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MOCK EXAMS

Behavior and Measurement

Introduction

Two of the most foundational skills that a behavior analyst must develop throughout their experience include defining and measuring behavior. Once a behavior analyst begins their supervision, their supervisees must learn what can be identified as a behavior, how to operationally define the targeted behavior, and how to accurately and reliably measure the behavior that is targeted. Once a targeted behavior has been operationally defined, a behavior analyst will need to collect data on the targeted behavior so that they are able to make endless decisions within a behavior change program. In an effort to use data efficiently, the behavior analyst must graphically display and systematically analyze the data.

As a behavior analyst continues to work on teaching a selected skill, it is important to understand the individual's motivation as well as know what their reinforcing items are and how motivating operations can be capitalized upon to teach a skill successfully. A skill can be taught through the use of various procedures. Naturalistic instruction is one procedure that capitalizes on an individual's motivation as new skills are being taught.

Furthermore, it is important for a behavior analyst to understand the various types of prompts that can be utilized to assist with skill acquisition programs. Stimulus and response prompt fading procedures have been known to be effective across different studies within the literature. Therefore, behavior analysts should be cognizant of these types of procedures so that they can further enhance learning opportunities for the individuals that they provide services to.

In this course, participants will learn to (1) identify the characteristics of an operational definition, (2) identify the essential components of a graph, and (3) discuss how to visually analyze data within and across conditions.

Section 1: Behavior

Within the field of behavior analysis, the overarching interest of behavior analysts rests around determining what is behavior. The field views behavior as being anything that an organism does (Pierce & Cheney, 2017). This definition is inclusive of both overt (i.e., hopping) and covert responses (i.e., thinking). An overt response is a visible and observable action or reaction. It is a behavior that can be directly seen and recorded by others, contrasting with covert responses, which are internal and unobservable.

It is important to understand that there is a difference in how a behavior analyst defines behavior and how it is defined colloquially. A behavior analyst is required to change their views on how they see the world, as well as how they describe and interpret behavior.

Operational Definitions

Developing operational definitions is the first step to be implemented when moving toward a science of behavior. Operational definitions are to be specific and include both examples and nonexamples of the word(s) being defined. One method for testing to determine if an operational definition is a good definition is whether or not accurate recording is able to be conducted. There are several things to consider when developing an operational definition. A behavior analyst should determine if there is sufficient information provided so that someone without any history with the individual would be able to record instances of the exhibited behavior. Furthermore, it should be clear as to what constitutes one instance of the behavior, and the parameters of the behavior should be clear. This means that the individual recording the behavior should know when the exhibited behavior meets the definition and when it does not meet the definition.

Measurement System

Once an operational definition has been determined, the data collection method that is the most appropriate for the behavior being recorded as well as the context in which the behavior is being recorded should be selected. One of the first differences that can be noted among various measurement systems is whether they are continuous or discontinuous. A continuous measurement system is an ideal method as it includes all instances of a behavior being recorded. However, there are some situations and contexts where a continuous measurement system is not feasible. In these situations, a discontinuous measurement system should be used. These types of situations would be when an individual is not able to record every instance of the behavior or if the behavior includes a compilation of multiple responses that are difficult to record. Additionally, some situations may include behaviors that are difficult to determine the exact onset or offset of the behavior being recorded. One consideration that should be provided to discontinuous measurement systems is the length of the interval. When shorter intervals are being utilized, this allows for more accurate data collection to occur.

Another distinction that should be made for different measurement systems is that of the difference between free-operant responses and responses that are limited by the presentation of a separate stimulus. The measurement of free-operant responses is the basis for the field of behavior analysis. Even though this may be the case, this distinction is often not at the forefront for those accruing fieldwork hours toward certification or those that are newer to the field. Free-operant responding includes those responses that are made at any point. On the other hand, trial-based data collection includes occurrences where the response is limited based on either the presence or absence of a particular stimulus or situation. This type of data collection is common within the field of behavior analysis. Despite this information, free-operant responding should still always be considered.

Additionally, the important dimension or feature of the targeted behavior should be identified. A behavior analyst can complete this step by noting several pieces of important information. First, the behavior analyst should know how often the behavior is being exhibited. Then, the behavior analyst should know the amount of time that the behavior is occurring in. Lastly, the behavior analyst should determine the amount of time that exists between the presentation of a specific stimulus and the onset of the exhibited behavior.

Interobserver Agreement (IOA)

IOA involves data collection by two separate observers to determine the extent to which these two observers align with one another. Ideally, it is often recommended that at least 20% of the sessions have IOA data collected for them for each phase (Kennedy, 2005). Levels of IOA that are considered to be acceptable should reach agreement of 80% or better. IOA is not only important for those individuals conducting research. It should also be consistently recorded in each setting that data are collected in. There are three main reasons as to why IOA data are invaluable (Cooper et al., 2020). IOA data are important as it is vital for training individuals how to collect data accurately. Individuals that are newer to the field of behavior analysis should record data alongside someone else that has been collecting data so that they are able to demonstrate mastery prior to them being the primary data collector. Next, a secondary data collector is able to prevent observer drift or other human bias that may be present. Lastly, data collectors that have high agreement increases the believability of the data. Often, as data are displayed in an effort to present a case for continued investment from the client, stakeholders, or insurance companies, IOA data that demonstrates high believability can be beneficial.

Section 1 Personal Reflection

Are there different scenarios that you have been exposed to that have resulted in your deciding on either a continuous or discontinuous measurement system for recording data? Which system did you choose? What were the advantages and disadvantages of choosing this type of system for the behavior that you were recording data for?

Section 1 Key Words

Continuous measurement system - all instances of the targeted behavior are recorded

Covert responses - internal and unobservable thoughts or reactions

Discontinuous measurement system - recording behavior during intervals within a session, rather than capturing every instance

Interobserver agreement (IOA) - degree to which two or more independent observers agree on the same observed values when measuring the same behaviors or events

Overt response - a visible and observable action or reaction that can be directly seen and recorded by others

Section 2: Graphical Displays

Every behavior change program is dependent on a fundamental component. This component includes the use of data. Data are consistently utilized to determine decisions that are made within a behavior change program whether or not the goal of the program is to increase an appropriate behavior or to decrease a challenging behavior. Supervisees are often found to excel in operationally

defining behaviors and recording data. Even though this may be the case, it can still be difficult to manage data and utilize it for decision making purposes. Graphical displays of the data that are collected allow for others to summarize, interpret, analyze, and communicate to others about the data that were collected.

