Functional Analysis of Problem Behavior: the Basics

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Main Points

- *Learned Functions of Problem Behavior*
- *Approaches to Assessment*
  - *Indirect methods*
  - *Descriptive analysis*
  - *Functional (experimental) analysis*
- *Functional analysis methodology*
  - *Key components*
  - *Variations and extensions*
- *Implications for Treatment*
  - *Elimination of establishing operations (EOs)*
  - *Elimination of maintaining contingencies*
  - *Behavioral replacement*

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Special Note

JABA

Journal of Applied Behavior Analysis

- *Spring 2013 (Vol. 46, #1)*
- *Special issue on functional analysis*
- *31 articles on various aspects of assessment & treatment*

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Why do people engage in problem behavior?

Biology: Physiological predisposition
- *Genetic endowment ➤ behavioral capacities*
- *Physiology does not produce specific problem behavior*

Personality: Mental or emotional disorder
- *Behavioral symptoms ➤ clinical diagnosis*
- *Clinical diagnosis ≠ explanation for symptoms*

Environment: Learning history
- *Experience ➤ new behavior*
- *Certain experiences ➤ problem behavior*

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Structural vs. Functional Analysis

❖ *Structural analysis:*
  ✦ *Identification of parts or components*
  ✦ *General: Of what is this thing made?*
  ✦ *Environment & behavior: What events are happening?*

❖ *Functional analysis:*
  ✦ *Identification of uses or purpose*
  ✦ *General: What does this thing do?*
  ✦ *Environment & behavior: Why are these events happening?*

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Functional Analysis of Behavior

❖ *Purpose:*
  ✦ *To identify the variables of which behavior is a function; to discover "cause-effect" relationships (Skinner, 1953)*

  ✦ *Goals:*
    ✦ *Understanding*
    ✦ *Treatment*
    ✦ *Prevention*

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Learned Functions of Behavior Disorders

- *Assumptions*
  - *Most behavior problems are learned*
  - *Adaptive and maladaptive behavior have common functions*

- Positive Reinforcement (Sr+, reward)
  - *Social (attention, access to tangible materials)*
  - *Automatic (sensory stimulation)*

- Negative Reinforcement (Sr-, escape or avoidance)
  - *Social (escape from task demands)*
  - *Automatic (pain attenuation)*

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Social-Positive Reinforcement
(Social Sr+)

Antecedent event
(Deprivation from attention)
↓
Behavior
(SIB, AGG, PD, etc.)
↓
Consequent event
(Blocking, reprimand, comfort,
leisure items, snacks, etc.)

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Function	Antecedent (EO)	Consequent (Sr)
Social Positive Reinforcement	Deprivation (no attention)	Attention
Automatic Positive Reinforcement	Deprivation (no sensory stimulation)	Sensory stimulation
Social Negative Reinforcement	Aversive stimulation (task demands)	Removal of task
Automatic Negative Reinforcement	Aversive stimulation (pain or discomfort)	Alleviation of pain

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Self-Injurious Behavior (SIB)

Behavior that produces injury to the individual's own body

- **Biting:** Closure of upper / lower teeth on the skin (also mouthing and sucking)
- **Eye Gouging:** Finger insertion into the ocular area
- **Head Banging:** Forceful contact of the head with a stationary object
- **Hitting:** Forceful contact of one body part with another or with a stationary object
- **Pica:** Ingestion of inedible substances
- **Rumination:** Regurgitation and reswallowing of previously ingested food
- **Scratching:** Raking-like or picking movement of fingernails on the skin

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Functional Behavioral Assessment

| *Precision*		*Simplicity*
Least	*Anecdotal (Indirect) Methods*	*Most*
❻	*Descriptive (Naturalistic) Analysis*	❽
Most	*Functional (Experimental) Analysis*	*Least*

❖ *Terminology*
  ◇ *Functional behavioral assessment (FBA): Any systematic attempt to identify sources of reinforcement for problem behavior*
  ◇ *Functional analysis (FA): Use of the experimental model to identify cause-effect (environment-behavior) relations*

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Kahng et al. (AJMR, 2002)

