

## TEACHERS AND PARENTS AS RESEARCHERS USING MULTIPLE BASELINE DESIGNS<sup>1</sup>

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Two teachers and a parent used three basic multiple baseline designs to investigate the effects of systematic reinforcement and punishment procedures in the classroom and at home. (1) A fifth-grade teacher concurrently measured the same behavior (tardiness) in three stimulus situations (after morning, noon, and afternoon recesses). Posting the names of pupils on a chart titled "Today's Patriots" was made contingent on being on time after the noon recess, then successively also the morning and afternoon recesses. Tardiness was reduced to near zero rates at the points where contingencies were applied. (2) A highschool teacher recorded the same behavior (daily French-quiz grades) of three students. She then successively applied the same consequences (staying after school for individual tutoring for D and F grades) for each student. At the points where the contingency was applied, D and F grades were eliminated. (3) A mother concurrently measured three different behaviors (clarinet practice, Campfire project work, reading) of her 10-yr-old daughter. She successively applied the same contingency (going to bed early) for less than 30 min spent engaged in one after another of the behaviors. Marked increases in the behaviors were observed at the points where the contingency was applied.

In a number of studies employing systematic reinforcement procedures to modify academic behaviors of pupils, a traditional experimental-group control-group research design has been incorporated to evaluate the effects of the programs. (e.g., Wolf, Giles, and Hall, 1968; Clark, Wolf, Lachowicz, 1968; Ward and Baker, 1968). In these studies, the progress of a group whose behaviors were exposed to systematic reinforcement procedures was compared to the progress of a control group that was not exposed to the procedures.

On the other hand, in many studies involving systematic reinforcement procedures, a reversal experimental design was employed

(e.g., Hall, Lund, and Jackson, 1968; Hall, Panyan, Rabon, and Broden, 1968; Thomas, Becker, and Armstrong, 1968; Madsen, Becker, and Thomas, 1968). In these studies, the progress of an individual subject or of a group was compared under successive baseline and reinforcement conditions. First, baseline observations were made to establish the pre-reinforcement level of performance; then, reinforcement procedures were instituted. Once a change in level of performance had been demonstrated, a brief return was made to baseline conditions. When the behavior returned to the baseline level, reinforcement procedures were employed once more to see if the level of performance achieved in the first reinforcement phase could be replicated.

Baer, Wolf, and Risley (1968) suggested the desirability of using another research strategy, called a multiple baseline, as an alternative to the reversal design in applied research. The multiple baseline design involves the measurement of several behaviors over time so that several baselines are established. Then, a behavior modification procedure is applied to one of the behaviors until a change is demonstrated in that behavior; then, the same procedure is applied to a second behavior, later to a third, and so forth. If the various behaviors change markedly at the point when

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the procedure is introduced, a strong inference of a causal relationship is established. To date, very few studies reported have used the multiple baseline research strategy, although Hart and Risley (1968) employed a multiple baseline design in their study of preschool language acquisition and Barrish, Saunders, and Wolf (1969) used a multiple baseline design in studying the effects of group contingencies, first during math period and then during reading period, to decrease talking-out and out-of-seat behaviors in a fourth-grade classroom.

The present studies illustrate the use of three basic types of multiple baseline designs: across situations, across individuals, and across behaviors. The studies are also of interest because in each case a teacher or parent acted as the experimenter and the prime observer. Most studies carried out in classrooms and homes have relied completely on outside observers and experimenters. Procedures that allow teachers and parents to act as observers and experimenters will more likely be used than those requiring extensive outside personnel.

## EXPERIMENT I

### *Subjects and Setting*

Twenty-five fifth-grade students from upper-middle-class families in the suburban area of Shawnee Mission, Kansas served as subjects. As a part of their daily routine, the 16 boys and nine girls in the class were allowed to go to the restroom and to visit the drinking fountain after recesses. Although most pupils returned to class without undue delay, there were usually a few pupils after each recess who returned a minute or two after class had resumed. This disrupted class and annoyed the teacher.

