The Role of the Conditioned Reflexive Motivating Operation (CMO-R) During Discrete Trial Instruction of Children with Autism

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Brief History of Motivation In Behavior Analysis

- Motivation in behavior analysis has frequently been confused with the role of reinforcement as a consequence.

- The clear identification of motivation as an antecedent environmental variable event began with the publication of B. F. Skinner's *Behavior of Organisms* (1938).

- Skinner included two chapters devoted to motivation

- He argued against the term “drive.” Skinner asserted that, “The ‘drive’ is a hypothetical state interpolated between operation and behavior and is not actually required in a descriptive system.” (p. 368)

Moreover, he differentiated between motivational control and stimulus control by declaring that a “Drive is Not a Stimulus”.

- He relied on the operations of deprivation/satiation and presentation of aversive stimuli to describe motivation.

- Keller and Schoenfeld's book *Principles of Psychology* (1950)
  - This book contained a chapter devoted to and titled “Motivation.” It contained several refinements to the topic of motivation (Sundberg, 2005)
    - They further developed the analysis of deprivation/satiation and response strength.
    - They provided detailed analysis of how an aversive stimulus can function as a motivational variable.
• Keller and Schoenfeld gave a name to a newly discovered behavioral variable, “The **establishing operation** is our independent variable, the behavior our dependent variable; the former is specifiable as to kind and degree, the latter is measured by the extent of change. The concomitant variation of the two gives rise to, and defines, the concept and problem of motivation” (Keller & Schoenfeld, 1950, p. 273).

• In the book Verbal Behavior (1957) Skinner provided a comprehensive analysis of how motivational variables contribute to a human’s initial acquisition of language (Sundberg, 2005).

• It is here that he introduced the concept of the **mand** and argued that it was separate from the other operants because of its **control by motivational variables, rather than discriminative stimuli**. He also described how motivational variables could be manipulated to evoke verbal behavior.

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**Refinement of the Concept of the EO**

Jack Photos

▪ Through a series of writings, Michael (1982; 1988; 1993; 2000; 2007) refined the concept and principle of the establishing operation (EO) and defined it as an “environmental event, operation, or stimulus condition that affects an organism by momentarily altering a) the reinforcing value of other events and b) and alters the frequency of behavior that has produced what is now valued.

▪ Michael (1993) described two (2) types of EOs: Unconditioned and Conditioned.
  Unconditioned EOs (UEOs) are “events or operations or stimulus conditions whose value altering effects are unlearned,”

  Conditioned EOs (CEOs) “value altering effects have been learned during the individual organism’s learning history.”
Unconditioned and Conditioned MOs

- Michael (2007) lists nine main unconditioned motivating operations (UMOs) for humans, e.g. food, water, pain, etc. By manipulating UMOs in the form of deprivation, satiation, and conditions of aversion, learners can be taught many important skills.

- For example, a teacher who takes advantage of the deprivation of food that occurs just prior to lunch would be more easily able to now teach a child to mand (request) a food item by saying its name.

- However, much of the reinforcement that leads to children learning important skills is conditioned. Therefore, a thorough understanding of conditioned motivation operations (CMO) is crucial.

- There are three types of CMOs as described by Michael (1993, 2007):
  1. Conditioned Transitive Motivating Operation (CMO-T)
  2. Conditioned Reflexive Motivating Operation (CMO-R)
  3. Conditioned Surrogate Motivating Operation (CMO-S)

Table of MO Effects


Motivational Operations (MOs)

