Executive Functions and Language:
Current Insights & Future Implications

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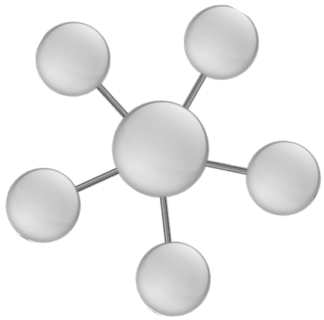
Agenda

- **Defining Executive Functions**
- **Language & Executive Functions**
- **Assessment**
- **Treatment**
- **How might we proceed into the future?**

Models of EXECUTIVE FUNCTIONS



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The Difficulty of Operationalizing Executive Functions

- What *are* they?
  - Processes?
  - Cognitive abilities?
  - Ability to problem solve?
- Inconsistent agreement of actual components
  - Attention? Working Memory?
  - Planning? Problem-Solving?
  - Inhibition? Initiation?
  - Shifting? Maintenance?
  - Self-monitoring? Self-regulation?
- Lack of one single definition
  - What they ARE
  - What they DO
  - HOW they "do"
  - What happens when EFs are disrupted….

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Defining According to Cognitive & Metacognitive Processes

- Discrete, separate, yet inter-related components
- With foundational cognitive processes:
  - **Working memory (visual and verbal)**
  - **Attention (and components therein)**
  - **Inhibition**
- **And distinct EF components:**
  - **Planning/organizing**
  - **Flexibility**
  - **Fluency**
  - **Initiation**
  - **Self-regulation**
    - *Pennington & Ozonoff, 1996*
    - *Anderson, 2002*
    - *Diamond, 2006; Thompson & Gathercole, 2006)*

How to define and evaluate these components?

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Defining EFs as Goal-Oriented Performance

- "**Those skills necessary for purposeful, goal-directed activity'**
  - *Anderson, 1998*
- **Future planning which is goal-oriented**, such as:
  - Collection & organization of relevant materials,
  - Development & execution of strategic plans
  - Use of feedback & modification of efforts
  - *Lezak, 1982, 1993*
- **Where the end goal is achieved**, given
  - Future planning
  - Holding plans or options in working memory
  - Inhibiting or initiating
  - Monitoring progress and shifting as necessary
  - *Henry & Bettenay, 2010*

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Defining EFs as a Supervisory Attentional System

- **Highly dependent upon ATTENTION**
  - **Routine responses to routine situations**
    - Are engaged *automatically*
    - Contention scheduling system assists in the application of these routine, over-learned responses
  - **Deliberate attention is required**
    - To inhibit these routine responses
    - To engage in inhibition and conscious control of responses or actions
    - To orchestrate the use of EF skills to generate a novel response to a novel situation
    - Thus allowing for goal-determination, planning, error recognition
    - And to avoid engaging in perseverative behaviors or responses
      - *Norman & Shallice, 1986; Shallice & Burgess, 1991, 1993*

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Defining EF as a Working Memory Model

- The **Central Executive**, conceptualizes a 'control system'
  - **Which is assisted and fostered essentially by working memory**
  - **Where working memory allows for the "simultaneous storage and manipulation of material"**
  - Where working memory capacity is limited
  - Where working memory is divided into sub-systems
    - **Central executive**
      - To control attention; select & direct incoming information for processing
      - To allow for the execution of 2 simultaneous tasks
      - As a bridge to the retrieval and holding of information from long-term memory
    - **Phonological loop**
    - **Visuo-spatial sketchpad**
    - *Baddeley, 2010*
    - *Baddeley & Hitch, 1974; Baddeley 1986, 1992, 1995, 1998*

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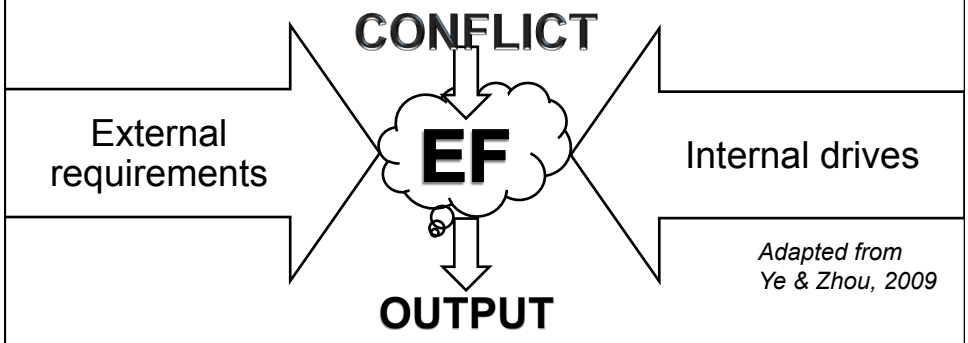
Defining EFs as Conflict Management

- Whereby EFs are "processes that monitor for the occurrence of conflicts in information processing**…..<u>evaluate current levels of conflicts and trigger compensatory adjustments</u>** of processing pathways."
  - *Ye & Zhou, 2009*



Adapted from Ye & Zhou, 2009

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Defining EFs as Response Control

- Defined as the **capacity to control responses** in the face of environmental demands, shifting requirements, or internal drives
  - "…intentions **capable of controlling subsequent conscious behaviors**"
    - *Luria, 1973*
  - "those capacities that enable …. independent, purposive, self-serving behavior successfully"
    - *Lezak, 1983*
  - "enable …. appropriate behaviors under novel circumstances in a developmental progression"
    - *Marlowe, 2000*
  - *"…*distinct processes that converge on a general **concept of control functions."**
    - *Stuss & Alexander, 2000*

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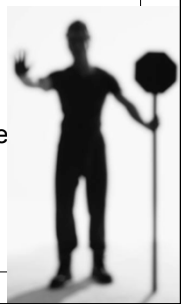
Defining EFs as Behavioral Inhibition

- **Inhibition**
  - **Of the prepotent response**
    - Sufficient to defer gratification or response to a future point in time
  - **Cessation of an ongoing response**
    - To allow for planning, decision-making, anticipation
  - **Interference management**
    - Prevent other competing events or stimuli from interfering with the process of inhibition
- Time-span
  - The application of inhibition in the present,
  - To future-based achievement
  - Delay a response in moment of conflict…
- Self-regulation
  - Generate novel responses in a purposeful, intentional manne
- Future outcomes
  - Minimize risk or negative consequences
  - *Barkley EF Def, 1997, p. 68*



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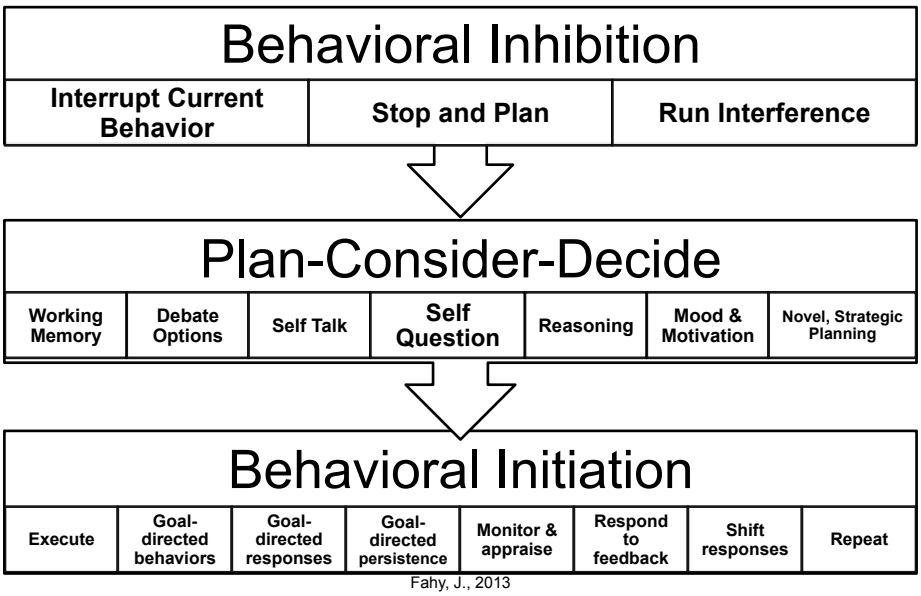
Adaptation of Barkley's model (Barkley (1997)



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Barkley's 2012 Model: Executive Functions = Self-Regulation

"the use of self-directed actions so as to choose goals and to select, enact, and sustain actions across time toward those goals usually in the context of others often relying on social and cultural means for the maximization of one's longer-term welfare as the person defines that to be."

