The Fixed-Interval Scallop in Human Affairs

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"Fixed-interval scalloping" is used to describe certain everyday patterns of behavior in textbooks and other educational communications. This is a misleading use of the term. It implies that the behavior is accounted for by the schedule, when, in fact, many other variables are operating. This paper reviews eleven such variables and the research evidence on them. These variables provide a more adequate account of complex behavior and point up areas of limited knowledge requiring further research in both laboratory and applied settings. Extrapolating from basic research on human fixed-performance suggests that there are phenomena of mutual interest to both basic and applied behavior analysts.

"In a fixed-interval schedule of reinforcement (FI) the first response after a designated interval of time is followed by a reinforcing stimulus" (Ferster & Skinner, 1957). Although only one response is required, animal laboratory studies of this schedule have revealed a steady state pattern in which there is a period of no responding immediately after reinforcement, termed the post-reinforcement pause, followed by a period in which the rate of responding positively accelerates up to the delivery of the next reinforcer. A cumulative record of this pattern is termed a "fixed-interval scallop."

Applied behavior analysts frequently refer to a flurry of activity preceding a regularly scheduled reinforcer as a fixed-interval scallop. This is done in common parlance as well as in more scholarly presentations. Here are a few typical examples:

"For example, you receive a paycheck for going to the payroll window only on the 1st and 15th of every month . . . a post-reinforcement pause is frequently observed on an FI schedule. That is, it is unlikely that you will go to the payroll window on the 16th of the month. An effect called scalloping also is frequently seen with behavior maintained by FI schedules. That is, as the predetermined interval draws close, the rate of the behavior begins to increase again. Nearly broke on the 29th, you go to the payroll window for an advance" (Lutzker & Martin, 1981).

"An excellent example of an FI response pattern in everyday experience is looking to see whether one's mail has arrived. For most individuals, mail delivery is once a day with (fairly) fixed periods of

time between deliveries. The response (looking for mail in the mail box) is reinforced (finding mail) daily. Immediately after reinforcement there is no longer a response. One does not resume looking for mail again until the interval is almost complete, the next day. At that point, looking for mail increases until reinforcement is obtained" (Kazdin, 1981).

"The final week is spent in a frenzy of long hours in the library and worry about the production. You can see now in the hypothetical cumulative graph that the student's hourly work behavior takes the form of the fixed-interval scallop which we discussed earlier. There is in the beginning a long initial pause for work not done at all which is followed by small but increasing amounts of behavior in following weeks until at the end of the interval, when the deadline is almost upon him, the student spends prodigious hours trying to make his performance meet the requirement" (Whaley & Malott, 1971).

The model provided by behavior analysts is followed by writers of general psychology textbooks. Of 130 introductory psychology texts published in the last decade which I examined, similar examples occur in over 100 of them. What is wrong with this practice? First, the examples are anecdotal rather than based on data. Secondly, the authors ignore research data that do exist on human FI performance. Finally, the analyses are misleading because they give the illusion of having accounted for the behavior when, at best, the account is incomplete. Many factors in addition to the schedule may be operating.

Some authors do recognize this difficulty. For example, Whaley and Malott (1971) note "Of course there is a great deal of difference in the requirements of the true fixed-interval schedule and the schedule of term paper deadlines." Sulzer-Azaroff and Meyer (1977)

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acknowledge the influence of interval size and schedule history on FI performance.

Many authors refer to observations of the scalloping phenomenon outside the laboratory, the most widely cited being that of Weisberg and Waldrop (1972) on the passage of bills by the U.S. Congress and that of Mawhinney, Bostow, Laws, Blumenfeld and Hopkins (1971) on the study behavior of students as a function of test schedules. These studies, like the more anecdotal examples, contain many more variables than the periodic recurrence of the availability of a response consequence. In most instances, a calendar or clock is available to assist temporal discrimination. Explicit instructions about the temporal requirements may also be given. A deadline implies a time limit after which further responding is ineffective (i.e., a limited hold). The response requirement, rather than a single effort, may be a sequence of responses analogous to a conjunctive ratio or chain schedules. The person is faced with competing contingencies, requiring other responses on other schedules. He/she most certainly has an extensive history of responding on time-based schedules. There are experimental data on the operation of such factors, though by no means is the picture complete. Nevertheless, a more adequate analysis can be provided by taking into account what is known, rather than by oversimplifying.

