The Relationship Between Motivating Operations & Behavioral Variability

Penn State Autism Conference – 8/3/2016

Jose Martinez-Diaz, Ph.D., BCBA-D

FIT School of Behavior Analysis

and ABA Technologies, Inc.

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

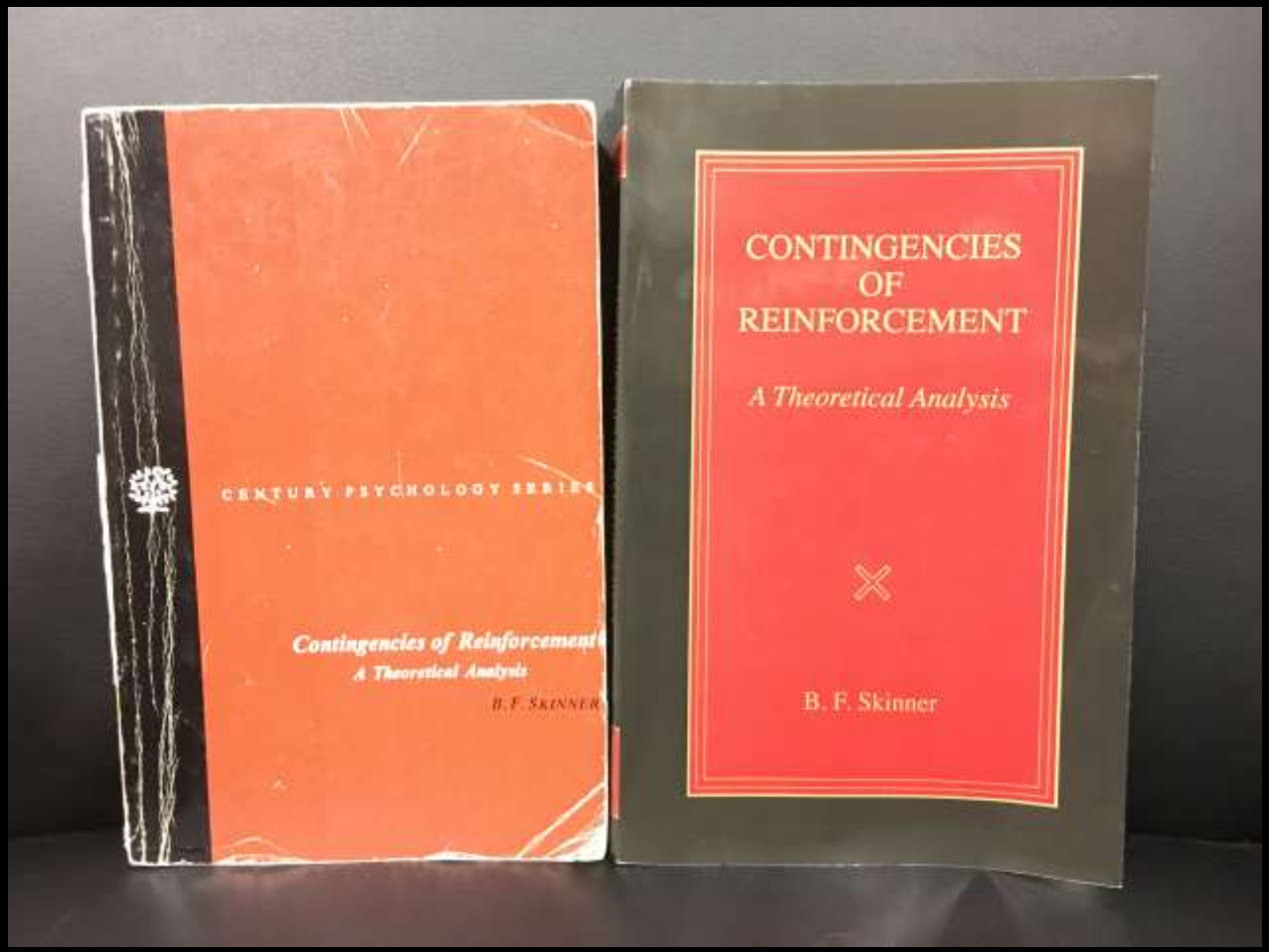
4 Branches of Behavior Analysis

- 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.

