

The AAZK Behavioral Husbandry Committee Presents

Training Tales...



Building Bridges: How to Select, Condition and Use a Bridging Stimulus

By

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The use of a bridging stimulus or event marker, commonly referred to as a bridge was made widely popular by Keller and Marian Breland (1951, 1966; Bailey, 2003). Countless resources describe what a bridge is and how to use it (Breland & Breland, 1951, 1966; Skinner, 1951, 1971; Pryor, 1999, 2009; Ramirez, 1999; Pear, 2001; Stafford, 2007). None the less, the bridging stimulus is sometimes misused, perhaps due to misinterpretations of the concept or lack of practical application. Trainers do not become proficient at their craft simply by reading about operant conditioning theory, as there is no substitute for practicing training with real animals (Ramirez, 1999). However, a foundation of behavioral knowledge will foster greater success in the field. In this article we will explore what a bridge is, how to select and condition a bridge, and how to use a bridge effectively.

What is a bridge?

In the language of animal training, a bridge refers to a conditioned stimulus that serves as a method of communication between a trainer and an animal to mark, or pinpoint, a desired behavioral response. A bridging stimulus is also a conditioned reinforcer or secondary reinforcer (Bailey, 2003; Breland, 1966). Initially this signal means nothing to the animal until it is paired with a primary (or unconditioned) reinforcer (Pryor, 1999; AAZK/AZA, 2003). As with other conditioned reinforcers, the reinforcement value of a bridge is learned through classical conditioning.

A common example of classical conditioning is Pavlov's dog, which began to salivate after a stimulus (metronome, bell, whistle, visual stimuli – he tested many types.) was repeatedly paired with food (Huitz and Hummel, 1997). Classical conditioning establishes the [bridging] stimulus as a reliable predictor of food and conditions the animal to recognize the stimulus as a reinforcer (Wood, 2008).

Lastly, the bridge is a cue or discriminative stimulus that tells the animal to expect reinforcement (AAZK/AZA, 2003). This may sound a bit anthropomorphic, but the bridge not only tells the animal "yes" or "good job" for a desirable behavioral response, it also says, "You can come get paid now!" An animal that understands the bridge will usually orient toward or move into the proximity of the reinforcement (wherever it has been delivered previously - be that a trainer or a remote feeder of some sort) after the bridging stimulus has been given.



A giraffe trainer at Zoo New England uses a whistle to mark desired behavioral responses.

(Photo by Kim Kezer)

Do you need a bridge?

The consequence of behavior is the tool that shapes behavior (Skinner, 1971), not the bells and whistles used in the process. Depending on the species and the training goal, a trainer may refrain from using a bridge and still achieve success. When deciding whether to use a bridge or not, examine the nature of the behavior being trained and the logistics of delivering reinforcement. If it is a behavior that does not require precision (e.g., shift into a holding area) and the reinforcement can be delivered immediately, then a bridge is not entirely necessary. However, if it does require precision (e.g., specific body positioning), then a bridge is useful so that the trainer can mark the exact moment the criteria for reinforcement are met. If a reinforcer cannot be delivered exactly when the criteria for reinforcement are met, the animal may not associate the reward with the correct behavior. Thus, the bridge adds a degree of accuracy in communicating with the animal.

How to select a bridging stimulus

A bridge can be any signal (audio, visual or tactile) that the animal can perceive (Ramirez, 1999). When choosing what type of bridge to use, the main objective is to select something that is distinct, precise, and easily discernable to the animal. A more precise signal (such as a clicker) is typically more effective than a less precise signal such as a word spoken (Wood, 2008). Verbal bridges can be effective; however, it is important to choose a distinct sound or word that is only to be used to mark behavior and not repeated in casual interactions with the animal. Verbal bridges are also challenging in that each trainer has a different tone and voice inflection.

Think about how the animal will perceive the signal by considering natural and individual history. For instance, dogs typically have excellent audio perception abilities and can detect both low and high frequency sounds (Garrod, 2009). This ability is part of a dog's natural history. However, if the individual is hearing impaired, which is a genetic trait in some breeds, a visual bridge would probably be more appropriate (Jack Russell Terrier Club of America, 2009). Some trainers actually use a tactile bridge, such as a light pat on the side, or perhaps a water slap for aquatic species.

It is possible and common to have more than one type of bridge for some species, such as tactile and auditory; however, it is not suggested to use them both at the same time. An example of an unusual bridge is told by Grey Stafford in his book, *Zoomility* (2007), where a trainer pushed her glasses up on her nose as a bridge in a dog show ring where overt reinforcement was not allowed. So whether you prefer whistles over clickers or visual signals over audio, any signal can be used as long as the animal can perceive it well, and it has been conditioned prior to using it as a bridging stimulus.

How to condition a bridge

Once the type of bridge has been selected, it needs to be conditioned or trained. Think of this as teaching the animal a common language. You have to speak the same language before you can communicate. If he/she doesn't understand what the bridge means, the signal will be meaningless and can likely cause confusion.

Conditioning the bridge is done by associating or pairing the bridging stimulus (whatever signal you chose) with a primary reinforcer (or a really effective secondary reinforcer). Most trainers use a favored food item to condition the bridge. It is important to remember that a bridge is only as strong as the reinforcer it is associated with; choose something they really seek out (e.g. a special treat or their favorite food).