The reader should remember that experimental laboratory analysis restricts many classes of variables so that the operation of a few may be systematically observed. Extrapolating from the laboratory to other situations is a risky business in that the presence of many more variables and their interactions are likely to obscure the relationships observed under controlled conditions. Such speculation is widely criticized (e.g., Chomsky, 1959), yet it has only been by expanding behavioral concepts such as discriminative stimulus and reinforcement beyond the realm of lighted discs and bird-seed (e.g., Skinner, 1953) that the technology of behavior has developed. In a sense, basic behavior analysis is like subatomic physics; no one directly sees

gamma-rays in a glass of water, and no one directly sees a fixed-interval schedule at Friday's pay-window, yet their influence may be detected and may be important.

The format of the paper will be to list each variable, to describe the laboratory findings on human FI behavior controlled by that variable, and then to speculate on how that variable influences behavior outside the laboratory.

Laboratory studies of human FI performance have seldom replicated the classic animal scallop pattern, though it is not the purpose of this paper to explore differences between animal and human laboratory behavior per se (c.f., Lowe, 1979; Lowe, Harzem & Bagshaw, 1978; Matthews, Shimoff, Catania & Sagvolden, 1977). Human responding on FI schedules in the laboratory has taken the form of high rates with no post-reinforcement pause, pausing for the entire interval with a single response at the end, a post-reinforcement pause abruptly shifting to a high rate (pause-and-run), as well as the scallop pattern. Which pattern and rate occurs is partly determined by the following variables.

Variables Influencing Human

Fixed-Interval Performance

1. Instructions. Skinner (1969) noted that instructions about contingencies may affect behavior differently than the contingencies themselves. Laboratory research has shown that experimenter-given instructions about the reinforcement contingency exert a strong effect on FI performance. Lippman and Meyer (1967) obtained low-rate temporally discriminated performance when they instructed their subjects that points were available after certain amounts of time, whereas instructions that points were available for a certain number of responses produced high constant FI rates. Kaufman, Baron and Kopp (1966) instructed subjects that points were available according to a FI or a VR (variable ratio) schedule, whereas they were really programmed on a VI (variable interval) schedule. Performance matched the instructions rather than the contingencies. They even found that instructed sub-

jects responded throughout a 3-hr extinction period. Baron, Kaufman and Stauber (1969) found that instructing subjects as to the periodicity of reinforcer availability resulted in response rates directly related to the FI duration in a multiple FI task, whereas non-instructed subjects responded at constant rates regardless of the FI value.

Galizio (1979) studied the effects of accurate and inaccurate instructions on multiple avoidance schedules of FI point-loss (see item #11). Accurate instructions served as discriminative stimuli and reinforcers and generated good schedule control of response rate. Inaccurate instructions resulting in point-loss generated indiscriminate high-rate responding, while inaccurate instructions resulting in no point-loss maintained control over response rate. Matthews, Shimoff, Catania, and Sagvolden (1977) proposed that the experimenter demonstration of the response-reinforcer contingency, rather than a shaping procedure, is analogous to an instruction and contributes to high constant FI rates. However, other researchers (e.g., Duvinsky & Poppen, 1982; Weiner, 1969) have obtained both high and low FI rates using a demonstration procedure.

