Chapter 6

MULTIPLE-BASELINE DESIGNS

Juan is a 27-year-old man of mixed Latino and African American descent. For the past 5 years, he has lived in a series of group homes and apartments for men diagnosed with schizophrenia and bipolar disorder. Juan, an only child, was diagnosed with disorganized schizophrenia midway through his senior year in high school following a 7-month period of deterioration during which his behavior became increasingly inappropriate both at school and at home. Prior to his deterioration, Juan had always been considered somewhat odd by the other children because of his unusual ideas and physical and social awkwardness. Juan had been a low-average student, earning mostly Cs and a few Ds in his courses. He played saxophone in the band and was friends with two other students who were also in the band. After school, Juan worked as a bagger in a small grocery store owned by his parents. Juan's teachers contacted his parents when Juan began wearing unusual combinations of clothing, such as wearing a pair of shorts over his jeans, and failing to bathe on a regular basis. His speech also became more unusual, with his responses littered with rhymes, such as "Let's go to the store, in the door" and made-up words, such as "Don't touch the nikto." His affect also changed and became more inappropriate, with giggling during serious discussions and facial grimacing. Juan's parents brought him to the hospital after he was found playing with his feces in the school bathroom. When the teachers attempted to remove him from the bathroom, Juan shouted at them to leave him alone and not to touch his "masterpieces."

Initial treatment for Juan was followed by an attempt to return him to his home. This led to another episode of disruptive behavior, resulting in his readmission to the hospital. Eventually, Juan was placed in a group home, where he received consistent monitoring and was able to spend a few hours each day working as a dishwasher in a local restaurant. Juan has been in a series of group homes and apartments over the past 5 years. He is typically asked to leave his group home or apartment when his

behavior becomes so inappropriate that the staff or other residents can no longer tolerate him. Juan reports that using his medication "just depends on whether the sun hiccups," leading to an inconsistent and potentially dangerous pattern of medication usage. At this point, Juan has been readmitted to the hospital to stabilize his medicine before he is placed in another group home or apartment.

Dylan and Daryl are identical 29-year-old twins of Caucasian and African American descent. Their childhood and teen years were described as "fairly normal" by their parents, because the boys had a small group of friends and adequate school performance. Both boys showed an early interest in religion and had planned to enter the ministry. However, during their first year at college, Dylan experienced a psychotic break. First, Dylan began skipping his classes to spend more time researching the Knights Templar and the Holy Grail. He believed that the Holy Grail was hidden on campus and that messages were carved into bricks on the campus buildings. Dylan was removed from school after failing the first semester and over the break was hospitalized with a diagnosis of paranoid schizophrenia. He was placed on antipsychotic medications to address his delusions and showed a reduction in his symptoms. However, on returning to college, he discontinued his medication and experienced a relapse. Since the initial relapse, Dylan has experienced four subsequent relapses separated by stays in group homes and apartments. In contrast, Daryl completed his first year of college successfully. During the second year, however, he experienced a psychotic break quite similar in nature to Dylan's. Daryl began spending more and more time locked in his dorm room and refused to eat in the dorm cafeteria. Daryl reported that he had tasted an odd metallic flavor in his food and was convinced that the cafeteria workers were trying to poison him. As weeks passed, he became more unkempt, quit sleeping, and refused to eat any food he had not prepared himself. By the end of the fall semester, it was clear that Daryl was also experiencing paranoid schizophrenia, and his parents admitted him to a psychiatric facility. As in the case of his twin, antipsychotic medications reduced his symptoms, and he was able to return to his college studies. Daryl finished his undergraduate degree in social work, but during his first job he discontinued his medication, leading to a relapse. Hospitalization and medication once again reduced his symptoms, but not as significantly as after the first episode. In the intervening years, Daryl has experienced two subsequent relapses, both related to his decision to discontinue his medication. Before his most recent relapse, Daryl was living in the same apartment facility as his twin, Dylan.

LOGIC OF THE MULTIPLE-BASELINE DESIGN

In Chapter 5, we described the classic withdrawal research design, a powerful and storied strategy for evaluating behavior change in individual subjects in response to

manipulated variables and applied interventions. Because of its strong reliance on intrasubject replication, the withdrawal design allows one to make strong inferences about behavior change, and this may explain the design's exalted status, both in basic laboratory studies and in applied settings. However, such designs become problematic when changes in behavior become permanent and unlikely to return to preintervention or baseline levels, or when removal of a clinical treatment may be ethically questionable. Fortunately, researchers need not despair when deciding against the use of a withdrawal design for ethical or logistical reasons. Confident conclusions about treatment effectiveness can be achieved through the use of **multiple-baseline designs**, in which a single transition from baseline to treatment (AB) is instituted at different times across multiple clients, behaviors, or settings (situations or conditions). Remember that the essential logic of all single-subject designs rests on the ability to replicate the effects of an independent variable or clinical intervention. This replication is simply achieved in a different manner in multiple-baseline designs from that in a withdrawal design.

Multiple Baseline Across Subjects (Clients)

You may recall John Doe from earlier chapters. A corporate executive suffering from obsessive–compulsive disorder, John spends a great deal of time each day washing his hands thoroughly because of a fear of contamination. Suppose that the psychologist working with John wishes to implement a behavioral therapy program for John but is not sure he wants to utilize a withdrawal strategy. This decision might be made either on ethical grounds or because the psychologist believes that once John's behavior changes, treatment removal is unlikely to result in a return of hand washing to its baseline level. The latter scenario is probably most likely in this particular case. It is, after all, the goal of behavior therapy to permanently alter some aspect of a client's functioning, and this is brought about through relatively well-researched and established principles of learning. As you can well appreciate, many skills, once learned, tend to persist in a person's repertoire, often for a lifetime. You possess numerous behavioral skills, such as dressing yourself, reading, cooking, driving, and many others, that you learned probably years ago but continue to rely on daily. In fact, you may not recall with much clarity when and how you learned these skills, but you would be dramatically aware of suddenly losing any one of these capabilities.

The goal of exposing a client to behavior therapy interventions is to produce an important and reliable change in the target behavior that will maintain itself beyond the formal parameters of treatment. One would not expect that these behavioral gains would disappear once treatment was removed. Subsequent to behavior therapy for hand washing, we would anticipate that John Doe may never return to the excessively high rate of hand washing that preceded treatment. Nevertheless, the

psychologist working with John Doe wishes to ensure that any reduction in John Doe's hand washing is the result of the behavioral treatment and not some other uncontrolled variable. Thus, he decides to conduct and evaluate an intervention using a multiple-baseline design. To do this, the psychologist decides to provide the behavioral intervention at different times for John Doe and for two other clients also diagnosed with obsessive–compulsive disorder, Sue and Dave. The study begins with the collection of baseline data from all three clients, as depicted in Figure 6.1. Notice, though, that the baseline phases are of unequal lengths across clients and that the intervention is consequently begun at different times for each client. This staggered or unequal baseline period is what gives the design its name. Indeed, multiple-baseline designs are often referred to as *staggered baseline designs*.

Notice in Figure 6.1 that each client receives the clinical intervention at a different time and that only one phase change, from baseline to treatment, occurs during the study for each client. There is no return to baseline after treatment. Thus, the multiple-baseline design represents a simple AB design, but it is replicated more than once to establish the reliability of the effect. The internal validity of such a design is ensured by the multiple replications of the intervention delivered across subjects, settings, or behaviors.

The design used by the psychologist in the present example is referred to as a **multiple-baseline across subjects (clients) design**. Each transition from baseline to treatment is an opportunity to observe the effects of the treatment, and making this transition at different times allows the researcher to rule out alternative explanations for any behavior change that occurs during treatment. If the phase change from baseline to treatment were instituted at the same time for all three clients, changes in behavior during treatment might prove difficult to interpret. Perhaps some extraneous event happened to coincide with the implementation of treatment and this variable had a comparable influence on all three clients' behavior. However, the likelihood that this variable (e.g., some historical event that impacts the target behavior) happened to occur simultaneously with treatment at different times for each client is extraordinarily low. This is one of the strengths of the multiple-baseline design. If each client's behavior (hand washing or other compulsive behaviors, in this case) remains stable during baseline, changing only with the transition to treatment, then we can be quite confident that the change resulted from the treatment, not from some uncontrolled variable. Thus, the multiple-baseline design, by allowing for several baseline-to-treatment phase changes at different points in time, is a powerful single-subject alternative to the withdrawal design.
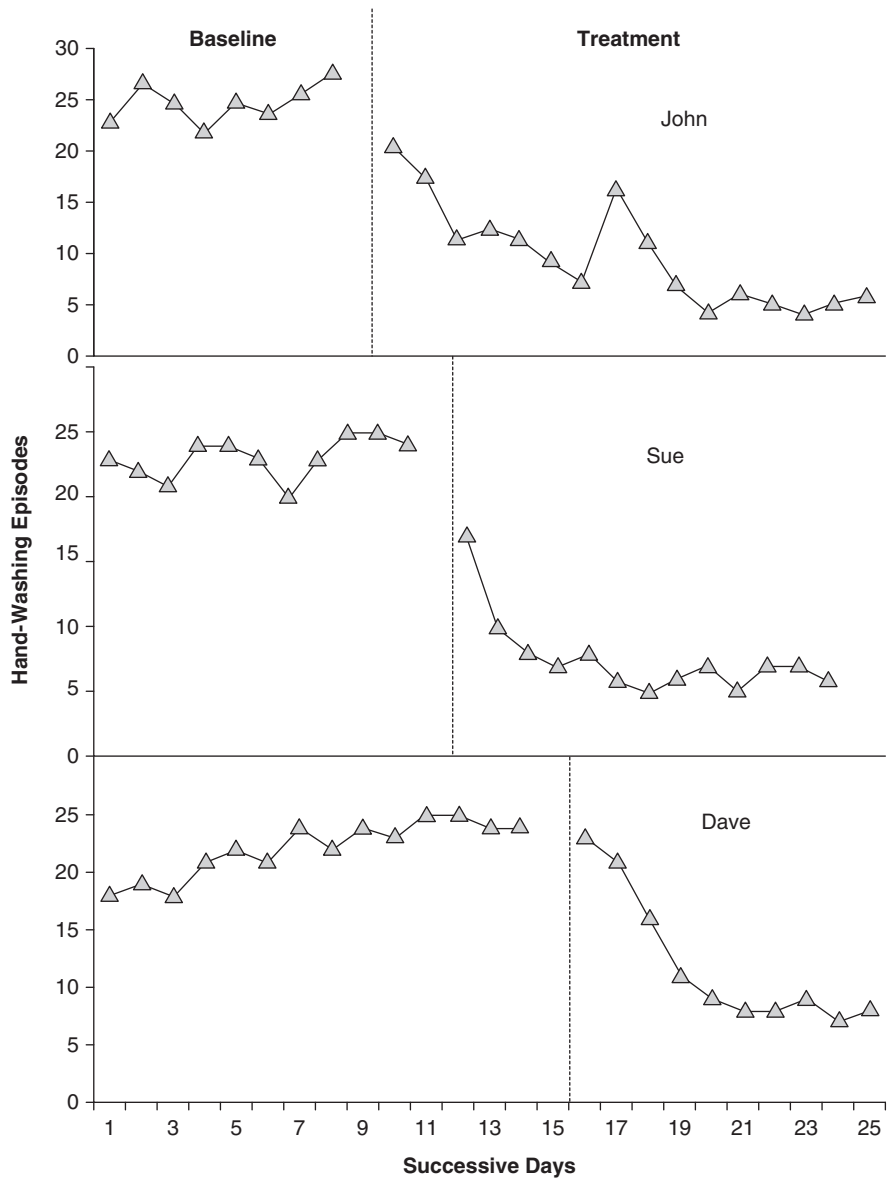
Figure 6.1   Multiple-baseline across subjects

Baseline data play the same comparative role in multiple-baseline designs as they do in withdrawal designs. Consequently, researchers place importance on ensuring a stable or steady-state baseline for each participant in the study. Substantial variability in behavior during baseline, or a trend in the same direction as the intended goal of intervention, proves problematic to the business of drawing conclusions. Such changes do occur on occasion, however, and the likelihood of this happening increases when the study is conducted in institutional settings in which clients have the opportunity to interact. When this is the case, the client receiving intervention first (John Doe, in our case) may undergo a change in behavior that influences in some way the behavior of the other clients, even though the others remain in the baseline condition. This may represent a social learning or modeling effect, and it is not altogether unusual in such settings. Obviously, the researcher would need to be aware of this possibility because it poses consequences for scientific decision making. On the one hand, strong causal inferences are difficult to support when changes in target behaviors occur prior to intervention, meaning that this kind of occurrence could challenge the internal validity of the study. On the other hand, a social modeling effect that might lead to positive changes in the behavior of clients not yet targeted for intervention is a pretty desirable clinical outcome. Such an effect may reduce the need for delivering the intervention individually to every client and takes advantage of the normal kinds of peer influences inherent in social settings. As we have seen before, an applied researcher encountering behavior change in clients who have not yet received intervention but who have interacted with other clients who have, is in the awkward position of having to interpret behavioral data that are both clinically desirable and scientifically ambiguous.

