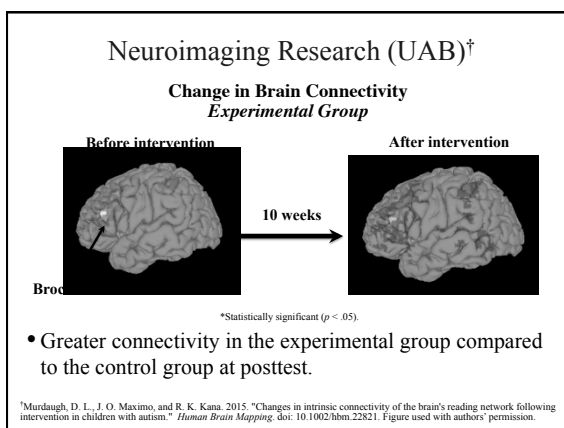
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**UAB Neuroimaging Research Results**

- "Overall, this study revealed widespread changes in functional connectivity of the brain's reading network as a result of intervention (V/V<sup>®</sup>) in children with ASD."
- "Thus, the findings of this study supports the principles of dual coding theory (Paivio 2007), and suggest the potential of a strength-based reading intervention (V/V<sup>®</sup>) in changing brain responses and facilitating better reading comprehension in ASD children."

Murdaugh, D. L., J. O. Maximo, and R. K. Kana. 2015. "Changes in intrinsic connectivity of the brain's reading network following intervention in children with autism." *Human Brain Mapping*. doi: 10.1002/hbm.22821.

Murdaugh, D. L., H. D. Deshpande, and R. K. Kana. 2015. "The Impact of Reading Intervention on Brain Responses Underlying Language in Children With Autism." *Autism Research*. doi: 10.1002/aur.1503.

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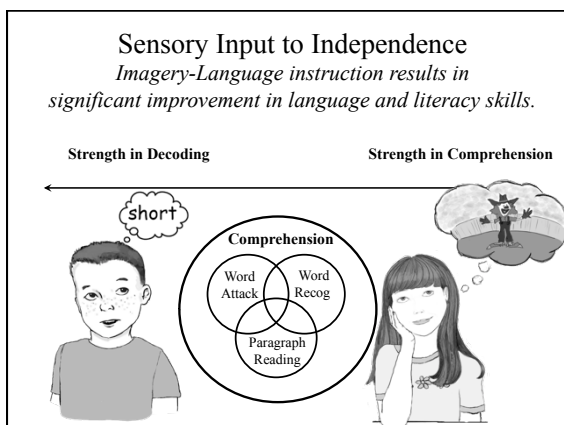
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### Summary

- The primary **cause** of weakness in language and literacy skills is at the sensory level.
- Reading has component parts and sensory-cognitive functions underlie each part.
- Two types of imagery—symbol and concept—can be developed and applied to language and literacy skills.
- Behavioral and neurological research validates the imagery-language connection resulting in changes in brain structure for children identified as dyslexic or ASD.

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*"If we measure sensory-cognitive processing, differentiate the diagnosis, and provide instruction to develop the sensory input of imagery, students can become **independent** in language and literacy skills.*

*"It is inaccurate to suggest that a reading disability is a lifelong handicap that cannot be changed and cured. If the brain can change, the behaviors can change."*

~ Nanci Bell

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