Thirty Years of Research on the Functional Analysis of Problem Behavior: What Have We Learned?

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Topics

- Historical basis for research on problem behavior
  - Respondent and operant conditioning
  - Functional analysis a la 1982

- Major themes in FA research
  - Assessment: alternative methods, extensions, limiting conditions
  - Treatment: Classification, antecedent interventions, treatment without extinction

- The future
  - Efficiency, neglected populations, general clinical disorders, prevention
History: 30 yr . . . How about 110 yr?

- Respondent conditioning
  - Experimental psychopathology in animals
  - Conditioned emotional reactions
  - Experimentally produced nervous disturbances
  - Experimental neuroses as learned behavior
  - Conditioned anxiety and hysteria

- Operant conditioning
  - Some quantitative properties of anxiety
  - Shock-maintained behavior
  - Punishment as a conditioned reinforcer
  - Shaping head banging in monkeys

“Production & Elimination of Symptomatic Behavior”
(Haughton & Ayllon, 1965)

- Dr A:

- Dr B:
Functional Analysis a la 1982: The Context

The JFK Institute
- Teaching hospital for JHUSM
- Specialty: developmental pediatrics
- Pediatric inpatient treatment (16-20 week stay)

Focus: Self-injurious behavior (SIB)
- Most dramatic behavior disorder in DD
- Often required both behavioral and medical intervention
- No systematic approach to intervention

General Intervention Strategy
- Immediate protection from harm
- Interventions derived from applied behavior analysis
- Treatment selection based on LRA
- 6-month review; failures often a function of time limit
- Needed: A better method for selecting interventions
- Kennedy-Hopkins influences
- Assumptions about behavioral interventions
- Some determinants of problem behavior identified
Influences at Kennedy/Hopkins

“An introduction to the study of experimental medicine” (Bernard, 1865 [trans. 1927])
  - “Observation shows facts, experiment explains them”
  - “Experimental analysis is our only means of searching for truth. . . . Nothing, I believe, is today as important to the progress of medicine”

Psychogenic seizures (Freeman)
  - “You reinforcement guys”

The Proposition

- Behavioral interventions involve rearrangement of contingencies
  - Success: New consequences eliminate or reverse those relevant to maintenance (determinants)
  - Identification of those determinants might facilitate treatment

- If SIB is learned behavior, it should respond quickly to a relevant contingency
  - SIB may be influenced by more than one reinforcement contingency
  - Contingencies difficult to isolate under typical conditions

- Would brief, controlled exposure to varied contingencies reveal the source of reinforcement for an individual’s SIB?
### Three Sets of Influential Studies

- **Attention as a reinforcer for SIB**  
  (Lovaas et al., 1965; Lovaas & Simmons, 1969)

- **Escape as a reinforcer for AGG**  
  (Carr et al., 1980)

- **Environmental deprivation as an antecedent for STPY**  
  (Berkson & Mason, 1964, 1965)

### Assessment Design Elements

- **Contingencies for PB**  
  - Attention, escape, nothing

- **Antecedent events to “set up” contingencies**  
  - Deprivation from attention, presentation of demands, no access to leisure items
  - Coincidental manipulation of EOs

- **Experimental model**  
  - Test: EO and contingency present
  - Control: EO and contingency absent

- **Multielement design**  
  - Efficient method for conducting multiple tests
## Functional Analysis Protocol

<table>
<thead>
<tr>
<th>Condition</th>
<th>SD</th>
<th>EO</th>
<th>Consequence</th>
<th>Contingency</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Attention</strong></td>
<td>S1</td>
<td>Th. ignores Cl.</td>
<td>Th. attends to beh. Problem</td>
<td>Positive rfmnt (attention)</td>
</tr>
<tr>
<td><strong>Demand</strong></td>
<td>S2</td>
<td>Th. presents learning trials</td>
<td>Timeout for beh. problem</td>
<td>Negative rfmnt (escape)</td>
</tr>
<tr>
<td><strong>Alone</strong></td>
<td>N/A</td>
<td>No stimulation</td>
<td>N/A</td>
<td>Automatic reinf</td>
</tr>
<tr>
<td><strong>Play</strong></td>
<td>S3</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A Control</td>
</tr>
<tr>
<td>Attn: Free</td>
<td>Demands: None</td>
<td>Toys: Free</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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### Typical Response Patterns

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

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

**Function: Automatic Reinforcement (self-stimulation)**
Indirect (Anecdotal) Methods

General Characteristics
- Questions about situations in which behavior occurs
- Data: verbal report (informant recall)
- Examples: MAS, QABF, FAST

