

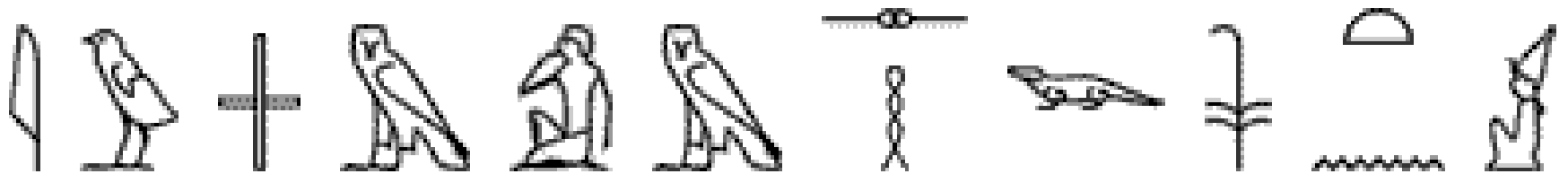
**The diagnosis and treatment of  
reading disorders:  
The role of working memory**

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# Disclosure statement

I have no financial interests or commercial relationships to disclose.

Employer: University of Western Sydney



Egypt, ~ 5000ya



China ~ 4000ya



Indus Valley ~ 3000ya



Maya ~ 2300ya

# Developmental cognitive disorders

A taxonomy of common conditions

# Orton (1937)

- developmental alexia
- developmental agraphia
- developmental word deafness
- developmental motor aphasia
- abnormal clumsiness
- stuttering

# Developmental cognitive disorders

- intellectual disability
- sensory impairments
  - visual impairment
  - auditory impairment
- motor disorders
- learning disorders
  - language disorders
  - dyslexias (reading disorders)
  - dysgraphias (spelling - writing disorders)
  - dyscalculias (arithmetic disorders)
- attention-deficit hyperactivity disorder
- autistic spectrum disorders
- other disorders

