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Comparing natural travel with artificial travel requirements in the study of foraging in the laboratory

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COMPARING NATURAL TRAVEL WITH ARTIFICIAL TRAVEL REQUIREMENTS IN THE STUDY OF FORAGING IN THE LABORATORY

by

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TO MY FATHER

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TO MY WIFE

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TO MY SON

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ABSTRACT

COMPARING NATURAL TRAVEL WITH ARTIFICIAL TRAVEL REQUIREMENTS IN THE STUDY OF FORAGING IN THE LABORATORY

by

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University of New Hampshire, May, 1992

Is moving from place to place equivalent to pressing a lever or pecking a key? This dissertation addressed this question by comparing natural travel (moving from place to place) with artificial travel requirements (to press on a lever). In two experiments foraging was modeled with operant behavior. Rats "searched" for food by pressing on the left lever. The patch provided a maximum of 1, 2, or 8 pellets. When the patch provided 1 pellet, rats captured the first prey with a .10 probability. The probability dropped to zero after one pellet. When the patch provided 2 or 8 pellets rats captured the first prey with a 1.0 probability. Each prey delivered on the left lever caused this probability to decrease to 0 in steps of .5 or .125 simulating patch depletion. Lever-press on the right lever reset the probability on the left lever to .10 or 1.0. To model artificial travel different reset-probabilities were scheduled on the right lever. The experimental situation was modified to model natural travel. Rats had to run 520 cm to travel back and forth between left and right levers. Experiments 1 and 2 revealed that as the number of available

prey in the patch increased the giving-up time increased. Experiment 1 showed that natural travel produced longer residence and giving-up times than the artificial travel conditions. Experiment 2 revealed that by pressing on retractable levers, rats made shorter residence and giving-up times than by pressing on standard levers. Sometimes, but not in systematic way, natural travel produced longer residence and giving-up times than by responding to the reset-probabilities. The natural travel with obstacles produced the longest residence and giving-up times. The natural travel with obstacles had more of an effect on residence and giving-up times that any other travel requirement. The residence and giving-up times obtained in Experiments 1 and 2 are in accordance with predictions derived from McNair's (1982) model. As the travel requirement increased the residence and giving-up time increased. This is predicted because the average rate of capture decreased as travel time increased.

INTRODUCTION

The study of foraging behavior by ecologists and biologists has led to the development of optimal foraging theory. The basic assumption of optimal foraging theory is that animals behave to maximize their fitness. To succeed in reproduction, foragers need to maximize net energy gain over the cost of foraging. If so, optimal foraging maximizes fitness. Many researchers have evaluated the assumption that animals behave to maximize their fitness by testing models of optimal foraging with experiments. Their main goal has been to develop an optimal foraging model able to characterize real foraging situations, the environmental aspects to be maximized, and the constraints imposed on the animal (Shettleworth, 1988).

Optimal foraging theory maintains that evolutionary events and conditions have shaped the behavior of species over generations. However, to be effective, evolutionary events and conditions must operate through proximate causation (Mellgren, 1982). Proximal causes are environmental events and conditions that operate in the immediate environment to affect foraging behavior and patterns of optimal behavior (Mellgren, Misasi, & Brown, 1984).

Biologists have studied evolutionary events and conditions, and psychologists have studied the proximate causes of behavior. Nevertheless, evolutionary biologists and psychologists have the same purposes: to study and understand behavior.

In the last thirteen years, the analysis of foraging behavior by ecologists and biologists has joined the study of schedules of reinforcement by psychologists. In the study of foraging behavior, ecologists and biologists have generated experiments similar to studies of reinforcement schedules (e.g., Houston & McNamara 1985; Kacelnik & Krebs 1985; Lea 1979; Redhead & Tyler 1988). In the study of choice, psychologists have designed experiments similar to studies of foraging (e.g., Baum 1982a, 1982b, 1987; Fantino, 1987; Fantino & Abarca 1985; Hanson & Green 1989a, 1989b).

Instrumental behavior is viewed as foraging, and foraging is studied as instrumental behavior. Both activities involve locomotion, and both are modified by their consequences (Baum, 1982b). Operant simulations of foraging have become common (Baum, 1982a, 1982b; Pietrewicz and Kamil, 1981). For example, operant techniques have been used (Collier & Rovee-Collier, 1981) to test MacArthur and Pianka's (1966) model of prey selection. Moreover, it has been suggested that the methods utilized in the laboratory by operant psychologists represent a suitable way to test optimal models of foraging (Kamil & Yoerg, 1982; Pulliam, 1981; Schoener, 1987).

By using optimal models of foraging, researchers try to predict how an animal (forager) searching for food will behave in a situation where its behavior depletes a small area (patch). That is, researchers try both to take account of the depletion of food by the forager within the patch, and to identify the variables that determine the animals' decision of when to move to a new patch (Redhead & Tyler, 1988). Among the variables to be considered in such a decision, the quality of a patch and the travel cost to other patches are the most important factors.

Optimal models of foraging have suggested that animals adopt rules to decide when to move to a new patch. Accordingly, foragers may leave the patch: 1) when a specific rate of prey capture is reached, 2) a fixed time after the most recent capture (the giving-up time rule), 3) after a fixed time, or 4) after they have captured a fixed number of prey.

To support the rule of rate of prey capture, optimal models of foraging assume that the environment provides food in a smooth continuous flow (MacArthur & Pianka, 1966; Charnov 1976). According to such a theory, foragers estimate the quality of the patch at any given moment by using the instantaneous rate of intake within a patch. As the patch is depleted the rate of intake decreases. When the rate of intake falls below that of the environment as a whole, it becomes necessary for foragers to leave the patch (Charnov, 1976).

Based on this assumption, optimal models of foraging predict an optimal residence time in a patch. This prediction has been supported qualitatively by observing foraging behavior in the field and by simulating foraging in the laboratory (e.g., Pyke 1984; Schoener 1987; Stephen & Krebs 1986). However, it has not been supported quantitatively (e.g., Fantino & Abarca 1985; Lea 1979), and the paradigm that optimal models of foraging follow to predict optimal residence time has been criticized (Gray, 1987).

McNair (1982) analyzed the assumption that the environment provides food in a smooth continuous flow. He argued that animals obtain discrete portions of food at irregular intervals. Under these circumstances the instantaneous rate of intake does not provide an accurate estimation of the quality of the patch. It would produce errors in estimations (Redhead & Tyler, 1988). To do an accurate estimation, one would need to make the instantaneous rate equivalent to the distribution of the patch yield over a specific residence time. McNair (1982) doubts that animals can adopt such a complicated strategy while foraging.

A viable strategy for animals while foraging is to check the length of time since the last prey capture, and decide to leave the patch when this time reaches a critical value, the giving-up time rule (Krebs, Ryan, & Charnov

1974). This rule has been supported by studies in which birds visited artificial patches, and their giving-up times fitted the predictions made by optimal foraging models (e.g., Ydenberg, 1984). However, some other experiments inspired by optimal foraging models, have found inconsistencies between observed and predicted giving-up times (Lea & Dow, 1984).

Rules based on a fixed time or a fixed number of prey captured, have been contemplated by optimal models of foraging as alternative strategies. Krebs and Cowie (1979) reported results suggesting that to leave the patch, foragers adopt the fixed time rule. However, Redhead and Tyler (1988) showed evidence indicating that animals use the rule of the immediate rate of reinforcement to leave the patch. Thus, under specific circumstances animals may adopt particular rules to leave the patch, the best strategy depends on food distribution within and between patches (Iwasa, Higashi, & Yamamura, 1981; McNair 1982).

