

# TEACHING EXECUTIVE FUNCTION SKILLS TO CHILDREN WITH AUTISM

Jonathan Tarbox, PhD, BCBA-D  
Halifax, May 3rd, 2017

## INTRODUCTIONS

- I am the director of the new Master of Science in ABA program at the University of Southern California
- Research director at FirstSteps for Kids, a service delivery agency based in Los Angeles, CA
- We use Applied Behavior Analysis (ABA) to help children with autism achieve their greatest potential
- My PhD is in behavior analysis, from Linda Hayes, at University of Nevada, Reno
- Audience?
  - ABA folks?
  - Teachers?
  - Parents?
  - SLPs, OTs, PTs?

### WHAT IS ABA?

SIMPLY STATED...  
REINFORCEMENT FOR POSITIVE  
CONSIDERANCE FOR NEGATIVE  
PROMPTING TO HELP YOU DO IT BY YOURSELF  
SYSTEMATIC SO YOU DON'T GET STUCK  
LEARNING SMALL THINGS LEADS TO BIG THINGS



### PARENT TO PARENT

#### What is ABA?

#### What is ABA?

Applied Behavior Analysis (ABA)

- The application of principles of behavior to produce reasonable change in behavior through the manipulation of the environment
- Identify functional relationships between behavior and the environment



*What is ABA?*

## WHAT IS ABA?



## CHAPTER I - SENTENCE I

“Applied behavior analysis is a science devoted to the understanding and improvement of human behavior.”

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## PRINCIPLES OF ABA

- Positive reinforcement
- Stimulus control / conditional discriminations
- Programming for generalization
- More-structured teaching (e.g., discrete trial training)
- Less-structured teaching (e.g., natural environment training, pivotal response training)
- Practice matters: MANY learning opportunities



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## DSM-V DIAGNOSTIC CRITERIA

### A. Persistent deficits in **social communication** and **social interaction**:

1. Deficits in social-emotional reciprocity
2. Deficits in nonverbal communicative behaviors used for social interaction
3. Deficits in developing, maintaining, and understanding relationships

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## DSM-V DIAGNOSTIC CRITERIA

### B. **Restricted, repetitive patterns of behavior, interests, or activities**, as manifested by at least two of the following, currently or by history:

1. Stereotyped or repetitive motor movements, use of objects, or speech
2. Insistence on sameness, inflexible adherence to routines, or ritualized patterns of verbal or nonverbal behavior
3. Highly restricted, fixated interests that are abnormal in intensity or focus
4. Hyper- or hyporeactivity to sensory input or unusual interest in sensory aspects of the environment

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Where would you say we spend the majority of our time programming?

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If we want to make sure we're addressing the core diagnostic aspects of autism, where else should we also focus?

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### SOCIAL COMMUNICATION

- Back-and-forth Conversation
- Sharing of Interests
- Emotions
- Initiating + Responding
- Nonverbal Communication
- Body Language + Gestures
- Facial Expressions
- Understanding Relationships
- Adjusting Bx to Social Context
- Sharing Pretence
- Interest in Peers

### RESTRICTED BEHAVIOR

- Insistence on Sameness
- Inflexible | Routines
- Rigid Thinking
- Fixated Interests
- Perseverative Behavior

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**SOCIAL PROGRAMMING**

- Play Skills
- Perspective-Taking
- Social Skills Interventions

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## SOCIAL COMMUNICATION

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## RESTRICTED BEHAVIOR

- Insistence on Sameness
- Inflexible | Routines
- Rigid Thinking
- Fixated Interests
- Perseverative Behavior

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# EXECUTIVE FUNCTIONING

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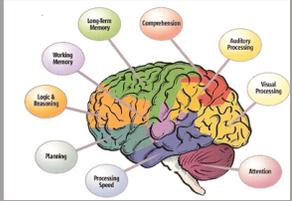
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# EXECUTIVE FUNCTIONS



- Prefrontal Cortex
  - With development of different areas associated with EF skills
- Clinical populations with EF Dysfunction
  - TBI results in loss of EF once present
  - ADHD
  - Dyslexia
  - LD
  - **ASD**

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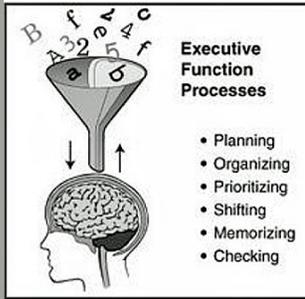
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# INTERRELATEDNESS OF EF SKILLS



- Executive Function Processes**
- Planning
  - Organizing
  - Prioritizing
  - Shifting
  - Memorizing
  - Checking



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Fantastic point. Let's self-monitor our progress before moving forward.

But wait! I was promised an ABA take on EF. So far we've only talked about the brain.



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# EXECUTIVE FUNCTIONS

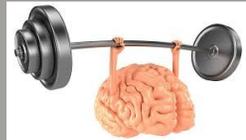
• Definition: Umbrella term used to describe the “chief operating system” localized in the prefrontal regions which includes higher level cognitive processes necessary for future oriented, **goal-directed behavior**.

- Working Memory
- Inhibitory Control
- Sustained Attention
- Cognitive Flexibility
- Planning + Goal Setting
- Organization
- Initiation
- Problem Solving
- Persistence, Self-Monitoring, etc.