While we are in the process of describing an instance in which the real-world exigencies of clinical treatment have a way of trumping the requirements of scientific rigor and control, another aspect of data presentation seen in Figure 6.1 is in order. In the multiple-baseline study described, the same clinical treatment is being administered to three separate clients suffering from obsessive–compulsive cleanliness, with the intervention being delivered at different times for each client. If you look at Figure 6.1, you will notice that it appears that each measure of the target behavior during baseline occurs at the same time for all three clients, at least during the early stages of the baseline phase, prior to the intervention being delivered to John Doe. In actuality, it is not always the case in practice that subjects are being monitored and their behavior recorded and measured at precisely the same time. Watson and Workman (1981) first made the distinction between **concurrent multiple-baseline designs**, in which simultaneous measurement does occur for all clients, and **nonconcurrent multiple-baseline designs**, when data collection does not occur simultaneously for clients. In the latter case, although clients are monitored and their behavior measured

for differing baseline phase lengths, it is not the case that all clients begin the base-line period at precisely the same time. In fact, it is possible that all of the data for one client are collected, both during baseline and treatment phases, before any data are collected for the remaining clients. Such decisions are often driven by professional and logistic considerations, not pure scientific logic.

Because concurrent measurement controls better for threats to internal validity, such multiple-baseline designs support somewhat stronger inferences than do nonconcurrent designs. Unfortunately, published accounts of multiple-baseline studies seldom clarify whether data collection occurred concurrently or noncon-currently, and the manner in which data have historically been graphed in multiple-baseline designs does not allow for such a distinction to be made (Carr, 2005). Glancing again at Figure 6.1, you would probably assume that all three clients (John, Sue, and Dave) underwent baseline measurement initially at the same time and that the first several data points represent measures taken from each client at the same time on the same day. This is an artifact of the conventional manner of plotting data on a multiple-baseline graph, and it may unwittingly lead the reader to conclude that the study utilized a concurrent multiple-baseline design. As sug-gested earlier, this may very well not be the case in an applied study carried out on clients who have separate lives, family responsibilities, work schedules, and so on. Several authors have argued the merits of nonconcurrent multiple-baseline designs, particularly within applied settings where simultaneous baseline measures may not be feasible (Carr, 2005; Harvey, May, & Kennedy, 2004). However, because of the different inferential strength of concurrent and nonconcurrent designs, these authors recommend that in published reports researchers make clear, in both their descrip-tion of research design and their method of data presentation whether the design rep-resented a concurrent or nonconcurrent multiple-baseline design. We provide an example of how this can be done graphically in the case study description at the end of this chapter.

The multiple-baseline across subjects design is a very common one in clinical settings, particularly in cases where several clients in the same environment exhibit similar medical or behavioral symptoms. By replicating a treatment regimen across several clients, researchers or clinicians can quickly assess treatment effectiveness without worrying about the logistic or ethical concerns attendant to a withdrawal design. Himle, Miltenberger, Flessner, and Gatheridge (2004) used a multiple-baseline design to evaluate the effects of a behavioral skills training program on the gun-play of eight preschool children. Through verbal instruction, modeling of appropriate behavior, rehearsal, and verbal praise for appropriate behavior, the children were taught the following sequence in response to finding a firearm: do not touch the firearm, leave the room immediately, and go tell an adult. During both baseline and intervention phases, target behaviors were scored on a scale that

ranged from 0 to 3, depending on how many of the behaviors in this sequence were performed. A score of 0 indicated that none of the behaviors occurred, and a score of 3 indicated that all three behaviors in the sequence were performed. Children who did not demonstrate the appropriate safety skills (scoring 3 on the target behavior measure) were given additional training until they met the criterion. Finally, a generalization test was done in the children's homes to assess whether the response sequence would occur in more natural environments outside of the original training environment (a room at the child's school).

Figure 6.2 shows the rating scores (0–3) for eight children for baseline, treatment, and additional (*in situ*) training. The figure is instructive because it allows the reader to extract considerable detailed information about the training sequence experienced by each child as well as the results of this intervention. Most of the children, for example, did not perform the trained response sequence consistently during the initial intervention. These children were given additional booster sessions during training, as indicated by the downward arrows on the graph. Also, several of the children required additional (*in situ*) training in which the adult provided corrective feedback and modeled the appropriate behavior. This phase of the study is indicated by the second vertical dotted line for 5 of the 8 children. Finally, generalization tests conducted in the child's home are indicated by closed triangle markers (data points) on the graph, distinguishing these observations from the majority of data collected at the school (closed circles). Clearly, most of the children required additional training on the response sequence to meet the criterion of 3 on the rating score. Figure 6.2 demonstrates the flexibility of single-case graphs in depicting the unique features that often characterize applied interventions. The graph is relatively easy to read and interpret, yet it contains a wealth of specific information regarding not only the details of the treatment phase but also the idiosyncratic responses of the children in both the classroom (training) environment and their home environment.

Apple, Billingsley, and Schwartz (2005) used videotape modeling to help train high-functioning autistic children to offer compliments to one another during social interaction. Autistic individuals often exhibit substantial social deficits, including proper turn-taking, interpersonal sensitivity, and initiating of conversations and/or other social exchanges. The researchers videotaped several segments in which well-liked classroom peers engaged in social exchanges characterized by different kinds of compliment-giving initiations. Each child was exposed to a baseline period of observation, followed by exposure to the videotaped modeling condition. Because the children were not observed to initiate compliments following videotape exposure, a second intervention condition was instituted, in which videotape modeling was again presented but followed by adult reinforcement for initiating compliments in subsequent interactions with peers. Figure 6.3 depicts the number of
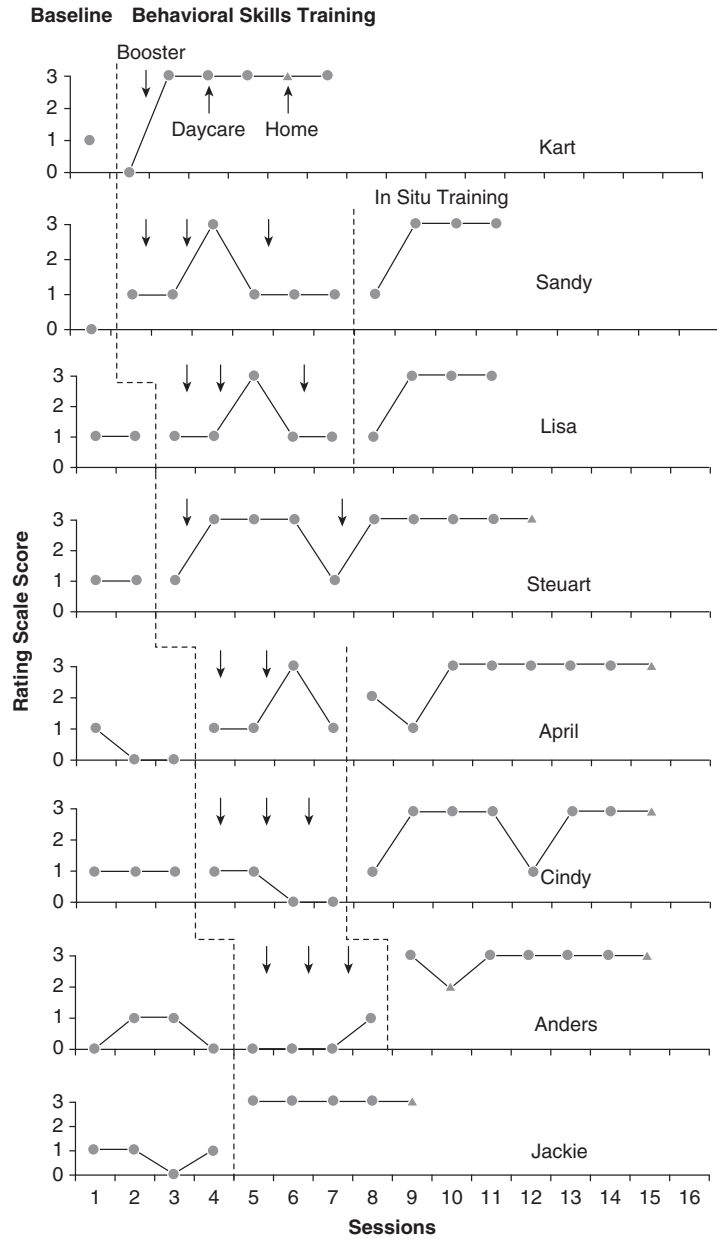
Figure 6.2   Each child's rating scale score during assessments conducted in baseline, behavioral skills training, and *in situ* training (if required) is depicted. The circles represent assessments conducted at the child's preschool, and triangles represent in-home assessments. Downward arrows in the BST condition represent training booster sessions.

Source: From Himle, M. B., Miltenberger, R. G., Flessner, C., & Gatheridge, B. (2004). Reprinted with permission of the Society for the Experimental Analysis of Behavior, Inc.

compliments during 15-minute observation periods for two children both during baseline and subsequent intervention periods. As can be seen, intervention consisted of several phases in which videotape modeling was delivered alone or in combination with reinforcement, followed by a withdrawal of reinforcement in a final phase. Clearly, both children initiated compliments only under the reinforcement condition.

Social competence in autistic children was also the focus of a study conducted by Ingersoll, Dvortcsak, Whalen, and Sikora (2005). Three children with autism-spectrum disorder were exposed to a developmental, social-pragmatic (DSP) language intervention to enhance their rate of spontaneous speech. DSP interventions conceptualize all language as occurring in social contexts, and the interventions focus on enhancing several forms of communication, including turn-taking, initiation of social exchange, and speech episodes. Specific intervention strategies usually include adult prompting of speech, manipulating aspects of the environment to provoke attempts at interaction and speech, and delivery of natural consequences for all forms of communication, including speech. In the present study, spontaneous expressive language in three children was observed during baseline conditions and subsequently during DSP treatment. In addition, spontaneous expressive language was observed and recorded during generalization sessions in the presence of each child's parents. As a result of treatment, all three children emitted more spontaneous speech during treatment relative to the baseline phase, with higher speech rates observed in the presence of the therapist during DSP treatment than during the generalization sessions with parents.