The other major factor that determines the decision of when to leave the patch is the travel requirement to reach the next patch. For example, Mellgren, Misasi, and Brown (1984) allowed rats to forage for food by climbing nail ladders to boxes containing food mixed with sand. They varied the amount of food in the patch and the distance (travel) to other patches. When the travel was constant and food varied in density, rats showed optimal usage of the patches. As the distance between patches increased the utilization of each patch increased. However, when the amount of food was constant or the distance between patches was short, rats did not behave in accordance with optimal models of foraging. Rats tend to underutilize high-density patches and overutilize low-density ones (Mellgren, Misasi, and Brown, 1984).

Optimal models of foraging predict that the utilization of the patch would increase if the travel time to other patches increase (Krebs, 1978). This prediction has been corroborated in the field (Anderson 1978; Zimmerman 1981), in the laboratory with no operant techniques (Cowie 1977; Hartling & Plowright 1979), and in several experiments in which all elements of the patch were simulated with operant techniques (Cuthill, Kacelnik, & Krebs, 1987; Fantino & Abarca, 1985; Hanson, 1987; Hanson & Green 1989; Killeen, Smith, & Hanson 1981; Lea 1979).

As predicted by optimal models, operant simulations that incorporate two sources of food (patches) have shown that travel requirements between patches affect foraging behavior. The residence time in one of the patches increases a function of the travel requirement to the alternative patch (e.g., Abarca & Fantino 1982; Fantino & Abarca 1985; Hanson 1987; Hanson & Green 1989a, 1989b; Killeen, Smith & Hanson 1981; Lea 1979). However, in operant simulations of foraging, travel has been modeled by requiring rats to press a lever or pigeons to peck a key. Thus, foragers "travel" by responding on a schedule for a given time and waiting in the same spot. When there is no locomotion involved in travel, animals save energy and it may produce data that optimal models of foraging do not fit (Cowie 1977; Kacelnik & Cuthill 1987). As noted by Mellgren (1982), travel in an open area may have other costs for foragers.

In addition, the operant laboratory has produced data indicating that different responses produce different results. For example, pigeons learn quicker to peck a key for food than to press a treadle (McSweeney, 1978).

Nevertheless, there are data suggesting that pecking a key has qualitatively similar effects to moving from place to place. Baum (1982a) exposed pigeons to a choice between two patches that provided food in concurrent variable-interval schedules, and he varied the travel between patches. As the travel increased the residence time in the favored patch increased and the visits to the other patch decreased. With the minimal distance between patches, Baum found that residence times in the preferred patch decreased, and the number of visits to the other patch increased (Baum, 1982a). These results resemble those obtained by Pliskoff and Fetterman (1981) for key-peck "travel".

Although in choice situations the effects of moving from place to place appear to resemble those of comparable instrumental responses (Baum, 1988), nobody has compared an operant response with a natural travel requirement within the same experimental situation.

The operant chamber has been modified to model natural travel in the laboratory (e.g., Baum 1982a; Krebs, Kacelnik, & Taylor 1978; Ydenberg 1984). However, the operant chamber has not been adapted to compare a natural travel requirement with operant behaviors such a pressing on a lever or pecking a key. Thus the following question remains unanswered: Is moving from place to place equivalent to pressing a lever or pecking a key? In two experiments, this dissertation addressed this question by comparing natural travel (moving from place to place) with artificial travel requirements (pressing on a lever).

EXPERIMENT 1

Natural travel was compared with artificial travel requirements. By pressing on the left lever rats depleted the patch in 1, 2, or 8 pellets. Under artificial travel conditions, the patch was reset by pressing on the right lever. Different reset-probabilities were scheduled. Under the natural travel condition, the patch was reset by passing around the central partition and pressing once on the right lever.

METHOD

Subjects

Four Long-Evans male, experimentally naive rats (A-104, A-230, A-101, and A-123) between 90 and 110 days old at the beginning of the experiment served. Animals were housed in individual cages with water permanently available, and maintained at 80% of their free-feeding weights (± 8 g).

Apparatus

The experimental chamber was a rectangular box 147 cm long, and 51 cm wide (see Figure 1). The box was divided all along by wire mesh except at the extreme end. Three 9 v DC lights were mounted on each side of the box: at 23 cm, 51 cm, and 117 cm from the front wall. Two response levers were mounted on the front wall, 3 cm from the floor and 33 cm apart. A pellet dispenser delivered pellets in a hopper on the left of the same wall, 3 cm from the floor, 7.5 cm from the left lever. The experiment was controlled by using a microprocessor (BCC-52). The data were collected and analyzed by using a Zenith PC computer.

Procedure

To run artificial travel conditions, direct passage from one lever to the other was permitted. Passage beyond 17 cm from the front wall (see Figure 1) was blocked with wire mesh. To run the natural travel condition, direct passage from the left to the right lever was blocked with wire mesh (see Figure 2). Changing from one side of the box to the other required passing around the central partition at 130 cm from the front wall. The total distance from left to right and back to left lever was 520 cm.

The left lever (patch) provided 1, 2, or 8 pellets (prey). When the patch provided 1 prey, the probability (p) of obtaining the prey by pressing on the left lever was .10. This probability dropped to zero after one pellet was obtained. When the patch provided 2 or 8 prey, p on the left initially was equal to 1.0. Pressing on the left lever caused p to decrease to zero in steps of .5 or .125, simulating patch depletion.

Pressing on the right lever reset p on the left to .10 or 1.0. Artificial travel was produced by five reset-probabilities (1.0, .25, .10, .05, and .025) scheduled on the right lever. The first response on the left lever turned off the lights on the left side and turned on the lights on the right side. Presses on the right lever that satisfied the schedule reset p on the left, turned off the lights on the right, and turned on the lights on the left, signaling reset of the patch.

Sessions ended when one of three conditions was met: 1) there were 90 visits to the levers, 45 to the left and 45 to the right lever, 2) subjects stopped pressing on both levers for more than 300 seconds, or 3) when subjects obtained within a session a maximum of 190 pellets.

Tables 1 to 3 show the different conditions, grouped by the number of prey available on the left side. The order in which they were studied and the number of sessions per condition appear in the last two columns of Tables 1 to 3. A minimum of ten sessions per condition were conducted. However, the number of sessions was increased when the natural condition or low reset-probabilities showed variability in the data.

Travel time was the predictor variable. It was recorded from the last press on the left lever until the first press on the left following reset on the right lever.

There were three criterion variables: residence time, giving-up time, and capture accuracy. Residence time was recorded for each visit from the first press on the left lever to the last press on the left lever. Giving-up time was recorded from the last pellet obtained in the patch to the last press on the left lever. Capture accuracy represents the percent of prey obtained per visit in the patch out of the available number.

Results

For each session of each condition, the arithmetic means of travel time, residence time, giving-up time, and capture accuracy were calculated.

An exploratory data analysis (EDA) was conducted. All sessions were included in the analysis. The arithmetic means of the giving-up and travel times were represented in clusters. Some examples are shown in Appendix A.

To summarize the data, I utilized an alternative measure of central tendency, "the bisquare-weighted mean" (BWM). The BWM technique was designed by Mosteller & Tukey (1977) to assign less weight to observations that depart from the middle of the distribution. The BWM technique was adapted (Killeen, 1989) to run in Basic machine language and utilized to calculate BWMs and median absolute deviations (MADs) for travel, residence, and giving-up times. Tables B19 to B21 (Appendix B) summarize the BWM values. For each condition, the variability in travel, residence and giving-up times was estimated. The MAD was added to or subtracted from the BWM values, to represent with two values the range of variability in these measurements. The BWM plus its MAD was called the BWM^+ value. The BWM minus its MAD was called the BWM^- value. In tables B19 to B21 (Appendix B) the BWMs appear in the center columns. The numbers to the right and left are BWM^+ and BWM^- values.

