

# Acalculia Classifications

- Ardila and Rosselli's (2002) classification system divides acalculia into two camps depending on the reason for arithmetic difficulties: *Primary Acalculia* and *Secondary Acalculia*
- Overlap can exist between these subtypes (Ardila and Rosselli, 2002)

Ardila and Rosselli (2002) Acalculia Classification System	
<b><u>Primary Acalculia</u></b> Anarithmetria	<b><u>Secondary Acalculias</u></b>
	Aphasic Acalculia
	Alexic Acalculia
	Agraphic Acalculia
	Dysexecutive (Frontal) Acalculia
	Spatial Acalculia

# Primary Acalculia (Anarithmetria)



- Primary Acalculia (also known as Anarithmetria) is characterized by an impairment in understanding how the numerical system is organized
  - Fundamental calculation deficit found in both oral and written modalities
- Associated with left posterior parietal lesions, especially the intraparietal sulcus and left angular gyrus (Ardila & Rosselli, 2002; Dehaene et al., 2004; Grimaldi & Jeanmonod, 2018)
- Symptoms include difficulties with:
  - Numerical concepts
  - Understanding number quantity and number positions relative to each other
  - Performing arithmetic sequences (e.g., count by 2)
  - Arithmetic symbol understanding
  - Tactile enumeration (Cohen et al., 2018)
- Can be present without language impairment, but is significantly correlated with aphasia (Basso et al., 2005)
  - Associated with “semantic aphasia” and with difficulties in understanding logical-grammatical relationships (Ardila & Rosselli, 2019)

# Aphasic Acalculia

- Characterized by calculation difficulties that arise from linguistic difficulties
- Types of errors can include:
  - Semantic errors (100 read as “ten”)
  - Syntax errors (difficulty understanding that *hundred* denotes different placements in “three hundred thousand, two hundred)
  - Morphological errors (15 read as “fifty”)
  - Lexicalization errors (163 written as 100603)
  - Decomposition errors (632 read as “sixty three, two)
- Calculation difficulties are different between fluent and nonfluent aphasias (Ardilo & Rosselli, 2002)
  - Broca’s aphasia encounters more difficulty with syntax of the arithmetical operations
  - Wernicke’s aphasia encounters more difficulty with lexical understanding
- Improvements seen in calculation parallel the improvements seen in language recovery (Basso, 2003)



# Alexic Acalculia



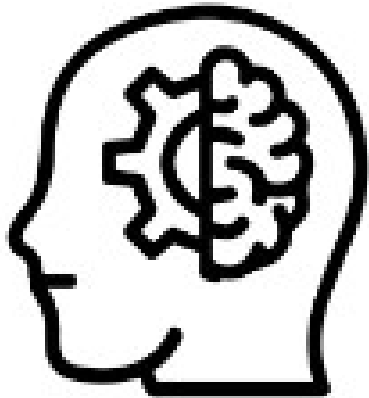
- Characterized by calculation difficulties that arise from reading difficulties
  - Typically, mental calculation skills will be stronger
- Digit-by-digit reading may be observed (359 is read as “three-five-nine”)
- Difficulty reading longer digit spans
- Some clients with visual integration difficulties may resort to kinetic writing (tracing number with finger on a surface or in the air)
  - Similar to how clients with pure alexia/letter-by-letter alexia may compensate

# Agraphic Acalculia

- Characterized by calculation difficulties that arise from writing difficulties
  - Typically, mental calculation skills will be stronger
- Difficulty will be observed in writing-to-dictation tasks and transcoding tasks
- Types of errors can include:
  - Number omissions
  - Fragmentation (25 is written as “20-5”)
  - Poorly formed writing due to motor impairment



# Dysexecutive/Frontal Acalculia



- Characterized by calculation difficulties that arise from executive functioning difficulties
- Attentional impairments will result in difficulties maintaining focus on task
- Preservation of numbers and more fundamental arithmetic skills may be observed, however complex mathematical concepts will be significantly impacted

# Spatial Acalculia

- Characterized by calculation difficulties that arise from spatial neglect
- Mental calculation skills are superior to calculation involving reading or writing
- Types of errors can include:
  - Exclusive overuse of one half of the page
  - Digit iterations (227 becomes 22277)
  - Feature iterations (e.g., extra loops are written for the number 3)
  - Difficulty maintaining horizontal direction when writing
  - Spatial disorganization
  - Writing over segments of the page that have already been used

