
◆

Functional Analysis of Problem Behavior: the Basics

*Brian A. Iwata
Distinguished Professor
Psychology & Psychiatry
University of Florida*

◆

1

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*

2

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*

3

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*

4

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?*

5

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*

6

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)*

7

Social-Positive Reinforcement (Social Sr+)

*Antecedent event
(Deprivation from attention)*



*Behavior
(SIB, AGG, PD, etc.)*



*Consequent event
(Blocking, reprimand, comfort,
leisure items, snacks, etc.)*

8

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

Self-Injurious Behavior (SIB)

Behavior that produces injury to the individual's own body

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

Functional Behavioral Assessment

Precision

Simplicity

Least

Anecdotal (Indirect) Methods

Most

⑥

Descriptive (Naturalistic) Analysis

⑧

Most

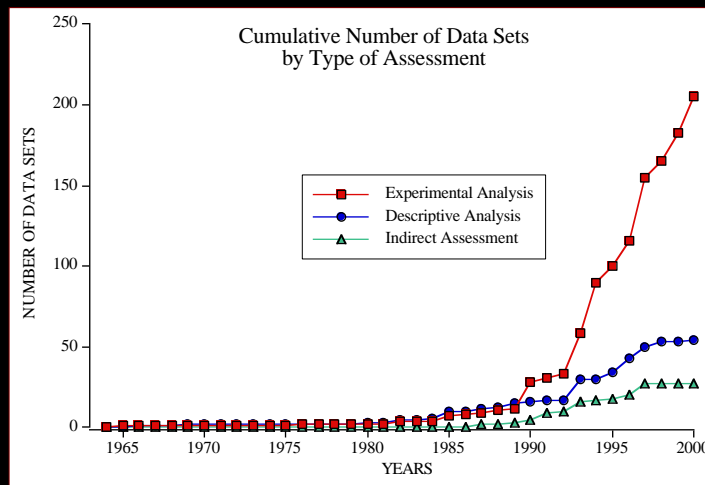
Functional (Experimental) Analysis

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*

Kahng et al. (AJMR, 2002)



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*

13

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*

14

Scatter Plot

Data Grid

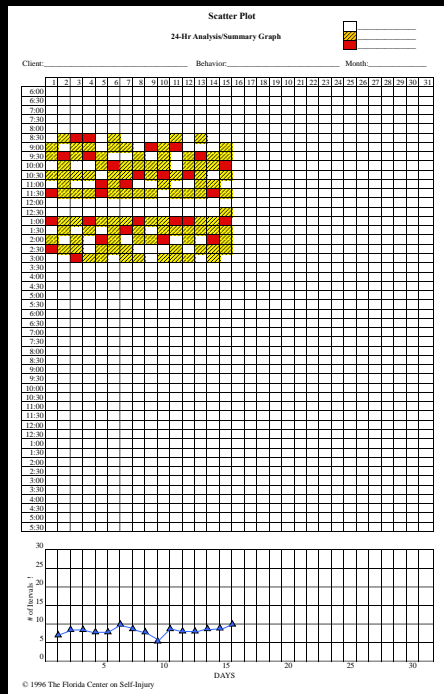
- ❖ Rows: 30-min intervals
- ❖ Columns: days
- ❖ Summary at bottom