The BWM, BWM^+ and BWM^- values were utilized to determine areas in the plot in which travel, residence, and giving-up times overlapped. The idea was to see if travel times caused by the different reset-probabilities overlapped with travel times produced by the natural requirement.

If natural travel and low reset-probabilities produced travel times of similar duration, then residence and giving-up times produced by low reset-probabilities should have values that overlapped values produced by the natural condition.

The BWM, BWM^+, and BWM^- values for travel, residence, and giving-up times were used to construct Figures A21 to A29 (Appendix A). Travel, residence, and giving-up times produced by low reset-probabilities overlapped travel, residence and giving-up times caused by natural travel. However, there were some instances of no overlap between values produced by natural travel and values produced by artificial travel requirements.

Tables 1 to 3 (center columns) show BWMs for travel, residence and giving-up times. Figure 3 in the left-hand columns of graphs, shows the BWMs for travel time (Y-axis) plotted against the reset-probabilities (logarithmic X-axis). Different symbols indicate the different subjects. Figure 3 shows that the reset-probabilities on the right lever produced systematic changes in travel times. As expected, as the reset-probability increased artificial travel time decreased. The function relating artificial travel time to reset-probability, was steeper when the patch was depleted in 2 pellets than when the patch was depleted in 1 or 8 pellets (see panel B, Figure 3).

Residence and giving-up times produced by artificial travel requirements were transformed to logarithmic numbers, and then the arithmetic means of these values were obtained for the conditions depleted in 1-, 2-, and 8-prey. Residence and giving-up times produced by natural travel were also transformed to logarithmic numbers, and the arithmetic mean of these values was obtained for each prey condition. In Figure 4, the arithmetic means obtained for residence and giving-up times (Y-axis) are plotted against the number of available pellets in the patch (X-axis). The filled squares indicate the residence times produced by artificial travel requirements. The empty squares represent residence times produced by the natural travel condition. The filled triangles symbolize the giving-up times produced by the artificial travel conditions. The asterisks represent the giving-up times produced by the natural travel condition. The bottom panel of Figure 4 shows the data averaged across subjects.

Figure 4 shows that on average natural travel produced longer residence and giving-up times than those produced by the reset-probabilities (see group mean in bottom panel of

Figure 12). Generally, as the number of available pellets in the patch increased, residence and giving-up times increased. With exception of the giving-up times for one subject (see asterisks in right-hand top panel for A-104), when the number of pellets in the patch switched from 1 to 2, the residence and giving-up times decreased in the natural travel condition. However, the giving-up times produced by artificial travel conditions increased with the same manipulation (see triangles across panels). When the patch was depleted in 8 prey, the longest residence and giving-up times were observed. Although Figure 4 show larger residence and giving-up time for natural travel, these means are misleading. The effect may be caused by an artifact of the arithmetic mean. The artificial travel requirements caused the residence and giving-up times to vary in duration.

In Figures 5 to 8 (left-hand panels), the residence and giving-up times (logarithmic Y-axes) are plotted against the travel times (logarithmic X-axis). Each figure shows results for one rat. All conditions are included in the left-hand graphs. The natural travel values are enclosed in boxes. Figures 5 to 8, left-hand columns of graphs, show that with exception of subject A-101 natural travel produced longer residence and giving-up times than artificial travel requirements. For A-101 when the patch was depleted in 1 or 2 pellets (top and middle panels, Figure 5), natural travel produced residence and giving-up times similar to those produced by low reset-probabilities. However, when the patch was depleted in 8 pellets, A-101 in the natural travel produced longer residence and giving-up times than by responding to the reset-probabilities (bottom panel, Figure 5 left-hand).

Generally, low reset probabilities were associated with long residence and giving-up times, and high reset-probabilities with short residence and giving-up times. Usually, natural travel was associated with long residence and giving-up times.

Regression lines were fitted to all residence and giving-up times produced by artificial requirements. The following linear equation was utilized:

$$Y(x) = a1 + a2 * x \qquad (1)$$

Coefficients: $a1 = (Sy * Sxx - Sx * Syx) / (N * Sxx - Sx^2)$

$a2 = (N * Syx - Sx * Sy) / (N * Sxx - Sx^2)$

Where $Sx = \Sigma xi$, $Sxx = \Sigma xi^2$, $Sy = \Sigma yi$, and $Syx = \Sigma yi * xi$. The BWM values of travel time were transformed to logarithmic numbers and entered in the equation as the values of the independent variable. The BWM values of residence or giving-up times were transformed to logarithmic numbers and entered in the equation as the values of the dependent variable. Values produced by the natural travel requirement did not enter the equation. Tables A34 to A39 summarize values and calculations (Appendix A).

Tables 7 to 12 show the regression outputs when the patch was depleted in 1 pellet (Tables 7 and 10), 2 pellets (Tables 8 and 11), or 8 pellets (Tables 9 and 12). The left-hand panels show regressions for the residence time, and the right-hand panels regressions for the giving-up time.

When the patch was depleted in 1 or 2 pellets, the linear equation accounted for the variability in residence and giving-up times (r^2 between .76 and .95, mean=.85). There were two exceptions, subject A-104 (r^2 between .05 and .48, mean=.23), and subject A-123 (r^2 between .26 and .90, mean=.68). When the patch was depleted in 8 pellets, the linear equation poorly accounted for the variability in residence and giving-up times (r^2 between .04 and .54, mean=.27).

Figures 5 to 8 show in the right-hand panels the regression lines for residence and giving-up times. The logarithmic values of residence and giving-up times (Y-axes) are plotted against those of travel times (X-axis). The filled squares indicate residence times, and filled triangles giving-up times. The coefficients a1 (Y-intercept), and a2 (slope) are included near each regression line. The coefficient a1 is the Y-intercept of the regression line and gives an indication of overall level of residence and giving-up times, as long as the slope is not too steep. Results from the natural travel condition are not included (compare left-hand columns of graphs with right-hand columns).

In general, the right-hand panels in Figures 5 to 8 show that there were not systematic deviations in residence and giving-up times from the regression lines. With exception of subjects A-101 and A-123 (middle panels of Figures 5 and 7), as the number of available prey in the patch increased the residence and giving-up times increased (compare values of a1 across panels). When the patch was depleted in 2 pellets, the residence and giving-up times of A-123 decreased (compare a1 in top panel with a1 in middle panel of Figure 7). However, when the patch was depleted in 8 pellets, the residence and giving-up times of A-123 increased (compare a1 in bottom panel with a1 in middle and top panels of Figure 7). The residence times of A-101 decreased when he depleted the patch in 2 pellets, but not the giving-up times (compare values of a1 in top and middle panels of Figure 5). Nevertheless, when A-101 depleted the patch in 8 prey, the residence and giving-up times were greater than when he depleted the patch in 2 or 1 prey (compare a1 value in bottom panel of Figure 5 with values of a1 in middle and top panels).

With the exception of A-101 in the 8-prey condition (a2= -.13), and A-104 in the 2-prey condition (a2= -.07), the slopes for residence and giving-up times were all positive (compare values of a2 across conditions in Figures

5-8). With the exception of subject A-123 (Figure 7), as the number of available prey in the patch increased the slopes of residence and giving-up times decreased (mean=.41 for the depleted-in-1, mean=.20 for the depleted-in-2, and mean=.06 for the depleted-in-8 conditions). However, when A-104 depleted the patch in 8 prey, the slopes of residence and giving-up times were steeper than when he depleted the patch in 2 prey (compare values of a2 in Figure 6 middle and bottom panels). For A-123 the slope of residence and giving-up times increased as the number of available prey in the patch increased. When A-123 depleted the patch in 2 prey, the slopes of residence and giving-up times were steeper than when he depleted the patch in 8 prey (compare values of a2 middle panel of Figure 7 with values of a2 in top and bottom panels).

