

# **Executive Function**

Jennifer Petrich, PhD



# Outline

- Review of executive functions (EF) and neurobiology of impaired EF
- How impaired EF manifests in dyslexic students
- How to address these deficits when working to remediate a dyslexic student



# What is Executive Function?

- A *set* of cognitive abilities that ***control and regulate other abilities and behaviors.***
- Executive functions include the ability to:
  - initiate behaviors (***task initiation***)
  - delay or prevent inappropriate responses (***inhibition***)
  - monitor, change or stop behaviors (***regulation***)
  - manage interference (***cognitive flexibility***)
  - plan future behavior when faced with novel tasks and situation (***reconstitution***)
- These skills occur on a ***continuum.***



# Functional Categorization

## ***Cognitive Skills***

- Working Memory
- Planning/Prioritization
- Organization
- Time Management
- Metacognition

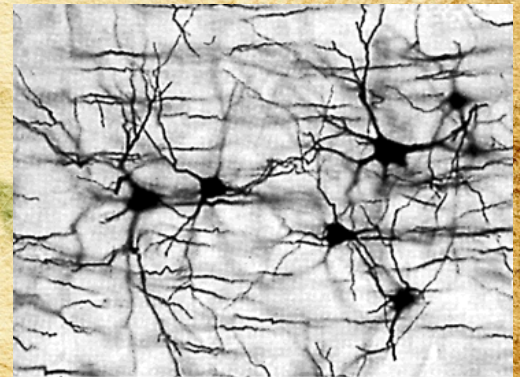
## ***Behavioral Skills***

- Response Inhibition
- Emotional Control
- Sustained Attention
- Task Initiation
- Goal-directed Persistence
- Flexibility



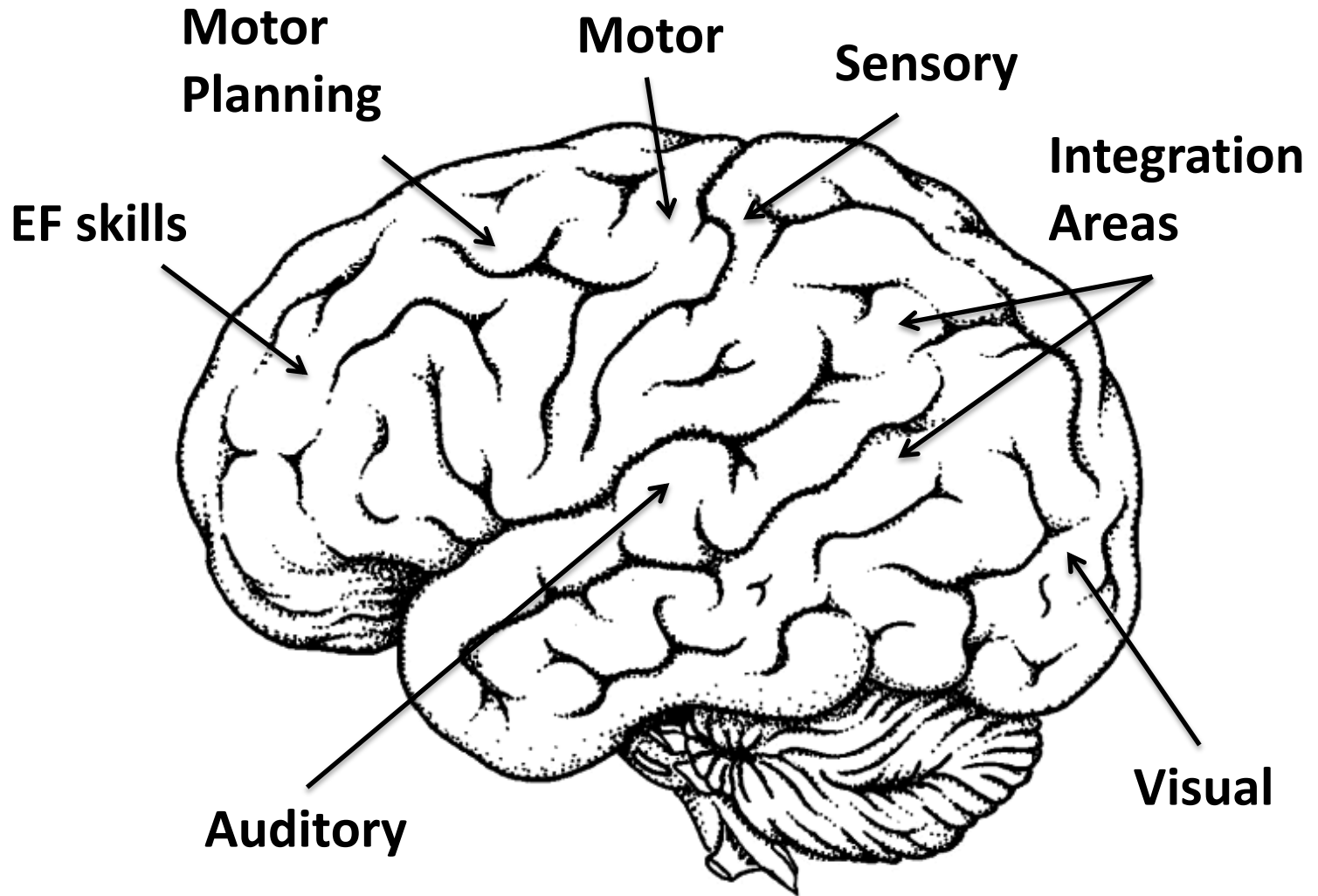
# Learning

- Learning by experience
  - Use it or Lose it
- Neural networks
- Multi-sensory instruction
  - Sensory
  - Motor
  - Auditory
  - Visual