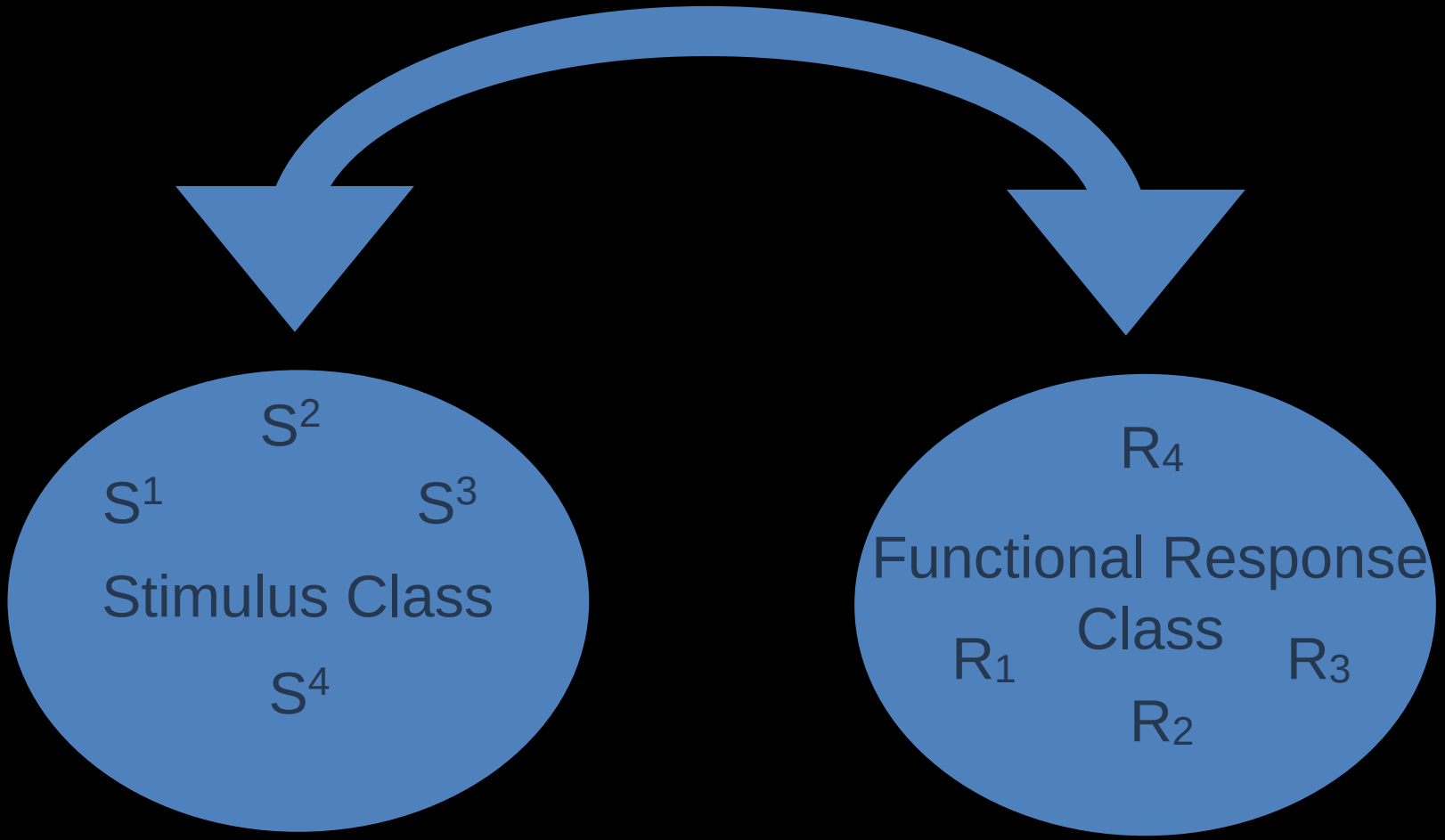
Functional Relation (Continued)

- In behavior analysis functional relations are between stimulus classes (independent variable) and response classes (dependent variable).