- *(Barkley, p. 176)*

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Barkley's 2012 Model: Executive Functions = Self-Regulation

- "the use of self-directed actions
- ***so as to choose goals***
- and to ***select, enact, and sustain actions***
- ***across time toward those goals***
- usually in the ***context of others***
- often ***relying on social and cultural means***
- for the ***maximization of one's longer-term welfare***
- *as the person defines that to be*."
  - *(Barkley, p. 176)*

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Barkley's 2012 Model: Executive Functions = Self-Regulation

- Multiple self-regulatory components of EFs
  - **Self-directed atttention**
    - Via multiple attentional networks
    - Resulting in self-directed awareness
  - **Self-directed restraint**
    - Via inhibition, over the span of time or physical distance
  - **Self-directed mental representations of events**
    - Resulting in thought-ideas
  - **Self-directed language**
    - Resulting in verbalized thought-ideas
  - **Self-directed emotional tone & motivational drive**
    - Resulting in the capacity to care, or to evaluate
  - **Self-directed novel reconstitution, using language or visual information, to generate ideas, solutions, options**
    - Resulting in the capacity to solve problems, such as we hope to achieve for long-term outcomes within our life, as they are important to us
  -

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EFs Defined as Self-Control and Realization

- **EFs as a means to control and realize the self**
  - From levels of alertness and attention
    - To engaged and deliberate perception of sensation, mindful of action and emotion
    - **To approach self-realization and self-determination**
  - Which brings along heightened self-awareness and analysis
    - To the extent that **one engages in long-term goal planning** and insight
  - And beyond,
    - To more **philosophical levels of insight into the integration of mind and body**
    - Eventually perceiving one's purpose in the **cosmic order of things**
      - *McCloskey, 2009*

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‘becoming a master of one’s own behavior’

As opposed to being ‘slave to the environment’

Vygotsky, 1978

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EFs are NOT the same thing as knowledge or intellect.

EFs are a complex network of interwoven metacognitive skills.

EFs emerge & mature over the course of about 25 years.

EFs interact with language to support internalization of rules, problem solving, and self-regulation.

EFs interact w/social perception, cultural networks, & cultural goals, to support social behavior.

EFs help organize and apply knowledge to support personal, academic, vocational, and social success.

EFs are often an assumed skill in many environments, such as schools, or even within the legal system.

Avoid the oversimplified definition of EFs being “prefrontal”

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Components of EXECUTIVE FUNCTIONS

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Why navigate such a complex network?

- Diagnostic challenges—What am I evaluating?
- Treatment-planning needs—What needs work?
- Quantifying observational insight—What's "impaired"?
- Replicating research—which we need much more of

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FOUNDATIONAL COGNITIVE PROCESSES?

- Three basic process of cognition necessary and fundamental to EFs:
  - **Attention**
  - **Inhibition**
  - **Working Memory**
  - *Diamond, 2006; Rueda et al. 2011*
- Deficits in these cognitive skills will likely contribute to impairment in the capacity to engage components of EFs

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ATTENTION

- May be defined as:
  - **"A limited capacity processing system that can flexibly allocate resources.."**
- Necessary to:
  - Detect incoming information
  - Allow for the engagement of other cognitive processes
  - In order to interpret, associate, plan, and initiate deliberate responses
    - *Kurland, 2011, ASHA*
- A complex process……..

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ATTENTION—Multidimensional

- Elements of attention in a hierarchy (just one model)
- Focused attention
  - Briefly direct attention to stimuli, without sustaining
- Sustained attention
  - Capacity to maintain attention, vigilance over time
- Selective attention
  - Capacity to maintain attention over time, to relevant or necessary stimuli, while screening out distractors
- Alternating attention
  - Capacity to shift sustained attentional efforts, to relevant or necessary stimuli, between specific tasks or demands
- Divided attention
  - Capacity to successfully sustain attention to multiple tasks or stimuli, simultaneously, while ignoring or filtering out distraction
- *Sohlberg & Mateer, 2001*

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ATTENTION—Multiple Networks

- Likely the synthesis of multiple neural networks:
  - Difficult to separate from working memory
  - Difficult to separate from EFs, in general
  - "types" of attention extend into both visual and verbal
- Overlapping networks may include:
  - Orienting
    - Thalamic and posterior parietal structures engage focused attention
  - Mediating
    - Anterior cingulate, prefrontal cortex structures pick up the deliberate vigilance, selectivity, flexibility, & monitoring of attention
  - Alerting
    - A more primitive network? A sort of "baseline vigilance" of being prepared to attend, relying upon brainstem structures
    - *Kurland, 2011, ASHA*

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INHIBITION

- Defined as:
  - **The capacity to self-stop responses, actions, or behaviors until such time that those actions are appropriate or required**
  - **The capacity to withhold, entirely, responses, actions, or behaviors that are inappropriate, or destructive**
  - **THE fundamental, initial element of EFs (Barkley)**
  - **THE EF component which allows for self-regulation, in general**
- Provides for
  - Time to plan strategically
  - Time to consider all potential options
  - Time to gather all required information or materials
  - The basis for delayed gratification, in order to achieve a greater outcome later (not now)

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WORKING MEMORY

- Defined as:
  - **'the ability to keep an item of information in mind in the absence of an external cue and utilize that information to direct an impending response'**
    - *Goldman-Rakic, 1995*
  - "Working memory refers to the system or systems that are assumed to be necessary in order to keep things in mind while performing complex tasks such as reasoning, comprehension and learning"
    - *Baddeley, 2010*
  - **Mental white board**
    - **Where messages can be held in mind for consideration, comparison, planning, or self-monitoring**
    - **(among other things)**
  - An immediate mental storage space
    - With limited storage capacity

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WORKING MEMORY

- Reliant upon:
  - Attention
  - Inhibition
  - Interference control
- Allows for:
  - **Retrieve information or experiences from LTM**
  - **Hold knowledge of the present situation in mind**
  - **Manipulate present and past information in working memory**
  - **Generate plans**
  - **Think in future tense**
  - **Consider and determine plans**
- May also allow for
  - Perception of time-passage

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COMMONLY RECOGNIZED COMPONENTS OF EF

1. Goal (Intention) Determination
2. Planning & Organization
3. Initiation & Persistence
4. Flexibility
5. Self-Monitoring & Regulation

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GOAL DETERMINATION

- Defined as:
  - The recognition of a need or desire to act
  - The engagement of a behavioral determination
  - The determination to use an old routine
  - Or to develop a new plan
- Is dependent upon:
  - Sophisticated language, verbal reasoning, and abstract thinking
  - The capacity to predict outcomes and anticipate consequences
  - The capacity to judge whether to do X now, later, or not at all
- Expectations for goal-determination, through development:
  - Externally-controlled when young (RULES)
  - And becomes increasingly internally-controlled with typical development and maturity

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PLANNING & ORGANIZATION

- Defined as:
  - *Approaches to demands*
  - Sufficient to generate relevant approaches for situation, or context
  - Sufficient to generate strategic approaches for given purpose
  - Designed to meet the intended outcome
  - Responsive to time constraints or changes in requirements
- Is dependent upon:
  - The ability to think temporally in order to sequence information
  - The ability to reason in order to recognize how materials or information interact with one another
  - The ability to identify and locate materials or information
  - The ability to work flexibly with what is on hand
- Expectations for development:
  - Proceed from simple & random, to complex and deliberate
  - By late teen years, able to engage in multiple strategic efforts

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INITIATION &PERSISTENCE

- Defined as:
  - The engagement and maintenance of *behavioral movement*
  - The ability to motorically initiate efforts, behaviors, or responses
  - The ability to SELF-start, rather than sitting around
  - The ability to engage in time-sensitive initiation, NOW, not later (or never)
  - The ability to motorically maintain efforts, behaviors, or responses, until the desired outcome is attained (persist)
  - The ability to continually re-start efforts as/if needed
- Dependent upon:
  - Ability to break large tasks into smaller parts, through reasoning and language
  - Ability to overcome lack of motivation or feelings of being overwhelmed, in order to self-start
  - Ability to sustain attention in the face of distraction
- Expectations for development:
  - Attentional systems relative mature by mid-teens

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FLEXIBILITY

- Flexibility is:
  - The capacity to disengage one particular set of behavioral responses,
  - In order to allow the determination of another set of behavioral responses,
  - Followed by the initiation of the second set of behavior responses
- Why?
  - Because success will always require change
  - Life is not static, predictable, or entirely manageable
  - Adaptation is, therefore, key
- Flexibility requires:
  - The re-engagement of the EF cycle, including goal-determination, and then planning & organization, followed once again by initiation
  - The capacity to generate yet ANOTHER set of plans and steps is highly dependent upon divergent reasoning

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SELF-REGULATION

- Defined as:
  - The continual act of ***monitoring*** one's efforts, actions, and responses
  - The continual act of ***appraising*** one's efforts, actions, and responses
  - The continual act of ***recognizing failure, in the moment that it occurs***
  - ***Thus supporting the capacity to shift efforts in order to meet current demands or expectations***
  - May also regulate ***drive and motivation***
    - *Lang, 1995*

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SELF-REGULATION

- **Dependent upon:**
  - Attention (to notice change in environment or demands)
  - Working memory (to retain insight)
  - Inhibition (to self-stop failed efforts)
  - Perception & interpretation of feedback, both overt & implied
  - **Capacity to re-engage EF skills, once again in an attempt to meet requirements or expectations**
    - Recognize new goal
    - Inhibit current efforts
    - Generate potential plans
    - Evaluate plans…….