# Brain Areas





# Foundational Functions

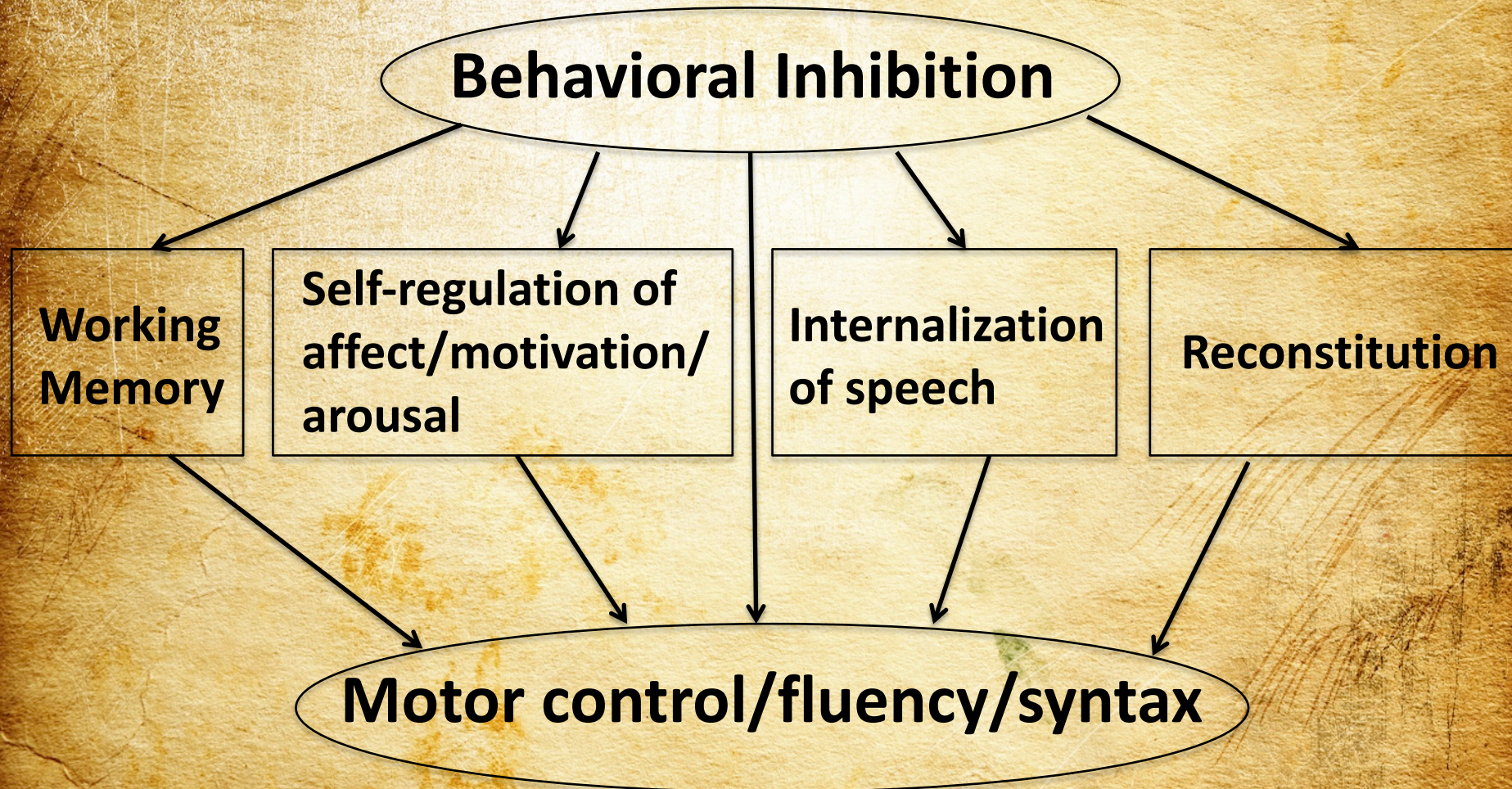
**Inhibition**

**Working Memory**

**Shifting/  
Cognitive Flexibility**



# Barkley's Hybrid Model





# General Accommodations

- Step-by-step instructions
- Written directions with oral instructions whenever possible
- Use visual organizational aids, visual schedules, and alarms
- Plan and structure transition times and shifts in activities.



