4. Provide an example of how a behavior has an impact on the physical environment. Provide an example of how a behavior has an impact on the social environment. (p. 3)
5. What does it mean to say that behavior is lawful? What is a functional relationship? (p. 3)
6. Describe the distinction between overt behavior and covert behavior. Provide an example of each. Which type of behavior is the focus of this book? (p. 4)
7. Identify the six characteristics of human behavior. (p. 4)
8. What does it mean to say that behavior modification procedures are based on behavioral principles? (p. 6)
9. What causes human behavior? Describe how a label might be mistakenly identified as a cause of a behavior. (p. 6)
10. Why is it important to describe behavior modification procedures precisely? (p. 7)
11. Who implements behavior modification procedures? (p. 7)
12. Why is it important to measure behavior before and after behavior modification procedures are used? (p. 7)
13. Why doesn't behavior modification focus on the past as the cause of the behavior? (pp. 7–8)
14. Identify nine defining characteristics of behavior modification. (pp. 4–8)
15. Briefly describe the contributions of Pavlov, Thorndike, Watson, and Skinner to the development of behavior modification. (pp. 8–10)
16. Identify at least one way in which behavior modification has been applied in each of the following areas: developmental disabilities; education; community psychology; business, industry, and human services; self-management; prevention; health-related behaviors; mental illness; rehabilitation; clinical psychology; child management; sports performance; and gerontology. (pp. 12–15)



2

# Observing and Recording Behavior

- How do you define a target behavior in a behavior modification program?
- What different methods can you use to record a target behavior?
- How does continuous recording differ from interval and time sample recording?
- What is reactivity of behavior recording, and how can you minimize it?
- What is interobserver agreement, and why is it important?

One fundamental aspect of behavior modification is measuring the behavior that is targeted for change. Measurement of the target behavior (or behaviors) in behavior modification is called **behavioral assessment**. Behavioral assessment is important for a number of reasons.

- Measuring the behavior before treatment provides information that can help you determine whether treatment is necessary.


**FIGURE 2-1** The supervisor collects data on the number of workers who arrive late.

- Behavioral assessment can provide information that helps you choose the best treatment.
- Measuring the target behavior before and after treatment allows you to determine whether the behavior changed after the treatment was implemented.

Consider the following example.

A supervisor in a manufacturing plant believed the company had a problem with workers showing up late for work. Before taking any remedial action, the supervisor recorded the arrival times of the workers for a number of days (Figure 2-1). The assessment showed that there were few instances of tardiness. In this case, behavioral assessment demonstrated that there was not a problem and that intervention was not necessary.

If the measurement of the workers' arrival times showed that there was a problem, the supervisor would develop a behavior modification plan to change the workers' behavior. The supervisor would continue to record arrival times as the intervention was implemented. The measurement of the workers' arrival times before, during, and after intervention would demonstrate whether the workers arrived late less frequently once intervention had been implemented.

## Direct and Indirect Assessment

There are two types of behavioral assessment: direct and indirect (Iwata, Vollmer, & Zarcone, 1990; Martin & Pear, 1999; O'Neill et al., 1997). **Indirect assessment** involves using interviews, questionnaires, and rating scales to obtain information on the target behavior from the person exhibiting the behavior or





from others (e.g., parents, teachers, or staff). Indirect assessment does not occur when the target behavior occurs but relies on an individual's recall of the target behavior. With **direct assessment,** a person observes and records the target behavior as it occurs. To observe the target behavior, the observer (or a video camera, in some cases) must be in close proximity to the person exhibiting the behavior so that the target behavior can be seen (or heard). In addition, the observer must have a precise definition of the target behavior so that its occurrence can be distinguished from occurrences of other behaviors. To record the target behavior, the observer must register the occurrence of the behavior when it is observed; various methods of recording are described later in this chapter. When a school psychologist observes a socially withdrawn child on the playground and records each social interaction with another child, the psychologist is using direct assessment. When the psychologist interviews the student's teacher and asks the teacher how many times the child usually interacts with other children on the playground, the psychologist is using indirect assessment.

Direct assessment is preferred. Direct assessment usually is more accurate than indirect assessment. This is because in direct assessment, the observer is trained specifically to observe the target behavior and record its occurrence immediately. In indirect assessment, information on the target behavior depends on people's memories. In addition, the people providing information may not have been trained to observe the target behavior and may not have noticed all the occurrences of the behavior. As a result, indirect assessment may be based on incomplete information about the target behavior. Therefore, most research and application in behavior modification relies on direct assessment.

The remainder of this chapter discusses direct assessment methods for observing and recording the target behavior in a behavior modification program, specifically the steps needed to develop a behavior recording plan. These steps include the following:

1. Defining the target behavior
2. Determining the logistics of recording
3. Choosing a recording method
4. Choosing a recording instrument

## Defining the Target Behavior

The first step in developing a behavior recording plan is to define the target behavior you want to record. To define the target behavior for a particular person, you must identify exactly what the person says or does that constitutes the behavioral excess or deficit targeted for change. A behavioral definition includes active verbs describing specific behaviors that a person exhibits. A behavioral definition is objective and unambiguous. As an example of defining a target behavior, unsportsmanlike behavior for a particular baseball player may be defined as yelling obscenities, throwing the bat or batting helmet, and kicking the dirt as the player walks back to the bench after striking out.

Note that the example does not refer to any internal states such as being angry, upset, or sad. Such internal states cannot be observed and recorded by another person. The behavioral definition does not make inferences about a person's intentions. Intentions cannot be observed, and inferences about intentions often are incorrect. Finally, a label ("a bad sport") is not used to define the behavior because labels do not identify the person's actions.

Labels are not behavior. Labels for behaviors are ambiguous; they can mean different things to different people. For example, to one person, unsportsmanlike behavior might mean fighting with a member of the other team, whereas another person considers it to mean cursing, throwing a bat, and kicking dirt. Specific behaviors can be observed and recorded; labels for the behavior cannot. In addition, labels can be used incorrectly as explanations of a behavior. For example, if a person is observed to repeat syllables or words when he talks, we might label him a stutterer. To then say that the person repeats syllables or words because he is a stutterer is an incorrect use of the label as a cause of the behavior. Repeating words or syllables is not caused by stuttering; it is a behavior called stuttering. The main value of labels is that they may be used as convenient shorthand when referring to a target behavior. However, the behavior must always be defined before it can be observed and recorded.

Will two observers agree? One characteristic of a good behavioral definition is that after seeing the definition, different people can observe the same behavior and agree that the behavior is occurring. When two people independently observe the same behavior and both record that the behavior occurred, this is called **interobserver agreement (IOA)** or **interobserver reliability** (Bailey, 1977; Bailey & Burch, 2002). IOA, which is commonly reported in behavior modification research, is discussed in more detail later in this chapter.