# BRAIN OR BEHAVIOR?

- Traditionally, EFs are considered brain functions
- But all EFs involve behavior
- Behavior is learned and it can be strengthened
- If even a small portion of EF performance is learned behavior, then we should be able to improve it
- We are not denying the participation of the brain, we are making the most of it



# RADICAL BEHAVIORISM

- How do we address mental and cognitive events as learned behavior?
- How do we retain our natural science foundation?
- Radical behaviorism: Mental events, if anything, are private stimuli and behaviors, nothing else
- Private stimuli can include discriminative stimuli and rules
- Private responses include complex verbal behavior and visualizing behavior

# RADICAL BEHAVIORISM

- Mentalistic words are a problem if they are used as explanations for behavior (e.g., “He had a tantrum because he was angry”)
- Mentalistic words are less of a problem if they are used as names for behaviors or stimuli and nothing else (e.g., thinking = private verbal behavior)
- Private verbal behavior (i.e., thinking) should be the same as public verbal behavior (i.e., talking).
- Still needs to be learned and still needs to be explained by behavioral principles

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# RELATIONAL FRAME THEORY

- Relational Frame Theory (RFT) is a contemporary behavior analytic approach to complex human behavior (Hayes, Barnes-Holmes, & Roche, 2001)
- Focuses on behaviors that are under the antecedent control of the *relation between two or more stimuli*
- The relation, itself, between two stimuli is the discriminative stimulus (not one of those stimuli by itself)

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# RELATIONAL FRAME THEORY

- Many classes of relational behavior (aka, relational frames)
  - Equivalence (A = B)
  - Distinction (A is different from B)
  - Opposition (A is the opposite to B)
  - Comparison (A is bigger/better/shorter/colder/ than B)
  - Hierarchy (A is a type of B)
  - Temporal (A is before B)
  - Conditional / causal (A caused B)
  - Deictic (I / you)

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## RELATIONAL FRAME THEORY

- Relational behavior is classes of generalized operants
- Relational behavior is **LEARNED VIA MULTIPLE EXEMPLAR TRAINING**
- Emergence of untrained behavior is a defining characteristic
- If you have one of these generalized operants, and you learn a relation in one direction, you will derived the other direction without training

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## RELATIONAL FRAME THEORY

- Most important point from RFT is multiple exemplar training until you get correct performance on untrained exemplars
- No time for any more coverage of RFT
- If you want to spend the time, you can conduct a very precise, detailed analysis of all of the complex EF behaviors in terms of RFT
- Or you can take a more crude approach and just teach lots of exemplars of the skill you are trying to teach
- This has usually been our approach

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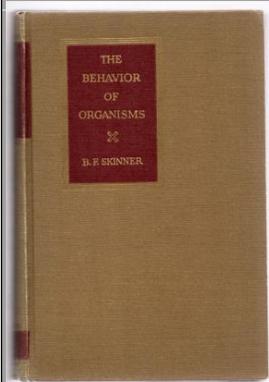
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## BEHAVIOR ANALYSIS AS COMPREHENSIVE



- Dream has always been a comprehensive science of psychology
- Including **EVERYTHING** humans do
- The Behavior of Organisms was not called the Behavior of Rats
- Or the Simple Behavior of Organisms

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# HISTORY OF BEHAVIOR ANALYSIS

- Strong tradition of starting simple
- Advancing to complex behavior only after very careful and very slow progress is made in research on simple behavior



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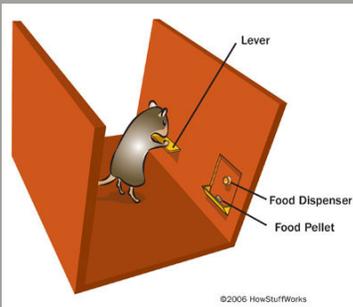
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## START SIMPLE: CONSEQUENCES ONLY



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Behavior → Reinforcer

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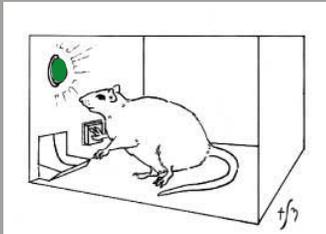
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## SLOW EVOLUTION: DISCRIMINATION



Sd → Behavior → Reinforcer

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# SLOW EVOLUTION: CHOICE



Behavior 1 → Reinforcer 1

Behavior 2 → Reinforcer 2

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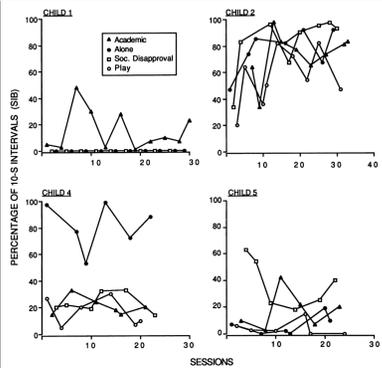
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# SLOW EVOLUTION: SKINNER BOX FOR SIB



Experimental Functional Analysis (Iwata et al., 1982)

Behavior → Attention

Behavior → Escape

Behavior → Tangible

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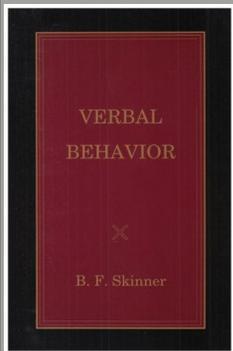
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# SLOW EVOLUTION: BASIC VERBAL OPERANTS



Tact

NV Stim → Behavior → Gen. Sr

Mand

EO → Behavior → Specific Sr

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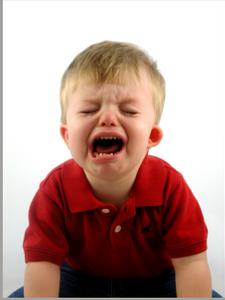
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# WHERE WE ARE

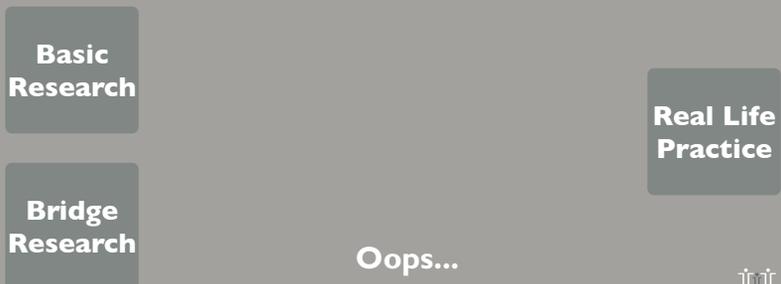
- TREMENDOUSLY powerful interventions for simple behaviors
  - Severe behavior
  - Basic verbal operants
- Still nowhere near a comprehensive science of psychology
- Slow progression from simple to complex is a choice, it's not a rule
- Other strategies might be complimentary