Within the field of applied behavior analysis (ABA), there are various graphical displays that can be used. Those that are commonly used by clinicians include that of line graphs and bar graphs. Although these are more commonly used by clinicians, it is strongly recommended that other types of graphs are utilized such as cumulative records and scatterplots.

A series of data points are formed to create a line graph that signifies various times and conditions that are ultimately connected by a line. Some type of quantifiable feature of the dependent variable as it relates to the independent variable is represented by a data point. Different features (i.e., trend, variability, level) can be used to analyze the line that connects the data points. Behavior analysts often use different variations of a line graph as they are able to provide variety to the user. For example, a line graph may integrate several dependent variable data paths, or a single dependent variable that has undergone two or more different conditions.

On the other hand, bar graphs display a depiction of the data in the format of a bar or column. With this format, the data are presented in a summary format instead of with each datum point. As a result, bar graphs are able to depict a large amount of data efficiently. These types of graphs also report mean or median scores. This does not allow for the trend or variability that is presented within a data path to be analyzed.

Components of a Graph

Even though there are several different graphs that an individual can select to depict data, each graphical display of data should include several key components. Although there are ample data collection software programs that can create a graph automatically once data are inputted, it is still necessary that a behavior analyst knows how to as well as understands how to create an accurate and complete graph. By learning how to graph data, a behavior analyst will have a better understanding of the graphical display. This can assist with a better interpretation, analysis, and communication regarding the data that are being graphed. Additionally, a behavior analyst is likely to work in a multitude of settings that take various approaches to graphing data. Despite one's placement within their work setting, Microsoft Excel will work the same way in each setting. As a result, if one is able to develop the skills necessary to create a graph using Microsoft Excel, then they will be able to create a graphical display of the data at any place they are at, despite any specialized software that is available to them.

The key components of any graph include the following features: horizontal axis, vertical axis, axis labels, condition change lines, condition labels, data points, data path line, and a figure caption (Cooper et al., 2020). A key may also be beneficial in different graphs. Most often, the horizontal axis (i.e., x-axis) will depict a passage of time. As a graph is being constructed, the behavior analyst should ensure that this passage of time is represented using equal intervals. Typically, behavior analysts may not record data every day of each week. For example, if a behavior analyst is employed in a public school setting, they may only collect data on days that school is in session. As a result, data would not be collected on the weekends. Therefore, it is important that a behavior analyst learns to create equal intervals across sessions, even if the spacing that occurs between each session is not the same (i.e., sessions may be spaced 1 hour apart and others spaced 4 hours apart). A multitude of metrics that measure the dependent

variable will be displayed on the vertical axis (i.e., y-axis). Often, the points that are lower on the graph or closer to the x-axis will be representative of lower values and vice versa. Furthermore, a behavior analyst will also need to ensure that they mark equal intervals along the y-axis. For example, if the y-axis depicts a frequency that ranges from 1 to 40, then the behavior analyst would need to space out their markings equally along the y-axis by possibly either 2's or 5's. Once each axis has been created, the behavior analyst should create clear and concise labels to note the information that is being displayed.

Visual Analysis

By conducting a visual analysis of data that has been graphed, this is typically done for two main reasons. The first reason that a visual analysis of data is conducted is to decide if a functional relation exists between both the independent and dependent variables (Johnston & Pennypacker, 1980). The second reason that a visual analysis is conducted is to decide if the changes that occur in the dependent variables are significant. A functional relation occurs when a consistent change in the independent variable reliably produces a change in the dependent variable. For example, if the delivery of a child's stuffed animal in response to the child's mands for a stuffed toy consistently and reliably increases the rate of mands for a stuffed animal, but placing the mands for the stuffed animal on extinction consistently and reliable decreases the rate of mands for a stuffed animal, then it can be determined that a functional relation between the delivery of a stuffed animal is contingent upon mands (i.e., independent variable) on the rate of mands for the stuffed animal (i.e., dependent variable).

Within Condition Analysis

When a behavior analyst begins to conduct a visual analysis of the data, this first involves analyzing the data within conditions and then across conditions. There

are several things that analyzing data within conditions consists of. It consists of evaluating the number of data points that are present, level, variability, and trend (WWC, 2020). To begin this analysis, a behavior analyst should determine if there are a sufficient number of data points that are present. The behavior analyst should consider if there are sufficient enough data points for them to be confident that the data points available provide an accurate estimation of the actual behavior. There are several factors that a behavior analyst should consider when determining this. Typically, it is believed that the more data points that are available across time will increase the probability that there is an accurate representation of the exhibited behavior, with more variable data requiring that there are more data points present when compared to that of data that are stable. However, more data points are not necessarily always better in every situation. For example, when a baseline condition should be maintained, this may require more data points. However, this would also mean that the individual receiving the intervention would have a longer latency to accessing the intervention. In certain situations where a lack of access to an intervention may pose a risk to an individual, the quicker that a transition can occur to the intervention may be more beneficial and worth the loss of confidence in the accuracy of the data (Cooper et al., 2020).

As the level of the data is evaluated, the behavior analyst should question the value at which the data congregate on the y-axis. This may be particularly easy to determine when the data are stable; however, it may be more difficult to evaluate when the data are variable. In most situations, a mean or median level line will be able to assist with determining this information with accuracy.

As the variability of the data is analyzed, the behavior analyst should determine the extent that the measures of behavior across time produce varied results. Situations where data points reflect various results across time are determined to be variable. Stable data, on the other hand, are considered based on the data

points that are approximately the same value on the y-axis. Data that are variable provide reason to doubt the accuracy of the results. Furthermore, data allow behavior analysts to predict how a behavior will be exhibited if changes are not made to the environment (Kazdin, 1982). Data that are stable provide a behavior analyst with confidence when predicting how a behavior will respond with limited data points; however, more data are needed to have the same level of confidence when the data are variable.

In an effort to evaluate the trend of the data, behavior analysts should determine the direction that the data path is taking. The trend of the data is usually described by the direction and magnitude. The direction is usually described with terms such as increasing, decreasing, or zero trend. On the other hand, the magnitude is described using the terms gradual or rapid (Kazdin, 1982; Roane et al., 2011). There are some situations where the trend will not be able to be determined. In these situations, information such as when the data increases, the data decreases, data are missing, or the data are highly variable should be included in the discussion.

