**Problem Behavior Maintained by Automatic Reinforcement**

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**Introduction**

Key feature of operant theory: Behavior is determined by its consequences (reinforcement contingencies)

A dilemma for behavior analysis: How does one account for behavior that occurs in the apparent absence of reinforcement?

Competing accounts

- Cognitive: Some behavior results from “intrinsic” motivation (internal causation)
- Behavioral: Some behavior produces its own reinforcing consequences
Automatic Reinforcement

An example
✧ “. . . when a craftsman spends a week completing a given object, each of the parts produced in the week is likely to be automatically reinforcing because of its place in the completed object” (Skinner, 1969, p. 18)

Definition
✧ “. . . reinforcement that is not mediated by the deliberate action of another person. . . . It is a natural result of behavior when it operates upon the behaver’s own body or the surrounding world” (Vaughn & Michael, 1982, p. 219)

Some Characteristics of Automatic Reinforcement

Response
✧ Public event: Distinctive topographical features
✧ Private event: Subtle, potentially unobservable features (e.g., perceiving, problem solving)

Effect on behaver
✧ Response produces stimulation
✧ Response alters physical environment

Synonyms
✧ Direct vs indirect reinforcement
✧ Nonsocial vs social reinforcement

“Automatic” refers to a general contingency
✧ Sr+, Sr-, or punishment
✧ Conditioned or unconditioned
Automatic Contingencies – Some Examples

Sr+
- Unconditioned: Consuming food, turning on a light
- Conditioned: Reading a book, practicing a musical instrument

Sr-
- Unconditioned: Scratching a mosquito bite, shielding eyes from glare of sun
- Conditioned: Channel surfing during TV commercials, cleaning dog poop from shoe

Punishment
- Unconditioned: Touching hot stove burner, going outside in Winter sans coat
- Conditioned: Video game “death” sound, playing wrong note on piano

Problem Behavior Maintained by Automatic Reinforcement

PB in the general population
- Substance abuse (narcotics, alcohol, tobacco)
- Behavioral excess (overeating, internet addiction)
- Habits (biting nails, cracking knuckles)

PB in IDD & ASD
- Stereotypy (STPY)
- Self injurious behavior (SIB)
- Other (echolalia, ritualistic behavior, etc.)
- Aggression highly unlikely
Assessment Issues

Functional analysis outcomes

- Insensitivity to social reinforcement (Sr+ and Sr-) AND
- Persistence in the absence of social stimulation
  - Occurs at high rates in alone condition or
  - Occurs at high rates in all conditions

Demonstration of a reinforcement effect?

- Sr vs EXT (Rincover, Newson, & Carr, 1979)

Demonstration of reinforcer substitutability

- Sr vs NCR (Lindberg, Iwata, Roscoe, Worsdell, & Hanley, 2003)
**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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<tbody>
<tr>
<td></td>
<td>Social</td>
<td>Automatic</td>
</tr>
<tr>
<td>Aggression</td>
<td>+</td>
<td>Ø</td>
</tr>
<tr>
<td>Tantrums</td>
<td>+</td>
<td>Ø</td>
</tr>
<tr>
<td>Noncompliance</td>
<td>+</td>
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<tr>
<td>Property Destruction</td>
<td>+</td>
<td>?</td>
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<tr>
<td>“Stereotypy”</td>
<td>?</td>
<td>+</td>
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<td>SIB</td>
<td>+</td>
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Are All Assessment Conditions Needed for All Problem Behaviors?

FA Variations for suspected automatic Sr function

- Extended alone sessions
  (Vollmer, Marcus, Ringdahl, &., 1995)
- 2:1 ratio of alone to attention / demand sessions
  (Roscoe, Iwata, & Zhou, 2013)
- “Alone” screening probes
  (Querim, Iwata, Roscoe, Schlichenmeyer, Virues & Hurl., 2013)

Vollmer et al. (1995), N=20
Roscoe et al. (2013), N=64

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: 5-min Alone or “No interaction” probes
- FA: Typical FA protocol (10 min sessions)
- Correspondence in 28 / 30 cases
Querim et al. (2013), N=30

Sterotypy

Aggression

SIB

Rincover et al. (1979)
Figure 6. Levels of SIB exhibited by Julie, Laura, and Robert during 10-min baseline and NCR-constant sessions (Phase 3, Study 2). Julie's data are summarized as percentage of intervals of SIB; Laura's and Robert's data are summarized as responses per minute of SIB.

ra) but delivered no further instructions and did not interact with the participant except to retrieve a dropped item and replace it on the table or tray. At the end of the session, the therapist informed the participant that the session was over and removed the materials.