Strengths
- Simplicity
- Efficiency

Limitations
- Poor reliability
- Questionable validity
Evaluations of Indirect Methods

MAS (Durand & Crimmins, 1988)
- $R = 52\%$ (Conroy et al., 1996; Duker & Sigafoos, 1998; Sigafoos et al., 1994; Zarcone et al., 1991)

QABF (Matson & Vollmer, 1995)
- $R = 78\%$ (Nicholson et al., 2006)

FAST (Iwata et al., 2013)
- $R = 71.5\%$

Descriptive (Naturalistic) Analysis

General Characteristics
- Direct observation of environment and behavior
- Data: narrative, frequency, conditional probability
- Examples: Scatter plot, ABC analysis, interval recording

Strengths
- Objective measures; highly reliable
- Identifies correlational relations (When I see X, I see Y)

Limitations
- Structural analysis only (What is happening?)
- Poor correspondence with FA outcomes (biased)
- Correlation relation $\neq$ functional relation
Evaluations of Descriptive Analysis

DA studies
- Poor correlation for likely variables (Wahler, 1975)
- Positive correlation for unlikely variables (Russell & Bernal, 1977)
- A & C events may occur rarely (Marion et al., 2003)

DA – FA comparisons
- Uniformly poor correspondence (Camp et al, 2009; Hall, 2005; Lerman & Iwata, 1993; Mace & Lalli, 1991; Pence et al., 2009)

Inherent limitation
- DA outcomes tend to be biased (McKerchar & Thompson, 2004; St. Peter et al., 2005; Thompson & Iwata, 2001, 2007)

Variations & Extensions of FA Methodology

Assessment elements
- Design elements, antecedent and consequent events

Behavior
- SIB, AGG, STPY, PD, bizarre vocalization, disruption, elopement, noncompliance, tantrums, rumination, etc.

Population
- ID, autism, MI, ALZ, Tourette, TBI, children, adults, elderly

Setting
- Inpatient, OP clinic, school, home
**Common Design Variations**

- **Multielement Design**
- **Reversal Design**
- **Pairwise Test-Control Design**

**The “Divided Attention” Condition**
*(Fahmie et al., 2013)*
“Social Avoidance”
(Harper et al., 2013)

- **Ann**
- Play
- Ignore
- Task Demand
- Attention
- Social Demand

“Elopement”
(Neidert et al., 2013)

- **LATENCY TO ELOPEMENT (s)**
- **TRIALS**
- Play
- Ignore
- Attention
- Corner

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Limiting conditions of assessment (FA)

Complexity: Too difficult
- Sorry, I cannot help you

Time constraints: Too much time
- BFA, single-function test, STPY screening

Setting constraints: No access to controlled setting
- Trial-based FA for classroom use

High-risk behavior: Too dangerous
- Protective devices, latency FA, precursor FA

Low-rate behavior: I rarely see it
- Lengthier exposure, idiosyncratic reinforcers, combined EOs, combined contingencies

Brief Functional Analysis
(Northup et al., 1991)

Interpretable outcomes: 46%
(Derby et al., 1992)
**Examples of Single Function Tests**  
(rarely used)

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**Trial-Based FA for Classrooms**  
(Bloom et al., 2011; 2013)

**General arrangement**
- *FA trials embedded into classroom routine*
- *2-min control (EO absent) ➞ 2-min test (EO present)*

**Attention (no tasks present)**
- *Control: Near student + pleasant conversation*
- *Test: Near student + ignore (attention following PB)*

**Task Demand**
- *Control: Observe while no task demands present*
- *Test: Frequent prompts to work (remove work following PB)*

**Alone**
- *Two consecutive test segments. Observe while student is not working, not interacting with others, and has no access to leisure items*
Correspondence: Social Sr-

Latency FA
(Thomason et al., 2011)
Functional Analysis of Precursors
(Fritz et al., 2013)

FA of Precursors

FA of Aggression

SESSIONS

Attention
Tangible
Play
Demand

Donald

Functional Analysis of Low-Rate Behavior
(Rolider et al., in prep.)