INTERIM SUMMARY

All multiple-baseline designs involve the replication of an AB phase change delivered in a staggered fashion over time. The multiple-baseline across subjects design involves delivering the intervention across two or more clients at different points in time. Each replication of the intervention allows one to draw an inference about the internal validity of the intervention because the staggered nature of the replications eliminates alternative explanations for behavior change. In addition, the multiple-baseline across subjects design contributes to the external validity of an intervention by way of its numerous intersubject replications.

MULTIPLE-BASELINE VARIATIONS

In the multiple-baseline across subjects design, the internal validity of the design is assessed through intersubject replication. In addition, you may recall from
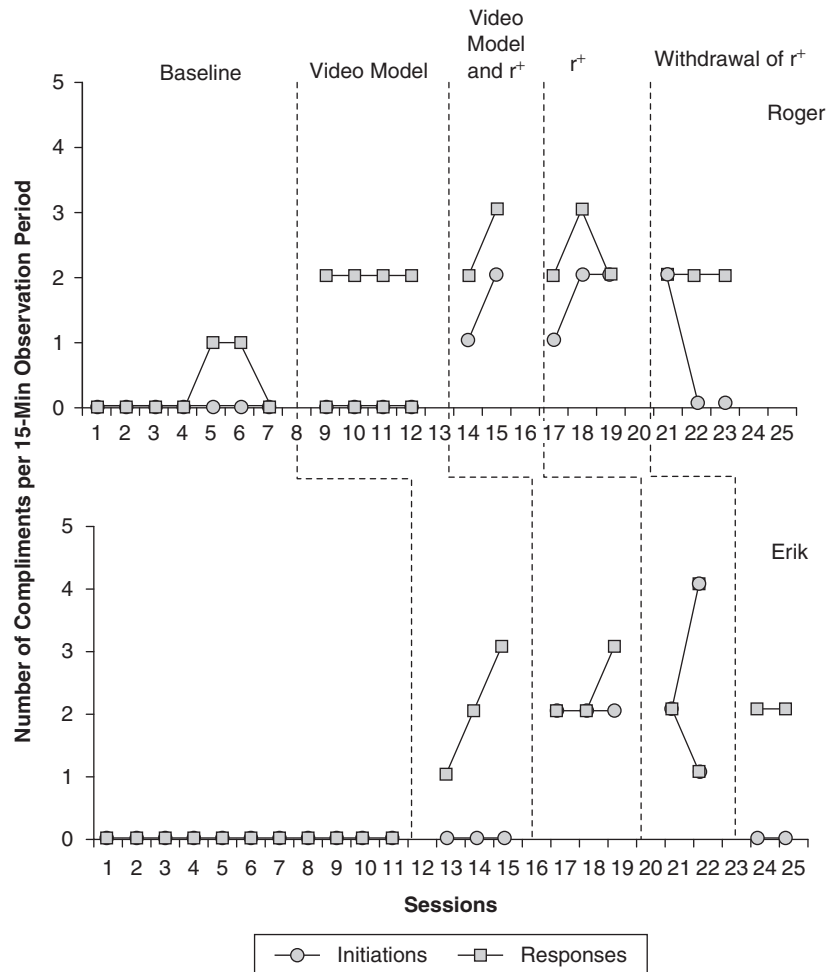
Figure 6.3   Frequency count of compliment-giving initiations and responses per observation period for the participants in Experiment 1

Chapter 4 that intersubject replication is also an important process in establishing the external generality of a research finding. Demonstrating the effects of an intervention across more than one client helps to ensure the general utility of the treatment, a matter that may be of some importance to other clinicians. Because of the relative ease with which interventions can be delivered to individual clients, single-case designs actually excel at establishing external validity through intersubject replication. Large-group designs, on the other hand, are inherently more cumbersome to replicate; thus, such designs tend to approach the external validity

of findings through various sampling strategies designed to increase the sample's representativeness rather than through experimental replication.

Multiple Baseline Across Settings/Situations

In many clinical settings, however, the question of importance is whether an intervention will prove to be effective for a given client across several different environments or settings. In this case, the researcher is primarily interested in demonstrating intrasubject replication, and this is ordinarily done using a **multiple-baseline across settings or situations design**. In a *multiple-baseline across settings* design, behavioral interventions are staggered across different settings or environments that might be encountered by a particular subject or client. Ordinarily, the same behavior is being targeted in each of the environments. Brandon, a 9-year-old diagnosed with attention-deficit disorder, has encountered significant difficulties both at home and at school because of impulsive and disruptive behavior. On the advice of a therapist, a behavioral intervention consisting of time-out and differential reinforcement contingencies is implemented both by Brandon's teachers at school and by his parents at home. Instances of poor impulse control or disruption of the class or family result in 5-minute time-out periods, and periods of appropriate behavior result in receipt of tokens that can be exchanged for special privileges, toys, snacks, and so on.

The behavioral intervention program is implemented in staggered fashion across three different environments: (1) the home classroom and (2) playground at school, and (3) at home. Figure 6.4 depicts the results of the program as carried out in these separate settings. The multiple-baseline across settings utilizes the same logic as do other multiple-baseline designs, with several phase changes from baseline to treatment being the key to establishing the behavioral intervention's effectiveness. Implicit in the multiple-baseline across settings design is the recognition that therapeutic gains that occur only in very few settings are of little use. Although Brandon's teachers would no doubt appreciate reductions in impulsive and disruptive behavior at school, his parents would be understandably disappointed if these changes were not also evident at home. Obviously, if the reverse were true, Brandon's teachers would consider the behavioral intervention less than successful. Of course, certain interventions might be appropriate only in specific environments (e.g., retraining a clerical worker in word processing in the workplace), but many behavior classes prove adaptive across a variety of settings. The multiple-baseline across settings design is particularly well suited to interventions whose objective is to bring about changes in behavior in more than one relevant environment.

Keep in mind that all multiple-baseline designs derive their strength from multiple AB (baseline to treatment) phase changes staggered over time. Each AB phase
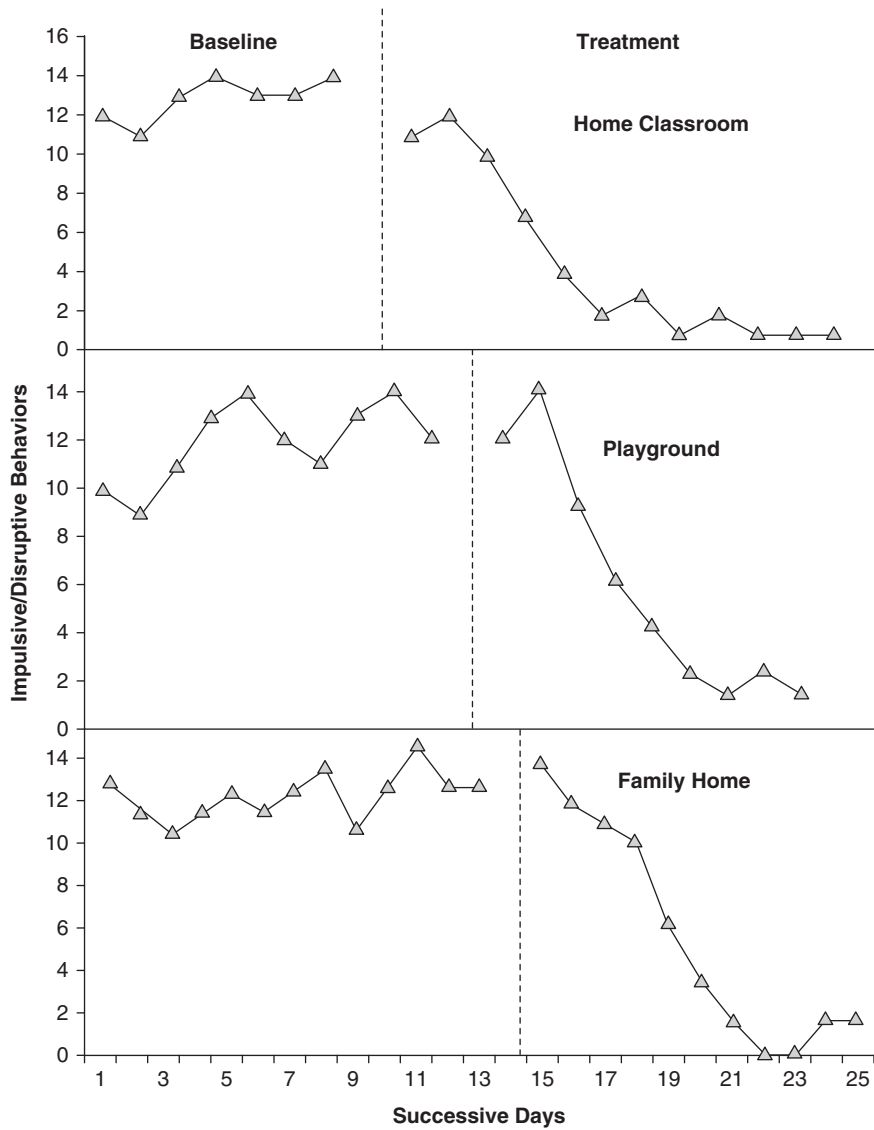
Figure 6.4   Multiple baseline across settings

change beyond the first comprises a replication. Needless to say, the more replications provided within a particular study, the more confident the researcher can be about the effects of the intervention. Most researchers consider two or three separate baseline phases to be the minimum number necessary for strong conclusions because this

allows for one or two replications of the original effect (Kazdin, 1994). Clearly, more baseline phases may be desirable in a given study, although the exact number of replications will likely be determined by practical factors inherent to the clinical setting.

In a study of a multicomponent therapy for musculoskeletal pain, Åsenlöf, Denison, and Lindberg (2005) conducted a multiple-baseline across settings design to assess changes in motor behavior, cognition, and perceived disability in two 49-year-old female patients with a history of chronic pain. The treatment was a complex, seven component program, including identification of goals, self-monitoring, skill acquisition, and response maintenance. Dependent measures included self-reported levels of disability due to pain. Because the treatment was a multicomponent intervention, different aspects of the treatment were added sequentially. For one client, treatment was delivered in staggered fashion across the following situations: purchasing food, making beds, driving, and household chores done by the sink. For the second client, the situations included driving, handling of wheelchairs (a job-related skill), and pony-harness racing, the latter being a preferred recreational activity.

Figure 6.5 depicts data for the client who was evaluated across the situations of purchasing food, making beds, driving, and doing household chores by the sink. Although change in the dependent variable was gradual, reductions in self-rated disability were apparent by the end of Phase B (analysis of basic skills) and increasingly so during Phase C (applied skills and generalization). In addition, the study employed a lengthy follow-up period of 1 year. Self-reported disability was measured at 1, 4, 6, and 12 months after treatment. As can be seen in Phase A_2 of the graph, self-reported pain disability was negligible during the follow-up measurements. Some additional discussion of this study is needed because it differs in some respects from conventional use of a multiple-baseline design. As you can see from the graph, the study involved not one phase change from baseline (A) to treatment (B) but two phase changes during treatment, plus a lengthy follow-up period to assess long-term maintenance of treatment gains. Because the treatment involved multiple cognitive and behavioral components, it was delivered in a sequential fashion, with later stages (Phase C) building on skills first developed in the early treatment stage (Phase B). In addition, the follow-up phase (A_2) can be conceptualized as a withdrawal condition, or return to baseline, because formal components of the treatment were not being actively delivered at this time. As a part of the overall treatment, clients had been taught numerous coping skills for managing potential relapse, and Phase A_2, although containing no direct treatment, was used to assess how well the clients managed their pain disability on their own after treatment. Consequently, this design can be viewed as a combination of a multiple-baseline and a withdrawal

design because it contains features of both designs. As it turns out, this kind of combination of design features is quite common in applied settings and actually contributes to the flexibility of the general family of single-case designs. We will have an opportunity in later chapters to explore some other ways in which the various design features of single-case research can be modified to more effectively meet the needs of applied researchers.