Table 2-1 lists behavioral definitions for common target behaviors and the labels associated with those behaviors. The behaviors that are described could be observed and agreed on by two independent observers. The labels, in contrast, are

**TABLE 2-1** Behavioral Definitions and Labels for Common Problems

| Behavioral Definition | Label |
|---|---|
| When Bobby cries and sobs, lies on the floor and kicks the floor or walls, or pounds toys or other objects on the floor, it is defined as a tantrum. | Tantrumming |
| Studying for Rae involves reading pages from a textbook, underlining sentences in the text, completing math or physics workbook exercises, reading notes from class, and outlining chapters from the text. | Studying |
| When Pat says no to someone who asks her to do something that is not part of her job, when she asks coworkers not to play music loudly while she is working, and when she asks coworkers to knock before entering her office, it is defined as assertiveness. | Assertiveness |
| Stuttering is defined for Joel as repeating a word or a word sound, prolonging the sound when saying a word, or hesitating more than 2 seconds between words in a sentence or between syllables in a word. | Stuttering |
| Any time Mark's finger is in his mouth and his teeth are closed together on the fingernail, cuticle, or skin around the nail, it is defined as nail-biting. | Nail-biting |





general names that are commonly used for these types of behaviors. Labels such as these may also be used to refer to behaviors other than those defined here. For example, in contrast with the definition given for Bobby in Table 2-1, a tantrum could be a label for the behavior of screaming, cursing at parents, slamming doors, and throwing toys on the floor. You must develop a specific behavioral definition that fits the target behavior of the person you are observing.

Researchers in behavior modification carefully define the target behaviors of people for whom they provide treatment. For example, Iwata and his colleagues (Iwata, Pace, Kalsher, Cowdery, & Cataldo, 1990) used behavior modification procedures to decrease self-injurious behavior in children with intellectual disabilities. Their definitions for three types of self-injurious behavior were as follows: "arm biting—closure of upper and lower teeth on any portion of the skin extending from fingers to elbow; face hitting—audible contact of an open or closed hand against the face or head; and head banging—audible contact of any portion of the head against a stationary object (e.g., desk, floor, wall)" (p. 13). In another example, Rogers-Warren, Warren, and Baer (1977) used behavior modification procedures to increase sharing in preschool children. They defined sharing as occurring "when one subject passed or handed a material to a second subject, when subjects exchanged materials, or when two or more subjects simultaneously used the same material (for example, two subjects coloring on the same piece of paper)" (p. 311).

**FOR FURTHER READING**

### Social Validity

When using behavior modification procedures to help people change their behavior, it is important to choose target behaviors that are socially significant; behaviors that the client agrees are important targets for change. One way to make sure you are choosing important (socially significant) target behaviors is to assess the opinions of the client or other important individuals (parents, teachers, etc.). When such individuals agree that the target behaviors are important and acceptable, they are establishing the social validity of the target behaviors. Kazdin (1977a) and Wolf (1978) discussed the importance of social validity in behavior modification and methods for assessing social validity.

## The Logistics of Recording

### The Observer

We have defined the target behavior to be recorded for a client, that is, a person who exhibits the target behavior and with whom the behavior modification program will be implemented. The next step is to identify who will observe and record the behavior. In a behavior modification program, the target behavior typically is observed and recorded by a person other than the one exhibiting the target behavior (i.e., an independent observer). The observer may be a professional, such as a behavior analyst or a psychologist, or a person routinely associated with the client in the client's natural environment, such as a teacher, parent, staff member, or supervisor. The observer must have proximity to the client to observe the target behavior when it occurs. The exception would be when the target behavior is observed via video. The observer must be trained to identify the occurrence of the target behavior and to record the behavior immediately. He or she also must have the time to observe and record the behavior and must be willing to function

as an observer. For example, a teacher may be asked to observe and record the target behavior of one of her students, but may not agree to do so because the demands of teaching her students do not allow her the time to function as an observer. In most cases, it is possible to develop a behavior recording plan such that a person can observe and record the target behavior of the client without too much disruption of his or her normal routine.

In some cases, the observer is the person exhibiting the target behavior. When the client observes and records his or her own target behavior, it is called **self-monitoring.** Self-monitoring is valuable when it is not possible for another observer to record the target behavior, as when the target behavior occurs infrequently or when it occurs only when no one else is present (Stickney & Miltenberger, 1999; Stickney, Miltenberger, & Wolff, 1999). Self-monitoring may also be combined with direct observation by another observer. For example, a psychologist might directly observe and record the behavior of a person who is receiving treatment for a nervous habit such as hair-pulling. In addition, the client might be asked to self-monitor the target behavior outside the therapy sessions. If self-monitoring is used in a behavior modification program, the client must be trained to record his or her own behavior in the same way that an observer would be trained.

## When and Where to Record

The observer records the target behavior in a specific period called the **observation period.** It is important to choose an observation period at the time when the target behavior is likely to occur. Indirect assessment information from the client or others (e.g., from an interview) may indicate the best times to schedule the observation period. For example, if staff members report that a patient in a psychiatric ward is most likely to engage in disruptive behavior (defined as screaming, pacing, and cursing at other residents) around mealtimes, the observation period would be scheduled during meals. The timing of the observation periods is also determined by the availability of the observer(s) and the constraints imposed by the client's activities or preferences. Note that the client or the client's parent or guardian must give consent before you can observe and record his or her behavior. This is particularly important when observation occurs without the client's knowledge. In such cases, the client must provide consent for observations to occur, with the understanding that some observations may occur at times unknown to him or her (e.g., Wright & Miltenberger, 1987).

Observation and recording of behavior take place in natural settings or in analogue settings. A **natural setting** consists of the places in which the target behavior typically occurs. Observing and recording a target behavior in the classroom is an example of a natural setting for a student. Observing a target behavior in a clinic playroom is an **analogue setting** because being in the clinic is not part of the child's normal daily routine. Observation in a natural setting is likely to provide a more representative sample of the target behavior. The target behavior may be influenced by the analogue setting, and observation in this setting may provide a sample that is not representative of the behavior under normal circumstances. However, there are benefits of observing in an analogue setting: It is more





controlled than a natural setting, and the variables that influence the behavior are easier to manipulate.

Observation of the target behavior can be **structured or unstructured**. When observations are structured, the observer arranges for specific events or activities to occur during the observation period. For example, when observing child behavior problems, the observer may ask the parent to make specific requests of the child during the observation period. During unstructured observations, no specific events or activities are arranged and no instructions are given during the observation period.

When self-monitoring is used, the client may be able to observe and record the target behavior throughout the day and may not be constrained by a specific observation period. For example, clients who are self-monitoring the number of cigarettes they smoke each day can record each cigarette smoked regardless of when they smoke it. However, some behaviors may occur with such frequency that the client could not record continuously throughout the day; for example, a client who stutters may engage in stuttering hundreds of times throughout the day. In cases such as this, the client would be instructed to record the behavior during observation periods agreed on in advance with the psychologist.

