The Relationship Between Motivating Operations & Behavioral Variability

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Outline

1. Introduction
2. Contingencies: Definition, Types, Variables in Operant Contingencies & Relationship to Functional Relations
3. Behavioral Variability
4. Motivating Operations & Behavioral Variability: From Conceptual Analysis to Behavior Analysis Practice
Part 1

Introduction
Behavior Analysis

- A natural science
- Subject matter: Functional Relations between response classes and stimulus classes
- Functional relations are developed and maintained by behavior-environment contingencies
4 Branches of Behavior Analysis

- Conceptual Analysis of Behavior
- Experimental Analysis of Behavior (EAB)
- Applied Behavior Analysis (ABA)
- Behavior Analysis Practice
Our Practice Should be Based on:

- A strong conceptual foundation
- Fluency is the basic principles of behavior as discovered through EAB
- Informed by ABA research
- Adhere to the 7 dimensions of ABA (e.g.,
  - Analytical
  - Conceptually systematic
C. of R.: A Theoretical Analysis
As Jack Michael Says…

“But even though one may be able to do good work without talking about it correctly, I can’t help but believe that even better work is possible when verbal practices are not seriously flawed.”
Part 2

Contingencies:
Definition, Types of Contingencies, Variables in Operant Contingencies, and the Relationship Between Contingencies and Functional Relations
Contingency vs. Functional Relations

- Contingencies have effects on behavior and on functional relations between environmental events and behavior.
- Functional relations are established and observed, but it would be incorrect to say that a functional relation had an effect...
- Contingencies lead to the development of functional relations, but not vice versa.
Functional Relation

• In behavior analysis *function* is used in its mathematical sense. (Skinner, 1953)

• A *functional relation* is simply a mathematical relation between two or more variables.
Functional Relation (Continued)

• In behavior analysis functional relations are between stimulus classes (independent variable) and response classes (dependent variable).
Functional Relation (Continued)

• A *functional relation* is said to exist when systematic manipulation of members of a stimulus class result in orderly, reliable, and predictable changes in members of a response class, such as those observed when we conduct a *functional analysis*. 
Functional Relation

Note: This does not represent time as a stimulus can be either an antecedent or a consequence.
Example of Response Patterns in an FA
These functional relations are:

- Probabilistic (not cause-&-effect or deterministic)
- Non-linear (cf., nonlinear equations in calculus)
- Complex as they change over time with respect to changing conditions (e.g., context) but allow us to make predictions.
Contingency

• A contingency exists when one event depends on another

• An event that is truly contingent on another only occurs if the other event occurs
  • For example, thunder only occurs if there is lightning

• However, contingent relations, typically, are weaker than “if and only if X, then Y”

• The dependencies are probabilistic
Types of Behavioral Contingencies

• Respondent

• Operant
  – Reinforcement Contingencies
  – Punishment Contingencies
Operant

• A response class that can be changed by its consequences
• Operants develop and change through the process of differential reinforcement (and sometimes differential punishment)
• These processes lead to differentiation and discrimination
Variables in Operant Contingencies

• Operants (Response Classes) - (DVs)
• Environmental Variables (IVs):
  – Consequences
  – Discriminative Stimuli
  – Motivating Operations
Basic Operant 4-Term Contingency

Environmental Context

MO $\rightarrow S^D \rightarrow R \rightarrow S^R$
Discriminative Stimuli and Consequences (A Review)

- Discriminative stimuli derive their effect on behavior due to a past history of differential availability of members of a consequence class contingent on the occurrence of a members of a response class.
Discriminative Stimuli...

- Evoke or abate responding as a result of this past history of contingent relations between antecedents, responses and consequences.
Differential Availability

• How likely is it that the consequence will follow a specific response now?
• Example:
  • Behavior: Opening the door
  • Consequence: Finding a sink
    • Door says “Restroom” - Likely
    • Door says “Storage” - Unlikely
Types of Discriminative Stimuli

• $S_{Dr}$
  – Discriminative Stimulus for Reinforcement
  – Evokes behavior due to past history of reinforcement...
Types of Discriminative Stimuli (continued)

- $S_{Δr}$
  - Discriminative Stimulus for Extinction (or lower density of reinforcement)
  - Abate behavior due to past history of extinction (or lower)…
Types of Discriminative Stimuli (continued)

- $S_{Dp}$
  - Discriminative Stimulus for Punishment
  - Abate behavior due to past history of punishment...
  - However, in this case, *suppress* may be a better term than *abate*.
Types of Discriminative Stimuli (continued)

- $S^\Delta p$
  - Discriminative Stimulus for unavailability of punishment
  - Evoke behavior due to past history of unavailability of punishment...

- Note: We have submitted a paper on this term as it only appears once in the literature and it is dismissed as unimportant.
Motivating Operations and Consequences

• Motivating operations derive their effect on behavior due to their establishing or abolishing effect on specific consequences which have reinforced or punished a response class in the past.
Review of Motivating Operations

- Motivating operations (MOs) alter the effectiveness of consequences and either evoke or abate behavior depending on the specific value-altering effect.
- MOs evoke or abate responding depending on the value-altering effect they have on specific response-contingent consequences.
- MOs also have been shown to either widen or narrow the stimulus generalization gradient.
Change in Effectiveness

• If the consequence occurs now, how likely is it to be effective as reinforcement or punishment for that behavior?