### *Observation*

The teacher, who was enrolled in a university course on management of classroom behavior, acted as the primary observer. She began recording the number of pupils who were late in returning to class after the morning, noon, and afternoon recesses. The teacher closed the classroom door 4 min after the first pupil entered the hallway outside the classroom on his way to the restroom after recess. Any pupil who entered the classroom after the door closed was counted as being late.

The teacher chose a pupil who was always prompt to make a simultaneous record of the number of late pupils. The correspondence of the teacher and pupil records was 100% on all 59 days of the study, except for the first, second, third, tenth, and seventeenth days. On each of these days, there was a difference of one in the number of late pupils recorded. The percentage of agreement of the records on days when the counts differed was computed by dividing the lesser tally of late pupils by the greater and multiplying by 100. The mean percentage of agreement for the study was 99%.

### *Experimental Phases and Results*

*Baseline or no-chart phase.* Records were kept of the number of pupils who were late returning to the room after the noon, morning, and afternoon recesses. No contingencies were in effect for being late after the noon recess during the first 13 days of recording. No contingencies were in effect for being late after the morning recess during the first 21 days of recording; and no contingencies were in effect for being tardy after the afternoon recess through the first 27 days of the experiment. Thus baselines of varying length were established. The median number of pupils late after the noon recess during this baseline phase was eight, while the median number late after both the morning and afternoon phases was four. (See Fig. 1)

*Patriots chart part.* Before the experiment, the class had been reading a series of patriotic books about the history of America. In the books, the children of the American colonists helped find powder for the soldiers, went on secret missions, carried messages for the colonists, *etc.* The class discussed how exciting it must have been to live in those days. They discussed how they could be patriots as children living in the 1960s. One suggestion was that if they obeyed class rules they were good citizens and, therefore, patriots. As part of their unit on patriotism, they had a class program in which they acted out some of the stories they had read and told how children today could be patriotic. Since patriotism seemed to have become so important, the teacher decided that for a pupil's name to be included in a list of students' names entitled "Today's Patriots" would probably be a reinforcing event.