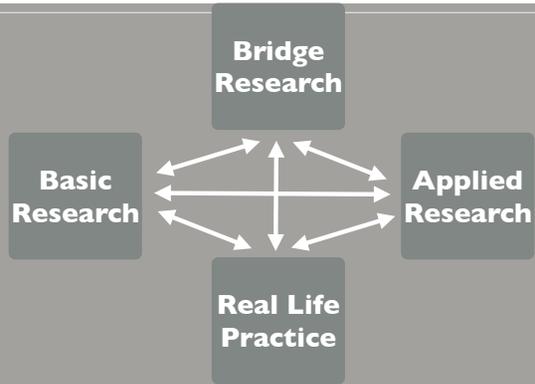
# PROGRESSION TOWARD COMPLEXITY



# PROGRESSION TOWARD COMPLEXITY



# ANOTHER MODEL



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# RADICAL BEHAVIORISM



- How can ABA be applied to executive functions???
- Behavior and environmental events
- “Mental” events consist of private stimuli and private behaviors
- No hypothetical constructs

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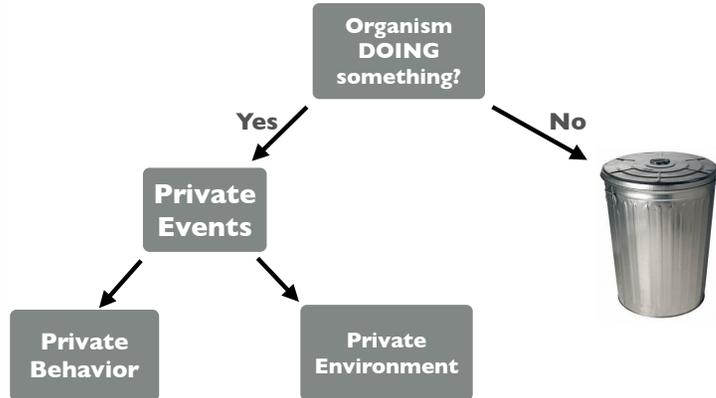
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## Mental Events



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# WHO'S THE EXECUTIVE?

- Skinner talked about self-control as two repertoires of behavior (primary and secondary repertoires)
- The “controlled self” refers to your normal, ongoing behavior
- The “controlling self” refers to a repertoire of behaviors you have learned that control your other



- Skinner believed one can control one's own behavior in the same way one controls other behavior: **By changing the environment in ways that affect the behavior**

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# SECONDARY REPERTOIRES OF BEHAVIOR



- Neuroscience: EF brain mechanisms / chemistry controls our behavior
- Behavioral approach: WE learn to control our own behavior by using other “secondary” behaviors to do it
- Practically speaking, these approaches can be complimentary, not contradictory

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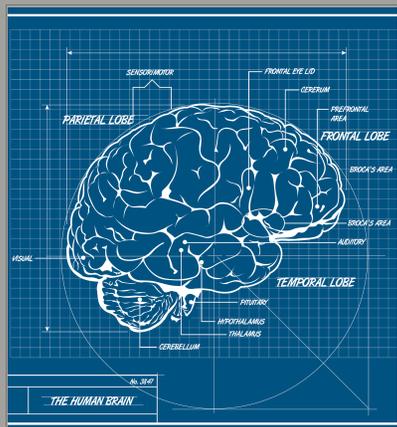
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# TYPICAL DEVELOPMENT OF EXECUTIVE FUNCTIONING

Our Guide to Programming

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# SHORT ANSWER?



- Think of yourself
  - Are there EF areas you tend to be stronger | weaker in?
  - How do you handle?
- As with much EF research, findings are not consistent
  - Some remediation found to be possible, other times less so
  - While working on remediation then, may also want to look at environmental supports

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LET'S SEE!

So we know our children need to learn these skills, they can be taught (sort of), but more needs to be done to generalize and make functional...  
HOW DO WE DO IT???



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FIRST STEPS  
early childhood program

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EXECUTIVE FUNCTION INTERVENTION

  
FIRST STEPS  
early childhood program

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# EF PROGRAMMING OVERVIEW



- ASSESSMENT
- TEACHING PROCEDURES AND GENERAL RECOMMENDATIONS
- PROGRAMMING AREAS

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## ASSESSMENT

Does My Client Have Deficits in Executive Function Skills?



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# STANDARDIZED ASSESSMENTS

- **Behavior Rating Inventory of Executive Function (BRIEF)**
  - Ages 5-18
- **Behavior Rating Inventory of Executive Function - Preschool (BRIEF-P)**
  - Ages 2-5, Parent and Teacher Forms
- **Test of Problem Solving (TOPS)**
  - Ages 6-12
- **Wisconsin Card Sorting Test (WCST)**
  - Ages 6.5-89
- **Stroop Test (children)**
  - Ages 5-14



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## BRIEF | BRIEF-P

- Standardized, norm-referenced multi-rater assessment of “real world” executive functions
- Authors define as “a collection of processes that are responsible for guiding, directing, and managing cognitive, emotional, and behavior functions, particularly during novel problem solving.”
- Clinical scales of the BRIEF measure the extent to which parents and teachers report **problems** with different types of behavior related to 8 different domains of executive functioning (Inhibit, Emotional Control, Plan | Organize, etc.)
  - Items like, “When sent to get something, forgets what he/she is supposed to get”
  - So the higher the raw score, the higher the t-scores | percentiles, the **higher the EF disfunction**

## BRIEF | BRIEF-P

- Useful tool for reporting general EF performance at baseline and following tx
- Provides a standardized score, to compare to average population

Sum of Raw Score to T-Score and Percentile Conversions

Scale / Index	Parent Form					
	Raw Score (7.14)	Raw Score CURRENT	T Score (7.14)	T Score CURRENT	%ile (7.14)	%ile CURRENT
Inhibit	23	17	65	51	89	59
Shift	23	20	87	77	99	98
Emotional Control	29	27	80	76	99	99
<b>BRI</b>	<b>75</b>	<b>64</b>	<b>80</b>	<b>69</b>	<b>99</b>	<b>98</b>
Initiate	22	20	80	74	99	98
Working Memory	24	19	70	58	95	81
Plan   Organize	29	23	74	61	97	86
Organization of Materials	17	11	69	50	96	55
Monitor	22	19	76	66	99	96
<b>MI</b>	<b>114</b>	<b>92</b>	<b>63</b>	<b>77</b>	<b>97</b>	<b>86</b>
<b>CEC (BRI+MI)</b>	<b>189</b>	<b>156</b>	<b>80</b>	<b>67</b>	<b>99</b>	<b>91</b>