- N=5 (SIB, AGG, PD)
- Low-rate PB in typical FA
- Modified FA conditions:
  - Combined EOs (Divided attn condition, multiple Sr+)
  - Combined contingencies (Sr+ and Sr-)
  - Unobtrusive alone condition (hidden camera)
  - Increased exposure (30-min sessions)
Modified FA Conditions

Extended Session Duration
What Have We Learned

Assessment
- Experimental approaches to assessment are viable
- Indirect methods are unreliable
- Descriptive analyses do not identify behavioral function
- FA methodology extremely flexible and generalizable
- FA variations available for most limiting conditions

Treatment

Classification of Intervention Procedures

Pre-FA: Structural approach (emphasis on procedures)
- Advantage: Well-defined practice guidelines
  - Eg: Planned ignoring vs. time out
- Disadvantage: Same procedure → different results
  (mechanism of behavior change unknown)
  - Planned ignoring → extinction (PB maintained by attention)
  - Planned ignoring → Sr- (PB maintained by escape)

Post-FA: Functional approach (emphasis on learning principle)
- Advantage: Generalizable across response functions
  - Extinction → cessation of reinforcement
- Disadvantage: Procedural details not well specified
  - Extinction → what procedures?
“Nonaversive” Behavioral Interventions
(aka Positive Behavioral Support)

- Behavioral momentum
- Behavioral support intervention
- Choice making
- Communicative correspondence training
- Curricular revision
- Differential reinforcement of other behavior (DRO)
- Differential reinforcement of alternative behavior (DRA)
- Differential reinforcement of communication (DRC)
- Extinction (EXT)
- Functional communication training (FCT)
- Functional equivalence training
- Gentle teaching (GT)
- Multimodal behavioral intervention
- Planned ignoring
- Response covariation
- Response priming
- Redirection
- Satiation
- Tolerance training

Reinforcement-Based Approaches to Behavior Reduction

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

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

#3 Replace the behavior with an alternative response
  - Differential reinforcement (DRA)
Renewed Interest on Antecedent Events

Previous terms
- Setting event
- Ecological variable
- Trigger

Establishing operation or EO (Michael, 1982)
- Antecedent event that (a) alters value of a reinforcer and (b) procuses behavior maintained by that consequence
- EO present Sr more valuable, R likely to occur
- EO absent Sr less valuable, R unlikely to occur
- As in food deprivation
- Assessment implications: Test vs. control conditions
- Treatment implications: The primary antecedent strategy

Some Examples of EO-based Interventions

PB maintained by social Sr+
- Noncontingent access to attention or tangibles (NCR)
- Noncontingent access to alternative Sr+

PB maintained by social Sr-
- Frequent work breaks (NCR)
- Demand fading (type, frequency, duration)
- Behavioral momentum (Hi-p sequence)
- Choice making

PB maintained by automatic reinforcement
- Noncontingent access to toys (NCR)
- Leisure instruction
What about Extinction?

PB maintained by attention
- Can you ignore severe SIB or AGG?

PB maintained by escape
- Can you prevent a combative client from escaping?

PB maintained by automatic Sr
- Can you prevent PB from producing stimulation?

Response Blocking of Attention-Maintained Behavior
(Dempsey et al., in prep)

Questions:
- Will blocking produce maintenance or extinction?
- Will blocking interfere with acquisition of Alternative R?

Phase 1: Response Blocking
- Prob Behavior $\rightarrow$ Block (No eye contact, no words)

Phase 2: Response Blocking + DRA
- Prob Behavior $\rightarrow$ Block (No eye contact, no words)
- Alt R $\rightarrow$ Attention (eye contact, praise)
Response Blocking of Attention-Maintained Behavior

Concurrent reinforcement schedules: Behavior change and maintenance without extinction
(Hoch et al., 2002)

- Does high-quality Sr+ for compliance compete with escape for PB?
- N=3 (autism or DD), SIB, AGG, disruption
- FA: Maintenance by escape
- Preference assessment: HP leisure items
- No Sr: PB →  
- Sr- / PA: PB →  
- Sr- / Sr-: PB →  
- Maintenance: Same as Sr-/PA, but task requirement increased (FR 2, 34, 102)
Antecedent Interventions for Escape-Maintained Behavior
(Rolider et al., in prep)

- N=6 (SIB, PD), all escape maintained
- Baseline: Low-p demands (30-s schedule)
  - Fading: 1 low-p demand  BL rate of low-p demands
  - High-p sequence: 3 high-p demands : 1 low-p demand
  - High-p Fading: 1 high-p sequence  X high-p sequences
  - High-p Low-P: All high-p demands  BL rate of low-p demand
- NCR (food): Low-p demands + continuous edibles
Hi-p Sequence Effective

NCR Food Effective
What Have We Learned

Assessment
- Experimental approaches to assessment are viable
- Indirect methods are unreliable
- Descriptive analyses do not identify behavioral function
- FA methodology extremely flexible and generalizable
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Treatment
- Match mechanism of behavior change to function of PB
  (reduced use of punishment, Pelios et al, 1999)
- Three general strategies for intervention: NCR, EXT, DR
- Greater emphasis on EO-based interventions (NCR)
- PB can be decreased without requiring extinction
  (NCR + DR overrides the effects of reinforcement for PB)