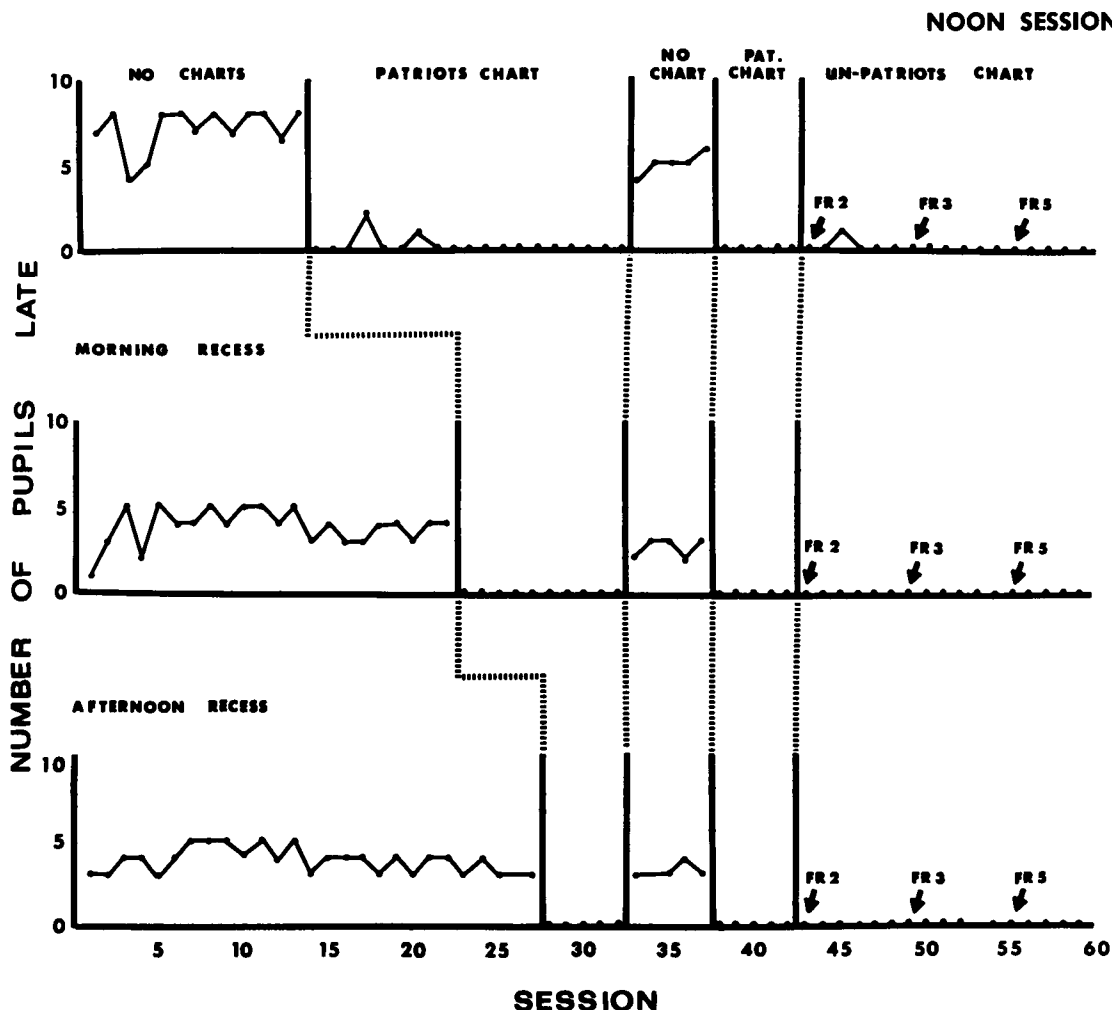


Fig. 1. A record of the number of pupils late in returning to their fifth-grade classroom after noon, morning, and afternoon recess. *No Charts*—baseline, before experimental procedures. *Patriots' Chart*—posting of pupil names on "Today's Patriots" chart contingent on entering class on time after recess. *No Chart*—posting of names discontinued. *Patriots' Chart*—return to Patriots' Chart conditions. *Un-Patriots' Chart*—posting of names on "Un-Patriots'" chart contingent on being late after recess (FR 2) every two days,, (FR 3) every three days, and (FR 5) every five days.

On the morning of the fourteenth day, the teacher introduced a "Today's Patriots" list which was to be posted on the bulletin board before the close of school each day. The teacher told the class that if they were inside the classroom before the door was closed after the noon recess, their names would be placed on the "Today's Patriots" chart. Nothing was said about the morning or afternoon recesses. As seen in Fig. 1, the number of pupils late after the noon recess under the Patriots' Chart condition decreased dramatically, while the number of those late after the morning and

afternoon recesses remained essentially unchanged.

On the morning of the twenty-second day, the children were told they must be in the room before the door was closed after the morning as well as the noon recess in order to have their names placed on the patriots' chart. Nothing was said about the afternoon recess. As shown in Fig. 1, under these conditions the number of pupils late at noon remained at zero; the number of late pupils after the afternoon recess remained at essentially the same level, perhaps slightly lower.

On the twenty-eighth day, the pupils were told that they had been excellent patriots but that beginning that day they must be in the classroom by the time the door was closed after all three recesses in order to be listed as a patriot. Under these conditions no pupils were recorded as being late after any of the recesses.

*No chart phase.* After five days in which no pupil was late after any recess, a reversal phase was instituted as a further check on the function of the chart as a reinforcer for being on time. On the thirty-third day, the pupils were told they had done so well and had such a perfect record of being patriots that the teacher thought she no longer needed to post any names. She stressed that she knew she could count on them to continue being patriots. Then, nothing more was said and no lists were posted during the week. As seen in Fig. 1, there was a return of late behavior.

