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

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Introduction & Overview

• 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 (Koegel, Carter, & Koegel, 1998; Koegel, Koegel, Shoshan, & McNerney, 1999).

• 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).

A Time Line of the History of Motivation

• 1938 - Skinner's book Behavior of Organisms:
  Two chapters are devoted to the treatment of motivation: "Drive" and "Drive and Conditioning: the Interaction of Two Variables."

• 1950 - Keller and Schoenfeld's book Principles of Psychology:
  This book contained a chapter devoted to and titled "Motivation." It contained several refinements to the topic of motivation (Sundberg, 2005).

• 1953 - Skinner’s book Science and Human Behavior:
  Devoted three chapters to motivation as an independent variable (Sundberg, 2005).

• 1957 - Skinner’s book Verbal Behavior:
  Here he provided a comprehensive analysis of how motivational variables play a significant role in a human's initial acquisition of language (Sundberg, 2005; 2013).

Definition

• A motivating operation is any set of events, stimulus, or condition that alters the value of some stimulus as a reinforcer and alters the frequency of some response that has produced that consequence (Michael, 1993).

• Michael (1993, 2007) states that motivating operations have two defining features:
  1. They alter the reinforcing value upward or downward of some other stimulus and
  2. They alter some dimension of a response associated with the change in reinforcing value of a stimulus that has followed it.

• In other words, motivating operations:
  1. ESTABLISH or ABOLISH the reinforcing value of another stimulus. This is called the VALUE-ALTERING EFFECT. The two terms for the value altering effects are Establishing Operation and Abolishing Operation.
  2. EVOKE or ABATE a response. This is called the BEHAVIOR-ALTERING EFFECT. The two terms for the behavior altering effects are Evocative Effect and Abative Effect.
Examples

• Food deprivation is a motivating operation because it:
  1. Alters upward the value of food as a reinforcer (Establishing Operation)
  2. Evokes all behaviors that have, in the past, produced food as a form of reinforcement (Evocative Effect).

• Food ingestion (satiation) is a motivating operation because it:
  1. Alters downward the value of food as a reinforcer (Abolishing Operation)
  2. Abates all behaviors that have, in the past, produced food (Abative Effect).

• Becoming too warm is a motivating operation because it:
  1. Alters upward the value of temperature decrease as a reinforcer (Establishing Operation)
  2. Evokes all behaviors that have, in the past, led to becoming cooler as a form of reinforcement (Evocative Effect).

Examples

• The return to a normal temperature is a motivating operation because it:
  1. Alters downward the value of temperature decrease as a reinforcer (Abolishing Operation)
  2. Abates all behaviors that have, in the past, led to becoming cooler as a form of reinforcement (Abative Effect).

Unconditioned and Conditioned MOs

• Michael (2007) lists nine main unconditioned motivating operations (UMOs) for humans. 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 (CMOs) 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)

• 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.

• An analysis of the typical instructional setting for many learners with autism provides an example of the development of CMO-R:
  1. The teaching of some children with autism requires the presentation of many instructional demands each day.
  2. Many of these learners have a history that has established the presence of the teacher, the teaching context, and the presentation of the instructional demand as an aversive condition and therefore evoke problem behavior which interferes with learning. Michael (1993, 2000) identifies these antecedent stimuli as reflexive conditioned establishing operations (changed to condition reflexive motivating operations (CMOs-R) in 2003).

• Consistent with this analysis, teacher presence, instructional materials, and teacher instructional demands may all act as CMOs-R for some learners and therefore evoke problem behavior that interferes with learning. The reported high rates of problem behavior evoked by discrete trial training with some children (Lovaas, 1982, 2003) may be related to the CMO-R.

Discrete Trial Instruction

• Discrete trial instruction (DTI) has been demonstrated to be an effective method of treatment and education for persons with autism (Smith, 2001).

• 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

- For our purposes today we are specifically discussing DTI in the context of presentation of instructional demands by an instructor at a table during one on one instruction.

Sylvia Video

A thorough conceptual understanding of motivation and a well-developed practical repertoire related to modifying instructional variables that will reduce the aversiveness of teaching and reduce problem behavior maintained by escape or avoidance can result in a more comprehensive analysis of an instructional situation and improved selection of appropriate instructional methods. (Michael, 2000).