Assessment Efficiency

Problems
- Full FA: ~ 6 hr of assessment
- BFA: ~ 50% hit rate
- Single-function test: Based on a guess
- Rating scales unreliable

One possible solution
- Rating Scale (if agreement) → Single-function test
Another Look at Indirect Methods

MAS & QABF (Smith et al., 2012, Study 2)
- $N = 8$
- 4/5 respondent agreements on MAS and QABF
- Correspondence with FA: 87.5%

FAST (Iwata et al., 2013, Study 2)
- $N = 69$, correspondence with FA: 63.8 %, and
- 48 FAST agreements, correspondence = 70.8, BUT
- 7 attention agreements, correspondence = 100%

Functions Examined via Rating Scales

Common functions of SIB
- Social $Sr^+$, social $Sr^-$, automatic $Sr$
- Rating scales based on FA of SIB; include same functions

Subsequent experimental work
- SIB: all functions
- AGG: Social functions (automatic $Sr$ unlikely)
- STPY: Automatic function (social functions unlikely)
A Screening Procedure for Behavior Maintained by Automatic Reinforcement
(Querim et al., 2013)

❖ Does brief exposure to “alone” probes predict function?
❖ PB maintained by automatic Sr should maintain
❖ PB maintained by social Sr should decrease
❖ N=30 (STPY, SIB, AGG)
❖ Screening: Alone or “No interaction” probes (5 min)
❖ FA: Typical FA protocol (10 min sessions)
❖ Correspondence in 28 / 30 cases
Potential Improvements in Efficiency

PB = STPY (noninjurious)
- Brief alone probes

PB = SIB
- MAS, QABF, FAST
- If agreement ➔ single-function test

PB = AGG
- MAS, QABF, FAST, but
- Delete automatic/sensory items
- If agreement ➔ single-function test

Neglected Clinical Populations

Autism
- Defining behavioral characteristics

ADHD
- Most prevalent diagnosis in students

Elderly
- Will be largest segment of population
Autism

Good news
- Data on SIB, AGG, STPY, PD generalizable from general ID population

What’s left: Unique behavioral characteristics
- Echolalia
- Social avoidance
- OCD-like rituals
- Rigidity – insistence on sameness
- Problems with transitions

Echolalia

Definition: Repetition of statement made by other
- Presumed function: automatic Sr (self stimulation)
- Could echolalia acquire social functions?

Given
- Severe language deficit
- Severe social deficit

Social situation #1
- Teacher speaking → No response → No attention
- Teacher speaking → Echolalia → Attention (Sr+)

Social Situation #2
- Teacher instruction → No response → Repeated prompting
- Teacher instruction → Echolalia → Avoidance of work (Sr-)
FA & Treatment of Arranging & Ordering  
(Rodriguez et al., 2012)

- Subjects: N = 3 (autism)
- DVs: Organizing (aligning objects), completeness (closing drawers/doors), washing/cleaning (wiping surfaces, picking lint/trash)
- FA conditions (room baited)
  - Attention, demand, no-interaction, play (control)
  - All Ss: maintenance by automatic Sr
  - (BI: Perhaps all these conditions were unnecessary)
- Treatment conditions
  - Matched items (appropriate alternatives)
  - Matched items + prompts
  - Matched items + response block (2 Ss)
  - Matched items + “product” EXT (1 S)

Matched items + prompt + product EXT

![Graph showing the percentage of arranging and ordering duration during Christie’s treatment evaluation. The graph includes BL (baseline), MI (matched items), MI + Prompts, MI + Prompts + Product EXT, and MI + Prompts + Product EXT + Teacher Implementation. Each phase is represented by different symbols and lines, indicating changes in percentage duration over sessions.](image-url)
ADHD

- **Impulsivity**: Preference for smaller immediate reward over larger delayed reward
- **Parametric preference**: immediacy > magnitude
  - **Current problem**: Small now > Large later
  - **Eliminate delay**: Small now vs. Large now
  - **Introduce delay**: Small now vs. Large (short delay)
  - **Lengthen delay**: Small now vs. Large (longer delay)

- **Frequent activity change**
  - Satiation to Sr+?
  - Low tolerance for aversive activity?