*Return to patriots' chart phase.* On the thirty-eighth day, the pupils were told that because some pupils were again returning to class late, the patriots' chart would be posted once more and that pupils must be on time after all recesses in order to have their names listed. As shown in Fig. 1, there was an immediate return to perfect promptness after recess.

*Un-patriots' chart phase.* Up to this point, whenever the patriots' chart condition was in effect, names were listed on a continuous reinforcement schedule, that is, every day. On the forty-third day, however, the pupils were told that "Today's Patriots" would be posted at various times, rather than every day. They would not know how often the list would be posted but were encouraged to keep a prompt record so that their names would be on it whenever it was.

In the course of the discussion, one of the pupils suggested that the names of those who were late should be posted rather than those who were on time. Other pupils agreed that this would be a good plan, stating as their reason that it was hard to find one's own name on the list because there were so many on it. Others suggested a larger chart that would be easier to see. Finally, the matter was put to a vote. The pupils voted to list those who were late and suggested it be called the "Un-Patriots'" chart, adapted from the commercial for the "Un-Cola".

Through the remainder of the experiment, an intermittent schedule was followed in post-

ing the "Un-Patriots'" Chart. Initially, it was posted every other day. Since the pupils were required to have a perfect record between postings, they were on a fixed ratio (FR 2) schedule. Beginning on the forty-ninth day, the chart was posted every third day (FR 3) and in the last week of the experiment it was not posted until the end of the week (FR 5). (As can be seen in Fig. 1, except for one pupil who was late at noon on the third day of the unpatriots' phase, there was a zero rate of being late after recess).

## EXPERIMENT II

### *Subjects and Setting*

Three tenth-grade students in a French II class met daily for 45 min at Shawnee Mission North High school in Shawnee Mission, Kansas. When the study was initiated, these students, two boys and a girl, had been receiving grades that were primarily Ds and Fs on quizzes given three to four times a week. These quizzes were given at the beginning or end of the class period to determine whether the pupils had studied the homework assignment the previous night or to see if they had paid attention in class that day.

Before the study, the teacher had talked with each of the students concerning their low test scores and encouraged them to make an effort at better performance. She reported having tried applying contingent verbal praise when one of them did well on a quiz as well as writing "good" or other remarks (in French) on their test papers. Contingent verbal praise had also been used to reinforce correct oral responses during recitation in class. These attempts had not been effective in increasing quiz performance.

### *Observation*

The teacher, who was enrolled in a course on management of classroom behavior, acted as the experimenter and primary observer. Letter grades were assigned the quizzes according to the following scale: A = 92 to 100% correct; B = 84 to 91%; C = 72 to 83%; D = 64 to 71%; F = 63% or below. As a check on the reliability of scoring, the teacher had an outstanding student score the quizzes independently. The agreement in scoring by the two was 100%.

### Experimental Phases and Results

**Baseline phase.** Quiz scores were recorded and graphed for all three pupils during the baseline phase when no special contingencies were being applied. Baseline conditions were in effect for 10 days for Dave, 15 days for Roy, and 20 days for Debbie. Figure 2 presents a record of their grades. Dave's median grade for 10 baseline quizzes was F. On a four-point scale (A = 4, B = 3, C = 2, D = 1, F = 0) his mean grade point was 0.4. Roy's median grade for 15 baseline quizzes was also F and his grade on a four-point scale was 0.7. Debbie's median for 20 baseline quizzes was F and her grade point was 0.4.

**After-school tutoring for low grades phase.** At the close of class after the tenth quiz had been given, the teacher informed Dave that because he seemed to be having trouble understanding his French lessons, beginning with the next quiz, whenever he earned a score of D or F, he would be required to come in after school and she would work with him until he

knew the lesson well. After these conditions were instituted, Dave's median grade was an A and his grade-point average on the four-point scale was 3.6. He received no Ds or Fs on any of the 15 quizzes given.