Functional Relation (Continued)

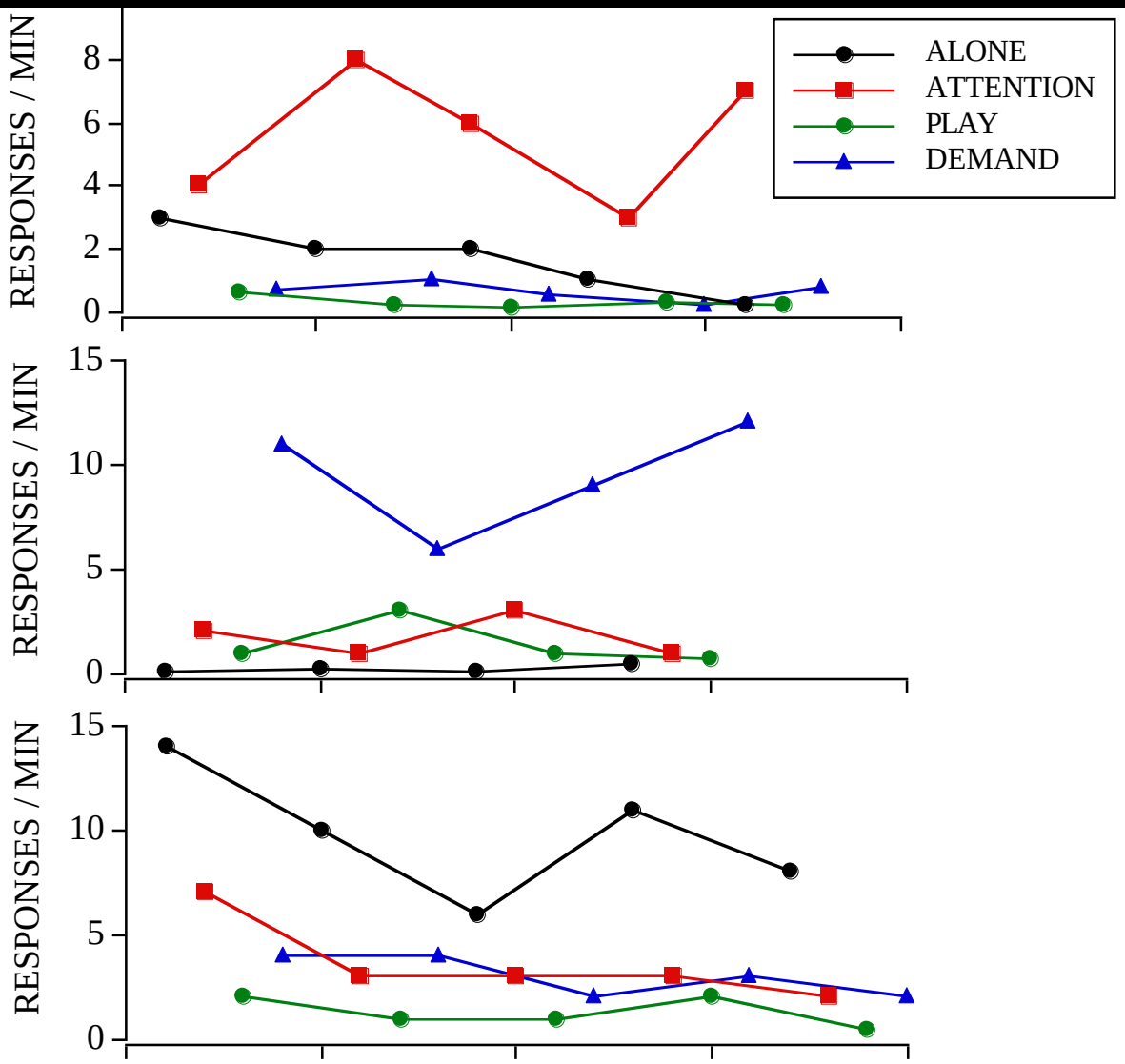
- A *functional relation* is said to exist when systematic manipulation of members of a stimulus class result in orderly, reliable, and predictable changes in members of a response class, such as those observed when we conduct a *functional analysis*.