## STANDARDIZED ASSESSMENTS

- **Strengths**
  - Well respected
  - Indicates child's skills compared to the general population
- **Limitations**
  - Does not give child-specific information on what or how to treat
  - Needs to be supplemented with observations in the natural environment



# DIRECT - OBSERVATIONS IN N.E.



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# WORKING MEMORY DEFICITS

## Assessing for EF Dysfunction



- Retrieval task failures
- Trouble remembering quick facts
- Difficulty remembering rules governing specific tasks
- Struggles with mental manipulation tasks
- Frequent off-task behavior | Inattention

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# INHIBITORY DEFICITS

## Assessing for EF Dysfunction



- Impulsivity
- Emotional explosiveness | Cries easily
- Laughs hysterically with little provocation
- Lack of personal safety
- General failure to “look before leaping”
- High level of physical activity and motion
- Inappropriate physical response to others
- Tendency to interrupt
- Tendency to disrupt group activities

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# COGNITIVE FLEXIBILITY DEFICITS

## Assessing for EF Dysfunction

- Perseverative behavior | Unable to drop topics of interest
- Difficulty with transitions
- Rigid and inflexible
- Demand | Require consistent routines
- Frequent off-task behavior | Inattention
- Unable to move beyond a disappointment
- Lack of creativity | flexibility in problem solving
- Tendency to apply same incorrect response even with negative feedback



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# SELF-REGULATION | MONITORING DEFICITS

## Assessing for EF Dysfunction



- Rushes through tasks
- Makes careless errors
- Often skips steps of task
- Doesn't check work or final result
- Fails to monitor progress towards goal
- Fails to demonstrate pride in goal attainment
- Does not track effect of behavior on others
- Does not adjust or alter behavior if ineffective or offensive

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# PLANNING & PROBLEM SOLVING DEFICITS

## Assessing for EF Dysfunction



- Fails to initiate tasks without direction
- Approaches tasks in a haphazardly fashion
- Gets caught up in the details and misses the main idea
- Becomes overwhelmed by large amounts of information
- Fails to obtain correct tools | materials in advance
- Fails to break down tasks or use strategies to problem solve
- Difficulty maintaining order in environment

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## EXECUTIVE FUNCTION PROGRAMMING MODEL

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## EXECUTIVE FUNCTIONING INTERVENTION

### 1. EF Skill Building

- Exercises to try to improve deficient EF Skills
- Ex: Practicing Multiple-Steps for Working Memory

### 2. Teaching Compensatory Strategies

- Strategies that may learn to implement him/herself to reduce the impact of EF deficits
- Ex: Child learns to make a "To Do" list

### 3. Environmental Supports

- Accommodations + Modifications to reduce the impact of EF deficits
- Ex: Visual Schedules in Classroom for Routines

### 4. Real-Life Application

- Rehearsing combination of all the above
- Fading to natural contingencies

"Lending them Our Frontal Lobes"

Dawson & Guare (2009)  
*Smart But Scattered*

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## EXECUTIVE FUNCTIONING SKILL BUILDING

Analogue Practice	Real-Life Practice
Contrived, more-controlled setting	Natural, less-controlled setting
Many practice opportunities	Fewer opportunities (either surreptitiously planned or naturally occurring)
Easy to control difficulty	Difficult to control difficulty level
Easy to control anxiety level	Difficult to control anxiety level
Generalization is a major concern	Generalization is more likely (but not guaranteed!)

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## ANALOGUE VERSUS NATURAL SETTINGS

- Analogue practice is like a musician practicing scales
- Naturalistic training is like a musician rehearsing whole songs
- Both are necessary to get you ready for the big concert
- Musicians in training spend LOTS OF TIME doing both
- If we want our clients to be great at EF skills, we need to allow lots of time for both

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## BRING THE FUN

- Like all other learning, people are going to learn EF skills more effectively if learning is FUN
- Two general approaches to bringing the fun:
  1. Big positive reinforcement
  2. Change the antecedents:
    - Make the task fun (e.g., games)
    - Intersperse with other fun tasks
    - Incorporate child choice
    - Make sure instruction is upbeat and fun



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## FOCUS ON GENERALIZATION

- We are interested in established flexible, generalized operant skills
  - No rote learning!
- Multiple exemplar training and other generalization procedures should be used throughout
  - Not as an afterthought!
- These skills are meaningless if they can only be used in the presence of the stimuli and settings that were included in training

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# MULTIPLE EXEMPLAR TRAINING

- Best way to get generalization of a skill
- DO NOT teach just one example of a skill
- Teach more and more new examples
- Test new examples to see if the learner is generalizing
- Keep teaching new examples until the learner can respond correctly to untrained examples

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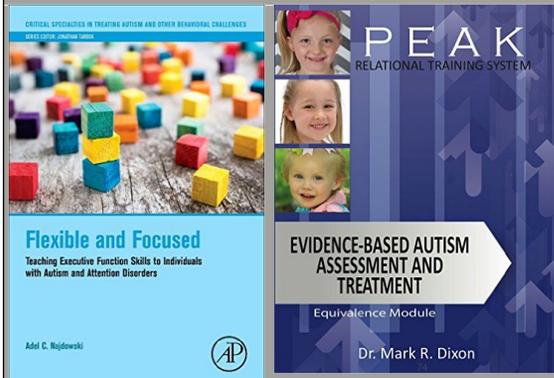
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# RESOURCES



**CRITICAL SPECIFICITY IN TREATING AUTISM AND OTHER BEHAVIORAL CHALLENGES**  
DANIELSON, PH.D. AND SALES

**PEAK**  
RELATIONAL TRAINING SYSTEM

**Flexible and Focused**  
Teaching Executive Function Skills to Individuals with Autism and Attention Disorders  
Adel C. Nijmowski

**EVIDENCE-BASED AUTISM ASSESSMENT AND TREATMENT**  
Equivalence Module  
Dr. Mark R. Dixon

- PEAK Transformation of Stimulus Function module to be published soon

  
FIRST STEPS  
early intervention program

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# PROGRAMMING THE SKILLS

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# PROGRAMMING AREAS

• Let's have a look at turning some of these brain functions into skills we can teach!