Kay, Harchik, and Luiselli (2006) conducted a multiple-baseline assessment of an intervention for excessive drooling by an autistic student who attended a public high school. The client, a 17-year-old male, had been diagnosed with both autism and mental retardation. He was capable of most self-care behaviors, possessed some reading ability, and was able to communicate well enough to be placed in a normal classroom. Unfortunately, his drooling problem, present since early childhood, proved disruptive to his academic progress (pooled saliva often damaged paperwork) and socialization (classmates avoided interactions with him and refused to sit near him). Because the client's drooling occurred across several locations, a behavioral intervention, consisting of self-monitoring, verbal prompts to wipe his mouth, and reinforcement for having a dry mouth, was delivered sequentially in three separate environments: (1) the classroom, (2) a community vocational setting, and (3) a cooking class.

As can be seen in Figure 6.6, the intervention was delivered at different times in each location, beginning with the classroom and followed by the community site and cooking class, respectively. A reduction in drooling, as measured by the number of saliva pools, is evident in each successive treatment phase. Because the intervention was initially delivered in the classroom, the two subsequent interventions (in the community and cooking class settings) served as two replications of the first phase change. It is clear that baseline levels of drooling in the community and cooking class settings did not change in response to the intervention being delivered in the classroom; however, when intervention was then delivered successively to the community and cooking class settings, corresponding changes in the target behavior occurred. These two replications following the initial intervention serve as controls to possible threats to internal validity. The staggered, or sequential nature of the phase change from baseline to intervention renders alternative explanations for the behavior change untenable.

Multiple Baseline Across Behaviors

Assessing an intervention through a multiple-baseline design does not require the use of multiple subjects or physical environments or settings, only several opportunities to replicate the intervention. The essential logic of the design is applicable as well
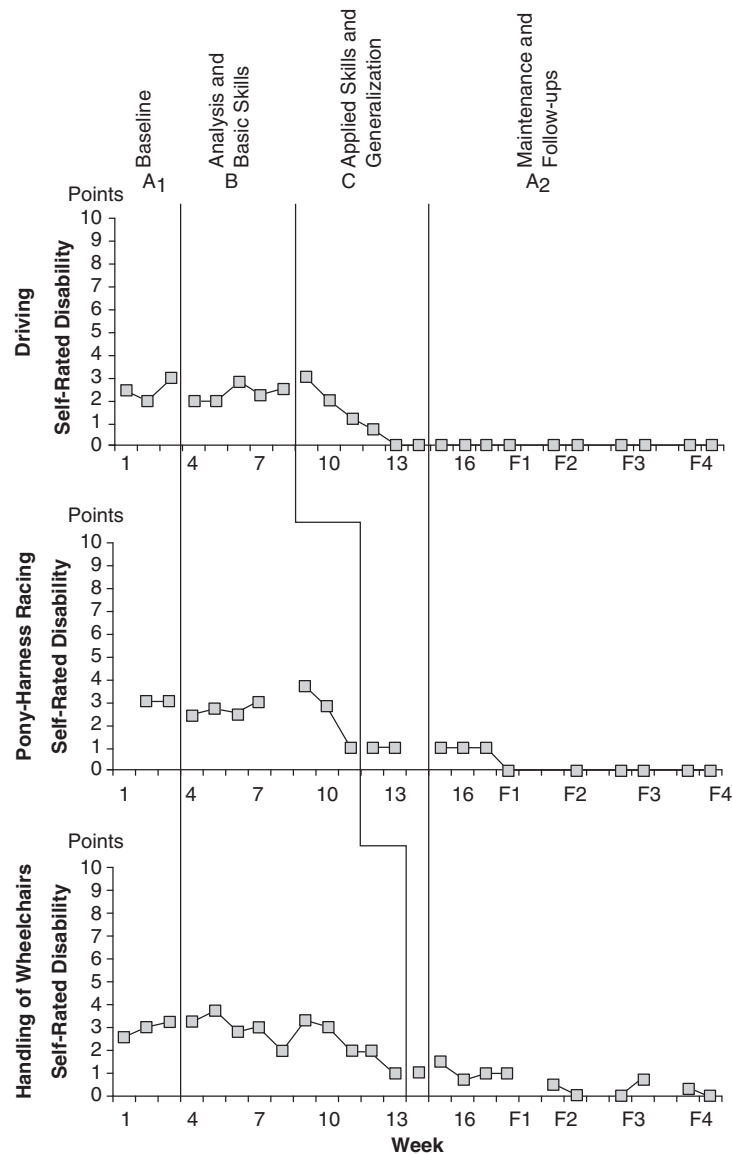
Figure 6.5   Patient 2's self-rated disability related to 3 prioritized behavioral goals (numerical rating scales 0–10, where 0 indicates "no disability"). The goals are presented from top to bottom in the same order as they were targeted in treatment. Weekly average values are displayed for phase A_1 (baseline), phases B and C (intervention), and phase A_2 (i.e., 1-, 4-, 6-, and 12-month follow-up examinations [F1–F-4]). The vertical lines across the graphs, from left to right, show the time of introduction of the different phases of the design.
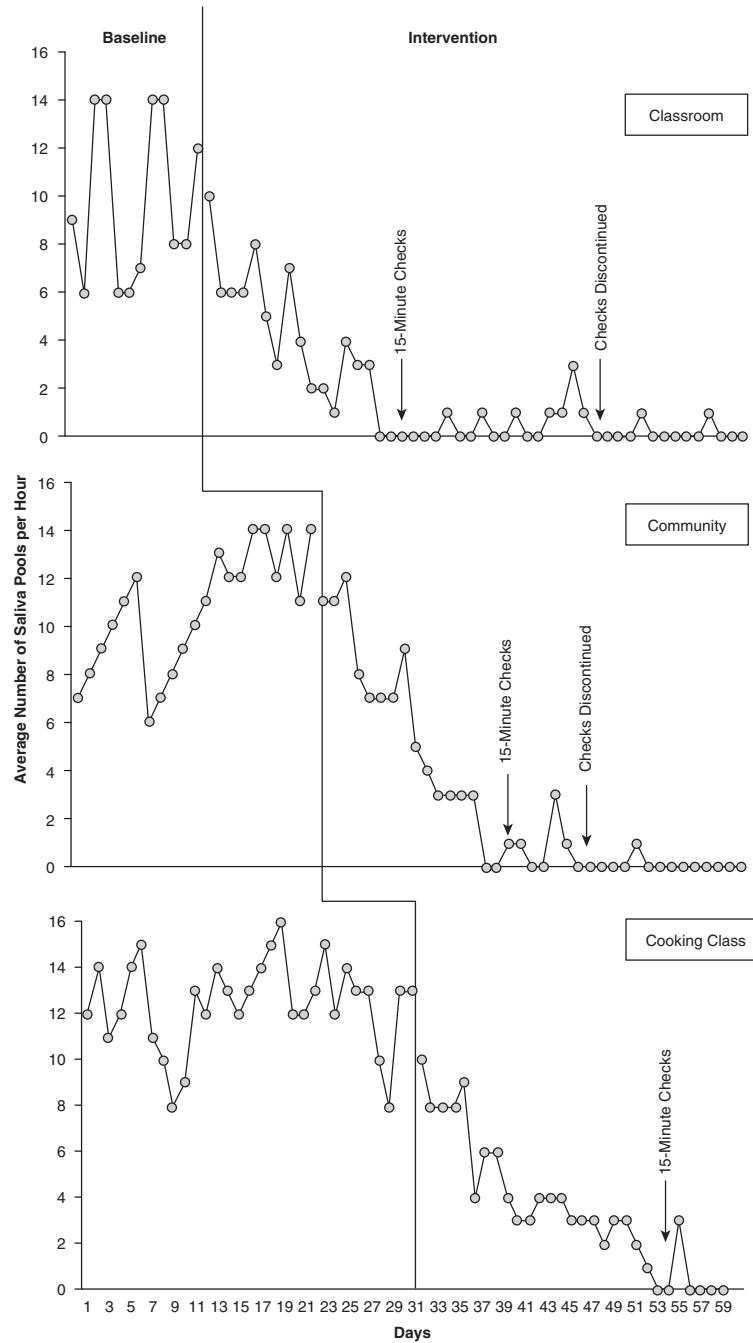
Figure 6.6   Number of saliva pools (average per hour) recorded during baseline and intervention phases

to different collections of responses or different parts of an individual's behavioral repertoire, as in a **multiple-baseline across behaviors** design. Figure 6.7 depicts a multiple-baseline design for Linda, a patient who, after a snowmobiling accident, has remained largely bedridden and inactive. Linda sustained only minor physical injuries from the accident, but family and friends are concerned that her lack of activity will eventually leave her weak, depressed, and unwilling to resume normal activities. Prior to the accident, Linda was a healthy and very active adult, engaging in numerous out-door activities. Among the objectives of the intervention is to encourage Linda to engage in different forms of exercise, each strengthening a different group of muscles or enhancing cardiovascular fitness.

Linda's physical therapist decides to monitor three types of exercise prior to implementing the exercise intervention: walking, lifting, and stretching. Walking is targeted because it is a relatively simple behavior in which Linda does engage to some degree (if only to go to the restroom or the kitchen). Lifting, which may con-sist of simply picking up clothes, books, and other items in the house, is targeted because of its benefits to the muscles of the arms and legs and because many every-day activities require lifting various objects. Finally, stretching is important because muscles that are not used tend to lose their elasticity and become more vulnerable to injury. As with any other single-subject design, the therapist begins by collecting baseline data on each of these separate behaviors. These data are depicted in the first panel of each section of the graph. As you can see, Linda engaged in very little phys-ical activity during the baseline phase. The physical therapist implemented the first intervention phase for the behavior of walking. The other two behaviors continued in baseline without intervention. After a period of several days, the intervention was then applied to the second behavior, lifting. Finally, the intervention was applied sev-eral days later to the last behavior, stretching.

