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PRACTICAL CLASSROOM MEASUREMENT:

PRECISION TEACHING

by

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(2nd Draft)

INTRODUCTION[1]

Strangely enough, Precision Teaching is not a method of teaching. It is a way of finding out what teaches. That is, it is a way in which the effects of teaching plans and learning environments may be continuously measured and assessed. With this information, the teacher is placed in a position where what works can be used more often and what doesn't work can be thrown out - for each child - individually. As a measurement system, Precision Teaching can be applied in any classroom, anywhere. It can be used to assess the effects of behavior modification programs, or psychotherapy; open classrooms, or lecture series. Any situation designed to change people should be describable in terms of the changes it is designed to produce. Precision Teaching measures those changes, and provides the information necessary to improve those situations. It's as simple as that.

Using the basic principles of measurement that grew out of the work of B. F. Skinner, Ogden Lindsley and others (including, to be sure, a large number of children, teachers, and parents) developed Precision Teaching as a practical solution to the continuous assessment of behavior in the classroom. Each of the guidelines and procedures used in Precision Teaching was carefully selected for its technical sophistication (precision) and utility in "real-world" situations (teaching). Since its introduction in 1964, the use of Precision Teaching has spread rapidly throughout schools, homes, service agencies, hospitals, institu-

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tions, and even laboratores. Today, although my no means universal, it represents the closest thing to a "standard" set of procedures that one is likely to find. It is growing still, of course, as each new piece of information it collects adds to the storehouse of information collected before. Precision teaching in 1974 bears only slight resemblance to precision Teaching in 1964. None of the procedures which will be discussed should be considered the "gospel", therefore, but only one of the most flexible tools available today -- one more stepping stone to the better understanding of growth, progress, and learning in us all.

THE MOVEMENT CYCLE

In the manuscript of Behavioral Assessment and Precise Educational Measurement a great deal of time was spent discussing behavior. It was concluded that if we are to see change in pupils, reliably and precisely, the target of our measurements must be directly observable behavior. Such behaviors were defined as those which could be heard, seen, or touched by the teacher, and by anyone else who happens to be present. In Precision Teaching, a number of other guidelines have been established which assist the teacher in pinpointing behaviors which are easily measured and more usually amenable to change.

The behavior must involve movement. If the behavior doesn't involve physical movement of some sort, then more properly it might be considered the absence of behavior. "Sitting still", "being quiet," and "staring straight ahead: are all things that a dead man could do. Dead men have no behavior. If the problem seems to be that "he just doesn't sit still," then more than likely there are a number of other behaviors which could be identified. What does he do if he doesn't sit still? "Gets out-of-seat,"

"throws paper," "raps his knuckles on the desk", these are likely to be the real problems, and they all involve movement. We don't really want a dead man that simply sits. Some movement, like the turning of pages, the raising of a hand, and writing are all right. If so, then identify the movements that you don't want, and concentrate on them. If the problem is just the opposite (i.e., too little movement), then find the movement you desire, and target those behaviors to increase. Working only with movement insures us that we are, in fact, working with behavior; and as will be seen later, movement is much easier to count, describe, and change.

The behavior must be repeatable. Unless a behavior happens more than once, it cannot be changed. It may happen, or it may not; but in either event, it cannot be altered. Suicide is a rather dramatic example. Once a child is successful in emitting suicide behavior he is beyond help. To deal with this important behavior, then, we must identify those behaviors which might lead up to the final act. If "self-derogatory statements," "threats of suicide", and "self-imposed injuries" can be changed, perhaps the suicide will never be attempted.

To a lesser extent, behaviors which occur at a very low rate present many of the same problems. They are repeatable, so they can be changed, but they occur so infrequently that the opportunities to change them are too few and far between. Take, for example, the parents that reward their children for getting "A's" on their report cards. For each "A", one shiny silver dollar. If the child is already doing well in school, then perhaps this small incentive will help to bring a few "B's" up to "A's". More than likely, however, the dollars will come too infrequently to effect the eventual critical effect of an "A". In order to have more opportunities to deal with and change the behavior of their children, the parents should identify those smaller behaviors (homework, quizes,

practices, etc.) that eventually lead to the "A". If these behaviors are changed early in the year, then the eventual desired results are more likely to be achieved. Generally, the more often a behavior occurs, the more often we are able to do something about it. The more often we work with behavior, the more likely it is to change. Ideally the behavior will occur at least 10 times each day we observe, count, and work with it. In some cases that will not be possible, but should nevertheless be considered whenever a behavioral target is selected.

The behavior should have a definite, countable cycle. In order for a behavior to be repeatable, it must have a cycle. That is, it must have a beginning and an end; and the end must be such that the behavior can begin again. If a child raises his hand, he cannot raise it again until he puts it down. Raise-hand, lower-hand -- that completes the cycle. The cycle is not only important because it makes the behavior repeatable, however, it also helps us count.

If we are to collect precise information about the number of times a behavior occurs, we must be careful to count only "whole" behaviors. There are times when a teacher is tempted, for example, to give a child credit for a digit he "almost" finished when taking his math-fact quiz. It's not really a five, but there's enough of it to know that it would have been a five, so she counts it. Later, when the child has gained a bit more fluency, her standards begin to tighten up. A five, is a five, is a five. Only completed digits count. In essence, she is either added a little to the earlier performance, or by the same standards, taken a bit away from his present performance. In either case the picture of progress she is likely to get is not the real progress of the child. Once a standard for performance has been established, and the behavior has been counted by those standards, then we cannot go back and compare behavior

which was counted under a different standard. To keep the standards the same, we must be sure and count a behavior only after the cycle is complete. To check ourselves, we should ask, "can the behavior start again?" With the example above, could the child have started another digit? No, if he did, then the five would have obviously been wrong.

In summary, the behavior selected for change should involve movement, be repeatable, and have a cycle with a definite beginning and end. If the behavior meets all of these criteria it is called, not surprisingly, a Movement Cycle. Examples will be found in Tables 1 and 2.

The Calibration of Movement Cycles

Some behaviors which meet the requirements of a movement cycle will still not adequately serve the purposes of measurement. The units of behavior may be too large or too small. Perhaps the behavior as defined allows for so many variations of behavior that one instance of its occurrance cannot be meaningfully compared with another. Finding the unit of behavior that is easily counted, that bears a direct relationship to the true objective of performance changes, and is relatively consistant in its properties each time it is emitted is called "calibration."

Calibration

To illustrate, assume that the overall objective of instruction is to teach the child to read orally. Many movement cycles could be defined: "reads books orally," "reads pages orally," "reads paragraphs orally," "reads lines orally," "reads words orally," "reads syllables orally," "reads phoenemes orally," etc. Each is a well pinpointed movement cycle. Each is observable, repeatable, and countable. Some, however, are not really suitable for our purposes. A "book" is much too large a unit. It may take days or even weeks for one to be read. Even then, there are short books and long books. How could we possibly find enough books that

were so similar that reading one could be directly compared to reading another? Our counts could change drastically because of book length, difficulty, and interest -- completely aside from any change in the child's skill. "Pages," "lines" and "sentences" are prone to the same problems. It is not until the level of "words" that the units begin to approach some reasonable similarity in size and are small enough to happen with reasonable frequency. Words have the additional advantage of being directly related to the common definition of oral reading -- the process of decoding written symbols into spoken words. Finally, words are much more easily classified as "spoken correctly" or "spoken incorrectly" than any of the grosser units described earlier. When is a book read correctly? The last two alternatives in the list above might offer some advantage. Syllables or phoenemes would, for example, provide greater consistancy in size and difficulty than words. Unless the material is specially coded, however, syllables and phoenemes would be quite difficult to count. In general, "reads words orally" will provide an adequate degree of precision and consistancy, and still be easy to count.

Calibration, the procedure of checking the behavioral unit to be measured, is an important step in the specification of targets for change. Calibration will insure that the critical unit of behavior is measured, and that the behavior counts may be easily obtained and compared meaningfully from day-to-day. Additional examples of calibration are provided in Table 1.

Insert Table 1 About Here

Fair Pairs

The educator does not change the behavior of his pupils merely for the sake of change, but to help them grow and develop. In the selection of behavioral targets great care must be exercised to be "fair." It is unfortunate, but true, that educators frequently emphasize the negative, and forget the positive behaviors of the pupils in their charge. Out of

315 pinpointed movement cycles listed by a group of 60 teachers as the behaviors they would most like to change in their students, 256 of them were behaviors they would like to see less often. There were only 59 behaviors, listed by 60 teachers, that were considered "positive." For whatever reason, the teachers were able to find 4.33 times more "wrong" things with their children, than behaviors which could be made "right."

If we keep taking behavior away from a child, without putting something back, what will we have left? "Don't get out of your seat." "Don't talk." "Don't write." "Don't ..." What about the "do's?" To avoid this problem, Precision Teachers follow two simple rules: First, if a behavior is to be accelerated (i.e., the plan is to make it happen more often), then fine, no other project need be planned. If a behavior is to be decelerated, however (i.e., the plan is to make it happen less often), then a second project must be designed to accelerate at least one other behavior. Thus the name, "fair pair."

Usually a fair pair is made up of behaviors that are incompatible with one another, that is, they cannot both happen at the same time. A child cannot read auto magazines if he is reading his history book; nor can he be frowning if he is smiling. One must be careful, however, to make sure that both parts of the pair are behaviors. The opposite of "swears," "does not swear," is really the absence of behavior! At times it will be necessary to select a pair that are only incidentally related because

TABLE 1

MOVEMENT CYCLE CALIBRATION

Possible Spelling Movement Cycles		Possible Arithmetic Movement Cycles
	UNITS TOO LARGE These movement cycles are in units which either are too large or make it difficult to discriminate a single response as either correct or incorrect.	
hears to write word lists*		writes answers to worksheets
hears to write words		writes answers to problems
	IDEAL UNITS These movement cycles are ideal, both as the target of instruction and as the object of measurement. The fundamental skill in spelling is maintained: the relationship of letters to one another in words. Digits are the critical factor in arithmetic; and in both, long words or problems with several digit answers are "counted" fairly, and unequal units are not equated with each other, as in answers problems or writes words.	
hears to write letters in sequence in words		writes digits to answer problems
	UNITS TOO SMALL These movement cycles are in units which are so small that the critical effect of the behavior is lost. They are also impractical to count in classroom settings.	
hears to write letters		writes marks to write digits to to answer problems

*This movement cycle is used to describe the common administration of a spelling test. The child hears the word and then writes it. Of course, hearing or listening are not observable movement cycles, but are included to differentiate a child who is copying words or writing words from his own thoughts.

there is no direct behavioral counterpart to the movement cycle of prime concern. For "swears," perhaps "says sentences without swearing" would suffice. Following are some additional examples of possible fair pairs:

Acceleration Targets	Deceleration Targets
raises hand before talking	talks out of turn
smiles	hits peers
shares toys	takes toys
answers teacher's questions	crys and runs away

Notice that in most cases the behaviors could occur at the same time. In each case, however, increasing the frequency of one behavior will give the child "something to do" as the other behavior begins to decrease in frequency. Actually, there is a bonus in being fair -- accelerating one behavior will very often make the other behavior decelerate more rapidly!

Priorities for Change

In any child there are likely to be a number of behaviors which could be targeted for change. Although it is sometimes useful to work with several behaviors at once (sometimes growth in one area will enhance growth in another), the teacher must be careful not to undertake more projects than he is able to administer and monitor effectively. It will be necessary to prioritize behavior projects in terms of their importance to the child's growth. In most cases, those priorities should be established as follows:

(1) Identify those behaviors which, if not changed, will result in the movement of the child from his present educational

situation to one which is for some reason less desirable. If, for example, a child's speech patterns prohibit his active participation in regular classroom activities, then "says sounds correctly" and "says sounds incorrectly" should be targeted and changed before it becomes necessary to remove the child from the regular classroom for speech therapy and remediation for all the work he missed. Other examples would include those social or antisocial behaviors (hits peers, interrupts, breaks furniture, swears, etc.) that may eventually require removal from the classroom. If the behavior selected involves deceleration (a project to reduce its frequency), then be sure to target a fair pair. Finally, when targeting these high priority behaviors be sure that the behavior selected is, in fact, the "root" or "total" problem. More than once a child has been referred to special education for reading problems when the real problems were "out of seat," "talking out of turn," or other behaviors that implied to the teacher that the child was "not paying attention." A little data collected on peers will often point out that our perceptions of what a child's problems are can frequently be wrong.

(2) Second in priority are those behaviors which will allow the child to continue his progress throughout school, and afterwards. Select those behaviors which are crucial for moving from one level of reader to the next, from one grade to the next, from special education to a regular class, or from school into a work environment. Examples would include the "core" academic subjects (oral reading, basic math facts), applied experiences (e.g., the use of math in shopping and basic bookkeeping), useful

social skills (e.g., saying "please", and proper table manners), and behaviors useful for continued peer interaction (e.g., certain game-playing skills, enough knowledge regarding subjects of interest to engage in peer conversations -- "talks about cars," "talks about politics").

(3) Third in priority are those behaviors which are "fun". "Makes paper mache constructions" might be useful in developing motor coordination or a sense of art, but is not really vital per se to the child. Nevertheless, in a complete school program such behaviors have their place. They make the general school experience far more enjoyable for both the teacher and the child; and may even add to those "general social skills," "leisure time skills," or "peer-interaction skills" that eventually promote the movement of the child to more advanced educational or work situations.

There will be Exceptions

Selecting behaviors which meet the requirements for a movement cycle will increase the probability that the behavior can be readily measured, has a direct relationship to the overall educational objectives, and is amenable to change. At times, however, there may be exceptions. Perhaps "stays in seat for five minutes" does make more sense than listing all of the alternative movements. Usually, such a target will present more problems than it solves, but there are exceptions. "Pounds lost", or "miles driven" are not really behaviors, although they imply a number of behaviors. Still, they may be the easiest way to collect data on matters important to you

e.g., seconds with head raised.

for example, instead of "pounds lost." Other targets for change may be tried, however; and if the goal is reached, then fine.

Insert Table 2 About Here

MEASURING THE MOVEMENT

Movements per Minute -- the Data

In the manuscript of Behavioral Assessment and Precise Educational Measurement a number of data types were analyzed. The basic unit of measurement, it was concluded, was most frequently a count of the number of times a behavior occurs. If the behavior has been well pinpointed, and all of its important dimensions have been listed, then a count provides the teacher with a precise statement of the amount and type of behavior which occurred each day.

Duration, latency, and other "time-only" data usually require stop watches or other special timing devices. The description of topographies, force, and other physical dimensions of behavior require a lot of writing or specialized instruments too. If the end of the movement cycle has been well defined, and is readily observable, then count data can be collected quite easily, with little time, and using devices which may be found in any classroom (to be discussed later). For these reasons the behavior count was selected as the basic measurement tool in Precision Teaching.

To standardize the counts, since they may be collected over different periods of time, Precision Teachers calculate rate or frequency. Simply, the behavior count is divided by the number of minutes spent observing the behavior. The result is a statement of the average number of behaviors one would see during each minute of observation, movements per minute.

$$\text{Movements per minute} = \frac{\text{the number of movement cycles counted}}{\text{the number of minutes spent counting}}$$

Even if a teacher always counts the behavior for the same number of minutes each day, the behavior frequency is still calculated. This allows the teacher

to compare his data with similar data collected by other people who may not have watched the movement cycle for the same amount of time. Everyone "talking the same language" can lead to alot of shared data.

Sharing

The concept of "talking the same language" is quite important in Precision Teaching. It avoids confusion and saves time when two or more people get together to discuss a child or project. Following is a list of certain other standard terms that are used in Precision Teaching to describe some of the conditions under which the movement cycle is counted. The implications of the concepts represented by each term are discussed in more detail in the manuscript on Behavioral Assessment and Precise Educational Measurement.

The record length is the total amount of time spent counting the movement cycle during any one day. The record length is always specified in minutes to facilitate the calculation of frequencies (movements per minute). Be sure and record only the number of minutes actually spent counting the behavior. If a school day is six hours long (6 x 60 = 360 minutes), but the behavior is not counted during recess or lunch (a total of 90 minutes), then the record length would by (360 - 90 =) 270 minutes.

Record lengths are usually selected so that at least 10 behaviors may be counted. For "out-of-seat" behaviors, that will usually mean the entire school day; and even then, a count of ten may not be obtained (if we are lucky). For higher rate behaviors, like oral reading where the child reads 100 words per minute, much shorter record lengths will work. Record lengths are usually never set less 15 or 30 seconds, however, since timing the counts might then require special equipment. Selecting certain record lengths will make the calculation of rates and frequency much easier. With a record length of one minute the behavior

TABLE 2

PINPOINTED AND CALIBRATED "ACADEMIC" MOVEMENT CYCLES

	Acceleration Targets	Deceleration Targets
Reading	Reads words orally correctly	Reads words orally incorrectly
	Sounds consonants orally correctly	Sounds consonants orally incorrectly
Mathematics	Writes digits legibly	Writes digits illegibly
	Writes digits to answer single digit plus single digit addition problems correctly	Writes digits to answer single digit plus single digit addition problems incorrectly
	Reads numerals orally correctly	Reads numerals orally incorrectly
	Counts objects orally correctly	Counts objects orally incorrectly
Writing	Copies letters legibly	Copies letters illegibly
Spelling	Hears to write letters in sequence in words correctly	Hears to write letters in sequence in words incorrectly
	Says alphabet letters in sequence one to another orally correctly	Says alphabet letters in sequence one to another orally incorrectly
Comprehension	Circles correct answer to multiple-choice questions	Circles incorrect answer to multiple-choice questions
Music	Marks pulses to note values correctly	Marks pulses to note values incorrectly
	Identifies pictures of instruments orally correctly	Identifies pictures of instruments orally incorrectly

TABLE 2 (cont.)

PINPOINTED AND CALIBRATED "NON-ACADEMIC" MOVEMENT CYCLES

Note: With non-academic behaviors, unlike academic behaviors where there are usually "correct" and "error" responses, it is often the case that the "opposite" of one behavior is the absence of behavior. The opposite of "combing hair," for example, is "not combing hair." Since that is not a movement cycle, it cannot be specified as part of a "fair pair." Many of the behaviors listed, therefore, do not have a recommended opposite. The selection of any other behavior which occurs or should occur with roughly the same frequency would, in most cases, suffice.

	Acceleration Targets	Deceleration Targets
Meal Time Behavior	Bites taken (if underweight)	Bites taken (if overweight)
	Bites taken with spoon	
	Bites taken with fork	
	Etc.	
	Bites without spilling	Bites with spilling
	Drinks from glass without help or spills	Drinks from glass with spills
	Chews with mouth closed	Chews with mouth open
	Asks politely for food	Reaches for food or demands food
Self-Help Behavior	Ties shoes correctly	Ties shoes incorrectly
	Puts on shirt	
	Puts on pants	
	Etc.	
	Washes hands	
	Combs hair	
	Asks to go to toilet	Wets pants
	Hits toilet	Misses toilet
	Picks up clothes	Drops clothes on floor
	Brushes teeth	

count will already be in terms of "movements per minute". With a record length of 10 minutes we only have to move the decimal point (26 movement cycles in 10 minutes = 2.6 movements per minute). With record lengths of 2 minutes, just divide the count by 2 (26 movements in 2 minutes = 13 movements per minute); for a record length of 30 seconds (.5 minutes), just multiply the count by two (26 movements in .5 minutes = 52 movements per minute).

Record lengths may be constant (the same) or variable (different) from day-to-day. Constant record lengths make the comparison of frequencies across days and the estimation of progress much simplier. Whenever possible, try to keep a constant record length by watching and counting the behavior for the same number of minutes each day.

The record floor is the lowest measurable "nonzero" frequency which may be calculated for any given record length. If we watch a child for 10 minutes, then the lowest frequency of behavior we could see would be one (the lowest possible count) divided by 10 minutes.

$$\text{The record floor} = \frac{1}{\text{the number of minutes spent counting}}$$

Since the record floor is really a statement of the record length in terms of frequency or rate, only one of those two pieces of information is necessary for most records. The record floor "looks" more like the rest of our data (movements per minute), so it is usually the one that is specified. As with record lengths, constant record floors are desirable. The record floor is one of the more important features of Precision Teaching data and should be studied carefully. If the reader is not sure of its implications, it is suggested that he review the section on record floors in the manuscript on Behavioral Assessment and Precise Educational Measurement.

Record Ceilings represent the limit of the other end of our measurement scale, that is, the highest possible frequency we can measure. To determine the value of a record ceiling, divide the highest possible behavior count by the record length.

$$\text{The record ceiling} = \frac{\text{the highest possible movement cycle count}}{\text{record length}}$$

If a child is given 10 minutes to work on a math-fact sheet, and there are 100 problems on the sheet, then the highest possible frequency would be (100 problems/ 10 minutes =) 10 math-facts per minute. If the movement cycle is "turns assignments in on time," then the ceiling will be determined by the number of assignments given.

Record ceilings place limits on how high a child may progress. As ceilings are approached, some children slow down, others speed up; and once the ceiling is reached, many children fall back down to a much lower frequency than they once enjoyed. None of these changes in behavior can be directly attributed to the child per se, but rather, they may be due simply to the ceiling. To understand the child and to give the child as much freedom as possible to grow and progress, the ceiling should be at least two times greater than the expected performance. With low rate behaviors (e.g., one which occurs only 2 or 3 times a minute), the ceiling should be at least 10 times greater than the highest expected performance. To raise ceilings, provide the child with more opportunities to respond (give him a math sheet with 500 problems, or provide more but shorter assignments) or time the behavior over a shorter period of time (give the child only one minute to work on 100 problems).

A special type of record ceiling, illustrated by the "assignments due" movement cycle, deserves special attention. At times an instructional tactic will

Teacher-paced.

"pace" the child. A typical example is the usual spelling test. One word is read, and then the teacher waits. When all children have indicated that they have written their responses, the next word is read. The child is paced not only by the teacher (he cannot proceed to the next word until it is read), but also by his peers (the teacher will not read the next word until his peers are finished). The assessment of a child's fluency in a situation like that is mixed up with the fluency of his peers and even the teacher. One alternative might be to test each child separately, moving from word to word quickly as one response is completed. That would take a considerable amount of time, however, perhaps several minutes per child. Another alternative would be to prepare a longer list of words and read them at a pace faster than that of the most fluent child in the class. Each child would write as many of the words as possible, attending to the last word he hears. No child could write all the words, but if many words are provided, every child will write enough words for the assessment of his progress in spelling. Both accuracy and fluency could then be assessed. Both are important. If the teacher still wishes each child to attend to each word, then two presentations could be made -- one for fluency, one for accuracy. The first would take only a few minutes, the second would take longer. The total increase in the time spent assessing spelling would not, however, be significant.

As with record floors, the record ceiling may be constant or variable. Constant record ceilings will make the interpretation of performances easier. Whenever possible, therefore, provide the same number of opportunities to respond each day, and count the behavior for the same length of time.

Performance ceilings are the present physical limits of a child's ability to respond. A child cannot read faster than he can talk; or write answers to

math-facts faster than he can write digits at random (without solving problems). Even in cases of severe physical disability these limits can usually be changed with the right type of practice; but when we set our aims for a child, performance ceilings must be taken into account. More will be said of this important topic under the section entitled "establishing proficiency rates" later in this manuscript. For the moment let us turn to the discussion of who may collect the data.

Data Collection -- Who?

The collection of frequency data involves keeping a record of the length of observation and a count of the number of behaviors which occurred during that time period. Since none of that information is very difficult to obtain, frequency data can be collected by teachers, aides, parents, the behaver, peers of the behaver or other children. In more than one instance, self-marking or self-recording of the behavior by the behaver himself has produced an important behavior change without a need for any additional program.

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Insert Figure 1 about here

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Where self-recording is not possible or desirable, teachers have been successful in recruiting the assistance of others. Parents are often eager to help, and even to try projects in their homes. Sometimes practicum classes can be set-up to allow high school students to act as aides in an elementary school. Children can also work in teams, counting and timing each other.

If the target movement cycle does not require oral responding and equal record lengths are established for the class, counting can be done at the same time for all. Sometimes a physical rearrangement of the classroom allows for more convenience in collecting the data. There are many resources available to the classroom teacher to assist in the collection of the data.

More detail for M.R.

Data Collection -- How?

Frequency data on targeted academic movement cycles is collected by counting the correct and error responses made by the student to a specific set of items in a predetermined amount of time. The items to which a child responds during the evaluation of an academic movement cycle have been called probes, timing sheets, and progress checks.

A probe is a set of items given to the behaver with which he demonstrates his current rate of responding. The probe for the movement cycles "reads words orally correctly" and "reads words orally incorrectly," for example, may be the child's current reader. For many target movement cycles in arithmetic computation, the "probe" is a mimeographed sheet with a set of problems which correspond to the target (e.g., single-digit addition, double-digit multiplication, two-digit subtraction with borrowing). In spelling, the list of words read aloud to the student constitutes the probe. For movement cycles such as "counts numerals aloud in sequence," there really is no probe other than the teacher's instructions and the record sheet used by the teacher to record the responses.

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Insert Figure 2 about here

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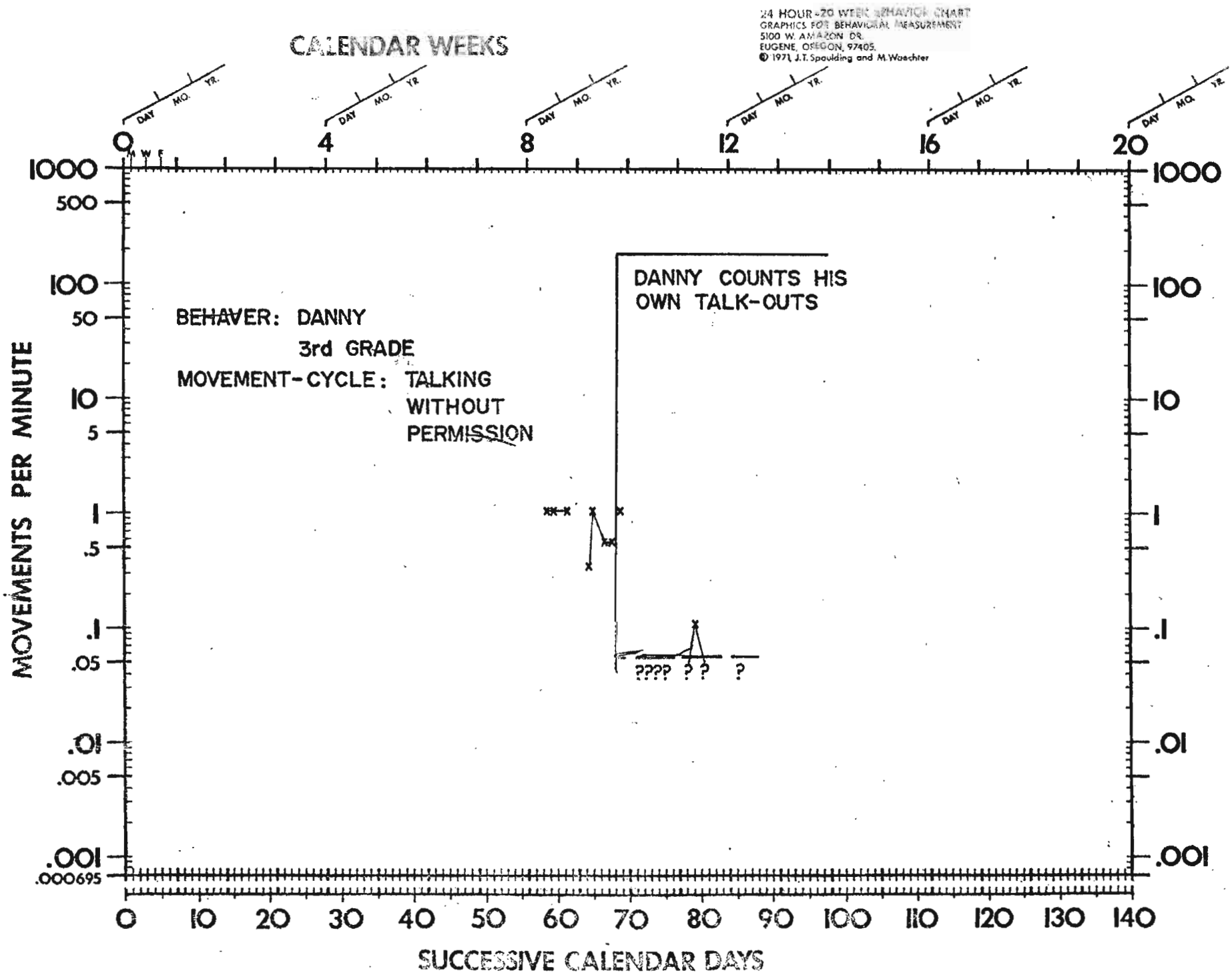
24 HOUR-20 WEEK BEHAVIOR CHART
GRAPHICS FOR BEHAVIORAL MEASUREMENT
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EUGENE, OREGON, 97405.
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CALENDAR WEEKS
DAY MO. YR.
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MOVEMENTS PER MINUTE
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SUCCESSIVE CALENDAR DAYS

FIGURE 1

Figure 2

Each of the examples in figure 2 represents a type of probe which may be constructed by a teacher to measure some aspect of academic performance. The Spelling probe, part A, is an example of a probe which is read by the teacher to the pupil. The instructions for use are clearly indicated on the probe sheet, so that aides, parent helpers, and others that may help in the collection of performance data will all follow the same procedures. The words are read quickly enough to that each student has an opportunity to demonstrate his fluency as well as his accuracy. Since the same list is read for several days, each child will eventually have an opportunity to respond to each word. No marks are made by the teacher on this type of probe, since each of the children will write the words he hears on a separate piece of paper; providing the teacher with a "permanent record" of their behavior. The Add Facts probe is given to each child, who then writes his answers directly on the sheet. The type of probe is labeled ("+w/o carrying (A)"), and spaces are provided for the child to write his name, the time spent on the probe (if he times himself), the number correct, and the number of errors. Rates correct and error are calculated if more than one minute is spent in working on the probe. In most cases, the child calculates and records the rates himself. Space is provided at the bottom of the probe for teacher checks and notes. The probe is divided into five sections (A through E), each section containing a known type of problem (answers all equal 19, answers equal 18 and 19, etc.). This will facilitate the identification of a child's problems, should they arise. The numbers at the top of each column indicate the number of digits, total, that the correct answers to the problems will contain (e.g., in the first column, there are 12 problems, each requiring two digits as an answer). The teacher or child, then, only has to count the correct or error digits, and subtract that number from the total to find the other. Digits, instead of answers, are counted to provide a finer level of "calibration", and a more precise measure of the actual level of performance. The oral counting rate probe is another example of a sheet used by the teacher, but in this case the child is instructed to orally count from zero to 100. Errors made by the child are marked on the sheet by the teacher, parent, peer, or aide administering the probe. Again, since the child will not use this sheet himself, instructions are printed at the top to make sure it is always administered in the same manner. The CVC word list is a second example of probe used by the child himself. He is given the sheet, and instructed to read the words from left-to-right, pointing to each word as he goes. Each type of error (insertions, substitutions, etc.) is noted by the person administering the probe on a second sheet identical to that used by the child.

SPELLING

Test No. 18 Time: ONE MINUTE

Directions to the students: "Write each of the words you hear. Don't try to write all of the words I read. Do the best you can. Ready.... Begin."

Directions to the administrator: Read one word every three seconds. Do not repeat any words. Do not answer any student questions during the test administration.

fib
sit
leg
can
met
far
let
sip
bad
run
cat
lip
nut
pig
hat
man
fig
pot
sat
gun
did
top
pop
hit
sad
vex
yet
pet
hop
fin

At the end of ONE MINUTE, say "Stop. Put down your pencils."

FIGURE 2, PART A

Name FIGURE 2, PART B + w/o Carrying (A) 4b

School Grade Date
TOTAL TIME_____ NUMBER CORRECT_____ CORRECT RATE_____
NUMBER ERROR_____ ERROR RATE_____

(A) (24)	(24)	(26)	(26)
12+7=	13+6=	12+7=	13+6=
11+7=	11+8=	11+7=	12+6=
13+6=	12+7=	13+6=	11+7=
11+8=	13+6=	11+8=	(E)
13+6=	11+7=	12+7=	13+6=
12+7=	12+6=	13+6=	11+8=
12+6=	13+6=	(D)	12+7=
13+6=	11+8=	12+7=	11+7=
12+7=	(C)	13+6=	11+8=
11+8=	13+6=	11+7=	12+7=
(B)	12+7=	11+8=	11+6=
13+6=	12+6=	13+6=	12+7=
12+7=	11+8=	12+7=	13+6=
		13+6=	12+6=

Incorrect (#) _____
Reverses (specify) _____
Illegible (#) _____

FIGURE 2, PART IC

Name

ORAL COUNTING RATE PROBE

Date

MARKING DIRECTIONS

Underline each numeral that the student repeats. One underline for each repetition.

Circle each numeral that the student omits.

Slash through each numeral which is mispronounced.

Slash after the last numeral the student says (at the end of one minute).

