*FI SCHEDULES AND PERSISTENCE AT GAMBLING
IN THE U.K. BETTING OFFICE*

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This study reports on the direct observations of customers in two U.K. betting offices gambling on horse and dog races. These observations revealed that bets were more frequently placed in the last minutes just prior to the start (the OFF), and that this was caused by high-frequency gamblers (customers who had eight or more bets in a session) consistently placing their bets in the last two minutes prior to the OFF. Low-frequency gamblers (three or fewer bets/session) avoided this time period placing their bets earlier, or after the OFF, *i.e.*, on a later race. It was argued that the betting behavior of the "gamblers" could not be explained either in terms of "skillful betting" or solely in terms of variable ratio schedules but was more adequately accounted for in terms of an interval schedule. It was further suggested that time-based schedules might be of heuristic value in generally understanding persistence at gambling while losing.

DESCRIPTORS: gambling, reinforcer, reinforcement schedules, adults

It is generally accepted that partial schedules of reinforcement are associated with greater resistance to extinction. This seems to hold across a wide range of tasks (Hilgard, 1962; Jenkins and Stanley, 1950; Lewis, 1960). On the assumption that resistance to extinction is analogous to persistence at gambling when losing, it has been assumed that pathological levels of betting behavior are a function of variable ratio (VR) schedules operating in the gambling environment (Skinner, 1953).

There is a paucity of behavioral studies of gambling but, nonetheless, the assumption that persistence at gambling is a function of VR schedules has been given some support in the laboratory. Lewis and Duncan (1956, 1957, 1958) using a fruit machine, found persistent gambling to be an inverse function of the percentage of reinforcement during an acquisition period. Continuing to bet without winning was also associated with the amount won in training and with the number of acquisition trials. The

generalizability of this gambling research is strictly limited by the fact that subjects were given unlimited supplies of tokens for the machine. Levitz (1971) in an analogue study of "compulsive" gambling (*i.e.*, continuing to bet "under conditions of tangible loss") attempted to overcome this limitation by having the undergraduate subjects gamble with both their accumulated cash winnings and their payment for participating in the experiment. Greater persistence while losing was found to be not only a function of "beginner's luck" (*i.e.*, winning on the first 22 trials) but also of whether or not the subject was told he had "beginner's luck" (*i.e.*, informed he was doing better than others even if he was *losing* money).

Even when subjects gamble with their own money it is exceedingly difficult to relate laboratory studies to real-life gambling. This is not only because of the usual objections regarding amounts of money, opportunity, and type of game (Kusyszyn, 1973), but also because of the duration of gambling training in the real world. Is it possible to generalize from behavior over 51 trials (Levitz, 1971) to, for example, the 1077 plays at roulette in a single session by a

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casino gambler (Hochauer, 1970)? What if the period of "tangible loss" extends over many years?

The dearth of behavioral studies of real-life gambling environments is such that answers to these questions are not available. Despite the fact that the experimental analysis of behavior has been demonstrated to have heuristic value in a wide variety of real-life environments (Kazdin, 1975; Ulrich, Stachnick and Mabrey, 1970), it has not been used in gambling research.

This brief paper summarizes an attempt to employ some components of the experimental analysis of behavior to the United Kingdom Off-Course Betting Office. Not much is known about customer behavior in betting offices. Customers consider the race commentary to be the most important single factor in the environment (Worth, 1970), and Newman (1972) reported that "progressive betting" or "chasing" (*i.e.*, raising the stakes when losing) was more common when the frequency of races rose to 4 per hour. Newman was a "participant observer" just prior to the policy change introduced by the Horse Race Betting Levy Board which increased the frequency of races broadcast in betting offices. It has been suggested (Moody, 1974) that this increase led to more customers becoming compulsive gamblers. No data are available to support such a suggestion other than the rapid growth of Gamblers Anonymous (GA), of whose members 90% previously bet primarily in betting offices (Dickerson, 1974).

From the anecdotal "therapies" of gamblers attending GA meetings it is apparent that, despite the fact that a gambler may say he wishes to stop gambling, once he has entered a betting office he may be unable to control or stop his betting. A study based upon an experimental analysis of behavior of the betting office environment and customer betting behavior was deemed likely to provide some understanding of why some gamblers in betting offices "lose control" of their betting behavior and become "compulsive."