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PURPOSE OF IT ALL

SELF-DETERMINATION
SELF-REALIZATION
ENVIRONMENTAL MANAGMENT

Effect control over knowledge, learning, social insight
Develop capacity to make 'good' decisions
Acquire ability to get things done, on time
Adapt and respond to unexpected, unplanned problems
Acquire ability to display social competence
Develop capacity to gain life wisdom
Discern what is true, right, or lasting
Perhaps, develop altruistic tendencies
Eventually, develop ability to focus outside of the self,… concern for welfare of others

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A brief word on DEVELOPMENT

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Developmental Variables

- Protracted time
  - 25 years of development
- Genetic roulette
  - Many syndromes involve concomitant EF deficits
- Environmental support
  - Avoidance of TBI
  - Coaches and models
  - Enriched & stimulating experiences
  - Scaffolded opportunities
  - Nutrition
- Neurologic development
  - Decent language system
  - Decent social perception system
  - Network development, refinement, and connectivity
  - Myelination, synaptic pruning

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Executive Function Development

- Individual components come 'on-line' at different times
  - Emerge
  - Develop
  - Mature
- Occurs in spurts and stages
  - Some skills available
  - While other skills have not yet emerged or matured
- Characteristically,
  - Young children lack judgment, wisdom
  - Adolescents trying out judgment, but need guidance
  - Young adults making life plans
  - Mid-life hopefully reflects long-term plans, goals, and effort

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Critical Stages in EF Development

- Birth-5
  - Attentional skills (need foundation)
- ~6 years
  - Mental Flexibility (begin to shift, control impulses more)
- 7-10
  - Planning & Organization (relevance & critical thinking appear)
- 9-12
  - Processing speed, divided attention (multi-task)
- Adolescence
  - Skills all on-line, but not yet mature
- Early 20's
  - Hopefully, mature
- Does appear to be responsive to brain exercise

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Interdependency of LANGUAGE & EFs

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Why care about the relationships between language and EF skills?

Because we really do not yet know what the relationship is, although everyone appears to agree that a relationship does exist.

Because EFs and Language appear to be entwined and inter-related on so many levels.

Because they both appear to be required for academic, social, and vocational success.

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What does Language do for us?

- **Language as a tool:**
  - Self-talk
    - Remind, organize
    - Regulate, inhibit
  - Structure
    - Sort, group, sequence, plan,
  - Verbal reasoning
    - Compare, predict, interpret
  - Mediating, articulating
    - Experiences, interactions

- **Language deficits:**
  - Diminished capacity to use these linguistic tools
  - Undermined EF capacity to
    - Regulate self, behavior, responses, timing,
    - Formulate plans
    - Mediate experiences
    - Organize conversations
    - Compare and reason
    - Predict and select
    - To engage in sophisticated thinking and problem solving

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Vygotsky: Language & EFs

- Initial stage of language use is spoken aloud
  - During an action, and is descriptive in nature
- This gradually becomes privatized speech
  - Reflects the internalization of one's thoughts
  - Which in turn help to control behavior
- But, self-guidance is not automatic
  - Language passes through at least 3 stages whereby it evolves into the "tool" we think of
  - A "tool" which can help us to guide and control behaviors
  - A "tool" which can assist in the development of plans
  - A "tool" which can even think into the future
- Ultimately,
  - Privatized speech moves from being sub-vocal to fully inaudible
  - Descriptive language moves towards prescriptive language

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Vygotsky's Stages of Egocentric Speech

- **3 levels of speech evolving from ages 3-7**
  - **Whereby language becomes internalized in nature, and serves as a feature of self-talk**
- *Syncretism of action phase (ages 3-4)*
  - Language gives emotional description (It's too high!)
  - Language used to request external help
  - Language is <u>not</u> used to help plan a solution
- *Reflecting/accompaniment phase (4-5 years)*
  - Language begins to be used by the child to describe his/her actions during the problem
  - Emergence of internal self-help is noted
  - Begin to see rudimentary foundation for self-planning

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Vygotsky's Inner Speech

- *Verbal planning phase (5-7 years); "speech-thinking"*
  - Language describes the problem
  - Language states/articulates the plan
  - Begin to see overt self-talk, self-plan, self-help

- **Inner speech**
  - The culmination of this developing skill-set
  - Not fully developed until 12 years of age
  - Eventually allows for development of logical, strategic solutions
  - The idea that WORDS change THINKING (attention, planning, organizing, evaluating, etc)

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Bronowski's Theory of Human Language

- Language (and inhibition) allow humans to
  - Reflect, plan, anticipate, and test outcomes
  - **Reference time, both past and future**
    - Freeze time; 'hold' events in WM in order to ponder them…to plan, to reflect
    - Draw upon past events while considering/applying them towards future actions
  - **Separate emotional tone from the situation at hand**
    - Through inhibition, we allow some neutral emotional distance to hold forth (in WM)
    - So that we have a fighting chance to tap into our language system (see below)
    - So that we have a fighting chance to engage in some reasonable self-regulation

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Bronowski's Theory of Human Language

- Language (and inhibition) allow humans to:
  - **Internalize one's thoughts, articulate/formulate plans**
    - Engage language system to internally represent thoughts
    - Explore options; form hypotheses; use private/inner speech
  - **Reconstitute thoughts/plans in novel way**
    - Move language beyond the descriptive, in order to use it as a prescriptive, directive 'problem-solving' tool
    - *We need to have immediate/fast access to language*
    - *In order to RECONSTITUTE in into completely novel statements*
    - We are constantly reconstituting syntax formats into a novel analysis of a novel problem
    - We analyze and then synthesize an endless array of options

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Verbal Reasoning & EF

- Syntax & Reasoning
  - If…then
  - Because
  - Whereas
  - Therefore
  - However,
  - Nevertheless
  - Future verb tense
  - Why and How questions
  - Sequential, temporal
- Semantics & Reasoning
  - Compare features
  - Differentiating features
  - Deduce or predict missing information based on comparisons
  - Infer main ideas
  - Determine analogous relationships
  - Rule out irrelevant information

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EFs as Control System in Auditory Comprehension

- **Auditory comprehension for conflicting potential messages requires PFC involvement**
- When messages are either plausible, or not
  - *e. g. The dog bit the man. The man bit the dog.*
- fMRI imaging found:
  - L parietal, *and …..*
  - Medial PFC & L ventrolateral PFC
  - Comprehension + conflict monitoring
- PFC engages for final decision-making on the most plausible, reasonable meaning
- *Ye & Zhou, 2009*
- **CONFUSION, MISINTERPRETATION!!!!!**

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EFs as Control System in Reading Comprehension

- **Reading comprehension for ambiguous sentences utilizes PFC**
- When statements are unclear
  - e.g. *Ronald told Frank that he had a positive attitude toward life. (who is he?)*
- fMRI imaging found:
  - Bilateral angular gyrus (parietal), and…..
  - Medial PFC
- Are EF skills engaged to assist in inhibiting unsupportable meaning?
- *YE & Zhou, 2009*
- **CONFUSED UNDERSTANDING; MISINTERPRETATION!!!**

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EFs as Control System in Appropriate Word Selection

- **For word selection & production, when competing alternatives must NOT be used**
  - Necessary for socially, culturally, or contextually appropriate word usage
  - Need to inhibit prepotent verb/response, and sift for appropriate
- Generate a verb specifically related to a given noun
  - Low-selection:
    - Generate verb associated with a noun that has few options ("kite"→ *fly*)
  - High-selection:
    - Generate verb associated with a noun that has many options ("rope"→ *hang, tie, loop, knot*)
  - Competition amongst potential verbs increases in high-selection, causing increased demand upon the language system
  - **fMRI indicated L ventrolateral PFC; lesion studies indicated patients could not sort through competing potential words!!!!!**
  - **TANGENTIAL; DISORGANIZED NARRATIVES!!!!!**

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EFs as Control System in Bilingualism

- **When selecting target language and controlling or inhibiting interference from non-desired language**
  - Analysis of initial phoneme when listening to words in target and non-target languages
  - Shift between word usage in different languages
  - Shift between word usage in same language
  - Direct attention to target language while inhibiting competing stimuli in other language
- fMRI: L dorsolateral PFC, anterior cingulate cortex
  - In *Ye & Zhou, 2009*
- AND, individuals who become bilingual at an early age appear to develop better INHIBITION than monolinguals
  - *Bialystok et al., 2004*
- AND, bilingualism may minimize risk of Alzheimer's *(Stern, 2003, 2006)*

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A Word About Broca's Area

- Motor
  - Motor-based speech planning
  - Speech production
- Working memory
  - Verbal working memory
- Language comprehension
  - Semantic processing, interpretation, plausibility
  - Syntactic processing, analysis, comprehension
  - Grammar learning tasks/mastery of new syntactic rules
- Language production
  - Syntactic parsing, movement
  - Even in languages with free word order
  - Syntax sequencing, building
  - Embedding of syntax structures
- Visuospatial sequencing
  - *Freiderici, 2011*

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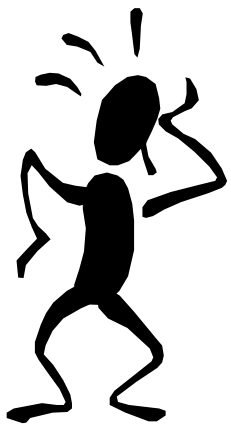
When things GO WRONG



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Are there EF 'profiles'?