Nothing was said to Roy until after the fifteenth quiz had been given, at which time the same contingency for D and F grades was put into effect. Roy's median grade for this phase was B, and his grade point increased to 2.8. He received no D or F grades.

Tutoring after school following quiz grades of D or F was instituted for Debbie after the twentieth class quiz. Debbie's median grade for the five days after experimental conditions were begun was C. Her grade point was 2.2 and, like Dave and Roy, she received no Ds or Fs.

### EXPERIMENT III

#### Subject and Setting

The subject of this experiment was Lisa, a 10-yr-old normal, active fourth-grade girl. Among her extra-curricular activities were music lessons on the clarinet and membership in a Campfire Girl troop. During the weeks of this study, cold weather confined the subject indoors after school for all but a few minutes of play outdoors each day. In order for her to earn ceremonial honor beads in an upcoming Campfire "ceremonial" she needed to complete several projects. She also had six book reports due before Christmas Vacation. Her regularly scheduled clarinet practice time was 30 min per day. The press of these activities caused the girl's mother to ask that she spend 30 min per activity during the after-school and evening hours during the four weeks before Christmas vacation. (Immediately after the study, the requirements for study and working on Campfire projects were reduced).

#### Observation

The girl's mother, who was enrolled in a university course on management of classroom behavior, acted as the experimenter and primary observer. A stopwatch was used to time all three behaviors. Time spent practising on the clarinet was measured from the time the first note was sounded until the subject announced she had finished. Time spent getting the clarinet out and putting it away after practice was not counted as part of the practice ses-

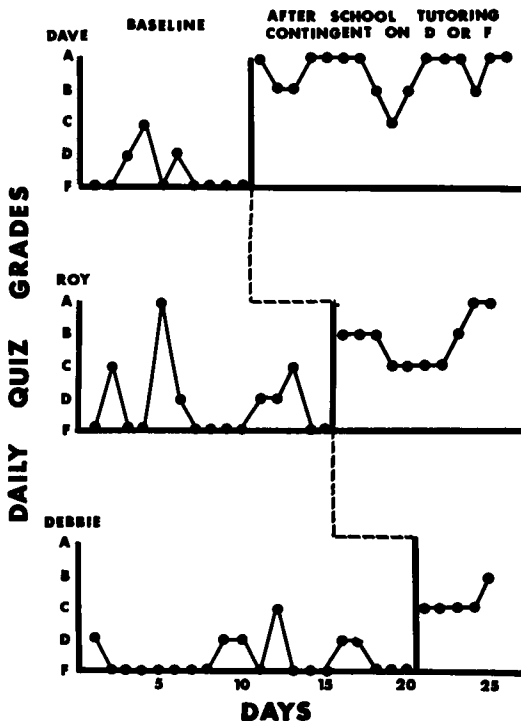


Fig. 2. A record of quiz score grades for three high school French-class students. *Baseline*—before experimental procedures. *After School Tutoring Contingent on D and F Grades*—pupils required to stay after school for tutoring if they score D or F on daily quizzes.

sion. Since the Campfire Girl projects included a variety of activities, time spent on them was measured after Lisa had explained to her mother what she was going to do, had gathered all needed materials and work actually commenced. Reading time was recorded from the time Lisa was seated at a table with her library book open until she closed the book. No time was deducted for occasional pauses when she looked away from the book to "day-dream". As long as the book was open and she was seated at the table in front of it, reading time was recorded.