# Diagnosis

The role of identifying cognitive variables

**Observation**

**Questionnaires**

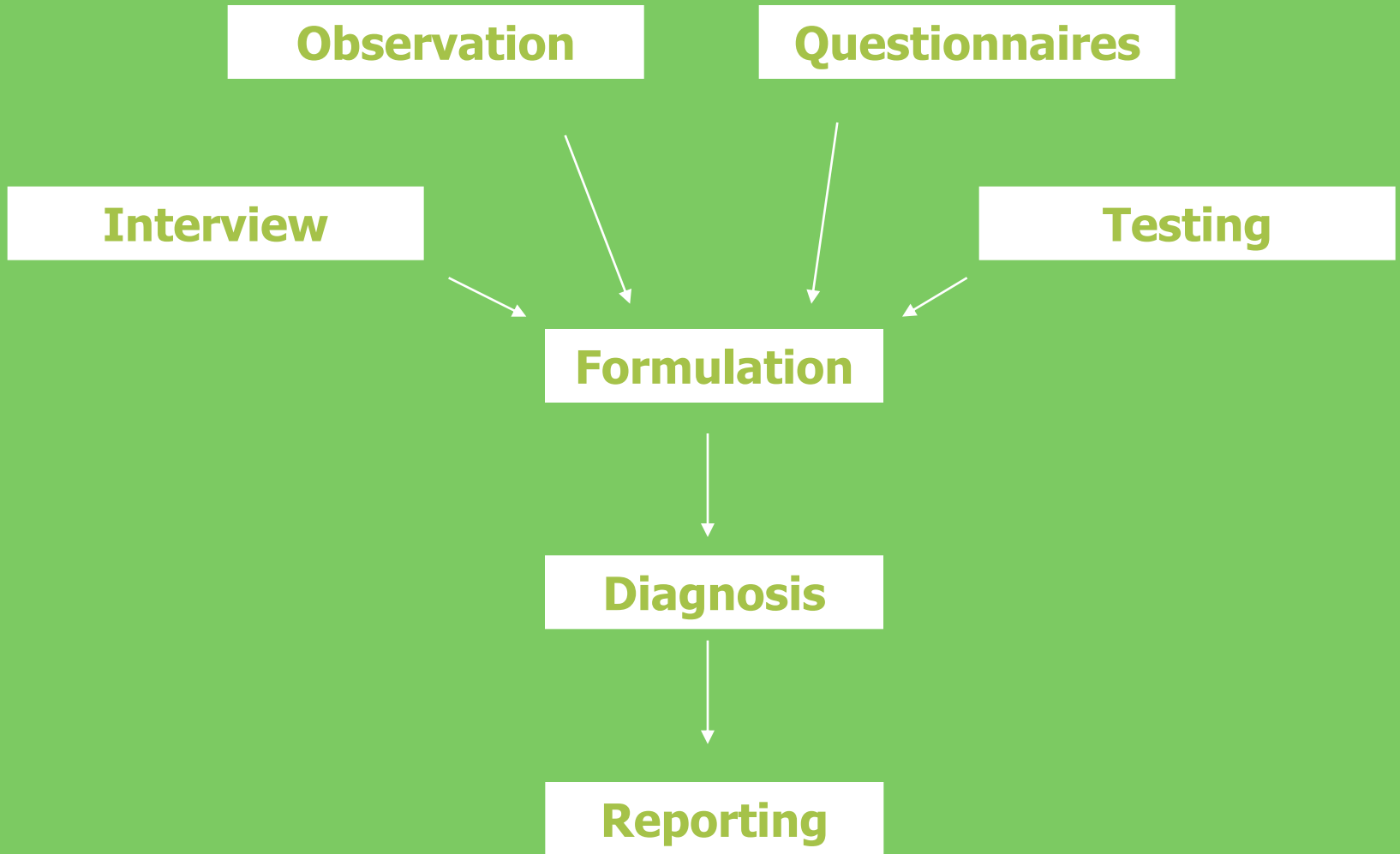
**Interview**

**Testing**

**Formulation**

**Diagnosis**

**Reporting**



# Competencies

1. theory of cognition

# Cognitive systems

- perceptual systems
- motor functions
- language
- memory
- spatial processing
- attention & executive functions
- quantitative
- social cognition

# Competencies

1. theory of cognition
2. psychological assessment
  - test administration and interpretation
  - psychometrics

# Tests

- intelligence
- language
- reading, spelling and writing
- arithmetic
- memory
- spatial abilities
- executive functions

# Test knowledge

- normative data
- psychometrics
  - reliability
  - validity
- administration & scoring
- interpretation

# Competencies

1. theory of cognition
2. psychological assessment
  - test administration and interpretation
  - psychometrics
3. knowledge of common disorders
  - cognitive profile
  - epidemiology

# Developmental cognitive disorders

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# Developmental dyslexia

The nature of reading disorders

“Dyslexia is a specific learning disability that is neurobiological in origin. It is characterized by difficulties with accurate and/or fluent word recognition and by poor spelling and decoding abilities. 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 may include problems in reading, comprehension and reduced reading experience that can impede growth of vocabulary and background knowledge.”

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# Specificity

- the child with a LD has a deficit in cognitive functioning which is specific to one domain, such that deficits do not extend to other areas of cognitive functioning
- e.g., the child with dyslexia has deficits specific to reading, which do not extend to other cognitive functions

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# Neurobiology

- increased prevalence within families
- genetic studies
- neuropathology
- neuroimaging