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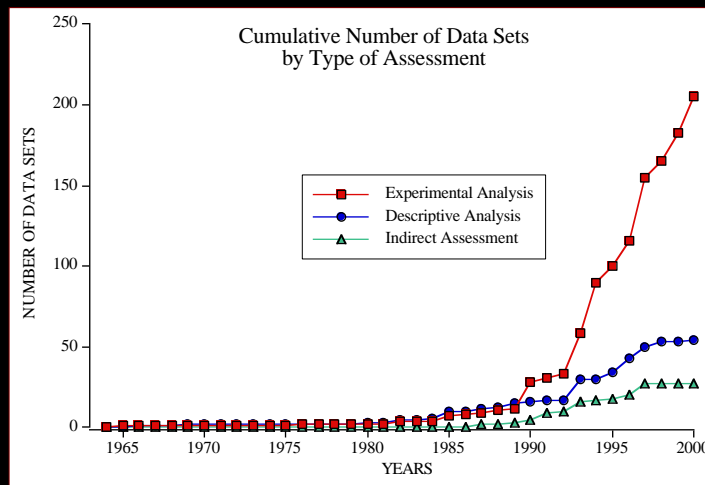
Indirect (Anecdotal) Methods

- General Characteristics
  - *Focus on circumstances under which behavior occurs*
  - *Based on informant recall (no direct observation)*
- Examples
  - *MAS (Motivational Assessment Scale)*
  - *QABF (Questions about Behavioral Function)*
  - *FAST (Functional Analysis Screening Tool)*
- Advantages
  - *Simplicity, efficiency*
- Limitations
  - *Poor reliability, questionable validity*
- Suggestion for implementation
  - *Use only as a preliminary guide*

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Descriptive (Naturalistic) Analysis

- General Characteristics
  - *Direct observation of circumstances under which behavior occurs*
- Examples
  - *Scatter plot: Temporal recording of behavior*
  - *ABC analysis: Recording of interactional sequences*
  - *Interval recording: Temporal recording of rapid sequences*
- Advantage
  - *More reliable than indirect methods*
- Limitations
  - *Structural analysis only; no information about function*

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Scatter Plot

Data Grid
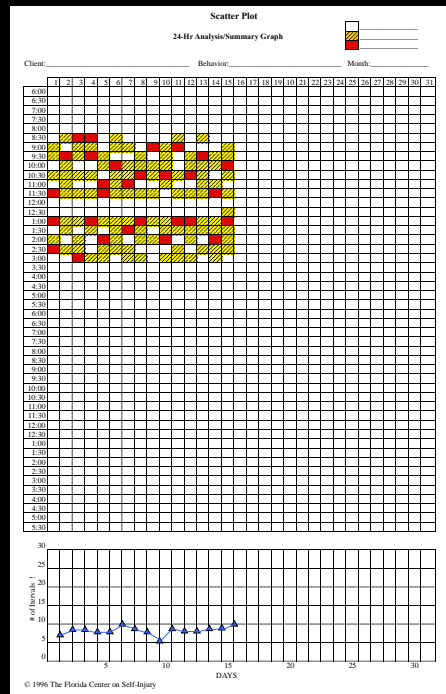- *Rows: 30-min intervals*
- *Columns: days*
- *Summary at bottom*

Record at end of 30-min intervals
- *Blank: No PB*
- */ (yellow): A little PB*
- *X (red): A lot of PB*

Summary
- *# intervals with PB*

Scatter Plot
24-Hr Analysis/Summary Graph

Client:_____ Behavior:_____ Month:_____

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A-B-C Analysis

Purpose
- *To identify naturally occurring, observable antecedents and consequences of behavior*