- Working Memory
- Sustained Attention
- Inhibitory Control
- Cognitive Flexibility
- Planning + Goal Setting
- Organization
- Problem Solving
- Self-Monitoring

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# INHIBITION

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# INHIBITION

- Inhibitory Control includes inhibiting, resisting, or not acting on impulses
- And the ability to stop one's own behavior at the appropriate time

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# INHIBITION

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# INHIBITION

- Inhibition, as a skill, is not merely the absence of a behavior
- It is *doing something* that then prevents one from doing something else or stopping current behavior
- We need to establish discriminative stimuli to cue clients to use these secondary repertoires of self-control behavior
- Important note: When we use extinction or punishment to decrease a behavior, we are not directly teaching inhibition skills

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# INHIBITION

- Related to flexibility
  - Sometimes requires inhibiting old, rigid ways of responding
- Related to stereotypy
  - Doing something new often requires inhibiting doing something old

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# SAMPLE PROGRAMMING: INHIBITORY CONTROL

## 1. EF Skill Building

## 2. Compensatory Strategies

## 3. Environmental Supports

## 4. Real Life Application



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# INHIBITION

## 1. EF Skill Building

- Draw a tree but don't use green
- Sing ABCs without saying the letter "m"
- Simon Says
- Bop-It
- Reading underlined word silently
- Jenga

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## 1. Inhibition Skill Building: Analogue Practice

- Happy bday without the bday



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# INHIBITION

## 2. Compensatory Strategies

- Self-talk, reflection
- Plan an alternative behavior
- Priming
- Stop-Think-Do



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# INHIBITION: STOP-THINK-DO



## Inhibitory Strategy: Stop-Think-Do

- Train in analogue setting at first
- Use visual support
- Fade prompts
- Fade visual support
- Fade to natural setting

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# INHIBITION

## 3. Environmental Supports

- Avoid situations with conflict
- Avoid situations that are loud or over-stimulating
- Avoid junk food
- Avoid stimuli that will evoke inflexible stereotypy



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# INHIBITION

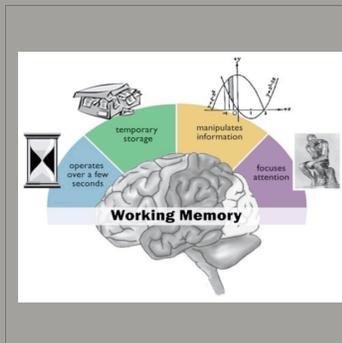
## 4. Real Life Application

- Not raising hand for X minutes while teacher talks
- Not finishing sentence when someone says "I get it"
- Not engaging in stereotypy when you hear a particular song or see a particular picture

# WORKING MEMORY

# WORKING MEMORY

- **"Working Memory"** is the term used to refer to the ability to
  - Hold +
  - Manipulate
- Information in the "mind" for short periods of time



# WORKING MEMORY

Evan

1. Stand up
2. Turn 360
3. Beat your chest
4. Sit Down

What was the name of our new friend?

12 9

91

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## WORKING MEMORY: BEHAVIORAL INTERPRETATION

- **Not at all obvious to me**
- You contact stimuli now
- Then time passes (i.e., a delay) and you contact other stimuli during that delay
- Then you contact new stimuli that cue you to respond to the old stimuli from before the delay
- The later stimuli must cue responding to temporal dimensions (e.g., “What phone number did I tell you BEFORE?”, “What was the FIRST number you heard?”)

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## WORKING MEMORY: BEHAVIORAL INTERPRETATION

- Responding correctly in contexts described as “working memory” requires excellent *attending behavior*
- Some researchers think there is no legitimate distinction between working memory and attention
- So improving working memory very likely involves strengthening attending behavior

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**1. EF Skill Building:**

**Backward Span Task**



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**1. EF Skill Building**



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## WORKING MEMORY

**2. Compensatory Strategies**

- List Writing
  - textual or Iconic
- Repetition | Rehearsal
  - whisper under breath
- Visual + Physical Cues
  - string on a finger | Post-Its
- Finger Cues | Counting
- Mnemonic Devices
  - Kings Play Cards on Fat Green Stools
- Use Humor | Funny Visuals
  - make silly mental picture
- Use of Agenda to plan and remember upcoming events

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## WORKING MEMORY: SAMPLE COMPENSATORY STRATEGY DATA



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## WORKING MEMORY

### 3. Environmental Supports

- Remove | Reduce Distractions
- Proximity
  - have needed items nearby
- To Do Lists
- Visual + Physical Cues
  - visual schedules hanging in room
  - model strategy for child
- Scribe for class lectures notes
- Audio text books

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## WORKING MEMORY

### 4. Real-Life Application

- Memorizes phone number and dials number
- Spelling tests / Listen and write tasks
- Mental arithmetic
- Reading and understanding content (reading comprehension tasks)
- Following multi-step directives (e.g. go find your shoes and put them by the door)

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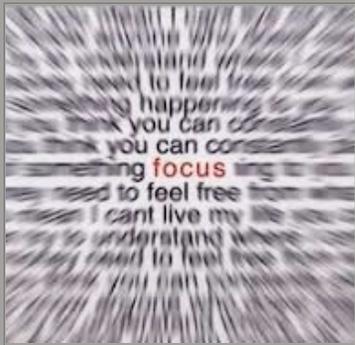
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## SUSTAINED ATTENTION

## SUSTAINED ATTENTION + PERSISTENCE



- Continuing to pay attention to task despite distractibility
- Persisting in the face of adversity

## SUSTAINED ATTENTION

### Sustained attention

- Paying attention to a particular stimulus for a prolonged period of time
- Almost by definition, *longer than you want to*
- If you wanted to pay attention that long, you wouldn't need training in it

### Competing reinforcement contingencies likely causing poor sustained attention:

1. Continue to pay attention to the same stimulus and get no reinforcement
2. Pay attention to something else and get reinforcement (or at least escape from boring stimulus)

# SUSTAINED ATTENTION

Sustained attention is  
**BORING!**

We need to make  
practicing it **FUN!**



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# SAMPLE PROGRAMMING: ATTENTION

1. EF Skill Building

2. Compensatory Strategies

3. Environmental Supports

4. Real Life Application



"My teacher said I don't pay enough attention in class.  
At least, that's what I think she said."