Instructions about periodic consequences such as class times, due dates, and delivery schedules are quite common in non-laboratory environments. When instructions concur with the contingencies, they control accurately-timed minimal responding (one response at the end of the interval) which is much different than a "scallop." A class lecturer who always starts precisely at the stated time will have students who show up punctually. Accurate instructions are reinforcing; people seek out instructions as to when events are scheduled, such as flight departures and TV show times. When instructions are inaccurate there may be several outcomes. Behavior continues to conform to the instructions as long as there is some pay-off for doing so, though some control may be lost. A professor may never arrive at the scheduled time but students generally conform to the instructed schedule because he arrives

"sooner or later." People also follow instructions because they are socially reinforced for instruction-following, even though the outcome of behavior itself is not reinforcing. Some students may "go through the motions," showing up for classes time after time, because of parental control rather than educational reinforcing consequences. Finally, when inaccurate instructions lead to extinction, cost, or other aversive consequences in the absence of additional contingencies, instructional control will be lost; behavior will come under the control of the prevailing contingencies. Students may stop attending lectures when all the material on the tests is from the textbook.

2. Self-instructions. In addition to experimenter instructions, subjects often generate verbal descriptions of the contingencies which may serve as self-instructions. Skinner (1969) noted that a person's verbal formulation of a contingency may serve as controlling stimulus for his/her behavior. Leander, Lippman and Meyer (1968) and Lippman and Meyer (1967) found that subjects' performance on FI corresponded to their verbal description of the contingencies; high rate subjects described ratio strategies while low rate subjects described interval strategies. Duvinsky and Poppen (1982) similarly obtained good correspondence between subjects' performance and their verbal statements of the contingencies on FI and conjunctive FI-FR schedules (see item #7). Accurate contingency statements and low-rate performance on FI was predictive of accurate contingency statements and optimal performance when the schedule was changed to a conjunctive requirement. Harzem, Lowe and Bagshaw (1978), in a series of studies comparing FI performance with and without an observing response (item #5) also found close correspondence of subjects' response rate and pattern with their verbal description of the contingencies. Such verbal descriptions may result in the development of mediation strategies which facilitate temporal discrimination. Most researchers who have bothered to ask have been told by their subjects that they often silently count or recite to pass

the time between responses on FI and DRL schedules (Bullock, 1960; Harzem, Lowe, & Bagshaw, 1978; Laties & Weiss, 1960, 1962, 1963; Lowe, Harzem, & Bagshaw, 1978; Poppen, 1972). These subject-generated descriptions and strategies may well serve as instructions and function similarly to external instructions (Lowe, 1979). Because of their covert nature, such events are difficult to experimentally verify or manipulate. Procedures which can be presumed to interfere with them, such as concurrent tasks, also disrupt FI performance (Laties & Weiss, 1963). Recent research indicates that FI performance by infants is more similar to other, nonverbal species than to older, verbal humans, suggesting the operation of verbal mediators (Lowe, Beasty, & Bentall, in press).

It is very common for people to construct their own verbal cues concerning periodically recurring events. A child may "count the days" until Christmas or summer vacation. We "remind" ourselves to take out the trash on Thursday or pick up the dry-cleaning on Monday. Like external instructions, rules that we figure out for ourselves may be inaccurate. It may not be necessary to arrive a half-hour early at a performance to get a good seat or an hour late at a party to be fashionable. More serious discrepancies between self-generated rules and external contingencies have been suggested as the basis for much maladaptive behavior (Ellis, 1962).

3. *Schedule history.* Laboratory studies (Weiner, 1964; 1969) of adults performing a button-pressing task for points have shown that experience with a differential-reinforcement-of-low-rate (DRL) schedule generates a response pattern of pausing for the duration of the interval and then making a single response on subsequent FI schedules. This pattern occurs even when the interval length and response rate on the FI differs from the previous DRL, so it is not simply a matter of the person not responding to the changed contingencies. Experience with FR schedules results in high rate constant responding on subsequent FI schedules, but the influence of the DRL experience persists even if the person has an inter-

polated period of FR schedules before being exposed to FI. Further research (Poppen, 1982) has shown that history influences performance on complex schedules with a FI component. Not only FI behavior, but patterns of interaction between component schedules, persist when contingencies change, resulting in less than maximal reinforcement.

These studies demonstrate the importance of prior learning on present behavior of humans. The persistence of behavior in the face of changed contingencies, what Weiner (1970) called "behavioral inertia," seems to occur as long as there is some minimal amount of reinforcement which is not directly a function of response rate (i.e., DRL patterns do not persist when the schedule is changed to FR and vice versa).