Figure 6 shows levels of SIB during the 10-min baseline and NCR sessions. Julie engaged in moderate levels of SIB during the baseline conditions. Her SIB decreased to low levels during NCR when she had access to the set of beads and string, and she manipulated the beads and string during a mean of 99.6% of the intervals. Laura engaged in variable but often high rates of SIB during both baseline conditions. Her rate of SIB immediately decreased when she was given access to the ribbon (she manipulated the ribbon during a mean of 94.7% of the intervals). Robert engaged in somewhat more stable and moderate rates of SIB during the baseline conditions. His rate of SIB quickly decreased when he had access to the bumble ball, which he manipulated during a mean of 96.2% of the intervals. Thus, data for all 3 participants showed that continuous access to their most preferred leisure item...

Reinforcement-Based Approaches to Behavior Reduction

#1 Eliminate the behavior’s establishing operation (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)
Strategy #1: EO Manipulations
(EO = Sensory Deprivation)

Noncontingent stimulation

- Vibratory stimulation and head banging (Meyerson, 1970)
- Food satiation and rumination (Rast, Johnston, Drum, & Conrin, 1981)
- Leisure items and SIB (Berkson & Mason, 1965; Lindberg, Iwata, Roscoe, Worsdell, & Hanley, 2003; Shore, Iwata, DeLeon, Kahng, & Smith, 1997; Vollmer, Marcus, & LeBlanc, 1994)

Other

- Exercise and varied PBs (Bachman & Fuqua, 1983)
- Exercise and SIB/STPY (Morrison, Roscoe, & Atwell, 2011)

Shore et al. (1997)

Figure 1. Percentage of intervals containing SIB and object manipulation during baseline and leisure conditions in Experiment 1.
Sensory Matching during NCR?

- N=3, pica
- Matched preferred to unmatched (3/3)
- Matched more effective (3/3)

Piazza, Adelinis, Hanley, Goh, & Delia (2000)
- N=3, varied PB
- Matched preferred to unmatched (2/3)
- Matched more effective (3/3) but unmatched effective

Ahearn, Clark, Debar, & Florentino (2005)
- N=2 vocal or motor STPY
- HP unmatched as effective as HP matched

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Piazza et al. (1998)

Figure 4. Pica per minute during the assessment of matched and unmatched stimuli for Mary (top panel), Brandy (middle panel), and Tad (bottom panel). BL = baseline, NCA = noncontingent attention.

It was reduced to near-zero levels with the addition of stimulation (either oral or non-oral). Thus, it appeared that any type of stimulation, rather than oral stimulation per se, was important to the reduction in Tad's pica. Even though a specific source of automatic reinforcement was not identified for Tad, the findings for Tad replicate those of Vollmer, Marcus, and LeBlanc (1994) and Ringdahl, Vollmer, Marcus, and Roane (1997) in that preference assessments were useful for identifying stimuli that compete with behaviors that persist in the absence of social contingencies.
For Tim, stereotypy occurred in an average of 50% of intervals during baseline (see Figure 1). Significantly lower levels were observed in both the unmatched ($M = 8\%$) and matched ($M = 14\%$) conditions. Engagement averaged 79% (range, 74% to 84%) in the unmatched condition and 77% (range, 73% to 86%) in the matched condition (data not shown). For Cris, stereotypy occurred in an average of 70% of intervals during baseline (see Figure 1). Significantly lower levels were observed in both the unmatched ($M = 6\%$) and matched ($M = 10\%$) conditions. Engagement averaged 85% (range, 82% to 90%) in the unmatched condition and 80% (range, 77% to 84%) in the matched condition (data not shown).
Strategy #2: EXT-Type Interventions
(Maintaining Sr = Sensory Stimulation)

Sensory EXT

- Manipulation of physical environment (Rincover, Newsom, & Carr, 1979)
- Supplementary stimulation (Aiken & Salzberg, 1984)
- Stimulus blocking (Dorsey, Iwata, Reid, & Davis, 1982; Roscoe et al., 1998)
- Response blocking (Reid et al., 1993)

Response effort

- Wrist weights (Hanley, Piazza, Keeney, Blakely-Smith, & Worsdell, 1998; Van Houten, 1993)
- Flexible arm sleeves (Irvin, Thompson, Turner, & Williams, 1998; Wallace, Iwata, Zhou, & Goff, 1999; Zhou, Goff, & Iwata, 2000)

Rincover et al. (1979)
NCR vs Sensory EXT
(Roscoe, Iwata, & Goh, 1998)

Van Houten (1993)
Wallace et al. (1999)

Figure 1. Levels of SIB and adaptive behavior (drinking) observed during baseline and arm restraint conditions when restraints contained different numbers of stays.