Across Condition Analysis

As the visual analysis of data continues, the next phase involves comparing the data across the different conditions. If there are differences that are present among the level, trend, and variability across adjacent conditions, this should be noted. This phase of the visual analysis includes analyzing the immediacy of change, overlap, and consistency that occurs across conditions that are similar when it is applicable (WWC, 2020). In an effort to evaluate the immediacy of change, the behavior analyst should determine how quickly the level changed in the subsequent condition. If the change occurred more immediately, then this would indicate a stronger likelihood that the change that occurred in the independent variable had an influence on the change in the dependent variable.

A change in the independent variable could be viewed as an introduction of a treatment, the withdrawal of an intervention, or even the modification of the independent variable. However, there are some situations where the intervention will need to occur over time in order for change to occur. For example, when an individual changes their diet to a healthier approach, it may take several weeks before the individual sees a change in their weight. When a delayed effect occurs, it is important to understand that this should not be interpreted that there is a lack of a functional relation.

The next component of an across condition analysis should include the behavior analyst determining how many data points overlap among the conditions that are adjacent. The behavior analyst can be more confident that the change that occurs in the independent variable can influence the change that exists in the dependent variable when there is little to no overlap present among the data points that exist in the conditions that are adjacent. On the other hand, the more overlap that is present in the data points in the conditions that are adjacent will lead to uncertainty of the functional relation that may or may not be present.

There will be times when a particular condition is conducted more than one time. For example, an ABAB design will repeat conditions. In these situations, the behavior analyst should determine if the data in both X conditions are similar. In the ABAB design example, the behavior analyst should determine if the data in both baseline conditions are similar and if the data in both of the intervention conditions are similar. When data are determined to have consistently responded to identical changes in the independent variable, this produces a higher likelihood that a functional relation is present. The more times that these conditions are able to demonstrate similar changes in the dependent variables, then the more confidence a behavior analyst can have that a functional relation exists between the independent and dependent variables.

ABAB Design

A design known as the ABAB design is also referred to as a reversal or withdrawal design. This type of design is a powerful design that can be used to demonstrate a functional relation (Kennedy, 2005). In this design, each letter represents a condition. Often, condition A represents the baseline phase, and condition B represents the intervention phase. Within condition A, the repeated measure of a specific behavior occurs. This allows the behavior analyst to predict how the specific behavior will be exhibited if environmental changes are not made. In the intervention phase or condition B, the targeted behavior is measured repeatedly while it is exposed to a new condition. If there is a change in the targeted behavior, this provides evidence that a functional relation may exist between the changes that occurred within the environment as they are associated with the two different conditions. In an effort to verify this hypothesis, both of the conditions are repeated. If the behavior continues to respond similarly across condition A and then changes consistently across condition B, this further increases the likelihood that a functional relation is present (Risley, 2005).

AB Design

A modification that exists of the ABAB design is that of the AB design. Similar to that of the ABAB design, the condition A and condition B each represent a phase of the intervention. Condition A and condition B are only conducted one time, which provides the opportunity to analyze across the different conditions. However, without the ability to replicate the conditions, this deters from the ability of a functional relation to be established. Even though this may be the case, what the AB design does not demonstrate with experimental control it does provide in practicality. There are several limitations that are present within both clinical and educational settings when a return to baseline occurs. As an

individual is making progress or even significant gains on a skill, it is difficult to persuade or even justify to stakeholders that a return to baseline, where the individual's skill demonstration was subpar, should occur. As a result, a behavior analyst should decide on an individual basis as to whether or not the benefits of an AB design outweigh the limitations. There are several thoughts that should be considered. First, the behavior analyst should consider the ethics of reinstating a particular condition especially when the individual's behavior or skill demonstration was subpar. For example, if an individual's behavior initially posed risks to the individual or others, then it may not be ethical to reinstate the baseline condition for this particular person (Cooper et al., 2020). Next, if the behavior analyst is implementing an intervention that has significant scientific support, then it is assumed that the scientifically supported intervention is likely causing a change in the dependent variable.

Multielement Design

When a switch occurs between two or more conditions, this is known as a multielement design. This type of design is best to use when comparing the effectiveness of two or more interventions of a particular behavior (Kennedy, 2005). There are several advantages that are associated with a multielement design in comparing two or more interventions relative to an ABCBC design. With a multielement design, the evaluation can be completed more quickly whereas an ABCBC design necessitates that stable responding occurs across several conditions prior to a comparison being able to be made. Furthermore, the quick alteration between interventions within a multielement design allows for control to be maintained for the threat of maturation to internal validity. This type of design is the most prominent design that is utilized within a functional analysis (Beavers et al., 2013).

Section 2 Personal Reflection

What type of graphical displays have you commonly used within your practice? Do you feel that one type of graphical display is preferred when discussing treatment results with stakeholders? Of the treatment designs mentioned, which treatment design do you think would be the most effective to utilize within your practice and the treatments that you implement? Do you feel that any of these would have more limitations than advantages or be limited in implementation within your practice?

Section 2 Key Words

AB design - a basic research structure consisting of two phases: a baseline phase (A) and a treatment phase (B)

ABAB design - includes all three phases of the ABA design, but then adds a second intervention phase (Phase B) after the withdrawal phase that allows researchers to replicate the intervention and assess whether the behavior change is consistently linked to the intervention

Bar graph - data are presented in a summary format instead of with each datum point in the format of a bar or column

Line graph - a series of data points are formed that signifies various times and conditions that are ultimately connected by a line

Multielement design - a single-subject experimental design used to compare the effects of two or more different interventions on a target behavior; this design involves rapidly alternating between these interventions, allowing for a direct comparison of their effectiveness