0	1	2	3	4	5	6	7	8	9	(10/10)
10	11	12	13	14	15	16	17	18	19	(20/30)
20	21	22	23	24	25	26	27	28	29	(20/50)
30	31	32	33	34	35	36	37	38	39	(20/70)
40	41	42	43	44	45	46	47	48	49	(20/90)
50	51	52	53	54	55	56	57	58	59	(20/110)
60	61	62	63	64	65	66	67	68	69	(20/130)
70	71	72	73	74	75	76	77	78	79	(20/150)
80	81	82	83	84	85	86	87	88	89	(20/170)
90	91	92	93	94	95	96	97	98	99	(20/190)
100										(3/193)

SCORING

1. Highest numeral counted _____
2. Total number of numerals omitted _____
3. Highest numeral counted without error _____
4. Total digits counted without error _____

FIGURE 2, PART D

NOG	CUT	RAP	WET	SOB	YUM	ZIP	7
DON	KEG	NUT	SIN	JOT	ZAP	WIG	14
BUN	VAL	BUS	FIG	TAX	GUM	RED	21
TIM	POD	SET	VAT	DUD	WEB	LOP	28
FIT	GUN	RAG	MOP	CAB	GUT	HEM	35
JOB	PAL	RED	MUD	LOG	ZAP	TOT	42
KED	SUM	JET	HIB	VIM	FED	RUT	49
KEN	LIP	VAN	POP	JAM	HOD	YES	56
LOT	NIP	HOG	TEN	GAL	RUB	FAN	63
BIT	YET	COG	ZEN	DIP	WAG	FUN	70
NOT	GAS	TOP	KIN	YAP	MEL	DOT	77
RIB	MUM	WED	LAD	NUN	KIT	PEN	84
TAM	CUD	GIG	POP	LUG	SIT	DEN	91

"reads CVC words" -- 91 unique words

Probes are constructed by 1) pinpointing and calibrating the movement cycle which is the target of instruction, 2) selecting items which test only that movement cycle, and 3) avoiding record ceilings and paced responding. In teaching reading decoding skills we might select "vowel sounds" as a crucial part of the curriculum. The pinpointed movement cycles would be "sounds vowels orally correctly" and "sounds vowels orally incorrectly." (Usually movement cycles such as "hears to write vowel letters" would not be selected, since the terminal objective is oral decoding, and writing letters is a different behavior entirely.) In constructing the probe to be used in evaluating student progress on this particular movement cycle, the teacher would construct a sheet with the letters of the vowels on it. If the aim was to reach a rate of 60 sounds per minute correct, with two or less errors, and the teacher planned a record length of 30 seconds, then the sheet should contain 50-60 letters (allowing for a rate twice that expected). Enough copies of the sheet would be made so that each day as the child sounded the vowels the teacher could record the responses as correct or incorrect directly on a copy of the same sheet used by the child.

Record lengths for the administration of probes should be long enough to allow at least ten correct behaviors. If available, one should use established proficiency rates as a guide (there will be a section on proficiency rates later in this manuscript).

Data Collection on Several Behavers

Frequency data on academic movement cycles can be collected on several behavers quickly in many different ways. If the response required of the behavers is oral, individual timings must usually be arranged. One teacher who was collecting oral reading data on 30 children divided her class into pairs. Each child would read aloud five minutes to his partner and then they would switch. After another five minutes they would switch again, and so on until the teacher called "time". During this time the teacher walked around the classroom and listened to each of the children in turn. Another possibility for collecting data on oral movement cycles is to assign the class a project which can be done without close, continual supervision (e.g., "workbooks," "arts and crafts," "free time") and then work with each child individually. If aides, other students, or parents are able to assist, the problems of arranging for individual timings are minimal.

Data collected on academic movement cycles which do not require oral responses can be collected during "group timings." Even if each student is working on a different math fact probe the timings can be given simultaneously. If each child were on a different spelling list, tape recordings of the words could be made by the teacher. Each child could then listen to his one minute section of the tape at his desk or in a special area of the classroom.

Frequency data on other kinds of movement cycles can be collected in many different ways. Wrist counters, golf counters, wrist abacuses and a piece of tape on the wrist marked with felt pen have all been used by teachers in counting behaviors. The "golden oldie" -- paper and pencil tallies -- is very functional in counting behaviors. One ingenious parent, whose children discovered the wrist

counter, placed pots around the house and dropped beans in them to record the occurrence of behaviors. She used different colored beans for each movement cycle she was counting. When asked by her children what the beans were for, she replied that she was sorting them for chile! At the end of her reference phase, the counting beans were cooked for dinner. Only imagination limits the methods devised for the collection of data.

Scoring the Data

Scoring can be done by the teacher, the aide, the parent, peers or by the behaver. Often self-correction provides an excellent learning experience. Scoring is, of course, according to the calibration of the movement cycle. Figure 3 shows an example of some scored probes.

- - - - - - - - - - - - - - -

Insert Figure 3 about here

- - - - - - - - - - - - - - -

Figure 3

This figure presents several examples of how probes may be scored. In the math-fact probe, incorrect or illegible digits are simply underlined. Note that even though the "zero-times-two" problem appears to have been corrected, it is still counted as incorrent since both the two and zero in the answer are still apparent. The teacher should refrain as much as possible in making judgments about "fuzzy" answers. If the performance of the child is not clearly correct, it is better to mark the answer as wrong and to work with the child on that problem, rather to assume that the child knows what he may not know.

In the consonant sounds probe notes are made according to the instructions provided on the probe to indicate the type of error that was made. This information will prove invaluable in devising the type of practice and instruction which will most benefit the child.

The spelling probe is scored by counting the number of "letters in sequence". The first "sequence" that the child must learn is that of placing the first letter in the word on the blank page after having heard the word from the teacher. If that part of the task is correctly performed, a "caret" is placed above the sequence "space-to-first letter". If the next letter is correct, another caret is placed above the sequence "first-to-second letter", and so on until the last letter. The final response required in spelling a word is really knowing when to stop. If a space occurs at the end of the last letter then a caret is placed above the sequence "last letter-to-space". If an error is made in a sequence, then a caret is placed below the word. If a child wrote "cnt" instead of "cat", for example, the scoring would be as follows: "space-to-c", correct; "c-to-n", incorrect; "n-to-t", incorrect; "t-to-space", correct. The total would then be 2 correct, 2 errors. The advantage to this type of scoring lies in the number and type of errors which may be detected. For example, if a letter is left out, then the total number of carets will be less than the total possible. The number possible is always equal to the number of letters plus one. "Cat", having three letters, has a possible four carets. If the child leaves out a letter, there will be one less caret. In the answer "ct", for example, the scoring would be: "space-to-c", correct; "c-to-t", incorrect; "t-to-space", correct. Total score: two correct, one error. Since two plus one equals only three, and we know that there should be four, we know that there must have been (4-3=) one omission. When there are double letters in a word and one of the double letters is left out, there will be no "errors" in the sequence, but our scoring will still reveal one omission. If "Seattle" were spelled "Seatle", for example, then the sequences "space-to-S", "S-e", "e-a", "a-t", "t-l", "l-e", and "e-space" are all correct (i.e., they are all appropriate to the word "Seattle", and do not occur more times than they should), but they only total seven responses when there should be eight. We know therefore, that there was one omission. Furthermore, since there was an omission with no errors, we know the problem must be with double letters. Finally, since this form of scoring accounts for "spaces", it can also be used in scoring such things as "write full name" and "writes address" and will attend to the fact that spacing between words, etc., is just as important as the words themselves.

Name M.K. Teacher _____ School _____
Grade _____ Correct 29 Error 4 Time _____ Date _____

2 × 4 = 8	4 × 1 = 4	5 × 2 = 11	0 × 0 = 0	1 × 1 = 1	2 × 0 = 0	3 × 4 = 12	5 × 3 = 15
1 × 2 = 2	8 × 4 = 32	7 × 1 = 7	9 × 3 = 27	10 × 0 = 0	5 × 1 = 5	4 × 4 = 16	3 × 2 = 6
0 × 1 = 0	3 × 3 = 9	1 × 2 = 2	2 × 7 = 14	4 × 5 = 20	5 × 6 = 13	5 × 5 = 25	7 × 3 =
8 × 2 =	9 × 1 =	3 × 8 =	2 × 2 =	0 × 2 =	7 × 2 =	5 × 7 =	4 × 2 =
9 × 4 =	10 × 2 =	3 × 0 =	7 × 4 =	10 × 4 =	4 × 0 =	9 × 5 =	1 × 8 =
6 × 8 =	6 × 6 =	8 × 7 =	7 × 6 =	7 × 7 =	9 × 2 =	10 × 5 =	6 × 8 =
10 × 6 =	9 × 6 =	10 × 9 =	9 × 7 =	8 × 9 =	10 × 7 =	6 × 4 =	9 × 9 =
5 × 2 =	7 × 8 =	9 × 6 =	1 × 3 =	3 × 1 =	6 × 9 =	8 × 7 =	2 × 9 =

FIGURE 3, PART A

FIGURE 3, PART B

CONSONANT SOUNDS 1 MINUTE

INSTRUCTIONS FOR ADMINISTRATION 4/6/71 Mike

EACH LETTER MAKES A SOUND. THIS LETTER, (SHOW "M") MAKES THIS SOUND---mmmmm. SAY THE SOUND THAT EACH OF THESE LETTERS MAKES. (give student copy) GO AS FAST AS YOU CAN. POINT TO EACH LETTER AS YOU SOUND IT. (demonstrate left to right on student's copy). IF YOU DO NOT KNOW A SOUND, SKIP IT, AND GO ON TO THE NEXT. READY.....BEGIN.

At the end of one minute, say STOP.

RECORD SHEET

m	t	r	d	s	f	j	j	h	z	(10)
d	l	z	n	p	k	j	z	k	r	(20)
t	v	h	d	f	z	l	z	n	b	(30)
hmm	p	j	z	t	r	d	v	j	f	(40)
h	z	z	p	n	c	l	b	m	k	(50)
s	j	n	z	t	v	d	r	p	s	(60)
l	g	f	h	m	k	r	b	c	s	(70)
d	v	t	n	g	l	p	z	j	b	(80)
h	m	c	r	k	f	m	t	r	d	(90)
s	f	v	g	h	z	b	l	c	n	(100)

MARKING INSTRUCTIONS

Slash through each letter sounded incorrectly. Write in above what the student said.

Circle each letter which the student skips.

Slash after the last letter sounded at the end of one minute.

SCORING

Correct 31 Error 13

Susan

Spelling

fib	4 CORRECT
cap	2 CORRECT, 2 ERRORS (cat)
bid	2 CORRECT, 2 ERRORS (bed)
run	4 CORRECT
nut	4 CORRECT
hat	4 CORRECT
man	4 CORRECT
tig	2 CORRECT, 2 ERRORS (FIG)
vet	2 CORRECT, 2 ERRORS (VEX)
hop	4 CORRECT

32 CORRECT

0 ERRORS

FIGURE 3, PART C

Once the probe has been scored, the data is recorded on a Rate Record Sheet. This form provides a record of the data and the relevant information about its collection. Figure 4 illustrates an academic-movement Rate Record Sheet.

Data on nonacademic movement cycles are recorded in essentially the same manner. Since each target in a fair pair might be observed for different record lengths, however, it is necessary to provide for each target separately. Rate Record Sheet II, shown in Figure 5, is designed for such use.

- - - - - - - - - - - - - - -

Insert Figure 4 about here

- - - - - - - - - - - - - - -

- - - - - - - - - - - - - - -

Insert Figure 5 about here

- - - - - - - - - - - - - - -

Data--Exceptions to the Rule

Frequency data is collected whenever the critical effect of the behavior chang can be described in terms of the rate of its occurrence, but there may be instances in which the critical effect is the duration or latency of a response. It may be that a teacher wants to change the time a particular student spends getting into line when asked to do so. Here, latency data would be collected on the time between the instruction to line up and when the student actually gets in line. The frequency of the behavior, since it would be limited by the number of times the class lines up, would not be very important. As a second example, a student may

RATED MOVEMENT CYCLES ____________________

BEHAVER ____________ age ______ grade ______
MANAGER ____________ lable ______
ADVISOR ____________
DATE PROGRAM INITIATED ____________

AIMS: acceleration: rate ________ date ________

deceleration: rate ________ date ________

* record count, rate must be computed

DAY	DATE	TIME	ACCEL.* COUNT	DECEL.* COUNT	COMMENTS (TIMER, PAGE, LINE, ETC.)	DAY	DATE	TIME	ACCEL.* COUNT	DECEL.* COUNT	COMMENTS (TIMER, PAGE, LINE, ETC.)
S						S					
M						M					
T						T					
W						W					
T						T					
F						F					
S						S					
S						S					
M						M					
T						T					
W						W					
T						T					
F						F					
S						S					
S						S					
M						M					
T						T					
W						W					
T						T					
F						F					
S						S					

FIGURE 4

RATED MOVEMENT CYCLES_____

_____

AIMS: acceleration: rate_____ date_____

deceleration: rate_____ date_____

BEHAVER_____ age_____ grade_____

MANAGER_____ label_____

ADVISOR_____

DATE PROGRAM INITIATED_____

ACCELERATION

day	date	time	count	rate	comments
S					
M					
T					
W					
T					
F					
S					
S					
M					
T					
W					
T					
F					
S					
S					
M					
T					
W					
T					
F					
S					
S					
M					
T					
W					
T					
F					
S					

DECELERATION

time	count	rate	comments

FIGURE 5

RATE RECORD SHEET II

only leave his seat without permission about once a day, but when he does, he stays out of his seat for quite a while. Rate or frequency data would be less meaningful and provide less useful information than duration data. Nevertheless, for most classroom behaviors, one will find that the critical effect can be usefully measured by the frequency of their occurrence.

PRESENTING THE DATA -- THE CHART

Charts are used to present data in a clear and easily interpreted manner. As was discussed in the manuscript on Behavioral Assessment and Precise Classroom Measurement, however, different types of charts can expand or contract the data in different ways -- sometimes making the data less meaningful instead of more so. The "6-16" or "6-cycle" chart[1] has been carefully designed to avoid many of the interpretive problems that other charts present. Among its advantages are the following:

(1) The 6-cycle chart uses a ratio scale to show the frequency of responding. Changes in performance are displayed proportionately to keep the apparent size of the change relative to the child's actual level of performance. A child changing from 10 to 20 words per minute (a times-two change or doubling of performance) will appear to have made the same magnitude of change as one going from 40 to 80 words per minute (also a times-two change). Each child and each performance of a child is judged in terms of itself, not some arbitrary "absolute" scale which makes changes in high rate behaviors appear more significant.

(2) The range on the chart allows us to chart and examine behaviors which occur only once each day (once per 24 hours or 1440 minutes = .000695 movements per minute) just as easily as behaviors which occur 1000 times in one minute. Being able to use the same chart for all behaviors greatly facilitates comparisons between the progress being made in one behavior with that of another giving the teacher more information to devise the best possible educational plan.

---

[1] The 6-cycle chart is available from its original designers, Behavior Research Co., Box 3351, Kansas City, Kansas 99103. Other producers of the chart are not set up to distribute them on a wide scale and/or have introduced modifications into the chart which prohibit direct comparisons between users of their chart and those used in this chapter. Additional materials for Precision Teaching are also availab from Behavior Research Co.

(3) Each chart covers 140 successive calendar days so only two charts are needed to follow a child through one school year. Since every day of the calendar is represented on the chart, it is also easy to determine when a child was in school, when he was not and when (even if the child was there) the performance was assessed or the program was changed.

(4) Since one type of chart can be used in so many different situations, comparisons with the data collected by other people using the same chart is much simplier. The development of various devices for making charting even easier has also been made possible. If everyone used a different chart, no one could afford to make the devices for each and every variation. These devices will be discussed at length later.

Other advantages of the chart will become apparent in succeeding sections. The value of using a standard chart canoot be overemphasized. The reader is strongly urged to employ such a chart with at least a portion of his projects so that the advantages will be made apparent on a personal basis.

Charting on the 6-cycle or 6-16 chart[2]

Day line run vertically up and down the chart. Each line represents one calendar day. The dark day lines are Sundays, the lighter day lines represent

---

[2] The 6-cycle and 6-16 charts are simply two versions of the same standard format. They are identical in size and proportion, so they may be compared or overlayed with one another. The only differences are that: the 6-16 chart goes down a little further in rates than the 6-cycle chart (down to 1 behavior in 24 hours or 1440 minutes to a rate of .000695 movements per minute, as opposed to one behavior in 16 hours or 1000 minutes); and the 6-16 chart has darker "five lines" (.005, .05, .5, 5, 50 and 500) which make the task of finding the middle of each cycle slightly easier. The 6-16 chart will be used in this chapter, but all that is said will apply equally well to both versions.

the other days of the week. Space is provided at the top of the chart to indicate one date for each month (four weeks). The numbers across the bottom of the chart indicate the number of successive calendar days which have passed since the first Sunday of the chart (usually the first Sunday or the 21st Sunday of the school year).

- - - - - - - - - - - - - - -

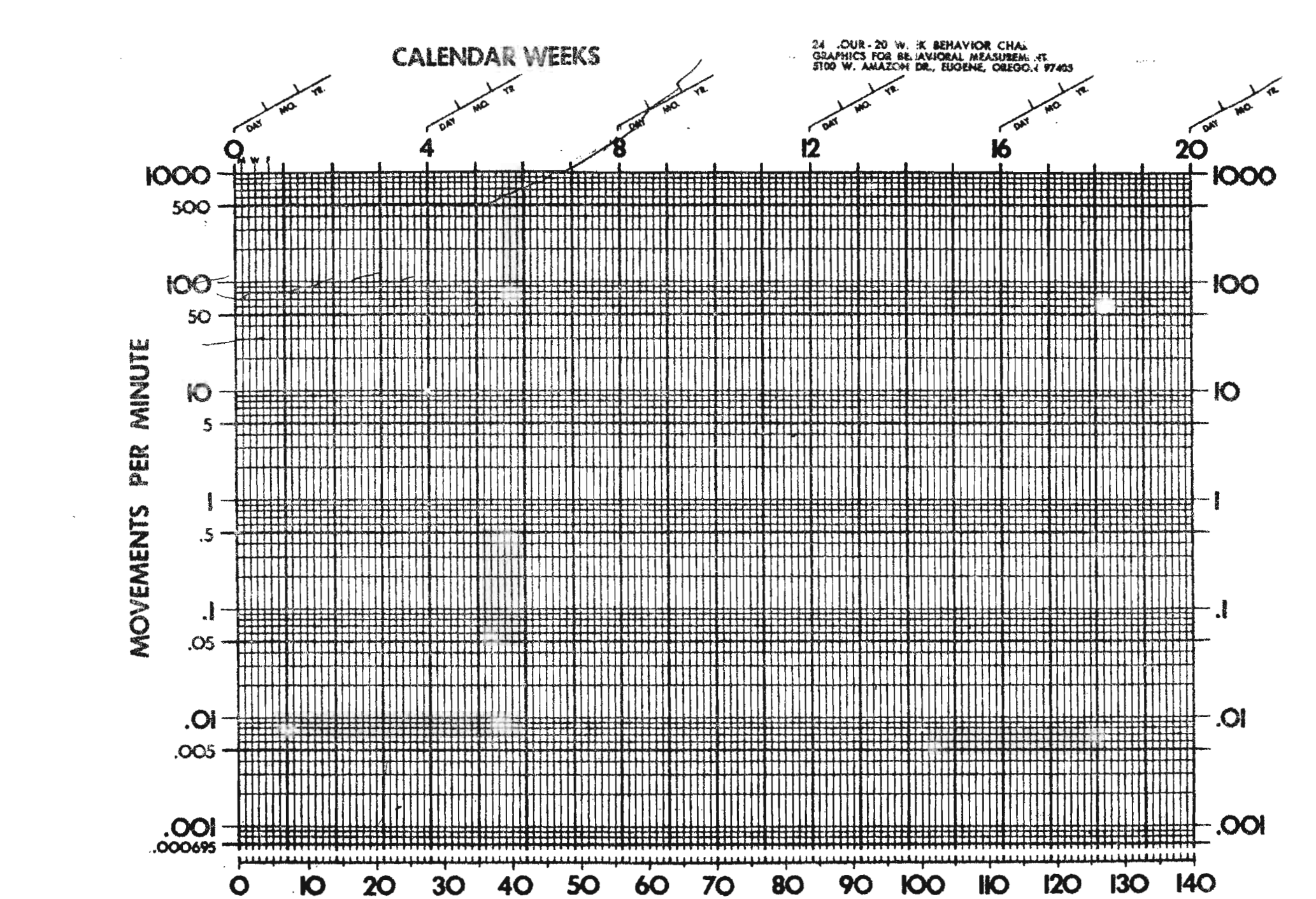
Insert Figure 6 about here

- - - - - - - - - - - - - - -

Rate or frequency lines run horizontally left and right across the chart. Each line represents a specified number of movements (behaviors) per minute -- the basic data of the Precision Teacher. The "one" line, running across the center of the chart, represents a performance where a child is emitting an average of one movement each minute. The next line up represents a performance of two movements per minute, then three, etc., until the line labeled 10 is reached. Starting with the rate line for 10 movements per minute, the lines begin to jump in increments of 10, not in increments of one as before. The next line up, therefore, is 20 movements per minute, then thirty, and so on. If a rate of 15 movements per minute is observed, then it is recorded between the line for 10 and the line for 20 movements per minute -- just as one would do any chart when the specific value for a piece of information does not correspond to one of the chart's lines. When the rate line for 100 movements per minute is reached the lines begin to jump in increments of 100 until the highest line for 1000 movements per minute is reached. The increments between successive rate lines is changed so that changes of the same relative size (e.g., changes which are all equal to a doubling of rates) will

all look the same. The change or distance from the one-line to the two-line (a times-two change) looks the same as the jump from the five-line to the ten-line (also a times-two change), and the same as a jump from the 400-line to the 800-line (again, a times-two change). In this manner, the apparent size of a change in frequency is always kept in perspective to where the frequencies began. Change in low frequency behaviors will be just as easily seen as proportionately equal changes in high frequency behaviors. Changes in the performance of a child just starting out will be as noticeable as changes in a child who has already attained some degree of fluency.

For behaviors which occur less often than once each minute, there are rate lines going down from the one-line of the chart. The next lowest line represents a frequency of .90 movements per minute (9/10ths of a behavior per minute), the next line down is .80 movements per minute, etc., with each line representing a frequency .10 less than the line above. When the .10 line is reached (one behavior every 10 minutes), the lines go down by increments of .01 movements per minute (.09, .08, .07, etc.) until a frequency of .01 is reached (one behavior in 100 minutes). The lines then go down by increments of .001 (one one-thousandths of a movement per minute) until a frequency of .001 is reached (one behavior in 1000 minutes). The 6-cycle chart stops here. The 6-16 chart, the one in this manuscript continues down a little more, by increments of .0001 movements per minute (one ten-thousandths of a movement per minute) until a frequency of .000695 is reached -- corresponding to one behavior in 1440 minutes (24 hours). Again, the spacing of the lines is carefully designed so that changes of the same relative size will all look the same on the chart.



PROJECT TEAM

SUPERVISOR _____ BEHAVER _____

ADVISOR _____ AGE ____ LABEL _____

MANAGER _____ NOTES _____

COUNTER _____ CHARTER _____

FIGURE 6, PART C

MOVEMENT CYCLE

NAME IT _____

COUNT WHEN _____

_____

_____ OCCUR

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Notice that the size of the increment between successive rate lines changes with every tenth line. It remains the same from .001 to .01, then changes and remains at the new value between .01 and .1, etc. Each series of lines (e.g., from 1 to 10, from 100 to 1000, or from .01 to .1) represents a "times-ten" change (the highest value is ten times greater than the lowest value). Each series is called a "cycle"; and there are at least 6 full cycles on each chart and a fraction of a cycle (.16) on the 6-16 chart as shown. Thus the names "6-cycle" and "6-16" charts respectively.

When using the standard chart, the first thing one should do is fill out the information requested at the bottom of the chart. That includes:

(1) The name of the behaver, or the person whose behavior is being charted;

(2) The age of the behaver;

(3) A label which describes what type of behaver the chart concerns (e.g., pupil, 3rd grader, teacher, mother);

(4) Any notes that further clarify the type of behaver involved or the purpose of the project (e.g., "afternoon data only", "natural as opposed to foster mother")

(5) The name of the charter, or the person who is responsible for recording the frequencies each day on the chart -- hopefully this will be the same as the behaver;

(6) The name of the counter, or the person who counts the behavior each day and calculates the frequencies to be charted;

(7) The name of the manager, or the person who is responsible for the plan or plans which may be devised to change the behavior being charted. In many cases, this may be the behaver himself;

(8) The name of the advisor, or any person who may be helping the manager devise change plans or interpret the data and chart; and

(9) The name of the supervisor, or any person who is ultimately responsible for the project, but who may not be actively involved in it from day-to-day. This could be a principal, a counselor, a parent, or it may simply be the same as the manager or advisor.

The people mentioned above describe what is called the Project Team -- those people who are in some way or another working together to help shape the behavior of the person being charted. In many cases the behaver himself will be most or all of the project team in an attempt to change his own behavior. In other cases the behaver might be the teacher, and the manager is the child -- children can sometime help adults grow too! "Importance" of project team members is not implied by their title. They should all be working together and can all be equally important in determining the success or failure of the project. Additional information required at the bottom of the chart includes:

(10) A description of the movement cycle to be counted ("name it"); and

(11) A description of when the movement cycle should be counted, that is, when the cycle may be considered to be complete ("count when-----occurs").

Dates are filled in along the top of the chart to indicate when the project data were collected. Now the charting begins. As each day's count is collected the frequency or rate of responding is determined and the result is plotted on the appropriate day-line of the chart. The frequency may be calculated using the formula given before (count divided by time), or may be found directly on the chart by using a rate finder.

A rate finder is a device which was developed for use on the standard chart. It enables the charter to find the record floor and frequency of the behavior for any given day without the use of formulas or the necessity of dividing one number into another. An example of a rate finder is given in figure 7. Notice that the rate finder is really just a copy of the chart's frequency scale ("movements per minute") from .10 to 1000. The finder is usually made out of a heavy clear plastic but one can actually be made by just cutting a strip off of one chartto use as a finder on another chart.

- - - - - - - - - - - - - - -

Insert Figure 7 about here

- - - - - - - - - - - - - - -

To use the finder, place it on the chart so its scale lines up with the day-line to be used. In the example, the Monday line of the eleventh week is the day to be charted. Find the line on the rate finder that corresponds to the number of minutes the behavior was counted (in this example, 30 minutes), and line that up with the "one-line" of the chart. Once the "one-line" of the chart and the "minutes-line" of the finder line-up with one another, the record floor may be found by simply moving down the finder to its one line. Usually an arrow is placed on the finder's one line to make it easier to locate. The record floor is marked with a short dash across the day line of the chart. Now, locate the line on the finder (don't move the finder) that corresponds to the number of behaviors counted that day. Next to that line, put a "dot" or an "x" to indicate that day's frequency or rate. In this case, the frequency for 10 behaviors counted over 30 minutes turns out to be .33 movements per minute.

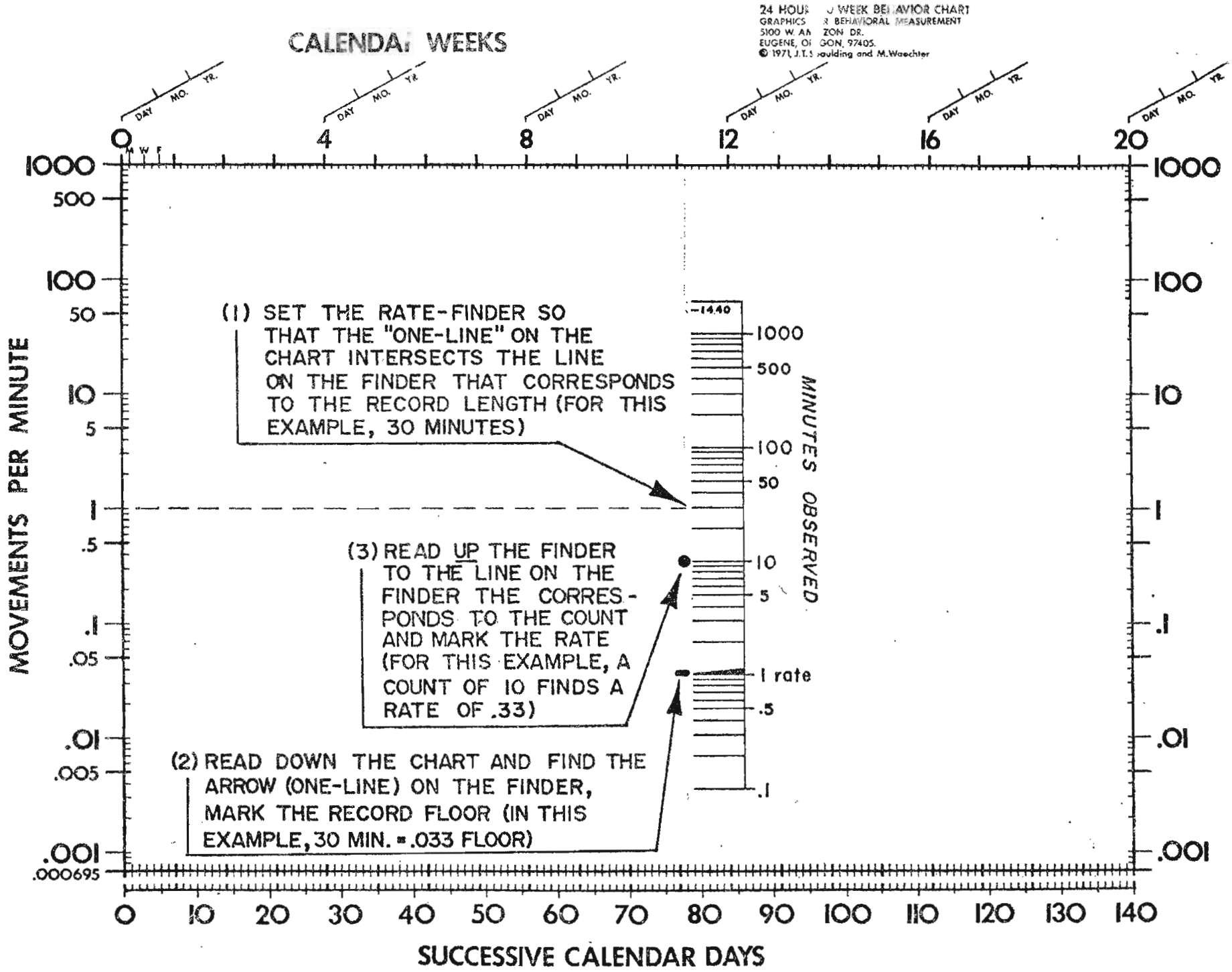
24 HOUR WEEK BEHAVIOR CHART
GRAPHICS FOR BEHAVIORAL MEASUREMENT
5100 W. AMAZON DR.
EUGENE, OREGON, 97405.
© 1971, J.T.S. Spalding and M.Waechter
CALENDAR WEEKS
DAY MO. YR.
0 4 8 12 16 20
M W F
MOVEMENTS PER MINUTE
1000 500 100 50 10 5 1 .5 .1 .05 .01 .005 .001 .000695
(1) SET THE RATE-FINDER SO THAT THE "ONE-LINE" ON THE CHART INTERSECTS THE LINE ON THE FINDER THAT CORRESPONDS TO THE RECORD LENGTH (FOR THIS EXAMPLE, 30 MINUTES)
1440
1000 500 100 50 10 5 1 rate .5 .1
MINUTES OBSERVED
(3) READ UP THE FINDER TO THE LINE ON THE FINDER THE CORRESPONDS TO THE COUNT AND MARK THE RATE (FOR THIS EXAMPLE, A COUNT OF 10 FINDS A RATE OF .33)
(2) READ DOWN THE CHART AND FIND THE ARROW (ONE-LINE) ON THE FINDER, MARK THE RECORD FLOOR (IN THIS EXAMPLE, 30 MIN. = .033 FLOOR)
0 10 20 30 40 50 60 70 80 90 100 110 120 130 140
SUCCESSIVE CALENDAR DAYS

FIGURE 7

With a little practice (a minute or so each day for a few weeks), teachers and children can learn to use the rate finder with enough fluency to chart 30, 40, or even more frequencies each minute. Even when each data point is charted on a different chart, necessitating a lot of "page flipping behavior", teachers and children can chart 6, 10, or more data points each minute. To chart all of the information collected on 30 children with four projects for each child should only take 12 or 15 minutes each day. Since children should be charting there own data whenever possible, the time will hardly be noticed once the techniques have been learned. To get the charting started many teachers will instruct one or two children in the chart and have them do all the charting for the class. When those children become proficient in their duties (the teacher checks their work), then each of those children teaches one or two other children. The work load for each child is thus cut in half. Each child continues to instruct other children until all children are charting. The teacher should continue, of course, to check the charts from time to time. Having the children do their own charting not only aids the teacher, but is often a priviledge for the children and an incentive to do better.

There are some additional short-cuts that should also be considered: First, If the behavior is always timed for one minute, then the count will equal the frequency and can be charted directly on the chart without the use of a finder. If the time is more or less than one minute, but always the same, then the record floor only has to be found once. A dashed line is then drawn indicating the record floor for all of the days on which data will be collected. Then, when the counts for each day are determined, the finder is placed so that the arrow (the one-line of the finder) falls on the floor, the line corresponding to the count is located

on the finder, and the rate is plotted just as shown in figure 7.

It should be noted that a rate/floor finder may be constructed to work for any ratio chart. All one needs to do is copy the scale of that chart onto a blank piece of paper or cut off the scale from an identical chart. Rate finders will not work on interval ("plus or minus") charts. When using charts where all of the rate lines are equally spaced, therefore, the rates must be calculated separately and then charted -- resulting in a great deal more effort. It should be apparent that the ratio chart not only represents changes in the more desirable proportional manner, but can also make charting easier.

Charting Conventions

The standard chart provides a flexible tool for the presentation of performance data. To maintain the usefulness of the standard, however, it is desirable that the chart be used in the same way by all people. A number of charting "conventions" have been developed to insure that the same information is provided in the same manner on each chart. As will be seen, these conventions not only increase the ease with which Precision Teachers are able to interpret each other's charts, but also increase the amount of information provided by each chart. The most common conventions are listed below and illustrated in figure 8.