METHOD

Betting office customer behavior was examined by direct observation, by brief structured interviews with 204 customers in betting shops, by questionnaire survey of members of GA, and by in-depth interviews with customers and GA members. This report briefly summarizes the direct observation data.

Subjects and Setting

These data were generated by the gambling behavior of customers in two betting offices in the city of Birmingham. The shops were not selected at random. On the basis of an examination of the social class distribution in the areas around the two offices (Edwards, Leigh, and Marshall, 1970), it was concluded that there were reasonable grounds for assuming that the customers would be a representative sample of city betting office gamblers. This conclusion was supported by a superficial comparison of these two shops with eight others selected at random and used in the collection of interview data. There were no obvious differences in terms of the facilities offered in the shops themselves nor in terms of the neighborhood shops and public houses.

All customers entering the two shops and placing bets during the periods of observation were included in the data. The duration of the observation periods and the study itself ensured that the data were generated by representative sample of customers. Between 30 and 40 (on weekdays) and 50 and 70 (on Saturdays) individual customers placed one or more bets.

Two subgroups of customers were identified for further data collection. "High-frequency gamblers" were defined as customers who bet on eight or more races on three or more days in any one week. Such customers were identified with the help of the shop manager and with information from a structured interview completed with customers in the shop. Seven customers who satisfied the criteria were identified

in the second betting office. (From the interview data collected in 10 betting offices the number of such customers was estimated to range from 4 to 8 per office.) "Low-frequency gamblers" were defined as customers who bet on three or fewer races on any one day. As most customers in this group placed one bet only, data were collected on 21 such gamblers in order to facilitate statistical comparisons with the much greater amount of data generated by the high-frequency gamblers.

Betting offices were legalized by the Betting and Gaming Act (1960). Such offices often have a shop front like other high street shops. A view into the shop is often obscured by a display of racing pictures. Inside the shop floor area (20 to 30 m²) is usually bare. A large display board shows runners and riders of the day's meetings. Form sheets are pinned around the walls. There are betting slip dispensers and ledges on which to lean. The place-take counter is usually placed across the far wall with security glass to the ceiling. There is always a clock and a loud-speaker (blower) to which is piped a live commentary from the race courses.

The opening hours vary, but most offices open at least 2 hours before the first race is broadcast. During this period the blower is silent except for the occasional announcement. Apart from the silence, there were other stark differences between this time and the racing period

when races were run and broadcast over the blower. Observation and timing of customers in and out of the office showed that during the racing period there were many more customers present and furthermore that they stayed for much longer periods. Throughout the period of study, over 90% of all bets placed were placed during the racing period. All data reported below refer to the racing period.

During the first four weeks of observation certain basic descriptive information on the betting office events was collected. The number of races broadcast each afternoon in a betting office varied greatly. On one weekday during the National Hunt (NH) season there may be as few as 22 races, 16 of which might be dog races, whereas on a bank holiday there may be so many races (for example, more than 100 horse races) that commentaries on them all could not possibly be given in the available time. The most usual combination during the initial period of observation was one or two dog meetings with two or three horse race meetings. This generated a total of between 24 and 32 races per weekday afternoon.

The frequency with which races were broadcast during the sessions of direct observation ranged from one race every 6.85 minutes to one every 16.13 minutes. For a total of 100 races on weekdays during the initial period of observation the average time between races was

Table 1
Blower Stimulus Chain for Dog and Horse Races

<i>Stimulus DOGS</i>	<i>Repetitions dogs</i>	<i>Time before OFF (min)</i>	<i>Stimulus HORSES</i>	<i>Repetitions horses</i>	<i>Time before OFF (min)</i>
1. They're parading	1	9-13	They're parading— They all go at— The runners at—	1	15-20
2. They bet at— 6/4 trap 2 etc.	3	0-4	They bet at— 6/4 Parsimony etc.	8-15	0-16
3. They're going in	1	0-2	They're going down	1	5-8
4. The hare's running	1	3-5 sec	They're at the start	1	1-5
5. —	1	—	They're going behind	1	1-2
6. —	—	—	They're in the stalls	—	—
7. THEY'RE OFF	—	0	They're under orders THEY'RE OFF	1	0-1 0