• Example:
  • Behavior: Opening the door
  • Consequence: Finding a sink
  • Sticky Hands: Effective
  • Clean Hands: Less Effective
Value-Altering Effects of MOs

Motivating Operations
Effect on Consequences

Establishing
Increases Value of Consequences

Abolishing
Decreases Value of Consequences
Four General Types of MOs & their Effects

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Basic Operant 4-Term Contingency

Environmental Context

MO $\rightarrow$ $S^D$ $\rightarrow$ $R$ $\rightarrow$ $S^R$
Positive Reinforcement Contingencies

Environmental Context

\[ \text{EO}^{r+} \rightarrow S^{Dr+} \rightarrow R_1 \rightarrow S^{r+} \]  

\[ \text{AO}^{r+} \rightarrow S^{Dr+} \rightarrow R_1 \rightarrow S^{r+} \]  

\[ \text{EO}^{r+} \rightarrow S^{\Delta r+} \rightarrow R_1 \rightarrow \text{EXT} \]  

\[ \text{AO}^{r+} \rightarrow S^{\Delta r+} \rightarrow R_1 \rightarrow \text{EXT} \]
Negative Reinforcement Contingencies

Environmental Context

\[ EO^{r-} \rightarrow S^{Dr-} \rightarrow R_1 \rightarrow S^{r-} \]

\[ AO^{r-} \rightarrow S^{Dr-} \rightarrow R_1 \rightarrow S^{r-} \]

\[ EO^{r-} \rightarrow S^{\Delta r-} \rightarrow R_1 \rightarrow \text{EXT} \]

\[ AO^{r-} \rightarrow S^{\Delta r-} \rightarrow R_1 \rightarrow \text{EXT} \]
Positive Punishment Contingencies

Environmental Context

\[ \text{EO}^{p+} \rightarrow S^{Dp+} \rightarrow R_1 \rightarrow S^{p+} \]
\[ \text{AO}^{p+} \rightarrow S^{Dp+} \rightarrow R_1 \rightarrow S^{p+} \]
\[ \text{EO}^{p+} \rightarrow S^{\triangle p+} \rightarrow R_1 \rightarrow S^{\triangle p+} \]
\[ \text{AO}^{p+} \rightarrow S^{\triangle p+} \rightarrow R_1 \rightarrow S^{\triangle p+} \]
Negative Punishment Contingencies

Environmental Context

\[ \text{EO}^p \rightarrow S^D_{p^\text{p}} \rightarrow R_1 \rightarrow S^p \]

\[ \text{AO}^p \rightarrow S^D_{p^\text{p}} \rightarrow R_1 \rightarrow S^p \]

\[ \text{EO}^p \rightarrow S^\Delta_{p^\text{p}} \rightarrow R_1 \rightarrow \emptyset S^p \]

\[ \text{AO}^p \rightarrow S^\Delta_{p^\text{p}} \rightarrow R_1 \rightarrow \emptyset S^p \]
Contingency vs. Functional Relations

• Contingencies have effects on behavior and on functional relations between environmental events and behavior.

• Functional relations are established and observed, but it would be incorrect to say that a functional relation had an effect...

• Contingencies lead to the development of functional relations, but not vice versa.
Contingencies & Functional Relations

• The stronger the contingent relation between a stimulus class and a response class the more probable that we will find an orderly, reliable, and predictable functional relation between the two.

• The stronger the contingent relation between two or more stimulus classes the more probable that a new functional relation will develop between a “neutral” stimulus class and the response class that was previously functionally related to the other stimulus class.
Function-Altering Effects of Stimuli

• When in a contingent relation with other stimuli, a stimulus may have effects on other stimuli. These other stimuli are likely to have an effect on the response class that were functionally related to the previously effective stimulus.
Function-Altering Effects of Stimuli – E.g.,

• Contingent pairing of the US with a neutral stimulus...

• Contingent pairing of an unconditioned reinforcer with another stimulus...

• The effect of contingent differential consequences on developing discriminative stimuli...

• The effect of MOs on consequences and on discriminative stimuli...
Part 3

Behavioral Variability
Variability

• Variability is the rule, not the exception, in the universe.
• Behavior is not the exception.
• The main function of science is to measure and explain variability.
• The science of behavior analysis has demonstrated that behavioral variability is a function of environmental variability.

(cf. Johnston & Pennypacker, 1980)
A Note about Selectionism

• Variation and selection
• 3 types of selection
  – Natural selection
  – Operant selection
  – Cultural selection
Behavioral Variability of:

• Single responses, within an operant response class, at a specific point in time
• Single operant response class across time
• Concurrent operants (i.e., concurrent response classes:
  – Probability at a specific point in time
  – Across time
Concurrent Operants

- Two or more alternative operants (response classes) that can occur either simultaneously or in close succession.
- Each is defined by a different set of contingencies.
- Note: Not the same as alternative responses that are members of the same operant response class)
Variability of Single Responses

• Topographical properties
  – Force/intensity
  – Other topographical properties

• Dimensional quantities of a single response across time
  – Duration
  – Latency
Variability of Single Operant Class

• Stimulus control across time
• Dimensional quantities of a single operant class across time
  – IRT
  – Rate
  – Celeration
• Differential probabilities of members of response class hierarchies across time
Variability & Concurrent Operants

• Variations in time allocation across two or more concurrent operant classes across time (cf. the Matching Law)

• Response class hierarchies and “Functionally equivalent alternative behavior”
Part 4

Motivating Operations & Behavioral Variability:
From Conceptual Analysis to Behavior Analysis Practice
MOs & Variability of Single Responses

- Force/Intensity
- Other topographical properties
- Duration
- Latency
MOs & Variability of Single Operants

• Stimulus control across time
• Dimensional quantities of a single operant class across time
• Differential probabilities of members of response class hierarchies across time
MOs & Variability of Concurrent Operants

• Time allocation & the Matching Law
• Differential probabilities of members of response class hierarchies across time
  – Response effort
  – Stimulus fading in
– Other MOs