In a multiple-baseline across behaviors design, replications of the intervention occur for the same subject or client but across different behaviors or dimensions of behavior. This means, of course, that each targeted behavior must be objectively defined and its dimensions and properties clearly designated for purposes of mea-surement. Also, as with other multiple-baseline designs, it is not unusual to observe some carryover of the intervention from one behavior to the next, resulting in noticeable trends in behaviors not yet being formally targeted for intervention. You can see in Figure 6.7, for example, that baseline data for lifting seem to be drifting upward near the end of the baseline period. Because this upward trend corresponds to the intervention phase for walking, this increase in lifting may represent a phe-nomenon known as **behavioral covariation**, in which responses that are function-ally similar to target behaviors undergoing treatment exhibit similar changes (Parrish, Cataldo, Kolko, Neef, & Egel, 1986; Sprague & Horner, 1992). For
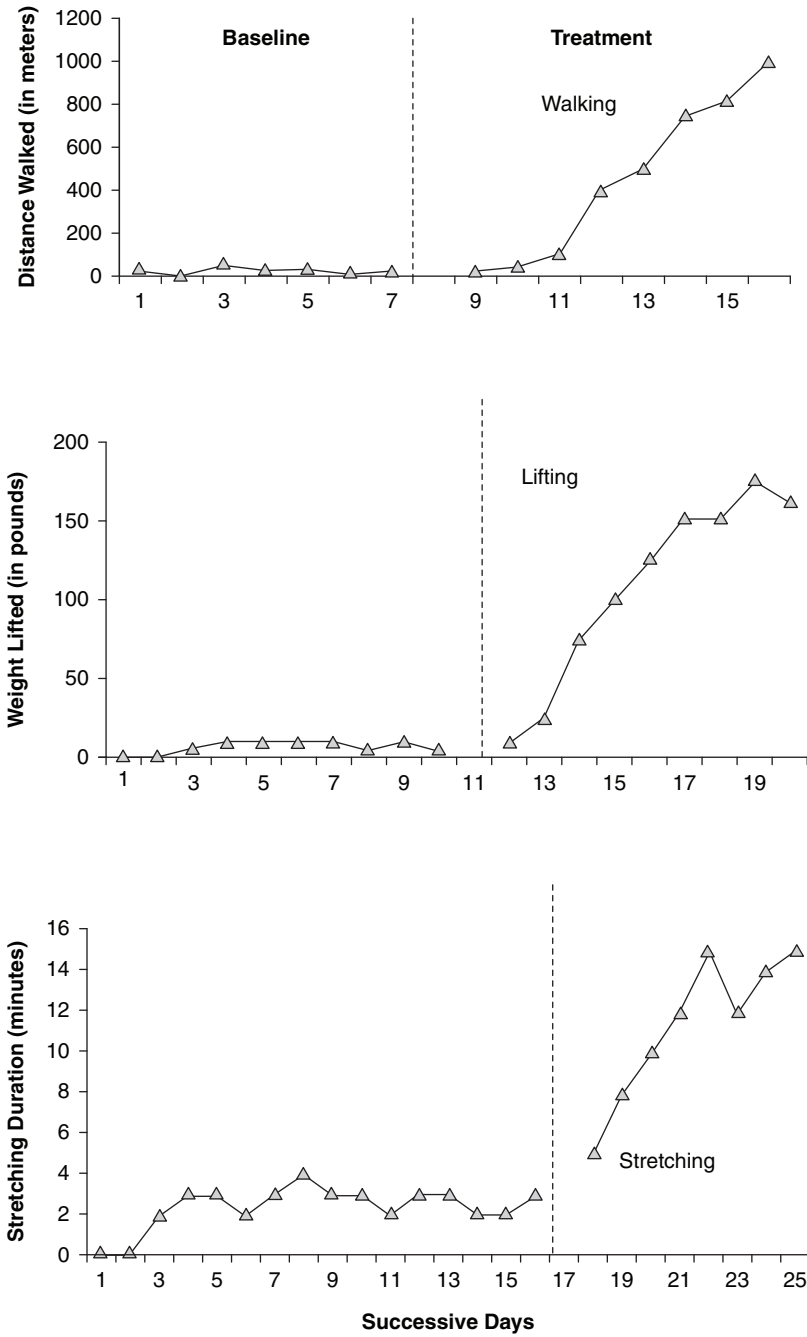
Figure 6.7   Multiple baseline across behaviors

instance, Ludwig and Geller (1991) observed that pizza delivery drivers, whose seat-belt use had been explicitly targeted for change, also were observed to increase their use of turn signals while driving, despite the fact that turn-signal use had not been targeted for change.

When dealing with several different client behaviors, or response dimensions, there is always the possibility that these separate dimensions or behaviors will inter-act or influence one another in complex ways. These interactions, although posing some difficulty for interpreting the effects of an intervention, can also prove clini-cally useful. Rosales-Ruiz and Baer (1997) suggested the phrase **behavioral cusp** to refer to changes in behavior that produce unintended, but potentially important, consequences. In the current example, enhancing Linda's ambulatory activity brings her into contact with a much larger and complex environment than she would experience if she remained bedridden. Thus, walking has many attendant consequences, only some of which may be foreseen by therapists in designing spe-cific treatment programs. In the case of Linda, lifting may occur more frequently during the walking intervention because her enhanced mobility brings her into greater contact with physical objects in her environment and the daily routines that normally occur in her environment. Once again, such an occurrence may be some-what frustrating to the researcher, but it is good news to the clinician. An interven-tion that brings about change not only in a specified target behavior but also in other, related behaviors—such as other forms of exercise—is in most cases regarded quite positively. At least in the present case, this behavioral cusp leads to a general increase in physical activity for Linda, without the necessity of targeting each behavior for treatment. In many cases, then, behavioral cusps are a desirable, though unplanned, by-product of intervention, even though, in multiple-baseline designs like this one, they may cast some doubt on cause-and-effect conclusions. Bosch and Fuqua (2001) posited that therapists should more proactively consider potential behavioral cusps when developing treatment programs. Smith, McDougall, and Edelen-Smith (2006) liken behavioral cusps to *killer applications* from the business world (e.g., Microsoft Windows obliterating DOS) and noted that behavioral cusps "produce transformational changes—changes that render prior repertoires obsolete" (p. 224).

Shabani, Wilder, and Flood (2001) used a multiple-baseline across behaviors design to evaluate a behavioral intervention for stereotypic rocking in a 12-year-old boy with multiple diagnoses, including autism and mental retardation. The boy, Larry, engaged in frequent and severe rocking motions in both solitary and social circumstances and across a broad array of environmental settings. Because the rocking behavior was observed to occur regardless of whether the boy was standing or sitting at a desk, the researchers delivered the behavioral intervention separately to each of these behaviors. The boy was first taught explicitly to moni-

tor his own behavior and to identify instances of both appropriate (not rocking) and inappropriate (rocking) behavior. Once effective discrimination was taught, a differential reinforcement of other behavior (DRO) procedure was implemented. In a DRO procedure, reinforcers can be obtained by engaging in behaviors other than those that are deemed inappropriate or undesirable. During the DRO procedure, the boy could receive access to preferred stimuli (reinforcers such as snack foods, videos, and Gatorade) if rocking had not occurred for a specified period of time. The length of this DRO requirement was gradually increased until the boy could abstain from rocking for 5 minutes.

Figure 6.8 depicts the results of the intervention for both standing and sitting. The final phase of the intervention involved a *thinning* of the DRO, meaning that the child had to abstain from rocking for longer periods in order to receive access to reinforcers (preferred stimuli). Not only was intervention effective in both the standing and sitting conditions, but the boy was also able to abstain from rocking for longer periods throughout the thinning phase of the study.

A multiple-baseline across behaviors design was also used by Johnson, McDonnell, Holzwarth, and Hunter (2004) to assess the effects of embedded instruction on academic achievement in three children with developmental disability who were enrolled in general education classes. *Embedded instruction* involves the teaching of student-specific academic skills within the context of normally programmed academic units or activities. The particular target skill or skills taught to an individual student are idiosyncratic and based on that student's individualized education program. Johnson et al. (2004) evaluated the use of embedded instruction for three students: two girls (8 and 9 years of age, respectively) and one 7-year-old boy. Because each child's individualized education program indicated different intervention objectives, the embedded instruction occurred across varying academic units and their respective behavioral targets. For instance, Wendy's embedded instruction occurred across three academic units: (1) Plants, (2) Insects and Spiders, and (3) Anatomy. Chuck's embedded instruction entailed identification of sight words chosen from a first-grade reading curriculum, and Brenda, who exhibited very little expressive language, was taught to make specific requests through the use of the Communication Builder, an electronic instrument containing pictorial icons that, when touched, produced a vocal request.

Figures 6.9a, 6.9b, and 6.9c show the results of the embedded-instruction intervention across the relevant academic behaviors for each child. It is clear that the embedded instruction was effective in increasing academic performance in all three children and across each target behavior category. Moreover, the last panel of each figure demonstrates that treatment gains appear to have been maintained beyond intervention, although not all target behaviors were assessed for maintenance for Wendy and Brenda. Finally, Johnson et al. (2004) collected **social validity data** from the
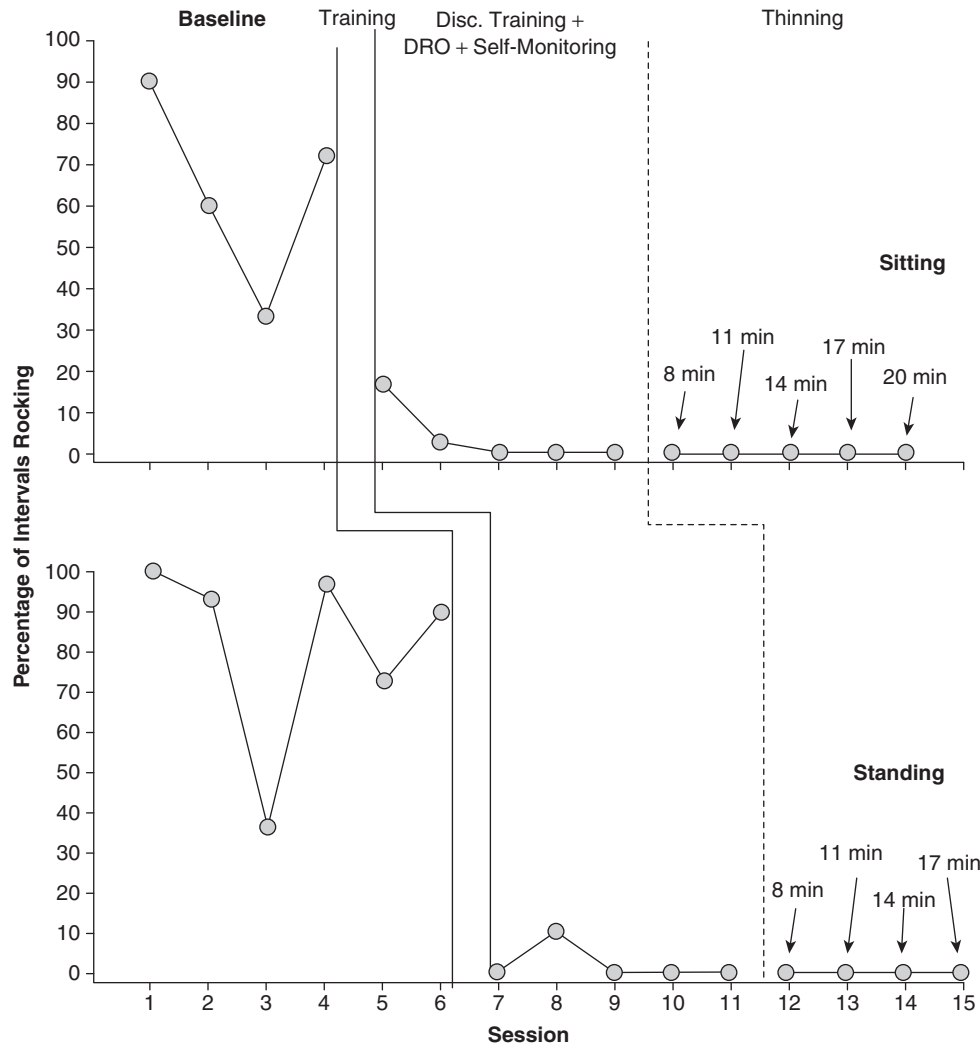
Figure 6.8   Percentage of intervals in which rocking occurred while Larry was sitting and reading a book (top) and standing and talking with the therapist (bottom) across baseline, training, intervention (i.e., discrimination training, DRO, and self-monitoring), and thinning phases