Typical procedure
- *Define target behaviors (B)*
- *Specify criteria for antecedent (A) and consequent (C) events*
- *Occurrence of B ➤ Record A, B, and C*
- *Organize A-C clusters*
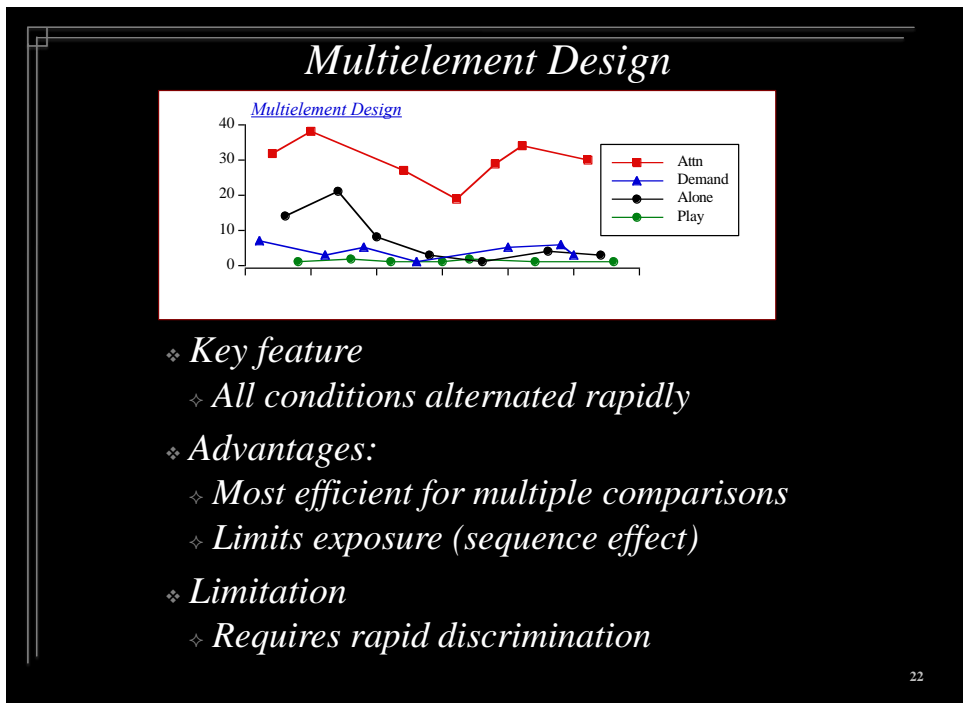- *Generate hypothesis based on A-C correlations with B*

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A–B–C Form

Layout
- *Client info*
- *Time*
- *Location*
- *Antecedent: Precedes PB*
- *Behavior: Target PB*
- *Consequence: Follows PB*

Record
- *Occurrence of PB serves as occasion for recording*

Summary
- *Organize A & C events into functional groupings*

Antecedent-Behavior-Consequence (ABC) Analysis

Client:_____ Observer:_____

Target Behavior: _____ Date:_____

Time	Location	Antecedents	Behavior	Consequences

Functional (Experimental) Analysis

- General Characteristics
  - *Systematic exposure to controlled assessment conditions*
    - *Test: Suspected antecedent and consequent present*
    - *Control: Suspected antecedent and consequent absent*
- Variations
  - *BFA, single-function, trial based, latency, precursor*
- Advantage
  - *Most precise method of assessment*
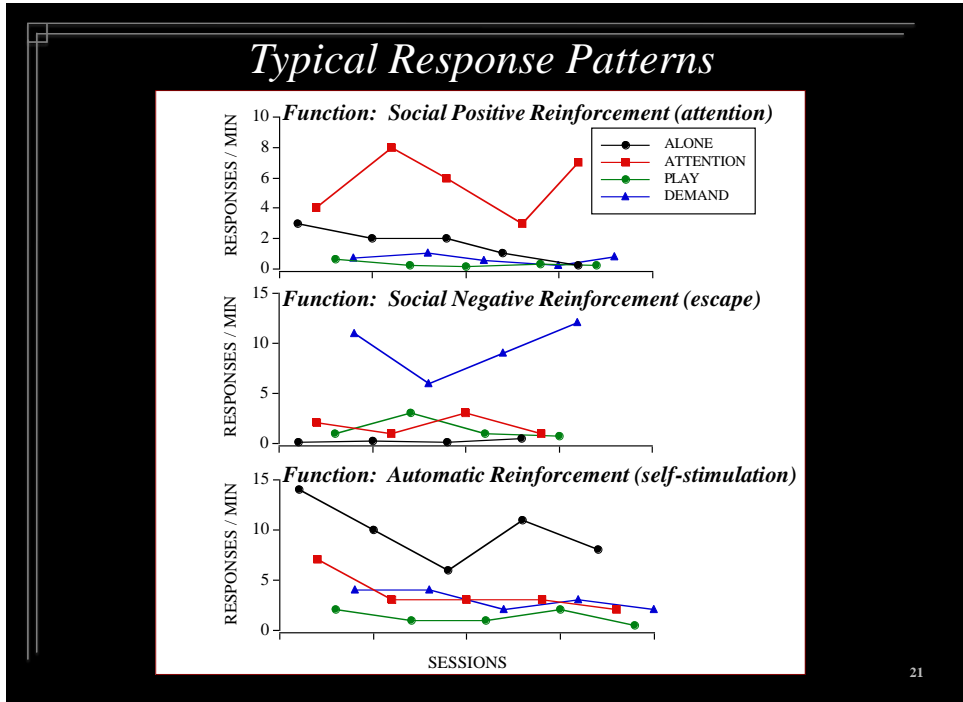- Limitation
  - *Most complex approach*