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

- Then we’ll look at the following two diagrams to discuss an applied clinical example. The following two diagrams depict an experimental preparation related to the development of a discriminated avoidance response. In other words, they show an analysis of how stimuli might be engendered with aversive properties and conditioned as CMO-R.

- The first diagram presents an analysis of how this occurs in the animal laboratory setting.

- The second diagram presents an analysis of how this occurs in the context of teaching.

- Both examples show how a previously neutral stimulus, after being consistently followed by a worsening set of conditions, comes to function as a warning stimulus for that worsening set of conditions. As a result, an avoidance response comes to be evoked by the presentation of the warning stimulus.

Development of the CMO-R in the Laboratory

Neutral Stimulus  | “Painful Stimulation” |
------------------|-----------------------|
(Tone) Presentation of Stimulus, Object or Event | (Shock) Worsening Set of Conditions |

Effects
= Termination of Worsening Condition as 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

Effects
= Establishes Termination of Worsening Stimulus (tone) as a Reinforcer and Evokes Behavior That Has Led to its Termination
Is The Tone an $S^0$ or an MO?

1. Does the antecedent stimulus or operation alter the value of the consequence or alter the availability of the consequence? In most cases the question is: “Is reinforcement now more valuable or more available?

Development of the CMO-R in the Classroom

Neutral Stimulus | “Painful Stimulation” (Worsening Set of Conditions) | Effects
--- | --- | ---
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 and Evokes Behavior That Has Been so Reinforced

Are the Demands an $S^0$ or an MO?

1. Does the antecedent stimulus or operation alter the value of the consequence or alter the availability of the consequence? In most cases the question is: “Is reinforcement now more valuable or more available?

Implications for Instruction

- When trying to reduce problem behavior that occurs during instruction, three methods of treatment are frequently used:
  - Differential reinforcement plus extinction
  - Functional communication training (FCT) plus extinction
  - Abolish the CMO-R

- Michael (2000) suggests a practical solution to this problem may involve the use of escape extinction (i.e., maintain demands when problem behavior occurs). In fact, escape extinction along with differential reinforcement of alternative behaviors (DRA) is the most common form of intervention for learners with autism who emit problem behavior when instructional demands are presented (Lovaas, 2003). Practitioners sometimes refer to this process as “working through” the problem behavior.

- Failure to recognize certain antecedent stimuli as reflexive MOs or mischaracterization of them as discriminative stimuli for problem behavior may stall attempts to reduce the problem behavior or may result in an over reliance on extinction (EXT). In most cases, alternative methods which do not reduce the aversiveness of the setting, such as DRA with extinction or FCT with extinction, have frequently been recommended.

- DRA involves reinforcing alternative (i.e., appropriate or desirable) behaviors. Simultaneously, reinforcement is typically withheld for occurrences of the problem behavior (EXT).

- One problem with this may be that if problem behavior is occurring at a high rate, there may be little opportunity to reinforce alternative appropriate behaviors.

- FCT involves the replacement of problem behavior with behavior that produces the same reinforcer that has maintained the problem behavior (Durand and Carr, 1991). Simultaneously, reinforcement is typically withheld for occurrences of the problem behavior (EXT).

- 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” and may lead to only temporary changes in behavior since the circumstances evoking the behavior remain in place.

- In addition, FCT results in high rates of manding for removal of CMO-R (demands). If this response is not reinforced problem behavior usually occur. If it is reinforced then very few learning opportunities are provided therefore rendering the procedure impractical.
Notwithstanding these concerns, practitioners will frequently choose to implement either of the following procedures when instructional demands during discrete trial teaching evoke problem behavior:

1. DRA + EXT – maintain the demand after problem behavior occurs as a form of extinction and then reinforce when correct responding occurs.
2. FCT + EXT – teach the learner to request removal of the task requirement following delivery of a demand as an alternative to problem behavior.

The decision to use either one of these approaches, FCT or DRA, combined with EXT is typically based upon an assumption that: 1) the demands must be presented because of the importance of the skills being taught and/or 2) that the instructional setting (i.e., demands) cannot be made less aversive.