Record at end of 30-min intervals

- ❖ Blank: No PB
- ❖ / (yellow): A little PB
- ❖ X (red): A lot of PB

Summary

- ❖ # intervals with PB



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

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

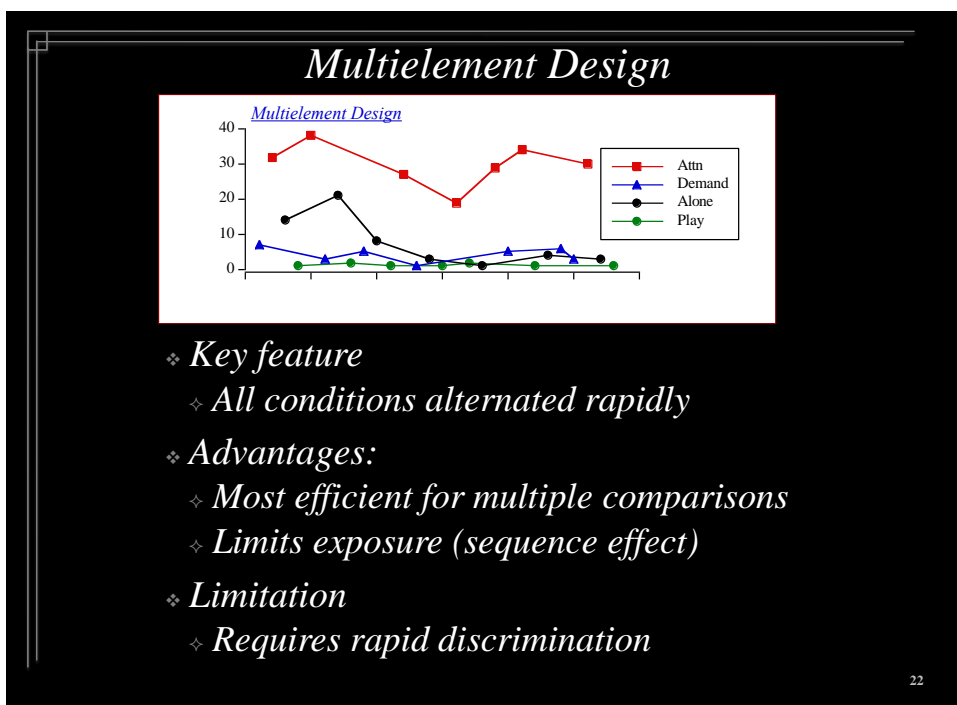
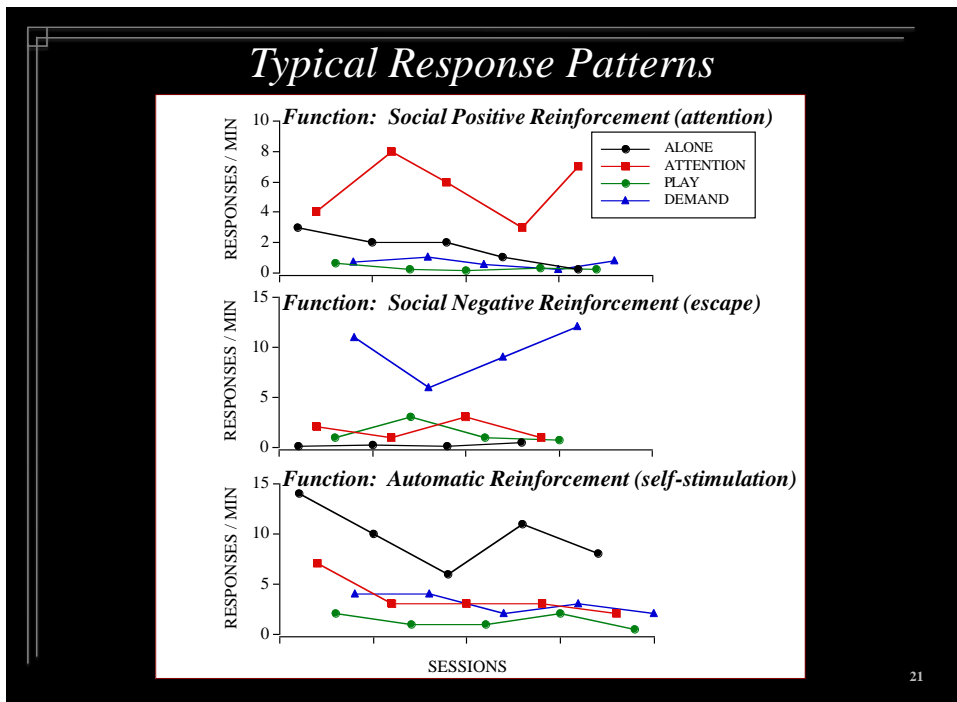
- ❖ Antecedent event: Establishing operation (**EO**)
 - ❖ Alters the effects of a reinforcer
 - ❖ EO present: Sr more valuable
 - ❖ EO absent: Sr less valuable
 - ❖ Example: Food deprivation → food more valuable

- ❖ 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

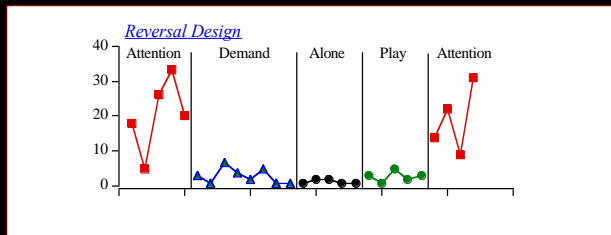
- ❖ Consequent event: Reinforcement contingency (**Sr**)
 - ❖ If-then relation between a response and a consequence
 - ❖ Contingency present: Behavior maintains
 - ❖ Contingency absent: Behavior extinguishes

Functional Analysis Protocol

<u>Condition</u>	<u>S^D</u>	<u>EO</u>	<u>Consequence</u>	<u>Contingency</u>
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