Some Key Terms

- Antecedent event: Establishing operation (EO)
  - *Alters the effects of a reinforcer*
  - *EO present: Sr more valuable*
  - *EO absent: Sr less valuable*
  - *Example: Food deprivation ➤ food more valuable*

- Antecedent event: Discriminative stimulus (S^D)
  - *Stimulus in whose presence reinforcement is more likely*
  - *S^D present: Sr available*
  - *S^D absent: Sr unavailable*
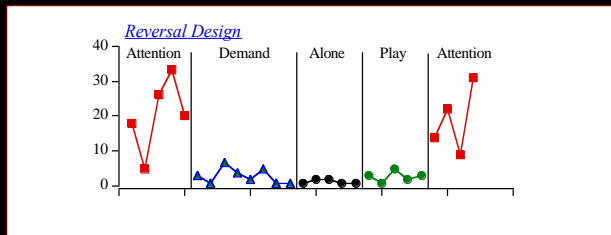 - *Example: Traffic light ➤ Stop/go more likely to be reinforced*

- Consequent event: Reinforcement contingency (Sr)
  - *If-then relation between a response and a consequence*
  - *Contingency present: Behavior maintains*
  - *Contingency absent: Behavior extinguishes*

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Functional Analysis Protocol

| Condition	S^D	EO	Consequence	Contingency
Attention	Th 1	*Th. ignores Cl.*	*Th. attends to beh. problem*	*Positive rfmnt (attention)*
Demand	Th 2	*Th. presents learning trials*	*Timeout for beh. problem*	*Negative rfmnt (escape)*
Alone	N/A	*No stimulation*	*N/A*	*N/A Automatic reinf?*
Play	Th 3	*N/A Attn: Free Demands: None Toys: Free*	*N/A*	*Control*

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Typical Response Patterns

Function: Social Positive Reinforcement (attention)

Function: Social Negative Reinforcement (escape)

Function: Automatic Reinforcement (self-stimulation)

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Multielement Design

Multielement Design

* *Key feature*
  * *All conditions alternated rapidly*
* *Advantages:*
  * *Most efficient for multiple comparisons*
  * *Limits exposure (sequence effect)*
* *Limitation*
  * *Requires rapid discrimination*

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Reversal Design

Reversal Design

(Attention, Demand, Alone, Play, Attention)

- ❖ *Key feature*
  - ✧ *Repeated exposure to each condition*
- ❖ *Advantage:*
  - ✧ *Facilitates discrimination*
- ❖ *Limitation*
  - ✧ *Potential sequence effect*

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Pairwise Test-Control Design

Pairwise Test-Control Design

(Attention v. Play, Demand v. Play, Alone v. Play)
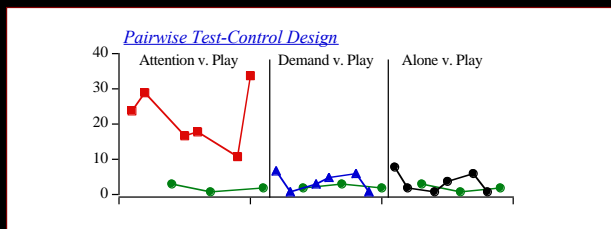
- ❖ *Key features*
  - ✧ *Single test and control conditions alternated*
  - ✧ *Test conditions arranged in reversal sequence*
- ❖ *Advantage:*
  - ✧ *Combines best features of multielement and reversal designs (facilitates discrimination, controls for sequence effect)*
- ❖ *Limitation: None*

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Challenges to Functional Analysis Methodology

- *Complexity of assessment: It's too difficult*
- *Time constraints: It takes too much time*
- *Setting constraints: I don't have a controlled setting*
- *High-risk behavior: It's too dangerous*
- *Low-rate behavior: I never see the behavior*
- *Uninterpretable results: I can't identify the function*

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Complexity of Assessment: Logic & Data

- Logical analysis
  - *What skills are required to conduct a functional analysis?*
- Empirical analysis
  - *Undergraduate students (Iwata et al., 2000)*
  - *B.A.-level therapists (Moore et al. 2002)*
  - *Teachers (Wallace et al., 2004)*
  - *Teleconferencing (Barretto et al., 2006)*

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Time Constraints
Brief Functional Analysis (BFA)