Insert Figure 8 About Here

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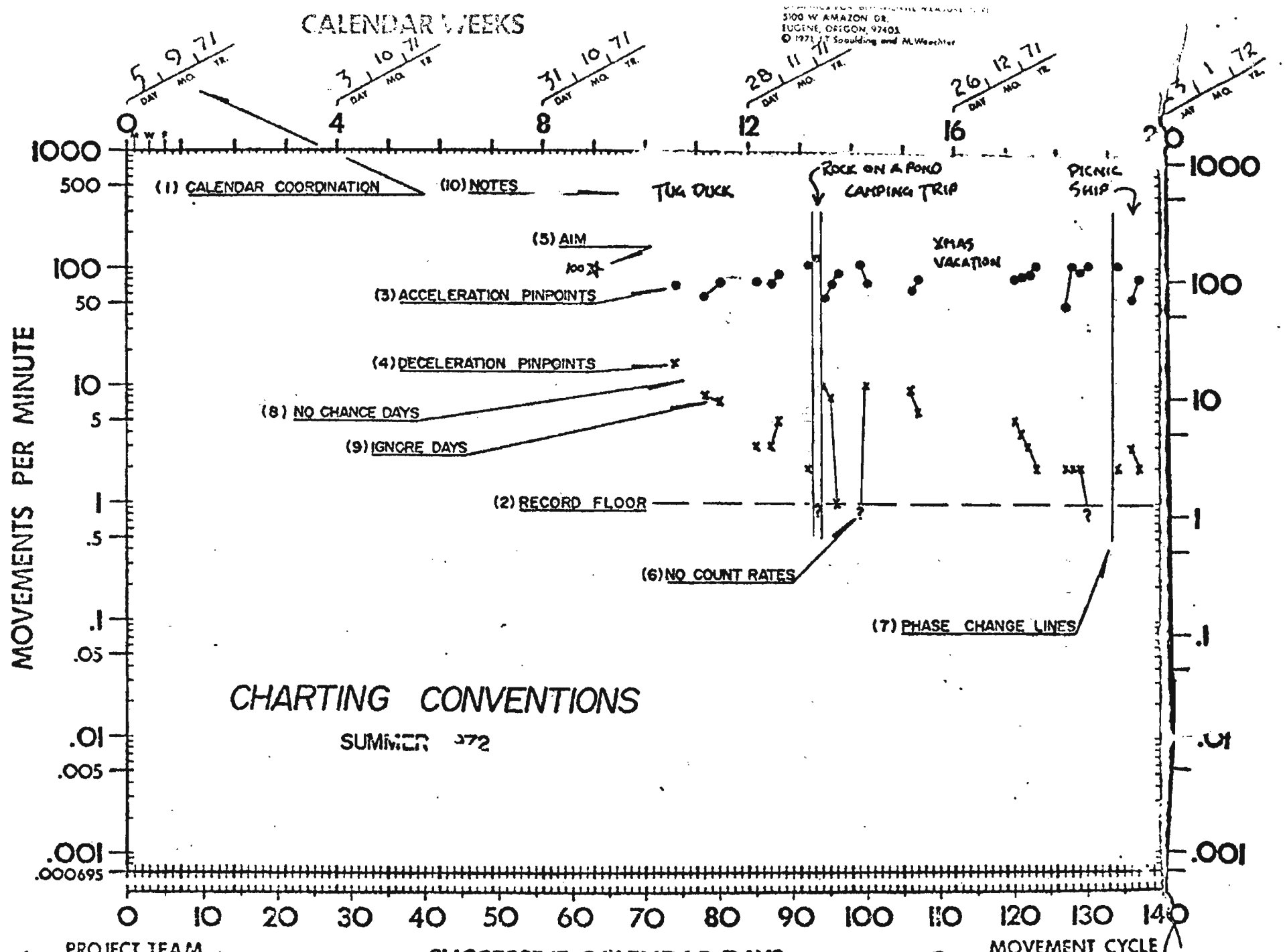
(1) Calendar Coordination: The dates listed across the top of each chart should be the same as those listed across every other chart being used at



CHARTING CONVENTIONS

SUMMER 72

FIGURE 8

PROJECT TEAM

SUPERVISOR God
BEHAVER Devin
SUPERVISOR K. Liberty
AGE 10 LABEL A 3
MANAGER J. Bowers
NOTES
J. Bowers CHARTER K. Liberty

MOVEMENT CYCLE

NAME IT Reads Words Orally
COUNT WHEN Reads from Hi
Linguistic Read
OCCURS

the same time. On the charts used during the first half of each academic year, the first Sunday on each chart is set to represent the first Sunday of September for that year. When it becomes necessary to change charts (in the 21st week of the school year), the last date on the first chart becomes the first date on the second chart. This means that if a project is started on the 10th week of the school year, the data are charted beginning on the 10th week of the chart. Although it may appear that some paper is wasted in this manner, it means that a teacher can tell at a glance when a project started, when changes were made, and by overlaying several charts, we can tell what effect a change in one project might have had on the behavior being charted for another project.

(2) The record floor is always charted as a dashed line across each day on which data are collected. If data are collected daily, and the record floor is always the same, then the record floor may be charted as a line extending from Monday to Friday of each week. If the record floor is always recorded on the chart, the original time and count data may be found by simply "reversing" the procedures outlined in figure 7 with the rate finder. The record floor also reminds us of the limits of our measurements and makes the comparison of charts with different floors mcuh more meaningful. Record ceilings, when they exist, are charted in the same manner, but at the top of the chart (there is no ceiling in this example). If the ceiling is always the same, it too may be drawn in ahead of time. Its dashed line, however, is usually drawn from

the Wednesday of one week to the Tuesday of the next week. This helps people to differentiate the ceiling line from the floor line.

(3) Acceleration data points are those that are charted for a movement cycle we wish to increase. A dot (.) is always used for acceleration project data so that the teacher can tell at a glance which way the frequencies are supposed to change. Note: The frequencies may not actually be going up in an acceleration project, but they are supposed to go up. Each frequency is charted as a dot, and then successive dots are connected by lines (except as noted below) so that the change from day-to-day is more readily apparent.

(4) Deceleration data points are those that are charted for a movement cycle we wish to decrease. An "x" is always used for a deceleration project so that the teacher can determine quickly the purpose of the project. Data charted with "x's" may not actually be going down, but they are supposed to. As with the acceleration data, the "x's" for successive days are connected with lines except as noted below. Any day with either a dot or an "x" is called a Rated Day.

(5) The aim, or goal of the project is indicated on the chart with a star. If the aim of a project is to increase the frequency of reading words orally to 100 words per minute, then a star is placed on the chart on the line representing 100 movements per minute (called the aim rate).

If we know when the aim should be met, then the star is placed on the day line representing that aim-date. If we do not know when the aim-rate should be met, then the star is placed just before the first day on which data were collected. In either event, the teacher and child now have something toward which they can work (they can "shoot for the stars"). The adequacy of the child's progress is much easier to interpret when the aim is clearly stated on the chart.

(6) Any frequency calculated for a day on which the behaver was observed, but the movement cycle did not occur is called a no count rate. Such rates are not called "zero rates" because we can't say that there was "zero behavior." All we can say for sure is that we counted no behavior. If we had watched the child for a longer period of time, perhaps some behavior would have occurred. Since we don't know what the actual frequency of the behavior might be (we only know that it is below the floor), no count rates are charted as question marks just below the record floor.

(7) Phase change lines are drawn on the chart each time a change is made in the project plan. The phase change line is drawn vertically, one-half day before the first data point collected after the change. This is to indicate as closely as possible when a change in the performance of the child might be expected to show up on the chart. Most phase change lines are solid heavy lines, but at times a teacher will use dotted lines

to indicate one type of change, and solid lines to indicate another type of change. No lines connecting data points are drawn across phase change lines.

(8) No chance days are days on which the movement cycle could not occur in the situation where it is usually counted. For school projects this would include weekends, vacations, and sick days. Also included would be days when the school schedule included a special activity which pre-empted the movement cycle period (e.g., reading period was taken up by an assembly). No data are collected on no chance days, of course, and so no data point can be charted for that day. To emphasize the days when the child could not practice the movement cycle they are left completely blank on the chart and no counting lines are drawn across them. Such days are easily picked out on the example chart. By making them obvious, the effects of absences or no practice can be easily determined. Does the child get better or worse over weekends? What was the effect of Christmas vacation as it approaches, and after it was over? In the example it looks as if the child stays pretty much the same or gets worse over no chance days. Perhaps extra practice at home should be set up to help the child progress more evenly.

(9) An ignore day is a day on which the movement cycle was practiced or emitt in the situation where it is usually counted, but for some reason the count was never recorded. Perhaps the data were lost or the teacher simply did not have time to go over and listen while the child was readin

aloud. Even though there is no data for an ignore day, the child did practice, so it must be treated differently than a no chance day. No data point may be drawn on such a day, but a line is drawn across the ignore day from the last rated data point to the next rated data point. Note that in the example there is only one ignore day. Over that day, however, the child improved -- whereas he usually failed to improve or go worse over no chance days. The distinction between the two types of days can be very important. Here it seems that the child does not necessarily have to be counted, he only has to practice. Perhaps some time could be saved by recording his rates only once every other day. Note: data should be collected as frequently as possible in a project until some evidence such as this indicates that less frequent data collection will not jeopardize the child's progress.

(10) Notes should be provided on the chart to indicate what types of changes have occurred, what happened on unusual days, and any other information which might help us to understand the chart. Those notes are not only important for others who look at our charts, but remind us about our own projects as well.

These conventions take no more time to employ than to ignore; but add considerably to the consistency and value of the chart. The clarity of information they insure can sometimes make the difference between a complex mass of lines and dots and a clear, precise record of a child's growth. Conventions allow us to become used to a chart, familiar with its meaning, and comfortable in its use. We see the child's progress more easily, resulting in more timely and appropriate decisions. It is as simple as that.

WHAT IS GOING ON, AND WHAT DOES WORK?

Teachers change behavior every day. Everyone does. If care is not taken to record exactly how that behavior is changed, though, it is very difficult to learn systematically from experience. Each part of the environment -- the place, time, materials, instructional method, etc., -- must be described and recorded. Then whe a change is made in that environment a check is run to see if any change occurred i the frequency of the target movement cycle. If a change in behavior DOES occur, then perhaps that alteration in the environment should be tried again when a simila behavior change is desired.

Many language systems have evolved for describing those things which might effect behavior. One of the simplest and most precise for use in the classroom is Lindsley's (1964) "IS-DOES equation". The IS part of the equation describes what is going on. If any part of the IS equation is altered, and a change is observed i the frequency of the movement cycle, then tnat change is recorded in the DOES equation -- that part of the plan or description of the environment does appear to change behavior. Note that one cannot be sure that the change in behavior was due to the change noted in the IS-DOES equation. Very likely many changes occur in the world of a child without the teacher even knowing about them. Any one of those cha could be responsible for the change in behavior. By noting in the DOES equation the element of the IS equation we suspect of causing the change in behavior, howeve a record of "things to try" is created for future use. By sharing the results of a DOES equation with other teachers and practitioners and noting the similarities between changes in the equation and changes in behavior, a great deal of "research" can be performed at very little expense. The process may be somewhat slower than m

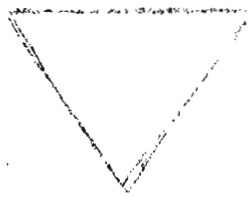
formal research projects, but on the other hand the data are from the "real world." If the teacher is careful in writing descriptions and precise in following the plans developed, there is no reason why the results cannot be just as significant and considerably more practical than a great deal of published research.

Following is a listing of the IS-DOES equation elements. Each part of each equation is used to describe a different part of the child's world. Some of the distinctions may be subtle, but all are important. Each element, when changed alone, may have considerable effect on the frequency of the movement cycle. At first glance one may think that the IS and the DOES equations are redundant. Remember, however, that the IS equation is used to record what "could" be affecting behavior, and the DOES equation represents those same elements after it has been demonstrated that there might be some effect on the child in question. It is very important to separate what we "think" to be true from that for which some evidence exists.

IS-DOES EQUATION

(1) Describe the "world" surrounding the movement cycle of concern, and determine what the relationship is between each part of that world and the movement cycle to be changed.

(2) If it IS a part of the movement cycle's world but no evidence exists that it does change that behavior, call it a ...



(3) If, after collecting and analyzing frequency data it appears that it DOES affect the behavior, call it a ...

PROGRAM	The general overall environmental setting. The time of day, the location of a class, or any other part of the world that remains constant for the time that the movement cycle is counted.	DISPOSITION (i.e., it "disposes" the child act a certain way)
PROGRAM EVENT	Any event which occurs independently of the movement cycle, that is, whether or not the movement cycle occurs. Examples would include the assignments given, any instructions before the movement starts or after the movement that are not given due to some part of the movement itself, a class bell ringing, or the items on a test.	STIMULUS (i.e., it "stimulates" the child act a certain way)
MOVEMENT CYCLE	The behavior. See the discussion of "pinpoints" and "movement cycles."	RESPONSE (i.e., the behavi is responsive to change)
ARRANGEMENT	The relationship between the number of times that a movement occurs and the number of times something happens after the movement. Express the relationship between the movement cycle and the event which follows by stating the number of times the movement must occur, then putting a colon, then stating the number of times the event which follows will occur. For example (1:10) means that for every one movement, the event that follows will happen ten times; (3:1) means that for every three movements, something will happen once.	CONTINGENCY (i.e., the ratio movements to even which follow is a effective way to make those events "contingent" upon responding)
ARRANGED EVENTS	Any event which always follows the movement cycle. It need not happen every time the movement cycle occurs, but when it does, it is after the movement cycle. Examples include "praise" for every correct answer, "art time" when 100 problems are completed correctly, and "time out" when the child is out of his seat more than two times without permission.	CONSEQUENCE (i.e., the event which is set to occur after the movement effective "consequates" the movement cycle)

A few additional comments on the elements of the IS-DOES equation might prove useful. First, the distinction between a PROGRAM and a PROGRAM EVENT is frequently a matter of degree. Usually the classroom as a whole would be considered part of the PROGRAM, but to the principal, who sees children move from one class to the next, the class may be more properly considered a PROGRAM EVENT. Similarly, the math fact sheet that is given to a child may be considered a PROGRAM EVENT, since it represents a "change in his world" that occurs "independently of the movement cycle." On the other hand, the fact sheet per se is there during the entire time that the child is working and the individual problems on the sheet might better represent the specific events which the teacher hopes will "stimulate" the correct response. If that is the case, then the sheet becomes a part of the PROGRAM, and the problems become PROGRAM EVENTS. (Note: if the child gets the solution to any given problem correctly, then that problem could legitimately be called a STIMULUS.)

In any case, most of the elements in a plan of instruction would be either part of the PROGRAM or PROGRAM EVENT section of the equation. Books, instructions, materials, "urging," explanations, are all likely to occur regardless of the movement cycle per se. They are things which are provided to try and "get the movement started," "guide the movement," or "define which movements are required." Another name commonly applied to such things is "cue." The unfortunate aspect of using that word, however, is the subtle implication that the event it describes works, and until the data are in, no such implication should be made.

The terms ARRANGEMENT and ARRANGED EVENT usually apply to things which the teacher does or sets up to "reinforce" or "punish" the behavior. That does not mean that those efforts always pay off. That is why they are included as elements

of the IS plan. Nevertheless, most of a teacher's attempts in that area will go here in the equation. Examples include "praises," "grades," "sending to the principal," or "giving extra time to work on the science project." Note that most of the arranged events listed are natural events which are likely to occur in the "real world." It is better to use that type of event when trying to consequate a child because they are less likely to build up a dependency in the child for things that are not going to be readily available once the class has finished. Who is going to give a child candy every time he does what he's supposed to do? Not very many people. People do praise one another, though, and the child might legitimately expect praise for work well done anywhere.

Finally, not everything can be listed in the IS-DOES equation. Some selective process must be employed. Try and pick those things which have the highest probability of affecting the behavior. Be careful, though, often there are things going on that are imporant but not immediately apparent. Lighting, the sound of trucks going by the school, the fact that the teacher reads a magazine during timings -- all could be important. Keep an open mind and eye.

Slightly different Is-Plan forms are used for academic behaviors as opposed to other kinds of behaviors. Figure 9 and Figure 10 present each kind.

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Insert Figures 9 and 10 about here

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Data on academic movement cycles is not usually collected during the instructional period per se, but during an "evaluation" or "practice" period. For this reason the Is-Plan is divided into two sections: TARGET, describing the program, program events, etc. in effect during the collection of data on the target movement cycles; and INSTRUCTION, describing the nature of the program,

IS – PLAN

RATED MOVEMENT CYCLES (target) _____

_____

AIMS: acceleration: rate _____ date _____

deceleration: rate _____ date _____

BEHAVER _____ age _____ grade _____

MANAGER _____ label _____

ADVISOR _____

DATE PROGRAM INITIATED _____

	program	program event (procedures/materials)	ACCELERATION movement cycle	ACCELERATION arranged event (arrangement)	DECELERATION movement cycle	DECELERATION arranged event (arrangement)
TARGET (rated movement cycles)						
INSTRUCTIONAL PROGRAM (non-rated movement cycles)						

FIGURE 9

IS—PLAN II

RATED MOVEMENT CYCLES (target) _____

_____

AIMS: acceleration: rate _____ date _____

deceleration: rate _____ date _____

BEHAVER _____ {age _____ grade _____

MANAGER _____ {label _____

ADVISOR _____

DATE PROGRAM INITIATED _____

PROGRAM	ACCELERATION			DECELERATION		
	program event	movement cycle	arranged event (arrangement)	program event	movement cycle	arranged event (arrangement)

FIGURE 10

program events, etc. designed to change those target movement cycles during a separate instructional period. The movement cycles during instruction may or may not be identical to the target movement cycles. Data is not usually collected on the movement cycles described as part of the instruction, but the student's behavior during instruction may certainly affect data collected on the target movement cycle during the evaluation period. Figure 11 shows an example of a completed "academic" Is-Plan.

- - - - - - - - - - - - - - -

Insert Figure 11 about here

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Any changes which are made in the events, procedures or materials described in the Is-Plan constitute a phase change. A phase change line is drawn on the chart when such a change is made to differentiate the data collected under each condition (See the section entitled "The Chart"). A new Is-Plan is written at this time, or a Decision Record Sheet is completed (discussed later).

In summary, the language of Precision Teaching provides educators with a vehicle to convey precise descriptions of behaviors targeted for change and the environmental events and conditions which may effect that change. The 6-16 Cycle Chart standardizes data presentation and recording. It is crucial to the process of measurement to use both precise language and standard data collection and presentation procedures.

DECIDING BEFORE IT'S TOO LATE

All too often a child is placed in a program, and then left to grow or die according to his fate. The evaluation of the program's ability to help the child grow is not undertaken until the completion of the project, after the child is supposed to have learned whatever he is to learn. Precise information should, rather, be collected continuously on the performance of the child and analyzed carefully on a regular schedule before the period of learning is supposed to be over. If a child is not growing, or if he is not growing rapidly enough to reach his aim, the program should be changed immediately. In earlier sections we discussed ways to continuously measure a child's growth and procedures for organizing that information so that the growth is "visible", but that is not enough. We must now determine how that information is to be used in a systematic manner to identify those children most in need of assistance, to prevent children from wasting precious instructional time, and to save children from those little failures that all too often snowball into the half-life of a truly handicapped adults. To begin our analysis, we must first know how a child's growth may be described.

A Description of Change -- The 'Celeration Line

When a child is grown and goes into the world people will be primarily concerned with what he can do. They are likely to ask, "How fast do you read?" or, "How many of these boxes can you assemble in an hour?" They will be interested in what the child has learned and only rarely will they be interested in how well he is able to learn more. As educators, we must strive to provide the child with all of the marketable skills we can. During the course of his education,

IS—PLAN

RATED MOVEMENT CYCLES (target): reads words orally correctly; reads words orally incorrectly

BEHAVER: John | age: | grade: 5 | label:

MANAGER: Judy

ADVISOR: K.L.

AIMS: acceleration: rate 100 date

deceleration: rate 2 or less date

DATE PROGRAM INITIATED: October 10, 1972

	program	program event (procedures/materials)	ACCELERATION: movement cycle	ACCELERATION: arranged event (arrangement)	DECELERATION: movement cycle	DECELERATION: arranged event (arrangement)
TARGET (rated movement cycles)	Room 5 1:15-1:45 pm 6 other students aide 18 desks	Teacher gives John Miami Linguistic Reader (at level he is reading--see arranged events) Teacher says "Read as fast and as carefully as you can. Ready.. begin." Times for one minute Teacher records error responses on her copy of the book.	reads words orally correctly	1": 1 Teacher records correct count on record sheet; John charts it Praise if above minimum 'celeration 100:1":1 go to next book	reads words orally incorrect	1": 1 Teacher records count on record sheet; John charts it 2: 1":1 go to next book if acce. at 100.
INSTRUCTIONAL PROGRAM (non-rated movement cycles)	Room 5 1:15-1:45 pm 6 other students aide 18 desks	20 minutes, Teacher gives John Miami Linguistic Readers Workbook (at level he is reading--see Target) 10 minutes. Aide shows John a flash card with con. vowel. con. words on it. Correction Procedure Aide says sounds in word slowly, as c--a--t--. Then says "say it fast"	circles correct answer reads word orally correctly says word orally correctly	1:1 day:1 Teacher returns corrected workbook 1:1 Aide says "good" and goes to next card. 1 : 1 Aide says "good" and goes to next word.	circle incorrect answer reads word orally incorrectly says word orally incorrectly	1:1 day : 1 Teacher returns corrected workbook. 1:1 to correction procedure: 1 :1 repeat correction procedure

FIGURE 11

however, we must be far less concerned with where a child is than we are with how rapidly the child is changing for the better. As long as there is growth there is a chance to reach any goal.

The amount of acceleration (increase) or deceleration (decrease) that a child makes each week has been called many things by many people. Precision Teachers prefer the term 'celeration and attach the ac or de when the occasion arises. Whatever one chooses to call it, though, 'celeration should be the focus of our concern. Unfortunately, as was mentioned in an earlier manuscript, the frequencies of a child's behavior rarely march smoothly up the chart. There are those days when the child feels particularly good and his behavior shoots much, much higher than we would expect. The next day, down he comes. Then there are those days when the world just isn't right and the child falls to a level of performance that we might have expected months ago. Somewhere in those ups and downs, plateaus and curves, the child may be making reasonably consistent progress or he may be failing. To see that overall growth or failure to grow can be difficult.

We need a 'celeration line that summarizes the child's direction with a simple, straight stroke of a pencil. A method for drawing such a line was described in figures 8 through 14 of the manuscript on Behavioral Assessment and Precise Classroom Measurement. The split-middle or quarter-intersect method of finding a 'celeration line is direct and simple. Children as young as 6 and 7 years of age have been known to find their own lines and help the teacher decide when it is time for a change in their programs. After a little practice it should take no more than 10 or 20 seconds to find the line. It is so quick that Precision Teachers have often referred to the split-middle as the "quickie method". Because

of the ease and speed with which the 'celeration line may be found and the accuracy that it usually provides in our analysis of a child's growth, the split-middle method for finding 'celeration lines will form the basis for almost all of the discussions which follow. If the reader is less than confident in his recollection of the split-middle method, he is encouraged to review the material mentioned above.

Once the 'celeration line has been found, the procedures for describing the line can be simplified for the Precision Teacher. In the manuscript on Behavioral Assessment and Precise Classroom Measurement a set of procedures were described for finding the slope (steepness) of the 'celeration line, but they entailed a lot of guesswork and division. Since the Precision Teacher uses a standard chart a standard device was developed to do the work for him. Earlier we saw how a rate finder could be constructed and used, now we will discuss a 'celeration finder. Refer to figure 12 for an example.

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Insert figure 12 about here

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The 'celeration finder, just like the rate finder, has a direct relationship to the scale of the chart. The rate finder was a duplicate of the rate scale which could be moved about on the chart. The 'celeration finder is a "blow-up" of the rate scale, that is, it is one cycle of the chart (from 1 to 10) increased to four times its usual size. This scale is placed on a plastic sheet that is exactly "four weeks wide" (i.e., as wide as four weeks of the standard chart's calendar scale). On the side of the 'celeration finder opposite the scale an arrow is placed which lines up with the "one-line" of the finder. To use the 'celeration finder, first draw the line and then:

(1) Place the 'celeration finder on the chart over the line, with the 'celeration scale on the right-hand side.

(2) Line up the finder so that its sides are parallel with the day lines (i.e., straight up and down).

(3) Move the 'celeration finder up and down on the chart, keeping it parallel to the day lines, until the arrow on the left-hand side touches the 'celeration line to be described.

(4) Read the slope of the 'celeration line at the point where it crosses the 'celeration finder's scale (on the right-hand side of the finder).

Notes: If the line is not long enough to cross the entire width of the finder, it must be extended on a straight edge of some sort lined up with it. The line must pass all the way from the arrow on one side of the finder to the scale on the other side in order for an accurate reading of the slope to be made. If the line is decelerating, then the finder is flipped-over (top to bottom) as shown in the second half of figure 12. What were labels of "times" slopes then become labels for "divide-by" slopes. If the slope of the line is greater than x10 (a very unlikely event, but possible), then start out as above (steps 1, 2, and 3), make a mark by the x10 label of the 'celeration finder's scale, and then move the finder straight up until the x1 of the finder's scale is where the x10 used to be. If the line now crosses the scale, then the answer should be read with an added zero (e.g., x2 would be read as x20; x3.1 would be read as x31.0). If the scale needs to be moved up more, do so, but answers are read with one more zero each time it is necessary to move the finder up one more cycle.

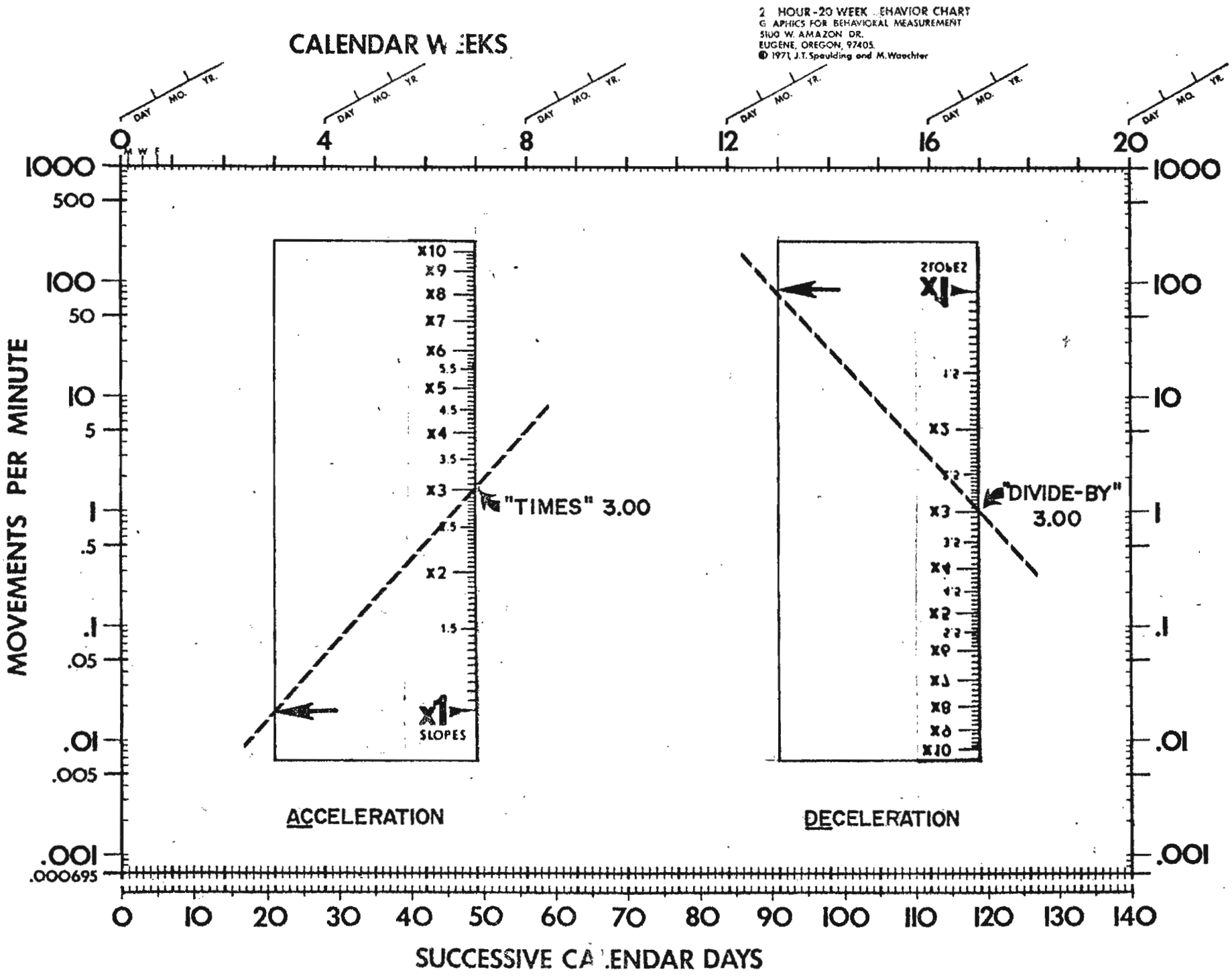

2 HOUR-20 WEEK BEHAVIOR CHART
GRAPHICS FOR BEHAVIORAL MEASUREMENT
5100 W. AMAZON DR.
EUGENE, OREGON, 97405.
© 1971 J.T. Spaulding and M. Waechter
CALENDAR WEEKS
DAY MO. YR.
0 4 8 12 16 20
MOVEMENTS PER MINUTE
1000 500 100 50 10 5 1 .5 .1 .05 .01 .005 .001 .000695
"TIMES" 3.00
"DIVIDE-BY" 3.00
x10 x9 x8 x7 x6 5.5 x5 4.5 x4 3.5 x3 2.5 x2 1.5 x1
SLOPES
ACCELERATION
DECELERATION
0 10 20 30 40 50 60 70 80 90 100 110 120 130 140
SUCCESSIVE CALENDAR DAYS

FIGURE 2

Using the split-middle method for finding a 'celeration line, and then the 'celeration finder for describing how steep that line is provides us with a precise statement of how the child is growing or changing from week-to-week. The next step is to analyze that growth and determine if it is sufficient for the child to reach the aims we have set.

Aiming for the stars

In the section on charting conventions it was suggested that the teacher decide just how fluent and accurate she wishes the child to be and to note those aims by placing a star on the chart at the appropriate frequencies. For example, the aim for "hits peer" might be set a "no counts in sixty minutes". A star would then be placed below the record floor on the chart. If the aim for "writes digits" was 60 correct and no errors per minute, then one star would be placed on the 60 movements per minute line of the chart and another star just below the record floor.

When possible the placement of the star should also indicate the day on which the child should meet the aim. If this can be done then all the teacher needs to do to decide if a child is likely to meet the aim is simply lay a ruler along the 'celeration line, extend the line to the aim-date, and see if it goes above or below the star. If the line passes on the correct side of the star (i.e., above it for an acceleration target, below it for a deceleration target), then we leave the program as it is. If the prediction indicates that the child is likely to fail, however, then the program is changed as quickly as possible to try and avoid that failure. Some examples of this procedure were given in figures 15, 16 and 17 in the manuscript on Behavioral Assessment and Precise Classroom Measurement.

If the teacher is not certain exactly when the aim should be met, then the star is placed on the chart before any of the data are collected (see, for example, figure 8 in this chapter). Using this procedure, of course, the line will always pass below the star (or above it, as the case may be), so our decision rules will obviously have to be changed. We begin in the same way by extending the line until it reaches the aim-rate. Then we note how many days it will take, based on our prediction using the 'celeration line, for the child to reach that aim rate. If the extended 'celeration line reaches the aim rate four weeks after the last data point we have, then we predict that it will take four weeks for the child to reliably be able to perform at that level. Is that too long? Is there that much time to give to this program? Those are the questions that the teacher must answer. If it seems that we can afford that much time, then the program is left the same. If there is not that much time left, then we must change the program now.

Both of the methods given above really require that the teacher knows the progress of the child, the desired level of performance (aim-rate), and has some idea as to when the aim should be met (aim-date). The only difference between the methods is whether we decide ahead of time what the aim-date is to be, or look at what the aim-date is likely to be and decide if that is acceptable.

Even if the decision is made to continue the program, the manager should not assume that everything will necessarily work out well. The prediction based on the child's 'celeration line may be in error! Nothing is perfect. Each day the manager should look at the chart to see if the new frequencies are following the prediction. If the frequencies appear to be changing from

what was expected, then a new line should be drawn and the whole decision making process repeated. In the first few days of a project in particular there is likely to be a higher than average rate of 'celeration -- children frequently get off to a start that only supermen could maintain over long periods of time. The first 'celeration line that we draw has the highest probability of being in error because it is based on the least amount of data. Each new line is likely to get better and better. Just watch the data carefully and draw a new line whenever in doubt. When more than 11 or 12 data points have been collected you can even start dropping the earlier data points when new lines are needed and use only the last 11 or 12 data points to find the child's latest 'celeration.

Minimum 'Celeration

The procedures discussed above sound fine as long as we know what rate we want the child to achieve and the date when the aim should be met. What if we only know the desired rate and really don't have the slightest idea of how long the child should take to reach it? That is a common problem and one which the authors met several times when helping teachers to formulate their decision rules. We decided that perhaps we should look at the data (always a good idea) and find out just how most children grow.