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# SUSTAINED ATTENTION

1. EF Skill Building

## Sustained attention tasks

- Reading a book
- Quiet time
- Repetitive tasks
  - Rainbow loom
  - Lanyards Beading
  - Cats Cradle
  - Origami



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# SUSTAINED ATTENTION

## 2. Compensatory Strategies

- Visual + Physical Cues
  - string on a finger | Post-Its
- Priming | Prior review of task analysis
  - i.e., eyes/ears on teacher, write 3 sentences, beat the timer, check off when done



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# SUSTAINED ATTENTION

## 3. Environmental Supports

- Use timers
- Preferential seating in classrooms and/or 1:1 aide
- Provide frequent breaks
- Reduce all distraction
- Select stimuli of interest
- Avoid stimuli that will evoke inflexible stereotypy



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# SUSTAINED ATTENTION

## 4. Real-Life Application

- Sits nicely and enjoys circle time activities
- Engages in on-topic reciprocal conversation with others
- Finishes meals in one sitting and on schedule
- Cuddles with Dad as he reads story book before bed
- Able to participate in group games and activities = FUN!

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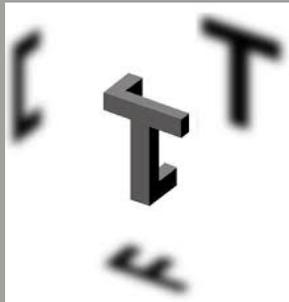
## COGNITIVE FLEXIBILITY

112

First Steps  
early intervention program

## COGNITIVE FLEXIBILITY

- Ability to switch between thinking about two different concepts
- And to think about multiple concepts simultaneously
- Also referred to as “**Set Shifting**”



113

## COGNITIVE FLEXIBILITY: BEHAVIORAL INTERPRETATION

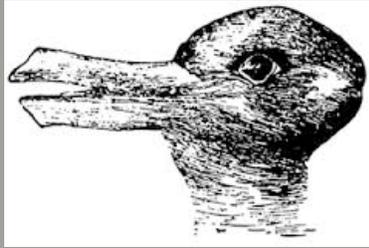
- Variability in behavior, while behavior remains relevant to task
  - Not random variability
- Sensitivity to ongoing environmental changes
- Sensitivity of rule-deriving repertoire to changes in ongoing environment
  - *When the environment changes, your descriptions of it and what behaviors you should do changes too*
- A better term would be “Behavioral Flexibility”



114

# IMPORTANCE OF FLEXIBILITY

- Necessary for creativity
- Necessary for problem solving
- Related to diagnostic features of ASD
- Rigidity can be aversive to others - it's bad for making friends!



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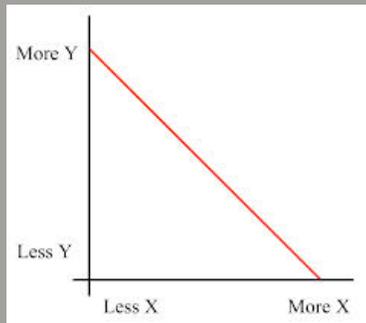
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# COGNITIVE FLEXIBILITY

Perseverative Responding



Flexibility

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# COGNITIVE FLEXIBILITY



- Variability, per se, can be reinforced (Neuringer, 2004)
- But, for some children with autism, variability seems to be aversive
- How do we make something less aversive???

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# FLEXIBILITY

## I. EF Skill Building - Analogue Practice

- Making up nonsense words
- Making up many different meanings for nonsense words
- Changing rules for known games
- Making up new games
- “Backwards day”
- Optical Illusions
- Changing the words to songs
- Changing schedule
- Having breakfast for dinner and vice versa
- Going by a “silly name” for the day
- Say word over and over till it loses its meaning

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## I. Flexibility Skill Training: Analogue Practice



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# COGNITIVE FLEXIBILITY

## 2. Compensatory Strategies

- Positive self-talk
- “What else could I do?”
- “It’s fun/silly to mix it up”
- Guided breathing
- Count to ten
- Imagery

## 3. Environmental Supports

- Access to “ambiguous” play materials
- Blocks | Clay | Fabric
- Art Materials
- Visual Cues | Models



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# COGNITIVE FLEXIBILITY

## •General tips

- Start with tasks the learner is likely to be successful with
- Gradually increase the frustration level, only as he/she is success at the previous level
- Actively program for practice
- Continue training more examples until learner generalizes to untrained tasks



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# COGNITIVE FLEXIBILITY

## 4. Real Life Application

- Tolerates change of plans
- Tries new food, new toy, new situations
- Able to learn from mistakes
- Can suggest alternative endings to stories, alternative rules for games
- Symbolic | Imaginary play
- Artistic expression
- Perspective taking

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# SELF-MONITORING | SELF-REGULATION

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# SELF-MONITORING | REGULATION



- Work-checking behaviors to assess one's own performance
- Monitoring the effect one's behavior has on others

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## SELF-MONITORING

- Skinner: We become conscious of our own behavior when our verbal community teaches us to notice what we are doing
  - “What did you do?”
  - “What are you doing?”
  - “Why are you doing it?”