A classmate of the experimenter came to dinner once a week, and participated in evaluating the reliability of the observation procedures. The classmate would arrive about the same time the children returned from school and would stay until the last task was completed. She used a second stopwatch and observed from a different vantage point than that of the mother. For example, she would sit in the living room to observe Lisa who was reading at a table in the kitchen. Although she could observe Lisa, she could not see Lisa's mother who was also in the kitchen working. Neither was able to hear the click of the other's stopwatch. For purposes of this study it was decided to round off all time measures to the nearest minute. If less than 30 sec showed on the stopwatch, they were not counted. If more than 30 sec showed, another whole minute was added. Under these conditions, agreement between the observers was 100% throughout the study. Data were recorded four evenings a week on Monday, Tuesday, Wednesday, and Friday.

#### *Experimental Phases and Results*

**Baseline.** Before baseline, Lisa was told that she was to spend 30 min each evening on each of the three projects, clarinet practising, Campfire honors, and book-report reading. Lisa agreed that to do so was necessary if she were to finish her projects on time. Lisa was instructed that her activities were being timed during the baseline phase. Figure 3 presents the records of the number of minutes Lisa spent engaged in clarinet practice, Campfire work, and book-report reading.

Lisa's mean baseline for time spent in clarinet practice was 13.5 min per day. Her mean time spent in Campfire work was 3.5 min per day, and her mean time spent in reading for book reports was 11 min per day.

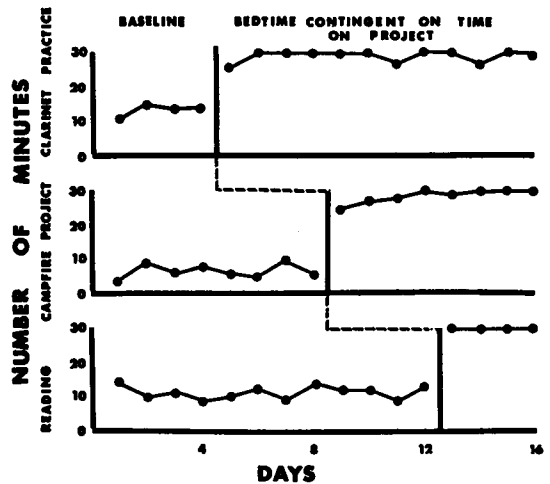


Fig. 3. A record of time spent in clarinet practice, Campfire honors project work, and reading for book reports by a 10-yr-old girl. *Baseline*—before experimental procedures. *Early Bedtime Contingent on Less Than 30 Min of Behavior*—1 min earlier bedtime for each minute less than 30 engaged in an activity.

**Bedtime contingent on clarinet practice.** At the beginning of the second week, Lisa was told that she would have to go to bed 1 min earlier than her regular bedtime on Monday, Tuesday, Wednesday, and Friday for each minute less than 30 min that she spent practising her clarinet. Under these conditions, she practiced 26 min the first day and 30 min a day thereafter. Her mean duration of practising for the entire phase increased to 29 min per day. Campfire work averaged 3.75 min per day. Book-report reading remained at the baseline duration of 11 min per day.

**Bedtime contingent on clarinet practice and Campfire work.** At the beginning of the third week, Lisa was told that she had not been spending enough time on her Campfire projects. Therefore, she would have to go to bed 1 min early for each minute less than 30 min that she worked on her Campfire projects as well as 1 min early for each minute less than 30 she practised her clarinet. When bedtime was made contingent on both clarinet practising and Campfire project work, Lisa spent adequate amounts of time engaged in both of these behaviors. The mean duration of practising the clarinet remained at approximately 29 min per day and Campfire work increased to about 28 min per day. Book-report reading remained at the relatively short duration of 11.5 min per day.

*Bedtime contingent on clarinet practice, Campfire work, and reading.* At the beginning of the fourth week, Lisa was told she would be required to go to bed 1 min early for each minute less than 30 that she spent reading for her book reports. The contingencies for clarinet practice and for Campfire work were also still in effect. Thus, when bedtime was made contingent on engaging in all three behaviors, Lisa's mean time spent practising was 29 min, time spent working on Campfire projects was 29.75 min, and time spent reading was 30 min. The mean duration of all three activities was 1 hr and 28.75 min, compared to a mean duration of only 28 min during the first baseline week.