For Renee was 20 thin stays. Although 15 stays suppressed Renee's SIB to almost zero, 20 stays completely eliminated her SIB and had negligible suppressive effects on drinking.

Dana exhibited high levels of both SIB and drinking during baseline. When the restraint sleeves were placed on her without any stays, Dana's SIB decreased to less than 10% of the intervals, whereas her drinking remained high. Thereafter, with the addition of 5, 10, or 15 thin stays, Dana's SIB was completely eliminated while her drinking occurred on progressively fewer trials. During the final three conditions (20 thin stays, 25 thin stays, five thick stays), both responses were completely eliminated. Therefore, sleeves containing no stays were selected for DRO (Target = no response).

Strategy #3: Differential Reinforcement

DRO (Target = no response)
- Escalating (30 min) DRO and scratching (Cowdery, Iwata, & Pace, 1990)
- Escalating VMDRO (5 min) and scratching (Toussaint & Tiger, 2012)

DRA (Target = Alt self-stimulatory response)
- Prompted toy play and STPY (Singh & Millichamp, 1987)
- DRA ineffective w/o prompts, Sr+, blocking (Lindberg, Iwata, & Kahng, 1999)
- Access to STPY as Sr for Alt R (Charlop, Kurtz, & Casey, 1990; Hanley, Iwata, Thompson, & Lindberg, 2000)
**Cowdery et al., 1990**

![Graph showing SIB (Self-Injurious Behavior) and Session length over sessions.]

**Lindberg et al. (1999)**

![Graph showing PERCENTAGE OF INTERVALS over sessions with different conditions: BL (Baseline), Prompts, Prompts with Sr+, RB (Response Block).]

- **Object manipulation**
- **SIB**
- **Ronald**
Default Strategy: Punishment

Early research: Contingent physical stimulation
- Aromatic ammonia, odors, shock, tastes, water mist

More recent research
- Overcorrection (contingent effort), physical restraint

Current research
- Response interruption and redirection (see review by Martinez & Betz, 2013)

Response Interruption & Redirection (RIRD)

Key features
- Interruption: Reprimand + response block
- Redirection: Instructed practice of some Alt R

Ahearn, Clark, MacDonald, & Chung (2007)
- N=4, vocal STPY
- RIRD: Questions until 3 correct vocal Rs w/o STPY

Ahrens, Lerman, Kodak, Worsdell, & Keegan (2011)
- N=4, 2 vocal STPY, 2 motor STPY
- Vocal RIRD: 3 vocal trials w/o STPY
- Motor RIRD: 3 motor trials w/o STPY
- No difference between vocal and motor applied to either STPY

Wunderlich & Vollmer (2015)
- N=7, all vocal STPY
- No Δ in PB when RIRD time included (N=4)
Clark et al. (2007)

Wunderlich & Vollmer (2015)
Delineating Subtypes of SIB Maintained by Automatic Reinforcement
(Hagopian, Rooker, & Zarcone, 2015)

FA patterns (N=39, varied SIB)
- I (high alone, low play): 41%
- II (high all conditions): 38.5%
- III (SIB and self restraint): 25%

Intervention analysis
- Treatment outcomes for Auto Sr subtypes vs. social Sr

Hagopian et al. (2015)
Opioid Hypothesis for SIB
(see research by Sandman)

Endorphin system
- Endogenous, neuropeptide regulatory system
- Physiological stress → endorphin release → increased pain threshold

Potential relevance to SIB
- SIB increased insensitivity to pain → SIB more susceptible to social consequences
- SIB Self-administration of narcotic

Treatment implications: Opioid antagonists
- Blocks uptake of endorphins → Extinction
- Decreases pain threshold → Automatic punishment

What about Automatic Sr-? (The pain attenuation function)

Response characteristics
- Cyclic response pattern?
- Correlated with physical symptoms? (allergy, dental condition, infection)
- Correlated with other behavioral changes (lethargy, appetite loss, sleep disturbance)?

Assessment Issues
- No direct test condition (cannot present EO)
- FA outcomes:
  - Medical condition present: PB in all conditions
  - Medical condition absent: No PB in any condition
General Treatment Strategies

- **Establishing operation: Pain or discomfort**
  - Alleviate discomfort (NCR)

- **Maintaining reinforcer: Pain reduction**
  - N/A (EXT contraindicated)

- **Behavioral replacement:**
  - Establish alternative pain reduction response

Pre-emptive Medication (Placebo) Training

**Medication assessment**

- Take a pill?
- Task analysis of pill taking
- Prompting & reinforcement

**Stimulus control assessment**

- Take at meals?
- Take at timed intervals?
- Request at meals or at timed intervals?

**Medication Reassessment**

- Periodic probes
- Generalization to actual medication