The artificial travel times usually produced systematic changes in giving-up time. The right-hand panels in Figures 5 to 8 show that there were only a few exceptions. Short giving-up times were associated with high reset-probabilities. Long giving-up times were associated with low reset-probabilities. However, the reset-probabilities generally caused less change in residence times across conditions (compare values of a2 for residence with values of a2 for giving-up times, right-hand panels in Figures 5 to 8), but see some exceptions (compare X coefficients of residence times with X coefficients of giving-up times) in

Tables 7 to 12.

When the patch was depleted in 8 prey, the longest residence and giving-up times were observed. Rats responding to the reset-probabilities produced less variation in giving-up times (see values of a2 in Figures 5 to 8), except for subject A-123 (right-hand bottom panel of Figure 7).

The BWM values of travel, residence, and giving-up times produced by the natural requirement were transformed to logarithmic numbers. Then, the slopes and intercepts from the regression lines were used to calculate estimates of the residence and giving-up times. Equations 2 and 3 were utilized

$$\text{Est GUT} = a1 + (a2 * \log TT\,[NT]) \qquad (2)$$

$$\text{Est RT} = a1 + (a2 * \log TT\,[NT]) \qquad (3)$$

where a1 was the constant and a2 the slope. GUT the giving-up time, RT the residence time, and TT [NT] the travel time for the natural travel requirement.

The logarithmic residuals of residence and giving-up times were calculated by using equations 4 and 5

$$\log \text{res GUT} = \log \text{GUT}[NT] - \text{Est GUT} \qquad (4)$$

$$\log \text{res RT} = \log \text{RT}\,[NT] - \text{Est RT} \qquad (5)$$

Tables B25 to B28 summarize these calculations (Appendix B).

The logarithmic residuals of residence and giving-up time calculated for natural travel, were divided by the standard errors of residence and giving-up time estimated for artificial travel requirements. In Figure 9, these calculations are plotted (Y-axes) against the number of available pellets per visit (X-axis). The Y-axis shows the number of standard error units that residence and giving-up time deviated from estimates based on the regression analysis. The larger these values the less natural travel produced residence and giving-up time durations that were equivalent to those produced by artificial travel requirements. In general, Figure 9 shows that when the patch was depleted in 2 pellets, residence time deviated more standard error units from estimates (mean= 7.14) than when the patch was depleted in 1 (mean= 5.59) or 8 pellets (mean= 2.50). However, giving-up time deviated more standard error units from estimates when the patch was depleted in 1 pellet (mean= 4.67) than when it was depleted in 2 (mean= 3.62) or in 8 pellets (mean= 3.44). Table C34 summarizes results of Figure 9 (see Appendix C).

EXPERIMENT 2

In Experiment 1 pressing on the right lever produced residence times that changed less than giving-up time durations. Travel time on the right lever produced systematic changes in giving-up times. Short durations were associated with high reset-probabilities and long durations with low reset- probabilities. However, residence times did not change in systematic way as a function of artificial travel. Sometimes the .10 reset-probability produced longer residence times than the .05 or .025 reset-probabilities.

In Experiment 1, variations in residence time may have been produced by deficiencies in stimulus control. At the beginning of a session, the first response on the left lever turned off lights on the left side and turned on lights on the right side. After that, presses on the right lever reset the probability on the left, turned off lights on the right, and turned on lights on the left, signaling reset in the patch. By switching from left to right and back to left without resetting the patch, sometimes animals produced longer travel times that actually included some unmeasured residence time.

Experiment 2 was designed to improve stimulus control. The idea was to provide better discrimination between residence and travel. To gain control over residence and travel times, the standard response levers were replaced with retractable levers. If a subject responding on the left switched to the right lever and pressed on it, the left lever was retracted and not extended again until responding on the right lever reset the patch to its original condition. This prevented responding in the patch until reset.

The patch was depleted in 1, 2, or 8 pellets. Only low reset-probabilities were studied and compared with natural travel requirements.

Method

Subjects

Five Long-Evans male, experimentally naive rats (C-1, C-2, C-3, C-4, and C-5) between 90 and 110 days old at the beginning of the experiment served. Animals were housed in individual cages with water permanently available, and maintained at 80% of their free-feeding weights (±8 g).

Apparatus

The apparatus was the same as in Experiment 1, except that the two standard response-levers were replaced with retractable response-levers.

Procedure

The procedure was similar to that in Experiment 1. The idea was to repeat conditions in which low reset-probabilities were scheduled on the right lever. However, when the patch was depleted in 8 pellets, a natural travel condition with obstacles was included. Three hurdles (obstacles), 25 cm wide and 12 cm high, were constructed with wire mesh. Two hurdles were placed, one on each side of the box, at 50 cm from the front wall. The other hurdle was placed at 130 cm from the front wall. Tables 4 to 6 show the different conditions, grouped by the number of available prey on the left side. The order in which they were studied and the number of sessions per condition appear in the last two columns of Tables 4 to 6. A minimum of ten sessions per condition were conducted. However, the number of sessions was increased when the natural condition or low reset-probabilities showed variability in the data. Predictor and criterion variables were the same as in Experiment 1.

Results

The same techniques were utilized to analyze the data. The analysis followed the same strategy as in Experiment 1. All sessions from each condition were included in the analysis. Some examples of cluster analysis are shown in Appendix A.

Tables 4 to 6 (center columns) show BWMs for travel, residence, and giving-up times. Figure 3 in the right-hand columns of graphs, shows BWMs for travel time (Y-axis) plotted against the reset-probabilities (logarithmic X-axis). Different symbols indicate the different subjects. Except for C-3 in the two pellets condition, the reset-probability of .025 produced longer travel times than any other probability. Functions relating reset-probabilities to travel times varied less than in Experiment 1. Travel time varied less with reset-probability but generally travel time decreased as the reset-probability increased.

Residence and giving-up times produced by artificial conditions were transformed to logarithmic numbers, and then the arithmetic means of these values were obtained for the conditions depleted in 1-, 2-, and 8-prey. Residence and giving-up times produced by natural travel were also transformed to logarithmic numbers, and the arithmetic mean of these values were obtained for each prey condition. In Figure 10, the arithmetic means obtained for residence and giving-up times (Y-axis) are plotted against the number of available prey in the patch (X-axis). The filled squares indicate the residence times produced by artificial travel requirements. The empty squares represent residence times produced by the natural travel condition. The filled triangles symbolize the giving-up times produced by the artificial travel conditions. The asterisks represent the giving-up times produced by the natural travel condition. The X's represent residence and giving-up times produced by natural travel with obstacles. The right-hand bottom panel of Figure 10 shows the data averaged across subjects. Figure 10 shows that with some exceptions (see C-1 and C-5), as the number of available prey in the patch increased residence and giving-up times increased. Except for C-3 (the mean of residence times produced by artificial travel requirements), when the patch was depleted in 1 prey, the means of residence and giving-up time produced by natural travel were greater than the means of residence and giving-up time produced by artificial requirements (compare empty squares and asterisks with filled squares and triangles). When the patch was depleted in 2 or 8 prey, (except for C-1, giving-up times) the means of residence and giving-up time produced by natural travel were similar to the means of residence and giving-up time produced by artificial requirements. With the exception of one subject (C-1), the longest residence and giving-up times were produced by natural travel with obstacles (compare X's with other symbols).

