

What We Know About the Bridge

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In this column, we explore the history of the conditioned reinforcer and its evolution in modern animal training. We then discuss what science tells us about the conditioned reinforcer, and address some current topics around the use of this tool in zoos and aquariums.

What is a conditioned reinforcer?

A conditioned reinforcer starts out as a neutral stimulus and becomes an effective reinforcer by virtue of its relation to some other reinforcer. For example, the sound of a clicker is initially meaningless to an animal. When the clicker sound is consistently paired with the delivery of food, that sound may become meaningful by virtue of its relation to food delivery. Specifically, it may take on the function of increasing the likelihood that behaviors it follows will be repeated.

This type of learning is called classical conditioning, and was first studied by Ivan Pavlov, a Russian physiologist who was initially interested in digestion. He noticed that the dogs he was studying began to salivate not only when food was delivered, but when they saw or heard other stimuli that had been repeatedly paired with food delivery. For example, the dogs salivated when they saw a food dish or heard the research assistant walking down the hall. Pavlov began to systematically vary the stimuli paired with food delivery to study this effect. He used metronomes, lights, and bells, and found that the kind of stimulus was not as important as the fact that the stimulus reliably signaled that food would be delivered soon. Since Pavlov's legendary studies, scientists studying classical conditioning have found it to be important in understanding many aspects of animal and human behavior.



The bridge

Classical conditioning was also important in the work of Marian and Keller Breland. The Brelands were students in Skinner's lab at Harvard in the 1930s, where they studied operant learning. In 1943, the Brelands started Animal Behavior Enterprises (ABE), using positive reinforcement to train animals for commercial purposes. In 1955, they opened IQ Zoo, where they showcased trained animals. Over the course of forty years, Marian and her staff of forty trainers applied humane training techniques to more than 15,000 animals of over 150 species. The training often involved the use of a conditioned reinforcer. The Brelands coined the term "bridging stimulus", or "bridge" for a conditioned reinforcer because it "bridged" the gap in time between the performance of the behavior and the delivery of the established reinforcer. Bob Bailey, who

worked with ABE for many years, has emphasized the importance of timing when using a conditioned reinforcer. "We analyzed the training of thousands of animals. We were convinced that the inconsistent or improper timing of the bridging signal was a major obstacle to efficient training" (Bailey, 1996).

Because of the Brelands' scientific background, ABE trainers knew the basic scientific findings on conditioned reinforcers. First, a conditioned reinforcer only becomes a reinforcer through pairing with an established reinforcer, and can only maintain its effectiveness through continued pairings. Second, the quality and consistency of reinforcers is important to behavior. When using a bridge, this means that we need to select established reinforcers that are highly preferred, and we need to deliver a reinforcer every time we use the bridge. When multiple trainers are involved, we need to select a bridge and a reinforcer that everyone can deliver consistently.

Some trainers are surprised to hear this because they have been taught to use a bridge every time the correct behavior occurs but only deliver the reinforcer sometimes. Some trainers have been taught that this constitutes a variable-ratio schedule. This is incorrect. When a





trainer uses a bridge and does not back it up with an established reinforcer, if the bridging stimulus is functioning as a conditioned reinforcer, the trainer is using a continuous schedule of reinforcement. However, it is unlikely that the reinforcing function of the bridging stimulus will be maintained if this arrangement is used routinely, because the inconsistent delivery of the established reinforcer will weaken the relation between the two over time. If the bridge is not functioning as a conditioned reinforcer and it does not reliably signal that an established reinforcer is on the way, it is meaningless to the animal. Either way, this is not a variable-ratio schedule and is not advisable as a training practice. We are not the first to talk about this. Fernandez (2001) cautioned against backing up the bridge intermittently, and Martin and Friedman (2011) argued against this practice as well, calling it “blazing clickers”. We won’t repeat all of these authors’ points here, and we encourage trainers to read their

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papers. We emphasize here some main points that are critical for trainers to understand.

Unpredictable vs. Unreliable

In our many discussions with trainers about the use of the bridge, we have often heard the claim that it is helpful to back up the bridge intermittently because unpredictability enhances performance. The idea that trainers need to keep animals “on their toes” by unpredictably backing up the bridge contains two more misconceptions.

The first misconception is that unpredictability is always a good thing. In fact, there are times when unpredictability in training can be detrimental. The effects of intermittent reinforcement have been extensively studied. In reality, animals don’t prefer unpredictability; they prefer immediate access to reinforcement (Field et al., 1996).

The second misconception is that intermittently backing up a bridge introduces helpful unpredictability. Remember, one of Pavlov’s original findings was that it was important for the conditioned stimulus to reliably signal that food was on the way. Ideally, a bridge should serve as a reliable signal for the animal. For example, think about a neon “Open” sign in the window of a restaurant. You rely on the sign to tell you whether the restaurant is open

when you drive by it. Now imagine that the “Open” sign is always on, whether the restaurant is open or not. Once you learn this, it’s unlikely that the sign will continue to have any meaning for you. It has become an unreliable signal. Instead of paying attention to the sign, you will either stop going to the restaurant because you never know when it’s open, or you might start paying attention to other signals, like whether there are cars in the parking lot or whether the restaurant’s outdoor seating is set up. Animals respond similarly to unreliable signals. If a bridge becomes an unreliable signal for reinforcement, an animal is likely to either stop responding (and maybe also show signs of frustration) or start paying attention to more reliable signals, such as the trainer’s hand placement or other body language.

Trainers often express concern that backing up every bridge would cause them to run out of food too quickly. There are several good solutions to this quandary. Trainers can often use smaller pieces of food or conduct shorter, focused training sessions. The use of a variety of different reinforcers is also a good idea and may serve to strengthen the bridge. When a conditioned reinforcer is paired with a variety of different established reinforcers, it can become a generalized reinforcer. This



type of conditioned reinforcer is more likely to maintain its effectiveness across different circumstances. Money is a classic example of a generalized reinforcer. A dollar bill has no value on its own. Its value comes from its pairing with many other kinds of reinforcers. There are two catches to making generalized reinforcers work. First, the trainer must make sure that all of the established reinforcers are, in fact, reinforcers. This means that each could be used on its own to teach a new behavior if necessary. Second, even generalized reinforcers are not immune to weakening through extinction. If the grocery store only accepts your money sometimes, that money will be less valuable to you. Even if a bridge is connected to a variety of reinforcers, if the bridge is not consistently followed by a reinforcer it will lose value.

When to re-evaluate conditioned reinforcers

Throughout this article we have recommended backing up the bridge every time and discussed the risk of weakening the bridge by delivering it without a reinforcer. So how can a trainer tell if their bridge has been weakened? We recommend keeping a close eye on the animals responding and looking for any of the following:

- Has the animal stopped physically responding to the bridge (orienting to the trainer)?
- Is the animal taking long pauses between responses?
- Is the animal distracted and uninterested during training?
- Has the animal's learning progress slowed down or ground to a halt?
- Is the animal showing signs of frustration?

If any of these things are happening, it is time to re-evaluate both the consistency of the bridge and the quality of the reinforcers. When a bridge is paired consistently with high-quality reinforcers, it can be an excellent tool for shaping and maintaining behavior. Our job as trainers should always be to communicate clearly with an animal. One way to do this is making sure our signals we give to our animals are reliable. 🐘

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