- *Northup et al. (1991): One, 5-min session of each condition*
- *Derby et al. (1992): 50% functions identified (40/79)*
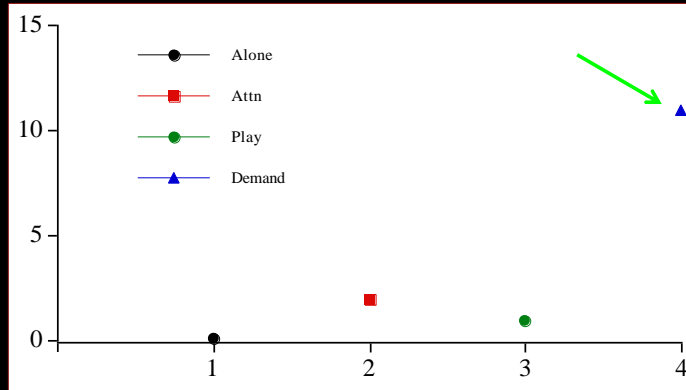
Time Constraints: Single Function Tests
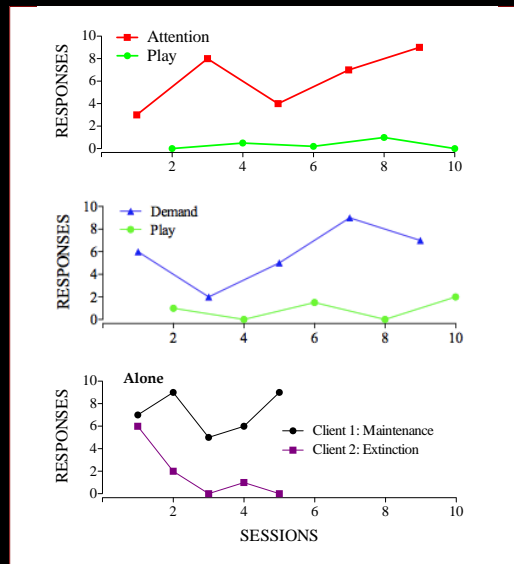
Setting Constraints

* FA in the home?
  * *Day et al. (1994), Harding et al. (2001), Nadjowski et al. (2008)*

* Typical FA in typical classroom?
  * *Berg et al. (2007); Derby et al. (1994); Dolezal & Kurtz (2010); Frea & Hughes (1997); Grauvogel & Wallace (2010); Lang et al. (2008, 2009, 2010); McComas et al. (2000, 2003); Mueller et al. (2003); O'Reilly et al. (2009)*

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Classroom-Specific, Trial-Based FA

(Bloom et al., 2011, 2013; Kodak et al., 2013; Lambert et al., 2013)

Classroom restrictions
  * *Rapidly changing activities ➤ Brief sessions*
  * *Contiguous test-control comparison (control precedes test)*
  * *Capitalize on naturally occurring activities*

Study arrangement (Bloom et al.): 4-min trial
  * *2-min control ➤ PB yes or no*
 * *2-min test ➤ PB yes or no*

Recommended arrangement: 5-min trial
  * *1-min control ➤ PB yes or no*
 * *4-min test ➤ PB yes or no*

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FA Trials

❖ Attention (no tasks present)
  ⬥ *Control: Stand near student; initiate pleasant conversation*
  ⬥ *Test: Stand near student but ignore; deliver attention only following problem behavior*

❖ Task Demand
  ⬥ *Control: Observe while no task demands are present*
  ⬥ *Test: Deliver frequent prompts to engage in difficult work; remove work following problem behavior*

❖ Alone
  ⬥ *Two consecutive test segments. Observe when student is not working, not interacting with others, and has no access to leisure items*