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 than “if and only if X, then Y”
- The dependencies are probabilistic

Types of Behavioral Contingencies

- Respondent
- Operant
  - Reinforcement Contingencies
  - Punishment Contingencies

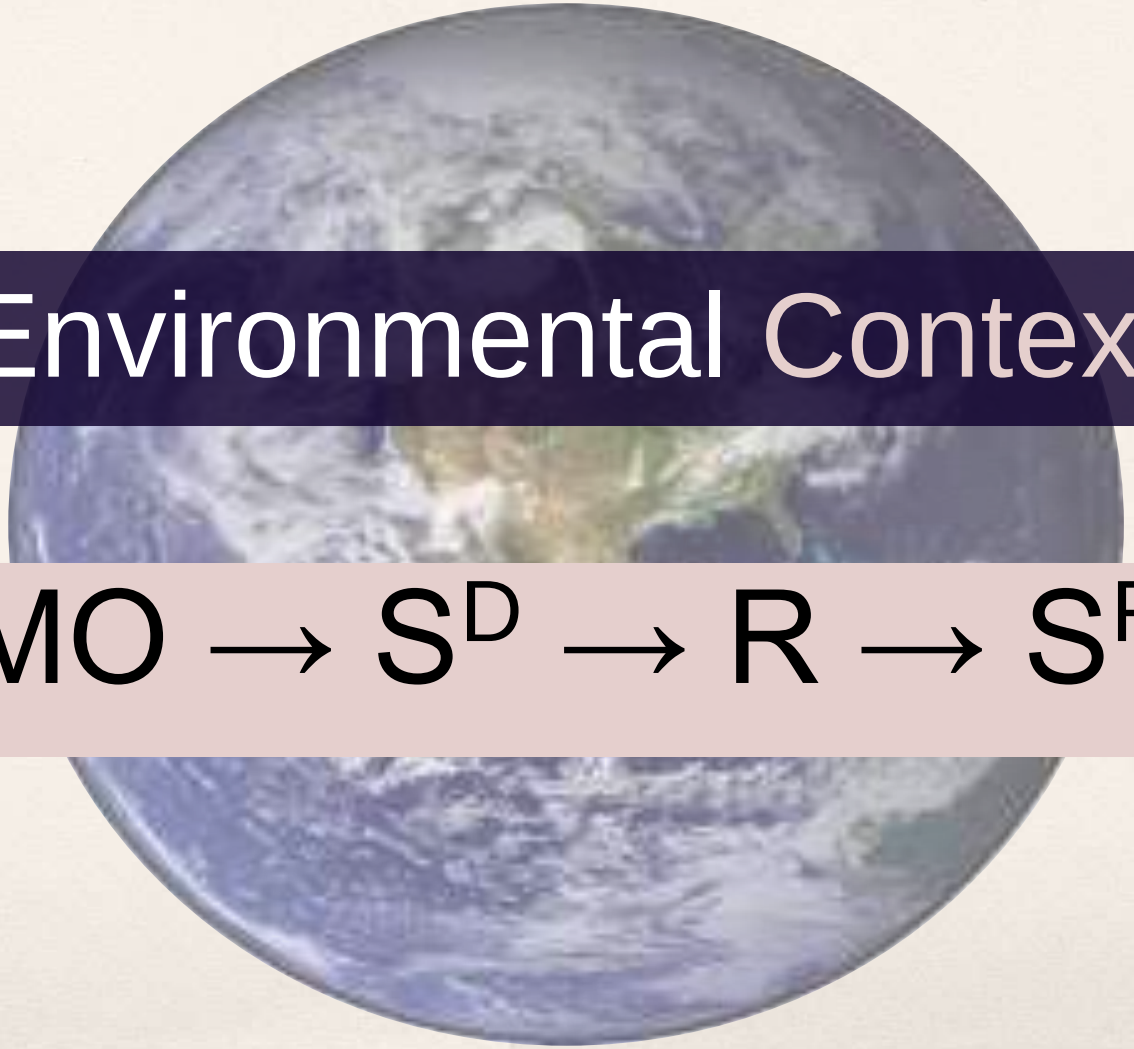
Operant

- 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 the 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)

- $S^{\Delta r}$
  - 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.