The mechanism for history effects may be the variable described previously, self-generated rules. Conversely, the reason for one's "crazy ideas" lie in one's reinforcement history. A person may develop a verbal statement of the contingencies or a response strategy which continues to control behavior when the contingencies change (Duvinsky & Poppen, 1982; Poppen, 1982). A history of waiting until the last minute to complete a project may generate statements such as, "I work better under pressure," and thus perpetuate procrastination. On the other hand, a person with a history of recognition for superior performance may tell him/herself, "I have to do my work perfectly," and engage in high rate work behavior while ignoring concurrent family responsibilities.

4. *Time-correlated stimuli.* Baron and Galizio (1976) showed that adding a series of lights which were discriminative for successive portions of the FI increased the efficiency of performance such that only one response at the conclusion of the interval typically occurred. Previously, Azrin (1958) and Long (1962) had shown that a stimulus correlated with the last part of an FI restricts responding to that portion of the interval.

Clocks and calendars are ubiquitous in human society, from the angle of the sun from the horizon to small mechanisms

worn on the wrist. Such devices tell us there is still plenty of time to get a task done, promoting post-reinforcement pauses and end-of-the-interval runs.

5. Observing response. The occurrence of time-correlated stimuli may be contingent on a response. Thus a two-response situation is described: one response produces the temporal stimulus, termed an observing response, and a second response results in reinforcer delivery, sometimes termed a consummatory response, and the start of another cycle (e.g., Holland, 1958). The stimulus may successively change as the interval progresses, or it may be a discrete stimulus which occurs when reinforcement is available. In a comparison of the discrete vs. successive stimulus procedure, Lowe, Harzem, and Bagshaw (1978) found that observing responses with a discrete stimulus were emitted with a pause-and-run pattern but that an accelerated (scalloped) pattern emerged with a continuously changing stimulus. They attribute this difference to the fact that subjects in the first condition reported counting to themselves during the post-reinforcement pause (see item #2) whereas subjects in the successive stimulus conditions did not report counting but relied on the external stimulus. It has been argued (Mathews et al., 1977) that the observing procedure should sustain post-reinforcement pausing due to the interruptive effect of the consummatory response on the observing response. However, high constant responding as well as low rates have been obtained with the observing procedure (Baron & Galizio, 1976; Blair, 1958).

Observing responses are prototypes of many naturally occurring situations in which one response results in temporal information which is discriminative for reinforcement of a second response. Examples are looking at a calendar, asking someone for the time, or turning on the radio in order to determine the time to engage in some other reinforcing behavior. The general effect of time-correlated stimuli, whether freely available or contingent upon an observing response, is to make the reinforced response occur at the minimal rate effec-

tive for reinforcement (i.e., once at the end of the interval). Thus by looking at a watch we are able to arrive on time for an appointment. The observing responses themselves may be distributed in many forms depending on other variables.

6. Concurrent schedules. It is not possible to develop an environment, even in the laboratory, in which only one set of response-reinforcer relations exists. As Catania (1966) notes, the single operant is a special case. What a person or animal does in a situation depends to a great extent on what else there is to do. Poppen (1972; 1982) demonstrated that when a concurrent FR schedule is available in which one or more ratios can be completed in the FI period, people spend their time in the FR component, responding on FI only at the end of the interval.

The relevance of these findings is that a person with many tasks to carry out, particularly those which pay off on a ratio basis, will perform those tasks in preference to responding on the FI. The student who waits to study until the night before the exam does so in part because he/she has concurrent responses to make: writing papers, eating, and talking to friends.

