

CHAPTER 5

Shaping and Response Differentiation

When Joe tries to talk with his stepfather about problems at school, his stepfather turns on the television and looks away from Joe. When Joe talks about sports, however, his stepfather looks at him, nods his head, and discusses the topic with him. Joe and his stepfather often have conversations about sports but rarely discuss the problems Joe is having at school.

Objectives

After completing this chapter, you should be able to do the following:

- Define a response class and give an example.
- Give an example of response differentiation.
- Describe how the DRO procedure can be used to decrease the rate of a response.
- Identify the steps involved in the procedure of shaping a behavior with successive approximations.

Differential Reinforcement

In Chapter 2, we defined operant behavior as behavior that is controlled by its consequences. The individual *operates* or acts on the environment to produce those consequences. The positive reinforcement procedure is used to increase the strength of an operant response. The extinction procedure is used to weaken or decrease the strength of an operant response. **Differential reinforcement** involves the use of both positive reinforcement and extinction. In this procedure, one

response is reinforced while reinforcement is withheld from other responses. When the reinforced response occurs frequently, to the exclusion of responses from which reinforcement is withheld, we say that the response has become *differentiated*.

For example, when Joe tries to talk to his stepfather about his problems at school or topics other than sports, his stepfather turns on the television and looks away from Joe. When Joe talks about sports, however, his stepfather looks at him, nods his head, and discusses the topic with him. Thus responses related to Joe's talking about sports are positively reinforced with attention, whereas those related to talking about problems at school are extinguished (see Figure 5.1a). It should not be surprising to learn that Joe's conversations with his stepfather are almost exclusively about sports. Responses related to talking about sports have become differentiated—that is, they occur with greater frequency than verbal responses dealing with other topics.

Differential reinforcement produces the highly skilled responses of artists, musicians, public speakers, and professional athletes. Desired responses are selectively reinforced and strengthened; reinforcement is withheld from undesired responses, and they are weakened or extinguished. For example, compare the refined forehand stroke of a table tennis champion with that of a novice or the bowing technique of a concert violinist with that of a beginner. In both cases, the skilled responses of the experts have become highly differentiated or refined through selective reinforcement of an increasingly narrow range of desired responses. Similarly, through training, supervision, and experience, the novice practitioner becomes more skillful in interviewing clients and helping them solve problems.

Response Class

Variability is a basic feature of operant behavior because a behavior is rarely repeated in exactly the same form. When a response is performed and followed by a reinforcer, it becomes more likely that the response will be performed again. The reinforcer also increases the strength or likelihood of occurrence of other responses that have the same or similar effect on the environment as the reinforced response. Thus not only is a single response reinforced but also a class or group of responses is reinforced. This group of responses—each member or response producing the same or similar effect on its environment (e.g., reinforcement)—is called a **response class** (Skinner, 1953).

One member of a response class can have a different *topography*, or form, from other members of the response class. For example, a variety of responses can be effective in getting food from your plate into your mouth. You can raise the plate to your face and let the food slide into your mouth, you can use your hands to put food in your mouth, you can throw a piece of food into the air and catch it in your mouth, or you can use a fork to put the food in your mouth. All these different responses are members of the same response class—getting food from your plate into your mouth. Although the topography of the responses differs, they are functionally equivalent because they all result in food getting from your plate into your mouth. Some of the responses, however, could be target responses in a behavior

change program to teach appropriate eating skills. You would not want to reinforce all members of the response class; rather, you would want to reinforce only those with the topography of the desired responses—that is, using a fork to move food from the plate into the mouth. Thus using a fork becomes the differentiated response for eating food from a plate.

In Joe's case, the response class that his stepfather consistently reinforces is "talking about sports." The responses associated with talking about sports are more likely to be performed because whenever one member of the response class is performed and reinforced, all other members are also reinforced. For example, there are many responses Joe could make that would be members of the reinforced response class, talking about sports. He could talk about any sport, individual athletes, last night's basketball game, or a famous baseball player. Talking about any one of these subjects with his stepfather could increase the likelihood of occurrence of any of the others (see Figure 5.1b).

Differential reinforcement can be applied to narrow the range of reinforced responses within a response class. For example, if Joe's stepfather were to positively reinforce him for talking about baseball and withhold reinforcement from other sports topics, soon Joe and his stepfather would talk only about baseball, to the exclusion of other sports (see Figure 5.1c). There are many responses involved in talking about baseball, however, and when any one of these responses is reinforced, it becomes more likely that every other member of that response class will be performed. For example, when Joe talks to his stepfather about the Florida Marlins and is reinforced, all responses included as members of the "baseball talk" response class are strengthened (see Figure 5.1d).