After looking at about 361 different projects on a variety of behaviors, each one with at least five data points (with an average of about 11) and where each project showed some growth in behavior, it was found that about 50% of the children were able to grow at a rate of x1.33 or better on acceleration projects and ÷ 1.46 on deceleration projects. 53% of the children could

get better than a x1.25 on acceleration targets and 66% of the children could do better than a ÷ 1.25 on deceleration targets. It was suggested to the teachers that if they knew where a child started and where they wanted him to end up, then perhaps these average 'celeration figures could be used to decide how long one might expect the child to move from one to the other. At first it was decided to use the 1.25 estimate for both acceleration and deceleration projects. That is, a line was drawn from the level of a child's present performance with a slope of times or divide 1.25 until the aim-rate was crossed. This line became the child's "dynamic" or "moving" aim, and program change decisions were based on whether the child met or exceeded that line on each successive day. If the child's performance fell below the line for three days in a row then the program was changed. More specifically, the rules for making decisions based on minimum 'celeration estimates are as follows:

1) Select <u>one</u> of the "fair pair" targets for which the 1.25 minimum will be employed. Don't try to set the 1.25 minimum for both targets at once. For academic projects usually the acceleration pinpoint is selected first. When the acceleration pinpoint has reached the aim-rate the deceleration pinpoint is targeted for possible program changes. Programs in which teachers have initially concentrated on the error rates have often resulted in correct rates which were too low and difficult to accelerate. Perhaps the behaver becomes "afraid" of making mistakes by going fast.

2) Draw the first minimum 'celeration line on the chart by performing the following steps: (Note: in the sequence of procedures which follow a clear plastic minimum 'celeration finder was used to help determine

just what a 1.25 line is. This device is really nothing more than a piece of plastic cut at an angle which is equivalent to a 1.25 slope. The reader may construct a similar device for his own use quite easily by taking a piece of heavy plastic, placing it on a chart, drawing a 'celeration line with a x1.25 slope, then a "flat" x1.0 line under it -- to use for positioning the device later, and then cutting the plastic along those two slopes.)

a) Initiate the project and collect three days of data.

b) Locate the mid-day of those on which the data were collected (i.e., the second rated day).

c) Locate the mid-rate of the data (i.e., the median rate value, see Behavioral Assessment and Precise Classroom Measurement for examples of how to calculate the median).

d) Draw a "cross" to show the intersection of the mid-day and the mid-rate. See figure 13.

- - - - - - - - - - - - - - -

Insert Figure 13 about here

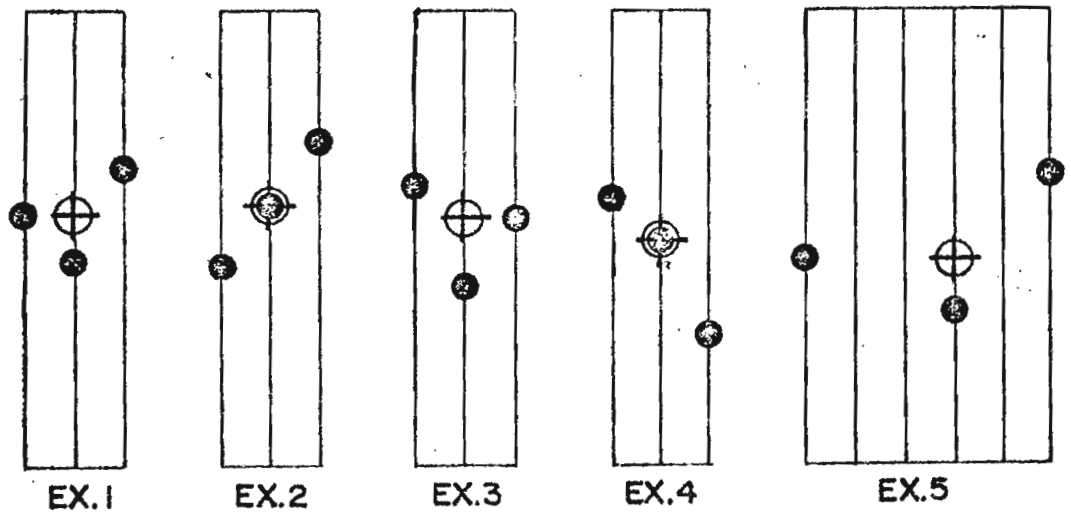
- - - - - - - - - - - - - - -

e) Align the 'celeration line of the minimum 'celeration finder (MCF) so that the point where the 1.25 and 1.00 lines cross is on this intersection of mid-day/mid-rate, and so the vertical/horizontal lines of the MCF are in harmony with your chart. See figure 14.

- - - - - - - - - - - - - - -

Insert Figure 14 about here

- - - - - - - - - - - - - - -



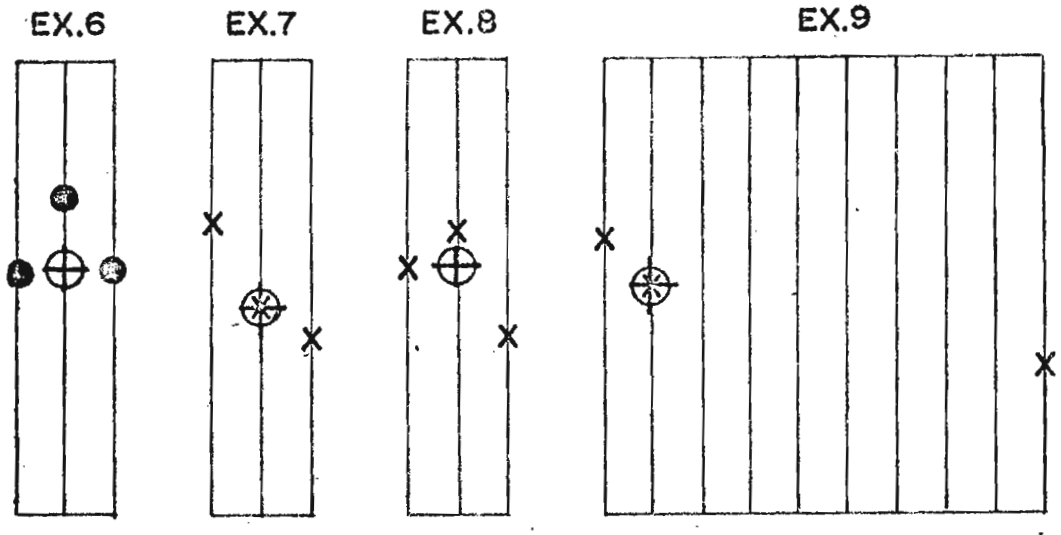


FIGURE 13

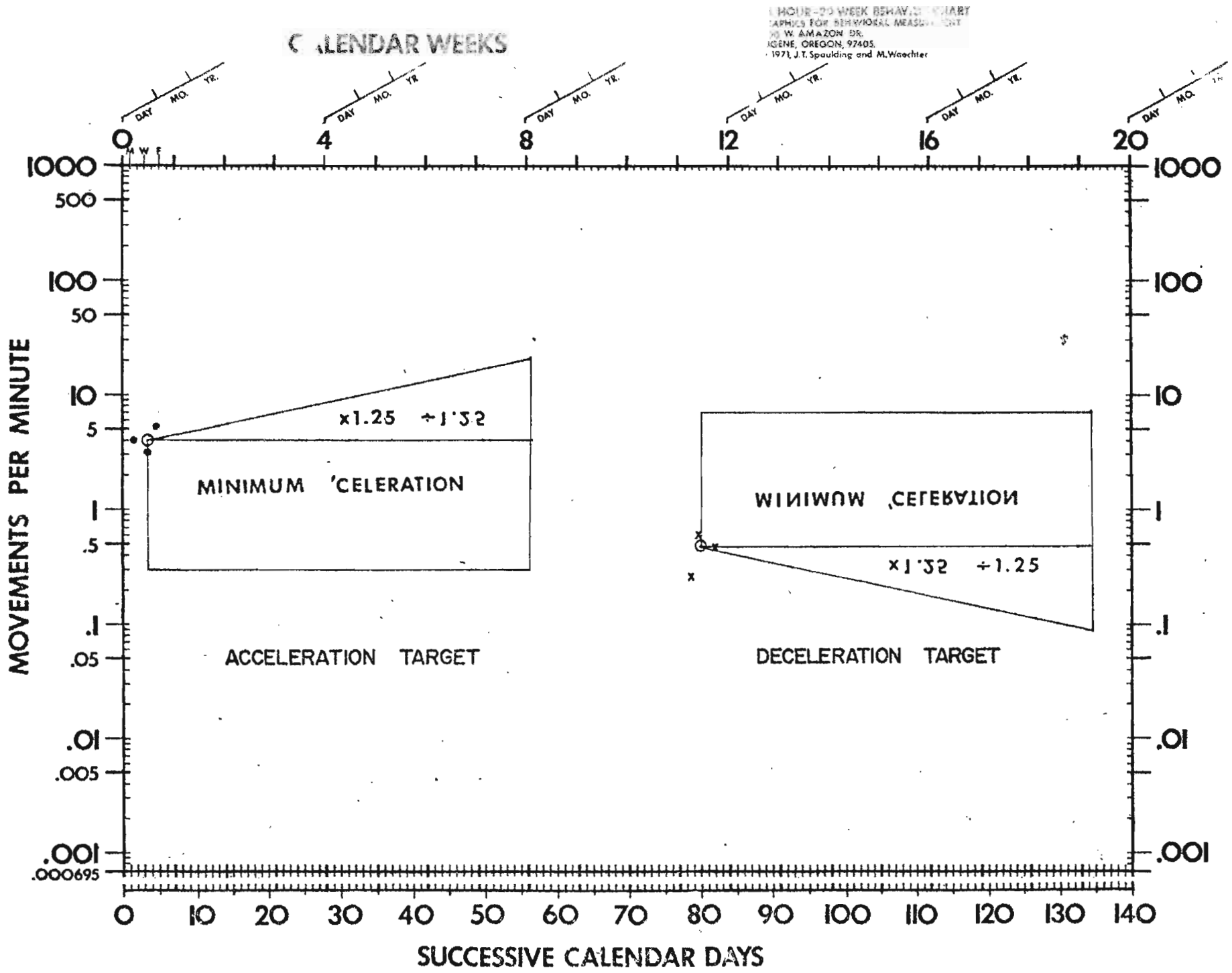

CALENDAR WEEKS
DAY MO. YR.
0
4
8
12
16
20
M W F
1000
500
100
50
10
5
1
.5
.1
.05
.01
.005
.001
.000695
MOVEMENTS PER MINUTE
×1.25 ÷1.25
MINIMUM CELERATION
ACCELERATION TARGET
DECELERATION TARGET
0 10 20 30 40 50 60 70 80 90 100 110 120 130 140
SUCCESSIVE CALENDAR DAYS

FIGURE 14

f) Draw the minimum 'celeration line along the MCF in pencil. This line represents the minimum desired rate of change. Extend the line until it reaches the aim or proficiency rate. See Figure 15.

- - - - - - - - - - - - - - -

Insert Figure 15 about here

- - - - - - - - - - - - - - -

3) Check the point where the minimum 'celeration line crosses the aim rate. If this data is too far in the future, then re-set the minimum 'celeration as follows:

a) Choose a new and reasonable date for the aim.

b) Mark a star (*) at the point where the target date and target rate lines meet.

c) Draw a line from the mid-day/mid-rate cross determined in step 2d above extending to the star drawn in step 3b above. This new line represents the new minimum 'celeration line -- it should be <u>greater</u> than 1.25. See Figure 16.

- - - - - - - - - - - - - - -

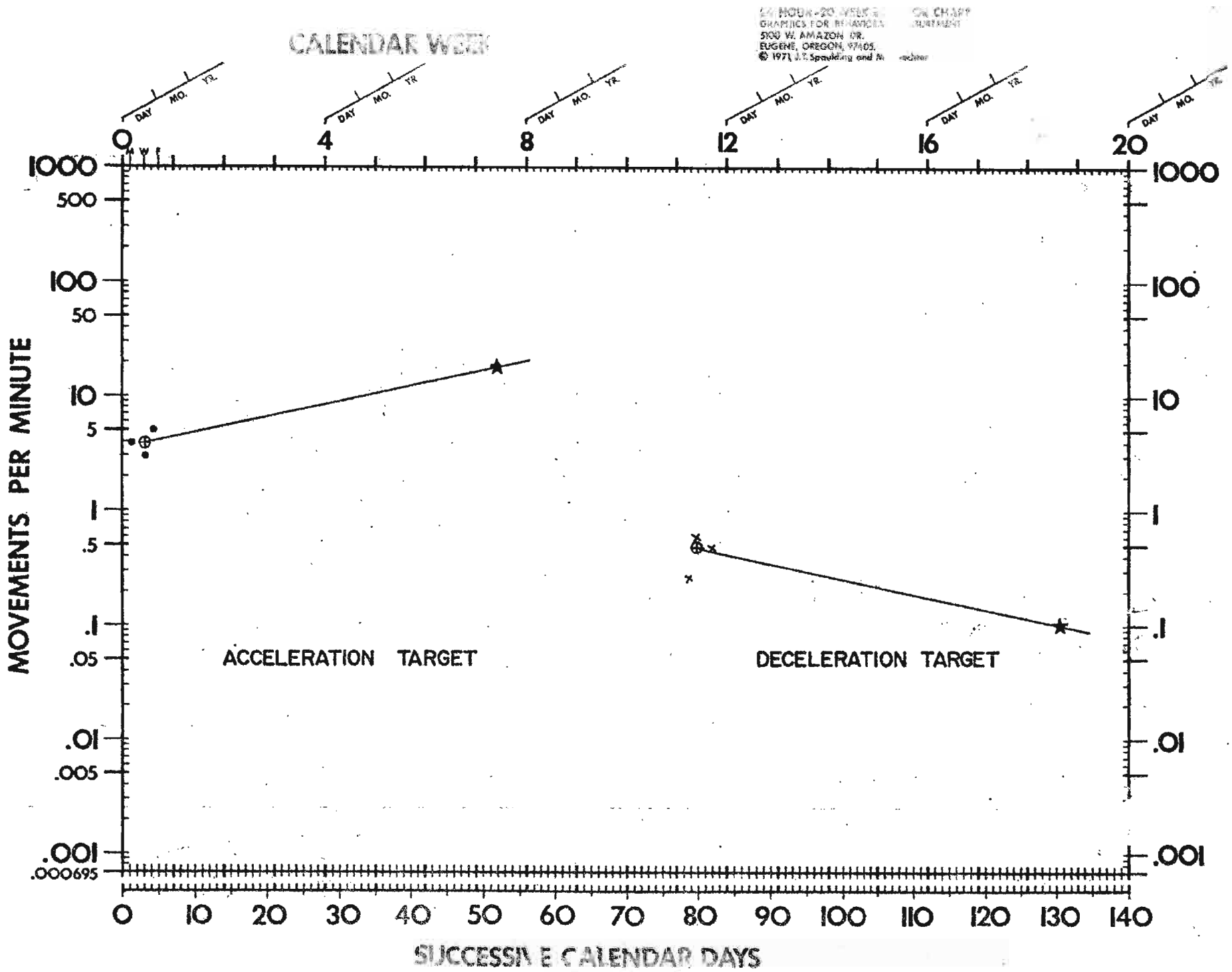
Insert Figure 16 about here

- - - - - - - - - - - - - - -

4) Collect more data and determine if a program change is needed. Program-change decisions are made by doing the following:

a) Chart each new day's frequency <u>on the day it is collected</u>.

b) Note whether the new data point is above or below the minimum 'celeration line.



GRAPHICS FOR BEHAVIOR
5100 W. AMAZON DR.
EUGENE, OREGON, 97405.
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FIGURE 15

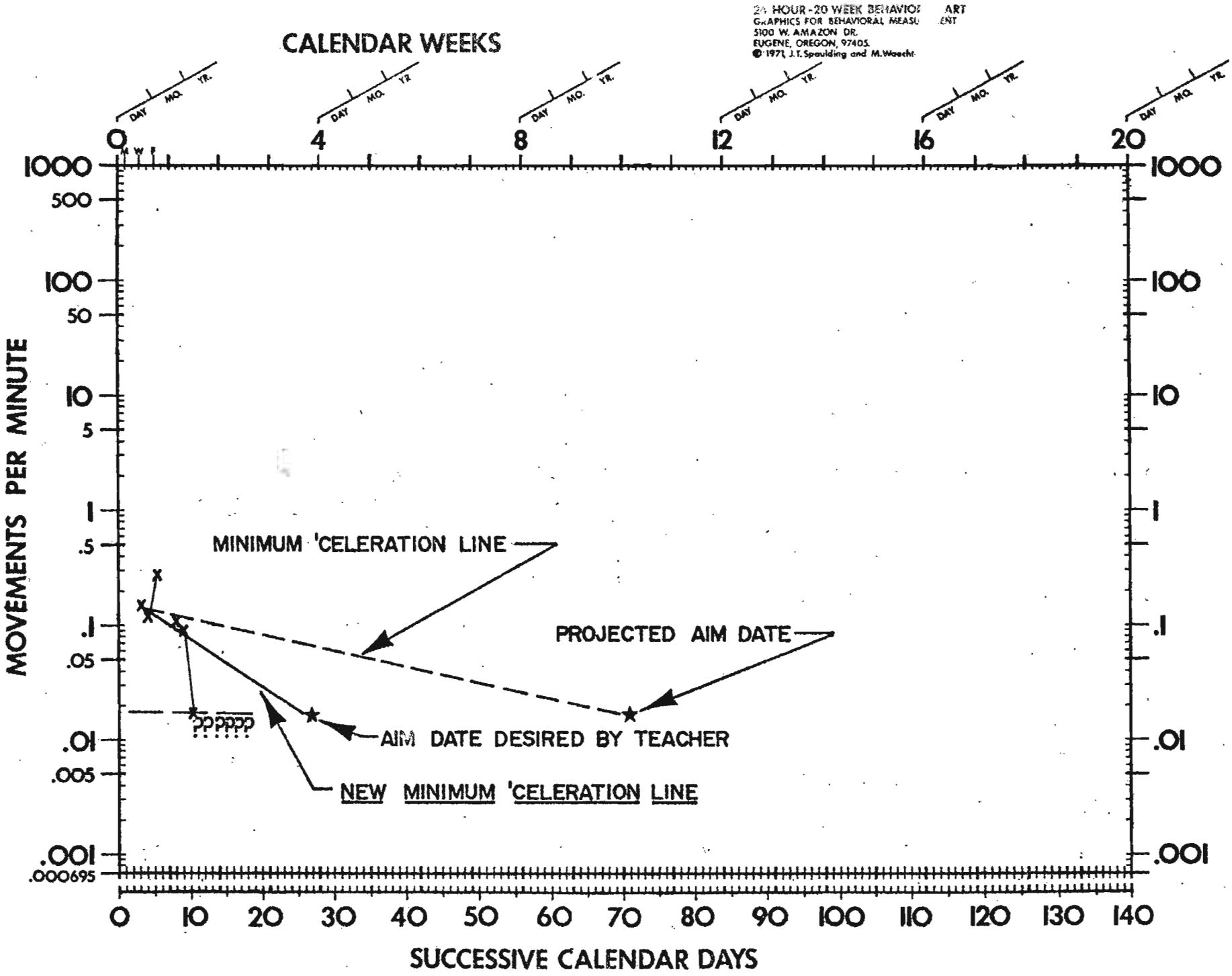
24 HOUR - 20 WEEK BEHAVIOR CHART
GRAPHICS FOR BEHAVIORAL MEASUREMENT
5100 W. AMAZON DR.
EUGENE, OREGON, 97405.
© 1971 J.T. Spaulding and M. Wacht
CALENDAR WEEKS
DAY MO. YR.
0 4 8 12 16 20
MOVEMENTS PER MINUTE
1000 500 100 50 10 5 1 .5 .1 .05 .01 .005 .001 .000695
MINIMUM 'CELERATION LINE
PROJECTED AIM DATE
AIM DATE DESIRED BY TEACHER
NEW MINIMUM 'CELERATION LINE
0 10 20 30 40 50 60 70 80 90 100 110 120 130 140
SUCCESSIVE CALENDAR DAYS

FIGURE 16

c) When the data for three days in a row fall below the minimum 'celeration line (for an acceleration project) or fall above the line (for a deceleration project), then a change in the program must be made. When counting rates above and below the line, do not count the initial three days used to locate the line. See Figure 17.

- - - - - - - - - - - - - - -

Insert Figure 17 about here

- - - - - - - - - - - - - - -

5) If necessary, make a change in the program.

a) Decide what to change (e.g., instruction, arranged events, length of observation).

b) Note the change to be made in the IS plan.

c) Draw a heavy vertical line on the chart to indicate that a change has been made. This phase change line should be drawn 1/2-day before the first data point after the change. Obviously, you will need to know when that data point is to be collected, or wait until it happens to draw the line. See Figure 18.

- - - - - - - - - - - - - - -

Insert Figure 18 about here

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d) Locate the rate line equivalent to the mid-rate of the last three data points before the change (i.e., the three data points that fell below the old minimum 'celeration line). Follow that line over to the day on which the first data point was collected after

the change. Mark a new "cross" where the rate line and day line found above meet. See Figure 18.

e) Using the MCF, draw a new minimum 'celeration line for the new phase. See Figure 19.

- - - - - - - - - - - - - - -

Insert Figure 19 about here

- - - - - - - - - - - - - - -

f) Label the new phase with a description of the change. See Figure 19.

g) Collect data for the new program. Continue as before. If three days in a row fall below the new minimum 'celeration line, then make another change in the manner described above. Try, Try, Try again.

Note: If (for an acceleration pinpoint) the data from three days in a row fall above the line (or vice-versa for a deceleration target), then fine. The 1.25 is a minimum 'celeration and anything better than that should not necessarily lead the manager to make a program change. Why spoil a good thing? If there is some reason why a program change should be made, even if there are not three days in a row below the minimum 'celeration line, then follow the procedures given below.

6) When making other changes:

a) Draw a phase change line 1/2-day before the first rated day in the new phase.

b) Label the new phase on the chart and update the IS plan.

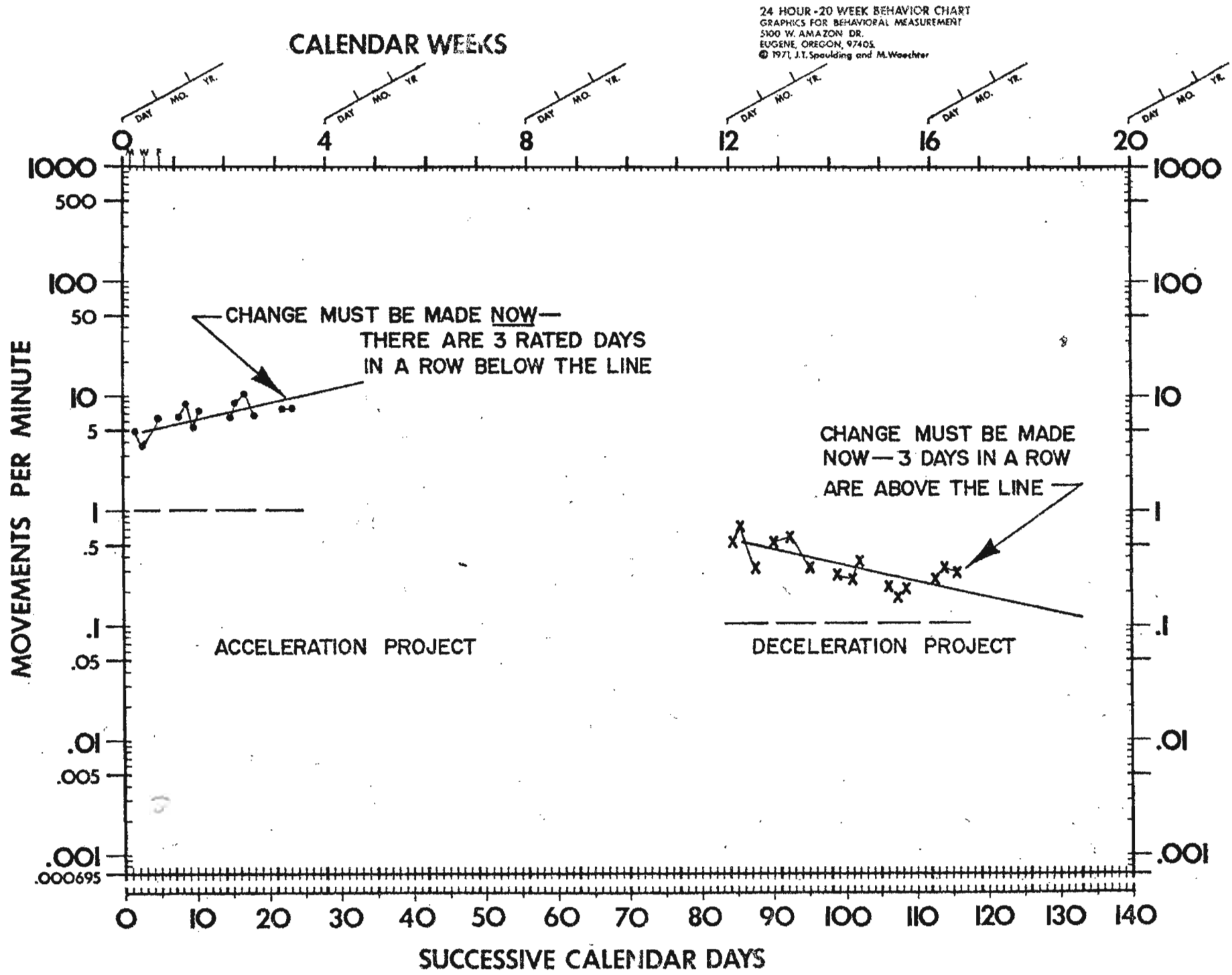
24 HOUR - 20 WEEK BEHAVIOR CHART
GRAPHICS FOR BEHAVIORAL MEASUREMENT
5100 W. AMAZON DR.
EUGENE, OREGON, 97405
© 1971, J.T. Spaulding and M. Waechter
CALENDAR WEEKS
DAY MO. YR.
0 4 8 12 16 20
M W F
1000 500 100 50 10 5 1 .5 .1 .05 .01 .005 .001 .000695
MOVEMENTS PER MINUTE
CHANGE MUST BE MADE NOW— THERE ARE 3 RATED DAYS IN A ROW BELOW THE LINE
CHANGE MUST BE MADE NOW — 3 DAYS IN A ROW ARE ABOVE THE LINE
ACCELERATION PROJECT
DECELERATION PROJECT
0 10 20 30 40 50 60 70 80 90 100 110 120 130 140
SUCCESSIVE CALENDAR DAYS

FIGURE 1

c) Extend the old minimum 'celeration line into the new phase. Do not draw a new 'celeration line. See Figure 20.

- - - - - - - - - - - - - - -

Insert Figure 20 about here

- - - - - - - - - - - - - - -

d) Continue to collect data. The behaver should still be able to meet the old minimum 'celeration line, even in this new phase. If not, then change again, but this time following the procedures outlined in step five above. See Figure 20. Note that in Figure 20 the data in phase two ("peer tutor") is above the 'celeration line, but is mostly flat or even decelerating. This is due to the fact that the original 'celeration line was set low and the initial actual 'celeration of the behaver was high. If this happens it would probably be wise to re-set the minimum 'celeration after the first week or so. If the teacher had done that in this project, perhaps the long period of "flat" frequencies in weeks 5 through 10 could have been avoided.

7) If an aim is reached by one of the "fair pair", but not the other, then concentrate on the one that has not reached the aim. If the minimum 'celeration technique was not applied to that pinpoint before, then do so now. Be careful to keep an eye on the pinpoint that has already reached the aim, however, so that phase changes in the other pinpoint's program will not adversely effect the work already accomplished. Once an aim has been reached, of course, a flat or x1.0 slope is acceptable 'celeration -- it is not necessary to demand the x1.25 slope any longer. See Figure 21.

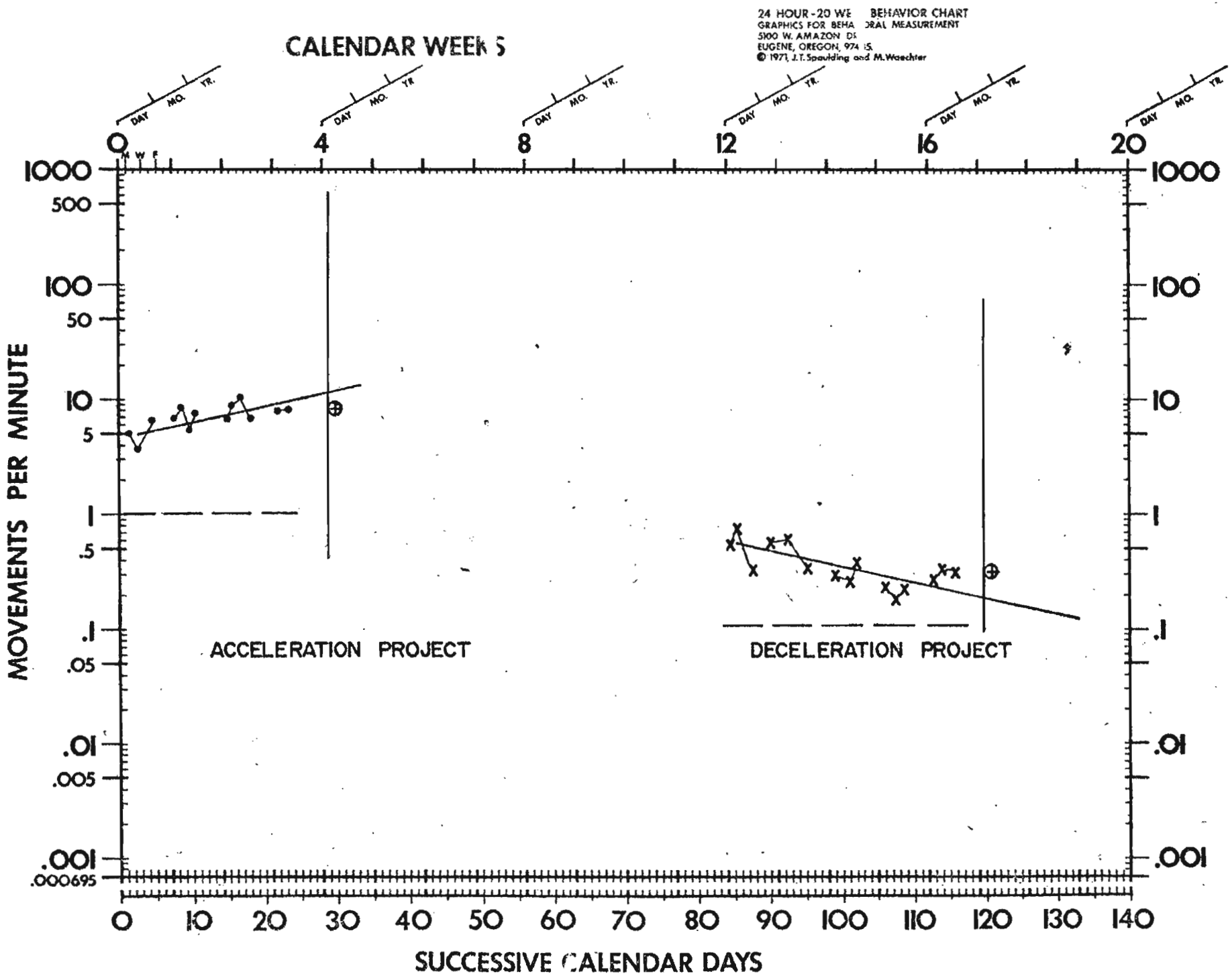
24 HOUR - 20 WE BEHAVIOR CHART
GRAPHICS FOR BEHA ORAL MEASUREMENT
5100 W. AMAZON DI
EUGENE, OREGON, 974 15.
© 1971, J.T. Spaulding and M. Waechter
CALENDAR WEEK 5
DAY MO. YR.
0 4 8 12 16 20
M W F
1000 500 100 50 10 5 1 .5 .1 .05 .01 .005 .001 .000695
MOVEMENTS PER MINUTE
ACCELERATION PROJECT
DECELERATION PROJECT
0 10 20 30 40 50 60 70 80 90 100 110 120 130 140
SUCCESSIVE CALENDAR DAYS