In behavior modification research, the people observing and recording the target behaviors usually are trained research assistants. They study the behavioral definition of the target behavior and then practice recording under the supervision of the researcher. When they can record the behavior reliably during practice sessions (after they have good IOA with the researcher), they record the target behavior during actual observation periods as part of the study. The observation periods used in behavior modification research often are brief (say, 15–30 minutes). When observations occur in natural settings, researchers usually choose observation periods that are representative of the usual occurrence of the target behavior. For example, observations may take place in a classroom, workplace, hospital, or other setting in which the target behavior usually occurs. In a study using behavior modification to improve children's behavior during trips to the dentist, Allen and Stokes (1987) recorded children's disruptive behavior (defined as head and body movements, crying, gagging, and moaning) while they were in the dentist's chair and the dentist performed dental procedures on them. In another study, Durand and Mindell (1990) taught parents how to use behavior modification procedures to decrease nighttime tantrum behavior (defined as loud screaming and hitting furniture) in their young child. In this study, the parents recorded the target behaviors for an hour before the child's bedtime because this was the time when the tantrum behaviors occurred.

When observations occur in analogue settings, researchers often simulate events that are likely to occur in natural settings. For example, Iwata, Dorsey, Slifer, Bauman, and Richman (1982) observed and recorded the self-injurious behavior of children with intellectual disabilities in therapy rooms in a hospital. During their observation periods, they simulated different events or activities that the children were likely to experience at home or at school. For example, the researchers observed the children as they played with toys, as teachers gave them instructions, and during times they were receiving no attention from the teacher. Iwata and his colleagues found that for each child, the self-injurious

behavior occurred at different rates in observation periods that simulated different events or activities.

## Choosing a Recording Method

Different aspects of the target behavior may be measured using different recording methods. These methods include continuous recording, product recording, interval recording, and time sample recording. Each method is described here.

### Continuous Recording

In **continuous recording,** the observer observes the client continuously throughout the observation period and records each occurrence of the behavior. To do so, the observer must be able to identify the onset and the offset (or beginning and end) of each instance of the behavior. In continuous recording, the observer can record various dimensions of the target behavior, particularly its frequency, duration, intensity, and latency.

The **frequency** of a behavior is the number of times the behavior occurs in an observation period. You measure the frequency of a behavior simply by counting each time that it occurs. One occurrence is defined as one onset and offset of the behavior. For example, you can count the number of cigarettes someone smokes. For this target behavior, the onset may be defined as lighting the cigarette and the offset as putting it out. You will use a frequency measure when the number of times the behavior occurs is the most important information about the behavior. Frequency may be reported as **rate,** which is frequency divided by the time of the observation period. Rate is often reported as responses per minute.

The **duration** of a behavior is the total amount of time occupied by the behavior from start to finish. You measure the duration of a behavior by timing it from its onset to its offset. For example, you might record the number of minutes a student studies per day, the number of minutes a person exercises, or the number of seconds a patient who has had a stroke stands up without assistance during rehabilitation sessions in the hospital. You will use a duration measure when the most important aspect of the behavior is how long it lasts. Duration may be reported as percentage of time, which is duration divided by the time of the observation period (Miltenberger, Rapp, & Long, 1999).

Some researchers use a **real-time recording** method in which the exact time of each onset and offset of the target behavior is recorded (Miltenberger et al., 1999; Miltenberger, Long, Rapp, Lumley, & Elliott, 1998). With real-time recording, the researchers have a record of the frequency and duration of the target behavior, as well as the exact timing of each occurrence of the behavior. Real-time recording can be carried out after video recording the target behavior in the observation period. The observer then plays the video and records the time indicated on the timer at the onset and offset of each occurrence of the behavior on a data sheet developed for real-time recording (Rapp, Carr, Miltenberger, Dozier, & Kellum, 2001). Alternatively, handheld or laptop computers with





software that permits recording of the exact timing of events can be used for real-time recording (Kahng & Iwata, 1998).

The **intensity** of a behavior is the amount of force, energy, or exertion involved in it. Intensity (also called magnitude) is more difficult to measure than frequency or duration because it does not involve simply counting the number of times the behavior occurs or recording the amount of time it takes to occur. Intensity often is recorded with a measurement instrument or by using a rating scale. For example, you could use a decibel meter to measure the loudness of someone's speech. A physical therapist might measure the strength of a person's grip to judge recovery from an injury. Parents might use a rating scale from 1 to 5 to measure the intensity of a child's tantrum. The parents would have to define the behavior associated with each point on the rating scale so that their ratings were reliable; their ratings would be reliable if they both observed a tantrum and recorded the same number on the rating scale. Intensity is not used as often as frequency or duration, but it is a useful measure when you are most interested in the force or magnitude of the behavior (Bailey, 1977; Bailey & Burch, 2002).

The **latency** of the behavior is the time from some stimulus or event to the onset of the behavior. You measure latency by recording how long it takes the person to initiate the behavior after a particular event occurs. For example, you could record how long it takes a child to start putting toys away after being asked to do so. The shorter the latency, the sooner the child initiates the behavior after the request. Another example of latency is the time it takes a person to answer the phone after it starts ringing.

*How does latency differ from duration?*

Latency is the time from some stimulus or event to the onset of the behavior, whereas duration is the time from the onset of the behavior to its offset. That is, latency is how long it takes to start the behavior and duration is how long the behavior lasts.

When using continuous recording, you can choose one or more dimensions to measure. The dimension you choose depends on which aspect of the behavior is most important and which dimension is most sensitive to change in the behavior after treatment. For example, if you want to record a person's stuttering, frequency may be the most important dimension because you are interested in the number of stuttered words. You can then compare the number of stuttered words before, during, and after treatment. If treatment is successful, there should be fewer stuttered words. However, duration may also be an important dimension of stuttering if there are long speech blocks or prolongations. In this case, you would expect the duration of stuttering to decrease after treatment.

*If you were recording a child's tantrum behavior (screaming, throwing toys, slamming doors), which dimension of the behavior would you measure?*

The example of a child's tantrum behavior is less clear. You may be interested in the number of tantrums per day (frequency), but you may also be

interested in how long each tantrum lasts (duration). Finally, you may be interested in how loud the child screams or how forcefully the child throws toys or slams doors (intensity). We hope that, after treatment, the tantrums will decrease in frequency, duration, and intensity; that is, they will occur less often, will not last as long, and will not be as loud or violent.