128

FIRST STEPS  
early intervention program

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## SELF-MONITORING



- Self-monitoring can be conceptualized as a secondary repertoire of behavior
- The behavior of looking at your own behavior
- Everyday examples:
  - Running pace
  - Checking your daily work calendar
  - Keeping a food intake log

129

FIRST STEPS  
early intervention program

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# SAMPLE PROGRAMMING: SELF-MONITORING

## 1. EF Skill Building

## 2. Compensatory Strategies

## 3. Environmental Supports

## 4. Real Life Application

130

# SELF-MONITORING

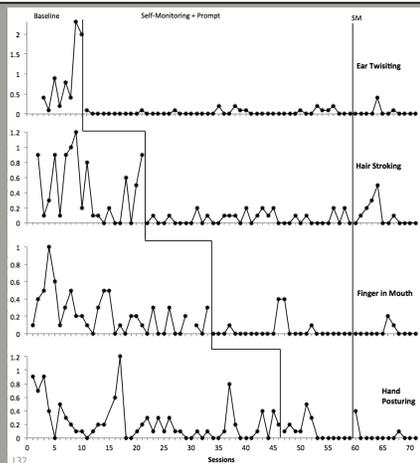
## 1. EF Skill Building

- Many empirically validated behavior change procedures involve self-monitoring and self-evaluation
- Habit reversal
- Goal setting and feedback
- Self-evaluation in training
- Occasionally, self-monitoring training, alone, changes behavior sufficiently

131

## Self-Monitoring Training: Sample Clinical Data

- Taught child to self-monitor stereotypy
- Taught one behavior at a time
- No change in consequences for stereotypy
- First included prompting to self-monitor
- Then removed prompting



132

# SELF-MONITORING

## 1. EF Skill Building: Steps for Teaching

- Teach client to observe their own behavior
  - Watch video
  - Look in mirror
- Teach client to record own behavior
  - Crayon, pencil, tallier
- Teach client to review total number of behaviors in specified period of time, compare to criterion
- Teach client to recruit reinforcement

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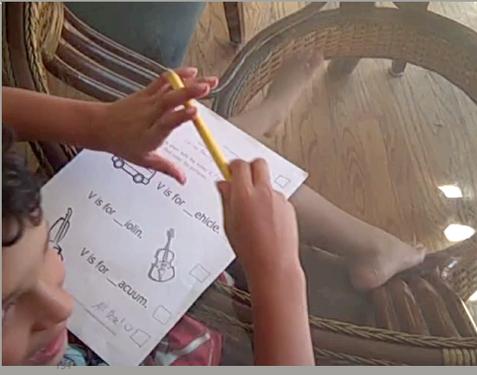
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# SELF-MONITORING | REGULATION

## 2. Compensatory Strategies

- Visual | auditory | tactile monitoring cues
- Self-monitoring | evaluation checklists



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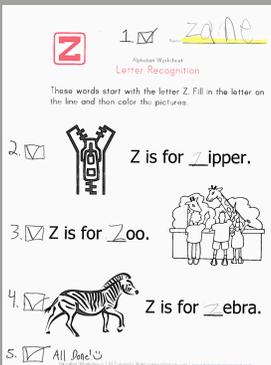
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# SELF-MONITORING | REGULATION

## 3. Environmental Supports

- Use of video for guided training
- Provide lists | definitions of target behavior
- Teach use of monitoring devices
- Access to reinforcement for use of self-monitoring procedures
- Add cues to work to prompt self-monitoring



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# SELF-MONITORING | REGULATION

## 4. Real Life Application

- Multiple step tasks | activities completed on time with targeted accuracy
- Error correction via increased self-monitoring | awareness
- Improved understanding of what behavior is required to achieve goal
  - Attention to process as well as product

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# PLANNING AND GOAL-SETTING

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# PLANNING + GOAL SETTING

- Anticipating future events, setting goals, and developing appropriate steps, organizing ahead of time to carry out a task or activity
- May involve imagining or developing a goal and then strategically determining steps to attain the goal
- Helps manage current and future-oriented tasks



138

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# PLANNING: BEHAVIORAL INTERPRETATION

- The behavior of talking about your own future environment and what behaviors will be needed
- Deriving rules that describe likely antecedents, your own behaviors, and the likely consequences those behaviors will produce
- Almost always a complex chain of many antecedents, behaviors, and consequences
- Almost always involves deriving new rules (not just following old rules)

139

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# PLANNING

## Steps

1. Identify goal
2. Organize and create steps needed to reach goal
3. Identify potential problems
4. Begin planned sequence of steps
5. Monitor progress
6. When problems come up, generate potential solutions
7. If successful, recruit reinforcement (if appropriate)

140

  
FIRST STEPS  
early intervention program

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# PLANNING IN REAL LIFE

## All Business - Or the Business of Fun?



  
FIRST STEPS  
early intervention program

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# PLANNING IN REAL LIFE

## All Business - Or the Business of Fun?



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# SAMPLE PROGRAMMING: PLANNING

1. EF Skill Building

2. Compensatory Strategies

3. Environmental Supports

4. Real Life Application



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# PLANNING STEPS

## I. EF Skill Building

- Create steps needed to reach goal
- Involves identifying likely future consequences of various future behaviors
- Rule-deriving
- Start small to teach the necessary verbal behavior
- Any board game: Before each turn, have learner say out loud what he is trying to achieve and what will happen if he makes various moves
- This is essentially creating and executing a plan with a single step

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# PLANNING | ORGANIZATION

## I. EF Skill Building

- Packing a Suitcase
- Shopping
- Packing for a picnic
- Legos
- Putting a game back into a box
- Organize materials needed for project
- Narrow down concept to main ideas
- Story Mapping
- Minecraft
- Math word problems
- Categories
- Passing things out to group of people in an organized manner
- Setting the table
- Dealing Cards

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# PLANNING

## 2. Compensatory Strategies

- To do list
- Decision trees
- Self-talk
- Looking things up on google
- Most of these strategies can be useful across most planning activities

**TO DO:**  
*Make a To-Do List!*

## 3. Environmental Supports

- Either make or assist client in writing steps of plan to refer to during project
- Provide regular free access to "loose parts"



146

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# PLANNING ACTIVITIES

## 4. Real-Life Application

### Tasks

- Plan a playdate
- Make a gift for mom
- Cook a meal or snack
- Pack for an outing
- Plan steps needed to complete a school project
- Chess
- Checkers
- Card games
- Mazes
- Connect Four
- Scavenger hunts

147

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# PUTTING IT ALL TOGETHER

## *The Art of Problem Solving*

148

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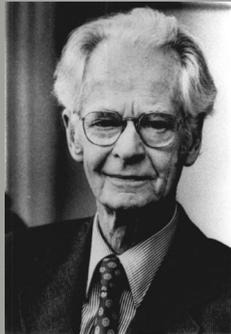
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## PROBLEM-SOLVING