The Elderly

Aging involves the interaction between two processes:
- Physiological changes correlated with getting older, and
- The environmental circumstances in which these changes occur

**Interactions result in:**
- Restricted sources of stimulus control (physical $S^P$s less effective, social $S^P$s removed)
- Restricted access to reinforcers (cannot engage in activity, fewer social reinforcers available)
- Mismanagement of contingencies (Sr of dependent behavior, punishment of independent behavior)
General Clinical Disorders

Clinical diagnosis (DSM)
- Emphasis on structure (symptoms)
- Does not identify causes (functional characteristics) of disorder
- Diagnosis = abbreviation for symptoms, not an explanation

Paranoid Schizophrenia
- Delusions + Hallucinations + Social withdrawal
- Why does John have delusions? ➔ Para Schizo
- Why does John have Para Schizo? ➔ He has delusions
- How do we measure Para Schizo as a thing?
- What produces symptoms (behavioral characteristics)?

Psychiatrists on Diagnosis

Cameron (1944)
- “Psychiatric classifications are not based upon convincing scientific evidence. No causal organisms have been identified; hence, we cannot fall back on them as we can with infectious diseases.”

McKinnon (2011)
- “Nature did not define the DSM’s official diagnostic criteria; committees negotiated them.”

McHugh & Slavney (2012)
- “Identifying a disorder by its symptoms does not translate into understanding its nature, which is grasped in terms of cause or mechanism”

Insel (2013 current director NIH)
- “People think that everything has to match DSM criteria, but you know what? Biology never read that book.”
**DSM - V**

*Some new diagnoses*

*Does you child have temper tantrums?*

*Is you teenager somewhat eccentric?*

*Do you have sex frequently?*

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**From Treatment to Prevention**

*By products of contemporary research*

✧ *Establishing operations (EOs)*  Determinants of reinforcer value

✧ *Reinforcement contingencies*  Determinants of response frequency

✧ *Identification of EOs & contingencies*  Prevention?
# Universal Risk Factors for Problem Behavior

## Environmental EOs
- Social deprivation ➔ Social Sr+ (attention) valuable
- Social demands ➔ Social Sr- (escape) valuable
- Sensory deprivation ➔ Automatic Sr+ (sensory) valuable

## Response Deficits
- Communication ➔ No control over social environment
- Compliance ➔ Inability to engage in target response
- Leisure ➔ Limited self-stimulatory repertoire

## Contingency Deficits
- Ineffective instruction
- Limited reinforcement for appropriate behavior
- Reinforcement for problem behavior

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# Amelioration of EOs

## Social deprivation
- Noncontingent (free) attention (Vollmer et al., 1993)
- Alt Sr+ during period of deprivation (Fisher et al., 2000)

## Social demand
- Frequent work breaks (Waller & Higbee, 2010)
- Demand fading (Pace et al., 1994)
- Hi-P instructional sequence (Mace & Belfiore, 1990)
- Noncontingent Sr+ during tasks (Kodak et al., 2003)

## Sensory deprivation
- Greater access to leisure items (Ringdahl et al., 1997)
Amelioration of Response Deficits

Communication (mands)
- Social deprivation ➔ “Attention please”
- Social demand ➔ “Break please”
- Described as DRA or FCT (Carr & Durand, 1985)

Compliance repertoire
- Imitation, motor, vocal (Garcia et al., 1971)
- Instruction following (Striefel et al., 1974)

Leisure repertoire
- Object manipulation & play skills (Lindberg et al., 1999)

Amelioration of Contingency Deficits

- Ineffective instruction
- Limited reinforcement for appropriate behavior
- Inadvertent reinforcement for problem behavior

Solution to all: Parent/caregiver training + feedback
“Prevention of problem behavior by teaching functional communication and self-control skills to preschoolers”
(Luczynski & Hanley, 2013)

- Subjects: N=12 preschoolers (6 experimental, 6 control)
- Sessions: Craft, leisure, fine motor (15-30 min)
- Target skills
  - Request for attention, materials, assistance
  - Tolerance of delay or denial
- Baseline: 20 trials / session
  - 8 evocative for attention
  - 8 evocative for materials or assistance
  - 4 delay / denial trials (materials or assistance)
- Treatment
  - Instructions, model, role play, reinforcement
  - Multiple probe design

Figure 1. Percentage of trials with the target skills for children in Classroom A. The horizontal dashed lines denote the 85% acquisition criteria line. BL = baseline.
Summary

Assessment
- Most problem behavior is learned
- Function is more important than structure (form) or diagnosis (synonym)
- The experimental model is the basis for cause-effect
- Use alternatives and abbreviations with caution

Treatment
- Emphasis on mechanisms of change (EO, EXT, DR)
- Challenge 1: Alternatives to EXT
- Challenge 2: systematic prevention agenda