Section 3: Motivating Operations

The relationship that exists between the antecedent, behavior, and consequence can be described through that of the three-term contingency of operant conditioning. As a clinician works to program and implement various skill acquisition and behavior reduction programs, one's focus tends to revert to the response-reinforcer relation or the response-punisher relation. Although this may tend to be the focus of a clinician, it is important to completely understand why a behavior is either exhibited or not. This can be done through the consideration of the influence that antecedents play within the three-term contingency. Even though a clinician understands that a particular stimulus acts as a reinforcer, the value or effectiveness of this particular stimulus will change and vary as time progresses. This concept was referred to as "drive" by Skinner (1938). When providing an example of this concept, one can think of chocolate as serving as a reinforcer for Frank's behavior. If Frank has not consumed any chocolate throughout the course of the day, the value of chocolate will more than likely increase and as it gets later in the day, the chocolate will act as a highly effective reinforcer. Furthermore, Frank is more than likely going to walk to the basket of candy that is positioned on a desk in the front lobby of the office where Frank works every day in order to obtain a piece of chocolate. However, on the other hand, the value of chocolate as a reinforcer will decrease after Frank has consumed a king-sized candy bar that his coworker brought him to celebrate his birthday. In conclusion, Frank will more than likely not engage in walking to the front of the lobby to obtain more chocolate from the basket. Therefore, as a result of this example, it is important for behavior analysts to determine what is maintaining a behavior as well as why a particular stimulus or event acts as a reinforcer at any moment in time (McGill, 1999).

The term establishing operation later was marked as describing the concept of drive (Keller & Schoenfeld, 1950). Establishing operation refers to an

environmental variable that briefly affects the effectiveness of a particular stimulus or event as a reinforcer as well as the current frequency of the behavior that has been in contact prior with the particular stimulus or event as a reinforcer (Keller & Schoenfeld, 1950). The term motivating operation was then later introduced and referred to the continuum acting in both a negative and positive manner meaning that the reinforcer can either be increased or decreased (Laraway et al., 2003). As a result, this can either increase or decrease the frequency of a particular behavior that has come in contact with reinforcement by the stimulus or event.

A motivating operation is described by two different effects. One effect is known as value-altering and the other effect is known as behavior-altering. Within the context of value-altering, an establishing operation establishes their effectiveness regarding a certain stimulus or event as a reinforcer. On the contrary, an abolishing operation abolishes its effectiveness regarding a certain stimulus or event as a reinforcer. When evaluating the behavior-altering property of a motivating operation, an evocative effect evokes a behavior that has been reinforced prior with a particular stimulus or event. On the other hand, an abative effect decreases the behavior that had been reinforced by the particular stimulus or event previously.

For example, you have just completed running a marathon on a bright, sunny day. When you complete the race, you are thirsty. The act of running a marathon induces thirst and establishes water as a reinforcer. You decide to walk to the nearest bottle filler and fill your bottle with water by first removing the lid on the water bottle. This is the behavior-altering evocative effect. The marathon running induced thirst evoked particular behaviors that had previously been reinforced through obtaining access to water. On the other hand, you just sat down to play a board game with your child and grabbed a glass of ice water to have with you. You drink this water in its entirety and your thirst is quenched. This is the value-

altering abolishing operation. In this particular example, water has been abolished as a reinforcer. As a result, you are unlikely to stop the board game, get up, walk to the water cooler, access a water bottle, or any other behaviors that have been previously reinforced with accessing water. This is the behavior-altering abative effect. The lack of thirst that is present abates any behaviors that have previously been reinforced by having access to water.

A behavior analyst should constantly keep in mind that behavior-altering effects, both evocative and abative, are different from function-altering effects. One should also remember that motivating operations are temporary. In the aforementioned example, the marathon running induced thirst will evoke behaviors that have been previously reinforced by having access to water for only a short period of time. Additionally, when one has a stomach that is full of water, this will abate those same behaviors for a short period of time. As time passes, water will become effective as a reinforcer again and as this happens, the behaviors that were previously reinforced by having access to water will also resume again. The current frequency of behaviors that are relevant are altered by the behavior-altering effects that are associated with motivating operations. Furthermore, consequences are associated with function-altering effects. The future frequency of any behavior is affected through use of reinforcement, punishment, and extinction (McGill, 1999).

Differences Between Discriminative Stimuli and Motivating Operations

In the beginning, it may be difficult for someone newer to the field of behavior analysis to understand the difference between discriminative stimuli and motivating operations. Both of these terms are antecedent variables and both of these terms evoke or abate behavior due to their relation to reinforcement or

punishment. Although this may be the case, a discriminative stimulus and stimulus delta either evoke or abate behavior due to their correlation with differential availability of reinforcement. In comparison, a motivating operation coincides with the differential effectiveness of reinforcement. This means that a discriminative stimulus signals that reinforcement is available, and an establishing operation establishes that the reinforcer is effective.

For example, let's imagine that you are on a road trip traveling out of state. Once you have been on the road for a couple of hours, your stomach begins to growl and you feel as though you are hungry. After you have had this feeling for about thirty minutes, you notice the sign for Burger King, take the next exit off of the highway, and drive in the direction of the drive thru for Burger King. While you were driving the first couple of hours of your road trip out of state, you had seen several different Burger King signs, but you did not exit the highway to begin the process of purchasing a whopper sandwich. You only decided to exit the highway when you saw the Burger King sign and you felt hunger pains. In contrast, you did not exit the highway when you first experienced the feeling of hunger. You actually had decided to wait about thirty minutes until you saw the Burger King sign before you exited the highway. In this situation, the Burger King sign is the discriminative stimuli that signals the availability of a whopper sandwich and hunger is the establishing operation that made a whopper sandwich effective as a reinforcer. If you look at this in a different way, the presence or absence of the Burger King sign did not determine the effectiveness of a whopper sandwich as a reinforcer. While you drove down the highway for approximately thirty minutes with hunger pains, a whopper would have been an effective reinforcer for you whether or not the Burger King sign was present. Instead, you did not try to make contact with reinforcement (i.e., eat a whopper sandwich) at any of the Burger King establishments that you passed on the highway the couple of hours prior to feeling hunger pains. During this timeframe, a whopper sandwich was not an

effective reinforcer as it did not evoke any whopper sandwich seeking behavior even when the presence of signal that a whopper sandwich was available was presented (i.e., Burger King sign that acts as a discriminative stimulus). As someone is learning to determine the differences between a discriminative stimulus and motivating operations, they should ask themselves if the stimulus that is present tells someone that a reinforcer is available. If this is the case, then the stimulus is a discriminative stimulus (i.e., Burger King sign). If the stimulus tells someone that a reinforcer can be effective within that moment of time, then this stimulus is a motivating operation (i.e., hunger pains).