Unless you measure the right dimension of a behavior, you may not be able to judge the effectiveness of treatment. If you are in doubt, or if multiple dimensions of the behavior seem relevant, the best course of action is to measure more than one dimension. Go back to the example of the child's tantrums. Figure 2-2 shows that, from an average of more than six per day during **baseline**, the frequency of tantrums decreased to less than two per day during treatment. (Baseline is the period during which the target behavior is recorded before treatment is implemented.) It appears that treatment was effective. However, Figure 2-3 shows the duration of tantrums before and during treatment. Before treatment, each of the five to eight tantrums per day lasted about 1 minute each, for a total of 5 to 8 minutes of tantrum behavior per day. During treatment, the duration of each tantrum was much longer, resulting in more minutes of tantrum behavior per day. Therefore, according to the duration measure, the tantrums got worse during treatment. This underscores the importance of measuring more than one dimension of a target behavior because more than one dimension can change after treatment.

Note also that, to demonstrate the effectiveness of treatment, you must use established research methods and an experimental design. Simply measuring the behavior before, during, and after treatment demonstrates whether the target behavior changed, but does not prove that the treatment caused the behavior change (see Chapter 3).

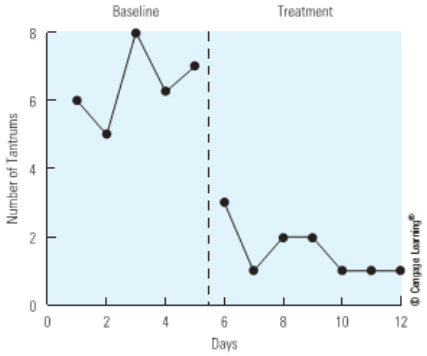



**FIGURE 2-2** The frequency of tantrums during baseline and treatment phases. During the baseline phase, the target behavior is recorded, but treatment is not yet implemented. Tantrums decreased from an average of more than six per day during baseline to less than two per day during treatment.





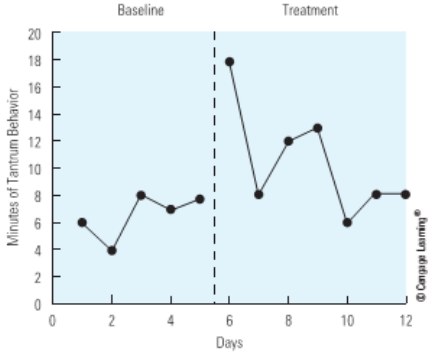



**FIGURE 2-3** The duration of tantrums during baseline and treatment phases. Tantrums increased from an average duration of 1 minute each or a total of 5 to 8 minutes per day during baseline to about 6 minutes each or a total of 6 to 18 minutes per day during treatment. Therefore, the duration of tantrum behavior per day did not decrease even though the frequency of tantrums decreased.

## Percentage of Opportunities

Percentage of trials or percentage correct is one final way in which event recording may be conducted. In this method, the observer records the occurrence of a behavior in relation to some other event, such as a learning trial or a response opportunity, and reports the results as the percentage of opportunities in which the behavior occurred. To say that a student complied with a teacher's requests 11 times during the observation period or got 13 words correct on a spelling test is inadequate information because there is no mention of response opportunities. Reporting the results as the number of times the behavior occurred divided by the number of opportunities provides more useful information. If the teacher made 12 requests and the student complied with the teacher's requests 11 times, the percentage of compliance is 11/12, or 92%. However, if the teachers made 25 requests and the student complied 11 times, the percentage is only 44%, a much less acceptable level of the behavior.

## Product Recording

Another aspect of a behavior that may be recorded is its product. **Product recording**, also called permanent product recording (Marholin & Steinman, 1977), is an indirect assessment method that can be used when a behavior results in a certain tangible outcome that you are interested in. It is an indirect measure because you are not observing and recording the behavior as it occurs. For example, a supervisor could count the number of units assembled in a factory as a product measure of a worker's job performance, or a teacher could record the number of correctly completed homework problems or workbook pages as a

product measure of students' academic performance (Noell et al., 2000). In their research on student behavior problems and academic performance, Marholin and Steinman (1977) looked at the math worksheets of students and recorded the number of math problems completed correctly as permanent products of the students' academic performance.

One benefit of product recording is that the observer does not have to be present when the behavior occurs. The teacher probably will not be present when students complete their homework assignments, but he or she can still measure the product of the behavior (completed homework problems). One drawback of product recording is that you cannot always determine who engaged in the behavior that led to the product you recorded. For example, the teacher cannot determine whether the students completed their own homework, whether someone else helped them, or whether someone did it for them.

## Interval Recording

Another method for recording behavior is to record whether the behavior occurred during consecutive time periods. This is called **interval recording.** To use interval recording, the observer divides the observation period into a number of smaller time periods or intervals, observes the client throughout each consecutive interval, and then records whether the behavior occurred in that interval. At the end of the observation period, the observer reports the percentage of intervals in which the behavior was observed (the number of intervals in which behavior occurred divided by the number of intervals in the observation period).

There are two types of interval recording: partial-interval recording and whole-interval recording. With **partial-interval recording,** the observer scores the interval if the behavior occurred during any part of the interval. With partial-interval recording, you are not interested in the number of times the behavior occurs (frequency) or how long it lasts (duration). You do not have to identify the onset and offset of the behavior; rather, you simply record whether the behavior occurred during each interval of time. The term "interval recording" is synonymous with "partial interval recording."

Suppose that a teacher is recording whether a child disrupts the class during each 15-minute interval in the class period. The teacher sets a timer to beep every 15 minutes. When the disruptive behavior occurs, the teacher marks the corresponding interval on a data sheet. Once an interval is marked, the teacher does not have to observe the child or record the behavior until the next interval begins. If the behavior does not occur in an interval, the interval is left blank on the data sheet. Thus, one benefit of partial-interval recording is that it takes less time and effort: The observer records the behavior only once during the interval, regardless of how many times the behavior occurs or how long it lasts.

With **whole-interval recording,** the occurrence of the behavior is marked in an interval only when the behavior occurs throughout the entire interval. If the behavior occurs in only part of the interval, the behavior is not scored as occurring in that interval. For example, if a behavior analyst were recording on task behavior in the classroom using whole-interval recording with 10-second intervals, the behavior analyst would score the interval for the occurrence of the on task behavior only if the behavior occurred throughout the entire 10-second interval.



Whole-interval recording typically is used for behaviors that are expected to have a long duration of occurrence. Whole-interval recording is used infrequently in research and practice.

When researchers use interval recording, they often choose short intervals, such as 6 or 10 seconds (Bailey, 1977; Bailey & Burch, 2002). In this way, they make many recordings of the behavior during the observation period and obtain a more representative sample of the target behavior than they could derive from longer intervals. For example, Iwata, Pace, Kalsher, Cowdery, and Cataldo (1990) used 10-second intervals to record the occurrence of self-injurious behavior (e.g., head-banging, slapping, and scratching) in children with intellectual disabilities. Miltenberger, Fuqua, and McKinley (1985) used 6-second intervals to record the occurrence of motor tics (e.g., jerking movements of the head or facial muscles, rapid eye-blinking) in adults. In this study, the researchers video recorded the adults in the observation sessions and then recorded the number of intervals containing motor tics from the videos. Every 6 seconds, the researchers recorded the presence or absence of the tic behavior.