## DISCUSSION

### *Multiple Baseline Designs*

The three present studies provide examples of three basic types of multiple baseline studies. When Baer *et al.* (1968) suggested the use of the multiple baseline technique, they did not differentiate the various types of multiple baselines that are possible. More recently, however, Risley and Baer (in press) have suggested that at least three different multiple baselines designs are possible in investigating the behavior of individual subjects. We suggest that these multiple baseline designs apply equally well to the behavior of groups if the behavior of the group members is summed or averaged, and the group is treated as a single organism. Such an application is illustrated in Exp. I.

One approach Risley and Baer (in press) suggested, involves obtaining baselines of two or more behaviors of the same individual and introducing experimental procedures to one of the behaviors after the other, causality being demonstrated if the behaviors change successively at the point where experimental procedures were applied and not before. Few such multiple baseline studies have been published, although Swarz and Hawkins (in press) used such a tactic to explore the effects of contingencies on number size, face touching, posture, and voice loudness in a sixth-grade girl. Risley and Hart (1968) used the multiple baseline design with a group in their investigation of language in groups of poverty area preschool children. The experiment carried out by Lisa's mother (Exp. III) was a very clear example of this type of multiple baseline design. Three of

Lisa's behaviors were measured. The same contingency was applied successively to each of the behaviors and at the points where the contingency was placed in effect, significant changes in rate were observed.

The second multiple-baseline design suggested by Risley and Baer (in press) was to measure concurrently the same behavior of several individuals in the same situation. After obtaining these baselines, experimental procedures could be applied successively to the behavior of one after another of the individuals. Few examples of this tactic in applied school settings have been reported; however, Revusky (1967) suggested a statistical treatment for analyzing data in such experiments. The second experiment in which the senior-high French students successively earned better grades on daily quizzes after the consequence of staying after school to be helped was invoked for the first, second, and third student, is an example of the use of this type of multiple baseline design.

The third type of multiple baseline tactic suggested by Risley and Baer (in press) was to measure the same behavior of a single individual concurrently in different stimulus situations. In the classroom, these stimulus situations could involve at least the five major dimensions of time, type of activity, identity of teacher, location, and composition of student group. (It could also, of course, vary in a multitude of other dimensions.)

The Barrish, *et al.* (1968) study is an example of this design applied to a classroom group. In their study, baselines of talking-out and being out-of-seat behavior were obtained during math and reading periods. Contingencies were then applied, first during math, then during reading. Thus, the stimulus situations differed in at least two major dimensions: time and type of activity. This is seen in the fact that reading period came after math period and in the fact that reading and math are by definition different types of activity. The location, the teacher, and the composition of the student group remained constant, as both math and reading were taught in the same self-contained classroom.

The classroom study in which the names of pupils who were on time were posted on the Patriots' Chart is an example of this third kind of multiple baseline. In this case, however, the stimulus situation varied along one major di-

mension only, that of time. In all three measurement situations (noon, morning, and afternoon), the same group of pupils was returning to the same classroom and teacher after the activity of recess. The location of the classroom and its relationship to the playground, washrooms, hallways, *etc.* remained constant. Thus, the only apparent change in stimulus situations was associated with whether it was the morning, noon, or afternoon recess.

#### *Instructional Control*

It should be pointed out that in each of the three present experiments, in which clear and dramatic effects were observed, the subjects were under good instructional control.

In each study, whenever the teacher or the parent announced a new experimental condition there was an immediate change in behavior directly related to the announced change in condition. This instructional control suggests that in all three cases the subjects had learned that when the teacher or parent announced conditions that would lead to a given consequence, the consequences would indeed follow. Thus, verbal cues from adults had become discriminative stimuli for consequences. (In other words, when the teacher or parent said something they "knew she meant it!") That instructional control is dependent on consequences, however, is dramatically illustrated in the Patriots' Chart study by the reversal procedure phase. Here, the teacher specifically asked pupils to continue being on time although she removed the patriots' chart contingency. Since tardiness increased, it can be seen that even though the teacher had previously shown strong instructional control when her statements promised consequences, instructional control was relatively weak when it was not accompanied by consequences.