When no specific concurrent task is designated, people (and other animals) often engage in adjunctive behavior (Staddon, 1977) which apparently helps them "pass the time" until a reinforced response is possible. People may respond continuously throughout the interval even though they can verbally describe the contingency (Duvinsky & Poppen, 1982; Harzem et al., 1978). Adjunctive behavior is particularly likely on a DRL schedule, which is similar to the FI except that responses which occur before the interval has elapsed have the consequence of starting the interval over again. During the DRL interval people may systematically press levers which have no direct consequences (Bruner & Revusky, 1961). On a concurrent FI-DRL, people may respond continuously on the FI component while waiting for the DRL period to elapse (Poppen, 1972, 1982). Such behavior may assist in discriminating the duration of the DRL interval when no other time-correlated stimuli are present,

though this possibility has not been adequately researched. Non-laboratory analogs of DRL situations are not readily apparent, though adjunctive behavior may be observed in waiting rooms where reinforcer-related responses, such as asking if the bus has arrived or the doctor is available, have been thoroughly extinguished. In such situations, tapping, pacing, or magazine page-flipping are common.

7. Conjunctive schedules. If a certain number of responses need to be completed in addition to the one at the conclusion of the interval, it is termed a conjunctive FI-FR schedule (Ferster & Skinner, 1957). The distribution of responses throughout the available time takes many forms. Duvinsky and Poppen (1982) found that when the ratio requirement was small and could be easily completed within the interval, people responded in a variety of fashions, completing the ratio early, responding steadily through the interval, or waiting until the end. As the ratio requirement increased, subjects were more likely to respond constantly throughout the interval. People also tended to optimize reinforcement, that is, to make only the required number of responses within each interval.

Outside the laboratory, it is often the case that many responses are required within a certain time period. For example, writing a term-paper requires many words or pages to be completed by the end of the semester; cooking requires many steps to be completed by meal time. The Duvinsky and Poppen (1982) study suggests that the larger the task requirement, the more likely people will be to work steadily at it throughout the time available. When more than enough time is available, performance will likely be influenced by other variables such as concurrent tasks (item #6) or schedule histories (item #3). For instance, a lawyer faced with a complicated proceeding is likely to work on preparing his/her case throughout the period preceding the court date, whereas a simple divorce decree may be whipped off at the end of the interval or any other available time before the hearing date.

8. Response cost and effort. It has

been suggested that one reason why humans respond at high rates throughout an FI in the laboratory is that the response effort is minimal, e.g., tapping a telegraph key. Many researchers have unsystematically increased the force requirement of their manipulandum when subjects were not displaying the desired FI pattern (e.g., Azrin, 1958; Baron & Galizio, 1976; Laties & Weiss, 1963). The one systematic study of this variable (Lippman, Leander, & Meyer, 1970) found no clear relationship between force requirement and response patterns within the range explored (20g to 1.2kg). Further research with a wider range of effort needs to be done. Certainly checking the mailbox for an important letter is more likely to occur at high rates if the mailbox is right outside the door as compared to being down several flights of stairs.

In the laboratory, cost refers to the subtraction of reinforcement from the existing total contingent upon each response. Its effect is to decrease FI response rate, usually to the extent that only one response per interval is emitted (Baron, Kaufman, & Stauber, 1969; Weiner, 1962, 1964, 1965, 1969). The reductive effect may not occur in some persons who have a history of FR schedule control (Weiner, 1970).

In a non-laboratory setting we would expect that responses which require much expenditure of the person's resources would be delayed until the end of the interval. For example, parking and library fines incurred by college students are often left unpaid until the next registration period.

9. Limited-hold. In the laboratory this refers to a brief period of time in which the reinforcer is available; if no response occurs the reinforcer becomes unavailable until another interval has elapsed. Some researchers have employed a limited-hold as part of their experimental procedure (e.g., Laties & Weiss, 1963; Lowe, Harzem, & Bagshaw, 1978), but systematic study of the effects of a limited-hold on human FI performance has not been performed. Infra-human research has shown that FI response rate increases with the addition of a limited-

hold (e.g., Morse, 1966). Baron and Galizio (1972) added a limited-hold in an attempt to increase observing responses in two subjects not responding on this contingency. It did not increase observing responses though rate increased on the reinforced manipulandum.