Conditioned and Unconditioned Motivating Operations

A motivating operation may be referred to as either unconditioned or conditioned. A motivating operation that is unconditioned (UMO) can either establish or abolish as a stimulus or event as a reinforcer that is effective without any previous learning experience. For example, when one has been deprived of food, then food becomes an effective reinforcer. Furthermore, when an individual has been deprived of sleep, then sleep will be established as an effective reinforcer without any previous learning history.

There are three different types of conditioned motivating operations (CMOs). These different types include surrogate CMO (CMO-S), reflexive CMO (CMO-R), and transitive CMO (CMO-T). A CMO-S refers to a stimulus that was previously viewed as being neutral; however, it becomes paired with an UMO to ascertain its motivating operation properties (Michael & Miguel, 2020). For example, it is best to think of this as the neutral stimulus acting as a surrogate for the unconditioned motivating operation. A friend may invite you to go out to eat with them for lunch. You had brunch just an hour earlier and filled your stomach to the max. However, you accept the lunch invitation with your friend and let them know that

you will not eat lunch since you are still full from the brunch that you recently ate. You drive on over to the restaurant that you are meeting at for lunch and before you think things through, you go ahead and order a cheeseburger and fries. This is possibly the work of a CMO-S. You have encountered a long history of pairing the various sights and sounds of a restaurant with feelings of hunger which acts as an unconditioned motivating operation that ascertains food as a reinforcer. As a result, even when you are not experiencing hunger, the various sights and sounds of the restaurant establish a cheeseburger and fries as an effective reinforcer. In turn, this evokes your behavior of ordering the food when the waitress comes to your table.

A CMO-R is often referred to as a signal for an upcoming aversive event that seeks to establish the termination of the signal as a reinforcer that is effective (Michael & Miguel, 2020). For example, your son is extremely terrified of needles. You take your son to the pediatrician's office to get his updated vaccinations. Once you are in the patient room, the nurse pulls out the different needles. Your son, at the sight of the needles, begins to scream, run, cry, and attempt to escape the room. The sight of the needle establishes the removal of the needle as a reinforcer that is effective. In turn, this evokes a myriad of behavior that have previously been reinforced by escape. This all occurs without the actual presence of the unconditioned motivating operation, the pain that is inflicted by the injection of a needle.

Although a CMO-R is often referred to as a threat stimulus that signals an upcoming event that is not pleasant, it is also considered to be a signal of an improvement, thought of as a promise (Langthorne & McGill, 2009). For example, Carter has decided to enroll in a college course that is difficult. After every class comes to an end, Carter's professor, Dr. Roberts, provides a quiz to each student. Carter has not done well on these quizzes and has actually failed the quiz on several different occasions. Carter has learned, however, that if Dr. Roberts

becomes sidetracked during class time when there is approximately 20 minutes left of class, this often establishes the continuation of the conversation that Dr. Roberts was having when he was sidetracked as a reinforcer because it acts as a promise that the class will not have sufficient time to take the quiz that is administered daily. In fact, this will evoke behavior such as asking additional questions that have previously been reinforced with the continuation of conversations that sidetrack Dr. Roberts and the entire class.

A CMO-T is known to establish another event or stimulus as a reinforcer that is conditioned (Michael & Miguel, 2020). There are several unconditioned motivating operations that act as CMO-T for stimuli that are associated with the unconditioned reinforcer. For example, Oliver is a four-year-old boy that is not able to reach some of the snacks that his parents have located on shelves in the pantry. A few hours after Oliver has completed his lunch, hunger acts as an unconditioned motivating operation that works to establish food as a reinforcer. It is also a CMO-T that works to establish the presence of his mother, who is able to open the pantry door and reach the snacks that are on the shelves, as a conditioned reinforcer. It also evokes the behavior of crying that also has a history of accessing Oliver's mother's presence and attention.

Application of Motivating Operations

As a behavior analyst works to develop various behavior analytic programs, the thought of motivating operations should be considered due to their relation that they have with the effectiveness of reinforcement. Motivating operations can act on and have an affect on the different outcomes that are associated with preference assessments (Gottschalk et al., 2000), functional analyses (O'Reilly et al., 2009), skill acquisition programs (Rispoli et al., 2011), and behavior reduction programs (Davis et al., 2014). Generalization of new skills may be facilitated

through the manipulation of motivating operations. Researchers have found that certains skills that were developed in one setting were unable to generalize to a new setting unless there was an establishing operation that was present.

It has often been found that CMO-Ts are manipulated in an effort to teach manding to an individual. A motivating operation is key and necessary in order to evoke a mand. In an effort to facilitate mand training that reaches beyond unconditioned reinforcers such as water and food, CMO-Ts are typically contrived in the works of naturalistic training. This means that the behavior analyst will work to contrive a situation where the client will want something as a means to gain access to another item. For example, Dr. Anthony is working in an effort to improve the mands of a student named George. George mands for different items that are associated with his basic needs. Some of these items include food and drink as well as his highest preferred toys. However, Dr. Anthony is looking to increase George's mand repertoire by expanding it to include other items. In an effort to do this, Dr. Anthony places George's favorite toy, a stuffed bear, on a shelf that is high and out of reach of George. When George shows that he is interested in his stuffed bear, Dr. Anthony says, "you can have your bear after you roll the ball (i.e., neutral item) across the floor, which evokes George's mand for ball." As a result, Dr. Anthony established the absence of the stuffed bear as a CMO-T for the value of the ball as a reinforcer.

Section 3 Personal Reflection

As you continue to work in your practice and apply reinforcement strategies, what types of conditioned motivating operations have been in place and how have they been manipulated to further increase skill acquisition or decrease a challenging behavior?