- Yes, generally speaking.
  - From diagnostic perspective, profiles of strengths and weaknesses are present
  - From a comorbid perspective, EF deficits usually co-exist with other disorders and concomitant problems
  - Effective EF treatment requires clear understanding of these profiles

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Etiologies of Executive Dysfunction

- Developmental neurological disorders:
  - ADHD, SLI, ASD, NLD, Tourettes,
- Environmentally-based neurological disorders:
  - Environmental Deprivation, exposure to toxins, poisons
- Acquired neurological disorders:
  - TBI, CVA, Parkinson's, dementias, anoxia, hypoxia
- Syndromes:
  - FAS, Williams, Fragile X
- Mental health disorders:
  - Schizophrenia, Bipolar Disorder, Depression, Reactive Attachment Disorder, Conduct Disorder, Oppositional Defiant Disorder
- Medically-complicated/fragile situations:
  - Premature birth, Low birth weight

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Specific Language Impairment & EFs

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Defining Specific Language Impairment (SLI)

- **Language is the primary deficit**
  - >1.25 SD below mean, *Tomblin et al, 1996*
  - >2SD below mean, *ICD-10*
- **Normal nonverbal skills**
  - Performance IQ >85, *Tomblin et al, 1996*
- **Discrepancy between language and nonverbal skills**
  - "An impairment in language disproportionately greater than the impairments in other nonlinguistic domains," *Webster & Shevell, 2004*
  - Language 1 SD< nonverbal, *ICD-10*
  - "substantial discrepancy," *DSM-TR-IV*
- And,
- Normal anatomical structure and functioning
- No other neurologic disorders which might account for language deficits

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SLI Types? A Heterogeneous Group

- Conti-Ramsden, 1997

- Good articulation, poor language
- Fair articulation, poor language
- Good articulation, decent exp. language, poor rec. language

- Good language, poor artic/phono
- Poor word reading
- Poor language, good naming

- Rapin and Allen, 1987

- Lexical–syntactic deficits
- Semantic–pragmatic deficits

- Verbal dyspraxia deficits

- Phonological programming deficits
- Phonological syntactic deficit

Law, Tomblin, Zhang, 2008

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Problems?

- **Various problems with the concept may exist**
  - The notion that 'only' language is impaired
  - Often, deficits in other areas ARE present
  - Research indicates children with SLI also have nonverbal deficits

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Cognitive/Processing Deficits in SLI

- Deficits in attention
  - *Spaulding, Plante, & Vance, 2008*
- Deficits in speed of information processing
  - *Leonard et al. 2007; Hoffman & Gillam, 2004; Im-Bolter et al. 2006*
- Deficits in visuospatial processing
  - *Marton, 2008*
- Deficits in verbal working memory
  - *Gathercole & Baddeley, 1990, 1993, 1995*
  - *Marton & Schwartz, 2003*
- Deficits in verbal and visuo-spatial working memory
  - *Hoffman & Gillam, 2004; Marton, 2008*
- Deficits in flexibility, with perseveration
  - *Marton, 2008*
- Deficits in visuo-spatial planning, rule-violation
  - *Marton, 2008*
- Deficits in social cognition
  - *Cohen et al.,1998*

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EFs in Preschoolers with SLI

- Using BRIEF-P *Parent & Teacher Ratings*
- Children with SLI more likely (x6) to be rated in clinically impaired range than their typical peers
  - *Wittke, 2011*

- Using BRIEF-P *Parent Ratings*
- Children with LI
  - Performed significantly worse on scales of Inhibition, Planning, and Shifting, than their typical peers
  - Presented with EF deficits in WM
- Children with typical language had typical EF skills
  - *Trainor, 2012*

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EFs in Preschoolers with SLI

- Using BRIEF-P *Parent Ratings*
  - In children with LI:
    - Significant relationships identified between multiple aspects of language and multiple elements of EFs
      - CELF-P Language Structure // WM & Plan/Organize
      - *Trainor, 2012*
    - Significant relationships identified between measures of narrative language and multiple elements of EFs,
      - Sentence length & information content // WM & Inhibition
      - *Trainor, 2010*

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EFs in Preschoolers with SLI

- Using BRIEF-P *Teacher Ratings*
  - Children with LI:
    - Performed significantly worse on scales of WM, Inhibition, and Planning, than their typical peers
    - WM deficits and borderline impairments in Planning
    - Significant relationships identified between multiple aspects of language and multiple elements of EFs, in children with LI
      - CELF-P Language Structure // WM & Plan/Organize
  - Whereas those with typical language also had typical EFs
    - *Genenbacher, 2013*

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EFs in School-Aged Children with SLI

- Using BRIEF *Parent & Teacher Ratings*
  - 22, 7-9 year-old children with SLI, & 22 matched peers
  - Nonverbal IQ >80; no other neurological disorders
- Children with SLI:
  - Mean BRIEF scores were not clinically significant. HOWEVER,
  - **Children w/SLI had higher mean scores on all BRIEF scales**
  - **59% of children in SLI group rated with EF impairments, ave 6 scales**
  - **27% of children in Typical group rated with EF impairments, ave 2**
- After controlling for nonverbal IQ differences between groups were found:
  - In Shift and WM (Parent ratings)
  - In Initiate, WM, Plan/Organize, and Monitor (Teacher ratings)
  - *Kuusisto, 2010*

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EFs in School-Aged Children with SLI

- Using CELF-4 and *BRIEF Teacher Ratings*
- 17 children, mean age 9 ½ years,
  - All referred for evaluation of auditory or language processing
  - All with prior history of language disorder
- Linear regression analyses
  - **BRIEF Plan/Organize →CELF-4 WM**
  - **BRIEF Working Mem → CELF-4 Receptive Langauge**
  - **BRIEF Initiate → CELF-4 Language Content**
  - **BRIEF Metacognitive Index →CELF-4 WM & Recep. Language**
  - **BRIEF Global Exec. Composite → CELF-4 Core Language**
  - **But no BRIEF performance was predictive of expressive language**
  - *Hungerford & Gonyo, 2007, ASHA*

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EFs in School-Aged Children with SLI

- Using **10 DIRECT measures of verbal & nonverbal EF skills**
- 160 children:
  - 88 TL, mean age 9;9
  - 41 SLI, mean age 11;9; 3/4 CELF-4-UK scaled scores 1SD <mean
  - 31 LLF, mean age 10;6; 1 or 1 CELF-4-UK scaled scores 1SD <mean
- After controlling for age, nonverbal IQ, verbal IQ, SLI group had significantly worse EF performance than typical in:
  - Verbal **AND Nonverbal Working Memory**
  - Verbal Fluency
  - **Nonverbal Inhibition**
  - **Nonverbal Planning**
  - No significant differences between EF deficits in SLI and LLF
  - *Henry, Messer, Nash, 2011*

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EFs in Adolescents with SLI

- Using *BRIEF Self and Parent Reports*
- 42 adolescents
  - 21 with SLI; 21 with typical language
- Adolescents in both groups rated themselves 'better' in EF skills than their parents did
- Significant differences in EF skills between groups:
  - SLI adolescents' EF behaviors rated significantly higher (poorer) than typical
  - 57% of parent ratings for SLI children resulted in EF impairment
  - 10% of parent ratings for the typical group resulted in EF impairment
- Parent concerns:
  - Worried about children's ability to use communication skills effectively in social interactions, live independently, obtain competitive employment
  - *Hughes, Turkstra & Wulfeck, 2009*

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A slight problem.....
in the use of problem-solving language

!

- 3 & 4 year old children: typical and SLI
  - Given bridge-building task
  - **Task-relevant, regulatory language analyzed & coded:**
    - Plans—GOING TO, MIGHT
    - Possibilities—CAN
    - Necessities—HAVE TO, WILL
  - Kansas Reflective-Impulsivity Scale for Preschoolers (KRISP)
    - Analysis of efficiency and impulsivity (speed & accuracy)
- Children with SLI
  - Produced fewer regulatory utterances, as a group
  - Those who DID generate more planful language during the task
  - Had lower efficiency scores on the KRISP

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How do you develop inner speech?

- **If you have a delay in language…….**
- **If you have a delay in processing……**
- **If you have deficits in executive functions……**

And, how do you use language as a tool to regulate behaviors, generate and reconstitute potential plans, formulate thoughts regarding outcomes or consequences?

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Challenges of ASSESSMENT

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Goals of EF Assessment

- **Confirm/rule-out presence of EDF**
  - *IS there anything wrong?*
- **Determine what to call the problem**
  - *What is the primary, underlying diagnosis?*
  - *What is the profile of EF deficits?*
  - *When, or where, are these deficits most problematic?*
- **Confirm/rule-out presence of other co-morbid disorders**
  - *What other non-EF deficits are also present?*
- **Generate recommendations**

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What to call the problem: *Frontal Lobe Syndrome?*

- **Generally refers to the nature of EF-type deficits resulting from an acquired lesion, associated with damage to the prefrontal cortex**
- With a cluster of typical deficits, including:
  - Disrupted attention, working memory
  - Impulsivity, distractibility
  - Perseveration
  - Changes in mood, behavior, personality
  - Apathy, anxiety, depression
  - Impaired reasoning, judgment
  - Deficits in self-appraisal, self-regulation

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What to call the problem: *Dysexecutive Syndrome?*

- Although similar to frontal lobe syndrome,
- Defined as:
  - **Deficits in various components of executive functions**
  - **NOT structurally-tied to only the prefrontal cortex!**
  - **May involve diffuse structural or functional dysfunction in other networks which ultimately link up with or are dependent upon the prefrontal cortex**
- Complicated by:
  - Etiology?
  - Causation?
  - Co-morbid?
  - Secondary or primary?
  - **Vague term—would need to be clarified and qualified**

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What to call the problem:
Concomitant Executive Dysfunction?