FIG RE 18

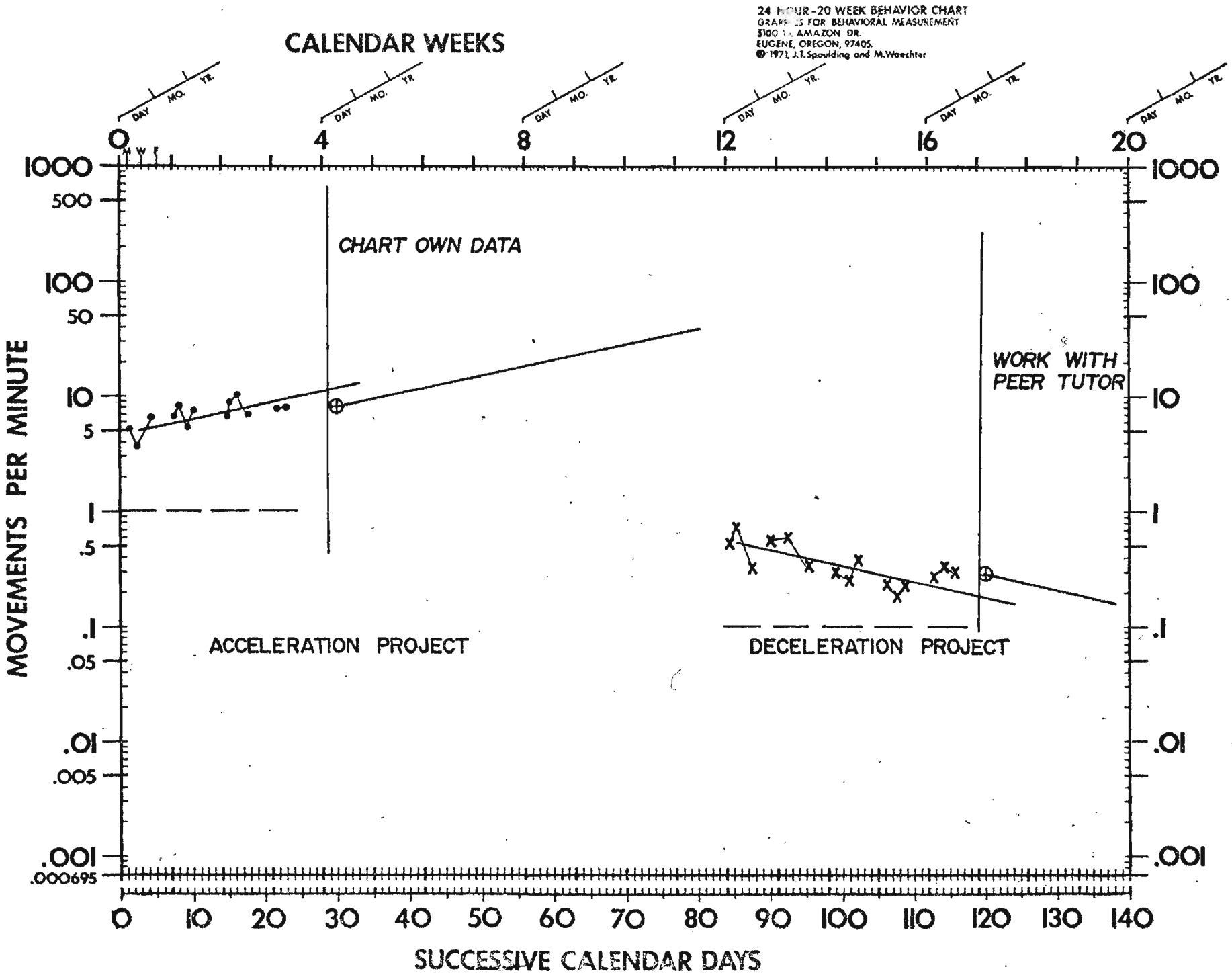
24 HOUR-20 WEEK BEHAVIOR CHART
GRAPHICS FOR BEHAVIORAL MEASUREMENT
5100 N. AMAZON DR.
EUGENE, OREGON, 97405.
© 1971, J.T. Spaulding and M. Waechter
CALENDAR WEEKS
DAY MO. YR.
0
4
8
12
16
20
1000
500
100
50
10
5
1
.5
.1
.05
.01
.005
.001
.000695
MOVEMENTS PER MINUTE
CHART OWN DATA
WORK WITH PEER TUTOR
ACCELERATION PROJECT
DECELERATION PROJECT
0 10 20 30 40 50 60 70 80 90 100 110 120 130 140
SUCCESSIVE CALENDAR DAYS

FIGURE 19

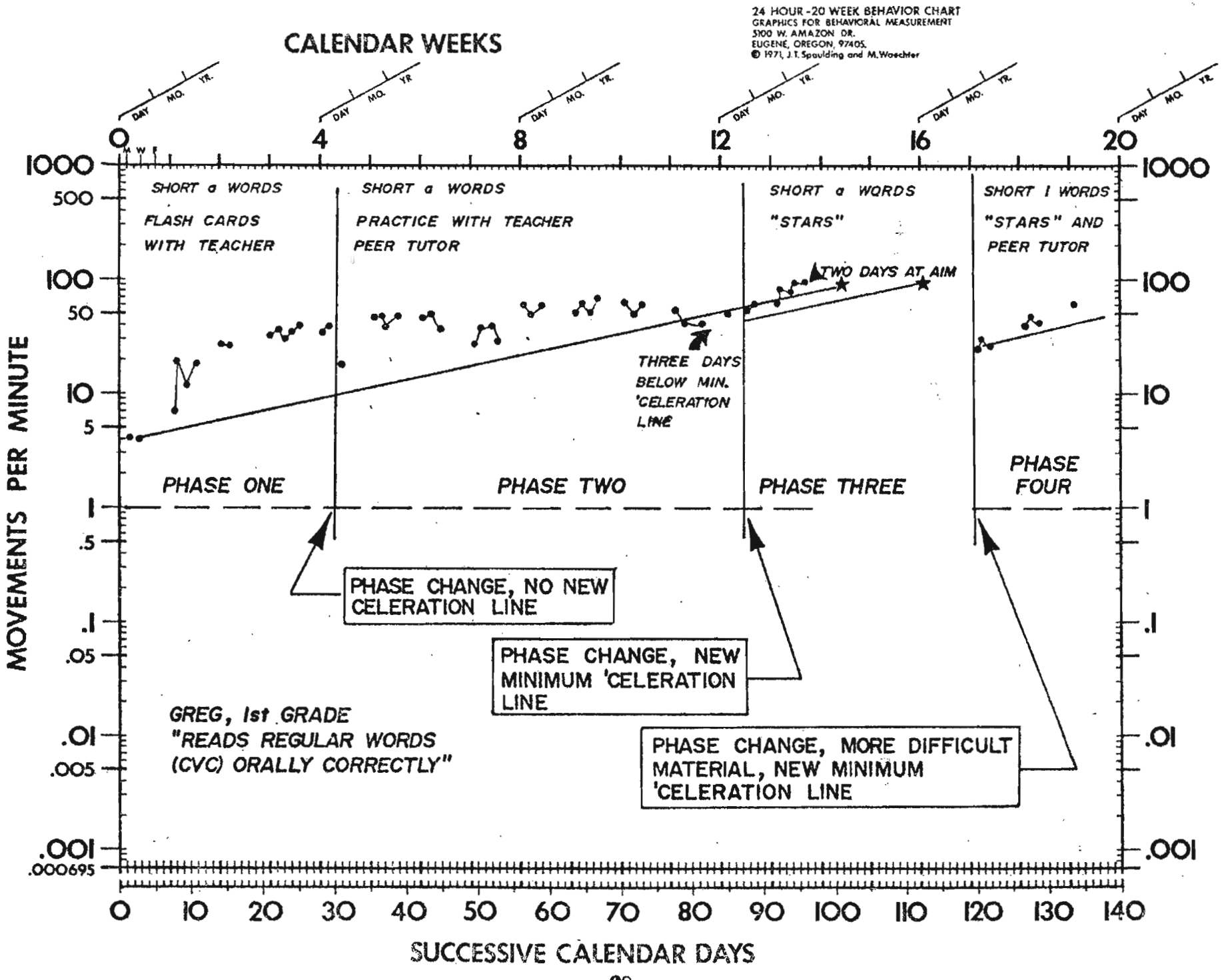
24 HOUR -20 WEEK BEHAVIOR CHART
GRAPHICS FOR BEHAVIORAL MEASUREMENT
5100 W. AMAZON DR.
EUGENE, OREGON, 97405.
© 1971, J.T. Spaulding and M. Woechter
CALENDAR WEEKS
DAY MO. YR.
0
4
8
12
16
20
M W F
1000
500
100
50
10
5
1
.5
.1
.05
.01
.005
.001
.000695
MOVEMENTS PER MINUTE
SHORT a WORDS
FLASH CARDS
WITH TEACHER
SHORT a WORDS
PRACTICE WITH TEACHER
PEER TUTOR
SHORT a WORDS
"STARS"
SHORT I WORDS
"STARS" AND
PEER TUTOR
TWO DAYS AT AIM
THREE DAYS
BELOW MIN.
'CELERATION
LINE
PHASE ONE
PHASE TWO
PHASE THREE
PHASE
FOUR
PHASE CHANGE, NO NEW
CELERATION LINE
PHASE CHANGE, NEW
MINIMUM 'CELERATION
LINE
PHASE CHANGE, MORE DIFFICULT
MATERIAL, NEW MINIMUM
'CELERATION LINE
GREG, 1st GRADE
"READS REGULAR WORDS
(CVC) ORALLY CORRECTLY"
0 10 20 30 40 50 60 70 80 90 100 110 120 130 140
SUCCESSIVE CALENDAR DAYS

FIGURE 20

- - - - - - - - - - - - - - -

Insert Figure 21 about here

- - - - - - - - - - - - - - -

8) Once both target behaviors have reached their final aims, then the following rules should be applied to determine how many days the project should continue before moving on to a new curricular area, a new step in the sequence, or whatever.

a) If the aim was reached without the necessity of phase changes (i.e., the behaver never had three days in a row on the wrong side of the 'celeration line), then one day with both target behaviors at or better than the criteria rates (aims) will probably be sufficient.

b) If changes were made (because the behaver had three days on the wrong side of the 'celeration line), then "more assurance" is needed that those behaviors are really mastered before new programs are started. The rule of thumb is: for every phase change in the project made because of failure to maintain at least the 1.25 minimum 'celeration add one day to the number of days the rates must be at or better than the aims before moving on to a new program. See Figure 21. For example, if no changes were made in the program then only one day at or better than the aim-rate is necessary. If four changes are made in the program then five days with rates at the aim should be collected before moving on. If seven changes were necessary, then eight days with rates at the aim should be collected. Behavior may be maintained at or

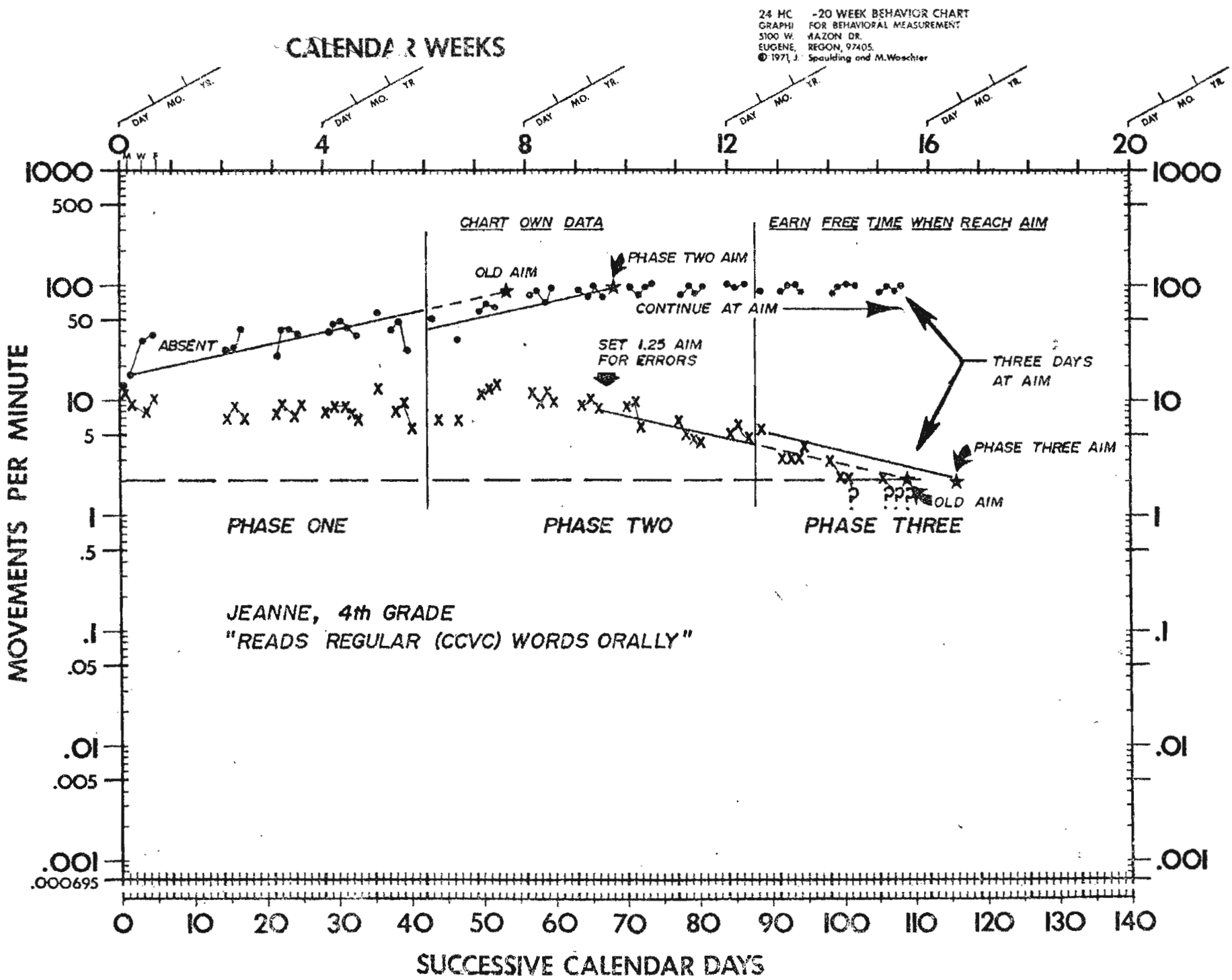
24 HC -20 WEEK BEHAVIOR CHART
GRAPHI FOR BEHAVIORAL MEASUREMENT
5100 W. AMAZON DR.
EUGENE, REGON, 97405.
© 1971, J. Spaulding and M.Wolschter
CALENDAR WEEKS
DAY MO. YR.
0 4 8 12 16 20
1000 500 100 50 10 5 1 .5 .1 .05 .01 .005 .001 .000695
MOVEMENTS PER MINUTE
CHART OWN DATA
EARN FREE TIME WHEN REACH AIM
PHASE TWO AIM
OLD AIM
CONTINUE AT AIM
ABSENT
SET 1.25 AIM FOR ERRORS
THREE DAYS AT AIM
PHASE THREE AIM
OLD AIM
PHASE ONE
PHASE TWO
PHASE THREE
JEANNE, 4th GRADE
"READS REGULAR (CCVC) WORDS ORALLY"
0 10 20 30 40 50 60 70 80 90 100 110 120 130 140
SUCCESSIVE CALENDAR DAYS

FIGURE 21

better than the aim rate for longer than the minimum suggested days. This might be particularly useful in projects dealing with "social" or "management" behaviors. In academic projects, however, new projects should be started as soon as some confidence in the mastery of the student is gained.

There are No Magic Numbers

A lot of numbers have been mentioned up to this point, among the most important of which was the 1.25 minimum 'celeration. There is nothing magic in numbers, however, and that includes the 1.25. The rate of progress that is acceptable in any given project depends upon the behavior, the child, the situation, and even the amount of time the teacher has to work with the child. The importance of the minimum 'celeration technique does not lie in the use of the 1.25 standard, but in the decision rules based on some concept of minimally acceptable progress. Any standard can be set and the same decision rules can be used. Below are some alternative approaches to setting the minimum 'celeration for use in the decision making process.

(1) Aim-Rate, Aim-Date: If it is known just how fluent a child must be in order to succeed and the date by which that fluency must be achieved, then the best and most practical way to set the minimum 'celeration is to simply, a) locate the aim star on the chart using the appropriate rate and day lines, b) locate the child's present performance level by collecting three days' data and finding the mid-day, mid-rate intersection (see figure 13), and then c) draw a line from the middle of his present performances to the star (aim). The line drawn in this manner will represent precisely the progress the child must achieve to succeed.

If the aim was established out of necessity (the aim-rate is an absolute minimum for some reason, and the aim-date cannot be set farther into the future -- perhaps school is letting out), then the line found in this manner is a real "minimum". If the line is very flat (x1.1 or less, for example), then perhaps you would want to consider an earlier aim date (see figure 16). Higher 'celerations, as long as they are reasonable, are always desirable.

(2) Catch-Up Slope: If a child is behind his peers, as would be the case in most special education classes or resource rooms, then the minimum 'celeration selected should be one that allows him to catch up. If his peers progress in reading at a rate of x1.20 movements per minute per week, then certainly the standard for the "slow child" should be 1.25 or 1.30. Anything less than that will "doom" the child to remain that same one or two steps behind his peers. It may sound strange to require a child that has obviously encountered difficulties to actually do better (in progress) than children who have not encountered difficulties, but it is the only fair thing to do. With a little extra help, a few more program changes, and aims which reflect real progress and not just "marking time", even the most severely handicapped child can surprise us. Don't underestimate the child! Expect more, give more, get more! Some examples of better-than-average 'celeration in children who are supposed to be "below average" will be given later in this section.

(3) Child-Can-Do Slope: Hopefully, catching up is not a problem. The child is already doing about as well as one would expect. The only concern is to insure that the child continues to grow, and if possible, actually increases his growth rate in accord with his own abilities. The teacher might then begin by simply collecting frequency data on several behaviors. After the child's "normal"

'celeration has been determined, a minimum 'celeration is selected from what he has demonstrated he can already achieve. Usually we do not select the lowest 'celeration he has demonstrated, but one that represents the 'celeration he achieved on, say, 75% of his projects. That will mean that we might expect that he will "fail" on 25% of the future projects and that we will have to change his program. Eventually, however, it is likely that our changes will take effect and that 100% of his 'celerations will be as good as his top 75% used to be. We set his aims a little higher, increase his minimally acceptable 'celeration a bit more, and start making our changes all over. In this way we guarantee that a certain proportion of his projects are likely to be successful (by the standard of the minimum 'celeration chosen from his data), but that we will still be working with him to help him achieve even better 'celeration on some of his projects. When finding a child's "average" 'celeration, usually we do not count those projects in which there was no growth or in which the 'celeration was actually in the wrong direction. Both of those two types of 'celeration are completely unacceptable. The 'celeration he achieved in the top 75, 80, 60 or whatever percent of his projects, should therefore apply only to those projects in which he was improving at some rate.

(4) Similar-Movement, Similar-Slope: Since children might accelerate or decelerate at different rates on different types of movement cycles, some teachers prefer to look only at similar projects when using a child's data to determine his own 'celeration. When determining a child's minimum 'celeration for two-term, single-digit subtraction facts, therefore, they mightlook primarily at his old 'celerations for two-term, single-digit add facts. Carrying the process one step further, one might look at the child's 'celeration when practicing the basic

movement (digits written) without solving problems of any type (i.e., have the child simply write numbers in sequence for 15 or 30 seconds each day). The writes-digit "movement 'celeration" will define how rapidly the child can progress in the "physical skill" and may indicate how he will progress in a related academic skill with a good program. In fact, with basic academic skills it appears that "basic movement 'celeration" is a very good predictor of future 'celeration.[2]

(5) Teacher-Can-Do Slopes: It is important that regardless of our pupils' progress, we always try and devise ways of helping them to progress more rapidly. We should accept no limit to the potential success of our students. In a classroom where changes are never made, even if the children appear to be making adequate progress, we should be suspicious of our complacency to accept what may be less than the best. Our contingencies for change should be established so that somehow, some changes are made. Without change there can be no improvement in our teaching; and let's face it, our teaching could very likely stand a little improvement. On the other end of the scale there are some teachers who are so anxious for "ultimate" progress that virtually every program is changed every day. Some programs take a little time to have effect. Unless the immediate effect of a program is absolutely disastrous (error rates much higher than correct rates, for example) we should give the program at least a three day trial period to see what can really happen. Perhaps just as importantly, a teacher who is changing a large number of programs each day may not have the time to really think the changes over and select the best change for the child, the movement cycle, the situation and the problem indicated by the data. How many changes

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[2] Hal Caufield, Clover Park Schools, Clover Park, Washington; personal communication, Winter, 1974.

can a teacher make daily? It depends on the changes, the child and the resources to which the teacher has access. Only experience and the data will tell. A teacher could, however, select the minimum 'celerations for each child on the basis of the child's past performance so that there is an expectancy of a certain number of changes to be made each day in the class as a whole. If the minimum 'celerations are set so that 10% of all previous projects had 'celerations below those marks, then it is likely that 10% of the projects will need to be changed each day. If there are 30 children in the class, each one working on 6 projects, then that means that the teacher might expect as many as 18 change-decisions daily. If the changes the teacher devise prove to be successful most of the time, then it can be said with confidence that the "teacher-can-do" with the minimum 'celerations selected. If all or nearly all of the changes are effective, then perhaps some consideration should be given to raising the minimun 'celerations and trying even more changes. If a number of changes are ineffective, then perhaps the teacher should try and design the standards so that fewer changes are required each day and more time is allowed to think each possible change through. The teacher-can-do method of selecting minimum 'celerations should never, of course, replace any consideration for the children. The standards which prove to promote the greatest possible growth in the children should be considered first. Within certain limits, however, it is likely that growth in children will be benefited by some consideration for the teacher's time as well.

There may be other ways for selecting a standard for minimum 'celeration. Several of the methods mentioned above might be considered simultaneously. It is important that some standard be selected, though, or that if the minimum 'celeration rules are not applied to change decisions at all, then some definite set of rules

are. Experience has shown us that it is all too easy to overlook potentially important changes in a child's progress if we rely simply on the old "eyeball" approach to data analysis. Two precision teachers in the State of Washington, for example, found that when they began to apply the minimum 'celeration rules in their work as resource teachers for learning disabled children they were able to nearly double their pupils' average weekly 'celeration in most projects. Over the months they found themselves raising each child's minimum 'celeration more and more and are now using standards ranging from 1.3 to 1.6 -- that's an average weekly growth rate of 30 to 60%! "Handicapped" children can grow. Knowing when they need additional help or a program change can really make a difference.

Fast Off the Starting Line, but Slow to Finish -- Seven Day Slopes

Many children really take off at the beginning of a project and make very rapid improvements in the first few weeks. More than likely this represents a period of acquisition in which the basic skills requisite to the task are learned. Whatever the reason, this high 'celeration frequently slows to a snails pace after awhile, and although children may have reached a level where they can perform the task at hand, they often fail to gain the real fluency ncessary for continued success. The project shown in figure 20 is a typical example.

Using the minimum 'celeration technique for deciding when to change a program can sometimes cause problems with this sort of data. The progress at the beginning of the project can take a child so high above the established minimum 'celeration line that he can stop progressing or even start to backslide for several weeks before his frequency falls below the line for even one day, let alone three days in a row.

To avoid that problem the teacher should be on the lookout for a slowdown in progress, even if the frequencies are still above the line; and if necessary the minimum 'celeration line should be relocated higher on the chart. Experience has proven, however, that when we simply say "if it looks like ...," we sometimes let things slide. After all, when is a slow-down a slow-down? When has progress fallen off to the point that we should reassess the position of our minimum 'celeration? We need more definite rules.

One set of rules which may assist us in assessing how a child's progress is changing from week to week is called seven day slopes. Seven day slopes is a procedure whereby we calculate a new 'celeration line for the child's data each day or every other day. The first 'celeration line is not calculated until we have seven days of data. Seven days will provide, in most cases, enough information for fairly accurate progress statements. When the next day's frequency is collected, the first day is dropped and the new information added. A new 'celeration line is found using just those last seven frequencies. The process is continued, adding a day and dropping a day to form a picture of how the child's weekly progress is changing.

- - - - - - - - - - - - - - -

Insert Figure 22 about here

- - - - - - - - - - - - - - -

The data from figure 20 are presented again in figure 22, without the notes. The arrow labeled (1) points to the first slope that the teacher would have calculated if the seven day slope method had been employed. This first slope is, not surprisingly, quite steep. The child is making fine progress and shoots well over the minimum 'celeration line set for him. Arrow (2) points to the

second seven day slope. This line is found by dropping the first data point that was collected and adding the eighth data point. The second line is even higher. The child appears to have actually bettered his initial progress. Fine. Several more slopes are calculated, each based on seven days' data, each using the next data point collected and dropping the "oldest" data point in the series used before. Some of these slopes are indicated by the dotted lines found on the chart. It is not hard to see that the weekly progress is getting slower and slower with each succeeding day. Finally, by the time that the last data point is collected in the first phase, the seven day slope is flat -- no progress is being made (see arrow #3). A change would certainly be appropriate and indeed a change was made. Unfortunately, the teacher involved in this project did not know about seven day slopes and since the data were still above the minimum 'celeration line, the change was not made to increase the child's progress. Following the rules of the minimum 'celeration line, therefore, the minimum 'celeration line was not moved up or down when the change was made. A change was made at point (A), but new standards were not set for 'celeration.

After the change the overall performance appears to have improved a little (the first seven day slope, indicated by arrow #4, starts higher than the end of the last seven day slope before the change). Weekly progress, however, still appears to be lacking. The seven day slope is still flat. The next seven day slope is even decelerating (see arrow #5). A change should be made now, at the point indicated by (B) on the chart, but the change was not made until point (C) when three successive frequencies fell below the old minimum 'celeration line. Six weeks of no progress and even some deceleration occurred before the teacher noticed that a change had to be made! Progress was possible, after all,

look at what happened when the teacher finally tried a change specifically designed to increase the child's growth rate (point C). The child begins to progress again and reaches his aim in only one week.

The authors are not trying to convince the reader that minimum 'celeration decision rules are worthless. Indeed, they appear to be among the best tools we have. Simply, no rules are infallible. We must be flexible enough to try several ways of analyzing the data in our attempts to achieve the greatest amount of learning in the shortest period of time. The seven day slope method takes more time to employ and should probably be used only when the "fast-start, slow-down" picture begins to form on the chart. When a seven day slope approaches the 1.25 minimum, or whatever other minimum you have set, then simply extend that seven day slope out to the aim, use that as the new minimum 'celeration and follow the rules accordingly. Be alert, be persistent, but above all, look at the data!

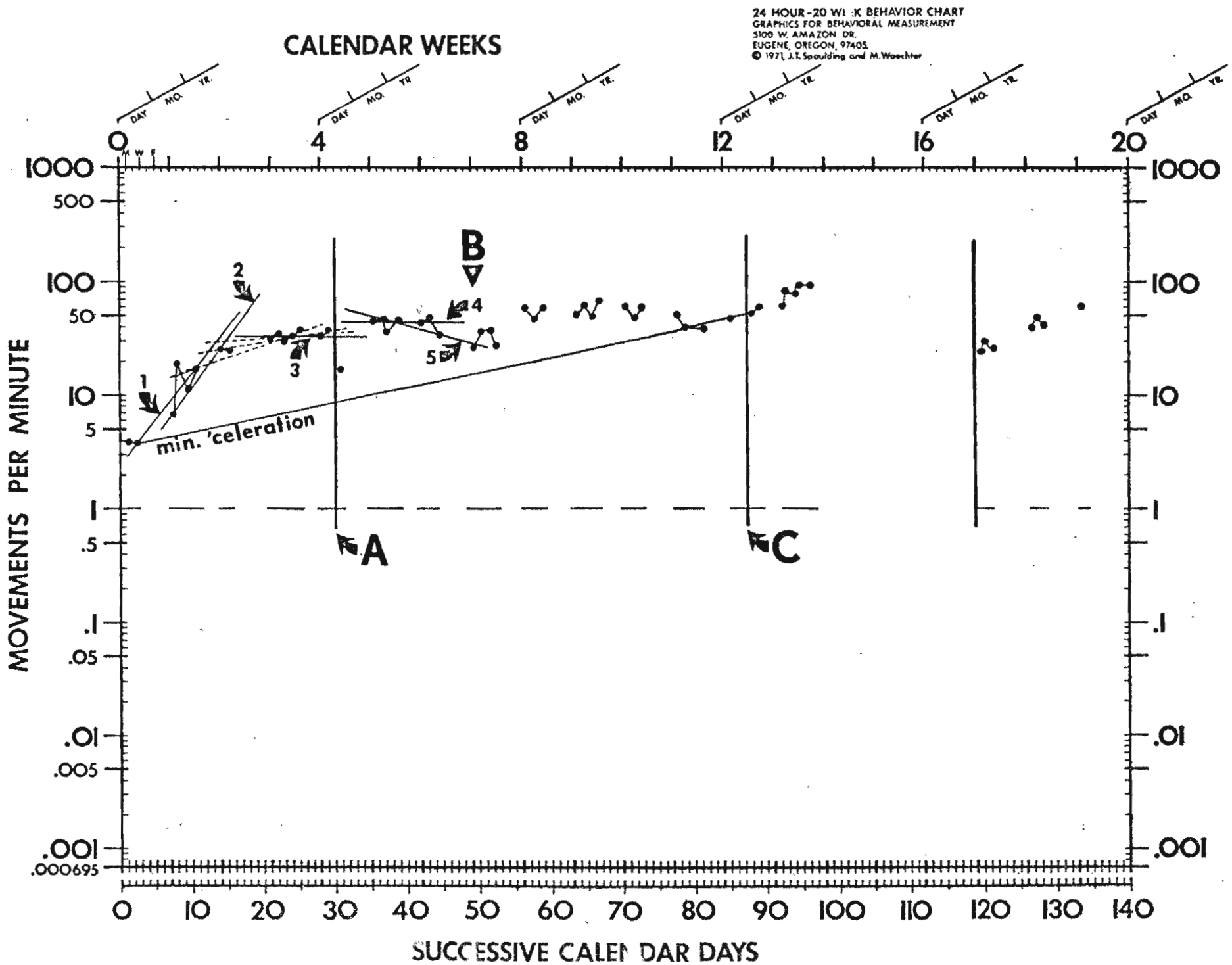
24 HOUR-20 WEEK BEHAVIOR CHART
GRAPHICS FOR BEHAVIORAL MEASUREMENT
5100 W. AMAZON DR.
EUGENE, OREGON, 97405.
© 1971 J.T. Spaulding and M. Waechter
CALENDAR WEEKS
DAY MO. YR.
0 4 8 12 16 20
W F
MOVEMENTS PER MINUTE
1000 500 100 50 10 5 1 .5 .1 .05 .01 .005 .001 .000695
A
B
C
1
2
3
4
5
min. celeration
0 10 20 30 40 50 60 70 80 90 100 110 120 130 140
SUCCESSIVE CALENDAR DAYS

FIGURE 22

WHAT SHALL WE DO? WHAT HAVE WE DONE?

Deciding when to change a program is only half the battle. Deciding what changes to make is the second half. Surprisingly, in the vast majority of cases the battle is all but won with most students when a teacher knows it is time for a change. Given an aim, precise information about the adequacy of their attempts to help the child (daily frequencies), and definite ways to use the information to decide when a change is necessary (the 'celeration line and decision rules), most teachers find that they already have a good idea of what to change. If necessary, they change and change and change. The changes may be simple or complex, they may come from their own ideas or experiences, from other teachers, parents, counselors, or indeed, even from the child himself. Then there is always the research--those well controlled and precisely defined demonstrations of better and more effective general learning environments. The journals abound. The resources are plentiful. We only need to remember that the child is an individual, and as such, he may not learn effectively and efficiently under the same conditions as other children. Handicapped children too, although frequently grouped and classified as if turned out from the same mold, are as different from one another as any child is from any other child. With his eyes on the child (and certainly his chart) and his ears open to suggestions for change the Precision Teacher finds that he can approach the individual child in a manner that allows both to win.

It is one thing, of course, to talk about the ability of a teacher to cope with the necessity of change, and another to actually experience that phenomenal

flexibility. Lindsley[1] has said that of a group of 500 teachers trained in the use of the chart, 80% were successful in their first attempt to change a behavior an additional 15% were successful with their second change in the program and the remaining 5% were successful on the third try. None of the teachers required help from their instructors in selecting a program change to try. All were eventually successful in achieving the aims they had set. The only teacher trained by the authors that was unsuccessful for three successive attempts to devise an effective change plan during the course of her training in Precision Teaching was working with a child in her class that displayed some rather severe behaviors. He would throw things through the windows, break desks, hit peers, swear and that was just the beginning. The teacher tried several rather sophisticated change plans that were reported in professional research journals--token economies, time out, and cost-contingencies just to name a few. Nothing had even the slightest effect. The chart showed no change. The teacher finally resolved to bring her data to the next Precision Teaching seminar, demonstrate with the data her failure and become the first teacher to ever be in a position to demand of her instructor assistance in devising a change plan. Although the failures bothered her, she confessed to a grim satisfaction in being the first. The day came and following school she would have an opportunity to share her data. Then it happened. The child with whom she had been working uttered a word that was to her particularly foul. Actually, the "utterance" apparently had a decible level capable of shaking the windows. She lost control. The teacher leaped across

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[1] Personal communication, Summer, 1968.

the room and before she knew what she was doing, she found herself standing on the student's desk...looking down at him. "Don't ever do that again," she said; and then understandably shaken by not only the child's performance, but her own, she left the room. He never misbehaved again in her class.

The point is simple. No one can tell you with total confidence what to do. Certainly no one is going to suggest that teachers go around standing on their pupils' desks. All anyone can do is suggest those tactics that have proven successful with similar children and learning situations before. There <u>are</u> some tactics that will work with a great many children. It is up to the teacher, however, that single person that stands in the class day after day working with and learning about the individual child, to assess and analyze each suggestion, to select those which hold the greatest promise for Billy, or Susan, or Jon and to monitor the results as carefully as possible--prepared to change and changing as the performance of the child demands.

Aside from the specific tactics to employ, that is, whether to use stars or pennies as consequences, whether to use Sullivan Programmed Reading or DISTAR for the reading program, there are a few rules of thumb that teachers have discovered in their data. There are a few basic patterns of growth that appear over and over again in the charts that hint about the type of change which might be effective. A few of those rules will be discussed below, but remember, suggestions are just that. You must evaluate each child not only from the experiences gained with other children, but also with the intimate knowledge you develop of that child as an individual.

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Insert Table 3 & Figure 23 here

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TABLE 3

SUGGESTED CHANGES FOR VARIOUS PATTERNS OF PERFORMANCE

The following suggestions are based on the assumption that the teacher has done his very best pinpointing and the movement cycles have been precisely calibrated and selected for the particular child whose behavior is to be changed. It is also assumed that those procedures and materials initially selected were chosen for some specific data-based reason. The following suggestions apply primarily to changes in projects dealing with academic behaviors, but the patterns which indicate a need for change are common to many project types.