# **Executive Function and Dyslexia**



# Internal Language

- Also called “self-talk”, “internal speech”, etc.
- Impaired in students with poor phonological processing/working memory
- Deficit results in “islands of knowledge”
- Required for:
  - following multi-step directions (recipe)
  - learning new motor tasks (tying a shoe, swimming)
  - copying visuo-motor input (letters; sign language)
  - establishing neural networks of activation (domino effect, e.g. NYC, right triangle)



# Creating Internal Language

- Increase phonological working memory
- Practice verbalizing externally
- Move from external to internal language using six steps:
  - I say, I do (modeling)
  - We say, we do
  - I say, you do (with verbalizing; say before doing)
  - You say, I do (follow instructions exactly)
  - You say, you do (external)
  - You say, you do (internal)



# Using Internal Language

- Practice with physical tasks (e.g. shoe tying)
- Practice imagery tasks (getting ready in the a.m.)
- Drawing on paper
- Use with other modalities to store information (language, pictures, gestures, concepts)
- Problem-solving
- Encoding new information



# **Applying Internal Language: Reading and Spelling**



# Applying Internal Language: Reading and Spelling

- Overview

- History of spoken English
- Writing systems are based on meaning not speech
- Homophone Principle
- Elements and Suffixing Conventions
- Scientific Investigation (SWI process)



# Scientific Inquiry

## Written Language

- Investigate semantics (meaning)
- Hypothesize about morphology (form/structure)
- Test your hypothesis using etymology (history and relatives)
- Investigate orthographic phonology
- Revise your hypothesis as needed



# Scientific Inquiry

- Four questions
  - What does it **mean**?
  - How is it **built**?
  - What are its **relatives**?
  - What segments of **pronunciation** are important for meaning?
- Model
  - Verbalize thought process/questions
  - Use signs/gestures
- Abstract out of the process (use visual cues if necessary)



# Scientific Inquiry

## Spellings to ponder

- Why is there a <g> in sign or a <w> in <two>?
- Why do we spell [dɪfrənt] <different> and not <difrent>
- Why do we not replace the <e> at the end of <change> in <changeable>?



# **Applying Internal Language: Math**



# Applying Internal Language: Math

- Overview
  - Number Sense
  - Operations/Math Facts
  - Word Problems
  - Fractions, Decimals, Percents
  - Algebra



# Applying Internal Language: Math

- Number Sense

- Concrete to imagery (manipulatives, number line, ASL numbers)
- Investigate and Verbalize (number, count, cardinal, ordinal, magnitude)

- Operations/Math Facts

- Concrete to Imagery (manipulatives, symbols, signs/gestures)
- Investigate and Verbalize (addition, subtraction, multiplication, division)
- Use what you know to figure out what you don't know



# Applying Internal Language: Math

- Word Problems
  - Concrete to imagery (manipulatives, signs)
  - What do we know, what do we want to know, how do we figure it out?
- Fractions, Decimals, Percents
  - Concrete to Imagery (manipulatives, symbols, signs/gestures)
  - Investigate and Verbalize (fractions, decimals, percents)



# Applying Internal Language: Math

- Algebra
  - Conceptual understanding
  - Investigate and Verbalize
    - Evaluate the expression
    - Isolate the variable
    - Solve the equation
    - Plot the ordered pair
    - Linear



# Math Example: Subtraction

- Conceptual: Whole vs. Parts
  - Start with the whole
  - Take away the part (encode with sign/gesture)
  - Result = part taken away, amount that is left
- Investigate: subtraction → sub + **tract** + ion
  - *trahere* = to pull, draw
  - subtract = to take away, draw from below
- draw pictures, use gestures
- verbalize steps
- solve example problem



# **Applying Internal Language: Writing**



# Handwriting

- Importance of writing by hand
  - Motor memory
  - Grapheme encoding
  - Different from typing
- Whole-part-whole thinking
- Use EF steps
  - Model
  - Verbalize
  - Practice



# Grammar

- Metacognition
- Form vs. Function
  - Parts of speech
  - Function in a sentence
- Importance of learning a 2nd language
- Whole-part-whole thinking
- Use EF steps



# Composition

- Use concrete cues (e.g. CHOPS)
- Break into steps
  - Outline
  - Rough Draft
  - Editing
- Whole-part-whole thinking
  - Word
  - Sentences
  - Paragraphs
- Use EF steps
  - Model, Verbalize, Practice



# Summary

**EF: input → inhibition → processing → output**

**Break down larger concepts and model language and thought process/language**

**Importance of verbalization/internal language**

**Use resources and multiple modalities to anchor language and concepts**

**Practice, practice, practice!**



# Resources

## ***Smart But Scattered***

Peg Dawson, EdD, and Richard Guare, PhD

## ***Executive Skills in Children and Adolescents***

Peg Dawson, EdD, and Richard Guare, PhD

## ***Promoting Executive Function in the Classroom***

Lynn Meltzer