#### *Effective Consequences*

The data also indicated that the consequences chosen were effective. In the high school French class, it was of special interest to note that the three students never came in contact with the consequence, yet it served to produce marked changes in their performance. In this case, avoidance behavior was observed. Such behavior was not too surprising in Dave's instance because he was athletic and staying after class to study French would have interfered with football turnouts. The results found

with Roy and Debbie indicated, however, that staying after school to receive help may be a punishing consequence for many pupils. It would be a mistake to conclude that this would be true in all cases. In Lisa's case, having to go to bed earlier than usual was also shown to be an effective consequence, one that would not be surprising to any parent of a pre-teen son or daughter.

It was a little more surprising, however, that the Patriots' Chart proved as effective as the data indicated. It is probable that many other teachers have tried the posting of names on a chart as a means of reinforcing desired classroom behavior. In most cases, the behavior of concern has probably been something other than returning to class on time after recess and the charts have probably been labelled "Today's Citizens", or "Our Good Workers", or some designation other than "Today's Patriots". Essentially, however, the tactics and aims have been the same. These other teachers may or may not have had successes equal to those achieved in this study, and at least some will be surprised at the present results, as was the teacher who conducted the study. She did not expect the degree of control effected by her procedures. Therefore, mention should probably be made of several important factors that may have contributed to the success achieved and would be important considerations for anyone trying to replicate the results. The fact that this technique proved so effective with this particular class may have been related to the rather extensive study by the students of the unit on patriotism. Reading stories about patriots, class discussions, and other such activities may have contributed to the reinforcing function served by listing pupils as "Today's Patriots".

#### *Discriminating Conditions*

Another factor that may have been related to the success of these studies is that the subjects were able to discriminate clearly when experimental conditions were in effect. In the cases of the French pupils and Lisa, it is not surprising that the necessary discriminations were made. In the case of the Patriots' Chart study, however, since the stimulus situations for noon, morning, and afternoon recesses were ostensibly similar in most dimensions, it would seem that there would have been near-maximum possibility for generalization of tardiness



behavior from one recess to another. As shown in Fig. 1, however, no generalization occurred and pupils continued to be tardy at recesses other than those for which contingencies were in effect. Thus, pupils were able to make discriminations as to reinforcement or non-reinforcement from the stimuli available that were associated with the various recesses, even though it would seem that the stimulus dimensions of all three after-recess situations were very much the same.

#### *Carrying out Consequences*

Two final factors related to both instructional control and discrimination conditions were that in all three studies, the pupils were told that the teacher (and in Lisa's case, the mother) was keeping an accurate record and they did experience the consequences every time that the teacher said they would. Thus, the relationship between the instructions and the consequences was consistent.

#### *Teachers and Parents as Experimenters*

Perhaps the most important aspect of these studies, beyond their illustration of three multiple baselines as a research tactic, is the fact that they were carried out by teachers and parents. As previously mentioned, most research reported up to now has employed skilled researchers with outside observers. These studies demonstrate, however, that teachers and parents can carry out important and significant studies in natural settings using resources available to them. In doing so, they demonstrated that systematic behavioral analysis procedures can be successfully employed by teachers and parents using resources and contingencies readily available in school and home settings.

It should perhaps be emphasized once more, however, that had not the experimenters chosen consequences that were effective, had the behaviors been less clearly specified, had the experimenters been less precise in carrying out the measurement and reinforcement procedures, it is improbable that such dramatic results would have been obtained. Others who attempt similar programs should attend to all of these factors if they expect to achieve a similar degree of control.

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