instructors in the form of a questionnaire that measured perceptions of effectiveness, costliness, and likelihood of implementation of embedded instruction in the future. In general, these ratings suggested that the instructors and paraprofessionals perceived embedded instruction as an effective and appropriate intervention for the
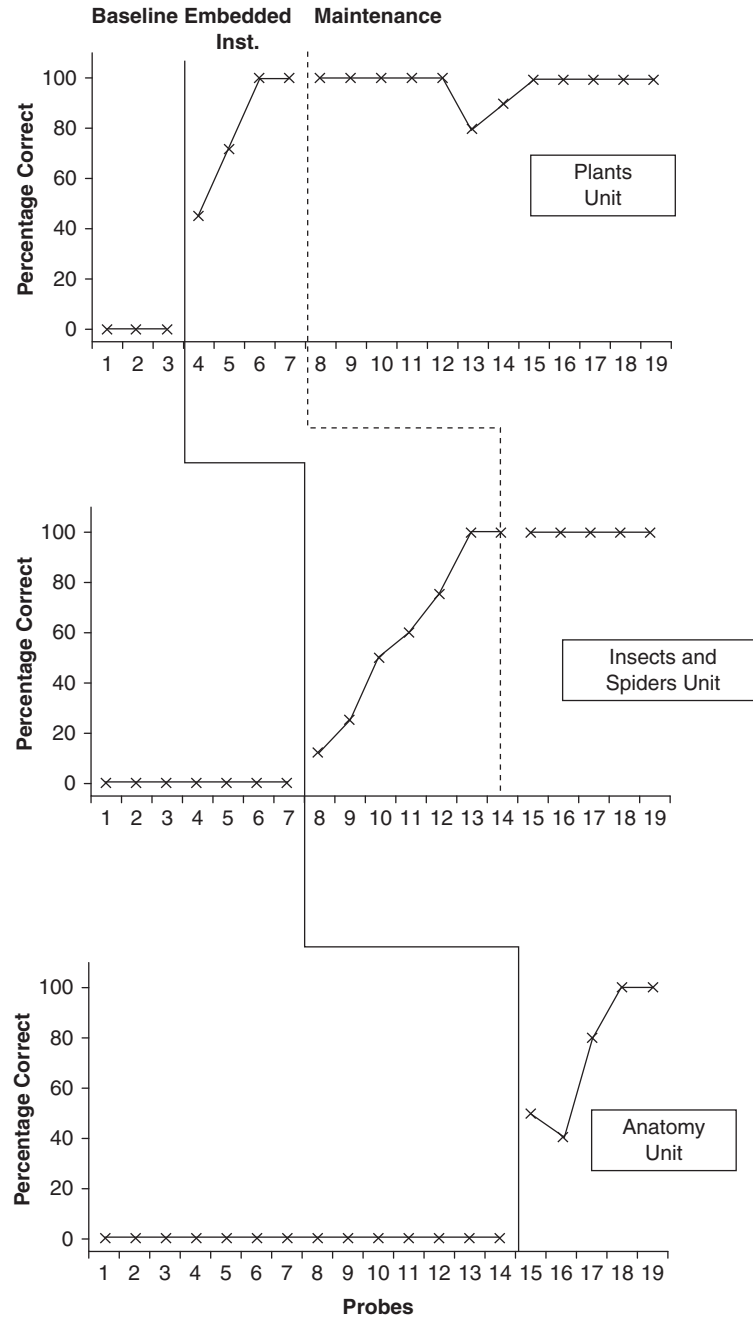
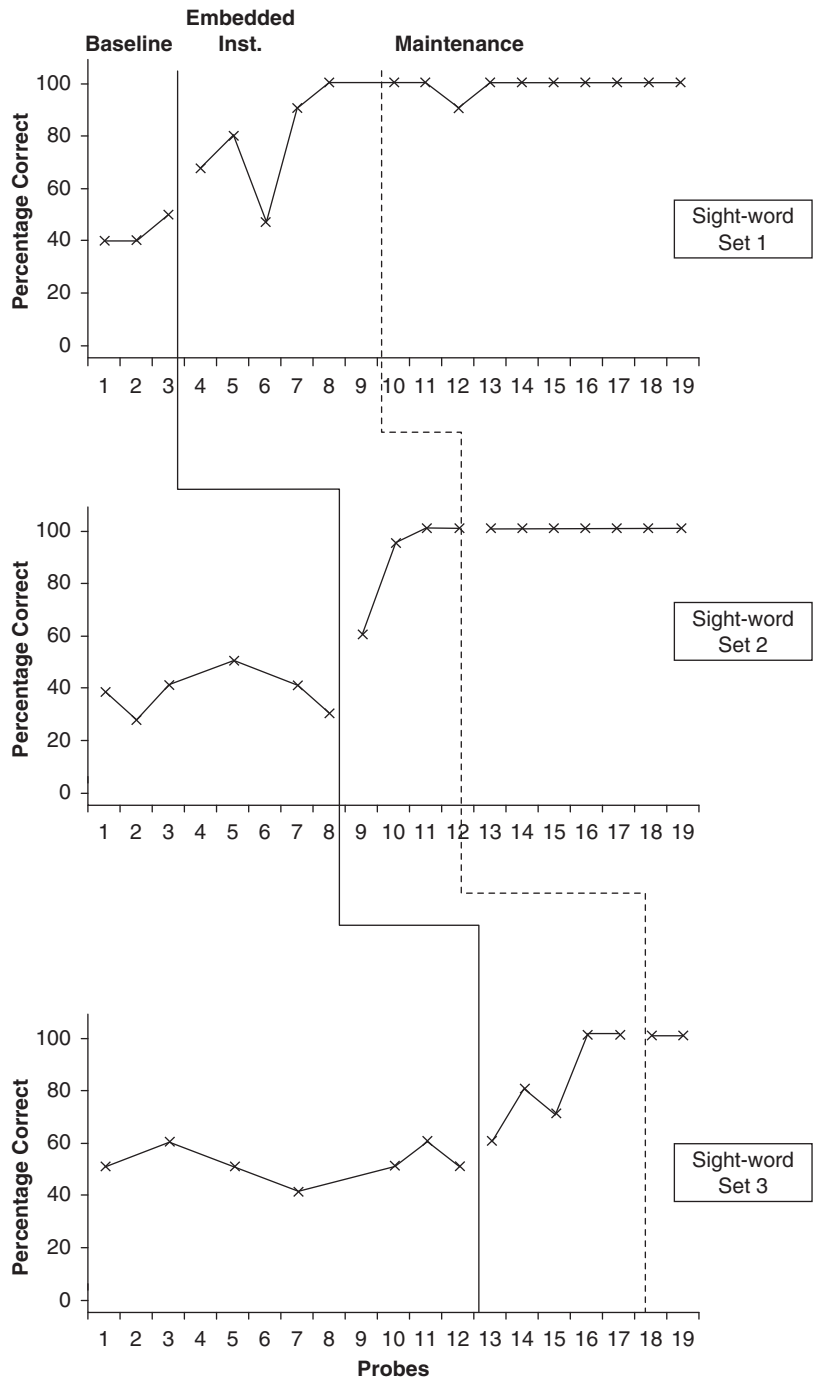**Figure 6.9a**   Percentage correct during testing probes for Wendy

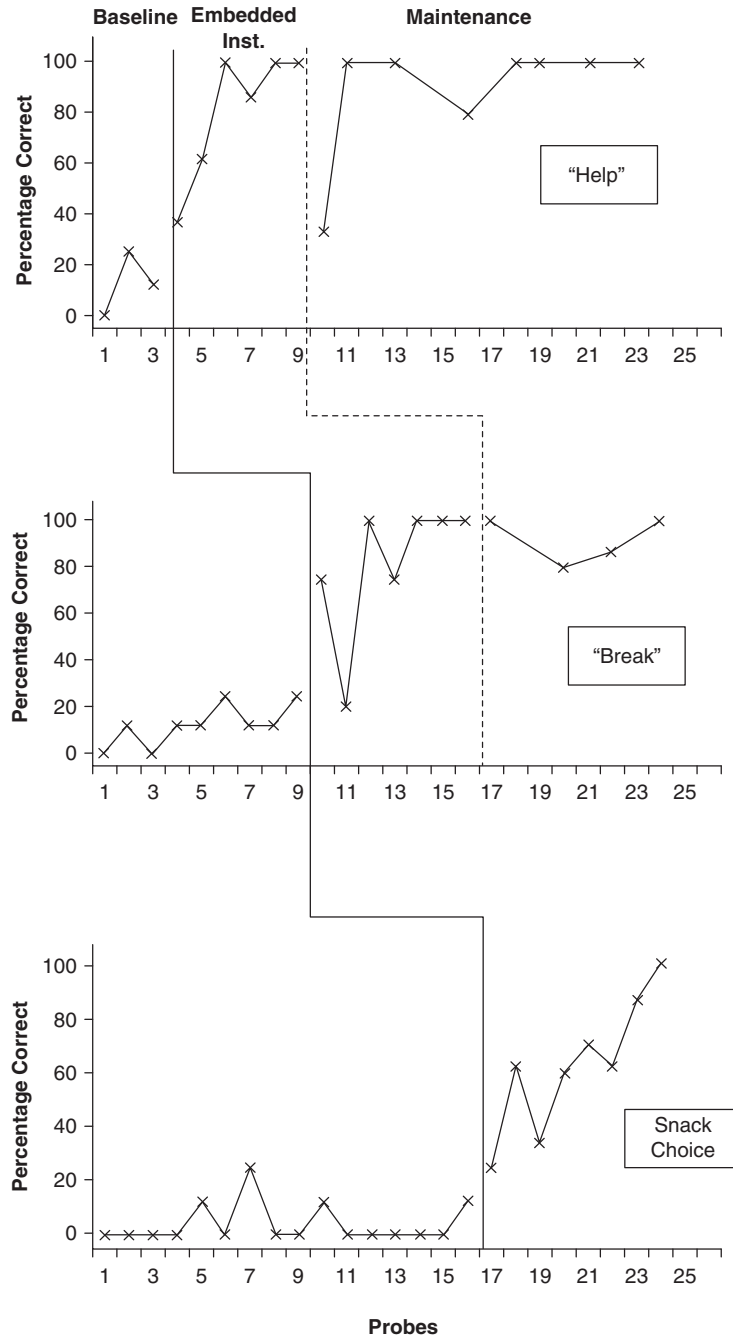**Figure 6.9b**   Percentage correct during testing probes for Chuck

Figure 6.9c   Percentage correct during testing probes for Brenda

three children. The use of social validation assessment is a particularly admirable aspect of the study. Although such data are seldom reported by researchers, their collection and use have been recommended by applied behavior analysts as an important adjunct to the analysis and interpretation of single-case data (Carr, Austin, Britton, Kellum, & Bailey, 1999; Kennedy, 2002; McDougall, Skouge, Farrell, & Hoff, 2006; Schwartz & Baer, 1991; Wolf, 1978).