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Correspondence: Social Sr+

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Correspondence: Social Sr-

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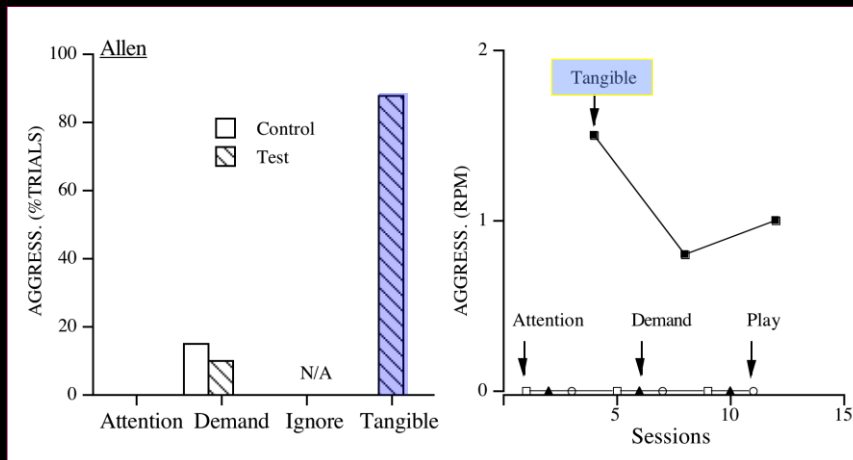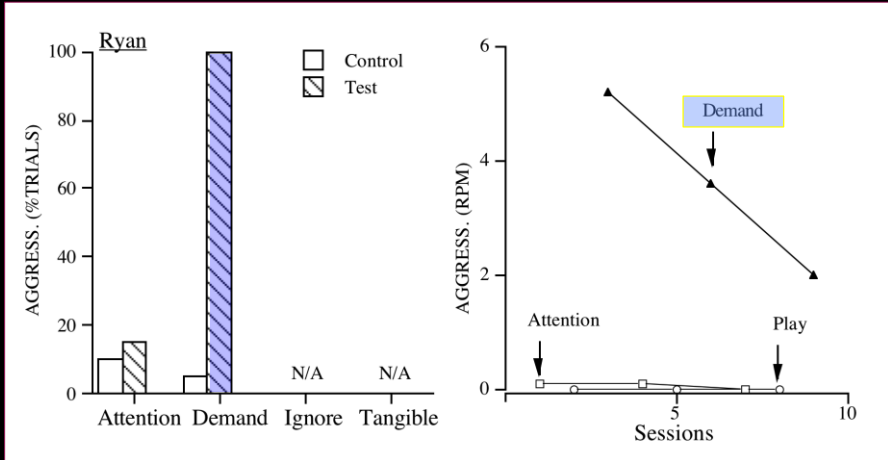
High-Risk Behavior

❖ Latency FA *(Thomason, Iwata, Neidert, & Roscoe, 2011, Study 3)*
  ✦ *N=10, SIB or AGG*
  ✦ *Latency FA*
    ▪ *Deliver consequence for 1st response and terminate session (or if no response in 5 min)*
    ▪ *Measure: # seconds to occurrence of 1st response*
  ✦ *Typical FA: Standard protocol, 10-min sessions*
  ✦ *Results: 9/10 correspondence*

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Correspondence: Social Sr+ (Attention)
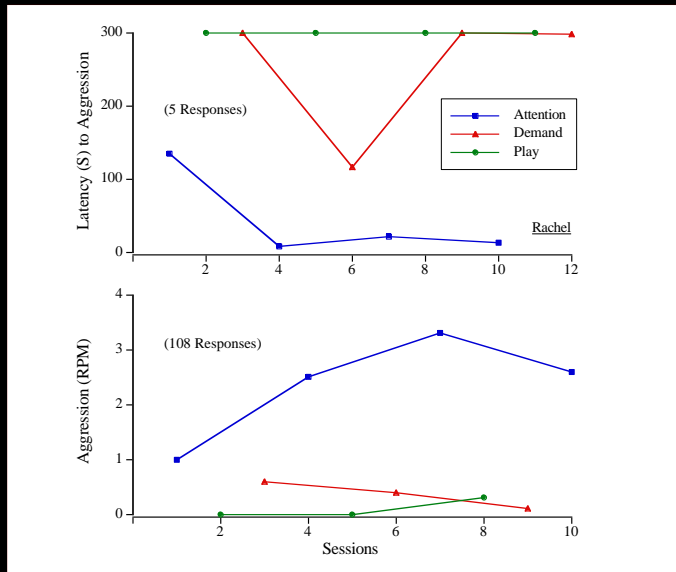
Correspondence: Social Sr- (Escape)
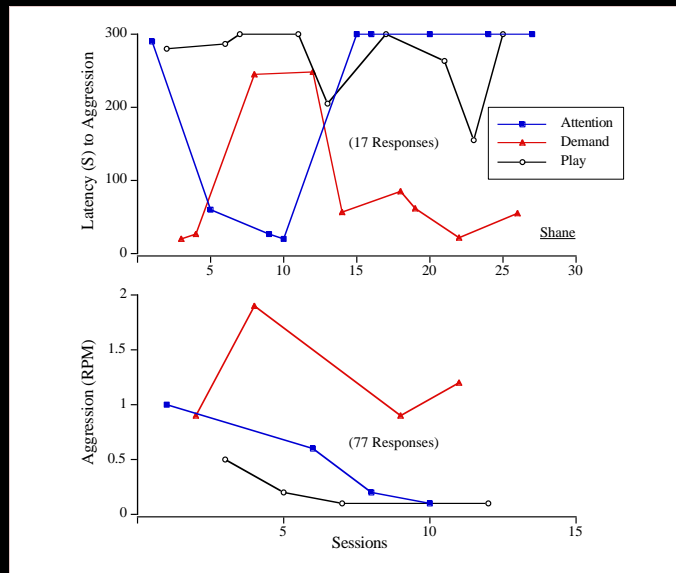
Precursor Behavior & Response Classes