Figure 5.1 is a set of diagrams of the differential reinforcement procedure depicting Joe's responses. From the diagrams, you can see how an increasingly narrow range of responses becomes differentiated. The diagrams also demonstrate that the words *response* and *behavior* refer to a class of responses or behaviors rather than to one discrete response or behavior. Similarly, one member of a response class represents a subclass of responses and not a single, discrete response.

The diagram in Figure 5.1a represents the differential reinforcement of talking about sports instead of school problems. When Joe talks about sports (R_1), his stepfather pays attention. When Joe talks about school problems (R_2), his talking is extinguished by his stepfather's withholding of attention. The effect of this differential reinforcement procedure—positive reinforcement for talking about sports and extinction for talking about problems—is **response differentiation**, an increased likelihood of Joe's talking about sports rather than talking about his problems.

Figure 5.1b shows that all members of the response class "talking about sports" are reinforced. Joe's talking about any sports topic is reinforced by attention from his stepfather.

Figure 5.1c shows the further differentiation of talking about baseball over all other sports topics. When Joe talks about baseball, his stepfather pays attention. When Joe talks about football, hockey, or any other sport, his stepfather withholds attention. The effect of this differential reinforcement procedure (positive reinforcement for talking about baseball and extinction for talking about any other

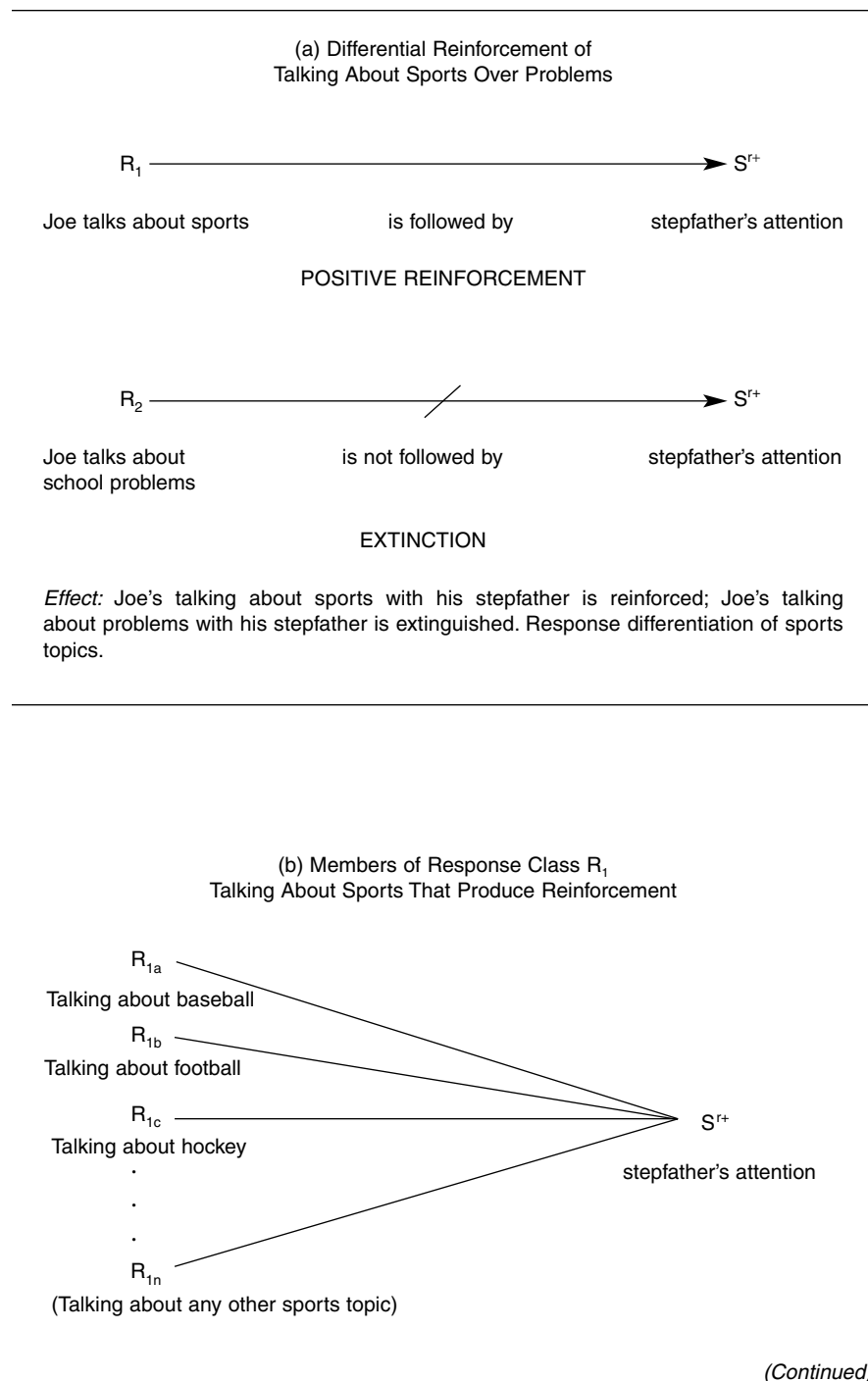
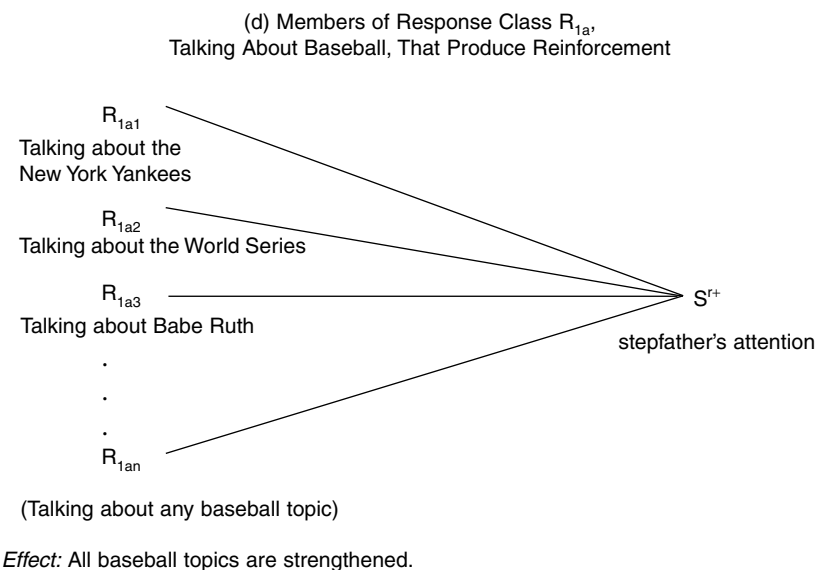
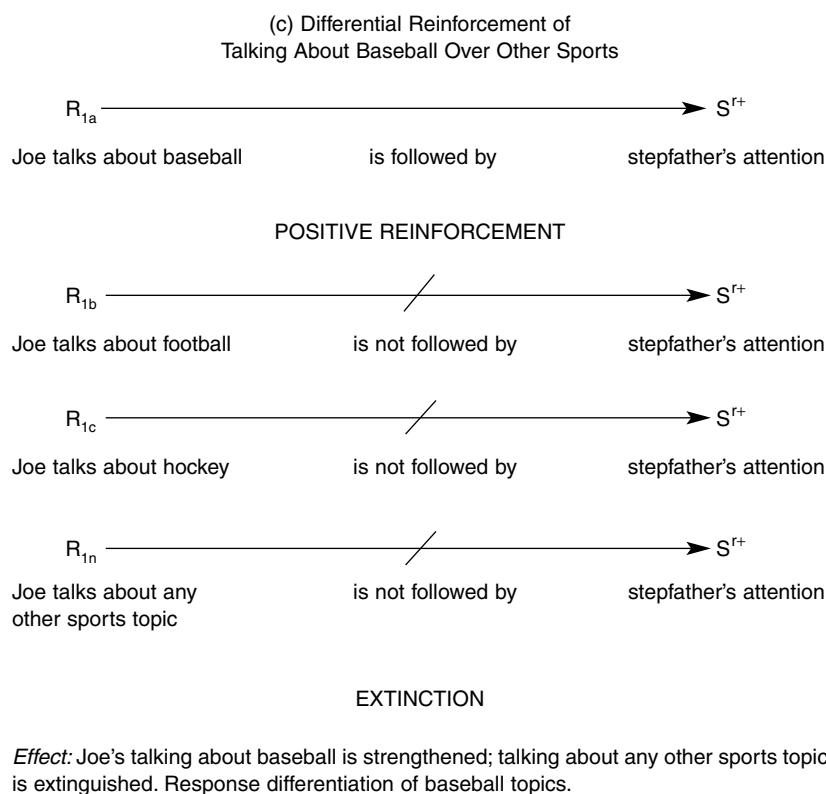