In some cases, frequency recording and interval recording can be combined to produce **frequency-within-interval recording.** With this method, the observer records the frequency of the target behavior but does so within consecutive intervals of time in the observation period (Bailey, 1977; Bailey & Burch, 2002). Frequency-within-interval recording shows you the frequency of the behavior and the specific intervals in which the behavior occurred.

## Time Sample Recording

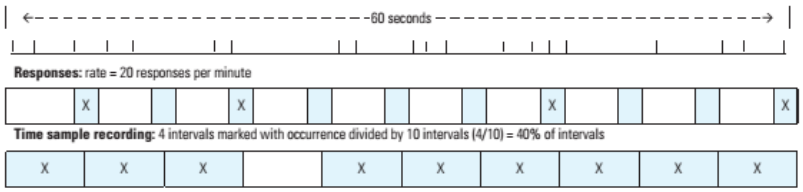
When using **time sample recording,** you divide the observation period into intervals of time, but you observe and record the behavior during only part of each interval. The observation periods are separated by periods without observation. For example, you might record the behavior for only 1 minute during each 15-minute interval, or you might record the behavior only if it is occurring at the end of the interval. Consider an observer who is using time sample recording to record a client's poor posture (defined as slouching, bending the back forward). The observer sets a timer to beep every 10 minutes and records an instance of bad posture only if the client's posture is bad when the timer beeps at the end of the interval. This variation of time sample recording is called **momentary time sample recording** or MTS. With MTS, the behavior is recorded only if it occurs at the exact instant the interval ends. Time sample recording is valuable because the person does not have to observe the behavior for the entire interval. Rather, the observer records the behavior that occurs during only a portion of the interval or at a specific time in the interval.

In interval recording or time sample recording, the level of the behavior is reported as the percentage of intervals in which the behavior occurred. To calculate the percentage of intervals, you divide the number of scored intervals by the total number of intervals during the observation period. A scored interval is an interval in which the behavior was recorded.

Below is an illustration of the difference between time sample recording and interval recording. The observation period is 1 minute and each vertical bar indicates one response. The data show that 20 responses occurred in the 1 minute

observation. In time sample recording, there are ten 10-second intervals but the behavior is recorded only if it occurs at the end of the interval (e.g., in the 3 seconds at the end of each 10-second interval). If the behavior occurs in the first 7 seconds of the 10-second interval it is not recorded. In interval recording, the behavior is recorded if it occurs at any time during the entire 10-second interval. In this example, the behavior was recorded in 40% of the intervals with time sample recording but it was recorded in 90% of the intervals with interval recording.

### Comparison of Time Sample and Interval Recording




### Recording Methods

| | |
|---|---|
| Continuous recording | Record every instance of the behavior occurring during the observation period. May record frequency, duration, intensity, or latency |
| Product recording | Record the tangible outcome or permanent product of the occurrence of the behavior |
| Interval recording | Record the occurrence or nonoccurrence of the behavior in consecutive intervals of time during an observation period |
| Time sample recording | Record the occurrence or nonoccurrence of the behavior in discontinuous intervals of time (time samples) during an observation period |

## Choosing a Recording Instrument

The final step in developing a behavior recording plan is to choose a recording instrument. The recording instrument is what the observer uses to register or make a permanent product of the occurrence of the behavior. Paper and pencil are used most often to record behavior. Put simply, the observer makes a note on the paper each time he or she observes the behavior. To record behavior most effectively, the observer uses a data sheet prepared in advance for the particular behavior. The data sheet helps organize the recording process by making it clear what the observer is to write down when the behavior occurs.

The data sheet in Figure 2-4 is used to record the frequency of a target behavior. Each time the behavior occurs on a particular day, the observer marks an X in one of the boxes for that day. The number of boxes with Xs filled in for each day





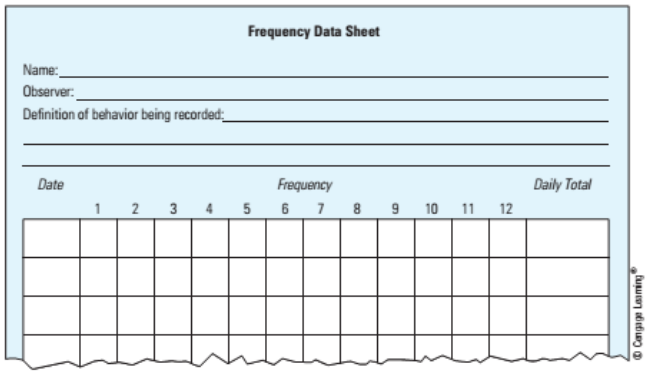



**FIGURE 2-4** This data sheet is used to record the frequency of a behavior. You put an *X* into a box each time the behavior occurs. If more than 12 instances of the behavior occur per day, continue recording on the next line.

signifies the frequency, or the number of times that the behavior occurred on each day.

The data sheet in Figure 2-5 is used to record the duration of a target behavior. On each day, there are places to record the times the behavior started (onset) and ended (offset). By recording the onset and offset of each instance of a behavior, you end up with a recording of how long the behavior occurred (duration), as well as how often it occurred (frequency).

An example of a data sheet used for 10-second interval recording is shown in Figure 2-6. Notice that there are 6 boxes on each line and 15 lines of boxes. Each box represents one 10-second interval, for a total of 90 intervals in 15 minutes. To use the 10-second interval recording method, the observer listens to a recording that signals the start of each interval. When the target behavior occurs, the observer puts a check mark in the corresponding interval box. If the target behavior does not occur during an interval, the observer leaves that interval box blank. Alternatively, each interval box could have one or more codes. The observer circles or puts a check mark through the code that represents the behavior observed in that interval. For example, the codes AT and RP could be used to signify the behaviors of attention and reprimand, respectively, when observing a parent's behavior while interacting with a child. If the parent pays attention to the child or reprimands the child in an interval, the observer would circle AT or RP, respectively, for that interval.

Other procedures for recording behavior involve writing the behavior down each time it occurs. For example, a person who wants to count the number of cigarettes she smokes each day may keep a note card tucked into the cellophane wrapper on the cigarette pack. Each time she smokes a cigarette, she makes a check mark on the note card and counts the check marks at the end of each day.

**Duration Data Sheet**

Name:_____

Observer:_____

Definition of behavior being recorded:_____

| *Date* | *Duration* | | | | | | *Daily Duration* |
|---|---|---|---|---|---|---|---|
| | Onset | Offset | Onset | Offset | Onset | Offset | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |



**FIGURE 2-5** This data sheet is used to record the duration of a behavior. You record the onset and offset time for each instance of the behavior. If there are more than three instances of the behavior per day, continue recording on the next line.

Likewise, a person who is recording his rude behavior might keep a small note pad in his shirt pocket; every time he makes a rude remark, he pulls out the note pad and makes a note of it.