Multiple-Probe Designs

The multiple-baseline design is a frequently utilized single-case strategy for applied researchers who wish to evaluate the effectiveness of an intervention likely to produce irreversible changes in behavior, or when withdrawing the intervention would be unethical. However, even the multiple-baseline design, as user friendly as it tends to be for applied researchers, must often be adapted to real-world circumstances that complicate the conventions of scientific measurement. For example, because multiple-baseline designs involve several (usually at least three) separate baselines, with interventions being delivered at staggered intervals, baseline phases tend to become progressively longer over the course of the study. Thus, the practical and ethical concerns regarding long baseline phases, although not unusual in other single-case designs, such as withdrawal designs, become especially relevant in multiple-baseline designs. In many clinical settings it is simply not feasible to obtain numerous measures of the target behavior over prolonged baseline phases.

Another complication that may render conventional baseline measurement irrelevant is that the target behavior may not exist in the client's repertoire. In essence, such a behavior has a zero level of occurrence, and it is consequently meaningless, and perhaps ethically questionable, to submit the client to repeated assessment under such conditions. For example, suppose a parent begins a program to teach a child with a developmental disability important self-care activities, such as tooth brushing. If, prior to the formal intervention, the child has never been observed to brush his or her teeth independently, then this target behavior has zero level of occurrence. Although a prolonged baseline phase of, say, 2 weeks, could be conducted, with daily measures of tooth brushing, the resulting data would be of questionable utility because the behavior has not yet been acquired by the child. Repeated measurements of the target behavior would have no value to the parent and would likely produce only frustration on the part of the child.

Under such circumstances, researchers are likely to opt for an adaptation of the conventional multiple-baseline design called a **multiple-probe design** (Horner & Baer, 1978). In such a study, assessment of baseline levels of the target behavior would likely entail quick probes, rather than repeated, or continuous, monitoring of

the behavior. A *probe* is a single, discrete measurement of a target behavior, often conducted at random, or at least not according to any predetermined time, in order to rapidly establish the natural rate of the behavior before intervention. In the case of a behavior that has not yet been established in a client's repertoire or behavior that may show extreme reactivity, one or two simple probes may serve quite adequately as baseline evaluations of the behavior. Thus the intervention can be delivered with less delay, and data obtained during treatment can still be reasonably compared with the levels of behavior obtained through the preintervention probe measures. In addition, researchers sometimes utilize probes to assess the long-term maintenance of behavior change following intervention phases. Once a program has effectively led to consistent tooth brushing in the child in the previously described scenario, discrete probes may occur at monthly intervals in order to assess the program's effectiveness over time. Such probes are rapid and are easily conducted follow-up measures, not continuous or repeated measures, which would likely prove more effort intensive or obtrusive.

Because of the ease with which they can be implemented and their fit to the real world exigencies of clinical practice, multiple-probe designs are commonly employed by applied scientists. Mandel, Bigelow, and Lutzker (1998) used a videotape program to help parents previously reported for child abuse and/or neglect to identify and remove safety hazards in the home. Hazards were identified using the Home Accident Potential Inventory—Revised (HAPI–R) (Tertinger, Greene, & Lutzker, 1984). Because of the sensitive nature of the study and the considerable time (approximately 45 minutes) needed to conduct assessment of the home with the HAPI–R, repeated baseline measurement was considered impractical. Consequently, a limited number of assessments were conducted during baseline (four to seven), and these were separated by intervals of several weeks. In addition, assessment of hazards occurred across different rooms in the house (e.g., kitchen, bathroom, bedroom, living room), and not all rooms were assessed during each home visit by the research assistants. Thus, baseline measurement consisted of probes rather than repeated or continuous monitoring. The intervention consisted of a series of four 10-minute videotapes demonstrating ways to improve safety in the home, and parents were required to watch the tapes in the presence of research assistants. For both families, the number of observed hazards in each room decreased after the videotape treatment. Follow-up probes were taken at 1 and 4 months after the intervention. Because one family experienced increases in safety hazards that approached baseline levels during these probes, a reintroduction of the intervention was conducted.

Padgett, Strickland, and Coles (2006) used a multiple-probe design to evaluate the effects of a virtual reality computer game on fire safety skills of five children

with fetal alcohol syndrome. Because none of the children could describe any appropriate behaviors in response to fire prior to the program, prolonged baseline assessment was deemed unnecessary. The virtual reality computer program demonstrated appropriate responses to fire in real-world environments, and all children demonstrated mastery of these steps after completing the program and at a 1-week follow-up assessment. Moreover, the follow-up probe occurred in a natural environment, suggesting that the acquired skills had generalized beyond the initial training environment.

Marshall, Capilouto, and McBride (2007) used a multiple-probe design across participants to evaluate improvement in problem solving among patients with Alzheimer's disease. Problem solving was measured using the Rapid Assessment of Problem Solving Test (Marshall, Karow, Morelli, Iden, & Dixon, 2003), which requires respondents to ask yes/no questions in order to target a picture embedded in an array of distracter pictures. Baseline probe measurement indicated that many of the patients were inefficient in solving this problem, simply guessing at the correct picture. Patients were then taught how to ask yes/no ("constraint") questions in order to identify the correct picture quickly and were taught that this strategy was more successful than simply guessing at the correct picture. After intervention, all patients demonstrated an ability to ask appropriate constraint questions when given word problems that were similar to those used on the Rapid Assessment of Problem Solving Test. In addition, follow-up probes at 2 and 4 weeks indicated that patients maintained the high rates of effective problem solving that resulted from the intervention.

INTERIM SUMMARY

Both the multiple-baseline across settings/situations design and the multiple-baseline across behaviors design allow for replication of an AB phase change within the same subject or client. Thus, these designs involve an intrasubject replication of an intervention and allow one to assess whether a clinical intervention leads to important change in more than one environment or for more than one target behavior. Behavioral covariation can occur in multiple-baseline designs because intervening in one client, behavior, or setting may carry over to nontargeted clients, behaviors, or settings. Although such carryover can prove problematic to drawing causal inferences, its benefits to adaptive functioning may be numerous and in the special case of behavioral cusps can influence in dynamic and transformational ways other aspects of the client's behavioral repertoire. The multiple-probe design represents a special adaptation of the multiple-baseline design, in which brief, discrete measures of the target behavior substitute for the longer, repeated measures ordinarily

utilized in single-case designs. These probes are often used to assess baseline levels of behavior when the relevant target behavior is known not to exist in the subject or client's repertoire, thus avoiding the need for unnecessary repeated assessment. Probes are also frequently used to assess long-term maintenance of behavior change following interventions.

THE CASE OF JUAN, DYLAN, AND DARYL

It is likely that no other disorder conjures the label of "madness" more clearly than schizophrenia. This devastating disorder affects approximately 2.2 million American adults, or about 1.1% of the population over the age of 18. Schizophrenia is known as a "thought disorder" that interferes with a person's ability to think clearly, to distinguish reality from fantasy, to make decisions, to manage emotions, and to interact with others. The first signs of schizophrenia typically occur during the teenage years or in one's early 20s. Unfortunately, the younger the person is when the symptoms begin, the worse his or her long-term prognosis. Most people diagnosed with schizophrenia suffer chronically or episodically throughout their lives. Even between episodes of active psychosis, lost opportunities for careers and relationships, stigma, residual or negative symptoms, and medication side effects often impact those who have been diagnosed with schizophrenia. Consistently, reports indicate that 10% of people who suffer from schizophrenia eventually commit suicide (Siris, 2001).

Despite common depictions in the media, a person suffering from schizophrenia does not have a "split personality." A "split personality" is formally diagnosed as *dissociative identity disorder* (American Psychiatric Association, 1994. Schizophrenia encompasses two broad categories of symptoms: (1) *positive symptoms*, which represent excesses of behavior, and (2) *negative symptoms*, which represent deficits in behavior. Positive symptoms include hallucinations (false sensory experiences); delusions (false personal beliefs that are sustained despite evidence to the contrary) that may be bizarre or implausible in nature; disorganized speech and thought characterized by incoherence, tangential speech, neologisms (made-up words), clanging (rhyming), or perseveration; and grossly disorganized behavior that may vary from childlike silliness to agitation to complete catatonia or marked decrease in reactivity to the environment. Negative symptoms may include a decrease or absence of emotional expressiveness, eye contact, and body language; *alogia*, or reduction in speech; and *avolition*, or an inability to initiate and persist in goal-directed activities. Interestingly, the positive symptoms are more amenable to current medications than the negative symptoms.

Although the specific causes of schizophrenia are still unknown, it is clear that both biological and early environmental factors lead to changes in the brains of individuals who exhibit the characteristic symptoms of schizophrenia. Treatment includes medications, increasing the structure of the environment, and reducing the emotional expressiveness, particularly in relation to hostile emotions, of people who interact with these individuals. This three-pronged approach seems to hold the best promise of reducing the positive symptoms and managing the negative symptoms to allow the individual to experience the most functional life possible. Unfortunately, because of medication side effects, disorganized thinking on the part of the individual experiencing schizophrenia, and beliefs that the medications are no longer working, many individuals, such as Juan, Dylan, and Daryl, do not take their medication as prescribed. This leads, as it has for Juan, Dylan, and Daryl, to both medical complications and social effects. To successfully manage cases such as the ones described here, many professionals will be involved, including psychiatrists, psychiatric nurses, clinical psychologists, social workers, and perhaps an occupational therapist. In the present case, we explore Juan's, Dylan's, and Daryl's case from the perspective of a clinical psychologist and a social worker.

A Clinical Psychologist's Perspective

First-generation antipsychotic medications, such as Thorazine and Haldol, which block the action of dopamine, have been found to work best for positive symptoms. Unfortunately, these medications have been found to have adverse side effects. Because of these problems, second-generation antipsychotic medications, such as clozapine (Clozaril), Risperdal, Zyprexa, Seroquel, Geodon, and Abilify were developed beginning in the 1980s. These medications are believed to decrease both positive and negative symptoms and produce fewer adverse side effects.

From the perspective of the individual being asked to take these medications, there are several problems. First, not all patients benefit, and those who do benefit may show only a reduction in symptoms rather than an alleviation of symptoms. Second, these medications are fairly expensive, leading some families to discontinue the medication. In addition, side effects may lead to discontinuation of the medicine altogether. The psychological impact of taking these medications may also be such that patients would rather take their chances without the medication. Finally, in cases such as Juan's, where there is significant disorganized thinking, the symptoms of the disorder lead to poor decision making on the part of the individual. Obviously, when Juan reports that he takes his medication depending on "whether the sun hiccups," it becomes clear that medication adherence is a major issue.

Compliance is of particular importance in psychiatric disorders. It has been estimated that as many as 50% of patients do not take their medications as prescribed.

For those suffering from schizophrenia, this percentage rises as high as 60% to 75% (Misdrahi, Llorca, Lancon, & Bayle, 2002; Weiden & Zygmunt, 1997). For Juan, Dylan, and Daryl, maintaining a consistent pattern of medication usage, as pre-scribed by their psychiatrist, is critical for their physical health and for reducing the strong positive symptoms of schizophrenia that they experience. With each subse-quent relapse, Juan's, Dylan's and Daryl's prognosis for a functional life decreases (Shepherd, Watt, Falloon, & Smeeton, 1989). Without the medication, Juan's symptoms lead to so much disruption that he is deemed an in-appropriate can-didate for the group home and ends up back on the street. For Dylan and Daryl, the nature of their delusions makes it difficult for them to function successfully. The current hospitalization, then, has two main goals for each of the men: (1) finding a medication that reduces their symptoms while presenting a minimal number of side effects and (2) helping each man to be more compliant with his medication regimen.