Figure 5.1 Diagrams of Differential Reinforcement of Joe's Responses

Figure 5.1 (Continued)

sport) is response differentiation—an increase in Joe’s talking about baseball compared with talking about other sports.

Figure 5.1d shows that all members of the response class “talking about baseball” are reinforced. Joe’s talking about any topic having to do with baseball is strengthened by attention from his stepfather.

The DRO Procedure

Differential reinforcement can be used to decrease the frequency of an undesired behavior by reinforcing behaviors *other than* the undesired behavior. Using the **DRO** (differential reinforcement of other) procedure, the undesired behavior is extinguished and desired behaviors are positively reinforced. In Case Example 3 (p. 268), the social worker told Juanita, Carla’s mother, to reinforce Carla when she put her toys away. The worker also could have instructed Juanita to reinforce *any* behavior Carla performed *other than* screaming. In applying the DRO procedure, reinforcement is withheld for undesired behaviors to decrease them. At the same time, any response other than the undesired response is reinforced and thereby strengthened.

Allen and Harris (1966) have reported on a case in which DRO was used to decrease the frequency of a child’s self-injurious scratching. When the child engaged in any behavior other than scratching, her mother praised her and gave her gold stars and tangible reinforcers. In a case involving sibling conflict, the children were reinforced with pennies and parental praise after each 1-minute interval during which no conflict (e.g., hitting or name-calling) occurred (Leitenberg, Burchard, Burchard, Fuller, & Lysaght, 1977). In these cases, reinforcement was given contingent on any behavior other than the undesired behaviors of scratching or physical and verbal attacks. The DRO procedure reduced the child’s scratching and the sibling conflict. Pleasant interactions also increased in both studies.

In some cases, the other behaviors that DRO might reinforce could be undesired. In the use of DRO to reduce sibling conflict, for example, any behavior other than physical and verbal attacks between siblings would be reinforced. That “other” behavior might also be undesired, however, such as throwing toys at other children, dumping clay and paint on the furniture, or lying on the floor and screaming and kicking. To avoid this, practitioners must specify the incompatible behaviors to be reinforced; this is called **DRI** (differential reinforcement of incompatible) behavior. An incompatible behavior is one that cannot be performed simultaneously with the target response. For example, sitting in a chair is incompatible with standing up, putting your hands on your hips is incompatible with touching another person, talking quietly is incompatible with screaming, and playing cooperatively with a toy truck is incompatible with hitting. Other responses incompatible with hitting are working together with others on an art project or cleaning up the yard. An incompatible response interferes with the target response.

In Case Example 3 (p. 268), Juanita could have used DRI to decrease Carla’s screaming. She could have positively reinforced Carla’s behaviors that were incompatible with screaming, such as reading or playing quietly with her dolls, asking her mother for help, talking about where the toys should go, and quietly picking up the

toys. Other reinforcement schedules involving differential reinforcement include differential reinforcement of high rates of behavior (DRH), differential reinforcement of low rates of behavior (DRL), and differential reinforcement of alternative behavior (DRA) (e.g., Catania, 1992; Vollmer & Iwata, 1992).

Currently, a changing philosophy about using aversive stimuli to reduce undesired behaviors focuses on reinforcement techniques to develop appropriate behaviors (e.g., Beare, Severson, & Brandt, 2004). Commonly used reinforcement techniques have included DRO and DRA. As an alternative to aversive techniques, functional analysis has also been used to identify reinforcers (e.g., attention) maintaining self-injurious or other dangerous behaviors (see Chapter 13). Reinforcement contingencies are then modified to develop alternative behaviors without using aversive stimuli (e.g., Kurtz et al., 2003).

Functional communication training (FCT) is a DRA procedure in which a client is taught to obtain a reinforcer by performing a desired behavior instead of the undesired behavior that produced that reinforcer (e.g., Wacker et al., 1998). For example, John stamps his feet on the floor to get his teacher's attention. An FCT procedure would teach John to perform an alternative behavior, such as raising his hand or holding up a picture card, to get his teacher's attention.