Not all instruments for recording behavior depend on paper and pencil. Anything you can use to register each occurrence of a behavior can be considered a behavior recording instrument. The following are some common examples.

- Use a golf stroke counter to record the frequency of a behavior. The golf stroke counter is worn on the wrist like a wristwatch. Each time the behavior occurs, you push the button on the counter (Lindsley, 1968). A small hand-held counter could be used in a similar fashion.
- Use a stopwatch to record the cumulative duration of a behavior. You start and stop the stopwatch each time the behavior starts and stops. Runners and joggers often wear watches with a stopwatch function that allows them to record the duration of their workouts.
- Use a laptop, smartphone, or other handheld electronic devices with an app for data recording to record the frequency and duration of many behaviors at once. You push different keys on the computer or handheld device each time different behaviors occur; as long as you keep pressing the key, the duration of the behavior is recorded (Dixon, 2003; Fogel, Miltenberger, Graves, & Koehler, 2010; Iwata, Pace, Kalsher, Cowdery, & Cataldo, 1990; Jackson & Dixon, 2007; Kahng & Iwata, 1998). Using smartphones for recording behavior is becoming more popular and numerous apps have been developed for this purpose (e.g., Whiting & Dixon, 2012). For example, two popular apps that permit frequency and duration recording as well as interval recording are the Direct Assessment Tracking Application (D.A.T.A., Behaviorscience.org) and Behavior Tracker Pro (Behaviortrackerpro.com).
- Use barcode technology for recording behavior. Each behavior being recorded is given a unique barcode and the observer has a sheet of paper with all the barcodes for the behaviors to be recorded. When a particular behavior occurs, the observer scans the barcode for that behavior to record its occurrence.
- Transfer a coin from one pocket to another to record the frequency of a behavior. Each time you observe the behavior, you move a coin from your right pocket to your left pocket. The number of coins in your left pocket at the end of the day equals the frequency of the behavior (assuming that you don't spend any of the coins from your left pocket).





**Interval Data Sheet**

Name:_____

Observer:_____

Date and time of observation:_____

Definition of behavior being recorded:_____

*Ten-second intervals*

| Minutes of observation | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|
| 1 | | | | | | |
| 2 | | | | | | |
| 3 | | | | | | |
| 4 | | | | | | |
| 5 | | | | | | |
| 6 | | | | | | |
| 7 | | | | | | |
| 8 | | | | | | |
| 9 | | | | | | |
| 10 | | | | | | |
| 11 | | | | | | |
| 12 | | | | | | |
| 13 | | | | | | |
| 14 | | | | | | |
| 15 | | | | | | |



**FIGURE 2-6** This is an interval recording data sheet. Each box corresponds to an interval, and a check mark is placed in a box when the behavior occurs during that interval. When the behavior does not occur during an interval, the box is left blank.

- Make small tears in a piece of paper each time a behavior occurs. At the end of the observation period, the frequency of the behavior is equal to the number of tears in the paper (Epstein, 1996).
- Use Ranger beads. Ranger beads (brought to my attention by Jason Hicks, a student in my behavior modification class, who first used them when he was an Army Ranger) consist of a strip of leather or nylon threaded through beads. They have two sections, each with nine beads. With the beads in one section, the person can record 1 through 9; with the beads in the other section, the person can count by 10s, for a maximum frequency count of 99. Whenever a target behavior occurs, the person moves a bead from one side of the strip to the other. At the end of the day or observation period, the number of beads moved to one side indicates the frequency of the target behavior. A similar recording system involves beads on a piece of leather or string worn around the wrist.
- Use a physical activity recording device (pedometer, accelerometer, or GPS device). A pedometer is a device, worn on the belt, that records each step a person takes while walking or running. Similarly, an accelerometer is a device worn by a person that records various aspects of physical activity including steps (e. g., Fitbit [Fitbit.com], Nike Fuelband [Nike.com]). A GPS device worn on the wrist records distance as a measure of how far a person walked, ran, or biked.

Recording must be immediate and practical. Regardless of the instrument used, the one characteristic of all behavior recording procedures is that the person observes the behavior and records it immediately (the exception is when a device such as a pedometer automatically records the behavior). The sooner the observer records the behavior after it occurs, the less likely the observer is to record incorrectly. A person who waits some time to record an observation may forget to record it at all.

One other aspect of a behavior recording procedure is that it must be practical. The person responsible for recording the target behavior must be able to use the recording procedure without much difficulty or disruption of ongoing activities. If a recording procedure is practical, the person is more likely to carry out the recording (or self-monitoring) successfully. A recording procedure that takes substantial time or effort is not practical. In addition, the recording procedure should not draw attention to the person who is doing the observation and recording. If this happens, the person may be less likely to carry out the recording procedure.

## Reactivity

Sometimes the process of recording a behavior causes the behavior to change, even before any treatment is implemented. This is called **reactivity** (Foster, Bell-Dolan, & Burge, 1988; Hartmann & Wood, 1990; Tryon, 1998). Reactivity may occur when an observer is recording the behavior of another person or when a person engages in self-monitoring. Reactivity may be undesirable, especially for research purposes, because the behavior recorded during the observation period is not representative of the level of the behavior occurring in the absence of the





observer or in the absence of self-monitoring. For example, when a disruptive child sees that someone is recording his or her behavior in the classroom, the child may decrease his or her disruptive behavior while the observer is present. Usually this change in behavior is only temporary, and the behavior returns to its original level once the child becomes accustomed to the observer's presence.

You can reduce reactivity. One way to reduce reactivity is to wait until the people who are being observed become accustomed to the observer. Another is to have the observer record the behavior without the people knowing that they are being observed. This may be accomplished with the use of one-way observation windows or with participant observers. A participant observer is a person who is normally in the setting where the target behavior occurs, such as a teacher's aide in a classroom. Another way to reduce reactivity is to use video recording. Reactivity is not likely to be a problem once the person becomes accustomed to the camera or if the camera is hidden.

Reactivity may be desirable. When a person starts to record his or her own behavior as part of a self-management project, the behavior often changes in the desired direction as a result of the self-monitoring (Epstein, 1996). For this reason, self-monitoring sometimes is used as a treatment to change a target behavior. For example, Ollendick (1981) and Wright and Miltenberger (1987) found that self-monitoring of motor tics led to reductions in their frequency. Ackerman and Shapiro (1984) reported that when adults with intellectual disabilities self-monitored their work productivity, their productivity increased. Winett, Neale, and Grier (1979) showed that self-monitoring of electricity use by people in their homes resulted in decreases in electricity use. Self-monitoring and other self-control strategies are discussed in more detail in Chapter 20.