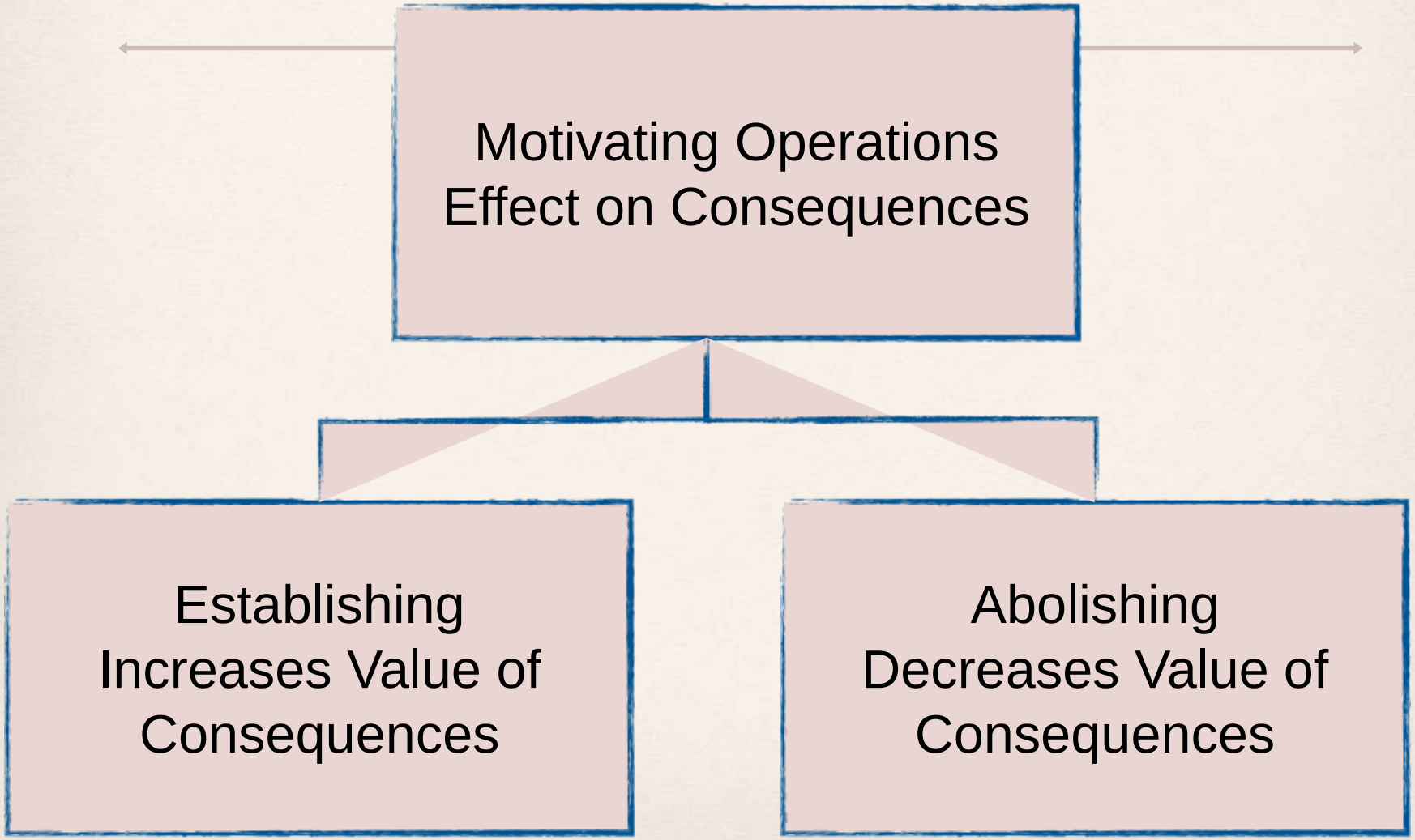
Review of Motivating Operations

- 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

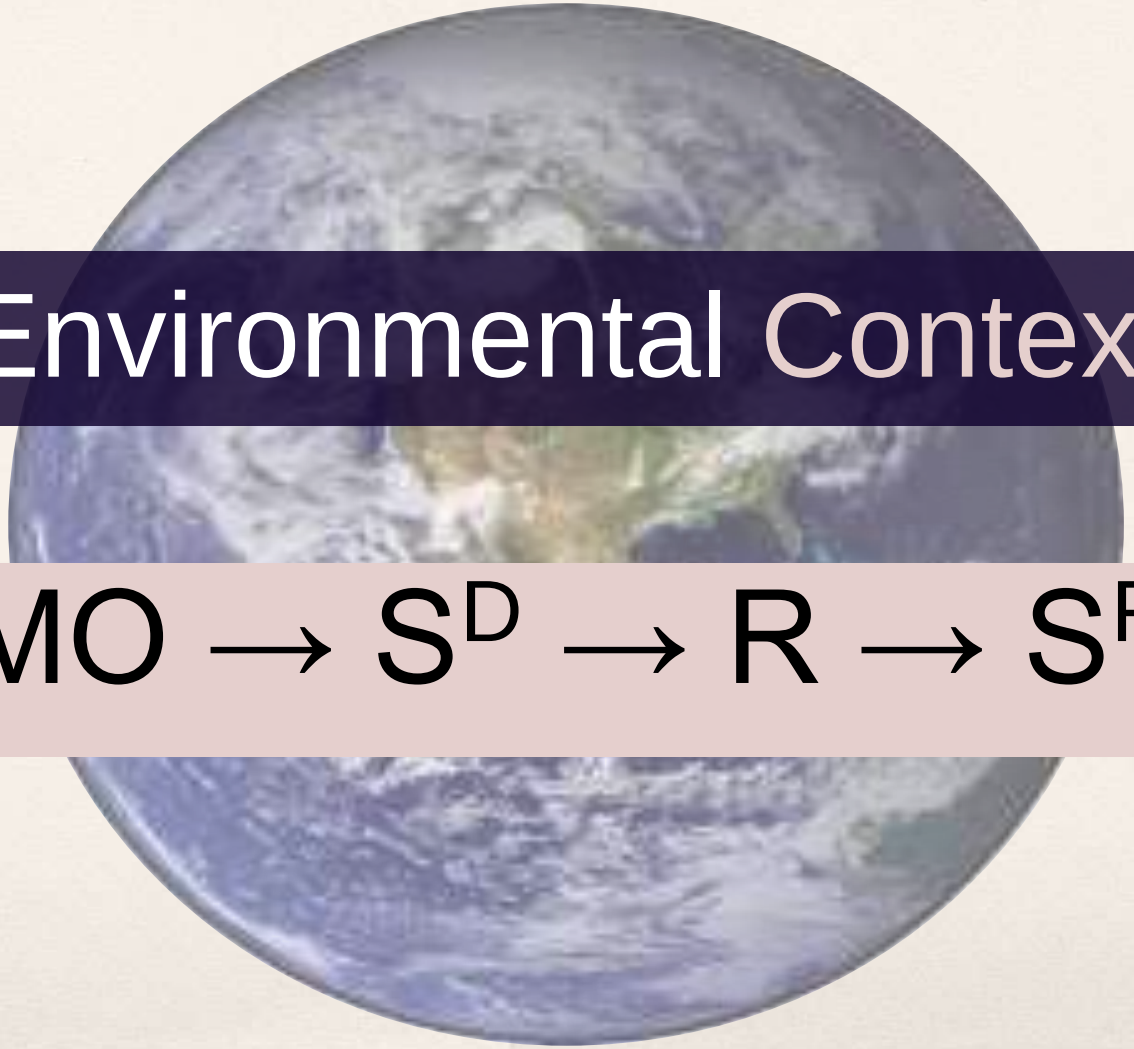
Value-Altering Effects of MOs



Four General Types of MOs & their Effects

	Evocative	**Abative**
Establishing (Increase Value)	EO related to Reinforcement EO^{sr}	EO related to Punishment EO^{sp}
Abolishing (Decrease Value)	AO related to Punishment AO^{sp}	AO related to Reinforcement AO^{sr}

Basic Operant 4-Term Contingency



Environmental Context

$MO \rightarrow S^D \rightarrow R \rightarrow S^R$

Positive Reinforcement Contingencies

Environmental Context