The limited-hold procedure corresponds in many ways to a "deadline" in the non-laboratory environment. In both situations, the consequence which is available for completing a response requirement at a specified time is withdrawn if the task is not completed at that time. An example is the grading period in school; examinations, papers, and projects generally must be completed by a certain date in order for a grade to be awarded. Responding after that period has no immediate effect; grades are not again given until the end of the next interval. The intended effect of a deadline is to extinguish waiting beyond the specified period and thereby increase responding before the interval elapses.

10. Duration of the interval. Laboratory studies of human FI commonly employ values of less than one minute, though durations of up to 10 min. have been investigated (Weiner, 1969). When subjects respond with a low rate pattern there is, of course, an inverse relationship between response rate and interval length (Baron, Kaufman & Stauber, 1969). Within the range of values studied, there is little evidence that subjects are more likely to respond with the low rate pattern given a longer FI interval (Weiner, 1969). Lowe et al. (1978) found that with a response-dependent continuous clock procedure (c.f., item #5) rate of observing responses was systematically related to FI length, though this was not the case with a discrete clock procedure.

In everyday situations the temporal schedule of reinforcement is often in terms of days, weeks, or months. With extended time periods it is likely that unreinforced responding will extinguish and that other variables will occur, such as concurrent schedules and time-correlated stimuli. The effect of these variables would be to delay responding until the end of the interval.

11. Aversive consequences. Not only are positive consequences scheduled at regular intervals, but periodic aversive events control avoidance and escape behavior. Experimental studies have employed electric shocks (Davison & Kirkwood, 1968), or time-out from money accumulation (Baron & Galizio, 1976; Baron & Kaufman, 1966) which could be postponed by responding. Both high rate constant responding and low rate temporally spaced responding were observed in different subjects in the above studies. Response-cost (Weiner, 1962; Davison & Kirkwood, 1968), time-correlated stimuli (Baron & Galizio, 1976), and instructions (Galizio, 1979) were effective in decreasing high rate responding under aversive schedules.

Non-laboratory instances of regularly scheduled aversive events are typically accompanied by instructions, so that people seldom experience the actual consequences of failures to respond. For example, utility cut-offs, fines, or imprisonment for non-payment of bills and taxes are usually avoided without actually contacting the contingencies. Instructional control is maintained by public example of those who do fail to respond appropriately. Payment of bills and taxes is a form of response-cost in which monetary loss is sustained in order to avoid a larger aversive event. That people wait until the end of the interval to make payment is consistent with laboratory findings on response-cost (item #8).

12. Combination of factors. Each of the preceding variables may be seen as influencing human performance on the FI schedule of reinforcement in one of two general ways: promoting either high rate responding or pausing throughout the interval. Those variables which increase responding in the laboratory include: a schedule history of high rate responding, certain values of a concurrent DRL schedule, a large conjunctive ratio requirement, a limited hold, and instructions. Those which increase pausing during the interval include: a schedule history of temporally spaced responding, time-correlated stimuli (freely available or dependent upon an observing response),

concurrent ratio schedules, response-cost or effort, and instructions. Although systematic investigations have not been carried out, it seems logical to assume that those factors which promote responding will be mutually facilitory, as will those that promote pausing. What happens when these factors oppose each other? Weiner (1969) showed that high-rate FI responding as a result of FR schedule history could be overcome by response cost or experience on a DRL. High rate FI responding due to a concurrent DRL was not affected by changing the temporal parameters of the schedule (Poppen, 1982) but was decreased by employing a concurrent FR instead of the DRL (Poppen, 1972). Instructions have been found to exert strong effects on FI behavior generating high or low rates, but instruction following is eliminated when it results in direct exposure to loss consequences (Galizio, 1979).

In applied settings, a major concern is not that people respond throughout an interval, but that they "wait until the last minute." Procrastination is a function of many factors which promote pausing for most of the available time; it is not simply a matter of FI "scallopings."

Re-Analysis of Popular Examples of Fixed-Interval Behavior

Three popular instances will be considered. The reader is encouraged to examine other situations for variables which contribute to the observed pattern of behavior.