## Interobserver Agreement

You assess IOA to determine whether the target behavior is being recorded consistently. To evaluate IOA, two people independently observe and record the same target behavior of the same subject during the same observation period. The recordings of the two observers are then compared, and a percentage of agreement between observers is calculated. When the percentage of agreement is high, it indicates that there is consistency in the scoring by the two observers. This suggests that the definition of the target behavior is clear and objective, and that the observers are using the recording system correctly. When high IOA is reported in a research study, it suggests that the observers in the study recorded the target behavior consistently. IOA should be checked at least occasionally when direct observation and recording are also used in nonresearch settings. In research studies, the minimally acceptable IOA is typically 80%, although 90% or better is preferred.

IOA is calculated differently depending on the recording method used. For frequency recording, IOA (expressed as a percentage) is calculated by dividing the smaller frequency by the larger frequency. For example, if observer A records 10 occurrences of aggressive behavior in an observation period and observer B records 9, IOA equals 90%. For duration recording, IOA is calculated by dividing the smaller duration by the larger duration. For example, if observer A records 48 minutes of exercise and observer B records 50 minutes, IOA equals 48/50, or 96%.

For interval recording, you check the agreement between the two observers in each interval. You then divide the number of intervals with agreement by the total number of intervals. Agreement is defined as the case in which the two observers both recorded the target behavior as occurring or as not occurring in a particular interval. Figure 2-7 shows the interval recording data from two independent observers recording the behavior of the same client at the same time. There were 20 intervals of observation and the 2 observers agreed on the occurrence or nonoccurrence of the behavior 17 times. Therefore, you divide 17 by 20, which equals 0.85, or 85%. IOA for time sample recording is calculated in the same manner as for interval recording.

There are two variations of IOA calculations for interval recording; occurrence only IOA and nonoccurrence only IOA. In occurrence only IOA, only those intervals where both observers scored the behavior are counted as agreements. Intervals where both observers did not score an occurrence of the behavior are not used in the calculation. In nonoccurrence only IOA, only those intervals where both observers agreed the behavior did not occur are counted as agreements. Intervals where both observers scored an occurrence of the behavior are not used in the calculation. Occurrence-only-IOA calculations provide a more conservative measure of IOA for low rate behaviors because it is easy to agree on the nonoccurrence of the behavior by chance. Nonoccurrence-only-IOA calculations provide a more conservative measure of IOA for high-rate behaviors because it is easier to agree on the occurrence of the behavior by chance. Figure 2-8 shows occurrence-only-IOA calculation and Figure 2-9 shows nonoccurrence-only-IOA calculation.

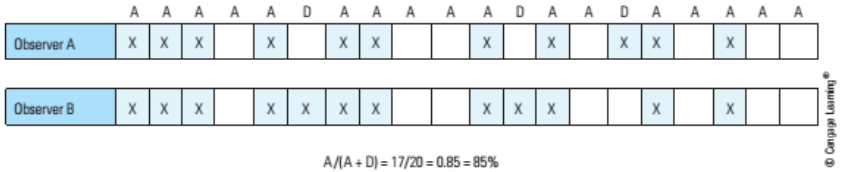



**FIGURE 2-7** A comparison of interval recording by two observers. An *A* indicates that the observers agreed that the behavior did or did not occur in an interval. *D* indicates that the observers disagreed: One observer recorded the occurrence of the behavior in an interval, and the other did not.

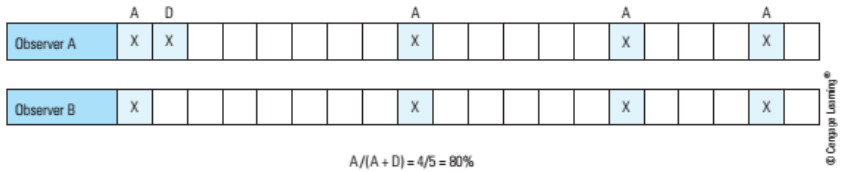



**FIGURE 2-8** Calculation of IOA using agreement on occurrence only. The number of intervals with agreements on the occurrence of the behavior is divided by intervals with agreements + disagreements. Intervals where both observers did not score an occurrence are not included in the calculation.





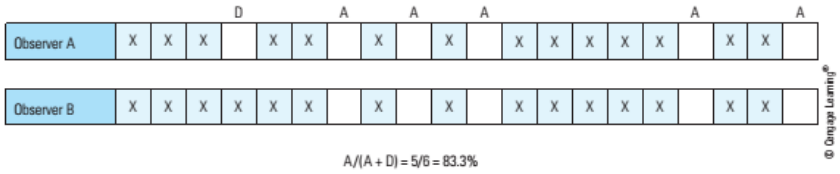



**FIGURE 2-9** Calculation of IOA using agreement on nonoccurrence only. The number of intervals with agreements on the nonoccurrence of the behavior is divided by intervals with agreements + disagreements. Intervals where both observers scored an occurrence are not included in the calculation.

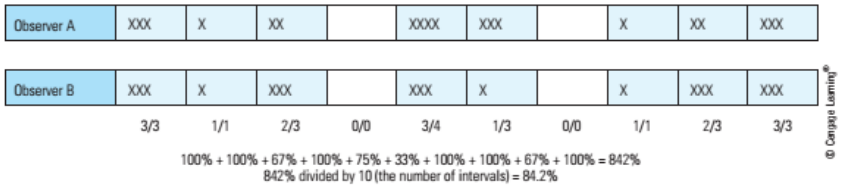



**FIGURE 2-10** Calculation of interobserver agreement for frequency-within-interval recording. A percentage of agreement is calculated for each interval, the percentages are summed, and the sum is divided by the number of intervals.

To calculate IOA for frequency-within-interval recording, you calculate a percentage of agreement between observers for each interval (smaller frequency divided by the larger frequency), sum the percentages for all the intervals, and divide by the number of intervals in the observation period. Figure 2-10 shows the calculation of IOA for two independent observers using frequency-within-interval recording.

## CHAPTER SUMMARY

1. A target behavior is defined by identifying exactly what the person says or does that constitutes the behavioral excess or behavioral deficit targeted for change. The behavioral definition should include active verbs describing the behavior the person exhibits.
2. The different methods you can use to record the target behavior include continuous recording of the frequency, duration, latency, or magnitude of the behavior; percentage of opportunity recording; product recording; interval recording; or time sample recording.
3. With continuous recording, the observer observes the client continuously throughout the observation period and records each occurrence of the behavior. With interval and time sample recording, the observation period is divided into a number of smaller time periods or intervals and the behavior is recorded as occurring or not occurring within each interval. With interval recording, the

intervals are consecutive time periods, and with time sample recording, the intervals are separated by periods without observation.

4. Reactivity occurs when the process of behavior recording causes the behavior to change, even before any treatment is implemented. Reactivity can be minimized by waiting until the person being observed becomes accustomed to the observer's presence. Another way to reduce reactivity is to observe people without letting them know they are being observed.
5. Interobserver agreement (IOA) is determined by having two observers independently record a person's behavior during the same observation period and then comparing the recordings of the two observers. You assess IOA to determine whether the target behavior is being recorded consistently.

