Functional Analysis of Problem Behavior: Basic Methods, Extensions, & Challenges

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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

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
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?
**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

**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)
**Social-Positive Reinforcement**  
*(Social Sr+)*

Antecedent event  
*(Deprivation from attention)*  
\[ \rightarrow \]

Behavior  
*(SIB, AGG, PD, etc.)*  
\[ \rightarrow \]

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

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**Diagram:**

- **Do you Need a hug?**
- **You’ll hurt yourself**
- **Can I read you a story?**
- **How about some ice cream?**
- **NO!**
### Function

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

### 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

Most

Anecdotal (Indirect) Methods

Descriptive (Naturalistic) Analysis

Functional (Experimental) Analysis

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)

Cumulative Number of Data Sets by Type of Assessment
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, no risk, potentially useful information

- Limitations
  - Poor reliability, questionable validity

- Suggestion for implementation
  - Use only as a preliminary guide
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
- Suggestion for implementation
  - Use to clarify definition of target behavior

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

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**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 (SD)**
  - Stimulus in whose presence reinforcement is more likely
  - SD present: Sr available
  - SD 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

<table>
<thead>
<tr>
<th>Condition</th>
<th>SD</th>
<th>EO</th>
<th>Consequence</th>
<th>Contingency</th>
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<tr>
<td>Attention</td>
<td>SD</td>
<td>EO</td>
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<td>Contingency</td>
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Typical Response Patterns

**Function:** Social Positive Reinforcement (attention)

**Function:** Social Negative Reinforcement (escape)

**Function:** Automatic Reinforcement (self-stimulation)

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
- **Ethical concerns about worsening of behavior**
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)

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)
### Probable Functions of Specific Behavior Disorders

<table>
<thead>
<tr>
<th>Behavior Disorder</th>
<th>Positive Reinforcement</th>
<th>Negative Reinforcement</th>
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<tr>
<td></td>
<td>Social</td>
<td>Automatic</td>
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<tr>
<td>Aggression</td>
<td>+</td>
<td>ø</td>
</tr>
<tr>
<td>Tantrums</td>
<td>+</td>
<td>ø</td>
</tr>
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<td>+</td>
<td>ø</td>
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<td>Property Destruction</td>
<td>+</td>
<td>?</td>
</tr>
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<td>“Stereotypies””</td>
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<td>+</td>
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<td>+</td>
<td>+</td>
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</tbody>
</table>

**Positive Reinforcement**

- Social: +
- Automatic: ø

**Negative Reinforcement**

- Social: +
- Automatic: ø
**Time Constraints: Assessment Sequence**

Indirect Method (MAS, QABF, FAST) – 2 informants

- **SIB:** All questions relevant
- **AGG:** Social questions only
- **STPY:** Automatic questions only

Single function FA if indirect outcome reliable

- **Social Sr+** (Positive): Attention (or Tangible) vs. Play
- **Social Sr−** (Negative): Demand vs. Play
- **Automatic Sr:** Alone vs. Play (or Alone probe)

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**Time Constraints: Single Function Tests**

![Graphs showing responses over sessions for different conditions: Attention vs. Play, Demand vs. Play, and Alone vs. Maintenance vs. Extinction across sessions.](image)
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)

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
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-
Rate (frequency) vs Latency

Latency = time from start to response

High rates ➔ Short latencies
Low rates ➔ Long latencies

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)

Precursor Behavior & Response Classes

Definition

✿ Topographically different than target response
✿ Precedes and predicts occurrence of target

Response chain (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)
Analysis of Precursor Behavior
(Smith & Churchill, 2002)

- Precursor
  - Different R that predicts occurrence of target R
- Method
  - N= 4 (3 SIB, 1 AGG)
  - FA #1: Contingencies on SIB / AGG
  - FA #2: Contingencies on precursor Rs
- Results
  - 4/4 matched FAs
  - PB 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 and lower rate of PB
  - Treatment of PB based on function of precursor
- Question: How does one identify the precursor?
  - See Fritz et al. (JABA 2013)

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)
More Reasons for Low-Rate Behavior
(I’m making these up)

Delayed EOs (as in “revenge”)
- EO ➔ either no opportunity or SD (punishment)
- EO ➔ delay ➔ opportunity available or SD (punishment) absent

Cumulative EOs (“the straw the broke the camel’s back”)
- EO 1 ➔ Not a problem
- EO 2 ➔ Not a problem
- EO 1 ➔ EO 2 ➔ EO 3 ➔ Problem

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
Summary of Functional Analysis Variations

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

Ethical Issues in the Functional Analysis of Problem Behavior

The issue: Exposure to conditions that increase risk

- Utility of the FA?
  - Data highly reliable (unlike indirect assessment
  - Identifies cause-effect relation (unlike DA)
  - The gold standard of assessment
- Explicit worsening of behavior?
  - “Sometimes it can be just as illuminating to demonstrate how a behavior may be worsened (B, W, & R, 1968)
  - FA involves exposure to common, everyday conditions
  - Analogy: Dermatologic patch test
  - PB does not get worse during an FA (Call et al., 2012; Kahng et al., 2015)
- Risk management and client protection?
  - FA policy and protocol
Risk Management: FA Policy

- Rational for FA: To identify causes of problem behavior
- General description: Exposure to common conditions that may influence PB
- Risk assessment: Medical evaluation, HS of injuries
- Approval, oversight, review: Who is in charge?
- Informed consent: A must
- Staff qualifications and competency: CBA + experience?
- Safeguards: Periodic status checks

Risk Management: FA Protocol

Description of:
- Conditions: Tests and controls
- Designs: Arrangement of conditions
- Duration: Arbitrary limit = 20 cycles of conditions?

Safety measures:
- Protective equipment (or blocking)
- Low-risk FA format: Latency, precursor

Session termination criteria
- Outcome (usually nature of injury)
- Response (type or rate)

Emergency procedures
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

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?
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)

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
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

**SO JUST GO DO IT!**

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**Implications for Intervention**
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)

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
**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+

**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