- **May be most useful to emphasize the secondary nature of EF deficits when they occur as a symptomatic expression of a primary disorder**
  - Especially when the audience may not fully associate the primary disorder with EF deficits
- Examples:
  - Asperger's syndrome, with concomitant Executive Dysfunction
  - Language processing disorder, with concomitant Executive Dysfunction
  - ADHD, with concomitant Executive Dysfunction
  - Schizophrenia, with concomitant Executive Dysfunction
  - Autism, with comorbid Language Disorder and Executive Dysfunction

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No Matter the Name…..

Dysexecutive Syndrome
Executive Dysfunction
Executive Function Deficits

These are considered to represent a cluster of functional impairments/symptoms

Which are NOT the root cause of, nor the location of, the nature of the disorder or diagnosis in question

UNLESS, you have an instance of a focal lesion to the PFC, with specific injury to those structures or connections engaged in EF

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RULE #1:
Don't be the Frontal Lobe

- **Let the individual do the thinking (not you)**
- **Do NOT give solutions or steps or instructions**
- **Do NOT point out errors or offer to fix problems**
- **Tasks must require the use of EF skills!**

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RULE #2:
Know How/What You are Evaluating

- **What EF skills is the test designed to evaluate?**
- **Do subtests evaluate only ONE EF skills, or multiple EF skills?**
- **What other NON-EF skills are also being evaluated?**

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Rule #3:
Analyze the Nature of EF Errors

- **Analyze EF performance in a hierarchical manner**
- **Identify a clear pattern of EF strengths and weaknesses**
- **What causes functional problems in daily life?**

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Rule #4:
Know What to Expect

- **Is EF development typical for client's age?**
- **Is EF pattern typical for the client's diagnosis?**
- **If acquired or traumatic, what is the expected overall recovery?**

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Rule #5: Multidimensional Eval

- **Engage in more than one type of assessment**
- **Plan for varied levels of task demand and difficulty**
- **Evaluate EF skills as they are applied in verbal, nonverbal, or functional situations**
- **Capture ecologically-valid insight!!!!!**

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Complications Selecting Tests

What EF skill does the test evaluate?

Does the test use direct or indirect assessment of EF?

Can the test help differentiate between language, reasoning, procedural application, and EF skills?

Can the test offer any developmental insight?

YOU NEED A RANGE AND VARIETY OF ASSESSMENTS

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Adapted from McCloskey, 2009

Informal INDIRECT Interview w/others Review of records, chart Interpretation of ratings from others	**Formal INDIRECT** Standardized rating scales: Teacher Parent Self Significant Other
Informal DIRECT Interview Observation Interpretation of standardized test performance Work samples Novel task completion	**Formal DIRECT** Standardized tests Specific to EF skills e.g. Attention test Inhibition test Fluency test Planning test

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Interviews for EF

- **Need to gather information ahead of time**
- **Need to determine how, exactly, to use direct or indirect, formal or informal measures**
- **Need to determine degree of awareness and perception of EF difficulties within the child's environment**

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EF Interview Guidelines

- **INVOLVE** all interested constituents
  - Child, parents, teacher, other
- **INQUIRE** using questions around specific EF skill-sets
  - Ask yes/no questions, using examples
  - Ask broad, open-ended questions
  - Ask follow-up questions
- **INSIGHT** required about child's specific ability to
  - Plan, organize, initiate, and sustain
  - Anticipate, control, monitor, regulate behavior
- **INTERPRET** with introspection
  - Combination of objectivity, respect, and also some degree of caution, due to subjective bias
- **INFORM** your plans for a multidimensional evaluation
  - Identify particular areas of need, concern

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EF Interview Options

- ***Executive Functioning Semistructured Interview***
  - *Kaufman, 2010*
  - Parent, Teacher, Student
  - Organized by EF areas
- ***Executive Skills Semistructured Interview***
  - *Dawson & Guare, 2010*
  - Parent, Teacher, Student
  - Organized by functional tasks
- ***Sample Interviews for Executive Functioning***
  - *Richard & Fahy, 2005*
  - Parent, Teacher, Child
  - Organized by capacity to engage in EF behaviors within home, school environments

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Direct Assessment Options

Standardized tests designed to evaluate individual components of EFs

And/or to evaluate underlying cognitive processes

But, not in a vacuum. There will always be some other element of processing, or a combination of another EF skill, in conjunction

While they do offer insight into a particular EF skill, it is within a lab-based task, rather than an ecologically-valid environmental application of the EF skill

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Delis-Kaplan Executive Function System (D-KEFS), 2001

- Ages 8-89
  - Standardized on 1750 children & adults
- 9 subtests
  - Stand-alone scaled scores
  - 7 traditional EF components
  - 2 verbal reasoning components
  - Verbal and visuo-spatial components
- Other details
  - Good test-retest reliability
  - Good construct validity
  - Clinical sensitivity

- Cognitive-process approach
  - Analyze problem-solving approach
- EF skills evaluated:
  - Flexibility of thinking
  - Inhibition
  - Planning
  - Problem solving
  - Concept formation
  - Abstract thinking

Delis, Kaplan, Kramer, 2001

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D-KEFS Subtests

- Proverbs Test
  - Abstract thinking
  - Semantic integration/ reasoning
- Twenty Questions Test
  - Category perception
  - Abstract thinking
  - Verbal deduction, logic
- Word Context Test
  - Verbal deduction given clues
  - Flexibility
- Trail Making Test
  - Visual scanning & attention
  - Sequencing
  - Shifting
  - Motor speed
- Tower Test
  - Visual attention
  - Visuo-spatial planning
  - Rule-learning
  - Inhibition
  - Flexibility (avoid perseveration)

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D-KEFS Subtests, cont'd

- Verbal Fluency Test
  - Timed verbal fluency
  - Letter, category, category shifting
  - Recall given constraints
- Design Fluency Test
  - Timed nonverbal fluency
  - Initiate strategy use
  - Generate options
  - Rule-adherence (inhibition)
  - Self-monitoring skills
- Sorting Test
  - Initiation
  - Flexibility
  - Concept formation
  - Problem solving
- Color-Word Interference
  - Verbal inhibition
  - Cognitive flexibility
- Stroop Test
  - Inhibition

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NEPSY-II

- Ages
  - 3-16
  - Standardized on 1200 children
- 32 subtests,
- 6 domains
  - Basic cognitive skills
  - Complex cognitive processes
- Other details
  - Test-retest reliability varies from fair to quite good
  - Mod-highly correlated--WISC-IV

- Attention & EFs
  - Sustained & selective attention
  - Working memory
  - Fluency
  - Initiation
  - Inhibition
  - Strategic planning
  - Regulation given feedback
- Language
- Social perception
- Visuospatial processing
- Memory & learning
- Sensorimotor

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NEPSY-II, EF

- Word Generation
  - Ages 5-16
  - Category, letter fluency
- Animal Sorting
  - Ages 7-16
  - Planning task,
  - But no verbal explanations
- Auditory Attention & Response Set
  - Ages 7-16
  - Inhibition task

- Design Fluency
  - Ages 5-12
  - Generate visual designs
- Clocks
  - Ages 7-16
  - Planning & organization
  - Time-telling & clock face drawing
- Statue
  - Ages 3-6
  - Inhibition
  - Stand motionless w/distraction
- Inhibition
  - Ages 5-16
  - Circle/square naming task
  - Switching component

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Behavioral Assessment of Dysexecutive Function—Children (BADS-C)

- Ages
  - 6-18
- Scoring:
  - Age-Scaled Scores
  - Percentiles
  - Overall Classification rating
  - Clinical profiles
- Dysexecutive Questionnaire
  - Initiation
  - Emotional regulation
  - Behavioral regulation
- *Emslie et al. 2003*

- Evaluates EF skills
  - Impulse inhibition
  - Rule following
  - Flexibility
  - Efficient planning
  - Sequencing
  - Novel problem solving
  - Use of feedback
  - Monitoring
- Other comments:
  - Makes demands on language
  - Complex spoken and printed task instructions

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BADS-C

- Subtests:
  - Playing Cards
    - Shift, adapt, flex
  - Water Test
    - Novel problem solving
  - Key Search
    - Inhibit, plan
  - Zoo Maps 1 & 2
    - Plan, contingencies
  - Six Part Test
    - Time constraints, rules, plan

- Focus was on embedding EF assessment within more ecologically valid tasks
- May not be sensitive enough to identify high-functioning individuals if used in isolation