## KEY TERMS

analogue setting, 24
baseline, 28
behavioral assessment, 19
continuous recording, 26
direct assessment, 21
duration, 26
frequency, 26
frequency-within-interval recording, 31
indirect assessment, 20
intensity, 27
interobserver agreement, 22
interobserver reliability, 22
interval recording, 30
latency, 27
momentary time sample recording, 31
natural setting, 24
observation period, 24
partial-interval recording, 30
product recording, 29
rate, 26
reactivity, 36
real-time recording, 26
self-monitoring, 24
structured observation, 25
time sample recording, 31
unstructured observation, 25
whole-interval recording, 30

## PRACTICE TEST

1. Why is it important to record the behavior you are trying to change when using behavior modification? (pp. 18–19)
2. Identify the four steps involved in a behavior recording plan. (p. 21)
3. What is a behavioral definition? How does it differ from a label for a behavior? (pp. 21–22)
4. Provide a possible behavioral definition of politeness.
5. Why is it important to identify who will record a behavior? (pp. 23–24)
6. What is meant by the term observation period? (p. 24)
7. Identify and define four dimensions of a behavior that may be recorded in a continuous recording method. (pp. 26–27)
8. Provide an example of frequency recording, duration recording, intensity recording, and latency recording. (pp. 26–27)
9. What is real-time recording? Provide an example. (p. 26)
10. What is product recording? Provide an example. (p. 29)
11. What is interval recording? Provide an example. (p. 30)
12. What is frequency-within-interval recording? Provide an example. (p. 31)
13. What is time sample recording? Provide an example. (p. 31)
14. Provide examples of three different recording instruments. (pp. 32–36)
15. Why is it important to record a behavior immediately after it occurs? (p. 36)
16. What is reactivity? Describe two ways to reduce reactivity during direct observation. (pp. 36–37)
17. What is interobserver agreement, and why is it assessed? (pp. 37–39)
18. Describe how you calculate interobserver agreement for frequency recording, duration recording, and interval recording. (pp. 37–38)
19. Describe how you would calculate interobserver agreement for frequency-within-interval recording. (p. 39)



## APPLICATIONS

1. When people want to change their own behavior, they can design and implement a self-management program. A self-management program involves applying behavior modification to one's own behavior. There are five steps in a self-management program:
   i. *Self-monitoring*. Define and record the target behavior you want to change.
   ii. *Graphing*. Develop a graph and plot the daily level of the target behavior on the graph.
   iii. *Goal setting*. Establish a goal for the desired change in the target behavior.
   iv. *Intervention*. Develop and implement specific behavior modification strategies to change the behavior.
   v. *Evaluation*. Continue to record the behavior and plot it on the graph to determine whether you changed your target behavior and achieved your goal.

   In this exercise, take the first step to start your own self-management program. Define a target behavior you want to change, and develop a behavior recording plan to measure the target behavior. As you complete this first step, consider the following questions:

   a. Did you define your target behavior in clear, objective terms?
   b. Did you determine the appropriate dimension of your target behavior to record (e.g., frequency or duration)?
   c. Did you choose a practical recording method?
   d. Will you be able to record your target behavior immediately each time that it occurs?
   e. What problems might you encounter as you record your target behavior, and how will you deal with these problems?

   Good luck in starting the self-monitoring component of your self-management program. You will learn the information you need to conduct the remaining steps of your self-management program in subsequent chapters.
2. Imagine you have a friend, James, who is studying to be an elementary school teacher. James is doing his student teaching this semester in a second-grade classroom in a public school. James mentioned to you that one of his students has trouble staying in her seat, paying attention during class, and participating in activities. This student, Sara, gets out of her seat and talks to or teases other children. When she is out of her seat, she does not pay attention to James, does not participate in activities, and disrupts the other children.

   James believes that if he could just get Sara to stay in her seat, he could get her to pay attention and participate. As a result, she would perform better in class, and the other students would also do better. James decides to consult with a Board Certified Behavior Analyst (BCBA) for help.

   The BCBA informs James that the first step he must take, if he is going to use behavior modification with Sara, is to develop a recording plan to measure her behavior. In this exercise, develop a plan that James could use to record Sara's out-of-seat behavior. Consider the following questions:

   a. What is the behavioral definition of out-of-seat behavior?

b. What recording method would you have James use to record Sara's out-of-seat behavior?
c. What instrument would you have James use to record the behavior? Will this instrument be practical for James to use as a teacher?

3. Eve plans to start a weight-lifting program. She wants to record her behavior once she starts the program so that she can measure the changes in her behavior as the program progresses. Describe how Eve could use frequency recording, duration recording, and intensity recording to measure her weight-lifting behavior.

## MISAPPLICATIONS

1. Gloria is taking a behavior modification class and has to do a self-management project. The behavior she has chosen to modify is her hair-twirling. She has defined this behavior as any instance in which she reaches up to the back of her head and wraps hair around her finger. The first step in her self-management project is to develop a behavior recording plan. Because she usually does the hair-twirling in her classes, she decides to record the behavior immediately after each class period. She will keep a 3 × 5-inch note card in her purse, and as soon as she leaves the classroom, she will get the note card out of her purse and write down the number of times that she twirled her hair in the class.
   a. What is wrong with this behavior recording plan?
   b. What changes would you make to improve it?
2. Ralph is going to implement a self-management project to help him decrease the number of cigarettes he smokes per day. He will define the behavior of smoking a cigarette as any instance in which he takes a cigarette out of the pack in his pocket, lights it, and smokes any part of it. He will record the number of cigarettes he smokes each day by counting the cigarettes left in his pack at the end of the day and subtracting this number from the number of cigarettes that were in the pack at the start of the day.
   a. What is wrong with this behavior recording plan?
   b. What would you do to improve it?
3. Below are examples of behavioral definitions of target behaviors in students' self-management programs. What is wrong with each of these behavioral definitions?
   a. Losing my temper will be defined as getting mad at my husband and yelling at him, walking into the bedroom and slamming the door, or telling him to "shut up" when he says something that frustrates me.
   b. Overeating will be defined as any time I eat more than I wanted to eat at a meal, or any time I eat so much that I feel bloated or my belt is too tight.
   c. Studying will be defined as any time I have my books open in front of me in the library or at my desk, the TV is off, and there are no other distractions.



# 3

# Graphing Behavior and Measuring Change

- What are the six essential components of a behavior modification graph?
- How do you graph behavioral data?
- What different dimensions of behavior can be shown on a graph?
- What is a functional relationship, and how do you demonstrate a functional relationship in behavior modification?
- What different research designs can be used in behavior modification research?

As we saw in Chapter 2, people who use behavior modification define their target behavior carefully, and directly observe and record the behavior. In this way, they can document whether the behavior has indeed changed when a behavior modification procedure is implemented. The primary tool used to document behavior change is the graph.