8.08 minutes. The duration of the race commentary varied according to the type of race; the shortest dog races lasted just less than 20 seconds, the shortest flat races just less than 60 seconds and NH races lasted more than 3 minutes. In addition to the commentary the blower broadcast a range of information prior to the start of each race. Although the content varied from race to race, there were certain patterns which were linked in time as the moment of the OFF approached. These are illustrated in Table 1 and a superficial comparison of horse and dog races highlighted some differences. Even if the first announcement *is* broadcast for dogs, the sequence of information preceding the race commentary itself lasts only 4 minutes, whereas for horses this sequence lasts at least 15 minutes. In addition there seemed to be fewer variations in the timing of the sequence in relation to the OFF for dog races. This would be predicted from the fact that 4 to 6 dogs can be prepared and started far more easily than 6 to 20+ horses.

The behavior of the customers themselves may also be listed among the stimulus changes in the environment. During the race commentary there was generally little or no movement about the office and most customers seemed to be listening to the commentary. After the race there was often a short burst of conversation as this was the one moment when the blower remained silent for a brief period. Customers were then observed to move around the office reading the form pinned up on view. Bets were placed by customers one or two at a time with the only observed difference being just before the OFF when several customers would often be at the counter simultaneously. There was nothing to distract the bettor, no information about the environment outside the betting shop, no news, and no view of the events in the street outside. The exception to this pattern was the behavior of customers who entered the office, placed a bet, and left immediately. Their behavior seemed to be unrelated to the sequence of events observed within the office.

Procedure

The betting response was defined as a customer relinquishing his betting slip to the clerk at the place-and-take counter, who would then immediately time-stamp it at the till. For some customers the definition of placing the betting slip on the counter would be sufficient to generate a reliable observation of responses, but on some occasions customers would stand at the counter with the slip under their hand ready to pass it under the grill at the last moment. A response was recorded only after the slip was relinquished and passed to the hand of the clerk.

The recording method chosen was simple and unobtrusive. The observer was behind the place-and-take counter with a clear view of the cash register. A small pad with columns with six different stake sizes (0-11, 12-50, 51-100, 101-200, 201-500, 500p, where 50p is about \$1) and rows for one-minute time intervals was used. A timing device fitted with a miniature earpiece emitted a tone every 60 seconds. The data were collected in a 6-month period covering the end of the National Hunt season and the beginning of the flat race season.

The frequency of betting responses (as defined above) was recorded in relation to its time of occurrence prior to the start of each race. Given the average time between races, a period of 8 minutes (6 before and 2 after) was selected for study, and any races that occurred more frequently within that period were excluded from the results. As the OFF would be unlikely to coincide with the observer's minute timing signal, the following practice was observed. When the OFF was called over the blower, the experimenter noted the position of the sweep second hand on the office clock. If the next bleep occurred within 30 seconds, all the bets that were recorded within the last race were placed in category 0 minute before the OFF. Conversely, if the time signal were more than 30 seconds after the OFF, the whole row was categorized as -1 minutes, *i.e.*, after the OFF.

During a 6-week period 32 hours of direct

observation were completed in the first betting office. During this time general descriptive data (as given above) and betting data (bet size and time of placement) on 71 NH races were collected. Periods during which betting data were collected started 15 minutes before the published start time of the first race and continued for between 3 and 4 hours depending on the number of races broadcast. A further 8 weeks (46 hours observation) were spent in the second office covering the end of the NH and the beginning of the flat racing season. Here betting data were collected for over 200 races for all customers gambling during the observation periods, and then subsequently, for high- and low-frequency gamblers. The betting behavior of high-frequency gamblers was recorded for the whole group during a single period of observation. On the first occasion five such gamblers were recorded using the same procedure described above and subsequently six gamblers (four of the original group plus two others who satisfied the criteria). Betting data for the low-frequency gamblers were collected by observing the first two customers (excluding high-frequency gamblers) who entered the office after the start of an observation period. Betting data were collected for these customers until they left the office or they bet for a fourth time. In either event the next-arriving customer was then observed.