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Test of Everyday Attention-Children (TEA-Ch)

- Ages
  - 6-18
  - 9 subtests
- Evaluates
  - Verbal attention
  - Visuospatial attention
  - Some EFs(inhibition)
  - Sensitive to developmental progression of attention
- Scaled scores
  - Comparison between attentional domains
- Other:
  - Complex language demands
  - Real-world materials
- Attention
  - Sustained attention
  - Selective attention
  - Alternative attention
  - Divided attention
  - Inhibited attention
- Executive Functions
  - Inhibition
  - Switching
  - Planning/Search

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Children's Color Trails Test, 1 & 2

- Ages 8-16
- Assesses
  - Subtle deficits in alternating, sustained attention
  - Sequencing
  - Set-shifting
  - Perseveration
  - Error awareness,
  - Error correction attempts
- Eliminates linguistically-loaded alphabet version
- Age-corrected SS derived from raw scores
- Interpretative guidelines include case studies in clinical populations
- Allows for inference between performance and brain-behavior relationships
- *Llorente, et al, 2003*

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Stroop Color & Word Test-Children

- Ages 5-14
  - Many interpretive patterns for clinical populations
  - ASD, MR, LD, PFC deficits, Reading disabilities, ADD/ADHD
- Assesses
  - Inhibition
  - Suppression of irrelevant responses
  - Perseveration
  - Sustained attention
  - Flexibility
- Scoring
  - Interference score and clinical patterns
  - Low Interference T scores (<40) in presence of normal Color and Word scores suggests PFC disorders because can read word, can identify color, but cannot suppress impulse to read the colored word instead of naming the color of the ink itself.
  - *Golden, 2003*

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Tasks of Executive Control (TEC)

- Ages
  - 5-7, Tasks 1-4
  - Ages 8-18, Tasks 1-6
- Computerized assessment, measuring cognitive response to increased demands
- Scoring
  - T-scores greater than 60 potentially clinically significant
  - Higher T-scores indicate poorer performance
- Increase in working memory load
  - N-back tasks
  - 3 levels
- Increase in inhibitory demand, response inhibition
  - Go/No-Go tasks
- Attention tasks
  - Vigilance, sustained & selective attention
  - *Isquith, Roth, & Gioia, 2010*

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Indirect Assessment Options

- **Often, daily failures and repeated observations contribute to concerns that something is wrong**
- **Purpose is to engage in observations of EF behaviors as the occur in the natural environment**
- **Need to determine a way to capture and standardized these observations**
- **What are the real-world implications for EDF?**

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Behavior Rating Inventory of Executive Function—BRIEF

- Standardized rating scale of EF behaviors observed in the home and/or school environments
- 86 item inventory
- 3-point rating scale
- Parents, Teachers, Self (ages 11+), or Informant
- Norm-referenced comparisons via T-scores
  - Where clinical impairment is indicated at/above T score 65
  - Higher T-scores indicate poorer performance
- Negativity Scale
  - Eliminates possibility of parent or teacher reporting in an abnormally "negative" manner
- Inconsistency Scale
  - Accounts for inter-question reliability of responses

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BRIEF Scales & Indices

- Scales
  - Inhibit
  - Shift
  - Emotional Control
  - Initiate
  - Working Memory
  - Plan/Organize
  - Organization of Materials
  - Monitor
- Behavioral Regulation Index (BRI)
  - Regulate behavior, emotion
  - Inhibition, emotional control
  - Shifting, self-monitoring
- Metacognition Index (MI)
  - Systematically solve problems
  - Initiate, plan, organize, execute, complete
- Global Executive Component
  - Behavioral Regulation Index + Metacognitive Index

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BRIEF—Versions

- Behavior Rating Inventory of Executive Function, Preschool (BRIEF-P)
  - Ages 2;0-5;11
  - Parent Form, Teacher Form
- Behavior Rating Inventory of Executive Function (BRIEF)
  - Ages 5-18
  - Parent Form, Teacher Form
- Behavior Rating Inventory of Executive Function, Self Report Version (BRIEF-SR)
  - Ages 11-18
  - Parent Form, Self
- BRIEF-Adult
  - Ages 18+
  - Self Report Form, Informant Form

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Integrated Assessment of EF and Language

- **Problematic because you are adding more variables to the mix**
- **Particularly, VERBAL REASONING**
- **FAVRES**

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Functional Assessment of Verbal Reasoning and Executive Strategies (FAVRES)

- ABI population, ages 18+
- Developed to provide *sufficiently challenging, complex tasks*
  - Given time pressure, quantity of information, degree of challenge
- 4 functional real-world tasks:
  - Planning an Event
  - Scheduling
  - Making a Decision
  - Building a Case
- Evaluates
  - Complex language comprehension
  - Complex language expression
  - Verbal reasoning & problem solving
  - Executive functions

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FAVRES

- Tasks require:
  - Consideration of 5 main factors
  - Inferential thinking
  - Discrimination of relevant from irrelevant
  - Weigh competing options
- Standardized scores:
  - Time
  - Accuracy
  - Rationale
- *Strengths & Weaknesses Checklist*
  - Qualitative scoring of executive behaviors
- *Analysis of Reasoning*
  - Getting facts
  - Eliminating irrelevant facts
  - Weighing facts
  - Flexibility
  - Generating alternatives
  - Predicting consequences

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Non-standardized EF assessment

- **Provides some structure for analysis of real-world EF performance**
- **Offers opportunity to provide immediate insight into the nature of the problem**
- **Helpful way to also educate others**

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Non-standardized EF Ratings

- *Executive Skills Questionnaire (ESQ)*
  - Dawson & Guare, 2009; 2010
  - Parent & Student forms
  - 33 questions, 11 EF skills
  - Rate from 1-5, where 1 = BIG problem, and 5 = NO problem
- *Executive Skills Rubric*
  - Dawson & Guare, 2010; adapted from Cape Elizabeth High School, Cape Elizabeth, Maine
  - Teacher & Self ratings
  - 11 areas of functional classroom performance
  - 4 levels of performance: Expert, Advanced, Developing, Novice

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Non-standardized EF Ratings

- Executive Function Observational Worksheet
  - Richard & Fahy, 2005
  - 8 EF skill areas to observe during functional task completion
  - Determine degree of independent self-regulation via series of Y/N questions
  - Identify if skill is performed: Independently, Consistently, Cued
- Executive Function Student Observation Form
  - McCloskey, 2007
  - 23 EF areas to observe during classroom performance
    - How well can student meet demands via self-regulation?
  - Also prompts for observation of strategies used by teacher
    - How much is teacher fostering EF skills?
    - How much is teacher externally guiding EF skills?

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Non-standardized EF Ratings

- *Profile of Executive Control System (PRO-EX)*
  - Good Samaritan Center for Continuing Rehabilitation, Puyallup, Washington, Braswell et al.
  - Measure of EF skills carried out by patient in daily situations
  - Staff & Family ratings
  - 7 EF scales, on 6 levels of observed independence
    - Goal selection
    - Planning/sequencing
    - Initiation
    - Execution
    - Timesense
    - Awareness of deficits
    - Self-monitoring

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Functional Assessment Options

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Functional Assessment RULES

- **Provide novel tasks with ecological validity**
- **Observe for independent use of any/all EF skills**
- **Do NOT point out errors**
- **Do NOT offer to get required or relevant items**
- **Do NOT give specific steps or solutions**

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Novel Task Example: TRAIL MIX

- Provide outcome requirements
  - Make enough trail mix to take home for your family
  - Make enough trail mix for 10 hungry graduate students
- Provide assorted materials
  - Some relevant, necessary
  - Some irrelevant, but with potential use
  - Some with no relevant use
- Tell the individual that "they are in charge"
  - Offer no help
  - Correct no problems
  - Initiate no efforts
- Observe and capture performance
- *Fahy, 2009*

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Multiple Errands Test (MET), SV

- Designed for individuals with acquired lesion to PFC
  - For inpatient or outpatient rehabilitation settings
- Require performance of multiple tasks within unfamiliar area
  - Buy 6 items
  - Locate and record information
  - Meet back at specific place in 20 minutes
  - Tell evaluator he/she is finished with the task
- Rules (verbal & written)
  - 20 minutes allowed
  - All tasks in any order
  - No more than X$ (will have 2X$ available)
  - Only on top floor; no leaving by other routes
  - No entry into shop unless to purchase listed item
  - Cannot return to shop once left
- *Shallice & Burgess, 1991; Alderman et al., 2003*

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Multiple Errands Test (MET)

- Categorize errors according to 5 types:
  - Inefficiencies
    - Using poor strategies
  - Rule breaks
    - Violating given rules during execution of the errands
  - Interpretation failures
    - Misunderstanding what is being asked
  - Task failure
    - Incomplete task performance
  - Asking for help from others
    - Not allowed
- Scoring
  - Norms available; Means and SD for # errors, Alderman et al. 2003

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Social Cognition & EF

- **The application of EF skills to underlying social perception, social interpretation, and social behavior**
- **Requires evaluation of social perception**
- **In addition to EF skills, particularly for self-awareness, self-regulation, inhibition, and attention**