Figures 11 to 15 show residence and giving-up times plotted against travel times in logarithmic coordinates. All conditions are included in the left-hand graphs. Each figure shows results for one rat. Natural travel results are enclosed in boxes. Figures 11 to 15, in the left-hand columns of graphs, show that except for one outlier each in the data of C-1, C-2, C-4, and C-5 in the depleted-in-one condition, natural travel produced residence and giving-up times of similar duration to those produced by low reset-probabilities (see Figures 11, 12, 14, and 15 top panels). Usually, natural travel with obstacles produced the longest residence and giving-up times (see subjects C-2, C-3, and C-5 in Figures 12, 13 and 15).

Generally, low reset-probabilities were associated with long residence and giving-up times, and high reset-probabilities with short residence and giving-up times, but for some conditions the times did not appear to vary systematically.

Regression lines were fitted to residence and giving-up times produced by artificial travel requirements. The BWM values of travel time were transformed to logarithmic numbers and entered the equation as the values of the independent variable. The BWM values of residence and giving-up times were transformed to logarithmic numbers and entered the equation as the values of the dependent variable. Values produced by natural travel did not enter the equation. Tables A40 to A45 (Appendix A) summarize values and calculations.

Tables 13 to 18 summarize the regression results. When the patch was depleted in 1 pellet (Table 13), the linear equation accounted for the variability in residence times (r^2 between .64 and .99, mean=.77). With a few exceptions (C-4, Tables 15 and 18), when the patch was depleted in 2 or 8 pellets the linear equation poorly accounted for the variability in residence and giving-up times (r^2 between .01 and .96, mean=.41; Tables 14, 16, and 17).

Regression lines for residence and giving-up times are shown in right-hand columns of Figures 11 to 15. The logarithmic values of residence and giving-up times (Y-axes) are plotted against those of travel times (X-axis). The filled squares indicate residence times, and filled triangles giving-up times. The coefficients a1 (Y-intercept), and a2 (slope) are included near each regression line. Results from the natural travel condition are not included (compare left columns of graphs with right columns).

In general Figures 11 to 15 show that there were not systematic deviations in residence and giving-up times from the regression lines. As the number of available prey in the patch increased the residence and giving-up times increased (compare values of a1 across panels in Figures 11 to 15). The increment in giving-up times was less consistent, but a1 was always greatest for the 8-prey patch. However, from the 1-prey patch to the 2-prey patch, a1 for giving-up times did not change for C-4, and decreased for C-1, C-2, and C-3 (compare values of a1, middle panels in Figures 11 to 15).

With exception of C-5 in the 8-prey patch (a2= -.02), the slopes for residence times were all positive (compare values of a2 across panels in Figures 11 to 15). As the number of available prey in the patch increased, the slopes for residence time decreased (mean=1.08 for the 1-prey, mean=.51 for the 2-prey, and mean=.09 for the 8-prey conditions).

Most slopes for giving-up times were positive, there were 5 exceptions out of 15 slopes (compare values of a2 in Figures 11 to 15). For the 2-prey condition, the slopes for giving-up times were greater (mean=.74) than for the 1-prey (mean=.15) or for the 8-prey conditions (mean=.02). However, in the 8-prey condition, for C-1, C-3, and C-5 the slopes for giving-up time were negative or close to zero (see a2 in Figures 11, 13, and 15 right-hand top panel). However, the slope of giving-up times was highest in the 2-prey condition for C-3 and C-4. For C-2, as the number of available prey in the patch increased, the slopes for giving-up times increased (see values of a2 in Figure 12).

Logarithmic residuals of residence and giving-up times were calculated. The same equations were utilized as for Experiment 1. Tables B29 to B33 summarize these calculations (Appendix B). The logarithmic residuals of residence and giving-up time calculated for the natural condition, were divided by the standard errors of residence and giving-up time estimated for artificial travel requirements. In Figure 16, these results are plotted (Y-axes) against the number of available pellets per visit (X-axis). The number of standard error units that residence and giving-up time deviated from estimates are indicated by positive or negative values. Large values indicate situations in which natural travel produced residence and giving-up time durations that were not equivalent to those produced by artificial travel requirements. In general, Figure 16 shows that when the patch was depleted in 1 prey, residence and giving-up time deviated more standard error units from estimates to positive values (means of .64 and 2.21 respectively) than when the patch was depleted in 2 prey (means of .11 and .47). When the patch was depleted in 8 prey, residence time deviated from estimates to positive values (mean= .15) and giving-up time deviated from estimates to negative values (mean=-.13). In the natural travel with obstacles residence time deviated more units from estimates to positive values (mean= 9.38) than giving-up time (mean= 6.02). Table C35 (Appendix C) summarizes results of Figure 16.

Discussion

On the whole, the results of this dissertation supported the use of operant techniques in the study of foraging behavior in the laboratory. Three issues will be discussed: a) feasibility of the method of Experiments 1 and 2, b) their relation with the optimal foraging theory, and c) the issue of equivalence between natural and artificial travel conditions.

Experiments 1 and 2 revealed that as the reset-probabilities increased artificial travel decreased (see Figure 3). Rats made the longest artificial travels by responding to the .025 reset-probability. Rats responding to the 1.0 reset-probability produced the shortest artificial travels. The different reset-probabilities required a different variable number of presses for reset. For example, the .10 probability required on average 10 lever-presses to reset the patch, the .05 probability required on average 20 lever-presses to reset the patch, and the .025 probability required on average 40 lever-presses to reset the patch. However, the 1.0 probability required just 1 response on the right lever to reset the patch, and the .25 probability required on average 4 lever-presses to reset the patch. Obviously, to press on the right lever once, rats needed less time than to press on the lever 4, 10, 20 or 40 times. Thus, because the different reset-probabilities required a different variable number of presses for reset, responding on the right lever produced artificial travels that changed as a function of the reset-probabilities (see Figure 3). This result confirmed that random ratio schedules of reinforcement can be used to vary artificial travel time (Baum, 1982b; 1987), but are artificial and natural travel equivalent?

Can rats pressing on a lever produce travel times of equivalent duration to the travel time they need to move from place to place? The answer to this question is yes. I compared artificial travel times with the travel time produced by the natural condition. I tried to determine if by pressing on the right lever, rats made travel durations equivalent to those they made by running in the natural condition.

In general, when the reset-probability was .10, the time rats used to press on the right lever an average of 10 times was similar to the time they needed to run in the natural condition. However, rats used more time to press on the lever an average 20 or 40 times (.05 or .025 reset-probabilities) than to run in the natural condition. Rats used shorter time to press on the lever 4 times or less (.25 or 1.0 reset-probabilities) than to run in the natural condition (see Figures A3 to A7, Appendix A).

Experiment 1 showed differences in the function relating reset-probabilities to travel times. The steepest function was obtained when the patch was depleted in 2 prey (see middle left-hand panel in Figure 3). In addition, responding to low reset-probabilities (.025 and .05), produced longer artificial travel times in Experiment 1 than in Experiment 2 (see group means in Figure A8, Appendix A). The differences in artificial travel times produced by low reset-probabilities suggested that in Experiment 1 the stimulus control functioned differently from Experiment 2. In Experiment 1, where lights were utilized to signal when the patch was replenished, rats sometimes switched from the left to the right lever and back to the left before they reset the patch. When this occurred changeover caused long artificial travel times. Rats switched prematurely between levers when the reset-probability was low (.025 or .05). In addition, when the patch provided 2 pellets, more premature changeovers from right to left lever were observed than when the patch provided 1 or 8 pellets. This caused the steepness of the functions relating reset-probabilities to artificial times (see left-hand middle panel in Figure 3).