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, edible, and so forth, rather than a demand.” (p. 387)

In the ABA literature, antecedent curricular revisions (Dunlap, G., Kern-Dunlap, L., Clarke, S., & Robben, R., 1991; McGill, 1999) have been used to abolish the CMO-R of teacher instructions and demands by:

2. 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, Poone, & El-Roy, 2000; Winterling, Dunlap, & O’Neil, 1987)

For a review of the literature on the application of the motivating operation to reduce problem behavior and discussion of the methods outlined in the section above see Carbone, Morgenstern, Zecchini, & Howard, 1984; Piazza, Moses, & Fisher, 1996; and Wolkery, Ault, & Doyle, 1992.

In other words, an analysis of the learning history of a child in which demands have come to function as reflexive MOs, such as the one presented earlier, may suggest interventions to abolish the value of escape as a reinforcer and, consequently, methods to adept problem behavior.

Abolishing the CMO-R in the Classroom

- Gradually increasing the number of demands (Kennedy, 1994; Pace, Ivancev, & Jefferon, 1994; Pace, Iwata, Cowdroy, Andree, & McIntyre, 1993; Piazza, Moses, & Fisher, 1996; and Wolkery & Evans, 1990; Zarcone, Iwata, Smith, Mazalek, & Lerman, 1994; Zarcone, et al., 1993)
- Gradually increasing the difficulty or effort of responses (Horner & Day, 1991; Iwata, Singer, & Horner, 2000; Richman, Wacker, and Winborn, 2001; Wacker, et al., 1990; and Wolkery & Evans, 1990)
- Immediately reinforcing alternative behaviors (Horner and Day, 1991)

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The following two tables summarize these teaching procedures and provide a self-assessment tool that can be used to determine what antecedent curricular revisions you need to make to your current instructional methods in order to more effectively abolish the CMO-R and abate the problem behavior exhibited by your learners.

<table>
<thead>
<tr>
<th>TEACHER DEMANDS</th>
<th>MATERIALS</th>
</tr>
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<tbody>
<tr>
<td>USE TEACHING PROCEDURES THAT ENSURE:</td>
<td></td>
</tr>
<tr>
<td>- Teacher is paired with Sr</td>
<td></td>
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<tr>
<td>- Greater magnitude of Sr</td>
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<td>- Higher rate of Sr</td>
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<td>- More immediate Sr</td>
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<td>- Less effortful R</td>
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<th>ABOLISHING THE CMO-R</th>
</tr>
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<tbody>
<tr>
<td>TEACHING METHODS</td>
</tr>
<tr>
<td>-------------------</td>
</tr>
<tr>
<td>PREVENT A STIMULUS THAT ACTS AS AN ABOLISHING OPERATION</td>
</tr>
<tr>
<td>PRESENT A STIMULUS</td>
</tr>
<tr>
<td>INTERFERING EASY AND HARD TASKS</td>
</tr>
<tr>
<td>FAIR OVERLAP AND IMPACT OF REINFORCERS</td>
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<tr>
<td>SATISFICATION</td>
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<tr>
<td>IMMEDIATELY PUNISH</td>
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<tr>
<td>PACE INSTRUCTION</td>
</tr>
<tr>
<td>REDUCE LEARNER ERRORS</td>
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<tr>
<td>PRESENT A STIMULUS TO TEACHER</td>
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<td>PRESENT A MATERIALS TO TEACHER</td>
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<tr>
<td>ENSURE:</td>
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<td>- Greater magnitude of Sr</td>
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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. Note the difference in learner cooperation.

    **Jack in High Chair**
    Jack Abolishing the CMO-R

  - This example shows a situation where the teaching environment and teacher instructions and demands acted as reflexive MOs. We will then see the same learner a few weeks later when the teaching procedures were changed to include methods that abolished the reflexive MOs. Note the differences in student and teacher responding.

    **KYLE Abolishing the CMO-R**
    0:1:24 as Reminder, Then 2:18: Abolishing the CMO-R

  - 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.

    [Josh and Vince]
    David R. Abolishing CMO-R Case Study

  - 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.

    [Rian & Brent, Nyan, James Video, DECLAN, Jack, Kaitlin Video, Katy Vocs, Katy 2010 1:30, Jordan, Shumdip, Andre, DAVID at Treetops, ELINOR, Vincent Video, John Luca, Sophie]