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Social Cognitive Processes

- Emotion/Social Perception
  - Capacity to recognize and interpret nonverbal messages
  - Whether they be facial, gestural, body language
  - Capacity to recognize that one's actions have an impact on others' thoughts
  - Culturally-expected, assumed, implied knowledge
- Social Problem Solving
  - Capacity to coordinate perspectives of others in order to recognize problems
  - Capacity to balance internal drives with external expectations or norms
  - Capacity to initiate, inhibit, or shift social behaviors

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EF & Social Cognition

- *"…across a wide age range, typically developing individuals with good EF are more likely than their peers to do well on tests of theory of mind and show positive self-concepts, and are less likely than their peers to display antisocial behaviours."*
- *Hughes, 2011. pp. 264*

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Social Skills Rating System (SSRS)*

- Ages:
  - Preschool, K-6th grade, 7th – 12th grade
  - Norms for boys and girls
  - Standardization population also included MH, LD, BD, Other
- Questionnaire
  - 34-57 items identifying social, behavioral skills
  - ALSO asked to rate perceived importance of said skills!!!
  - Scale of 1-3 (never, sometimes, very often)
- Raters:
  - Teacher, parent, student (older)
- SS Mean = 100; SD = 15
- *Gresham & Elliot*

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Social Skills Rating System (SSRS)

- Provide insight into SOCIAL behaviors, strengths, weaknesses
  - Cooperation, Empathy, Assertion, Self-Control, Responsibility
  - and importance of social skills, problem behaviors, academic competence
- Provides insight into BEHAVIORAL challenges
  - Externalizing problem behaviors
  - Internalizing problem behaviors
  - Hyperactive
- Provides insight into ACADEMIC competence
  - Overall appraisal of student's functioning, relative to classmates

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Don't forget about children with "just" language impairment

Consider evaluating EFs children whom see you for language evaluation

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The challenges of EF TREATMENT

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TREATMENT????

- What to do?
  - Be an external frontal lobe?
  - Create environmental adaptations?
  - Create an EF-friendly culture?
  - Educate and explain?
  - Develop compensatory strategies?
  - Model, coach, scaffold?
  - Teach specific EF skills?
  - Develop and encourage brain ownership?

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PROBLEMS

- Deciding upon treatment protocols is complicated and difficult
- Evidence-based practice is evolving
- EF development may be an assumed skill, particularly in the academic setting
- Executive dysfunction may be misinterpreted as laziness, willful noncompliance, or lack of concern

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TEACH THINKING

SCAFFOLD, GUIDE, COACH

- **Cognitive Apprenticeship**
  - **MAKE THINKING VISIBLE**
  - Teach novice problem-solvers master techniques
  - Offer guided-experience learning opportunities
  - Focus on the development and mastery of metacognitive skills
  - Offer external models of internal thinking processes
  - Offering coaching, reflection to the novice
  - Require the novice to explain and engage
  - *Collins, Brown, Newman, 1989*

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TEACH THINKING

SCAFFOLD, GUIDE, COACH

- **Thinking Together**
  - **MAKE THINKING DELIBERATE**
  - Small problem-solving groups (math & science)
  - Collaborative talking and reasoning
  - Ask WHY questions
  - Use REASONING words
  - (if, because, so)
  - Build awareness of language as a tool
  - Negotiate decisions & solutions
  - *Mercer & Sams, 2006*

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USE LANGUAGE AS A TOOL

- **MEDIATE COGNITION VIA LANGUAGE**
  - Concepts:
  - **Do work within the zone of proximal development**
    - Push towards the next level of functioning
    - Assisted performance during everyday activities
    - Scaffold more sophisticated cognitive skills
  - **Use language as a tool for mediation of thinking**
    - Verbal mediation to achieve goal
    - From minimal to maximal levels of assistance
  - Cueing hierarchy was used to foster story grammar planning
    - *Schneider & Watkins, 1996; Wertsch, 1984; Vygotsky*

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ZONE of PROXIMAL DEVELOPMENT

- ZPD
  - Range in performance between independent task-completion and potential task-completion with assistance
  - Guided learning or instruction can support development of the next level of accomplishment
- Scaffolding
  - Active means of supporting thinking mastery
  - Children require external support in the use of thinking tools before they can internalize them to become independent thinkers
  - Transition from master-guided performance to independent performance

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Tools of the Mind

- **Educational curriculum to foster EF skills**
  - **Direct training in EF skills incorporated into the daily classroom**
  - Vygotskian theory of language & socio-cultural interaction
  - Uses scaffolding, direct training, increased demands
- TOOLS (concrete graphic symbols)
  - External aids (ears when you need to listen, lips when you may talk)
  - Songs (to prompt timely task-completion)
- REGULATE BEHAVIOR (of others; of self)
  - Paired-work allows one child to DO (self-reflect)
  - And the other child to CHECK (inhibit, monitor)
- PRIVATE SPEECH (to self, still audible)
  - Modeled by teachers
  - Encouraged in children during pretend & play activities
  - Used in rule-switching games (patterns; go-no go)
- DRAMATIC PLAY (to plan ahead)
  - Who will we be? What are we doing? What will we need?
  - *Bodrova & Leong, 2007*
  - *Diamond, 2007*

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TEACH SELF-TALK

- Using self-talk as self-control, 7-9 year old children w/ hyperactivity, poor self-control
- Improvement on non-task measures of inhibition & planning
- Protocol:
  - Perform a task while you talk out loud
  - Child performs task while you talk out loud
  - Child performs task again while talking to self
  - Child performs task again while whispering to self
  - Child performs task again without lip movements
- Phrasing:
  - *Remember to go slow*
  - *I have to be careful*
  - *I'm doing fine so far*
  - *Even if I make an error, I can go on slowly and carefully*
    - *Meichenbaum & Goodman, 1971*

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TEACH SELF-TALK

- EXAMPLES
  - ***Stop, think, plan, do***
  - ***I need help***
  - ***What's next***
  - ***Plan first***
  - ***Good or bad***
  - ***What's wrong***
  - ***Write it down***
  - ***Do this, or that***
- PORTABLE
  - Key rings
  - Checklists
  - Cue cards
  - White boards
  - Tally marks
  - Check marks
  - Cross out when done
  - Color coded prompts

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TEACH MINDFULNESS

- **What am I doing?**
- **What is happening around me?**
  - Be “present” and grounded in the moment
  - Engage actively, beyond “just” auditory listening
- Use body:
  - Turn towards input
  - Quiet other movements, if possible
- Use eyes:
  - Watching for important cues, markers, signs
  - Watching eye-gaze for important insight
  - Watching body-movement for important clues
- Use mouth:
  - Close it while someone else talks

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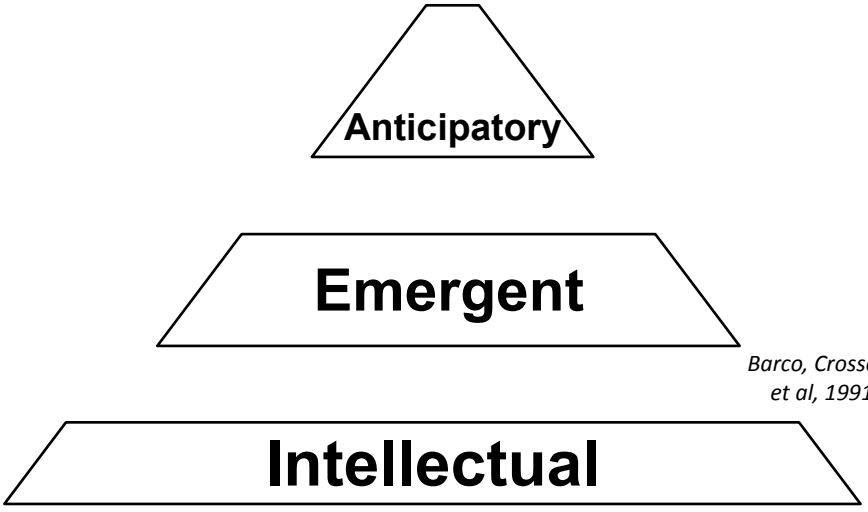
TEACH AWARENESS



Barco, Crosson, et al, 1991

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DO ACTUAL TASKS

- "Inner speech….cannot be directly observed"
  - *Sturn & Johnson, 1999, p. 2*
- **Do actual tasks which require observable action**
  - **And also require actionable VERBS**

- Language-Motor links
  - Read a verb, motor & premotor cortices fire
  - Say a verb, motor & premotor cortices fire
  - Hear a verb, motor & premotor cortices fire
  - "spread of neuronal activity….bidirectional" (p. 88)
  - Engaging in motor acts actually increases processing speed for language

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GET INSIGHT—USE FAILURE

- **Allow failure (within reason)**
- **Freeze the moment in time (capture on video)**
- Label the problem
  - "Unsafe"
  - "Incomplete"
  - "Unexpected"
- Link the problem to an underlying deficit
  - Inattention, wandered off
  - Inattention, didn't fill in last page
  - No future-planning, didn't talk through needed items

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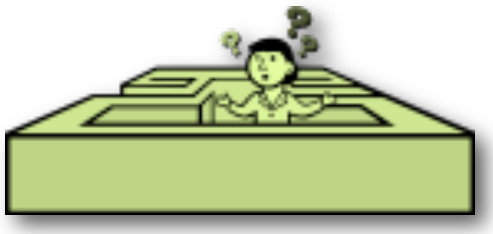
ASK QUESTIONS

- **PROVOKE**
  - What is your goal?
  - Do you have a plan?
  - What is your plan?
  - What are you doing?
- **PREDICT**
  - What will happen next?
  - Let's predict and write it down
  - So, which way will work?
- **ANALYZE**
  - How do you know that?
  - How can we prove that?
  - Do we have evidence?
  - Have we tried that before?