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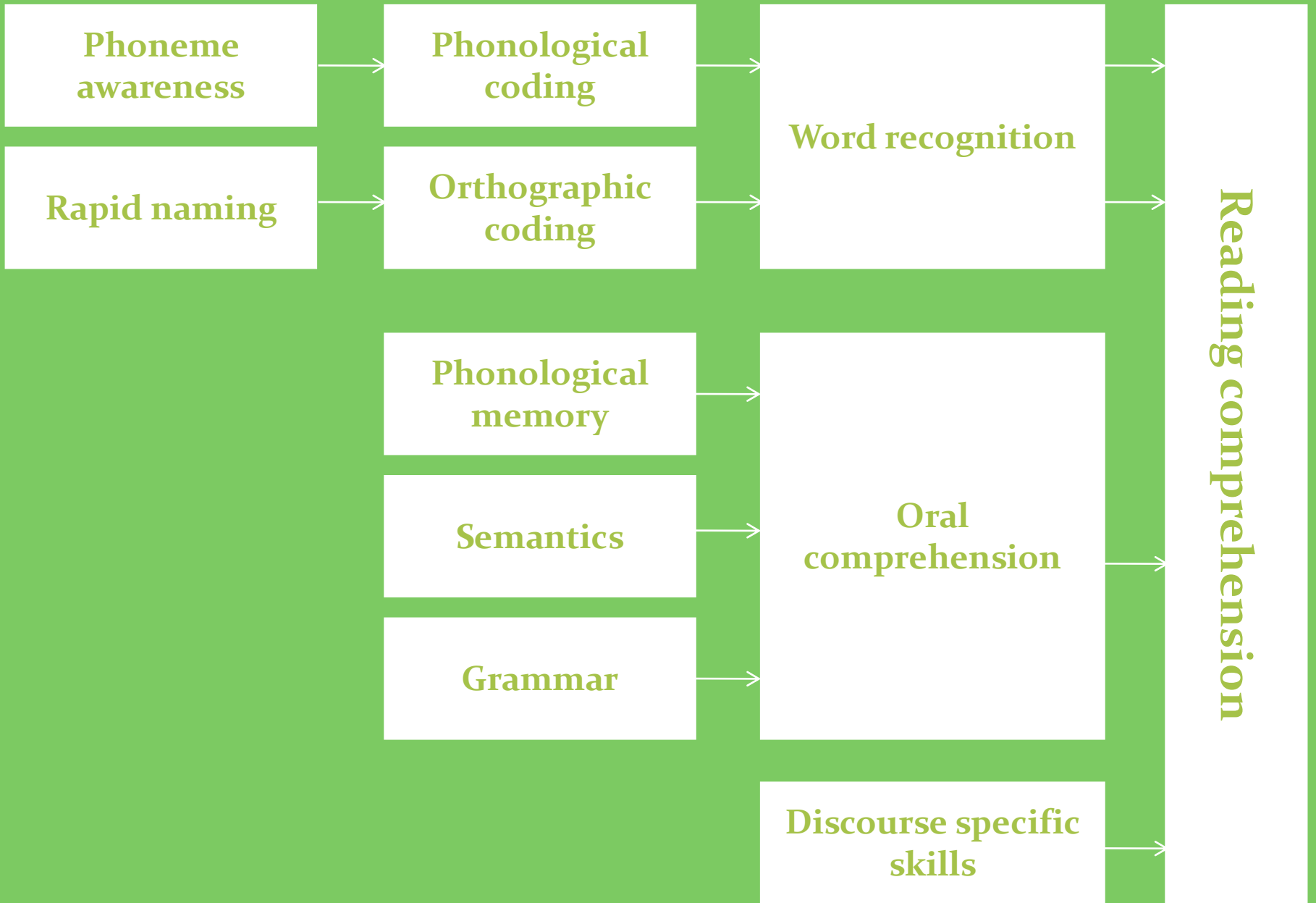
**Phonological  
decoding**



**Word  
recognition**



**Reading  
comprehension**



“Dyslexia is a specific learning disability that is neurobiological in origin. It is characterized by difficulties with accurate and/or fluent word recognition and by poor spelling and decoding abilities. **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 may include problems in reading, comprehension and reduced reading experience that can impede growth of vocabulary and background knowledge.”

# Theories

- intelligence
- visual perception
- auditory perception
- phonological processes
- cerebellar deficit

# Phonological impairment

- children with dyslexia have deficits in phonological aspects of language and working memory
- these deficits underlie poor development of reading, and deficits in certain other aspects of cognitive functioning

**Visuo-spatial  
sketchpad**

**Central  
executive**

**Phonological  
loop**



Speech input



Non-speech input



**Phonological  
store**

**Articulatory  
rehearsal**



# Dyslexia

- primary deficits
  - phonology / working memory
- secondary deficits
  - reading
  - spelling
  - writing
  - verbal fluency
  - verbal learning
  - acquired verbal knowledge

# Dyslexia and SLI

- poor decoding
  - phonology
  - “specific reading disorder”
- poor comprehension
  - grammar
  - “reading disorder - poor comprehender”
- broad deficits
  - phonology, grammar, semantics
  - “SLI” or developmental language disorder

		language disorder	“poor comprehender”	reading disorder
oral language	phonology	x	o	x
	grammar	x	x	o
	semantics	x	x	
	pragmatics	x	x	
written language	graph-phon conversion	x		x
	word recognition	x		x
	text comprehension	x	x	x
	spelling	x		x
	writing	x	x	x
memory	verbal working memory	x		x
	verbal learning	x	x	
crystallised	general knowledge	x	x	x
quantitative	arithmetic	x	x	x

# Identification

# Early identification

- importance of identifying those children who skills are weaker than peers
  - ~ 8% children are slow to develop these skills
  - ~ 2% significant and lifelong difficulties
- intervention before Year 2 maximises outcome