Section 3 Key Words

Abolishing operation - abolishes its effectiveness regarding a certain stimulus or event as a reinforcer

Behavior-altering - property of a motivating operation where an evocative effect evokes a behavior that has been reinforced prior with a particular stimulus or event and an abative effect decreases the behavior that had been reinforced by the particular stimulus or event previously

CMO-R - referred to as a signal for an upcoming aversive event that seeks to establish the termination of the signal as a reinforcer that is effective

CMO-S - refers to a stimulus that was previously viewed as being neutral; however, it becomes paired with an UMO to ascertain its motivating operation properties

CMO-T - known to establish another event or stimulus as a reinforcer that is conditioned

Establishing operation - refers to an environmental variable that briefly affects the effectiveness of a particular stimulus or event as a reinforcer as well as the current frequency of the behavior that has been in contact prior with the particular stimulus or event as a reinforcer

Motivating operation - refers to the continuum acting in both a negative and positive manner meaning that the reinforcer can either be increased or decreased

Unconditioned motivating operation (UMO) - can either establish or abolish as a stimulus or event as a reinforcer that is effective without any previous learning experience

Value-altering - an establishing operation establishes their effectiveness regarding a certain stimulus or event as a reinforcer and an abolishing operation abolishes its effectiveness regarding a certain stimulus or event as a reinforcer

Section 4: Naturalistic Instruction

One type of procedure that focuses on capitalizing on an individual's motivation as new skills are being taught is known as naturalistic instruction. Therefore, it is important to have an understanding of motivating operations as this will enhance a behavior analyst's ability to implement naturalistic instruction in an effective manner. It is often found that naturalistic instruction is contrasted with that of discrete trial training. Both of these strategies are commonly used and implemented with children. On one hand, naturalistic instruction is viewed as being less structured than that of discrete trial training. With naturalistic instruction, the reinforcer aligns directly with the behavior instead of arbitrary reinforcers (i.e., tokens, edible items) that are used within discrete trial training sessions. Furthermore, there are lesser teaching trials when naturalistic instruction is used and each trial is led by the client as well as based on their own interest instead of being directed by the clinician. While there are a multitude of specific naturalistic instruction strategies, there are common components that exist such as context, motivation, and consequence.

Context

It is important to consider the context of naturalistic instruction. As the name of the procedure implies, the instruction is provided in the environment where the behavior naturally occurs. The context is inclusive of the setting, the individual that implements the instruction, and the ongoing activity. For example, when the setting is considered, instruction may occur in the activity room at the child's

home instead of at a table inside the ABA clinic. When considering activities that are ongoing, instruction may occur during the child's free time instead of during their one-on-one instruction with a therapist. It is important to note that naturalistic instruction does not require each of these items to be met; however, the closer that the instructional context is able to be to the context where the behavior occurs, then the more likely it will be that the individual will be able to effectively use the behavior in that particular context.

In an effort to demonstrate how an intervention is able to be implemented within contextually appropriate activities, researchers have recommended that established routines that target goals should be identified. For example, if an individual that is receiving supervision has developed a gross motor goal for the individual they provide services to, then this goal could be targeted for implementation during the bathing activity which is a routine. It may be more convenient for caregivers to implement teaching opportunities through the integration of routines as routines are repetitive and familiar for the individual receiving services. Furthermore, researchers have encouraged clinicians to facilitate trainings for caregivers so that they are able to implement communication teaching trials throughout their everyday routines (Roberts & Kaiser, 2011). It has been shown that most of the literature is focused on the use of routine-based instruction with young children (Hwang et al., 2013; McWilliam, 2016); however, it is suggested that this strategy could be employed with and translated to older individuals as routines are a part of life for individuals throughout the course of their life.

Motivation

Naturalistic instruction contains teaching trials that are only conducted when an establishing operation is in place, making this instruction procedure different from

other instruction procedures. This means that the individual receiving services will need to show some indication that motivation is in place prior to a teaching trial being implemented. An individual's preferred items are able to be identified through the means of a preference assessment or also by showing the learner different options and having them choose between the choices. Motivation is able to be captured through blocking access to items that are preferred, placing preferred items out of the individual's reach (i.e., on a shelf), or by providing them with a small sampling of the item (i.e., one piece of a puzzle). For example, researchers have been able to teach caregivers how to present three different items to their child and ask the child to choose one item (Gillett & LeBlanc, 2007). The caregiver was then able to block access to the item that the child selected and provided them with access to this item contingent on the child making a vocalization.

In addition to the aforementioned example, another way to capture an individual's motivation is to interrupt a behavioral chain. This method requires that the individual that is receiving services to be able to complete a chained task on their own without assistance as well as the terminal reinforcer of the behavior chain to sufficiently motivate the individual. This means that if the behavior chain is to make a sandwich, then the individual receiving services will need to be motivated to gain access to the sandwich if their request for the missing bread to complete the chain of responses is to happen. This method of interrupting a behavior chain is an effective way to contrive motivation because the individual is motivated to access the terminal reinforcer and completion of the chain is what results in access to this item. For example, researchers were able to insert opportunities to request items into leisure behavior chains that were already established by integrating the use of a device to listen to music and preparing a drink for two adult individuals with an intellectual disability (Rosales & Rehfeldt, 2007). Even more so, the researchers were able to present most of the items that

were required for completing the behavior chain while they also withheld certain items that were needed (i.e., headphones, spoon). As the participant initiated a step within the behavior chain that required an item that was missing, this became an opportunity for them to ask for the item that was missing. Some other examples that exist of interrupting behavior chains may include telling a child that they can go outside to swing on their swingset and "forgetting" to unlock the door to the area where the swingset is at which provides the child with an opportunity for them to say "open" or requesting an individual to complete their laundry and providing them with a bottle of laundry soap that is empty which provides them with an opportunity to ask for a new bottle of laundry soap. Additionally, another example would be for a professor to bring bagels to class for their students creating an opportunity for the students to ask where the knives are to cut the bagels and apply cream cheese. The interruptions that occur and are presented during these opportunities should appear as silly mistakes instead of as sabotage. From the individual's perspective that is learning, the opportunity should look as though it is a natural consequence and not something that was planned.

If the individual loses motivation, the trial will come to an end and the behavior analyst will try to recapture the motivation needed in order to present another trial. It is vital that the individual's motivation is followed. It is inappropriate to continue to prompt a request if the individual is no longer interested as it does not coincide with naturalistic instruction.

Consequence

Within naturalistic instruction, the consequence that is implemented is to be directly related to the behavior that is targeted. For example, if a child asks their parent to "open" a door that is locked, the parent should open the door for the child. In contrast, during the implementation of structured teaching approaches

like DTT, tangible items that are not related, edible items, and even tokens are often delivered to the individual once a targeted response has been completed. When implementing naturalistic interventions, not only is a natural consequence provided but it is also common for there to be less stringent response requirements to be in place. Approximations of different responses are being reinforced because responses that are being targeted during naturalistic instruction are continually being shaped.