Shaping With Successive Approximations

Differential reinforcement, as previously discussed, is a technique for increasing the strength of selected responses that are members of a response class. To develop a response that differs significantly from members of an existing response class, we can use the procedure of **shaping with successive approximations**. The shaping procedure involves the use of differential reinforcement to strengthen members of one response class. After these responses are performed consistently, the criterion for reinforcement is shifted to another response class that more closely approximates the target response to be developed. This procedure is repeated until responses are performed and reinforced in a response class that includes the target response.

Shaping with successive approximations is a procedure used to develop a new behavior or one that rarely occurs. A shaping procedure was used as one part of a treatment program to reinstate speech in Justin, a 10-year-old boy who stopped speaking after witnessing his mother's death in a car accident. At first, Justin was reinforced with candy and praise for any speech sound he made. After he consistently made speech sounds, the criterion for reinforcement was shifted to speaking words. After Justin consistently spoke words, the criterion for reinforcement was shifted from words to phrases. In this way, Justin's speech was shaped using successive approximations until he spoke in complete sentences.

In shaping with successive approximations, a series of initial and intermediate behaviors are established in successive approximations to the desired target behavior. The initial response that is reinforced bears some resemblance to the target behavior (e.g., speech sounds and speaking in sentences) so that the intermediate responses can be progressively shaped toward the target behavior. To shape a behavior, the practitioner takes the following steps:

70 BEHAVIOR CHANGE IN THE HUMAN SERVICES

1. Specify the target response (desired behavior).
2. Specify the positive reinforcer(s) to be used.
3. Specify initial and intermediate responses.
4. Reinforce the initial response each time it occurs and withhold reinforcement from other responses until the initial response is performed consistently.
5. Shift the criterion for reinforcement from the initial response to an intermediate response.
6. Reinforce the intermediate response until it is performed consistently, then shift the criterion for reinforcement gradually to other intermediate responses that are increasingly similar to the target response.
7. Reinforce the target response when it is performed.

Justin's therapist used shaping with successive approximations to reinstate Justin's speech as follows:

1. The target behavior was for Justin to speak in sentences in response to questions the therapist asked.
2. The positive reinforcers given to Justin were candy and verbal praise from the therapist.
3. The initial response criterion included any speech sound. Intermediate responses included words and phrases that Justin spoke in response to questions the therapist asked.
4. Initially, any speech sound Justin made was reinforced.
5. When Justin made speech sounds consistently, the criterion for reinforcement was shifted to words. Justin was required to speak words before receiving the candy and praise.
6. When Justin was speaking words consistently, the criterion for reinforcement was shifted to another intermediate response class, phrases, which was the next approximation to the target behavior. Speaking in phrases was reinforced until Justin spoke in phrases. The criterion for reinforcement was then shifted to speaking in sentences.
7. Justin was reinforced for speaking in sentences in response to questions the therapist asked. At that point, Justin's speaking was reinforced by many people in his environment and further treatment could proceed.

A therapist employed shaping with successive approximations to teach Barbara, a teenager with muscular dystrophy, to walk with crutches instead of using a wheelchair. Although Barbara could be more independent and active on crutches, she initially refused to use them, preferring to rely on her mother or sisters to push her wheelchair. The therapist used the following steps to shape Barbara's use of crutches:

1. The target response was walking 50 steps on crutches.
2. The positive reinforcer was praise (e.g., “good,” “very good,” and “that’s it!”).
3. The initial response was movement toward the crutches, which were placed within Barbara’s reach. Intermediate responses included touching the crutches with her hand, holding the crutches in her hand, using the crutches to raise herself from the wheelchair, standing up with the crutches properly positioned, and taking from 1 to 49 steps on the crutches.
4. Initially, when Barbara made any movement toward the crutches, she was reinforced with praise.
5. When Barbara reached toward the crutches each time they were placed within her reach, the criterion for reinforcement was shifted to the next intermediate response, touching the crutches.
6. Touching the crutches was reinforced until the touching responses were performed consistently. This procedure of reinforcing one response until it was performed consistently, and then shifting the criterion for reinforcement to the next intermediate response, continued until the target behavior, walking on the crutches, was performed and reinforced.
7. Barbara was reinforced for walking 50 steps on the crutches.