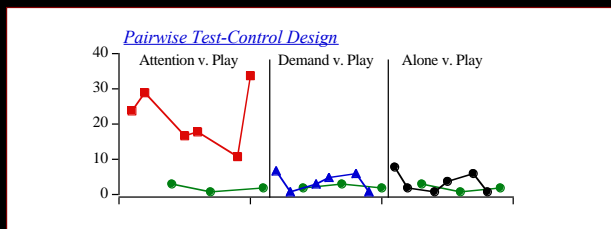
Reversal Design



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

23

Pairwise Test-Control Design



- ❖ *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*

24

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*

25

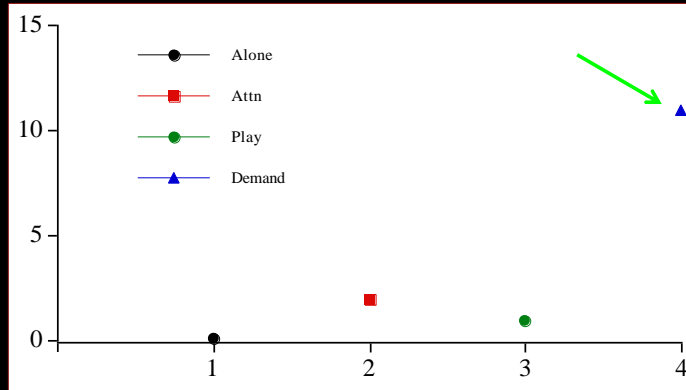
Complexity of Assessment: Logic & Data

- ❖ *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)*

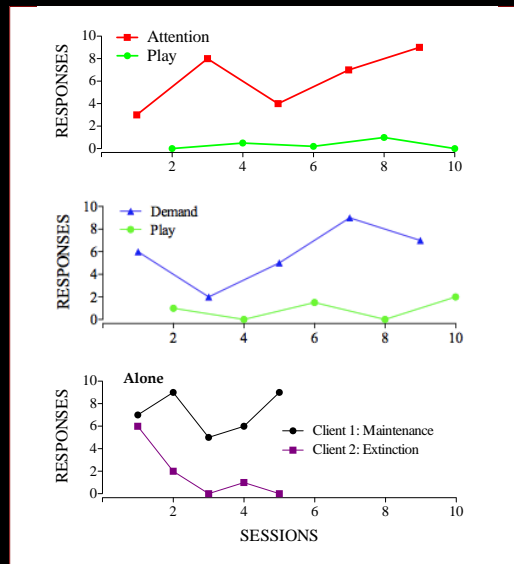
26

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)*

29

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

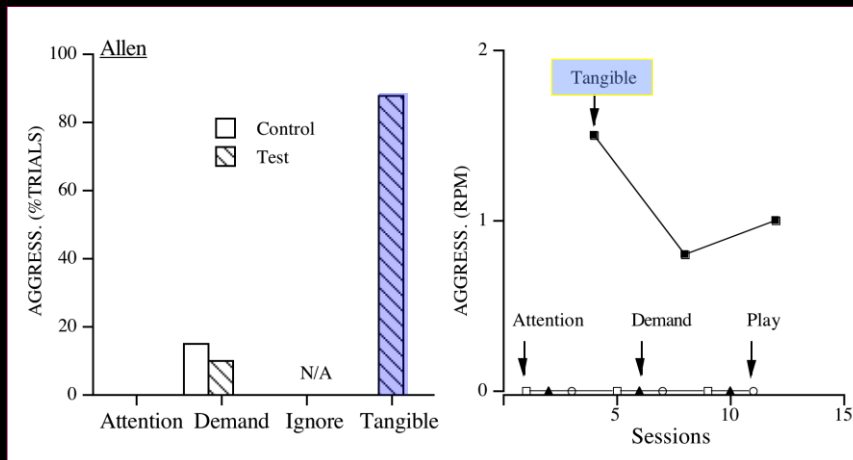
- ❖ *1-min control → PB yes or no*
- ❖ *4-min test → PB yes or no*