Section 4 Personal Reflection

Have you ever used naturalistic instruction to teach a skill to an individual? What skill did you try teaching using naturalistic instruction? Did you find this procedure to be more effective in teaching the selected skill than another procedure such as DTT?

Section 4 Key Words

Naturalistic instruction - type of procedure that focuses on capitalizing on an individual's motivation as new skills are being taught

Section 5: Stimulus and Response Prompts

Behavior analysts diligently work to develop skill acquisition programs where the response that is targeted is evoked by a specific discriminative stimulus. If a particular stimulus is unable to evoke a targeted response, then that specific stimulus is not considered to be a discriminative stimulus. In most of these cases, this particular stimulus is known as a criterion stimulus. Furthermore, more stimuli will be needed in order to evoke a certain response. Supplemental stimuli that are paired with a criterion stimulus that will increase the probability of a

desired response are referred to as prompts (Noell et al., 2011). A prompt is not considered to be a critical component of the three-term contingency (Dietz & Malone, 1985; Cengher et al., 2018). Instead, it has been noted that the pairing that occurs of the prompt with the criterion stimulus and then the further fading of the prompt will result in stimulus control that occurs from the prompt to transfer to the criterion stimulus so that it becomes a discriminative stimulus (Demchak, 1990; Noell et al., 2011). This process of transferring stimulus control is considered to be complete once the desired stimulus, which is now known as the discriminative stimulus, is able to evoke the targeted response without the use of a prompt (Dietz & Malone, 1985).

For example, researchers were able to transfer stimulus control of pigeon key pecking successfully through the use of stimulus fading (Terrace, 1963). This process is referred to as errorless learning as the pigeons under study made few errors during the systematic transfer of stimulus control.

Prompts are divided into either stimulus or response prompts. A stimulus prompt is a prompt where the stimulus is manipulated in some manner (Cegher et al., 2018; Etzel & LeBlank, 1979). It is presented at the same time as the criterion stimulus. This can include the properties of the stimulus being changed or even adding to the stimulus. For example, a behavior analyst that is teaching an individual to differentiate between two numbers could simultaneously present the numbers but make the stimulus that is correct bigger and the stimulus that is incorrect smaller. A different example could be through the use of a positional prompt where the behavior analyst informs the individual to “touch the number two” while the card with the number two on it is placed closer to the individual and the other card, the card with the number four, is placed further away from the individual.

A response prompt, on the other hand, includes the use of an additional stimulus that is added in an effort to evoke the targeted response (Cegher et al., 2018; Noell et al., 2011). Conclusively, the criterion stimulus and the response prompt are not present at the same time; however, the response prompt is presented after the presentation of the criterion stimulus.

Furthermore, there are four different forms of response prompts: verbal, gesture, model, and physical guidance. Verbal prompts are inclusive of vocal verbal instructions. For example, when a behavior analyst prefers for an individual to clean up their toys, the behavior analyst may say to the individual to "clean up" (criterion stimulus) and then follow that by saying "pick up the car and put it in the bin" (Verbal prompt). Gesture prompts typically utilize head nods or pointing. When using the aforementioned example to demonstrate the use of a gesture prompt, after the behavior analyst has used the instruction of "clean up" (criterion stimulus), the behavior analyst may then point to the car that is on the rug or nod to the bin in which the car should be placed (response prompts). Model prompts are inclusive of both vocal physical models of the response that is desired. For example, a model prompt would include the behavior analyst demonstrating how to pick up a car and put it in a bin. Lastly, physical guidance is centered around the behavior analyst physically guiding the behavior analyst to complete the desired task. For example, after the behavior analyst has provided the instruction to "clean up," the behavior analyst would physically take the individual's hand, place it on top of the car, and guide the individual to place the car in the bin. Response prompts are often thought of as being on a continuum from least intrusive as being verbal prompts to the most intrusive including the use of physical guidance (Noell et al., 2011). This continuum of least intrusive to most intrusive prompts is individualized. For example, it is not correct to believe that a physical guide would be the most helpful prompt for an individual as some individuals may find that the use of physical guidance to be aversive and

potentially engage in avoidance or escape maintained behaviors if they are prompted with physical guidance. As a result, this type of prompt would not be helpful for the individual. In a similar manner, some people will assume that verbal prompts are the least intrusive prompts; however, it has been noted that these types of prompts are often difficult to fade. If this is the situation with a particular individual, then verbal prompts may not be considered as part of the continuum. The continuum that has been mentioned also occurs within each type of prompt category as well. For example, a vocal model can vary from modeling the beginning sound of a specific word to modeling an entire sentence or more. On the opposite end of the continuum, the controlling prompt can be found. A controlling prompt is known as a type of prompt that consistently results in the individual being able to emit the targeted response (Wolery et al., 1992).

Stimulus Prompt Fading

There are two techniques that are used to fade stimulus prompts. These include the use of either stimulus fading or stimulus shaping. Both of these particular techniques begin with the criterion stimulus being manipulated, but the type of manipulation is dependent on the type of prompt fading technique

Stimulus Fading

The technique of stimulus fading begins with a stimulus where this type of manipulation does not include the shape or configuration of the stimulus (Etzel & LeBlanc, 1979). Instead, a dimension of the stimulus that is noncritical (i.e., size, intensity, color, position) is altered. In an effort to transfer the stimulus control from the stimulus that has been altered to the criterion stimulus, which in turn would make the criterion stimulus a discriminative stimulus, the altered dimension is faded systematically. For example, a behavior analyst may be teaching an individual to point to a car in an array of two different vehicles when

told to, “touch the car.” The behavior analyst selects a noncritical dimension of the stimulus, the size of the car, and alters this but eventually fades this as trials progress. The size of the car may start out as being twice the size of the object in the other vehicle picture and then is systematically faded to become smaller across trials until it is comparable size to the vehicle in the other picture.

Furthermore, stimulus fading may also start out with the superimposition of a particular stimulus that is then faded (Cooper et al., 2020; Terrace, 1963). For example, a superimposition may be faded so that the stimulus that evokes the vocal response “car” is able to be transferred from a picture to the text “c-a-r”. In this type of example, a picture of a car can be used with the text “c-a-r” placed over the picture of the car. In subsequent images, the image of the boat is lessened in color and salience so that the text “c-a-r” is more prominent. Then, in additional pictures, the image of the car is removed so that only the text “c-a-r” is in the display.