No interobserver reliability studies were completed, primarily because of the difficulties in introducing yet another new person behind the counter. The relative simplicity of the observation system, the unambiguous definition of the betting response, and the fact that the frequency of betting responses never rose above 8 per minute may have reduced, but not eliminated, observer bias or error. A comparison of stake-size data collected in a structured interview and by the above direct observation methods yielded on a simple χ^2 analysis (Underwood, Duncan, Taylor, and Cotton, 1954) no significant differences in distribution of stake size between the two data collection methods ($df = 5$, $\chi^2 = 3.88$, $p > 0.5$).

RESULTS

Data collected for 71 races in the first office gave 28 races with starts sufficiently spaced for there to be no overlap for the 6 minutes prior and 2 minutes after the OFF. These data ($N = 311$ bets) confirmed the superficial observation noted above that there was an acceleration in the frequency of bet placement just prior to the OFF and a deceleration thereafter ($df = 4$, $\chi^2 = 67.9$, $p < 0.001$). This was replicated in the second office and is illustrated in Figure 1 (number of races = 30; number of bets = 415). Additional data collected in the second office were used to examine the relationship of the time of bet placement with the duration of the race commentary and with the timing of key announcements before the OFF (Dickerson, 1974).

The data comparing high- and low-frequency gamblers are summarized in Figures 2 and 3 for time of bet placement and size of bets, respectively. A Chi-squared analysis of the six 1-minute time intervals prior to the OFF was highly significant ($df = 5$, $\chi^2 = 122.7$, $p < 0.001$). High-frequency gamblers were much more likely to place their bets just before the OFF. In addition high-frequency gamblers place significantly more bets greater than 100p and

Fig. 1. Cumulative mean bets placed by all gamblers per race for a total of 28 races.

Fig. 2. Comparison of the cumulative percentage bets placed per minute by high- and low-frequency gamblers.

fewer bets of less than 50p than low-frequency gamblers.

As the group of high-frequency gamblers was very small, the behavior of four of the original group plus two other customers who satisfied the same criteria was observed during a further four sessions of racing. Over 200 bets were recorded for these six customers and the same pattern of betting was observed with over 70% of all bets laid on weekdays occurring in the last 2 minutes prior to the start of the race commentary. Further data collected on low-frequency gamblers indicated that their betting responses were much less predictable. Nonetheless, it appeared that they avoided the period just prior to the OFF, placing their bets either well before the OFF or after the OFF, *i.e.*, betting on a later race.

DISCUSSION

The descriptive information given above suggests that there is a strong and definite time-based component running through the sequence of events in the betting office. All the races are published and run approximately to time. Although the time intervals between races vary, there exists little of the true randomness that is the important feature of variable interval schedules. Apart from the regular pattern of auditory

Fig. 3. Comparison of the distribution of size of bet for high- and low-frequency gamblers.

stimuli broadcast by the blower prior to the start of each race, there is also a large (accurate) clock publicly displayed within each betting office.

If one aspect of the observer's interest in completing this study was to provide some insight into the way in which some betting office customers "lost control" of their betting behavior and became "compulsive" gamblers, then certainly as far as the animal literature on schedules is concerned one of the most powerful "controlling" schedules is the fixed interval (FI) plus clock (Ferster and Skinner, 1957). Human subjects may produce scalloped performance also if they are given a clock, where there is a response cost, and when they have had prior experience of differential reinforcement of low rates of responding (DRL) (Weiner, 1969).

Returning to the above data there is evidence to suggest that high-frequency gamblers exhibit betting behavior that is different from customers who stay briefly. The betting responses of these gamblers were highly predictable, occurring in the last moment before each race started and involving higher stakes. (Although losses could not be recorded simultaneously with the time and size of bet, it is accepted that 80% of all stakes is eventually lost (Moody, 1972). This is probably a conservative estimate for high-frequency gamblers because they are more likely than other customers to restake their winnings.)

Within the behavioral framework outlined above, although it is rare for a customer to bet more than once within a single time interval, there appeared to be less variability of betting response as the response was more regularly associated with the stimulus changes immediately preceding the OFF. In a post hoc explanation such as this, the question remains as to whether or not it is reasonable to assume that these data provide some support for the hypothesis that the betting responses of customers who stay in the office are a function of a conjunctive schedule involving both ratio and interval components or whether or not there are some alternative competing explanations.