Risperidone, a second-generation antipsychotic drug, was chosen for use with each man. This drug has been shown to be effective in reducing positive symptoms of schizophrenia and for creating few extrapyramidal side effects (Song, 1997). As a result, Juan was started on a regimen of 4 mg of risperidone daily, eventually being stabilized at 6 mg of risperidone daily. Both Dylan and Daryl were able to be stabi-lized on a regimen of 4 mg of risperidone daily. Once the men were stabilized, the clinical psychologist began work with each man on adherence to the medication reg-imen after being released from the hospital. When released, Juan will be placed in an apartment for men with psychiatric disorders, at the request of his parents. Dylan's and Daryl's parents have chosen the same facility for their sons. Men living in this apartment complex are visited once a week by a social worker. Given that the social worker will meet with the men once a week, the clinical psychologist and the social worker decided to work together to facilitate compliance. No staff members, other than an apartment manager, live at the apartment complex, making it critical that the men comply with their medication with minimal assistance.

A Social Worker's Perspective

From the perspective of a social worker, the responsibilities associated with a patient diagnosed as schizophrenic may be numerous. First, upon the initial diag-nosis, the social worker will need to establish a relationship with the family or sig-nificant other to formulate a psychosocial assessment. A social worker may also work with the family to help them understand and cope with their family member's schizophrenia. This may involve addressing the family's denial of the disorder and in handling the possibly severe mourning reaction that is commonly experienced. When a child experiences his or her first psychotic break, the family's reaction may

be severe, requiring regular and intense contact with a social worker. Social workers frequently need to work in a crisis mode, addressing the many issues arising as a result of the initial or subsequent hospitalization and the readjustment of family relationships. Finally, social workers may conduct therapy groups to help patients discuss their feelings in relation to discharge and to make plans for aftercare. This may involve going with a patient to a day program or making home visits. Today, most individuals diagnosed with schizophrenia are able to live and work in the community.

For Juan, the repeated hospitalizations and relapses he has experienced have complicated his treatment picture. His parents, who are now in their late 60s, are unwilling to have Juan back in their home. They believe that it is critical for Juan to be able to live in the community on his own so as to be prepared for their eventual deaths. As an only child, Juan has no siblings who might be involved in his care. Likewise, having never married and having lost contact with his high school friends, Juan has few social contacts outside of his part-time job as a dishwasher.

Dylan's and Daryl's parents live in the same city and are only in their 50s, but they have divorced, and neither feels capable of caring for their adult sons. Both parents have professional careers and are gone during the day. Dylan and Daryl have one older sister who lives in another state and is very busy with her own career and family. Daryl's education as a social worker provides the possibility that he will be able to work in the field, which he has done intermittently since graduating from college, if he can maintain his medication. Dylan, however, has few social outlets and prefers to stay in his room or walk by the river.

To achieve the highest level of functioning, each man must adhere to the medical regimen prescribed. Working together, the clinical psychologist and social worker have agreed to monitor and implement a program to assist the men if they become noncompliant upon leaving the hospital environment. During the aftercare planning stages, the clinical psychologist and social worker both stressed to the men the importance of taking their medication on a daily basis, emphasizing that the medications reduce the symptoms of schizophrenia, allowing them to lead more successful and productive lives. As an aid to taking the medication, each man was trained to leave his medications next to his coffeepot and to take the medication each morning. The percentage of prescribed pills actually taken each week was counted by the social worker during her weekly visit. As might be expected, given that the men were not hospitalized on the same day, they were also not released on the same day. Juan was released 4 weeks prior to Dylan, who was released 3 weeks prior to Daryl.

Beginning, then, with Juan, the first 3 weeks following discharge can be viewed as a baseline period. As can be seen in the first panel of Figure 6.10, Juan's
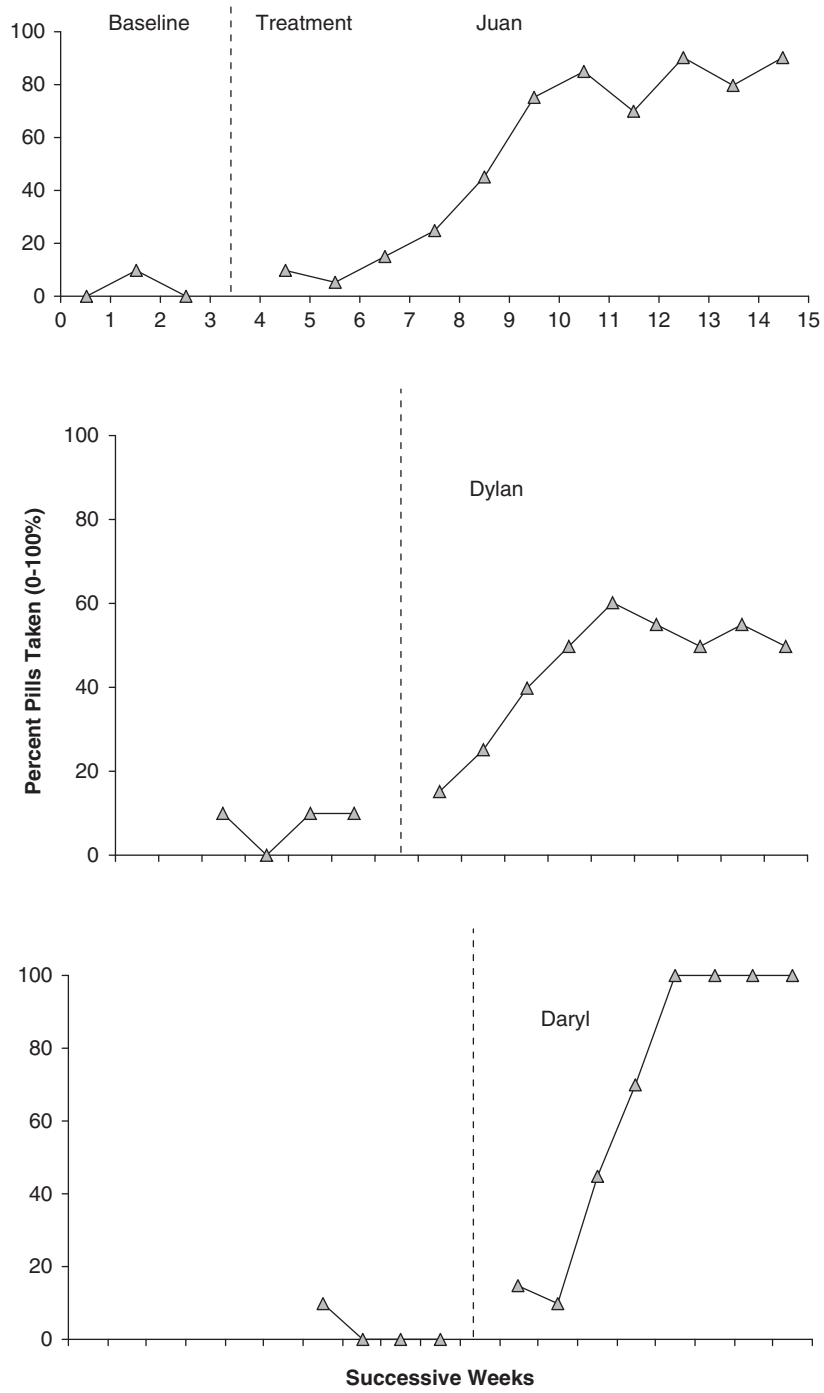
Figure 6.10   Percentage correct during testing probes for Chuck

medical compliance was very low during this baseline period, increasing his chances of a relapse. During the intervention, Juan purchased a pillbox and was then taught to keep his medicine in the pillbox in the same location, that is, next to his coffeepot. The second panel of Figure 6.10 demonstrates that Juan's compliance steadily rose throughout the intervention phase. You will notice that Dylan's baseline data in Figure 6.10 did not begin until Juan's treatment had already begun. This is also true of Daryl's baseline measures, which began only after both Juan and Dylan had begun to receive treatment. Because baseline measures were not taken until the three men were released from the hospital, length of baseline measurement did not increase with each client often the case with multiple-baseline designs. However, because the baseline data were collected at different times and the treatment (medication placement) was also staggered, or delivered at different times for each man, the principal element of the multiple-baseline design remains intact. Thus, the design used in this case study is a nonconcurrent multiple-baseline design, as described earlier in this chapter. This example once again illustrates the common trade-off that occurs between scientific rigor and clinical objectives. The three phase changes at different times add inferential strength to a design despite an inability to collect simultaneous and prolonged baseline measures.

INTERIM SUMMARY

The case of Juan, Dylan, and Daryl illustrates the potential for using a multiple-baseline design to evaluate a clinical intervention delivered to separate clients. Although such interventions may not, for ethical reasons, allow for complete withdrawal of treatment, multiple AB phase changes, conducted at different times and across three separate clients, provide strong evidence for the intervention's effectiveness.

KEY TERMS GLOSSARY

Multiple-baseline designs Single-case designs in which only one phase change from baseline to intervention (AB) occurs but is replicated across either subjects, settings, or behaviors.

Multiple-baseline across subjects (clients) A multiple-baseline design in which several AB phase changes occur in staggered fashion across more than one subject or client.

Concurrent multiple-baseline design A multiple-baseline design in which all baseline measures are taken simultaneously.

Nonconcurrent multiple-baseline design A multiple-baseline design in which separate baseline data are not collected at the same time.

Multiple-baseline across settings or situations A multiple-baseline design in which several AB phase changes occur in staggered fashion across two or more separate settings or situations.

Multiple-baseline across behaviors A multiple-baseline design in which several AB phase changes occur in staggered fashion across two or more distinct target behaviors.

Behavioral covariation Changes in nontargeted behaviors that may be functionally similar to behavior being targeted for intervention.

Behavioral cusp Behaviors that, although not being specifically targeted for change, may have important and very broad consequences in a specific setting or for a specific client.

Social validity data Information, usually obtained from the client or the client's family, friends, or coworkers, that serves to demonstrate the effectiveness of a treatment.

Multiple-probe design An adaptation of the multiple-baseline design in which brief or "probes," or baseline measures, are taken prior to intervention, and sometimes as follow-up measures, because prolonged baseline phases or repeated dependent variable measures are impractical or unethical.

SUPPLEMENTS

Review Questions

1. What is the general rationale for conducting a multiple-baseline design? What is the major difference between this design and a withdrawal design?

2. Why is it difficult to tell from a traditional single-case graph whether a concurrent or nonconcurrent multiple-baseline design was used?

3. Why might researchers in applied settings be more likely to conduct nonconcurrent than concurrent multiple-baseline designs?

4. What is behavioral covariation, and what problems might it produce for drawing causal inferences in a multiple-baseline design?

5. What is meant by the phrase *behavioral cusp*? Describe an example of a behavioral cusp that might be relevant in an applied setting.

6. Why might a researcher use a multiple-probe design? Describe an instance in which this design would be preferred over another variation of the multiple-baseline design.

Suggested Readings/Helpful Web Sites

Rosales-Ruiz, J., & Baer, D. M. (1997). Behavioral cusps: A developmental and pragmatic concept for behavior analysis. *Journal of Applied Behavior Analysis, 30,* 533–544.

This article introduces the important concept of *behavioral cusps*, a term that refers to ways in which specific, targeted behaviors may bring a client into contact with new environments or new consequences. Thus, behavioral cusps have the potential to extend behavioral repertoires beyond the parameters of a specific intervention, making them especially powerful in applied settings.

http://www.nimh.nih.gov/health/topics/schizophrenia/index.shtml
This Web site, offered by the National Institute of Mental Health, provides helpful information about schizophrenia. In addition to descriptions of symptoms, theories of etiology, and treatment options, several links lead to Web sites that detail medications, contemporary research on schizophrenia, and support organizations.