In Experiment 2, responding on the retractable levers to low reset-probabilities, produced shorter artificial travel times than responding on the standard levers (compare group means in Figure A8). Responding on the retractable levers produced less variation in artificial travel times. The function relating reset-probabilities to travel times was similar across conditions (see right-hand graphs in Figure 3). Thus, the retractable levers produced more uniformity and better control of travel times.

Optimal Foraging Theory

According to Charnov's (1976) marginal-value theorem, foragers follow optimal rules to decide when to leave a patch. Charnov assumes that foragers will remain longer in a patch that offers high energy intake per unit of time (E/T) than in a patch that offers low E/T. Accordingly, foragers estimate the quality of a patch based on an instantaneous rate of intake. Charnov's marginal-value theorem says that the forager will leave a patch when the rate of intake decreases to a point at which it falls below the average provided by the environment, and "that this marginal capture rate should be equalized over all patches within a habitat" (Krebs, Ryan, & Charnov, 1976).

The marginal-value theorem predicts that the forager's residence time in a given patch will increase if the travel to other patches increases or if other patches have low quality (Charnov 1976; Krebs 1978). Krebs, Ryan, & Charnov (1974) interpreted this to mean that an optimal forager will use the same giving-up time for all type of patches within an environment, even if these patches differ in quality. In addition, they suggested that the "giving-up time should be shorter in better habitats, where the average capture is higher" (Krebs, Ryan, & Charnov, 1974). Accordingly, the giving-up time should be inversely related to the average capture rate for the environment. Since as travel time increases average rate of capture decreases, giving-up time should increase with travel time.

The predictions from the marginal-value theorem have generated controversy in the study of foraging behavior. It is necessary to differentiate the marginal-value theorem from the marginal value rule (Stephens & Krebs, 1986). The marginal-value theorem is not a rule that foragers use to leave the patch. It is a method that a theorist may utilize to estimate optimal residence times based on gain functions and travel times. The marginal-value theorem is a method "that finds the rate-maximizing rule from a known set of rules" (Stephens & Krebs, 1986). The marginal value rule is a rule that foragers may use namely, to assess the instantaneous rate of gain in a patch and leave when the rate of intake falls below the average provided by the environment (McNamara, 1982). So, the marginal value rule may or may not control the forager's decisions of when to leave the patch, and it may or may not be an optimal rule in a given environment (Stephens & Krebs, 1986).

In Experiment 1 and 2, foraging was studied in different environments, each environment had one type of patch, and travel was varied within each environment. The patches differed in quality by varying the number of available prey. Each prey-condition lasted many days. The probability (p) of obtaining the prey by pressing on the left lever, and each reset-probability scheduled for the right lever formed a pair of probabilities. Each pair of probabilities constituted a different patchy environment. For the depleted in 1-, 2-, and 8-prey conditions, there were 7 different patchy environments: five reset-probabilities, the natural travel without obstacles, and the natural travel with obstacles. With 1 available prey in the patch, p of obtaining the prey was .10, with 2 prey p finished at .5, and with 8 prey p finished at .125. So, the giving-up time should be shorter for the 2-prey condition and about the same for the 1-prey and 8-prey conditions. However, in Experiments 1 and 2 the giving-up time increased as a function of the number of available pellets in the patch (see bottom panel in Figure 4 and right-hand bottom panel in Figure 10). Rats did not keep the same giving-up time in the patch within an environment.

Often, rats obtained all the available pellets and still persevered in the patch. Ideally, rats should have adopted a strategy of obtaining a fixed number of prey, and then leaving the patch. But rats did not do this, particularly in the 1-prey patches, where one might expect the giving-up time to be zero.

Thus, Experiments 1 and 2 showed that as the number of available pellets in the patch increased the giving-up times increased (see Figures 3 and 10). The richer the patch was, the longer rats persisted in the patch. When the patch provided 8 pellets per visit, rats produced the longest residence and giving-up times. This result is consistent with the conclusion that more plentiful schedules of reinforcement produce greater persistence of responding than less plentiful ones (Nevin, 1979).

In addition, Experiments 1 and 2 showed that the residence and giving-up times increased as a function of the travel requirement. The residence times obtained in Experiments 1 and 2 agreed with predictions from the marginal-value theorem; as the travel requirement increased the residence time increased (compare residence time across conditions in Figures 5-8 and 11-15). This result has been corroborated in both the field (e.g., Anderson 1978; Zimmerman 1981) and in the laboratory (e.g., Cowie 1977; Killeen, Smith, & Hanson 1981; Lea 1979; Mellgren, Misasi, & Brown, 1984). However, the giving-up times obtained in Experiments 1 and 2 did not agree with Krebs, Ryan, & Charnov's (1974) prediction that an optimal forager will use the same giving-up time in the patch within an environment.

If rats were following the "marginal-value rule" as Stephens and Krebs (1986) call it, how would giving-up time be expected to change with increases in travel? If giving-up time depends only on final capture rate, then it ought to remain constant, because final capture rate was unaffected by travel (see capture accuracy measure in Tables 4-6, the number of pellets obtained remained high throughout Experiment 2). Moreover, when the number of available pellets in the patch switched from 1 to 2, the giving-up time produced by artificial travel conditions increased (see triangles in Figures 4 and 10). This deviation of giving-up time from that of optimal models of foraging, suggested that an optimal decision to leave the patch may not be to maintain the same giving-up time in the patch within an environment (Krebs et al., 1974), but to increase the giving-up time as the quality of the patch improves (McNair, 1982).

Charnov's (1976) marginal-value theorem offers no clear explanation of why giving-up time should covary with residence time. The reason is that "giving-up time never enters into the model on which the marginal-value theorem is based" (McNair, 1982). The marginal-value theorem was designed to make predictions concerning patch residence times, it was not designed to predict giving-up times. McNair (1982) designed a model, analogous to Charnov's (1976) model, to predict optimal giving-up times. McNair (1982) provided some numerical examples demonstrating that larger giving-up times should be used in better quality patches. Moreover, McNair's model predicts that "increasing the mean interpatch travel time increases the optimal GUT's, as well as the mean patch yields and residence times" (McNair, 1982).

The residence and giving-up times obtained in Experiments 1 and 2 are in accordance with predictions derived from McNair's (1982) model. As the travel requirement increased the residence and giving-up time increased. This is predicted because the average rate of capture decreased as travel time increased. The right-hand graphs of Figures 17 and 18 illustrate these results. The group means of residence, giving-up time, and average rate of capture (Y-axes) are plotted against the group mean of travel time (X-axis). The filled squares represent the group means of residence time, the triangles the group means of giving-up time, and the asterisks the group means of the average rate of capture. The average rate of capture was estimated by taking the mean of prey captured per visit (the capture accuracy measure in Tables 1-3 and 4-6) and dividing it by the mean of travel time plus the mean of residence time (results are summarized in Tables C36 and C37, Appendix C). Natural travel results are enclosed in boxes. In the left-hand panels of Figures 17 and 18, the group means of residence time, giving-up time, and average rate of capture (Y-axes) are plotted against the probability on the right lever (X-axis) to facilitate comparisons between natural travel and artificial travel requirements (the data for each rat are plotted in Figures A39-A43, Appendix A).