Start with some free feeding of the reinforcement to condition the animal to quickly take the food items as they are presented (Skinner, 1951). Once the animal reliably ingests the food immediately when presented then begin conditioning the bridge. Give the intended bridging stimulus (or signal) directly prior to presenting the food item (Breland & Breland, 1951, 1966; Skinner, 1951). In order to allow for multiple trials in one session, use the smallest reward possible (i.e., tiny bites rather huge portions). This way the animal can consume each bite quickly and does not become satiated or full. Likewise, end the session prior to satiation to have the greatest effect. To test the animal's response to the bridge, the trainer should wait until the animal is not oriented toward the source of reinforcement (the trainer or food dispenser) and then try giving the bridging stimulus. An immediate change in orientation or approach to the area where food was previously presented indicates that the bridge has been effectively conditioned (Skinner, 1951).



A mandrill at Zoo New England is conditioned to a clicker for a bridge. (Photo by Christina Demetrio)

The number of pairing required to condition the bridge will depend upon the species and individual being trained. Some species and individuals learn associations faster than others. Karen Pryor says three to four pairings of the bridge with the reinforcer should be enough to condition the bridging stimulus (Karen Pryor, personal conversation). However, it is better to have too many pairings than not enough so that it is certain that the animal understands what the bridging stimulus means before it is used in training. Watching for food seeking behavior is the best indicator of whether the bridge has been conditioned or if more pairing trials are needed.

How to use a bridge

After the bridge is conditioned it can be used to train new behaviors and to continue to mark existing desired behaviors. A basic learning trial will look something

like this: “cue” (trainer gives a discriminative stimulus, S^D , or behavior request), response (animal does the behavior), bridge, reinforce (follow with an additional secondary or primary reinforcer).

If the animal has not been conditioned to elicit behavior with a cue, the bridge can still be used to condition behavioral responses using various training techniques (such as capturing, free shaping, observational learning, successive approximation, etc.). The trainer can then mark the desired response by giving the bridging stimulus and following with a primary reinforcer. So in this case, the learning trial would start with the behavior, then bridge, and reinforce. The intended cue can then be added for future trials as the behavior is offered at more frequent or reliable instances. In other words, just as the bridge means nothing until conditioned, the cue means nothing until trained as well.

The bridging stimulus is given at the exact moment the criteria for reinforcement are met (i.e., the desired behavior occurred). Accurate timing of the bridge is essential to marking the behavior you wish to reinforce. If the bridge is too early or too late, it will reinforce a different portion or aspect of the behavior. Essentially, the animal will give the response that was previously reinforced, which might not be the exact desired response if the bridge was not timed effectively. For instance, when training an open mouth behavior it is important to bridge as the mouth is opening, rather than when the animal has started to close its mouth. Bridging a split second too late could teach the animal to think it is being asked to close its mouth rather than open.

For consistent communication, the bridging stimulus should be given in the same manner each time. It is most effective if the bridge is a short, distinct signal so that it can mark specific aspects of behavior. Lindsay Wood studied the efficacy of bridging types (2008) and found that a clicker was more effective than a verbal bridge, perhaps due to the preciseness of the clicker. Accordingly, bridging repeatedly as a sort of ‘jack pot’ (i.e., multiple clicks in a row or a long whistle) is not advisable. Repeating the bridge to emphasize a behavior response only marks multiple behaviors (or whatever behaviors occurred after the first bridge), (Stafford, 2007). The primary reinforcer can be varied in magnitude according to performance, but the bridge should remain consistent in style and duration of execution.

It is a good practice to quickly follow the bridging stimulus with a primary reinforcer, even after it is conditioned, to maintain its effectiveness as a secondary reinforcer. The bridge does have reinforcing qualities of its own; however, it is only as effective as the reinforcement it is associated with (Stafford, 2007). On this subject, Ivan Pavlov wrote, “...repeated application of a conditioned

stimulus which is not followed up by reinforcement leads to a weakening of the conditioned reflex”, which he termed, “extinction of a conditioned reflex” (1927). His data illustrated that with latency to reinforce, or even the absence of reinforcement (he tested both), the conditioned response decreased (in this case the volume or presence of saliva diminished). While the bridging stimulus is a handy tool for marking behavioral events by conditioning it as a secondary reinforcer, it is not intended to be a replacement for reinforcement (Katie Kalafut, personal conversation, December 2009).

Conclusion

There are many resources available (books, journals, scientific search engines) that can assist animal trainers in furthering their knowledge of training concepts and techniques such as the bridging stimulus. This article is by no means the authority on the subject; it is more of a compilation or summary of what we have learned with respect to an essential training tool. We recommend that animal keepers dedicate time to study animal behavior training in literature and academic resources to reap the benefits of knowledge for their zoo animal training charges. To summarize what we have discussed in this article about the bridging stimulus, the most important factors to remember are: a) The bridge should be a unique signal only given when a desired behavior response occurs, b) it should be given at the precise moment the criteria for reinforcement is met, and c) it should be followed by a reinforcer to maintain its effectiveness as an event marker. After using the bridge to train a few behaviors it can become second nature to the trainer, as practice is often the best lesson.

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