Definition
⬥ *Topographically different than target response*
⬥ *Precedes and predicts occurrence of target*

Chain relation (sequence of responses, different reinforcers)
⬥ *Put on coat (stay warm) ➤ walk out door (go somewhere)*
⬥ *Get out of chair (close to target) ➤ aggression (attn or escape)*

⬥ Response class (substitutable responses, same reinforcer)
⬥ *Ask for water (water) ➤ go looking for water (water)*
⬥ *Swear at teacher (escape) ➤ aggression (escape)*

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High-Risk Behavior

Analysis of precursor behavior (Smith & Churchill, 2002)
⬥ *N= 4 (3 SIB, 1 AGG)*
⬥ *FA #1: Contingencies on SIB / AGG*
⬥ *FA #2: Contingencies on precursor Rs*
⬥ *Results:*
    ⬥ *4/4 matched FAs*
    ⬥ *SIB lower during FA of precursor R*
⬥ *Implications*
    ⬥ *If one can identify a precursor to PB, and*
    ⬥ *If precursor and PB members of the same functional class*
    ⬥ *FA of precursor ➤ function of PB*
    ⬥ *Treatment of PB based on function of precursor*

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Why does Problem Behavior Occur at Low Rates?

- *Insufficient exposure to test condition*
  - *Lengthen sessions (Davis et al., 2012)*
- *Idiosyncratic EO or reinforcer*
  - *See reviews (Hanley et al., 2003; Schlechenmeyer et al., 2013)*
- *Response class hierarchy*
  - *Do not combine PBs (Richman et al., 1999)*
- *Combined EOs (same maintaining contingency)*
  - *Divided attention condition (Mace et al., 1986)*
- *Combined contingencies (Sr+ and Sr- simultaneously)*
  - *Escape to tangible condition (Zarcone et al., 1996)*
- *Covert behavior*
  - *Hidden observation (Ringdahl et al., 2002)*
  - *Response product measures (Maglieri et al, 2000)*

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Undifferentiated Results: Case Analysis
(Hagopian et al., 2013)

Modifications to 82 undifferentiated FAs
- *Most effective: Design change (pairwise, extended "alone")*
- *2nd most effective: Separating aggregate responses*
- *Least effective: Antecedent changes (location, stimuli)*

Results
- *One modification: 55/82 cases clear*
- *Two modifications: 16/24 cases clear*
- *8 cases unresolved*

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Summary of Functional Analysis Variations

Limitation		Suggestion
Complexity	➤	Sorry, I cannot help you
Time	➤	BFA (extended), Single-function test
Setting	➤	Trial-based FA
Risk	➤	All approximations and occurrences, Protective devices, Latency or Precursor FA
Low-rate	➤	Lengthen sessions, combine EOs or contingencies, unobtrusive observation
A mess	➤	Simplify design, separate PBs

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RECAP: Functional Behavioral Assessment

- ❖ Indirect Methods
  - ◇ Simple but unreliable
- ❖ DA: Descriptive (Naturalistic) Analysis
  - ◇ Reliable but time consuming; structural analysis only
- ❖ FA: Functional (Experimental) Analysis
  - ◇ The gold standard but complex

- ❖ Common recommendations
  - ◇ Three-stage assessment: Indirect ➤ DA ➤ FA
  - ◇ Two-stage assessment: DA ➤ FA
  - ◇ My suggestion: Neither

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What about DA vs. Indirect Methods?