<table>
<thead>
<tr>
<th>Value-Altering Effect</th>
<th>Behavior-Altering Effect</th>
</tr>
</thead>
<tbody>
<tr>
<td>MOs alter the current reinforcing effectiveness of some stimulus, object, or event.</td>
<td>MOs alter the behavior of all types of responding that have been reinforced by the same stimulus, object, or event that is altered in value by the same MO.</td>
</tr>
<tr>
<td>Reinforcer Establishing Effect:</td>
<td>Reinforcer Abolishing Effect:</td>
</tr>
<tr>
<td>food deprivation increases effectiveness of food as rfnt.</td>
<td>food deprivation increases effectiveness of food as rfnt.</td>
</tr>
<tr>
<td>food ingestion decreases effectiveness of food as rfnt.</td>
<td>food ingestion decreases effectiveness of food as rfnt.</td>
</tr>
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<td></td>
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</tr>
</tbody>
</table>

Developed by Jack Michael and added with permission
• All three CMOs (3) have been implicated as behavioral variables within the applied research related to the treatment of persons with autism and developmental disabilities.

• Several review articles have appeared in the literature describing the clinical implications of the motivating operation:

  Smith & Iwata, 1997
  Wilder & Carr, 1998
  McGill, 1999
  Langthorne, McGill & O’Reilly, 2007
  Langthorne & McGill, 2009
  Carbone, Morgenstern, Tirri, & Kolberg, 2010
  Carbone, 2013
  Laprime, 2013
  Laraway, Syncerski, Olson, Becker & Poling, 2014
The Motivating Operations Concept: Current Status and Critical Response

Sean Laraway · Susan Snyderski · Ryan Olson · Bernd Becker · Alan Poling

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Abstract This paper reviews the current status of the Motivating Operation Concept (MOC), followed by a critical response to Whelan and D. Barnes-Holmes (2010), who argued against the MOC and proposed an alternative analysis of motivation, the Consequence-Finding Operation (CFO). In this paper, we: (a) review the MOC and discuss its conceptual and empirical status, (b) clarify certain aspects of the MOC, (c) correct Whelan and D. Barnes-Holmes’s inaccurate descriptions of the MOC, and (d) critique the CFO and related concepts. We demonstrate that the MOC is a high-impact innovation in behavior analysis that provides a useful theoretical framework for analyses of operant (instrumental) behavior. In contrast, the case made by Whelan and D. Barnes-Holmes for the competing CFO concept suffers from a range of problems. We, therefore, conclude that the MOC provides a superior and more useful behavioral analysis of motivation.

Keywords Motivating operations · Conditioned motivating operations · Establishing operations · Abolishing operations · Evocative effect · Abusive effect · Motivation · Consequence valuing operations

Behavior-analytic formulations of motivational concepts have evolved since the field’s founding. For example, Skinner (Skinner 1938, 1953, 1957) described motivational variables such

The Analysis of Verbal Behavior

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The Establishing Operation and Teaching Verbal Behavior

Vincent J. Carbone, Carbone Clinic

Twenty years ago Michael (1993) refined and extended the concept of the conditioned establishing operation (CEO). With this paper he updated his previous treatment of the topic (Michael, 1982) by providing terminological refinements and conceptually clear descriptions of the reflexive and transitive CEOs. In the 20 years since the publication of that paper there has been an increase in the application of CEOs as independent variables in the teaching of verbal behavior in applied setting. The purpose of this paper is to provide a brief overview of clinical applications of the EO to the teaching of verbal behavior during the last 20 years.

Key words: applied, establishing operation, motivation, verbal behavior
• As a result of Michael's writings on the topic and the terminological revision from “establishing operation” (EO) to “motivating operation” (MO), (Laraway, Syncerski, Michael & Poling, 2003) the concept gained recognition as an important variable in clinical practice.

The Reflexive Conditioned Motivating Operation

• Understanding and applying the concept of the motivating operation (MO) is essential to teaching verbal behavior and other skills to children with autism.

  • Research and manualized treatment packages emphasize the importance of motivation in teaching children with autism especially during high demand situations, (Koegel, Carter, & Koegel, 1998; Koegel, Koegel, Shoshan, & McNerney, 1999).

  Jack Part 1

• The typical set-up for discrete trial instruction (i.e., high rate of demands, presence of specific materials associated with demands, presence of the teacher, etc.) may evoke problem behavior maintained by escape or avoidance.