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PROMPT SELF-ANALYSIS
cueing hierarchy

1. Ask general question about quality of work.
   - *"Is there anything wrong with your plan?"*
2. State the general presence of errors in the work.
   - *"Well, there IS/ARE some problems; can you find them?"*
3. State the type of errors in the work.
   - *"Your plan is missing some steps/details." OR*
   - *"Everything is here, but your words don't make sense."*
4. Quantify the number of each type of error present in the work.
   - *"There are _____ steps/details missing in your plan." OR*
   - *"I can't understand what you mean in _____ steps of the plan."*

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PROMPT SELF-ANALYSIS
cueing hierarchy

5. Tell exactly where the problem is, and what type of problem it is.
   - *"Something is missing after #_____."*
   - *"Something is missing in #_____."*
   - *"Number_____ isn't clear."*
6. Show child where the problem is.
   - *"This is what is wrong."*
7. Require client to fix stated problem.
   - *"You need to _____."*
   - *assumes no independent error fixing*

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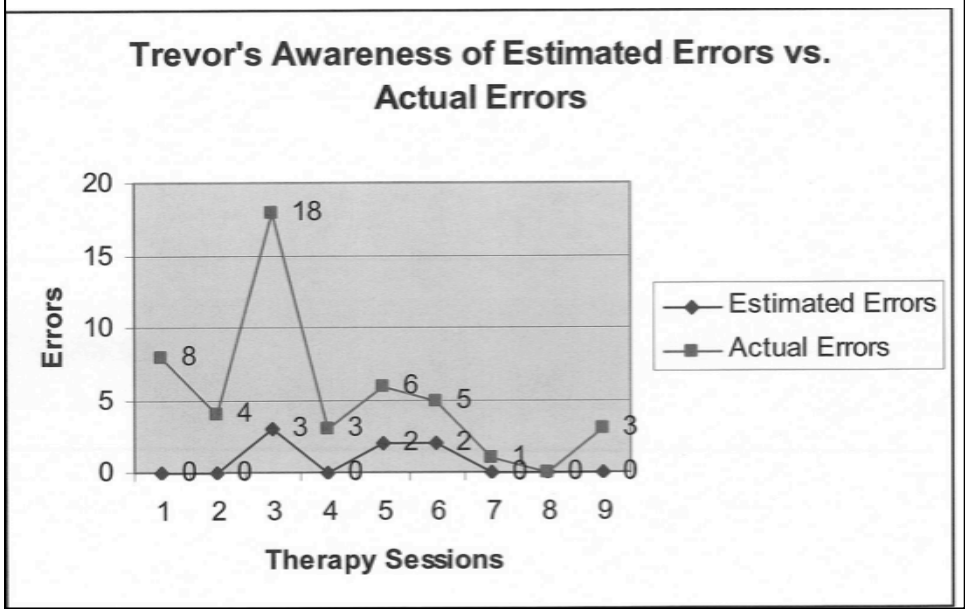
PREDICT PERFORMANCE



WHO HELPS?

Someone else, until you have awareness, insight, and perception of needing help

- No point in expecting strategy-use until:
  - Can recognize problems
  - Can identify errors/deficits when they occur
  - Can link errors/deficits to problems
  - Can predict WHEN they'll need to compensate
  - Can recognize HOW they'll need to compensate

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This is the key point.

You cannot self-correct what you do not see.

You cannot use a compensatory strategy for something you do not recognize.

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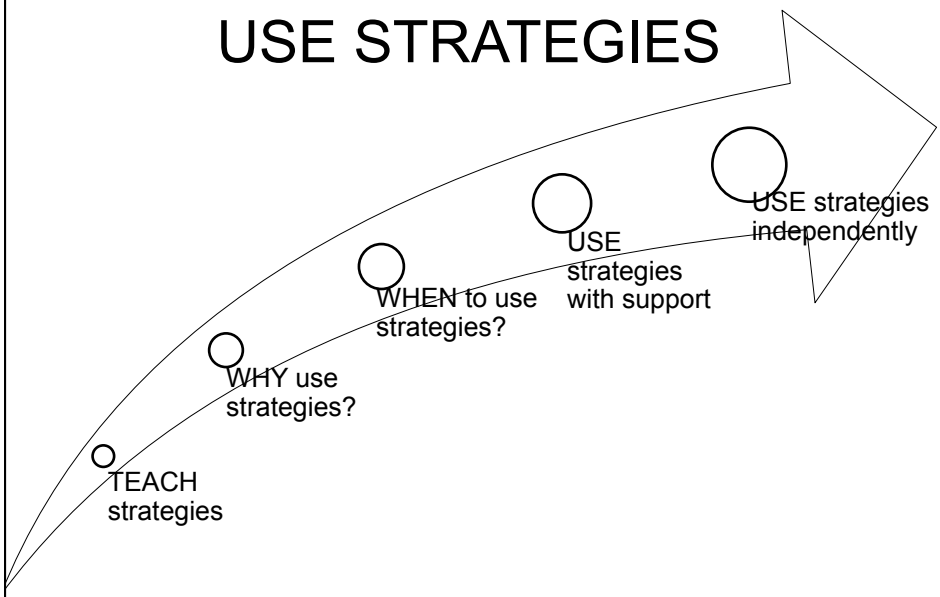
USE STRATEGIES



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TALK ABOUT THE BRAIN

- TALK ABOUT THINKING
- LET'S LEARN TO THINK & PLAN
- TAKE YOUR BRAIN TO THE GYM
- BRAIN OWNERSHIP MANUAL
- USE WORDS TO PLAN
- USE WORDS TO REASON
- USE WORDS TO ANTICIPATE

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future challenges and philosophical questions

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Mental Health Disorders & EFs

- Schizophrenia
  - Delusions, hallucinations, paranoia
  - Difficulty with all EFs
  - Poor inhibition, planning, organization, flexibility, self-awareness, problem solving
- Conduct Disorder
  - Trouble applying EF skills in the moment
- Antisocial Personality Disorder
  - Disregard for, and intent to disrupt, others; reckless and intentionally harmful behavior
  - Poor inhibition, planning, flexibility, self-awareness
- Bipolar Disorder
  - Poor planning
  - Impulsivity, poor shifting
  - Poor self-appraisal, particularly during Manic phase

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Other Disorders with Executive Dysfunction

- Premature birth
- Autism
- AD/HD ….. Which some might argue “IS” EF……
- Depression
- Obsessive-Compulsive disorder
- Oppositional Defiant disorder
- Substance abuse & dependency
- Fetal alcohol syndrome
- Dementia
- Parkinson’s Disease
- Aphasia
  - And many, many more

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Legal Issues and EFs

- At what age is one capable of voluntary control?
- At what age is one legally held responsible for voluntary control?
- What mental or cognitive operations are required, and fully developed, to allow one to engage in:
  - Voluntary control
  - Intentionality
  - Knowledge of consequences
  - Desire for consequences
  - Decision-making
- What excuses, or justifications (if any) warrant lesser culpability? *Hirstein & Sifferd, 2011*

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We Expect *Planfulness*

- To consider others' needs
- To anticipate consequences
- To inhibit harmful or negative behaviors
- To control impulsive rage or emotion
- To collaborate with societal and cultural demands

- And, we wonder why, or how, people can do the things they do…..

- Awareness of Executive Dysfunction must expand
- Treatment for Executive Dysfunction must evolve

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Executive Functions as a Fundamental Need

- Feelings of exclusion, loneliness, isolation disrupt selective attention, task-persistence, reasoning, and decision-making

- Stress disrupts the capacity of the PFC to function as necessary

- Sleep-deprivation and lack of exercise disrupts cognitive and metacognitive functions

- *Diamond, 2010*

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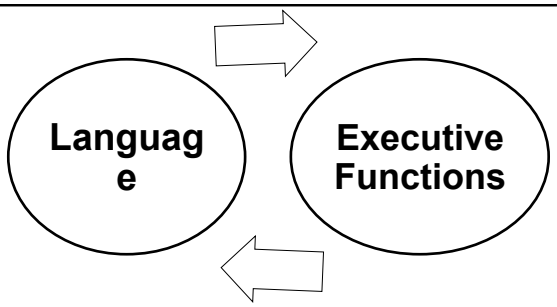

Words are the tools of the mind

SLPs are perfectly positioned to:

Foster language as a tool for thinking

Educate and explain the nature of thinking and planning

Collaborate with other disciplines to share knowledge

Conduct research to broaden the range of evidence-based practice

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Thank you,