The performance patterns are separated into five basic categories: Acquistion, the period during which the child is learning the basic skills required by the task; Fluency-building, the period after the basic skills have been acquired and during which the child increases the speed and accuracy of his performance to the level required for maintenance, generalization and success in later tasks; General, or patterns which may apply equally well to acquisition or fluency-buildi situations; Criteria, where one of a fair pair (either the acceleration or deceler ation target) has reached criteria, but the other has not; and Change, those patterns which may result in the first days' data following some program change to a higher task level (i.e., following attainment of criterion performances in the previous task level). In order to differentiate between the stages of acquisition and fluency-building the authors have elected to state specific criteria: If a child is able to perform at least 20 correct examples of the behavior being counted, with 10 or less errors, then we consider him to have demonstrated a basic understanding of the task (acquisition), and to now be working primarily on fluenc If one or the other of these criteria has not been met, then we consider the child to still be in the acquisition stage of learning. The reader is asked to remember however, that there are no magic numbers. Depending on the task, these numbers ma change considerably. Only experience with the type of children you confront and the types of behaviors you wish to teach will eventually determine if the 20/10 rule is adequate. If the changes suggested in this table for either acquisition or fluency-building do not appear to function adequately, then perhaps the reader should first attempt a redefinition of the transitional rates between those two stages of learning.

Each of the performance patterns is paired with a description and suggestion(s) for change. If more than one suggestion is provided, then they will be ordered by their likelihood for success. In the absence of any other criteria for selection, simply try suggestion "a", then "b", and so on until success is achieved. Don't be afraid to mix-and-match or to add your own ideas to the list. These suggestions are just to get you started. Once you have a little data of your own, you should make your own table.

Finally, references are provided along with most of the suggestions to figures contained in this chapter which demonstrate with real data the type of performance described and the effect of the changes suggested. The reader is encouraged to study these figures carefully. Although the specific patterns you are likely to encounter will undoubtedly be somewhat different, the more experience one has with data, the more one is able to learn from it.

TABLE 3 (CONT'D)

ACQUISITION PATTERNS

PATTERN	DESCRIPTION	CHANGE SUGGESTIONS
A1 (·)count 20 or less → ↘ (x)count above 10 → ⇒	During skill acquisition the acceleration target is not growing and errors are either not changing or accelerating.	(a) Step back to the next lowest skill in the hierarchy and move <u>that</u> skill to a higher aim or to proficiency (see figure 23A). (b) Slice back to a slightly easier version of the same skill (see figure 23B). (c) Try a new instructional procedure for the same skill (see figure 23E).
A2 (·)count 20 or less → ↘ (x)count below 10 → ↘	During skill acquisition the correct rate is flat or decelerating and the errors are below 10. If errors are accelerating, change when your data fit example A1 above.	(a) Slice back to a slightly easier version of the same skill (see figure 23B). (b) Try a different instructional tactic (see figure 23E). (c) As a last resort, move to an easier prerequisite skill, as shown in Figure 23A.
A3 (·)count 20 or less → ↗ (x)count above 10 ⇒	During skill acquisition the correct count is accelerating as errors accelerate or maintain.	(a) Change the instructional tactic (see figure 22E). (b) Change nothing and wait until another pattern develops. Often instructional or contingency changes designed to change error performances during skill acquisition will hamper fluency and the behaver becomes "afraid" of going faster and making mistakes (see figure 23F).
A4 (·)count 20 or less → ↗ (x)count below 10 → ↘	During skill acquisition the correct count is accelerating as errors decelerate or maintain. Note: if errors are accelerating, wait until another pattern develops.	Leave your program alone, you're doing fine! See figure 23D.

TABLE 3 (CONT'D)

FLUENCY BUILDING PATTERNS

PATTERN	DESCRIPTION	CHANGE SUGGESTIONS
F1 (·)count above 20 ↘ (x)anything below 10 → ↗ ↘	The skill has been acquired but the program is not effective in increasing fluency.	(a) Try another contingency for faster work (correct), see figure 23H. For example, every day that his rates improve over his last <u>best</u> day he is allowed to lead the lunch line or have free time. Don't set the contingency for rates better than the previous day or you may get a pattern like this: where the child is "paid off" every other day for essentially no progress. (b) Simply try telling the child to "go faster". (c) It is possible that the child is "forgetting" the skill. If a contingency or cues fail to work, try a "skill review".
F2 (·) count above 20 → ↗ (x)anything below 10 → ↘	This pattern usually appears once the skill has been acquired and the aim is fluency. The acceleration target is not accelerating and is the main problem.	(a) Try a contingency for faster work and don't worry about errors until the acceleration aim is met. An example of this pattern and change is shown in figure 23G. (b) If the errors are consistant from day-to-day, try drilling on those errors to decelerate them (see figure 23E).
F3 (·)count above 20 ↗ (x)anything above or → ↘ below 10	Again, this pattern will appear frequently when fluency in correct rates is the target. The correct rates are accelerating, which is quite acceptable.	Your program is doing fine. Don't worry about the errors until the acceleration aim is met. See figure 23I.

TABLE 3 (CONT'D)

PATTERN	DESCRIPTION	CHANGE SUGGESTIONS
(·)any rate, growth, then flat 	Any rate or count, the correct counts stop progressing and flatten out after a period of good growth.	(a) If the child has reached his aim, move on to the next level of the curriculum. (b) If the child has reached a record ceiling, give him more opportunities to respond. (c) If the child has reached a performance ceiling (e.g., he is writing the digits in answers to math-fact problems as rapidly as he can write digits in sequence), then work with the basic movement cycle (e.g., writes digits in sequence -- without problems). (d) If none of the above limitations appears to be the case, then try a contingency on the correct count (see F1 above and figure 21).
F5 (·)any rate, any count; flat with no progress, then decel eration. 	At any count or rate the correct counts begin to decelerate after a period of growth or maintenance.	The child is more than likely "bored". He <u>can</u> do better, he already <u>has</u> done better. For some reason it simply isn't worth his while any more. (a) Move to a new step in the curriculum (if at one time he reached his aim rate, even if it wasn't for the required number of days). (b) Set a contingency for maintaining or improving his correct counts. Note that deceleration can't be due to an increase in the difficulty of the material in this case, since such a change would have been noted by a phase change line. See figure 23H.

GENERAL PATTERNS

TABLE 3 (CONT'D)

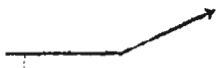
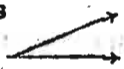
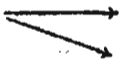
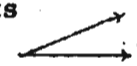
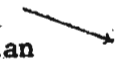
PATTERN	DESCRIPTION	CHANGE SUGGESTIONS
G1 (x)deceleration or no progress, then acceleration. 	At any count or rate, a deceleration target begins to accelerate after a period of deceleration or maintenance.	(a) Try an added contingency on the errors. (b) If the child was at one time at the aim rate, then perhaps he is bored and a more difficult task will work.
G2 (·)or(x)high variability, big changes from day-to-day. 	At any rate or count the daily performances jump all over the chart -- the child may or may not be progressing overall, but any gains made in a week are smaller than the daily "ups and downs".	A large number of other variables (aside from the instructional plan or management plan) are probably controlling the movement cycle. Perhaps the peers are paying off some behavior that you are trying to decelerate. Try and find out what those other factors may be, and attempt to reduce their effect by eliminating them (e.g., put the peers on a program to reduce their "pay-offs"), or at least make their effect more consistant from day-to-day. Alternatively, the problem may be in the consistancy of the program itself. Are the conditions of the program the same from day-to-day? Are the problems the same? Is the time when the counts are collected the same? Is there usually the same number of people in the room? Try and keep things as much the same as possible. See figure 26.
G3 (x)good deceleration, then flat 	At any rate or count the error counts flatten out after a period of good deceleration.	(a) Check the record floor and lower it if the child has reached it or is very close to it. (b) Check to see if the same errors are being made each day, if so, then "drill on errors" or have special practice. (c) establish a contingency on errors.

TABLE 3 (CONT'D)

GENERAL PATTERNS

PATTERN	DESCRIPTION	CHANGE SUGGESTIONS
G4 (x)greater than corrects  (·)less than errors 	Any time when the errors are flat or accelerating at a rate greater than or equal to the corrects which are flat or decelerating.	(a) Check to see if you have the right pinpoint. It may be too advanced for the student. If so, then "slice back" to a smaller task level (e.g., see figure 23A). (b) If you think that the task level is essentially appropriate, try drilling on errors (e.g., see Figure 23E).
G5 (x)greater than corrects  (·)less than errors 	The errors are greater than the corrects and are flat or accelerating, but the corrects are also accelerating.	(a) If it looks like the corrects will "overtake" the errors, then leave the project alone for a while (e.g., see Figure 23F). (b) If it does not appear that the corrects will overtake the errors, then treat like pattern G4 above.
G6 (x)greater than corrects  (·)less than errors 	The errors are greater than corrects, but the errors are going down and the corrects are going up.	(a) If the rate of progress for corrects appears good, then leave the project alone (see figure 23F). (b) If you are really concerned, treat like pattern G4 above.

CRITERION PATTERNS

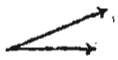
PATTERNS	DESCRIPTION	CHANGE SUGGESTIONS
C1 (·)at aim * (x)not at aim 	The aim for corrects has been reached (and a flat line-of-progress is now appropriate), but the errors are not at their aim and are flat or accelerating.	(a) Try a contingency on errors (e.g., points for "best-yet"error rate). (b) If the corrects are over the aim-rate (better than they need to be), then try telling the child to "slow down". (c) If the child has been in the program a long time, he may be "bored" -- try moving on ahead of time (but keep close track of the errors in the next step or phase).

TABLE 3 (CONT'D)

PATTERN	DESCRIPTION	CHANGE SUGGESTIONS
C2 (·)not yet at aim ⟶ (x)at aim *	The errors have reached their aim, but the corrects are still not at aim and are flat or decelerating.	(a) Set a contingency for correct responses (see figure 23J). (b) try more frequent practices. (c) If you are not certain what the aim should be, move on to more difficult material; but if the errors shoot up way beyond the corrects in the next material, then go back to the previous level and try for a higher correct aim.
C3 (·)at aim * (x)at aim *	Both the corrects and errors are at aim.	NICE! You've reached the aim of the project in that phase. Move to the next step of the curriculum or program.

CHANGE PATTERNS

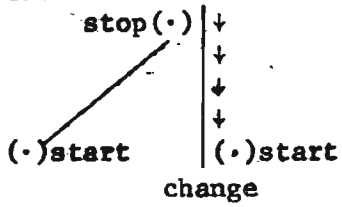
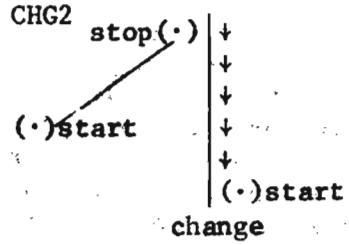
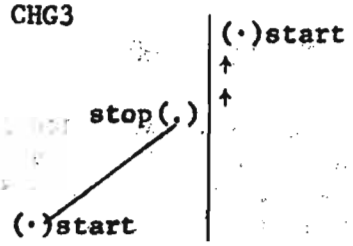
PATTERN	DESCRIPTION	CHANGE SUGGESTION
CHG1  	After a change, usually following attainment of the aim for one level of the curriculum, the student is moved to the next step in the series and the starting rate for the new phase is the same as the starting rate for the old (last) phase.	If the starting rate in a new phase is the same as the starting rate in the previous phase, then it is likely that the rate of progress achieved by the child will also be the same. If the rate of progress in the old phase was acceptable, then this pattern is desirable. If the rate of progress in the old phase was not acceptable, however, then another change should be made -- probably to an "intermediary" step halfway between the difficulty level of the old phase and the difficuly level of the new phase. See Figure 27B.

TABLE 3 (CONT'D)

PATTERN	DESCRIPTION	CHANGE SUGGESTION
CHG2  	After a change the starting rate for the new phase is lower than the starting rate for the last phase.	Chances are that the rate of progress or 'celeration in the new phase will not be as great as it was in the old phase. If the 'celeration in the old phase was a "minimum" (should not be less), then another change is advisable. If the rate of change or progress in the old phase was higher than it had to be, then perhaps more data should be collected to determine the child's new progress before a change is considered. See figure 27B, the change between the fourth and fifth phases for an example of a starting rate that is lower than a previous starting rate.
CHG3  	After a change, the start rate for the new phase is actually higher than or equal to the stop rate in the old phase.	The jump in curriculum is too small, or the sequence of steps in the task hierarchy is wrong. If the end rate in the last phase was acceptable (at aim), then move on immediately to the next step in the series. If this jump occurs with several children at the same point in the task sequence, then consider changing the sequence or grouping several steps together. See figure 34.

Note: The patterns and suggested change tactics for error counts and rates following a program change follow the same rules as those given above for correct rates and counts. Of course, the patterns would be reversed, since error rates should be going down. Try and select your changes so that the error rates in the new phase are at essentially the same level as the error rates in the old phase started. Error rates that are lower in a new phase than they ended up in the old phase (i.e., the reverse of the patter shown in CHG3 above) are more acceptable, however, than a jump up in correct rates right after a change. In general, change analysis concentrates more on correct data than on error data. Remember: the change patterns and suggestions given above pertain to changes made in academic projects in which the child has already achieved the aim in one phase and is advancing in the curriculum. Patterns for "management" behaviors and changes as a result of failure to achieve the aim should be assessed differently, and will be covered later.

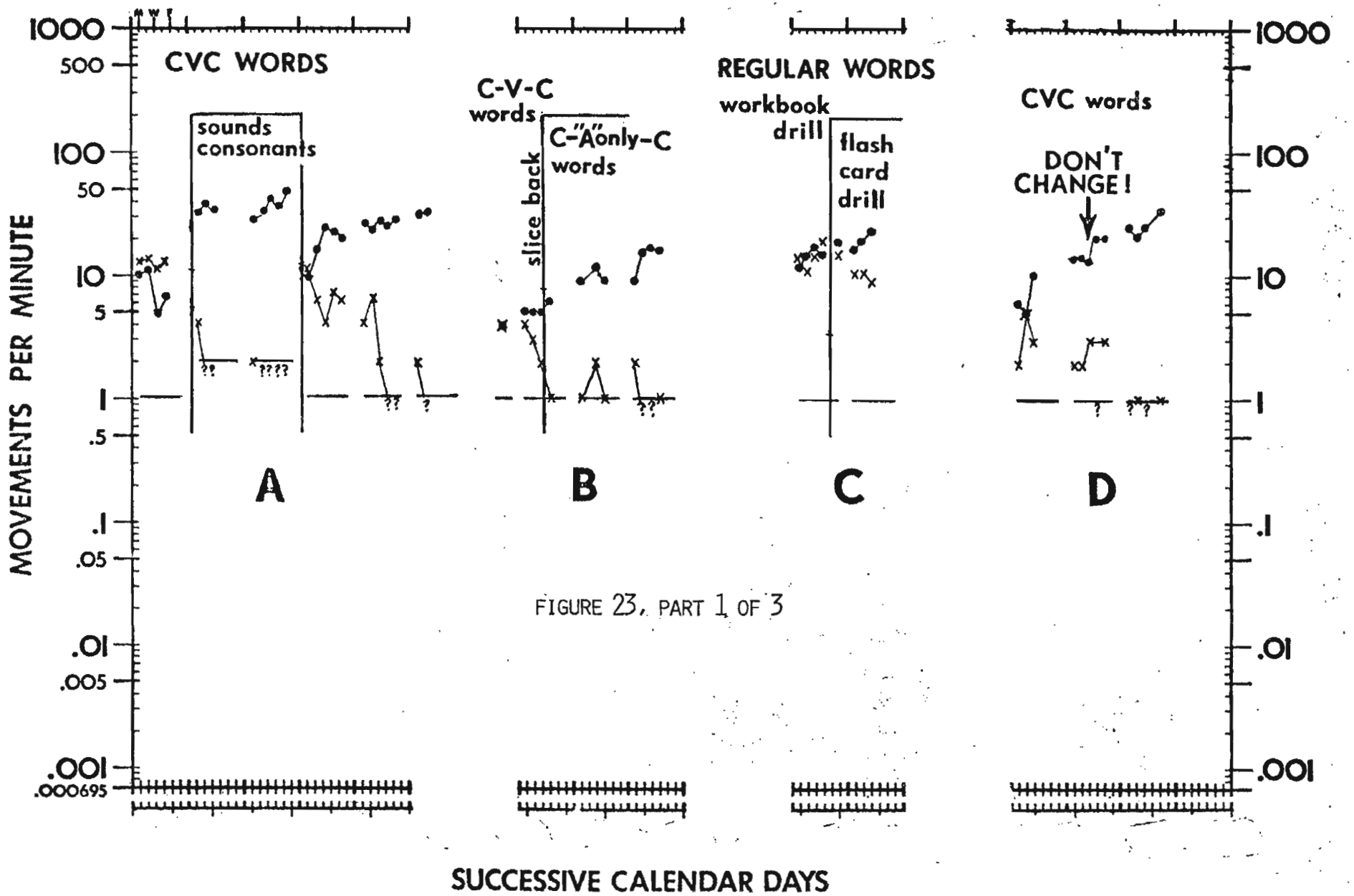


FIGURE 23, PART 1 OF 3

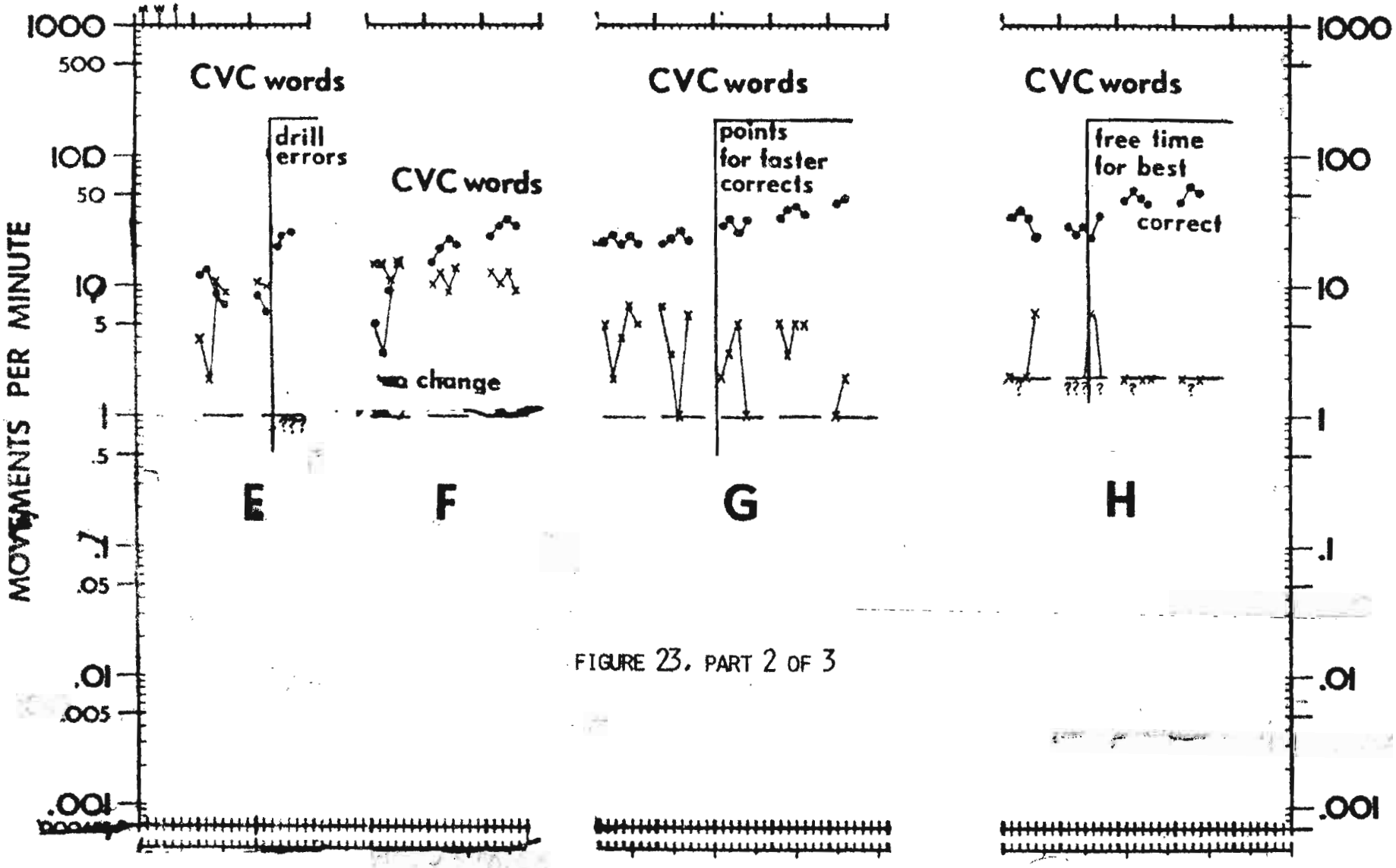


FIGURE 23, PART 2 OF 3

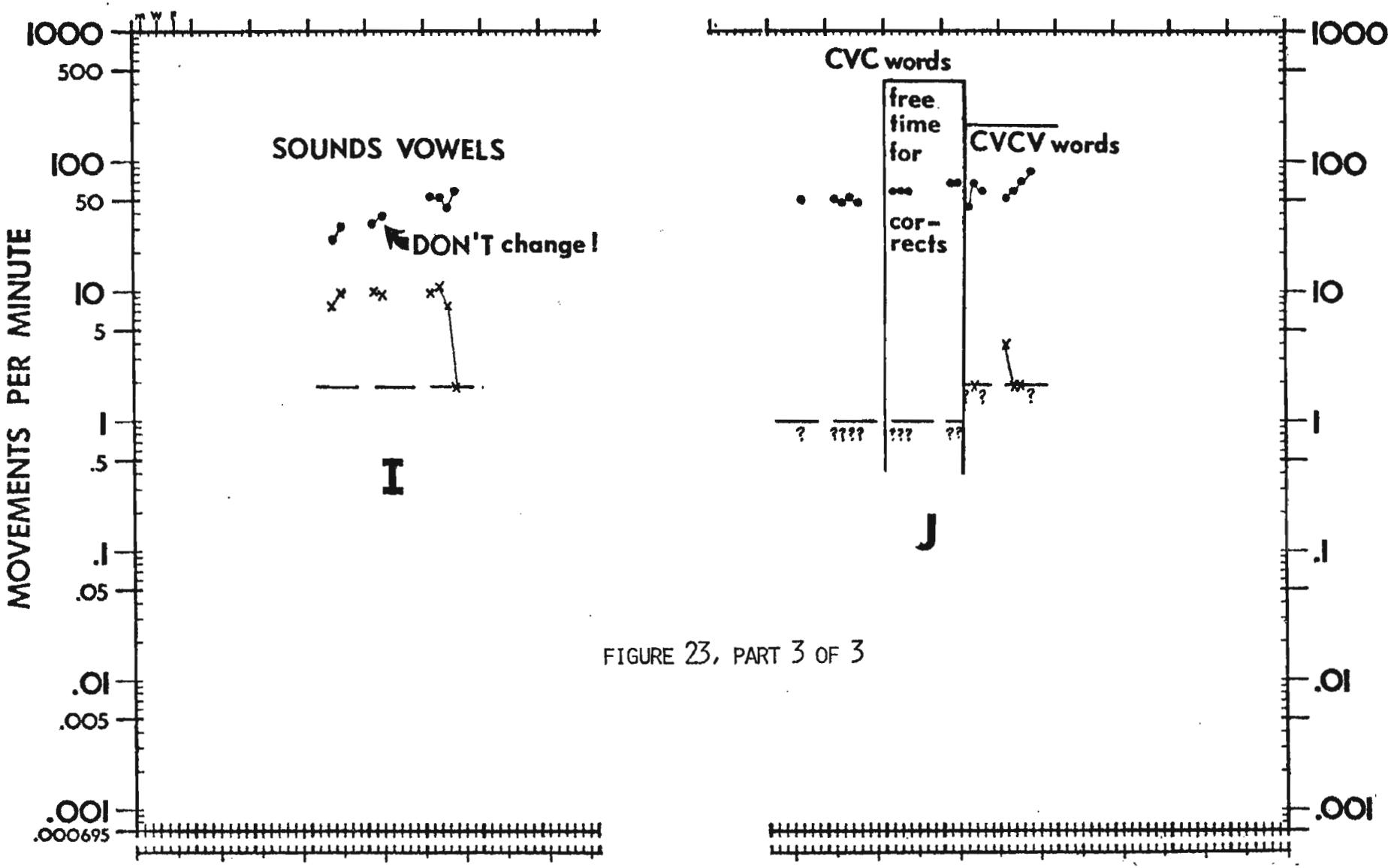


FIGURE 23, PART 3 OF 3

The patterns presented in table 3 are stylized. The data presented in figure 23 and the other referenced charts are real. The real data are not as "tidy" as the lines and dots and x's in table 3 suggest. Some liberal interpretations of your data may be necessary when trying to match them up with the alternatives presented in table 3. In any event, the change suggestions should be critically examined in light of your personal knowledge of the child and situation you face. With practice, patience and careful records you should begin to formulate a table of your own. Perhaps we should even have a table for each child. What patterns in performance with what program changes lead to what results? To keep the type of records which will enable you to learn from your experiences we must discuss a method for precisely describing changes in our plans and the alterations produced in behavior patterns as a result of those changes.

What Did I Do?

Each time it is found necessary to make a change in the program of a targeted behavior the manager should record those changes on the Is-Plan (see the section on "Recording Environmental Events and Conditions -- the Is-Plan"). If changes are not recorded, it will be difficult to determine later which set of conditions or events was most effective in helping the child to learn. If that information is lost, then the experience gained through the program will not be availabe for use in future programs and with future students.

As an alternative to the use of the Is-Plan per se, the manager may find it more convenient to record changes on a Decision Record Sheet. An example of such a sheet is provided in Figure 22. This form, when used in conjunction with the Is-Plan and chart will provide all the important information concerning changes in behavior and the events or conditions which appeared to influence those changes.

- - - - - - - - - - - - - - -

Insert Figure 24 about here

- - - - - - - - - - - - - - -

The "behavior and Person" information spaces on the Decision Record Sheet are identical to those found on the 6-16 chart, the rate record sheet and the Is-Plan. The remainder of the form provides spaces for: 1) the date of the change (i.e., the date when the change actually took effect -- not when it was planned); 2) the reason for the change (e.g., three days below the minimum 'celeration line); 3) the name of the person(s) making the decision to make a change and 4) a description of the exact changes that were made in the program. In addition to filling out the Decision Record Sheet it is wise to make a note directly on the chart describing briefly what the change involved. Such notes may be of tremendous assistance when analyzing charted data quickly or when trying to explain a program to another person.

What Difference Did It Make?

Once a program is changed it is important to summarize and record the effect it had on the performance of the student. On-going analyses should not only determine if a particular program is working, but how much better or worse it is working then the last program in effect. Two types of effects will be discussed in particular -- steps, or changes in frequency which occur immediately following the program change and 'celeration changes, or changes in the weekly progress of the behaver.

The Step Change describes the difference between the point where one 'celeration line (from the last phase) ended and the next 'celeration line began.

DECISION RECORD

TARGET MOVEMENT CYCLES_____ BEHAVER_____ age_____ grade_____

_____ MANAGER_____ label_____

AIMS: acceleration: rate_____ date_____ ADVISOR_____

deceleration: rate_____ date_____ DATE PROGRAM INITIATED_____

DATE	PERSON MAKING CHANGE	REASON FOR CHANGE	DESCRIPTION OF CHANGE

FIGURE 24

That difference is considered to be representative of the immediate effect of the program change. The change may be an immediate increase in frequencies (called a "step up"), or an immediate decrease in frequencies (called a "step down"). Of course, there might be no immediate change in frequencies and therefore no step. To calculate the value of a step change (refer to Figure 25 for an example):

1) Draw the 'celeration lines for each phase. The end of the 'celeration line for the first phase and the start of the 'celeration line for the second phase should both be extended to touch the phase change line.
2) Calculate or estimate the "rate value" of the point at which each 'celeration line touches the phase change line. In Figure 25, for example, the ending rate of the first 'celeration line is 25. The beginning rate for the second 'celeration line is 35.
3) Divide the largest of the two intersection rates by the smallest of the two intersection rates. In the example above, 35/25=1.40.
4) If the step is "up", then label the answer to step 3 a "times" change. If the step is "down", then label the answer a "divide by" change. In the example used before the answer would be "x1.40".
5) Record the step change at the base or top of the phase change line -- wherever there is the most room.

- - - - - - - - - - - - - - -

Insert Figure 25 about here

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Step changes are usually interpreted as a difference in "motivation" (i.e., what the behaver "gets" for better performance) or opportunity (e.g., the material

is now easier, or something new has been explained). Changes in "ability" to perform the movement cycle are usually considered to be learned more slowly and are demonstrated by changes in 'celeration, not steps.

The 'celeration change describes the effect of the program change on the weekly progress of the behaver. Calculation of these effects is based on the standard procedures that were described in the chapter on Behavioral Assessment and Precise Classroom Measurement. Briefly those procedures are:

1) Draw and measure the 'celeration line. In Figure 25, the values of the two 'celeration lines were x1.20 (for the first phase), and x1.30 (for the second phase).

2) Divide the largest 'celeration line by the smallest when the two slopes are either both "times" slopes, or both "divide-by" slopes. In the examples used above, both were "times" slopes, so the calculation is 1.30/1.20 = 1.08.

If the 'celerations were in opposite directions (i.e., one of the 'celeration was "times", and the other was "divide-by"), then multiply the two slope values instead of dividing one into the other. For example, if one 'celeration line had a slope of ÷ 3.00 and the other had a slope of x 2.00, then the 'celeration change would be 3.00 x 2.00 = 6.00.

3) Label the change as "times" (X) if the child is now accelerating more rapidly up the chart, or is decelerating less rapidly (i.e., if progress along the second 'celeration line would place him higher on the chart than continued progress along the first 'celeration line if they both started in the same place, that is, if there were no step). Label

the change as "divide-by" (÷) if the child is accelerating less rapidly up the chart, or more rapidly down the chart (i.e., if progress along the second line would place him lower on the chart if both lines started in the same place).

Table 4 reviews the procedures given above for the calculation of progress change and for ascribing the appropriate label to the change. Each of the basic change patterns are considered, but notice that no steps (immediate changes in the level of performance) are shown. Steps will not effect the calculation of the progress change. If a step occurs in your data, simply try and imagine which of the patterns shown in table 4 would be most like your chart if you moved the second 'celeration line up or down on the chart (keeping it always at the same angle or slope) until it started where the old 'celeration line ended. The arrows drawn from the dotted line in each case (i.e., the prediction of where the old 'celeration line would have gone) to the solid line (the actual 'celeration line after change) indicate the direction of change.

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Insert Table 4 here

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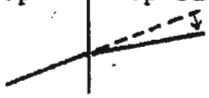
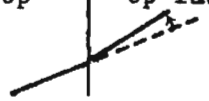
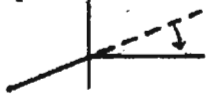
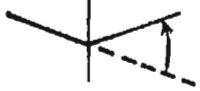
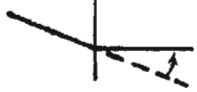
'Celeration changes describe the effect of the program change on the behaver's progress. Since any week-to-week progress (which is at least in the right direction) carried over a long enough period of time will eventually move the student's frequencies from anywhere on the chart to any aim that might be specified the effects of 'celeration changes are generally considered to be more "far-reaching" than those of the step.

TABLE 4

First Phase 'Cel. (1)	Second Phase 'Cel. (2)	Procedures for Calculating Change	Label (Direction of Change)
Up	Up slower 	Divide the slope of (1) by the slope of (2).	(÷) divide-by
Up	Up faster 	Divide the slope of (2) by the slope of (1).	(x) times
Up	Flat 	Simply use the slope value of (1).	(÷) divide-by
Up	Down 	Multiply the value of (1) times the value of (2).	(÷) divide-by
Flat	up, down, or flat (anything) 	Simply use the slope value of (2).	Use the label for slope (2) -- can be (x) or (÷).
Down	Up 	Multiply the value of (1) times the value of (2).	(x) times
Down	Flat 	Simply use the value of slope (1).	(x) times
Down	Down slower 	Divide the value of (2) by the value of (1).	(x) times
Down	Down faster 	Divide the value of (2) by the value of (1).	(÷) divide-by

What Does It All Mean?

Both the immediate and the long range effects of a program change may be summarized in the Step and 'Celeration statements described above. Each may be analyzed separately or in conjunction with the other.

If a step change occurs but no change in 'celeration is noted (or is not an important consideration at the time) then that program may be a useful tactic to employ again when Immediate effects are desired. For example, assume that a child is transferred into a class two weeks before the end of school. In the time left to work with the student good weekly progress would be of little importance. Tactics which produced large steps in previous projects would be the wisest choice. Even if progress falls off or goes the wrong way after producing the "step up", the undesirable effects of those 'celeration changes would not be very great in the time left to the student for work.

If, on the other hand, a teacher is planning a program which will be started at the beginning of the school year and continued for as long as necessary, then the most important aspect of performance for the teacher to consider is 'celeration The teacher would want to use those tactics and materials which produced the greatest 'celeration in the right direction for the longest period of time. If program changes are needed and there are still several months left in the school year, then 'celeration is still the most important aspect of performance to consider. Programs which produced good 'celeration changes, therefore, would be selected first.