• Using methods that increase the motivation to respond, thereby decreasing the tendency of children with autism to engage in behaviors maintained by escape or avoidance, may be critical to positive long-term outcomes (Koegel, Koegel, Frea, & Smith, 1995).
CMO-R Definition

• To paraphrase Michael's (1993, 2007) definition, any stimulus which has been repeatedly correlated with a worsening set of conditions will come to function as a CMO-R, in that the onset of this stimulus will establish its own termination (removal) as a form of reinforcement and will evoke any behaviors that have previously produced such reinforcement.

• Let’s first look at an non-human experimental preparation related to the CMO-R.

• Then we'll discuss an applied clinical example.

• Lets look at an experimental preparation related to the development of a discriminated avoidance response. In other words, lets look at an example of how stimuli might be engendered with aversive properties and conditioned as CMO-Rs.
CEO-R
NON-HUMAN LABORATORY EXAMPLE

Reflexive MO Definition: Warning Stimulus
When a previously neutral stimulus is correlated with a worsening set of conditions, presentation of that stimulus:

Value Altering Effect - establishes termination of the stimulus as a reinforcer.

Behavior Altering Effect - evokes all behaviors that have terminated the stimulus

![Diagram of stimulus presentation and behavioral responses]

Development of the CMO-R in the Laboratory

Neutral Stimulus               “Painful Stimulation”                      Effects

(Tone) Presentation of Stimulus, Object or Event

Time →

(Shock) Worsening Set of Conditions

= Termination of Worsening Condition is a Reinforcer & Evokes Behavior That Has Been So Reinforced

After repeated correlations in the above sequence...

Warning Stimulus (CMO-R)

(Tone) Presentation of Stimulus, Object or Event

= Establishes Termination of Warning Stimulus (tone) as a Reinforcer and Evokes Behavior That Has Led to its Termination
Discrete Trial Instruction & The CMO-R

• A widely recommended teaching method, discrete trial instruction (DTI), has been demonstrated to be an effective method of treatment, (Smith, 2001), but can lead to high rates of problem behavior in some children with autism.

• The instructional method includes a teacher presenting instructional material in a precise and sequenced manner so that it evokes frequent responses to the material by the learner.

• Following each learner response the teacher presents a consequence that usually takes the form of some type of feedback that either indicates the responses are correct or incorrect.

• Correct responses usually result in a suspected form of reinforcement to strengthen the responses.
Following incorrect responses the teacher provides feedback indicating an error and usually conducts an error correction procedure.

The instructional demands could be in the form of presentation of verbal responses of the teacher (What is it? Touch your nose, etc.), presentation of nonverbal stimuli (pictures, objects to match), or some combination of both (Tell me which one you drink from).

**WHAT SKILLS ARE TAUGHT USING DTI?**

- DTI instruction can be used to teach almost any skill in any environment.
- In this context we are talking about teaching skills that are representative of the core deficits of persons with autism at a desk or instructional table.

The skills taught during DTI at an instructional table usually include the following:

1. listener behavior (commands and selection)
2. tacting (labeling)
3. motor imitation
4. visual performance (matching, sorting, etc)
5. intraverbal behavior (responding to what is said)
6. echoic responses

**Sylvia Video**

- Let's look at the causes of problem behavior during discrete trial instruction and how the CMO-R may be implicated.
## Development of the CMO-R During Instruction

<table>
<thead>
<tr>
<th>Neutral Stimulus</th>
<th>“Painful Stimulation” (Worsening Set of Conditions)</th>
<th>Effects</th>
</tr>
</thead>
</table>
| Presentation of Instructional Demands, Instructional Materials and Presence of Teacher | - Session Begins with Removal of Positive Reinforcement  
- Low value Positive Reinforcement  
- Low rate of Positive Reinforcement  
- Frequent Social Disapproval  
- Effortful Responses Required  
- Difficult Responses Required  
- High Rate of Demands  
- Frequent Learner Errors  
- Delayed Positive Reinforcement  
- Low magnitude Positive Reinforcement | Termination of Worsening Condition is a Reinforcer & Evokes Behavior That Has Been so Reinforced |