Studying for examinations: Examinations are periodically scheduled opportunities for reinforcement (grades, certification) requiring an effortful, perhaps aversive response (writing the exam), and precurent behavior (studying). "Cramming," or studying at high rates for only a brief period prior to the exam, may be a problem. What variables affect the distribution of study behavior? There is a limited-hold, a date beyond which the examination is not available. Many studying responses are required—pages to read, problems to work—making the situation analogous to a conjunctive schedule with a high ratio requirement. These factors should contribute to studying throughout

the interval. On the other hand, the student is instructed as to the time of the exam, temporal cues discriminative for the exam time are widely available, the duration of the interval is lengthy, the behavior of studying is effortful, there are numerous concurrent contingencies which compete with studying, the student may have an extensive history of procrastination, and he/she may have developed some study rules such as "I do better if I can review everything immediately before the exam." These factors promote the pause-and-run (not scalloped) pattern of "cramming" (see Michael, 1980, for a similar analysis).

Checking one's mailbox: If the mail arrives at a regular time each day, the person is likely to construct a rule, such as "the mail comes at 10 a.m." He/she may then engage in observing responses, such as checking a clock. These responses may occur in a scalloped pattern, increasing in frequency as 10 a.m. approaches, but actually checking the box only occurs once at the end of the interval. One may also engage in concurrent activity, such as attending a meeting that regularly ends at 10 a.m. The conclusion of the meeting is then discriminative for mailbox checking. The magnitude and nature of the reinforcer may also affect behavior. An anticipated sum of money may increase the rate and change the pattern from once-at-the-end-of-the-interval to a scallop, while an anticipated bill may result in avoidance or delay.

Bill-passing by Congress: The passage of a bill is the end-point of long chains of behavior involving many people. The behavior of this social "organism" supposedly reflects the summation of behavior of the individuals comprising it. What factors affect the behavior of Congresspersons, culminating in a legislative act? Calendars and clocks abound. Concurrent tasks are plentiful, especially early in a session when committees are formed and power lines drawn. Conjunctive tasks preparatory for the bill passage are carried out—hearings, lobbying, trade-offs, drafts, and redrafts. Reinforcement is available for high density bill passage; riders and amendments favorable to

special interests can be attached more easily in the rush of activity. And legislators have a long history of behaving in such a fashion.

CONCLUSIONS

Periodic contingencies are a common occurrence in human affairs, from the ringing morning alarm to the income tax due date, and behavior displays regular cycles in relation to these contingencies. But to extend our science and technology of behavior beyond that of our ancestors, who were controlled by periodic events such as the change of seasons and migration of herds and attributed them to the action of gods, we need to more thoroughly analyze the contingencies which control behavior.

To summarize:

1. It is often useful to identify non-laboratory phenomena in terms of their laboratory counterparts. For example, having identified teacher attention as reinforcement, we can now apply much of what is known about the contingencies of differential reinforcement to the classroom. But identifying the delivery of paychecks or semester grades as a FI schedule has not led to a similar advance in technology. Such "irrelevance" may be partly responsible for disinterest in basic research.

2. Part of the problem lies in the fact that many variables in addition to the reinforcement schedule are overlooked. Some possible contributing factors have been described in this paper.

3. It may be useful to utilize what is known about these variables in applied settings. For example, procrastination is often a major problem for many people. It is a function not only of a FI schedule and can be more effectively analyzed and modified if these additional variables are recognized and manipulated. Changing a class schedule of examinations from an instructed FI (regularly scheduled announced times) to a VI (unannounced "pop" quizzes) may generate disruptive emotional behavior rather than effective study behavior. It may be more fruitful to

examine concurrent and conjunctive task requirements.

4. Attempts to apply or even extrapolate from basic research points up many gaps in our knowledge. In particular, little or nothing is known about the effects of reinforcer magnitude, self-generated instructions, lengthy temporal intervals, or complex response classes and topographies on FI performance. And we have only minimal knowledge of complex schedules.

5. Both basic and applied researchers could profitably learn from the work of each other.

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