ABA based on scientific study of human behavior
- Emphasis on objective measurement
- Direct observation (DA) superior to opinion (indirect)

BUT
- DA: Objective approach to structural analysis
- Indirect: Subjective approach to functional analysis

And if you read the research carefully:
- Neither method identifies cause-effect relations very well
- DA much more complex than indirect
- DA takes about 15-20 times longer than indirect
- Clinical interview easily accommodates indirect assessment
- DA poses some risk; Indirect poses none
- Indirect errors probably random; DA errors probably biased

So . . . which would you use?

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Recommended Assessment Sequence

Step #1: Clinical interview + MAS, QABF, or FAST

Step #2: Brief (10-15 min) observation (or skip entirely)

Step #3: Functional analysis (FA, BFA, single function test, trial-based FA, latency FA, precursor FA)

Rationale: Clinicians may do #1 well but not #2 or #3. Compare the value of watching a client for 30 min (#2) vs. seeing what a client does when ignored, when presented with demands, etc. (#3)

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Barriers to Implementation

Current status of FA methods
  ⋄ *The standard in clinical research and practice*
  ⋄ *Still not the the most common approach to assessment*
  ⋄ *Why the 30+ year lag in widespread application?*

Commonly mentioned limitations
  ⋄ *Practical constraints*
  ⋄ *Ethical issues*

The real barriers
  ⋄ *Most academics have never conducted an FA of PB*
  ⋄ *Most graduate students never learn how to conduct an FA*
  ⋄ *DA is an excellent structural analysis (A ➤ B ➤ C)*
  ⋄ *Everyone knows how to conduct a DA*

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Implications

for

Intervention

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Classification of Intervention Procedures

- Structural approach: Emphasis on procedures
  - *Advantage: Well-defined practice guidelines*
    - *Time out, overcorrection*
  - *Disadvantage: Behavior chance mechanisms unknown (Same procedure ➤ different results)*
    - *Planned ignoring ➤ extinction vs. Sr-*
    - *Reprimand ➤ punishment vs. Sr+*

- Functional approach: Emphasis on contingencies
  - *Advantage: Generalizable across response functions*
    - *Extinction ➤ cessation of reinforcement*
  - *Disadvantage: Procedural details not well specified*
    - *Extinction ➤ what procedures?*

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Reinforcement-Based Approaches to Behavior Reduction

- *Eliminate the behavior's establishing operation or antecedent event (deprivation or aversive stimulation)*
  - *Noncontingent reinforcement (NCR)*

- *Eliminate the behavior's maintaining contingency*
  - *Extinction (EXT)*

- *Replace the behavior with an alternative response*
  - *Differential reinforcement (DRA)*

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Function: Social Positive Reinforcement

* *Establishing operation: Deprivation from attention*
  * *Noncontingent attention (NCR)*

* *Maintaining reinforcer: Attention*
  * *EXT (attention) or "planned ignoring"*

* *Behavioral replacement:*
  * *Establish an alternative attention- seeking response*

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Function: Social Negative Reinforcement

* *Establishing operation: Aversive stimulation (e.g., demands)*
  * *Noncontingent breaks from work (NCR)*
  * *Maintenance tasks substituted for acquisition tasks*
  * *Reduced session duration*
  * *Demand fading (frequency or difficulty)*
  * *High probability (Hi-p) instructional sequence*
  * *Noncontingent Sr+*

* *Maintaining reinforcer: Escape*
  * *EXT (escape); EXT (attention) contraindicated*

* *Behavioral replacement:*
  * *Reinforce precursor behavior*
  * *Establish an alternative escape behavior*
  * *Strengthen compliance via Sr- and Sr+*

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Function: Automatic Positive Reinforcement

❖ *Establishing operation: Generalized deprivation*
  ⬥ *Noncontingent stimulation (NCR)*

❖ *Maintaining reinforcer: Sensory stimulation*
  ⬥ *EXT (sensory); mechanical devices, blocking, etc.*
  ⬥ *Response effort inerventions*

❖ *Behavioral replacement:*
  ⬥ *Establish an alt. self-stimulatory response*

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Multiple Control - Treatment

Functions	Attention Seeking Response	Escape Response	Self-Stimulatory Response
Social Sr+ Social Sr-	X	X	
Social Sr+ Automatic Sr+	X		X
Social Sr- Automatic Sr+		X	X

The problem: Social Sr+ & Social Sr-
⬥ *Extinction procedurally incompatible across functions*
  Sr+(terminate interaction) vs. Sr- (continue interaction)
⬥ *Use context as the determinant of intervention*
⬥ *Demands absent: Assume Sr+; Demands present: Assume Sr-* 52