# Test selection: optimal

- WISC-IV / WPPSI-III (or SB-5)
- WIAT-II (reading, spelling, arithmetic)
- CELF-4 (if concerns over language)
- BASC-2 / CBCL / CBRS
- ABAS-2 (if low IQ)
- Conners-3 (if query re ADHD)
- SSRS (if query re social functioning)
- ADI-R, ADOS, SCQ (if query re ASD)
- BRIEF (if query re executive functions)

# Test selection: minimum

- WISC-IV
- WIAT-II (reading subtests)
- BASC-2 / CBCL / CBRS

# Case 28

VC	110	RLI	115
PR	121	ELI	93
WM	83	LCI	110
PS	91	LSI	98
FS	105	CLS	98

# Case 28

WR 80

MR 108

PD 91

NO 89

RC 98

SP 87

# Interventions

What works?

# Treatment

- training in phonological skills improves phonological skills and reading in non-dyslexic children
- however more limited improvements in children with dyslexia
- severity of phonological deficit predicts progress



# Coloured lenses

NARA	number	mean effect size
Accuracy	4	0.068
Comprehension	17	- 0.093
Rate	15	0.114
Total	15	0.127

# Coloured lenses

WRMT	number	mean effect size
Letter identification	11	- 0.107
Word Recognition	10	- 0.101
Comprehension	11	0.105
Rate	13	0.015

“The etiology of [learning] difficulties is multifactorial, reflecting genetic influences and abnormalities of brain structure and function... Visual problems are rarely responsible for learning difficulties. No scientific evidence exists for the efficacy of eye exercises ("vision therapy") or the use of special tinted lenses in the remediation of these complex pediatric neurological conditions.”

A Joint Statement of the American Academy of Pediatrics,  
American Association for Pediatric Ophthalmology and Strabismus,  
and American Academy of Ophthalmology

# Sensory integration therapy

“... reveal absolutely no unique benefits, regarding any of the tested outcome areas, conveyed by SI therapy to the children with learning disabilities (and purported SI dysfunction) who served as subjects in those studies... the current fund of research findings may well be sufficient to declare SI therapy not merely an unproven, but a demonstrably ineffective primary or adjunctive remedial treatment for learning disabilities and other disorders”

Hoehn & Baumeister (1994)

# Sensory-motor interventions

	number	mean effect size
Word recognition	36	- 0.02
Comprehension	33	- 0.06
Oral reading	17	- 0.04
Vocabulary	25	- 0.01
Speed/rate	8	- 0.04

“You simply can’t kill it. It simply bides its time in exile after being dislodged by one of history’s periodic attacks upon it and then returns, wearing disguises or carrying new *noms de plume*, as it were, but consisting of the same old ideas doing business in the same old way”.

Mann (1979)



# Diagnoses

		<i>n</i>	%
• language disorder		8	6%
• reading disorder	6	4%	
• intellectual disability	2	1%	
• “low IQ” ( $\leq 85$ )	20	14%	
• average IQ (86-100)	36	26%	
• 2 <sup>nd</sup> quartile (101-119)	40	29%	
• 1 <sup>st</sup> quartile (120+)	28	20%	

VC < PR (10+)

Sensitivity	.25
Specificity	.70
PPP	.05
NPP	.94

*Does low VC and low WM predict the presence of a language disorder?*

VC, WM  $\leq 91$  and VC < PR

Sensitivity	1.00
Specificity	1.00
PPP	1.00
NPP	1.00

# Guidelines

- if both VC and WM  $\leq 91$  and PR > VC, probable language disorder (but consider exclusions)
- if FSIQ 80-85, don't diagnose language disorder unless > 15-20 points between FSIQ and CLS
- if FSIQ < 80, don't diagnose a (specific) language disorder



# Information for diagnosis

- cognitive functioning
  - language
  - intelligence
  - academic achievement
  - specific cognitive functions
- behavioural and emotional functioning
  - behavioural problems
  - mood
- social functioning
  - social interaction
  - social understanding