Right-hand panels of Figures 17 and 18 show that in general residence and giving-up time increased as travel time increased. The average rate of capture decreased as travel time increased. Left-hand panels of Figures 17 and

18 show that natural travel and the .025 reset-probability produced longer residence and giving-up times, and lower average rates of capture than any other artificial travel requirement. In Experiment 2, natural travel with obstacles produced the lowest average rate of capture and the longest residence and giving-up times (see right-hand bottom panel of Figure 18 and Table C37). When the patch was depleted in 1 or 2 pellets residence time, giving-up time, and average rate of capture varied more with travel time than when the patch was depleted in 8 pellets.

An alternative optimal strategy to both Charnov's (1976) optimal residence time and McNair's (1982) optimal giving-up time, is the strategy of hunting by expectation developed by Gibb (1962). Accordingly, foragers leave the patch after a fixed number of prey captured. Redhead and Tyler (1988) trained rats to press on the right lever to obtain food according to a progressive variable-interval schedule of reinforcement that simulated patch depletion. The schedule was reset by pressing on the left lever. To model travel time, Redhead and Tyler (1988) increased to 25 seconds the time between pressing the left lever and obtaining a reinforcer from the right lever. They found (Experiment 2), in accordance with the marginal-value theorem, that when the travel time increased the overall residence times increased. However, they reported that rats "appeared to dispense with the giving-up time after the first few trials (p.92)". Redhead and Tyler reported that to decide when to leave the patch, rats used the inter-reinforcement interval value (Redhead & Tyler, 1988).

Experiments 1 and 2, the rats may have used the inter-reinforcement interval as an indication of when to leave the patch, rather than using the giving-up time. Since the inter-reinforcement interval was not recorded, I have no data to support this conclusion. However, if rats used the inter-reinforcement interval as in Redhead and Tyler's (1988) experiment, giving-up times should have decreased from 1 to 2 pellets. On the whole, results of Experiments 1 and 2 agreed with the conclusion that the forager's decision of when to leave the patch is determined by the number of available prey in the patch (Iwasa, Higashi, & Yamamura, 1981).

Equivalence of Natural and Artificial Travel

I tried to determine if rats responding to the reset-probabilities generated equivalent residence and giving-up times to the natural condition. The arithmetic mean of residence and giving-up times produced by artificial requirements was compared with that produced by the natural condition. Although Figures 4 and 10 appear to show larger residence and giving-up times for natural travel, these means are misleading. The effect may be caused by an artifact of the arithmetic mean. The artificial travel requirements caused the residence and giving-up times to vary in duration. High reset-probabilities (1.0 or .25) produced short residence and giving-up times, and low reset-probabilities (.01, .05, and .025) generated long residence and giving-up times. Thus, short times produced by high reset-probabilities may have brought down the mean for artificial times.

Experiment 1 suggested that residence and giving-up times in the natural travel were not equivalent to residence and giving-up times in the artificial travel requirements (see Table C34). Often, residence and giving-up times in the natural condition deviated from estimates based on artificial travel (see Figure 9). There were many instances of logarithmic residuals of residence and giving-up times that deviated from estimates more than 2 standard error units (see Table C34). But maybe that was due to the tendency to premature changeover from the right to the left lever (poor stimulus control).

Results of Experiment 2 indicated that there were few violations of equivalence with retractable levers (see Table C35). Only when the patch was depleted in 1 pellet, it was clear that giving-up times in the natural travel were not equivalent to giving-up times in the artificial travel requirements. In addition, these violations of equivalence were only consistent for two rats (see C-3 and C-4; maybe C-5 assuming that 2 standard error units constitutes an outlier). Moreover, Figure A33 (Appendix A) revealed that all the overlap between the variability in giving-up times for natural and artificial travel requirements tends to undermine the significance of the large deviations in giving-up times in the one-pellet condition (see Table C35 and Figure 10). The giving-up times of C-3 produced a negative slope in the regression analysis (see right-hand panels of Figure 13) and that tended to inflate the deviations, when the giving-up times for natural travel were actually not that different from the others. For C-4, the giving-up times were close to a line, producing an unusually small standard error, which tended to inflate the calculated deviation.

Although Experiment 1 suggested that natural travel had more of an effect on residence and giving-up times than artificial travel, Experiment 2 showed much less effect (see Figure 10 and Table C35). However, the natural travel with obstacles had a strong effect in the rats' residence and giving-up times. In this condition, rats produced the longest residence and giving-up times. That is, rats persevered a long time in the patch before they switched to the right lever. With some exceptions, in the natural condition with obstacles, the residual of residence and giving-up times deviated more standard error units (means of 9.38 and 6.02 in Table C35) from estimates based on artificial travel than in the natural condition without obstacles means of .15 and -.13 respectively. The natural condition with obstacles had more of an effect on residence and giving-up times than the natural travel without obstacles and produced the longest residence and giving-up times (see left-hand panels in Figures 11, 12, 13, and 15). These results suggested that the natural condition with obstacles demanded from rats more energy than any other travel requirement. Rats reacted differently to natural travel with obstacles than to artificial travel requirements, indicating a possible non-equivalence between natural travel with obstacles and artificial travel requirements. The results of Experiments 1 and 2 call for more research in which natural and artificial travel requirements are compared within the same experimental situation, particularly experiments in which travel will be more difficult than running (e.g., climbing).

The results of Experiments 1 and 2 supported the conclusion that with minimal modifications to the operant chamber, it is possible to introduce natural travel into operant experiments (e.g., Baum 1982a; Krebs et al. 1978; Ydenberg 1984). However, results of such experiments may change when natural travel is included. For example, choice situations in which a large travel is required between instrumental response alternatives produces different effects on the forager's behavior than choice situations that require a small travel between response alternatives. Baum (1982a) utilized concurrent variable-interval schedules of reinforcement and varied the travel requirement between response alternatives. Baum found a strong preference for one response alternative when the travel requirement was large. The pigeons' rate of changeover between response alternatives decreased as the travel requirement increased. Baum also included a natural travel condition with an obstacle (a hurdle). He found that the visit duration (residence time) increased on both response alternatives as the natural travel increased, and particularly as the hurdle was raised. In fact, Baum found that the natural travel by itself had less effect on the pigeon's behavior than the natural travel with the obstacle (Baum, 1982a).

Experiments 1 and 2 indicated that in a choice situation between two instrumental response alternatives, a large travel requirement without obstacles controlled the rats' behavior in a similar way to that in Baum's (1982a) experiment. For Experiment 2, in the natural travel without obstacles, rats spent about the same time on the left lever as with comparable artificial travel requirements. However, results of Experiment 2 suggested that by running in the natural condition without obstacles, rats did not consume more energy than by responding to the .05 or .025 reset-probabilities. In the natural travel condition with obstacles, rats may have spent more energy than in any other travel requirement. This suggests a possible non-equivalence between natural travel with obstacles and artificial travel requirements.

On the whole, Experiments 1 and 2 demonstrated that by using operant techniques, it is possible to compare in the same experimental situation natural travel with artificial travel requirements. The residence and giving-up times obtained in Experiments 1 and 2, suggested that the effects produced by natural travel in patch utilization are sometimes not equivalent to those produced by artificial travel requirements. The conclusion that ratio schedules of reinforcement can be used to model travel in the laboratory (Baum 1982b; 1987; 1988) needs to be taken with caution.

To determine if natural and artificial travel produced the same effects on the foragers' behavior, we must to evaluate them within the same experimental situation. Under these circumstances, the experimenter can make direct comparisons between natural and artificial travel requirements. The experimental situation can be adapted to reproduce a travel requirement that resembles travel in the real world. When this condition is satisfied, it maybe possible to demonstrate that natural travel does not produce the same effects on foraging behavior than artificial travel requirements. To predict that natural and artificial travel requirements affect the utilization of the patch in similar ways, we must demonstrate empirically that they do not differ from each other.