If If "time" is not an important factor (necessitating, thereby, the selection of programs emphasizing either step or 'celeration changes), then programs should be selected on the basis of their overall effect. To determine

this combined effect, follow these procedures: First, extend the 'celeration line from the first phase of the project all the way to the end of the next phase of the project. If more than 30 days are involved, this extension is not likely to be very accurate. Still, it will have to serve the purpose. The point (frequency) where this extended line ends up is where one would expect that the student would have been on that date, had no program changes been made . (NOTE: Never project a line below the record floor, or above a record or performance ceiling. If a line does go below a floor or above a ceiling, then stop it and start a new line that is flat and runs just above the ceiling or just below the floor (whichever applies). Now, look at the end of the last 'celeration line in the project. The point where that line ends up is the best estimate of where the student actually was when the project ended. Even if the line is different from any actual rate which was collected on that date, actual rates are supposedly subject to some error (e.g., the child feels badly, so the rate goes down a little). The 'celeration line, however, is supposed to "cancel out" those errors. If successful, the line will be a better estimate of a student's "functional" level of performance for any given day. Taking the end of that line, then, and comparing it with the end of the first 'celeration's extension to that date, should allow one to see what the overall combined effects of step and 'celeration changes were throughout the project. When selecting programs, certainly the magnitude of this overall effect produced with previous students or behaviors should be considered. Figures 26 and 27 demonstrate some of these considerations.

- - - - - - - - - - - - - - - -

Insert Figures 26 and 27 here

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FIGURES 26 AND 27

Figure 26 is a chart of an "emotionally disturbed" fourth grader's "writes digits correctly on two-term, single-digit add facts". It is an excellent example of a step-up, progress-change-down change in performance. The teacher correctly surmised that the child was not likely to make his aim of 50 digits per minute by the date set if the program were left alone (notice the prediction based on the first 'celeration line and how it passes under the aim-star). A change was tried that had a good immediate effect (a step up of x2.08). The 'celeration in the second phase flattened out, however, so that no weekly progress was made after the change. On the last rated day, the initial step change of 2.08 had dwindled to an overall net effect of only x1.30. In general, a x1.30 would be considered a good change, but there does not appear to be any hope for further progress, as there was with the old 'celeration line. By the 21st day after the change we could expect that the old 'celeration would have caught up with the new level of performance and that at this no effect point any advantage in making the change would have been cancelled out (note the point where the two 'celeration lines would cross). Making a second change before the no effect point will result in an overall net effect of "up" (an improvement in behavior over that which we would have expected under the old program); making a change after the no effect point would probably result in an overall net effect of "down" (a lower performance, overall, than we would have expected under the old program). A change with the project shown in Figure 26 should be made as quickly as possible. So, it should be obvious that change can be both good and bad. In this case, the change will be good as long as we do not leave the child in the new program too long. The change might end up to be a bad choice in the long run if we do not change, because the progress from week-to-week is so much lower than it was before. Where only a small amount of time is available to work with a child, this change might be tried again. Where there are several months left in the school year, however, another plan which produces more favorable 'celeration changes should be considered the next time the teacher encounters a similar problem with a child. Figure 26 provides examples of some other change patterns the teacher might encounter.

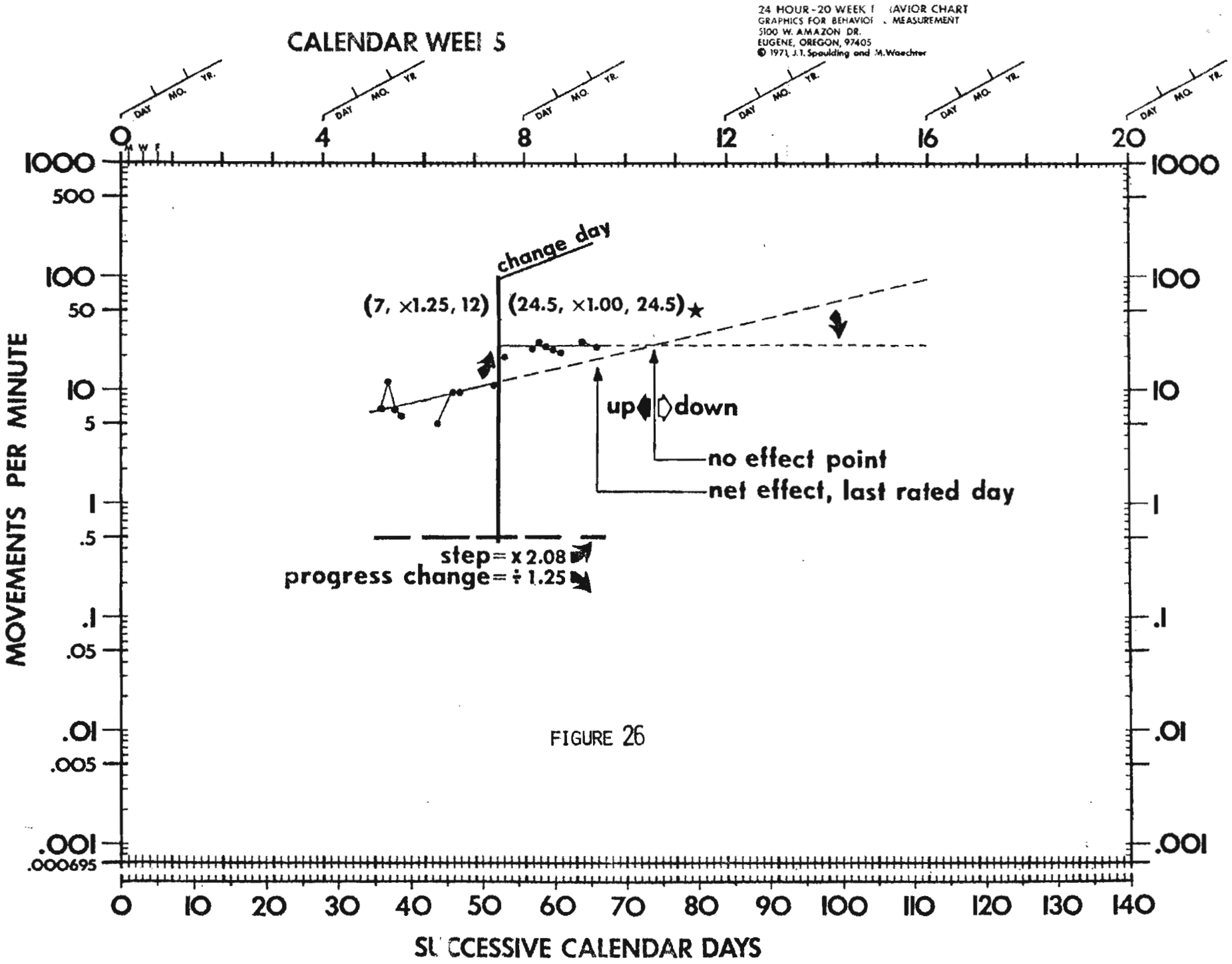
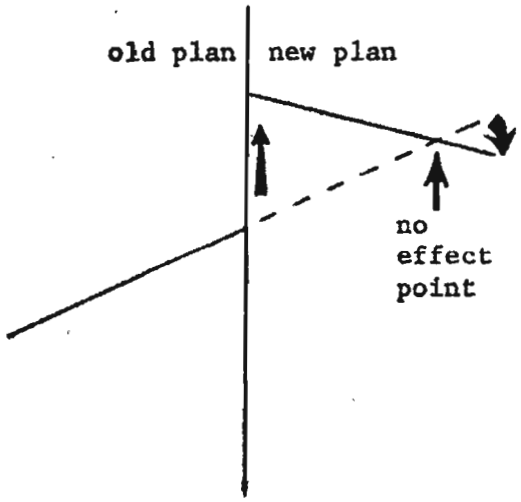

24 HOUR - 20 WEEK BEHAVIOR CHART
GRAPHICS FOR BEHAVIOR MEASUREMENT
5100 W. AMAZON DR.
EUGENE, OREGON, 97405
© 1971, J.T. Spaulding and M. Waechter
CALENDAR WEEK 5
DAY MO. YR.
0 4 8 12 16 20
M W F
1000 500 100 50 10 5 1 .5 .1 .05 .01 .005 .001 .000695
MOVEMENTS PER MINUTE
change day
(7, ×1.25, 12)
(24.5, ×1.00, 24.5)★
up
down
no effect point
net effect, last rated day
step = x 2.08
progress change = ÷ 1.25
0 10 20 30 40 50 60 70 80 90 100 110 120 130 140
SUCCESSIVE CALENDAR DAYS

FIGURE 26

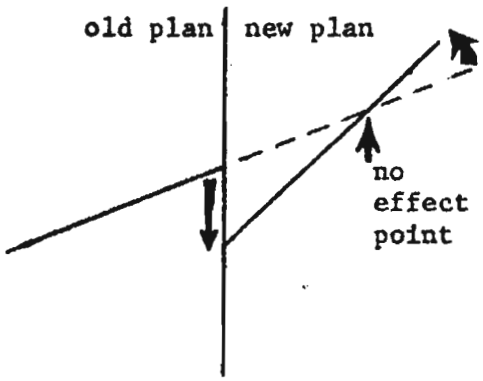
FIGURE 27

The interpretation of changes when trying to improve a child's performance.



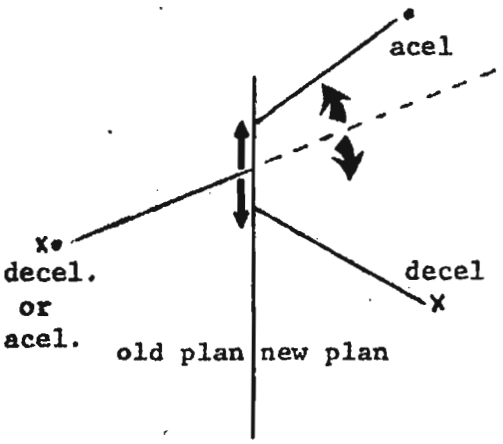
STEP-UP, PROGRESS-CHANGE-DOWN

This is the same pattern that was found in figure 26. For an acceleration project this change is desired when only a short time is available to work with the child (e.g., the end of school is only a few weeks away) -- given that the point of no effect is beyond the time you plan to use the program. If the step size is expected to bring the child all the way up to his aim, of course, a change pattern of this type would be completely acceptable. For a deceleration target a change of this type would be acceptable if the second 'celeration line is headed in the correct direction, and enough time were available to overcome the adverse effects of the initial step-up (i.e., the number of weeks left to use the program exceed the expected no-effect point).



STEP-DOWN, PROGRESS CHANGE-UP

For an acceleration project plans which typically produce this pattern should be avoided if only a short period of time is left to use the plan (i.e., the point of no effect falls after the plan must be abandoned), but if a long period of time remains to leave the child in the new program, the overall affect after the point of no effect will be good. For a deceleration project programs which produce this effect will be acceptable for periods of use before the point of no effect, but will result in poorer performance after the point of no effect.



STEP-UP, PROGRESS-CHANGE-UP
or
STEP-DOWN, PROGRESS-CHANGE-DOWN

Obviously, for an acceleration target, the step-up, progress-change-up effect is ideal. Any program which produces that type of change frequently should be selected whenever possible. The step-down, progress-change-down type of change would be the worst possible effect. Any program which produced this effect with any regularity would be avoided in acceleration projects. The reverse would be true in the case of a deceleration project.

Of course, once a child achieves his aim-rate for the specified number of days, one of two things should happen: the project should either be terminated (perhaps with continued, but intermittent practice reviews); or the child should be moved on the next level in the task hierarchy. In the latter case, the type of performance changes one wishes to see will depend upon how finely the steps in the hierarchy are sliced. If the steps are quite small, then one would expect the child to move from one level to the next on almost a daily basis. If that were the case, then hopefully there would be very little if any drop in performance from one step to the next. The net result would be frequent phase changes with essentially a flat performance line running along at or above criterion level. An example of such a project may be found in Figure 28, part A.

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Insert Figure 28 about here

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Figure 28, part A, represents a project conducted on a fifth grade boy during his remedial reading sessions. The first book read was "Twin Mystery" and the second was "Faraway Places" (basal). During the timings the child reads the same page over again day-after-day until he reaches the criterion rate of 100 words rea orally in one minute. The dotted lines indicate when the child was moved from page-to-page. When a specified number of pages have been read in this manner, then a new book is introduced. In the beginning the child is having no apparent trouble. Each day he meets criterion and each day he is given a new page to read. The performance line runs flat, just above the criterion of 100 words per minute. On the sixth page to be introduced, however, his performance drops (roughly a ÷2.00). It only takes him a day to reach criterion after the drop, but that is

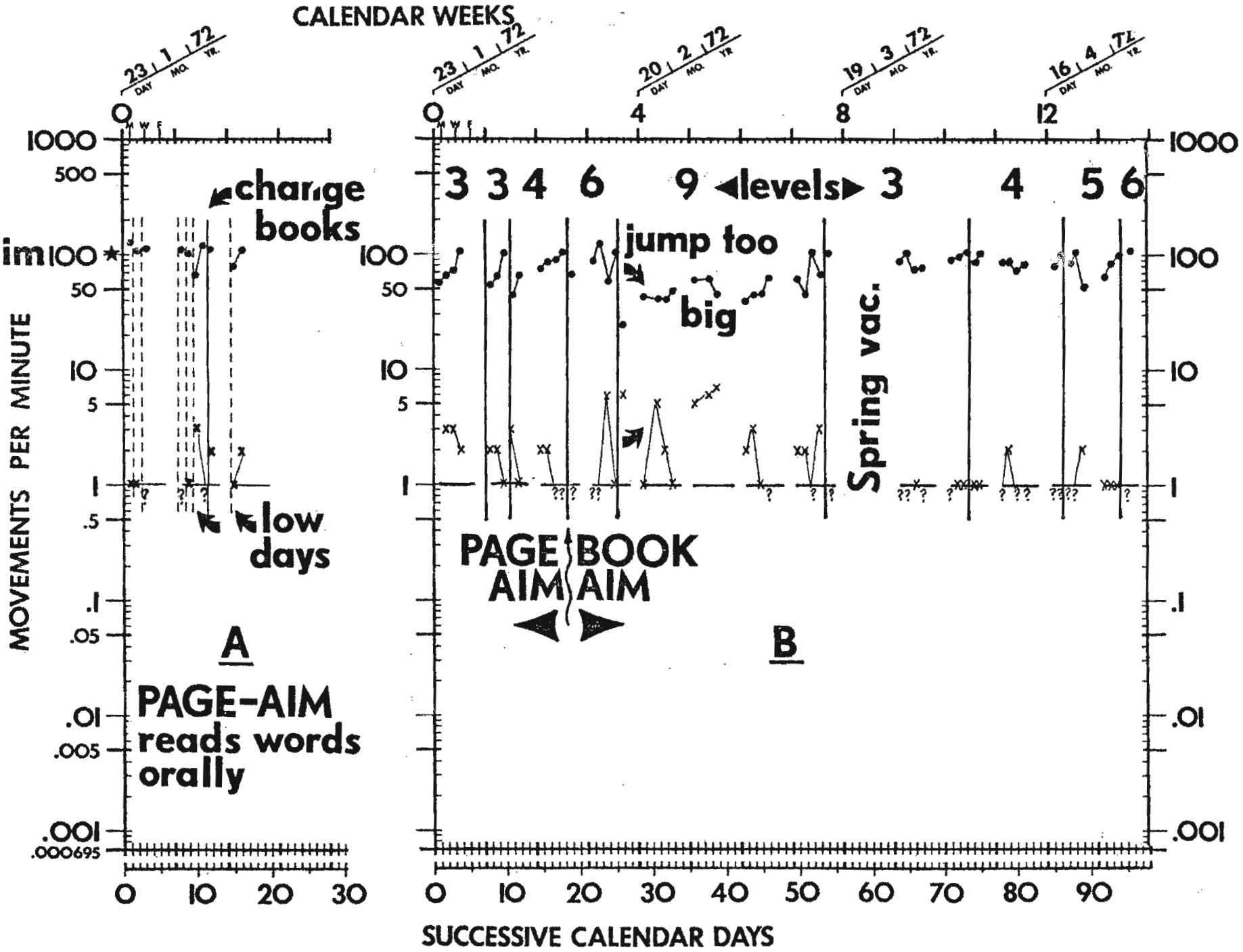

CALENDAR WEEKS
23 | 1 | 72
DAY | MO. | YR.
20 | 2 | 72
19 | 3 | 72
16 | 4 | 72
0
4
8
12
1000
500
aim
100
50
10
5
1
.5
.1
.05
.01
.005
.001
.000695
MOVEMENTS PER MINUTE
charge books
low days
3 3 4 6 9 ◄levels► 3 4 5 6
jump too big
Spring vac.
PAGE AIM
BOOK AIM
A
B
PAGE-AIM
reads words orally
0 10 20 30
0 10 20 30 40 50 60 70 80 90
SUCCESSIVE CALENDAR DAYS

FIGURE 28

twice as long as usual! A drop in performance of that size in a program like this should tell the teacher that for some reason the conditions are not the same. Perhaps the child doesn't feel well, or perhaps the teacher was not presenting the material in the same fashion. More than likely the material became unexpectedly difficult at that point. Even in the best of readers there are sometimes points where the sequencing of difficulty levels breaks down for one child or another. In the future the teacher might avoid or re-sequence the guilty page. When the next book is presented his correct rate is at criterion, but his errors are higher than before. The next change produces another drop and continued problems with error rates. It might be coincidence, but all of these subsequent problems may have stemmed from that one misplaced page. Be alert! Try and use information like this when preparing the next child's program.

The alternative to "super-finely" programmed material is a sequence of curric which takes fairly large steps with each change. That is, several new pieces of material are introduced at each new level. Each step is likely to cause some deceleration in initial performance, but if the steps are not <u>too</u> large, then the 'celeration in each phase should allow the child to master the material in a relatively short period of time. Even though the steps are larger, it is still desirable that they each represent essentially the same amount of material and that they be sequenced in a reasonable order. If perfectly designed for the particular student, each new level will produce a learning pattern exactly like the last. The starting rates will be the same and the 'celeration or time necessary to reach criterion will be the same. Figure 28, part B provides an example.

The data presented in part B were collected by the same remedial reading

teacher that conducted the project presented in part A. The child is again a fifth grader, but this time she is using the Miami Linguistic Readers. The "levels" specified along the top of the chart refer to the book number used in any given phase.

The contingencies in this project began just like those used in project "A". The same page was read day after day until the criterion was reached. Two pages in level three were tried and then a page in level four. Nice progress was made in each case, but it was taking much longer for this child to reach criterion on each page than it took with the other student. Obviously, what is "finely-sliced" for one child may not be finely-sliced at all for another. The first two phases do demonstrate, however, an almost ideal "large step" performance pattern. The starting rate for both phases are the same and the 'celerations are very close. If this pattern had continued, then we could be very sure the ultimate success or failure of the child. When moved to level 4, however, the pattern begins to break. The starting rate for this phase is a little lower (÷1.20 lower) than it was for the first two phases and the 'celeration is not as great. The teacher decided that a change in the plan was needed. She decided to drop the "read-page-over" contingency and let the child read a new page every day. She also decided that since he had met aim with the level 4 page, that she might as well try for a jump and go right on to level 6. Generally, making two changes at once is a bad idea. If the performance changes, you don't know which program change made the difference. In any event, the child performed reasonably well in level 6. The rates didn't go up quite as neatly as they had before, but after all, he's reading a different page every day. Encouraged by the success of the child with the first attempt to skip a leve

the teacher might have considered skipping another. Unfortunately, the books got mixed up and the child began reading in level 9 before the teacher knew what was happening! That's a pretty big skip and the data show it. The start rate goes way down (÷2.70) from what is was in the first few phases and the 'celeration is not nearly as great as it had been. After stumbling through the misplaced level the teacher decided to start over. With straight sequencing and a new page every day, the child progresses through levels 3, 4, 5, and 6 with essentially a flat line at or above criteria. Level 5 looks a little off (perhaps the readers are not as well sequenced there); but in general it appears as if the teacher has found a reasonable set of contingencies for this particular child.

When moving from one level of the curriculum to the next, the pattern that is "best" will always depend on the size of the steps considered and the child whose behavior you are charting. There is no "one way" to interpret the data; but in general, if you find a pattern in one phase that is acceptable to you (i.e., if he maintained that pattern throughout the year the child would move through all of the material desired), then try and arrange subsequent materials to recreate that pattern as closely as possible.

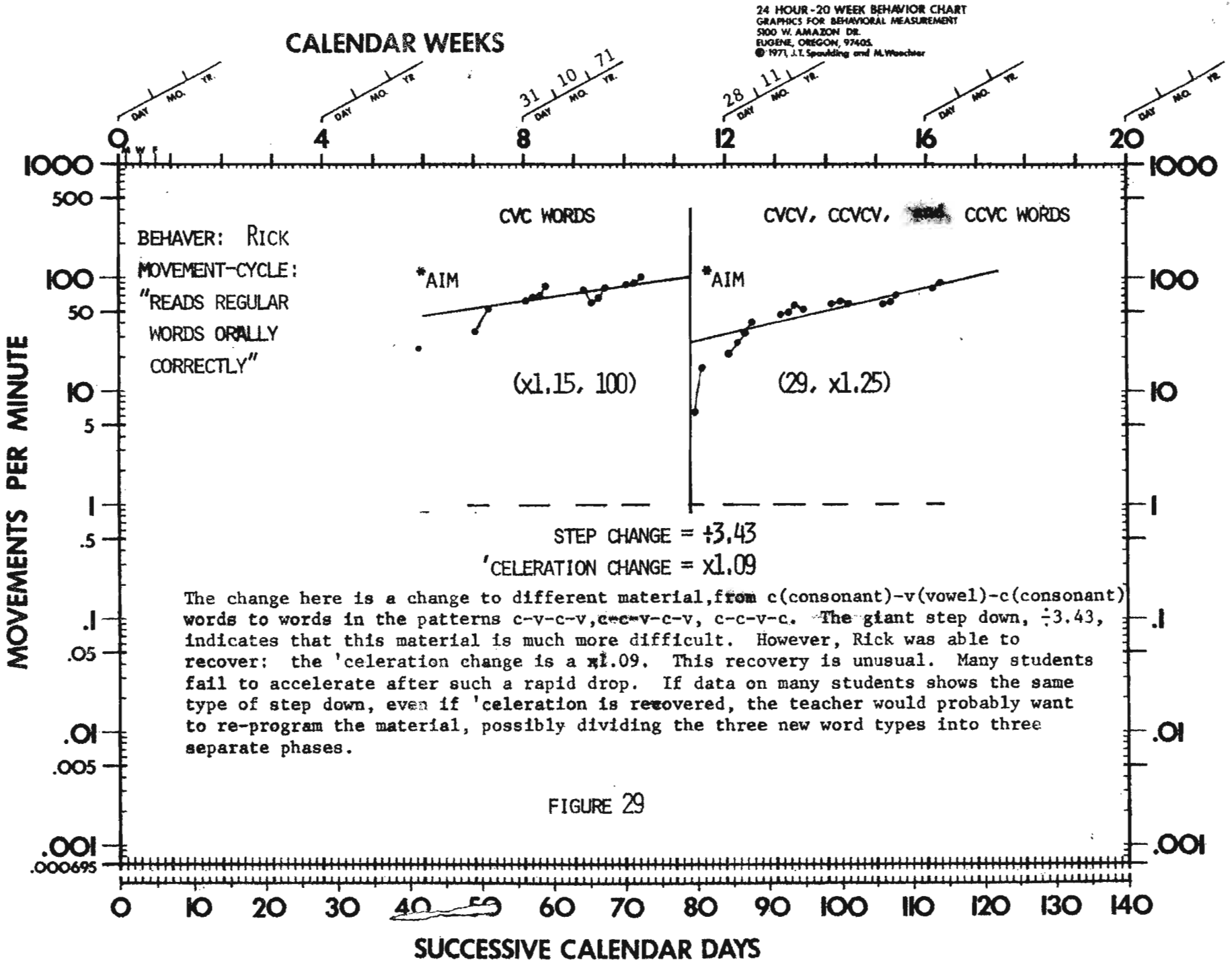
The use of step and 'celeration change statements will provide a means for program reviews and comparisons which in turn will indicate possible alternations to be made in the presentation of material, the sequencing of curriculum, effective consequences and other program variables. With that body of knowledge to draw upon the chances are improved immensely that future changes and curriculum will be effective. Figures 29 through 33 illustrate some of the programming decisions that may be aided through an analysis of the data. Figures 32 and 33 are

particularly important in that they are projects on virtually identical behaviors in two similar children, but the decisions reached in each case are dramatically different. In one case the decision was based on the charted data. In the other case the decision was made in spite of the data. As you will see, it made a very big difference in the lives of the children involved. Data only help if we look at them!

- -

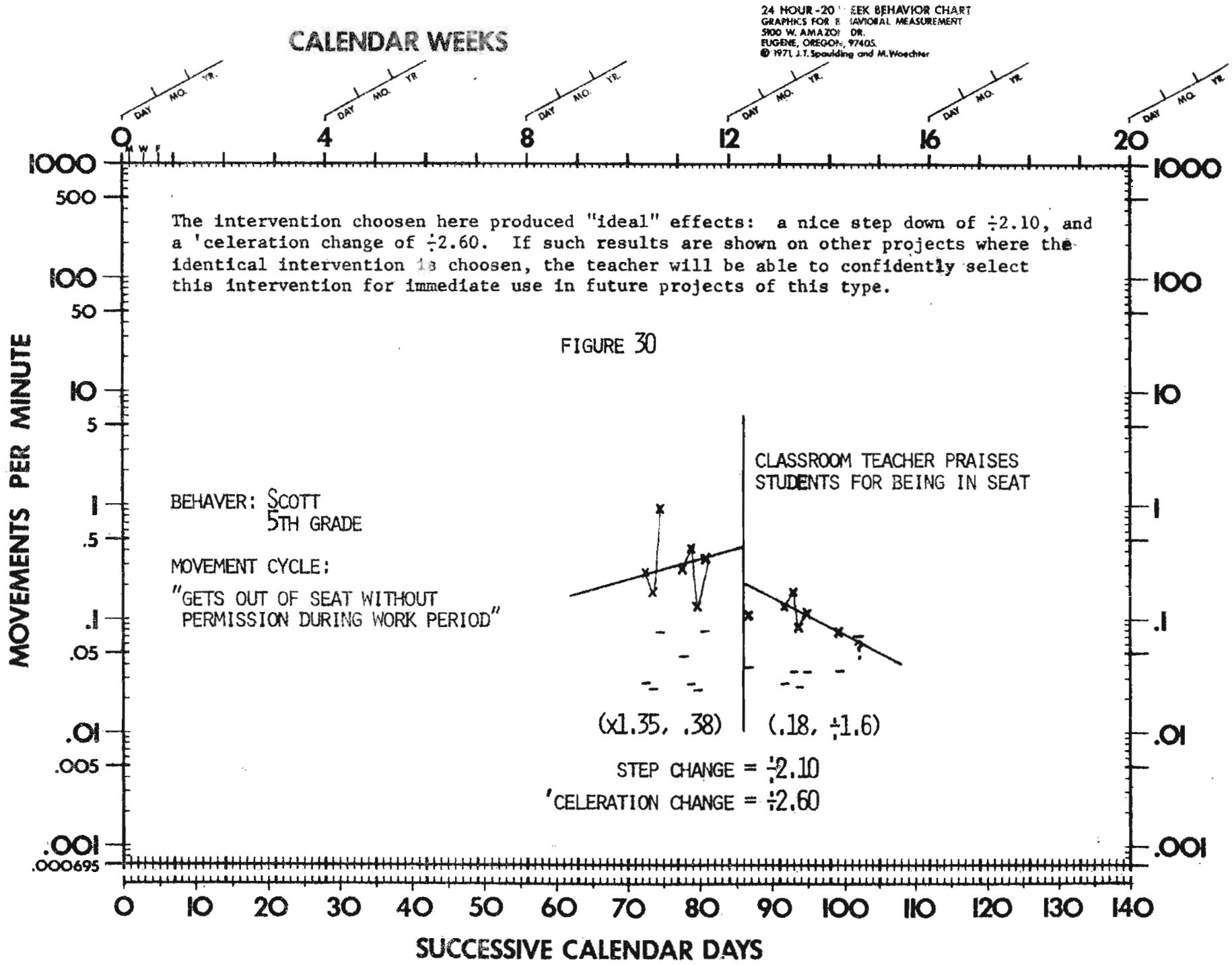
Insert Figures 29 through 33 about here

- -



The change here is a change to different material, from c(consonant)-v(vowel)-c(consonant) words to words in the patterns c-v-c-v, c-c-v-c-v, c-c-v-c. The giant step down, ÷3.43, indicates that this material is much more difficult. However, Rick was able to recover: the 'celeration change is a x1.09. This recovery is unusual. Many students fail to accelerate after such a rapid drop. If data on many students shows the same type of step down, even if 'celeration is recovered, the teacher would probably want to re-program the material, possibly dividing the three new word types into three separate phases.

FIGURE 29


24 HOUR-20 WEEK BEHAVIOR CHART
GRAPHICS FOR BEHAVIORAL MEASUREMENT
5100 W. AMAZON DR.
EUGENE, OREGON, 97405.
© 1971, J.T. Spaulding and M. Woechter
CALENDAR WEEKS
DAY MO. YR.
0 4 8 12 16 20
M W F
1000 500 100 50 10 5 1 .5 .1 .05 .01 .005 .001 .000695
MOVEMENTS PER MINUTE
The intervention choosen here produced "ideal" effects: a nice step down of ÷2.10, and a 'celeration change of ÷2.60. If such results are shown on other projects where the identical intervention is choosen, the teacher will be able to confidently select this intervention for immediate use in future projects of this type.
FIGURE 30
BEHAVER: SCOTT
5TH GRADE
MOVEMENT CYCLE:
"GETS OUT OF SEAT WITHOUT PERMISSION DURING WORK PERIOD"
CLASSROOM TEACHER PRAISES STUDENTS FOR BEING IN SEAT
(x1.35, .38)
(.18, ÷1.6)
STEP CHANGE = ÷2.10
'CELERATION CHANGE = ÷2.60
0 10 20 30 40 50 60 70 80 90 100 110 120 130 140
SUCCESSIVE CALENDAR DAYS

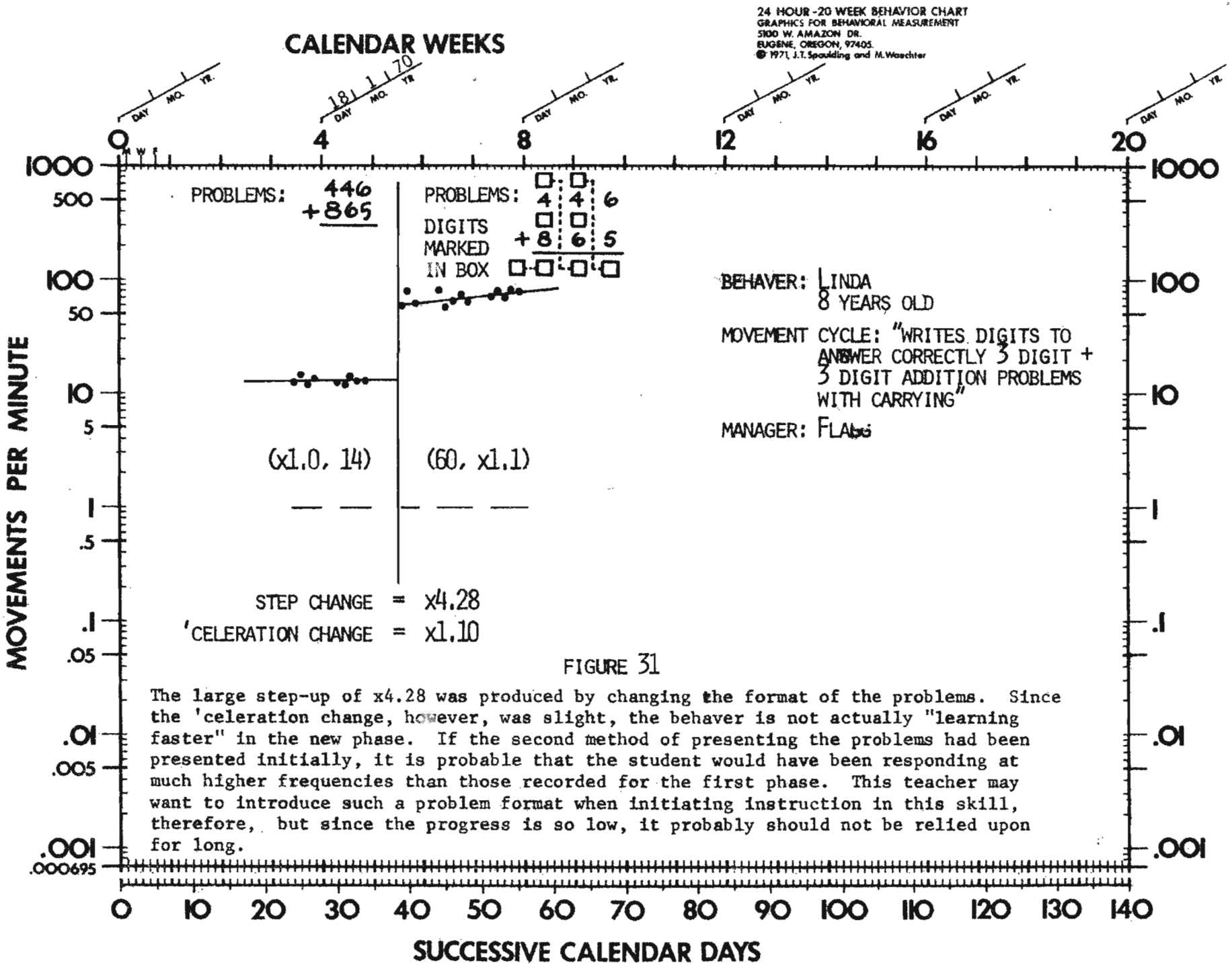


FIGURE 31

The large step-up of x4.28 was produced by changing the format of the problems. Since the 'celeration change, however, was slight, the behaver is not actually "learning faster" in the new phase. If the second method of presenting the problems had been presented initially, it is probable that the student would have been responding at much higher frequencies than those recorded for the first phase. This teacher may want to introduce such a problem format when initiating instruction in this skill, therefore, but since the progress is so low, it probably should not be relied upon for long.

