Operant conditioning

Contingencies

A useful way of conceptualizing the relationship between behavior and the environment is using the three-term contingency. (Contingency refers to the functional or causal relationship between the behavior and the environment.) The three terms in the three-term contingency are the antecedent stimuli, the behavior and the postcedent stimuli. Antecedents and consequences constitute the environmental stimulation that influences the behavior.

The antecedent is what comes immediately before the behavior. Once we have confirmed the functional relationship (that is, that the stimulus actually does cause or reliably control the behavior), we refer to the antecedent stimulus as the discriminative stimulus (S\text{D}). There are often numerous stimuli sharing control over behavior, even though we normally simplify the process by identifying the stimulus that exerts the most control. The term behavior is general and may represent any measurable action an individual exhibits. Particular instances of a behavior are called responses. We avoid speculating about redundant or fictitious constructs that cannot be observed, measured and verified, such as the so-called “mind.”

The postcedent stimuli involve everything that comes immediately after the behavior. Many things occur after a behavior, and only some of them are functionally related to the behavior—that is, influencing its likelihood on subsequent occasions. Once a functional relationship has been demonstrated, the postcedent stimulus is called a consequence.

The three-term contingency is made up of two two-term contingencies, which together (usually) describe the entire functional relationship between the environment and the behavior. The first two-term contingency is the S\text{D}–behavior relationship. The second two-term contingency is the behavior–consequence relationship. These two contingencies are functionally and integrally related. The behavior–consequence contingency functions to strengthen or weaken the S\text{D}–behavior relationship or, put another way, to strengthen or weaken the evocative capacity of the S\text{D}. Conditioning creates changes to the structure of the body of the learner via stimulation from the environment, which change the evocative capacity of the S\text{D} on subsequent presentations.

By determining the three-term contingency that operates in any particular response, we describe the relationship between the behavior and its environment and we therefore explain the cause of the behavior (identifying the dependent and independent variables and their relationship). The principles of behavior discussed below elaborate how these relationships operate.

Below is a representation of the three-term contingency, first in general form and then after the functional relationship has been established for a specific instance of a behavior:

\begin{align*}
\text{Antecedent} & \rightarrow \text{Behavior} \rightarrow \text{Postcedent} \\
S\text{D} & \rightarrow \text{Response} \rightarrow \text{Consequence}
\end{align*}

Sometimes, a four-term contingency is appropriate. When another variable becomes important in controlling behavior, it can be advantageous to include a fourth term in the description of a contingency. For our purposes, including an initial term to account for any function-altering variables that participate in controlling the behavior can sometimes be useful. This is not necessary in a contingency analysis if the three-term contingency provides adequate predictive and explanatory power. However, when another function-altering variable exerts significant control over the behavior of concern and modification of it may be useful in changing the behavior, inclusion of a fourth term becomes useful.

Function-altering stimuli (often broken down into motivating or establishing operations, setting events, sensitization, habituation, potentiation, etc.) will be discussed in more detail below. These function-altering stimuli are distinct from the S\text{D} that evokes the behavior; they are stimuli or conditions that provide a context, or additional stimulation that changes the evocative capacity of the S\text{D}. Examples are the presence of some other distinct stimulus, conditions of deprivation or satiation of the reinforcer, or medical conditions, such as pain. Such stimuli are often ongoing, rather than presented discretely immediately before the
behavior. These context-setting stimuli result in the S^D becoming more or less likely to evoke the behavior.

Below is a depiction of a four-term contingency:

\[ S^F \rightarrow S^D \rightarrow \text{Response} \rightarrow \text{Consequence} \]

More complex multiple-term contingency analyses exist, but these three- and four-term contingencies will suffice for now. Interested readers are directed to Fraley (2008) for discussion of multiple-term contingencies and function-altering stimuli.

**Law of effect**

The law of effect is the perfect place to start in outlining the principles of behavior. The law of effect simply states that the likelihood of an operant behavior is a function of the consequences it has generated in previous performances. There are, basically, two kinds of consequences: those that produce a “satisfying state of affairs” and those that produce an “annoying state of affairs” (in the terminology common when the law of effect was formulated). If a behavior produces a satisfying outcome, that behavior will be more likely again on subsequent occasions. If a behavior produces an annoying outcome, that behavior will be less likely in the future. We no longer define the principles of behavior in terms of “pleasant” or “annoying” but simply by whether the consequence does, in fact, increase or decrease the strength of behavior on subsequent occasions. The law of effect is the foundation principle for operant conditioning. If an animal is doing something, it is surely because, in the past, that behavior has contacted a reinforcer. It is “getting them something” or “getting them out of something.” It is why all of us do anything we do, operant-wise.

We often say that consequences strengthen or weaken the behavior. This is fine when we are trying to simplify the process, but it is not as complete as saying that consequences provide the conditioning history that creates changes within the animal that increase or decrease the probability of the S^D evoking the behavior on subsequent occasions of its presentation. To elaborate, the consequence of a behavior does not affect the behavior that preceded it (a teleological fallacy), even though we often say that “the animal does such and such in order to get the treats” or “the consequence strengthens the behavior” or “the animal does what works.” The future does not cause the past. The consequence only changes the future probability of the behavior on subsequent exposures to the S^D. And it does not strengthen the behavior directly but rather causes changes in the animal’s body (stimulation) that thereby change the probability of the behavior being performed on subsequent occasions (conditioning)—learning occurs physically within the subject.

We will discuss five kinds of consequences, three that weaken behavior and two that strengthen behavior. The two that strengthen behavior are referred to as reinforcement; two of the three that weaken it are referred to as punishment. These four principles involve changes to the postcedent environment. They are different from the fifth kind, extinction, which involves an absence of postcedent environmental change for previously reinforced behaviors—in other words, withholding reinforcement. In reinforcement and punishment procedures, you can present a stimulus following the behavior (a “positive” consequence), or remove a stimulus following the behavior (a “negative” consequence). This means that you can have positive reinforcement and negative reinforcement, and positive punishment and negative punishment.

Figure 1 provides a flow chart that illustrates how to analyze any particular operant conditioning instance and identify the principles operating on the behavior in question.

---

**About the Author**

James O’Heare, CABC, is the President of The Companion Animal Sciences Institute, Director of the Association of Animal Behavior Professionals, editor of Journal of Applied Companion Animal Behavior, and owner of BehaveTech Publishing. James has studied the natural science and technology of behavior extensively. His books, Separation Distress and Dogs, The Dog Aggression Workbook, Aggressive Behavior in Dogs, Dominance Theory and Dogs, Empowerment Training and Canine Neuropsychology, are translated into multiple languages and sold throughout the world. James has been helping companion animal guardians resolve problem behavior, writing and teaching since the early 1990’s.