- B. F. Skinner: A problem is a situation where an outcome would be reinforcing, if only you had a behavior needed to produce it
- In other words, you know what you want but you don't know what to do to get it



149

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## PROBLEM-SOLVING

### **Problem-solving as a Class of Behavior:**



- Behaviors you engage in that result in identifying the behavior needed to bring about the desired outcome
- In other words, it's the skill of figuring out what you need to do to get what you want

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# PROBLEM SOLVING + AUTISM

- Solving novel problems is **critical to human functioning**
- Previous research has shown that many children with ASD have **deficits in problem solving skills** (Minshew et al., 1997)
- **Very little previous research** has evaluated procedures for teaching problem solving skills to children with ASD

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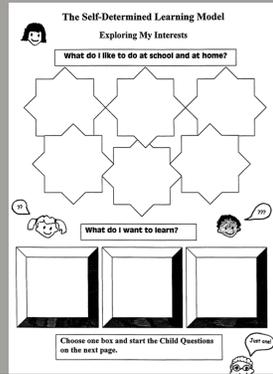
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# SELF-DETERMINED LEARNING MODEL OF INSTRUCTION

- Manual by Palmer and Wehmeyer (2002)
- Intellectual disabilities in general education (Agran et al, 2006)
- Middle school students with developmental disabilities (Agran et al, 2002)
- Limited to one problem, in school setting
- Solutions are usually doing what teacher says



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# PROBLEM-SOLVING VS PLANNING

- Problem-solving is similar to planning
- Both involve deciding what you need to do in the future, in order to produce a particular outcome
- Planning is what you do before there is a problem (and may prevent problems)
- Problem solving is what you do when a problem comes up



153

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# PROBLEM-SOLVING VS PLANNING

Planning	Problem-Solving
Prepare for a play date	Make your friend feel better after you accidentally hurt his feelings
Planning how to complete a school project	The tool you need for a project breaks while you are working on the project
You buy a new skateboard and plan how to assemble the parts	A bolt on your skateboard breaks and you need to fix it

154

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# PROBLEM-SOLVING

## Steps

1. Identify problem **ATTENTION**
2. Explain why it's a problem **WORKING MEM**
3. Generate potential solutions **FLEXIBILITY**
4. Choose a solution and implement it **PLANNING**
5. Monitor progress **SELF-MONITORING**
6. If unsuccessful, choose a new solution **FLEXIBILITY**
7. If successful, recruit reinforcement (if appropriate)

155

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# PROBLEM SOLVING PUZZLES

## All Business - Or the Business of Fun?



Bunny Peek a Boo!

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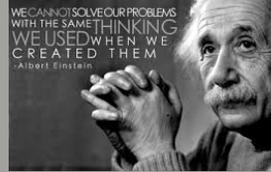
# SAMPLE PROGRAMMING: PROBLEM SOLVING

## 1. EF Skill Building

## 2. Compensatory Strategies

## 3. Environmental Supports

## 4. Real Life Application



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# PROBLEM-SOLVING: SKILL BUILDING

## 1. EF Skill Building

• Depending on functioning level of learner, either:

- Use forward chaining start teaching first step (easier)
- Or use total task chaining to teach all steps at once (harder)



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# PROBLEM-SOLVING: SKILL BUILDING

## • Prompting and Fading

- Use ample prompts at first, so learner is successful
- Fade out prompts to encourage independence
- Use “leading question” prompts rather than directive and echoic prompts
- Guide the learner to “figure it out” rather than telling her what to do
- Leading question prompts
  - “What do you think might work?”
  - “Is that going to fix it or make it worse?”
  - “I wonder what would happen if you did X....”

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# PROBLEM-SOLVING EXAMPLES

Problems	Solutions
Crayon breaks	Tape it back together Pick a different color Use it anyway
Bottle of glue is jammed	Squeeze harder Poke it with a paper clip Use tape or staples instead
Can't open a box that is taped shut	Get scissors to cut tape Peel tape off Tear box
Not enough chairs for everyone to sit on	Use something else as a chair Sit two people on one chair Find another chair

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# PROBLEM-SOLVING AS A BEHAVIORAL CHAIN

## Steps

1. Identify problem
2. Explain why it's a problem
3. Generate potential solutions
4. Choose a solution and implement it
5. Evaluate success
6. If unsuccessful, choose a new solution

161



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- Problem: Books won't all fit in bins



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# PROBLEM-SOLVING

## 4. Real Life Application

- Computer stops working
  - stays calm, immediately engages problem solving steps:
    - ✓ assesses possible reasons,
    - ✓ based upon assessment, devises potential solutions,
    - ✓ implements best solution,
    - ✓ evaluates effectiveness,
    - ✓ selects another possible solution if needed,
    - ✓ fixes computer and **gets back to work!**

# WRAPPING IT ALL UP

## Our ASD clients appear to have significant EF deficits

- Behavior often rigid and inflexible; an “insistence on sameness,” difficulty with creativity / imaginative thinking
- Often demonstrate perseverative interests
- Tend to fail to be “future oriented”
  - often unable to identify goal or purpose,
  - need assistance to “stop”, “think” **of potential immediate and long term consequences**, then “do”
  - have extreme difficulty self-monitoring
- Impulsive behavior evident in many clients

# BRAIN-BEHAVIOR CONNECTION

- Executive Functions necessary for everything we, as human beings, DO....
  - Given we are not born with fully developed EF skills, safe to assume a biology + learning effect
  - Our kids have not acquired many EF skills, likely due to biological factors
  - As behavior analysts, it is time to use our skills and get our kids learning and developing EF skills
  - By programming for EF skills, we reduce core diagnostic symptoms and enable new and adaptive and socially meaningful behavior to be learned!

# CONCLUSION

- Using ABA principles and procedures to analyze and teach EF skills will:
  - Establish useful skills for individuals with autism
  - Expand the science of behavior analysis to be a more comprehensive science of psychology
  - Multiple exemplar training works!
  - Don't forget to focus on generalization, it is always the toughest challenge!

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