Certainly it may be argued, as indeed it is by some customers, that the person who bets just before the OFF has had opportunity to observe all the price changes and to look for a sudden shortening of odds that may indicate late interest in a particular horse or dog at the race track. On these grounds it is argued that it is more skillful to bet late in the time interval prior to each race. There is obviously a skill element in the timing of bet placement just as there is in the whole process of selection, involving as it does form, distance, rider, weight, position, going. Placing a bet closer to the OFF, however, has to be weighed against the general trend toward progressively shorter odds as the date and time of the OFF approaches. The fact that gamblers invariably bet at the last moment and indeed carry out the complex selection process in the betting office (Dickerson, 1974) amid the noise and pressure of limited time and information, undermines the "skill argument." The fact that bets are placed latest of all on short races cannot be explained in terms of a skill component.

In other gambling situations (such as craps) where the outcome is chance determined, it has been shown that gamblers display a propensity to view their gambling behavior as determined, at least partly, by personal skill at the game (Csikszentmihalyi and Bennett, 1971; Langer,

1975). Because invariable late bet placement in the betting office is, in terms of skill, maladaptive, it is reasonable to suggest that the betting office high-frequency gambler, by describing his betting as skillful, commits the same fallacy as the craps player.

If the sequence of events in the betting office is assumed to function as an FI schedule, then scalloped (late bet) performance would be expected (Weiner, 1969). Customers know the time sequence, they have a clock, and there is a cash response cost. Whether or not the early betting behavior of gamblers, often involving the use of once weekly multiple bets, may be considered as experience of DRL merits further consideration.

There is a conceptual difficulty in the hypothesis that the betting behavior is a function of an FI schedule. In general terms this schedule results in a response probability of zero for the greater portion of the time interval, followed by a very rapid swing in the last few moments of the time interval to a response probability approaching unity. This is established where the subject can make many responses per fixed interval, but if subjects were limited to one response per fixed interval, would the group data show the same scalloped pattern?

A discussion of schedules can be clarified by establishing the premise that for the high-frequency gambler in the betting office (and probably in other gambling environments) there exist two distinct reinforcers (*i.e.*, excluding interpersonal reinforcers, such as the status gained by large stakes). The first is cash (both the collection of cash at the counter and cognitions of past and future winnings) which is usually considered in terms of a VR schedule. The second is the interval of time immediately following the start of a race whether defined in terms of a race commentary, the subjective experience of the gambler, or his physiological reactions.

For the high-frequency gambler it is inadequate to describe this latter reinforcer as merely

secondary to associations with cash. In behavioral terms these associations must be weak, firstly because only cognitions of cash won can occur in close temporal contiguity with the commentary (collection of the cash itself occurs much later), and secondly because the commentary will, on the majority of occasions, be associated not just with the absence of cognitions of cash won but with strongly aversive cognitions of cash lost. The race commentary (and probably the spinning of the roulette wheel) is more appropriately conceptualized as a distinct reinforcing event giving rise to descriptions of the "frenzy" and "excitement" of high-frequency gamblers. Such excitement is not generated by cognitions of cash won but by the very process of the gambling behavior and environmental changes.

Thus, if such a distinction is made between "cash" (including cognitions of cash won) and "excitement," then it is likely that the former is delivered on a VR schedule reinforcing a return to the gambling environment and longer periods of betting once there. The "excitement" reinforcer is delivered at fixed intervals of time contingent upon the occurrence of one (or more) betting response at any time within that interval. Applying the principle of the timing of reinforcement then, gamblers' betting responses occurring closer to the time of delivery of reinforcement will be differentially more strongly reinforced. Thus the betting response of the high-frequency gambler in a betting office consistently occurs just prior to the start of the race commentary and the group data of such gamblers have the appearance of FI scallops.

It is probable that the betting responses of the high-frequency "gamblers" such as those described in this study are not significantly different from a criterion group of "compulsive gamblers" composed of GA members (Dickerson, 1974). Arising from the discussion above, the hypothesis that betting office contingencies function as a training program leading from low-frequency to "compulsive" levels of gambling has been explored (Dickerson, 1977).

In conclusion the results of a limited behavioral analysis of one real-life gambling environment suggest that behavioral explanations of persistence at gambling in terms of VR contingencies alone are probably inadequate. Persistence at other gambling games, particularly under conditions of continued financial loss, may be more adequately explored and understood by a consideration of the repetitive fixed temporal sequence of events which encompasses the betting behavior of gamblers in most gambling environments.

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