$EO^{r+} \rightarrow S^{Dr+} \rightarrow R_1 \rightarrow S^{r+}$	$EO^{r+} \rightarrow S^{\triangle r+} \rightarrow R_1 \rightarrow EXT$
$AO^{r+} \rightarrow S^{Dr+} \rightarrow R_1 \rightarrow S^{r+}$	$AO^{r+} \rightarrow S^{\triangle r+} \rightarrow R_1 \rightarrow EXT$

Negative Reinforcement Contingencies

Environmental Context

$EO^{r-} \rightarrow S^{Dr-} \rightarrow R_1 \rightarrow S^{r-}$	$EO^{r-} \rightarrow S^{\triangle r-} \rightarrow R_1 \rightarrow EXT$
$AO^{r-} \rightarrow S^{Dr-} \rightarrow R_1 \rightarrow S^{r-}$	$AO^{r-} \rightarrow S^{\triangle r-} \rightarrow R_1 \rightarrow EXT$

Positive Punishment Contingencies

Environmental Context

$EO^{p+} \rightarrow S^{Dp+} \rightarrow R_1 \rightarrow S^{p+}$	$EO^{p+} \rightarrow S^{\triangle p+} \rightarrow R_1 \rightarrow \oslash S^{P+}$
$AO^{p+} \rightarrow S^{Dp+} \rightarrow R_1 \rightarrow S^{p+}$	$AO^{p+} \rightarrow S^{\triangle p+} \rightarrow R_1 \rightarrow \oslash S^{P+}$

Negative Punishment Contingencies

Environmental Context

$EO^{p-} \rightarrow S^{Dp-} \rightarrow R_1 \rightarrow S^{p-}$	$EO^{p-} \rightarrow S^{\triangle p-} \rightarrow R_1 \rightarrow \ \oslash S^{P-}$
$AO^{p-} \rightarrow S^{Dp-} \rightarrow R_1 \rightarrow S^{p-}$	$AO^{p-} \rightarrow S^{\triangle p-} \rightarrow R_1 \rightarrow \ \oslash S^{P-}$

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