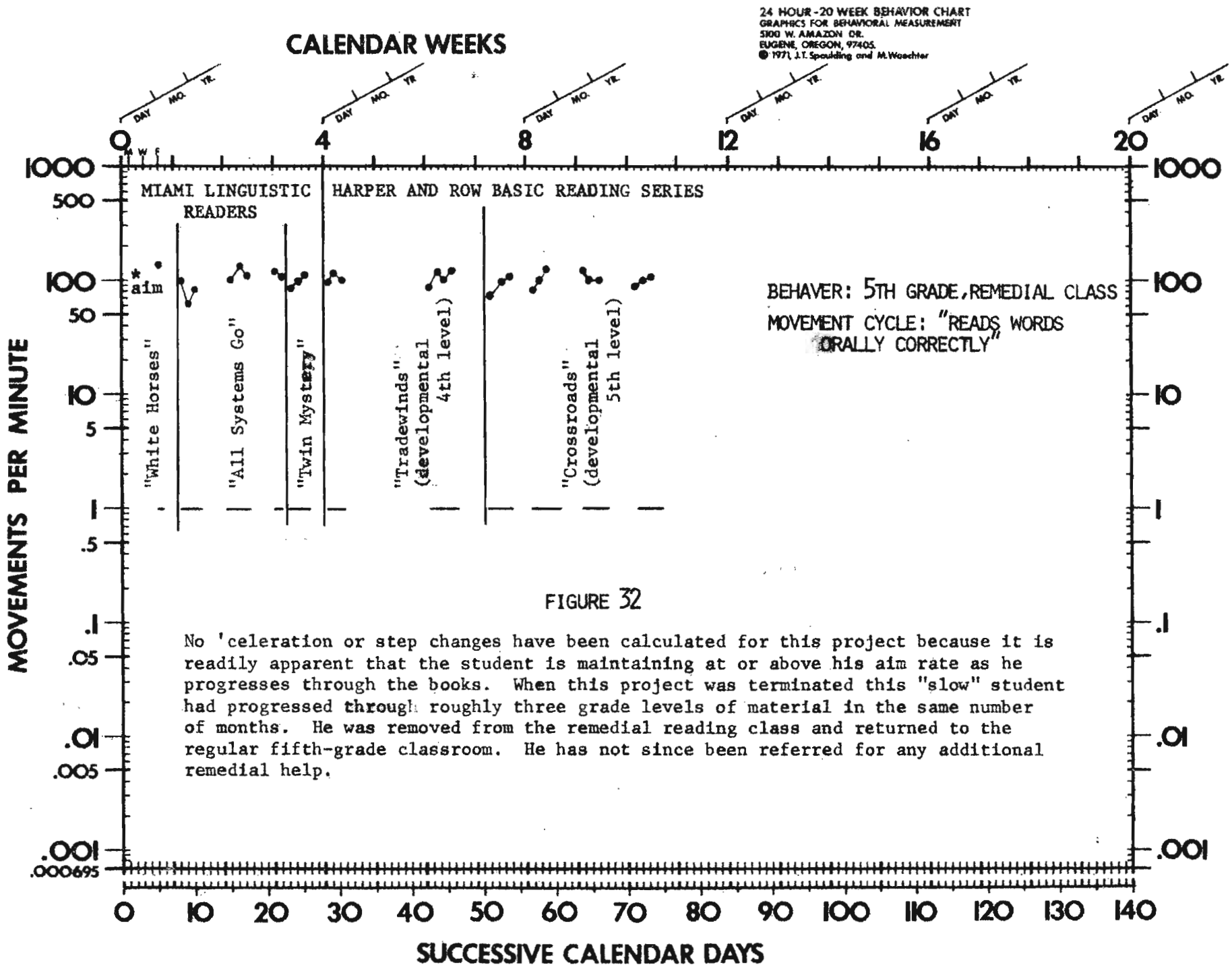


FIGURE 32

No 'celeration or step changes have been calculated for this project because it is readily apparent that the student is maintaining at or above his aim rate as he progresses through the books. When this project was terminated this "slow" student had progressed through roughly three grade levels of material in the same number of months. He was removed from the remedial reading class and returned to the regular fifth-grade classroom. He has not since been referred for any additional remedial help.

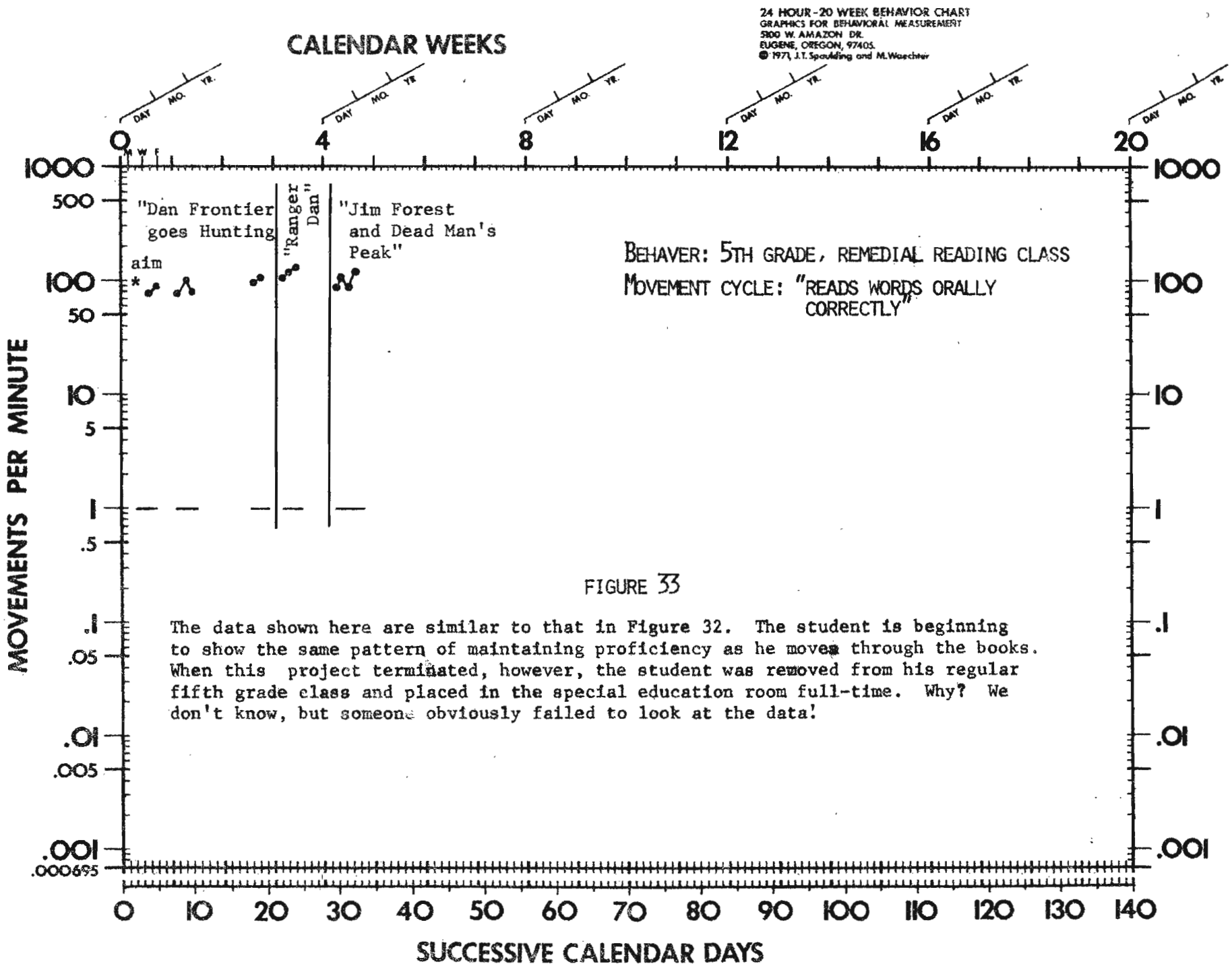


FIGURE 33

The data shown here are similar to that in Figure 32. The student is beginning to show the same pattern of maintaining proficiency as he moves through the books. When this project terminated, however, the student was removed from his regular fifth grade class and placed in the special education room full-time. Why? We don't know, but someone obviously failed to look at the data!

WHERE ARE WE GOING?

In earlier sections we discussed "aims", "criteria" and from time-to-time, "proficiences." Without these goals most of the decisions we make from data would be impossible. Only general statements of what these terms mean have really been presented, however, and only the barest hints have been mentioned as to how they are actually selected or set. Up until this point a detailed discussion of proficiencies would have been difficult. Knowledge of the data to be collected, the behavior to be examined and the means by which the charts may be analyzed were necessary. We are now ready to finally discuss where we want the child to go; but the decisions which will be covered here should really be made before any project begins.

Establishing Proficiency Rates

To be "proficient" in the colloquial sense is to be "skilled, adept and expert". Proficiency in the behavioral sense refers to those characteristics of responding (e.g., rate, accuracy, progress) which are necessary to insure the success of the behaver in some other predetermined situation. Before the specific attributes of proficiency for any behavior may be defined, therefore, one must first specify the "situation" for which the behaver must be prepared and the crite for "success" in that situation.

Ultimately the situation for which we all must be prepared is "the world". When trying to determine how fast a child should read, therefore, it would probably be most desirable to determine what the minimum reading rate must be to insure that the child will be "successful" in the world. If "successful" means being

a lawyer with a salary of at least $40,000 per year, then one could conceivably go out and measure the reading rates of all such persons. This may seem a little far fetched, but to some extent "on the job" criteria can be set. In one case, for example, a number of mentally retarded persons were trained to make beds for a rest home. When finally placed on the job the employer expressed dissatisfaction with their work. When their trainers examined the situation they found that the other workers in the home were, among other things, able to put pillow-cases on five pillows in three minutes (1.67 pillows per minute) and have the seams straight. The people they had trained could not work that rapidly. They were returned to the training situation, brought to a "pillow-case-proficiency level", returned to the job and all went well from there on. By defining the situation in which the behaver would ultimately have to perform (i.e., the rest home), the definition of success (e.g., the number of pillow cases which should be put on in one minute and how the seams should lie), the training institution was eventually able to define and produce "proficient" workers.

In the classroom it is a little more difficult to define either the "situations" in the real world, or the characteristics of "success" in those situations that have a direct relationship to the behaviors being taught. In some cases, however, it is simpler than it may appear. For example, what is proficiency in oral reading? Many teachers would respond, "the faster the better!" Really? What is the purpose in oral communication? Generally, to communicate. Oral practice also serves the purpose of letting the teacher know how well the child decodes. The fact is, however, that an encoding process is occurring too and if that behavior is to be useful in later life, proficiency levels should be set. So, what is an "expert" oral reader? A good answer might be a newscaster. Such people

must talk rapidly, but clearly. They must communicate a great deal of information without sounding "hurried" or "lacking in expression". If children could read as well as newscasters, then chances are that they would have the oral skills necessa to insure "success" with that behavior later in life. Taking a few timings on the six o'clock news will reveal that newscasters have a very consistent reading rate of around 135 to 155 words per minute. It is unlikely that a child would ever have to read (orally) faster than that. Silent reading is another matter.

Other aspects of the curriculum might be related to other real-life situations (e.g., math fact rates with black-jack dealer count rates). For the most part, however, the most convenient "situation" in which to test the adequacy of one part or step in the curriculum is the next part or step in the curriculum. Simply, if a series of behaviors is programmed in a sequence of instruction, then each step in the sequence should prepare the behaver for success in the next step of the sequence. Since the two "situations" occur in close temporal proximity it should be easy to determine if the aims set for one level of instruction actually prepare the child for success in the next. The problem lies, of course, in defining what "success" is in that next level.

There are essentially two types of behavior change which may be noted in two types of behavior, steps and 'celeration change in correct and error pinpoints. Success could be defined in terms of any one or more of these factors. For example one teacher may define success as "no errors when moved to the next step in the curriculum" (placing, perhaps a slight over-emphasis on accuracy). Another teacher might define success as "no change in 'celeration and no step when changed to the next step in the curriculum" (meaning that the change in curriculum would have to be very small, or the behaver is an extremely stable performer). In any event,

there are literally dozens of possible rules and combinations of rules which could be devised to define "success" when a new program or situation is introduced. Until a great deal more research is completed on the relationship between classroom behaviors and the post-school world, the definition of success employed will have to be to some extent arbitrary. Bearing that in mind the authors suggest the following criteria: A behaver has reached proficiency in one part of the curriculu (relative to the next step in the sequence to be taken) when his rate, accuracy, and/or 'celeration is such that when the change is made to the next level:

1) There is no significant change in rates of responding, if the curriculum is sequenced in very small segments; or,
2) The starting rate in the next section of the curriculum is no lower than the starting rate in the last section of the curriculum; the 'celeration in each phase is essentially the same as for each other phase; and the time necessary to reach criterion in each section of the curriculum is essentially the same as for each other section of the curriculum.

See table 3 and figures 27 and 28 for examples and further discussion.

These criteria are only general guidelines. If some variance exists, however, then it is desirable that there be a "counter move" by some other variable. If a child makes a step-down between sections of the curriculum that is twice as great as one would normally expect, but makes twice the 'celeration gains, then the two factors would tend to cancel each other out -- he would end up essentially where he would have if he changed according to pattern. It would be difficult to argue that the change had not been successful. Figure 34 provides an example of "give-and-take" success. The aim is set at 30 digits written correctly per minute on multiplication problems. Problem types for each phase are illustrated at the top. After the first change the performance is maintained, although the 'celeration is much less. By the first definition of success given above, this would be acceptable. After the second change there is a large step

down (÷2.27), but 'celeration improves (x1.17) over the previous phase and the child ends up with a rate above that which was set as the aim (60 instead of 30). By the second set of rules given above this phase change would also be considered successful. For this child, then, when considering this small amount of performance data, an aim of 30 would appear to be a reasonable level of proficiency (i.e., it prepares him for "successful" performances in the next phase). For better equalization of the patterns, however, the teacher might consider making the jump between the level of material in phases one and two a little larger in future programs and the jump between phases two and three a little smaller.

- - - - - - - - - - - - - - - -

Insert Figure 34 about here

- - - - - - - - - - - - - - - -

Once the definition of "success" has been established the educator may then set about the business of finding out just what proficiency <u>is</u> for a particular skill or task for most children. There are essentially two ways in which this may be done. Both, unfortunately, involve trial-and-error, time and a great deal of data collection and analysis.

The first method involves breaking a few rules. It was stated in an earlier section that program decisions should always be based on the performance of individual learners. Now the authors suggest that you break that rule. If a behavior is being taught about which very little is known regarding proficiency or "suspected" proficiency, then specify a particular number of days for its instruction, say, two weeks. If any children are actually getting worse during those two weeks, then of course they would be dealt with on an individual basis. Those children who are making <u>some</u> progress, however, are kept on schedule and

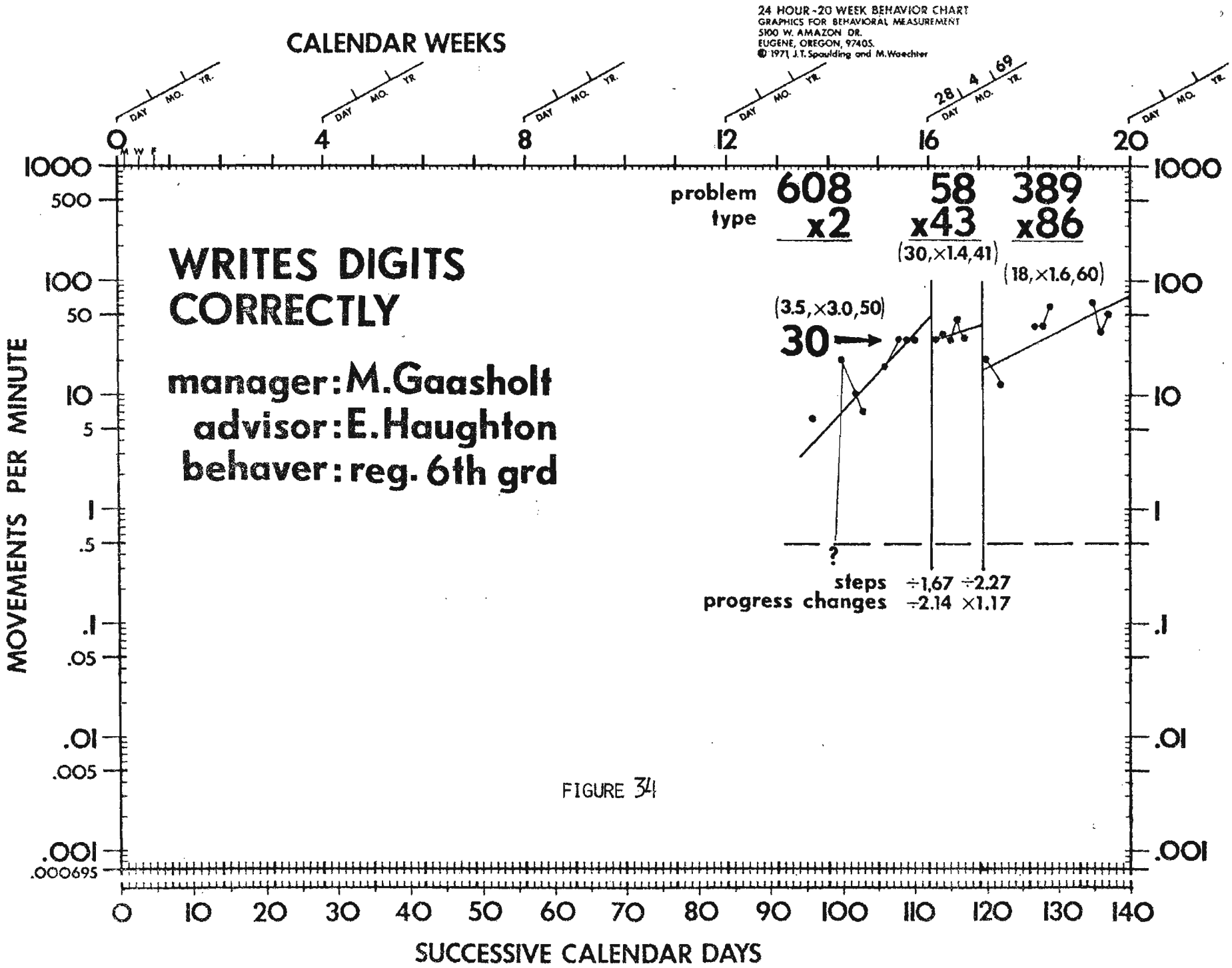

24 HOUR-20 WEEK BEHAVIOR CHART
GRAPHICS FOR BEHAVIORAL MEASUREMENT
5100 W. AMAZON DR.
EUGENE, OREGON, 97405.
© 1971 J.T. Spaulding and M. Waechter
CALENDAR WEEKS
DAY MO. YR.
28 4 69
0 4 8 12 16 20
M W F
WRITES DIGITS CORRECTLY
manager: M.Gaasholt
advisor: E.Haughton
behaver: reg. 6th grd
problem type
608 x2
58 x43
389 x86
(30,×1.4,41)
(18,×1.6,60)
(3.5,×3.0,50)
30
?
steps ÷1.67 ÷2.27
progress changes ÷2.14 ×1.17
MOVEMENTS PER MINUTE
1000 500 100 50 10 5 1 .5 .1 .05 .01 .005 .001 .000695
0 10 20 30 40 50 60 70 80 90 100 110 120 130 140
SUCCESSIVE CALENDAR DAYS

FIGURE 34

changed the moment the two weeks are up. The next step in the sequence is then taught for two weeks and a change is made again. The process is repeated until the curricular areas are all covered or school lets out.

When the data are analyzed, those children who succeeded in the second step (using the definition of "success" specified eralier) are separated from those that "failed" (i.e., failed to meet the criteria specified for success -- they may not have "failed" altogether, but did not meet the minimal standards). The data for those children are then examined to see if the first phase data for one group are different in any way from the first phase data for the other group. It may be, for example, that every child that reached a rate of responding of 50 or better succeeded in the next phase. A rate of 50, then, would be defined as proficiency and that would be the aim set for the next group of children to go through that sequence. NOTE: Although it is most common to set correct and error proficiencies equal to some absolute rate or frequency, it is possible that the data will show progress to be the most important factor in determining success in future curriculum. That is, it may be less important what the frequency of behavior is at the moment of change and more important what the 'celeration of the behaver is. Watch the data closely.

The second method for the determination of proficiency rates (i.e., rates per se or rates of progress) may really only be employed after some "guesstimate" of the proficiency rate has been made. An aim is established for all students based on what one believes to be the actual level of proficiency. Instead of changing all students at the same time (as was the case in the method described earlier), students are moved from one step in the curriculum to the next only when they reach the preset aim. If the aim turns out to be at or above the actual level of proficiency for that step, then all of the children will do well in the

next step. If, on the other hand, a number of children do not fare well when the change is made, the aim should be revised. When the aim has finally been found that insures success at the next level in the curriculum, then that "aim" may be called a "proficiency level".

In general, the application of either of the two methods mentioned above for the determination of proficiency levels requires several "cycles". The process must be repeated over and over again on different children before enough data are collected to "zero in" on the actual proficiency level sought. If more than one teacher work on the same problem and share the data they collect with one another, the time involved may be reduced considerably. Sharing will, of course, require that the teachers utilize "standard" techniques such as those which were presented in this chapter to insure that the comparisons made are meaningful and clear.

Proficiency rates are designed to insure success in new situations. Once established, they should not be changed for behavers who are younger, older, or handicapped unless there is a clearly defined physical ceiling which limits the performance of the movement cycle. If proficiencies are not enforced in a program, then the manager should be particularly watchful of the data. If the behaver does not perform "successfully" after being advanced without having attained proficiency then before other program changes are tried the behaver should probably be returned to the previous step to work toward a higher aim.

PRACTICAL CLASSROOM RESEARCH DESIGNS

"Research," to many educators, has a bad name. It brings to mind a hoard of sober-faced young graduate students decending upon the classroom and demanding virtually the same sober-faced behavior on the part of everyone concerned. Conditions are set, spontaneity is forbidden and the teacher finds herself having to "ignore" some of the children she feels need the most help. After the data have been collected and the steely-eyed young recluses have vanished, nothing is ever heard from the ivory tower again -- until the next time, that is. Somehow "research" happens in the class (or to the class), but the results and the answers to all those wonderful questions never quite get back to the class. It need not be so.

All research has to be is the very careful collection of precise information under known conditions. True, certain procedures should be followed so that the behavior changes noted in the data may be ascribed to some particular change in the environment, but those procedures do not necessarily have to disrupt the ongoing educational process of the students or present an undue burden to the teacher. Through the preceeding sections a number of strategies and procedures for the collection of precise behavioral information have been discussed. All of those procedures that were recommended have been employed by teachers in classrooms with the "normal" number of children (too many) and with the "usual" number of resources (too few). All of these procedures recommended have assisted teachers, parents and learners to become more accurate, more proficient and even more efficient in what they do. Yes, with practice and determination those procedures can actually reduce the work involved in teaching and learning. In short, those procedures can be both practical and provide the level of precision needed to conduct "research."

It will be the purpose of this brief section to outline a few more strategies which will assist the teacher in that endeavor.

Rule Number One: Don't change more than one thing at a time. If a teacher wants to see if one type of math fact sheet produces higher rates of responding, then she should try it. If the rates go up when the fact sheet is used, then there's some evidence to support its value. When trying to find out what the effect of the sheet is, however, don't change the length of time the student has to work on his math. If both changes in the program are made at the same time, then it would be impossible to determine which one then caused the increase in rates of responding. If one program change is made, then the effects are easily determined. If two or more program changes are made at once, then its anybody's guess.

Rule Number Two: Try it more than once. Even though care is taken to change only one part of a student's program at a time, there are many changes which occur in the life of a child that educators know nothing about. Just because a child's rate of oral reading goes up when a new book is introduced, it doesn't mean that the book had to cause that change. Perhaps it stopped raining. Perhaps the local little league just won its first game. Who knows, perhaps the change in the book did help, but any change would have helped after six weeks with Dick and Jane! In order to be sure that the effect noticed was due to the planned change, the same change has to be tried more than once.

Some changes can be tried on the same child over and over again. If the real difference between reading books is just the size of type, then the teacher could have the child read from one book on Monday, a different book on Tuesday, back to the first book on Wednesday, and so on, until enough data have been

collected to show any differences in rate which the two books might produce. If the rates with one book are noticeably higher than the rates with the other book, then the teacher may be somewhat confident as to the effects produced by type size.

This method, the alternation of materials or techniques used for the same behavior and on the same child, is called the "ABA..." design. The first "A" represents the time when the first procedure is tried. The first "B" represents the time when the second procedure is tried. Then, another "A" is noted to indicate that technique "A" is being tried once more. The number of alternations could and probably should go on for several additional cycles. An ABABAB design would be one where each technique was tried three times. An ABABA design would be one where the "A" condition is tried three times and the "B" condition only twice. With greater numbers of repetitions, greater confidence in the results can be gained. There will probably be a limit to the amount of learning that can take place, or the amount of time that can be afforded, however, before one technique must be selected and employed "full time".

Some behaviors might not be "reversible". If a teacher uses one method to teach a child to identify geometric shapes, then she can't very well try a different method on the same child the next week -- that child already knows his geometric shapes. One can't really expect a child to "forget" just so a little research can be performed. If the effects of learning are likely to prohibit the use of the same child and the same behavior over again, then one of two strategies will have to be employed.

First, the same child could be used, but with a different behavior. Perhaps instead of geometric shapes the alternative teaching method could be employed with colors. If the teaching method is not "tied" to one curricular area, then

this is a likely solution to the problem of "irreversible learning." Some care must be taken, however. The two behaviors selected must be very similar to each other. If "points to shapes" was counted when teaching the geometric shapes, then "points to colors" should be counted when teaching colors. Also, the teacher should be reasonably confident that the child is equally "ignorant" with respect to colors and geometric shapes, that there is no difference in his physical ability to discriminate one over the other and that he has no particular "preference" for one task or the other (aside from the teaching method to be tested).

Finally, there is the element of time. "Time" can sometimes account for behavior change. Not because of time itself, but what it represents -- the approach of Christmas, an impending dentist appointment, or the 24 hour "bug." When testing to see if one particular teaching method will work, therefore, it should be tried at different times. That does not mean that the child isn't receiving <u>any</u> instruction for both behaviors, just that the particular teaching method to be tested isn't applied at the same time to both behaviors. For example, programs are started for both geometric shapes and colors at the same time. In both cases, the "usual" lectures are given and tests administered. After collecting a few days data, the "new" system is introduced with the lectures on geometric shapes, but <u>not</u> with lectures on colors. Data collection is continued for a few more days, and <u>then</u> the new system is introduced with the colors as well. If the behavior rates went up when the new system was added to the geometric shapes, there is some evidence that the new technique works. If the behavior rates <u>also</u> went up in the colors program, though, even before the new system was applied to that part of the curriculum, then maybe the

change noted was due to something else that just "happened" to occur at the same time. On the other hand, if no change is noted in the rates for the color program when the new system was applied to the geometric shapes, then the change in the geometric shapes data was probably not due to the simple passage of time. The next question, then, is whether or not the new system will produce a change in performance rates on colors when it is tried. If not, then perhaps the new system was not responsible for the change in geometric shapes after all. If a change is noted in the rates with colors, however, and that change occurred only after the new system is applied to it, then there is some fairly strong evidence that the new system can really effect behavior. The teacher is in a position to say that the new procedure produced a change in the rates of the programs to which they were applied and that the change was produced in more than one behavior and at more than one point in time.

The alternative to using two behaviors and the same child is the use of two or more children and the same behavior. Essentially the same procedures are employed, but now the procedure is applied to different children at different times with all of the children working on the same behavior. This approach is most reasonable, of course, when the teaching methods or materials to be tested apply to only one type of behavior.

These two techniques are both examples of a multiple baseline design. A "baseline" is a time at the beginning of a study when the present rates of responding and progress of the subject(s) are assessed before the new program change is tried. The purpose of the baseline or "before phase", as it is sometimes called, is to establish some data against which the effects of the new program may be compared. If the child is already accelerating rapidly,

then even greater acceleration or progress would have to be produced by the new program before it could be considered useful or effective.

The term "multiple baseline" comes from the fact that more than one baseline is established for either several behaviors or for several students. Some baselines are of slightly different durations than other baselines, so that the effects of "time" can be ruled out in the final analysis.

Rule Number Three: Give it a good chance . . . Whether only one student is studied or many, the teacher should be sure to give each new program a chance to work and indeed, the student should even be given time to show progress in the baseline phase. For example, frequently when a teacher starts to collect data on a student, that alone will start to increase or decrease his rate. Eventually the effects of data collection per se should wear off (if nothing else in particular is going on to support the progress), but it may take some time. If the teacher makes a change in the program before the initial effects of data collection have worn off, then any effect noted after that change may in part still be due to the data collection and not necessarily to the program change alone. Analyses of effect, therefore, are not likely to be entirely accurate.

In the first phase of the project (the baseline or before phase) the teacher should watch the data carefully. In most cases there will be a "high initial acceleration" where the student makes very rapid progress. Usually that acceleration starts to wear off after about three or four days and the daily progress after that point is much slower. If that happens, then collect about four or five data points after the slowing down is noted before introducing the change. If, on the other hand, the student does not appear to change in

daily progress very much, then simply collect somewhere between seven and nine data points total before making a change. That number of data points will usually allow a reasonably accurate line-of-progress to be drawn, against which the effect of the change may be assessed.

After a change is introduced in the program, allow the same seven to nine days for it to take effect. If the rate of progress is still changing after that time, then let it go a little longer. In most cases, however, it will not be particularly advantageous to let the phase run longer than eleven or thirteen rated days before another change is made. In any event, let the data be your final guide. If the results appear quite apparent, then as few as five data points may be all that are needed to be reasonably confident of program effect. If the change is more subtle, or the data are "bouncing" all over the chart, then let the phase run longer. As with data in general, greater confidence may be gained through the use of many students and many behaviors. Check a program on as many students and behaviors as possible.

The techniques, rules and guidelines suggested above are far from complete. They will not insure that the most sophisticated research possible will emanate from the classroom. They are, however, practical approaches to the problem of answering questions with some degree of confidence. Since the questions investigated are posed and answered by the teacher, they will in any case relate to that class. If care is applied, then the answers found will also be of benefit to others.

A word of caution. Education is for children, not for research. If during any research conducted in the classroom, behaviors that are acceleration targets are left to "deteriorate" into deceleration, or to maintain at lower than desirabl

frequencies just for the sake of research, it is the child who must pay. Ethically studies which result in the non-facilitation of the education for any individual student cannot be condoned except in "extreme" cases or with "non-essential behaviors". Teachers cannot justify such projects on the basis of research and changes should be made immediately in those programs. The research after all, is done to help educators help children. Let's not let that research interefere with each child's right to the best possible education.

WHAT NEXT?

As a basic measurement and decision-making tool, Precision Teaching offers the educator a great deal. Primarily, though, it is a way in which we can be sure of "listening to the children". If they do not perform in the manner that we expect, the charts will tell us so. We cannot find ourselves at the end of the year looking at 30 illiterate children and saying, "What happened?" The data will tell us what happened; and if we listen to the data often enough, we are likely to catch those problems before they really get out of hand. Precision Teaching is not the whole answer, but it's a good way to start looking for one. So remember:

(1) PINPOINT the directly observable behaviors that concern you. Follow the rules for a movement cycle whenever you can.

(2) SET YOUR AIM in clearly definable terms. It's hard to get where you're going if you don't know where that is.

(3) COUNT the number of times the pinpointed behavior occurs. Try and keep the situations in which you count as nearly alike as possible from day-to-day and standardize the counts by the calculation rates or frequencies.

(4) CHART the data daily, or have the child do it. We must be able to see the changes as they occur. Using the standard chart and charting conventions will help you in getting the most from the pictured data.

(5) LOOK at the chart regularly, daily if possible. Data that's never seen doesn't do anyone any good.

(6) DECIDE whether the present plan should be continued or changed; but use the data when you do. Select appropriate decision tools ahead of time (e.g., the minimum 'celeration) and avoid "I think" and "I feel" statements as much as you can. If you don't have the necessary data,

then do the best you can, but start collecting the necessary data for the next decision.

(7) CHANGE the program if necessary. Change the program if the child doesn't look like he's going to make his aim (but change before he fails), or change the program after the child reaches the aim (but before he's wasted two or three weeks bouncing around above the aim waiting for the rest of the class).

(8) TRY-TRY-TRY AGAIN if the first change doesn't bring the expected results Children are not all the same. Just because the method we try has worke in all of the previous cases, don't assume that it will work this time.

That's all there is to it. It's the lives of children we are talking about; and as Lindsley once put it, we have to "care enough to chart." So where do we go next? Out to find a child. More can be learned from a child and a chart than all the books in the world.