TONE ON \[\rightarrow\] Time \[\rightarrow\] SHOCK

### After repeated presentations of the above sequence……..

<table>
<thead>
<tr>
<th>Warning Stimulus (CMO-R)</th>
<th>Effects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Presentation of Instructional Demands, Instructional Materials and Presence of Teacher</td>
<td>Establishes Termination of the Warning Stimuli as a Reinforcer and Evokes all Responses That Have Led to Their Removal</td>
</tr>
</tbody>
</table>

TONE ON \[\rightarrow\] LEVER PRESS
• A thorough conceptual understanding of motivation and a well-developed practical repertoire related to modifying instructional variables may reduce the aversiveness of teaching and reduce problem behavior maintained by escape or avoidance.

• This may result in a more comprehensive analysis of an instructional situation and improved selection of appropriate instructional methods. (Michael, 2000).

Implications for Instruction

• When trying to reduce problem behavior that occurs during instruction, two treatment methods are frequently implemented:
  • Differential reinforcement plus extinction
  • Functional communication training (FCT) plus extinction

  Less often practitioners rely extensively on procedures to:
  • Abolish the CMO-R

• Michael (2000) suggests a practical solution to problem behavior may involve the use of escape extinction (i.e., maintain demands when problem behavior occurs).

• Heavy reliance on extinction during episodes of problem behavior during Discrete Trial Instruction is common.

• Failure to recognize the role of the CMO-R or confusing this behavioral variable with a discriminative stimulus may result in less effective outcomes. (Michael, 2000)
TREATMENT CHOICES

- Differential reinforcement (DRA) + extinction

- Functional communication training (FCT) + extinction

- Abolish the conditioned reflexive motivating operation (CMO-R)

- **Differential reinforcement (DRA) + extinction** involves reinforcing alternative (i.e., appropriate or desirable) behaviors **while** simultaneously, reinforcement is typically withheld for occurrences of the problem behavior (EXT).

  Problems
  i. Must maintain aversiveness of the instruction and demands (CMO-R)
  ii. High rates of extinction usually occur, especially at first
  iii. Difficult to increase rate of demands to clinically important levels without problem behavior resurging

  Kyle
• **Functional communication training (FCT) + extinction:** involves the replacement of problem behavior with a mand response that produces the same reinforcer that has maintained the problem behavior (Durand and Carr, 1991).

  Problems
  • Maintains aversiveness of the instruction and demands
  • Reinforcement of each mand precludes instruction
  • Difficult to increase rate of demands to clinically important levels without problem behavior resurging

  Peter Video

• McGill claims that merely replacing problem behavior and not altering the EO may raise ethical concerns since FCT methods leave in place a “counterhabilitative environment” which may lead to only temporary changes in behavior since the circumstances evoking the behavior remain in place.

• Use of either method is predicated on the notion that the aversiveness of the instruction can not be reduced without removing all demands.

• Michael (2007) suggests the following instead:
  …one should not assume that the ultimate phases of the demand cannot be made less aversive. Increasing instructional effectiveness will result in less failure, more frequent reinforcement, and other general improvements in the demand situation to the point at which it may function as an opportunity for praise, edibles, and so forth, rather than a demand. (p. 387)

In other words, an analysis of the learning history of a child in which demands have come to function as reflexive MOs may suggest interventions to abolish the value of escape as a reinforcer and, consequently, methods to abate problem behavior.
Clinical Examples of How To Abolish The CMO-R

• While abolishing the CMO-R appears to be an effective method of reducing problem behavior during instruction, in practical application infrequent use is made of this independent variable.