30

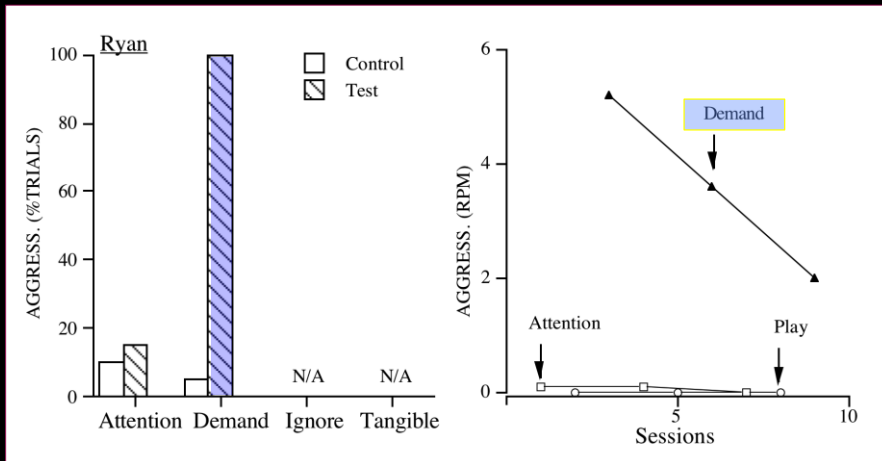
FA Trials

- ❖ 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

Correspondence: Social Sr+



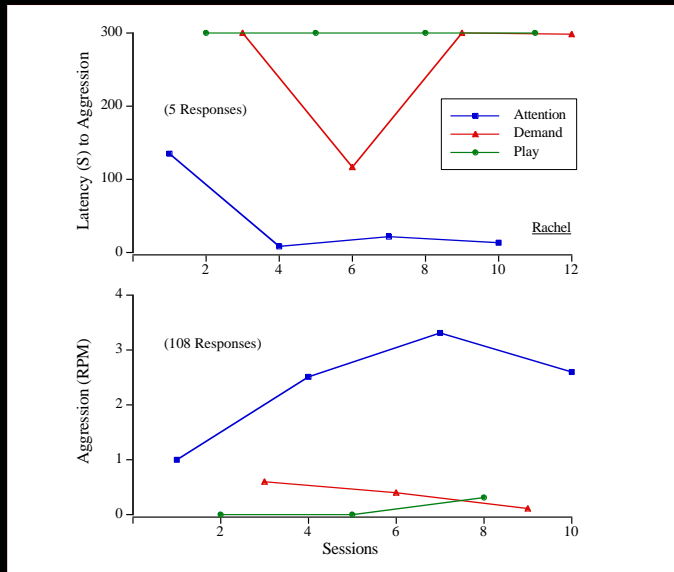
Correspondence: Social Sr-



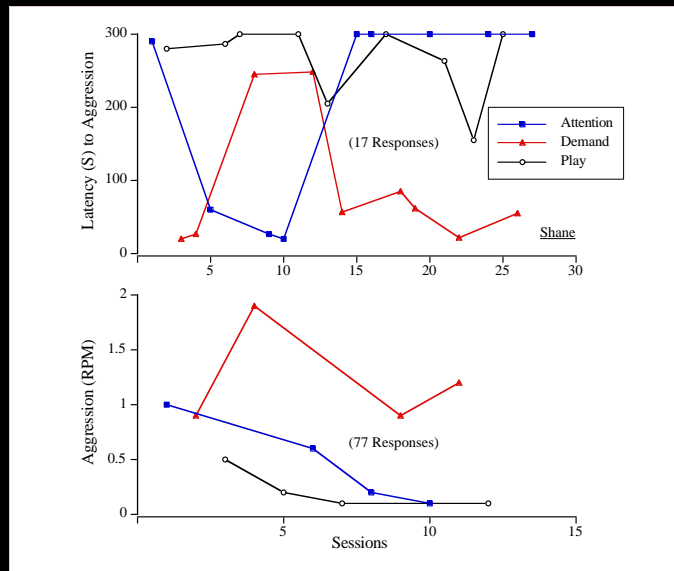
High-Risk Behavior

- ❖ 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

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)*

37

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*

38

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)*

39

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*

40

Summary of Functional Analysis Variations

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

41

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***

42

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?

43

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)

44

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 ($A \rightarrow B \rightarrow C$)*
- ❖ *Everyone knows how to conduct a DA*

45

Implications for Intervention

46

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?*

47

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)*

48

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*

49

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+*

50

Function: Automatic Positive Reinforcement

- ❖ *Establishing operation: Generalized deprivation*
 - ❖ *Noncontingent stimulation (NCR)*
- ❖ *Maintaining reinforcer: Sensory stimulation*
 - ❖ *EXT (sensory); mechanical devices, blocking, etc.*
 - ❖ *Response effort interventions*
- ❖ *Behavioral replacement:*
 - ❖ *Establish an alt. self-stimulatory response*

Multiple Control - Treatment

<i>Functions</i>	<i>Attention Seeking Response</i>	<i>Escape Response</i>	<i>Self-Stimulatory Response</i>
<i>Social Sr+ Social Sr-</i>	X	X	
<i>Social Sr+ Automatic Sr+</i>	X		X
<i>Social Sr- Automatic Sr+</i>		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-*

Summary

*You **SHOULD** conduct a functional analysis*

- ❖ *More reliable than a questionnaire or rating scale*
- ❖ *More efficient and precise than a DA*

*You **CAN** conduct a functional analysis*

- ❖ *Easy to do (control antecedent and consequent events)*
- ❖ *Procedural variations for almost all limiting conditions*

Results of a functional analysis

- ❖ *Identify effective reinforcement-based interventions*