# DSM-5 - proposed

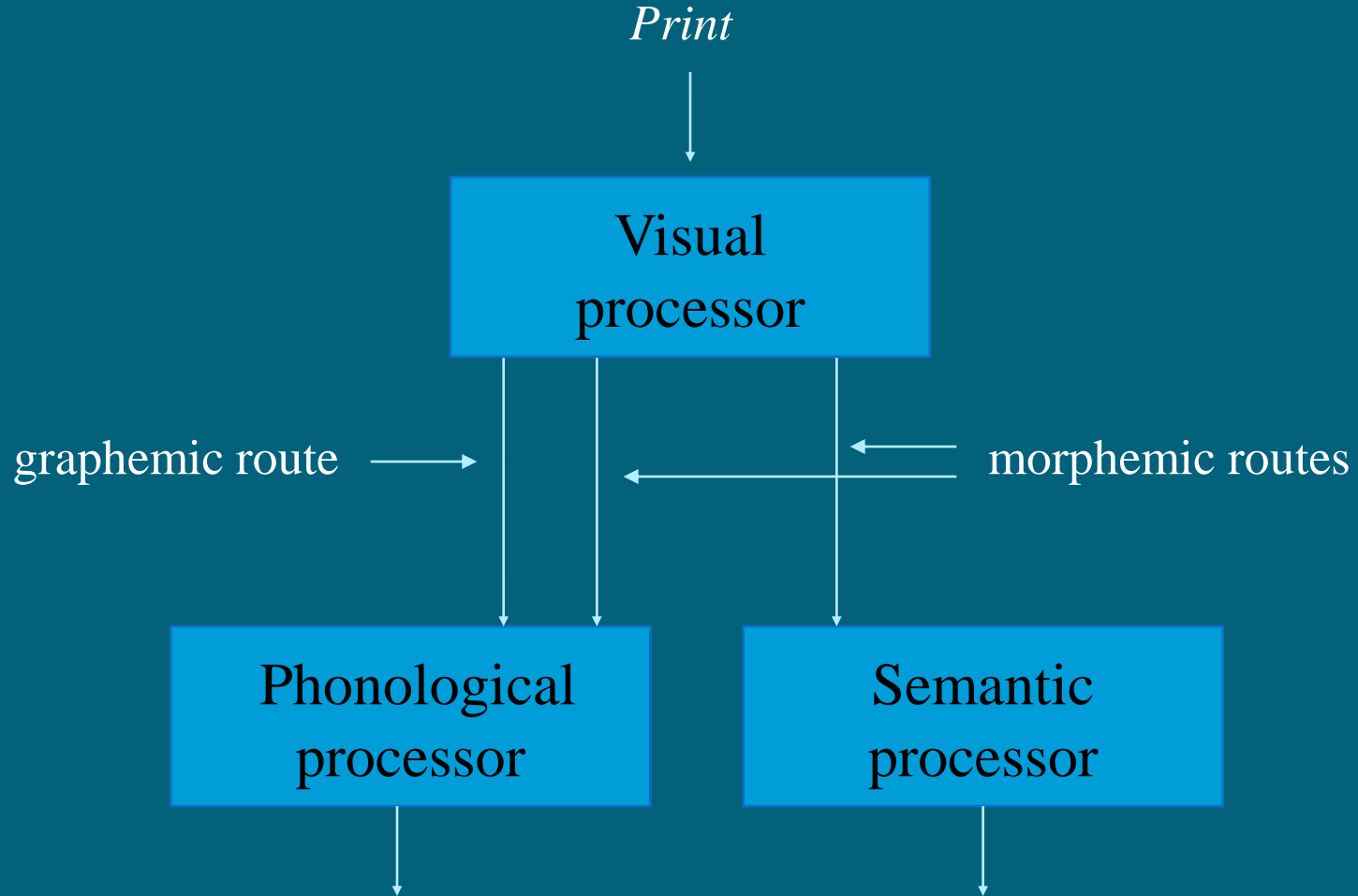
- Learning Disabilities (new category)
  - Dyslexia
  - Dyscalculia
- Communication Disorders (no change)
  - Expressive Language Disorder
  - Mixed Receptive-Expressive Language Disorder
  - Phonological Disorder
  - Stuttering
  - Communication Disorder NOS

# DSM-5 - proposed

- Autistic Spectrum Disorder (revised)
- Attention-Deficit and Disruptive Disorders
  - ADHD (nature of changes uncertain)
  - ADHD NOS
- Developmental Coordination Disorder (minor changes)

# Overview

- what are the key features of a reading disorder?
- how does a reading disorder relate to working memory and other areas of cognitive functioning?
- how is a reading disorder identified?
- how is a reading disorder treated?



Seymour (1990)

*Print*

Abstract Letter  
Identification

Orthographic  
Input Lexicon

Semantic  
System

Phonological  
Output Lexicon

Phonological  
Output Buffer

*Speech*

Phonological  
decoding