• Here are several examples of how to apply these antecedent manipulations to abolish the CMO-R, thereby increasing the effectiveness of instruction:

  • The first situation is one where all stimuli associated with an instructional environment initially acted as reflexive MOs. Here the CMO-R was abolished through pairing with strong competing reinforcers or through presentation of an abolishing operation. Note the difference in learner cooperation.

Reminder Jack Part 1

Part 2

Jack MVB

Effects Of PreSession Pairing On The Challenging Behavior And Academic Responding Of Children With Autism

Amanda N. Kelly1,2, Judah B. Axe1,2, Ronald F. Allen1* and Russell W. Maguire1

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2Department of Education, Simmons College, Boston, MA, USA
3Keiki Educational Consultants, Inc., Honolulu County, HI, USA

Presession pairing is an antecedent-based procedure in which an instructor engages with preferred items with a child for a few minutes before an instructional session. Although this procedure has been described in manualized treatment guidelines for working with children with autism, there are currently no direct investigations of whether this manipulation has a beneficial impact on target responding or the child’s social interactions. Functional analyses with three children with autism showed escape or attention and escape as reinforcers for their challenging behavior. Preference assessments identified highly and moderately preferred stimuli. In the context of a multiple baseline across participants design, the participants exhibited fewer challenging behaviors when instructional sessions were preceded by presession pairing than when they were not. Academic responding showed modest increases. Subsequently, in the presence of presession pairing with a novel task, the participants emitted no challenging behavior and similar or higher levels of accurate academic responding. One participant was available for a maintenance session without presession pairing 5 months later and showed near-zero levels of challenging behavior and comparable levels of accurate academic responding. The implications of the findings and future directions are discussed. Copyright © 2013 John Wiley & Sons, Ltd.
Here is a video of a teacher abolishing the CMO-R during a discrete trial training session with an uncooperative learner. Take note of how prior to these curricular revisions escape from the instructional situation was the most valuable reinforcer. Following the curricular revisions, however, the learner quickly returns to the instructional environment without problem behavior.

Britt Case Study
Josh
Josh MVB
The Role of the Reflexive-Conditioned Motivating Operation (CMO-R) During Discrete Trial Instruction of Children With Autism

Vincent J. Carbone,1 Barry Morgenstern,2 Gina Zecchin-Tirri,3 and Laura Kolberg

Abstract
The principle of motivation has resurfaced as an independent variable in the field of behavior analysis over the past 20 years. The increased interest is the result of refinements of the concept of the motivating operation and its application to the learning needs of persons with developmental disabilities. Notwithstanding the increased emphasis upon modification of motivating operations to reduce problem behavior, there is limited recognition of this important behavioral variable in autism treatment literature. An overview of antecedent-based instructional modifications that lead to a reduction of escape and avoidance behavior of children with autism during instruction is provided. An analysis of these instructional methods as motivating operations is proposed. A conceptually systematic analysis of the influence of instructional methods is offered as a tool for improving the selection and implementation of effective teaching procedures.

Keywords
motivating operations, establishing operations, autism, escape and avoidance behavior, discrete trial instruction