Stimulus Shaping

Stimulus shaping is known for beginning with a stimulus where the overall configuration of the discriminative stimulus is changed (Dietz & Malone, 1985). The configuration in which the stimulus control is transferred is systematically changed. For example, when teaching an individual the word “car,” the first image may begin with a complete picture of a car. Then, as each subsequent image is shown to the individual, the image of the car will change so that components of the image are used to form components of the text “c-a-r.” The images will continue to be altered until the last image is only of the text “c-a-r” and no longer contains any components of the image car.

Response Prompt Fading

There are four techniques that are used to fade response prompts. These techniques include least-to-most prompting, most-to-least prompting, graduated guidance, and time delay (Cooper et al., 2020).

Most-to-Least Prompting

In an effort to integrate the use of most-to-least prompting, a behavior analyst should determine the hierarchy of prompts that are to be used from least to most intrusive. During the beginning teaching trials, the behavior analyst should deliver the most intrusive prompt that was identified within the hierarchy. After the individual has met a predetermined criterion, then the behavior analyst will need to transition from using the most intrusive prompt to using the second most intrusive prompt that was previously identified. Then, after the individual has met a specified criterion, the behavior analyst will need to transition to a less intrusive prompt. This process will continue to be implemented until all identified prompts are able to be faded and the targeted behavior is able to be evoked by the discriminative stimulus. Although the goal of this process is to move from most to least intrusive prompts, the behavior analyst may also decide to move up the prompt hierarchy across trials as the individual responds and engages in different behaviors. For example, if the behavior analyst decides to integrate a hierarchy of prompts that consists of physical guidance, gesture, and verbal prompts and the individual requiring the prompts has mastered the predetermined criterion associated with physical guidance, then the behavior analyst would deliver the subsequent trials using a gesture prompt. If at any point during those trials the individual requiring prompts made numerous errors after the prompt, the behavior analyst would more than likely return to using physical guidance as a prompt for several more trials in an effort to prevent any additional errors being made.

Least-to-Most Prompting

The response prompt technique known as least-to-most prompting is also recognized as a system of least prompts. This technique also includes the use of a prompt hierarchy. As each teaching trial is implemented, the behavior analyst waits for the individual to respond independently. If the individual does not emit a response, then the behavior analyst will implement the least intrusive prompt that is identified in the hierarchy. Then, the behavior analyst will wait again for the individual to respond and deliver the next prompt in the hierarchy until the individual emits a correct response. In contrast with most-to-least prompting where one prompt is delivered per trial, this technique involves the behavior analyst continuing to deliver prompts that are increasingly more intrusive or considered as helpful until the individual is able to emit a response that is correct. Two advantages that have been noted with this technique are that the individual has the opportunity to respond independently and the integration of the prescriptive nature of least-to-most prompting (Billingsley & Romer, 1983; Noell et al., 2011).

Graduated Guidance

Graduated guidance is a technique that is similar to most-to-least prompting. This technique begins with the prompt that is the most intrusive and also considered the controlling prompt. However, in contrast to that of the most-to-least prompting where the prompting level decreases across trials, this technique allows for the prompting intrusiveness or helpfulness to also change from moment to moment. For example, if the behavior analyst is working to teach an individual how to draw a circle, the behavior analyst may provide the individual with a full physical guidance prompt when starting the circle, but take away their hand momentarily as the individual draws part of the circle. Then, the behavior analyst can return their hand to the individual as they continue to move around

the paper to finish the completion of a circle. Graduated guidance allows the individual to demonstrate the ability of their skill with the maximum possible independence available. On the other hand, an unsystematic fading approach is not viewed in a favorable manner by behavior analysts (Wolery & Gast, 1984).

Time Delay

The technique of time delay begins with a controlling prompt being selected. In contrast to the aforementioned prompt fading techniques, this technique utilizes one prompt across all prompt fading trials. The first trials within this process begins with the controlling prompt being delivered at the same time as the criterion stimulus (i.e., zero second prompt delay). Instead of systematically changing prompts throughout each trial, the delay that occurs between that of the criterion stimulus and the prompt is increased systematically (Touchette, 1971). There are two different types of time delay. These two types consist of progressive time delay and constant time delay (Snell & Gast, 1981). In the implementation of progressive time delay, the delay that occurs between the criterion stimulus and prompt is increased systematically across the different trials, often in increments of one or two seconds. Constant time delay, on the other hand, similarly begins with the simultaneous delivery of the criterion stimulus and the prompt. However, after several occurrences of a zero-second delay, the delay that is used is increased to a time that is fixed across all subsequent trials. The response that is emitted from the individual determines the duration of the constant delay. This means that it is determined based upon what is deemed to be an acceptable delay between that of the discriminative stimulus and the targeted behavior that occurs within the natural environment.

The procedures that have been mentioned within both the stimulus and response prompt fading procedures have been known to be effective across different studies within the literature. It has been noted that stimulus prompting is

considered and found to be more effective and efficient when compared to that of response prompting (Cengher et al., 2018). However, it has also been noted that the comparisons that are made of the different response prompting techniques infer that there are individual variables that have an impact on response prompting techniques that are the most effective and efficient (Cengher et al., 2018).

Section 5 Personal Reflection

What do you believe is the goal of skill acquisition? What are some examples of stimulus prompts that you have been able to incorporate into different skill acquisition programs that you have implemented? What are some examples of response prompts that you have been able to incorporate into different skill acquisition programs that you have implemented? Based on the information provided in these questions, which type of prompt did you find to be the most successful with the individuals you provide services to and why?

Section 5 Key Words

Controlling prompt - a type of prompt that consistently results in the individual being able to emit the targeted response

Prompt - supplemental stimulus that is paired with a criterion stimulus that will increase the probability of a desired response

Response prompt - includes the use of an additional stimulus that is added in an effort to evoke the targeted response

Stimulus prompt - a prompt where the stimulus is manipulated in some manner and presented simultaneously with the criterion stimulus

Stimulus fading - a dimension of the stimulus that is noncritical (i.e., size, intensity, color, position) is altered; in an effort to transfer the stimulus control from the stimulus that has been altered to the criterion stimulus, which in turn would make the criterion stimulus a discriminative stimulus, the altered dimension is faded systematically

Stimulus shaping - beginning with a stimulus where the overall configuration of the discriminative stimulus is changed; the configuration in which the stimulus control is transferred is systematically changed

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