Shaping with successive approximations involves a gradual process in which a response must be developed at one level before reinforcement is shifted to the next level of approximation. After a desired response is performed, it is reinforced immediately to ensure that reinforcement is given only for appropriate responses. If the criterion for reinforcement is shifted too quickly to the next level, or if insufficient reinforcement is given, the response could extinguish. If a response receives too much reinforcement, however, it can become fixated at that level so that it is difficult to develop the next intermediate response. The shaping procedure relies on reinforcing responses that the individual is currently performing and gradually shifting the criterion for reinforcement to intermediate responses until the target response is performed.

Instructions and prompting are often used with shaping to facilitate the acquisition of new behaviors. Although shaping alone is useful with individuals who do not follow instructions, the shaping procedure becomes more effective when instructions or prompts are given at each step (see Chapter 6). Physical guidance can be used, where appropriate, to facilitate shaping. Demonstrations of the target behavior by a model can also be used to promote rapid development of desired behaviors (see Chapter 8).

Shaping with successive approximations can also include the use of punishers (see Chapter 9), as occurs in the children’s game of “hot and cold.” In this game, an object is hidden from a child who has left the room. When the child returns, he or she must find the object with the help of only two types of feedback from the rest of the group: When the child moves closer to the hidden object,

72 BEHAVIOR CHANGE IN THE HUMAN SERVICES

the group says “hot” (positive reinforcer), and when the child moves away from the hidden object, the group says “cold” (punisher). The group uses “hot” to increase or strengthen responses toward the hidden object and “cold” to decrease or weaken responses away from the object. The child performs responses that result in the others saying “hot” and stops performing responses that are followed by their saying “cold.” Thus “hot” serves as a positive reinforcer for performing responses that lead to the hidden object, whereas inappropriate responses are weakened by “cold.”

Summary

1. Differential reinforcement involves the use of both positive reinforcement and extinction. One response is positively reinforced and increases in strength or likelihood of occurrence, whereas other responses are extinguished and decrease in strength or likelihood of occurrence.
2. Response differentiation is the result of differential reinforcement that involves selective positive reinforcement of certain responses and extinction of others. The reinforced responses become differentiated—that is, they are performed frequently to the exclusion of the extinguished responses.
3. The words *response* and *behavior* actually refer to a class of responses rather than a single response. When one member of a response class is reinforced, all responses in that class are also strengthened. Therefore, one member of a response class represents a subclass of responses rather than a single, discrete response.
4. The DRO procedure can be used to decrease undesired behaviors by reinforcing any behaviors other than the undesired one.
5. Differential reinforcement of incompatible behavior (DRI) is used when a behavior that interferes with the target behavior is specified to receive reinforcement, thereby reducing the likelihood that the undesired behavior will be performed.
6. Shaping with successive approximations is a procedure for establishing a new behavior or one that rarely occurs.
7. Shaping with successive approximations involves using differential reinforcement to strengthen members of one response class and then shifting the criterion for reinforcement to other response classes until the desired target behavior is performed. Intermediate behaviors are reinforced and developed as successive approximations to the desired behavior.
8. Instructions, prompting, modeling, and the use of punishers can also be used with differential reinforcement to develop new behaviors.

Suggested Activities

1. With one class member who has volunteered to be a subject out of the room, identify a behavior to shape in that person without using any verbal instructions. When the subject returns to the room, another student who has volunteered to be the shaper uses a toy clicker, a whistle, or hand clapping as a reinforcer to shape the subject's behavior. The rest of the class should remain silent and refrain from providing any cues to the subject. The only instruction the subject should receive is that whenever he or she hears the clicker, the whistle, or the clapping, he or she should imagine receiving a wonderful reinforcer. How long did it take to shape the correct response? Was the correct response performed and reinforced? Repeat this exercise a few more times with different shapers and subjects. Discuss your observations regarding the factors that facilitated or hampered successful shaping and the experience of being a subject or shaper.
2. Pair up with another class member and silently select a class of verbal responses (e.g., about food, clothing, cars, travel) that you will differentially reinforce in your partner using attention and conversation. Use differential reinforcement to narrow your partner's conversation so that he or she talks only about the class of responses you have identified. When both partners have had a turn at this exercise, discuss your observations regarding what seemed to work best in achieving the desired behaviors.

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74 BEHAVIOR CHANGE IN THE HUMAN SERVICES

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