<table>
<thead>
<tr>
<th>TEACHING METHODS</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>PRESENT A STIMULUS THAT ACTS AS AN ABOLISHING OPERATION</td>
<td>Use strong competing reinforcers. Initially correlate the teaching environment with highly valuable and high-density reinforcement relative to the conditions that have typically been interrupted at the start of teaching sessions.</td>
</tr>
<tr>
<td>FADE IN EFFORT AND DIFFICULTY OF RESPONSES</td>
<td>Present instructional demands in which the stimuli and response requirements vary from trial to trial. Do not mass trial across one skill or one operant.</td>
</tr>
<tr>
<td>FADE IN # OF DEMANDS</td>
<td>Use errorless teaching methods that incorporate time delay prompting procedures. In other words, use methods that insure high levels of correct responding.</td>
</tr>
<tr>
<td>INTERSPERSE EASY AND HARD TASKS</td>
<td>Try to keep a ratio of about 80% known (i.e., easy) tasks to about 20% unknown (i.e., difficult) tasks.</td>
</tr>
<tr>
<td>REDUCE LEARNER ERRORS</td>
<td>Use a VR schedule of reinforcement, but initially start by presenting a lower number of demands before delivering reinforcement. Then, gradually increase the number of demands presented before delivering reinforcement until reaching the desired VR schedule.</td>
</tr>
<tr>
<td>MIX &amp; VARY TASKS</td>
<td>While fading in number of demands, also gradually fade in the effort related to responding by slowly increasing the difficulty of the demands being presented. In other words, start with demands that require low effort responses and gradually increase to demands that require more effortful (i.e., more difficult) responses.</td>
</tr>
<tr>
<td>EXTINCTION</td>
<td>When problem behavior occurs, treat with extinction. For behaviors typically maintained by positive reinforcement, do not deliver the reinforcer. For behaviors typically maintained by negative reinforcement, do not allow escape to occur (i.e., maintain the demand).</td>
</tr>
<tr>
<td>IMMEDIATELY DELIVER Sr+</td>
<td>Immediately deliver reinforcement for appropriate behaviors.</td>
</tr>
<tr>
<td>PACE INSTRUCTION PROPERLY</td>
<td>Initially use the shortest inter-trial interval (ITI) possible. This should typically start off around 1 – 2 seconds.</td>
</tr>
</tbody>
</table>

David Video, Bobby Ext
Narvan, Josh L.
• In the ABA literature, antecedent curricular revisions (Dunlap, G., Kern-Dunlap, L., Clarke, S., & Robbins, F.R., 1991; McGill, 1999) have been used to abolish the CMO-R of teacher instructions and demands by:

  • Pairing and making available strong competing reinforcers (Abolishing Operation)

  • Mixing and varying the skills taught (i.e., mixed verbal behavior sessions)
    (Dunlap, 1984; Dunlap & Dunlap, 1987; Dunlap, Dyer, & Koegel, 1980; Dunlap & Koegel, 1980; McComas, Hoch, Paone, & El-Roy, 2000; Winterling, Dunlap, & O’Neil, 1987)


  • Interspersing high rates of “easy” demands with lower rates of “hard” demands
• Gradually increasing the number of demands
  (Kennedy, 1994; Pace, Ivanic, & Jefferson, 1994; Pace, Iwata, Cowdery, Andree, & McIntyre, 1993; Piazza, Moses, & Fisher, 1996; Weld & Evans, 1990; Zarcone, Iwata, Smith, Mazaleski, & Lerman, 1994; Zaracone, et al., 1993)

• Gradually increasing the difficulty or effort of responses

• Immediately reinforcing alternative behaviors
  (Horner and Day, 1991)

• Pacing the instruction properly
Figure 2. Frequency of problem behavior per session by suspected function during fast, medium, and slow teacher presentation rates for David and Sarah.

Figure 1. Frequency of problem behavior per session during fast, medium, and slow teacher presentation rates for David and Sarah.
• Finally, here are several different learners of varying skill levels whose instructors are using procedures that reflect manipulation of the variables that abolished the aversive nature of the teaching setting. Note in particular the use of errorless instruction which reduces the frequency of errors, intersperse of high rate of mastered items, the mixing of all the skills being taught (mixed VB), the relatively brisk pace of the instruction, the high rate of reinforcement, etc.

MVB Videos

If you are interested in a more comprehensive coverage of this topic go to the following URL and scroll to the date July 31, 2013:

http://autism.outreach.psu.edu/archive/conference-schedule-2013

This is a video of a 3 hour presentation I did on July 31, 2013 at the National Autism Conference Penn State University. Jack Michael was in the audience and made some comments during the presentation.

THE END
References


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