In summary, Experiment 1 showed that the natural travel condition produced longer residence and giving-up times than the artificial travel conditions. But maybe that was due to a poor stimulus control. Experiment 2 revealed that by pressing on the retractable levers, rats made shorter residence and giving-up times than by pressing on the standard levers. Sometimes, but not in systematic way, natural travel conditions produced longer residence and giving-up times than the reset-probabilities. However, in the natural travel with obstacles, rats produced the longest residence and giving-up time durations. The natural travel with obstacles demanded from rats more energy than any other travel requirement.

Conclusions

1. This dissertation examined the utilization of operant techniques to the study of foraging behavior in the laboratory.

2. As expected, artificial travel times varied inversely with reset-probabilities.

3. In Experiment 1 rats made longer artificial travel times than in Experiment 2. This result indicated that in Experiment 1 the stimulus control functioned differently from Experiment 2. In Experiment 1 lights sometimes failed to control the rats' switching, with the result that rats switched from the right to the left before they reset the patch. Thus, changeover produced long artificial times and caused the functions relating reset-probabilities to travel

times to be steep.

4. Experiment 2, eliminated the premature changeover. Thus, the function relating reset-probabilities to travel times was similar across conditions.

5. Experiments 1 and 2 showed that the residence and giving-up times generally increased as a function of the travel condition.

6. With some exceptions rats made the longest residence and giving-up times when they had to run in the natural condition or when rats had to respond to the .025 reset-probability.

7. Experiments 1 and 2 found that as the number of available pellets in the patch increased the giving-up times increased. The richer the patch was the longer rats persevered in the patch. Rats did not leave the patch when their rate of pellets intake decreased below the average provided by the environment. Often, rats obtained all the available pellets and still persevered in the patch.

8. Experiments 1 and 2 indicated that the quality of the patch interacted with the travel requirement to control the residence and giving-up times. When rats depleted the patch in 8 pellets, and they had to run in the natural condition or to respond to the .025 reset-probability, rats produced the longest residence and giving-up times.

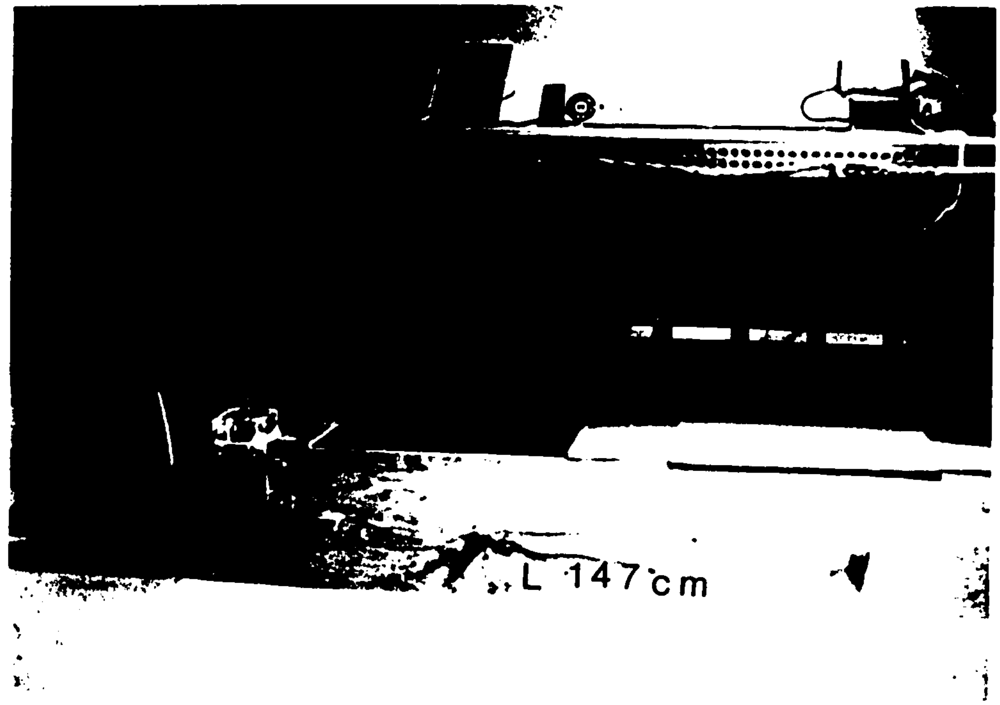
9. Experiment 1 showed that residence and giving-up times in the natural travel were not equivalent to residence and

giving-up times produced by artificial travel requirements, but Experiment 2 showed much less of an effect.

10. By making more difficult the natural condition for the rats, I found that maybe a difference between the natural condition and the artificial requirements. Rats responding to natural travel with obstacles made the longest residence and giving-up times. The natural travel with obstacles had more of an effect on residence and giving-up times than any other travel requirement. That is, natural travel with obstacles demanded from rats more energy than any other travel requirement. In the natural travel with obstacles, rats persevered a long time in the patch.

11. Experiments 1 and 2 demonstrated that by using operant techniques, it is possible to compare in the same experimental situation natural travel with artificial travel requirements. The operant chamber can be modified to include natural travel in the laboratory. To determine if natural and artificial travel requirements produced the same effects on the forager's behavior, we must evaluate them within the same experimental situation. To predict that natural travel and artificial travel requirements control the utilization of the patch in similar way, we must demonstrate empirically that they do not differ from each other.

Figure 1. The experimental situation, the bottom panel shows the set-up for artificial travel conditions.


L 147cm

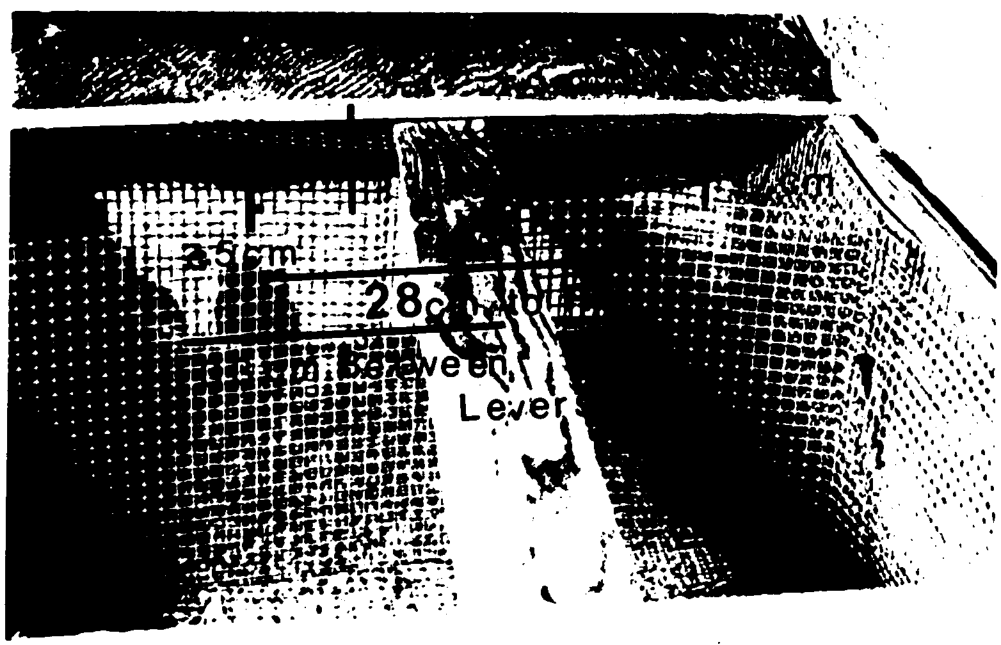
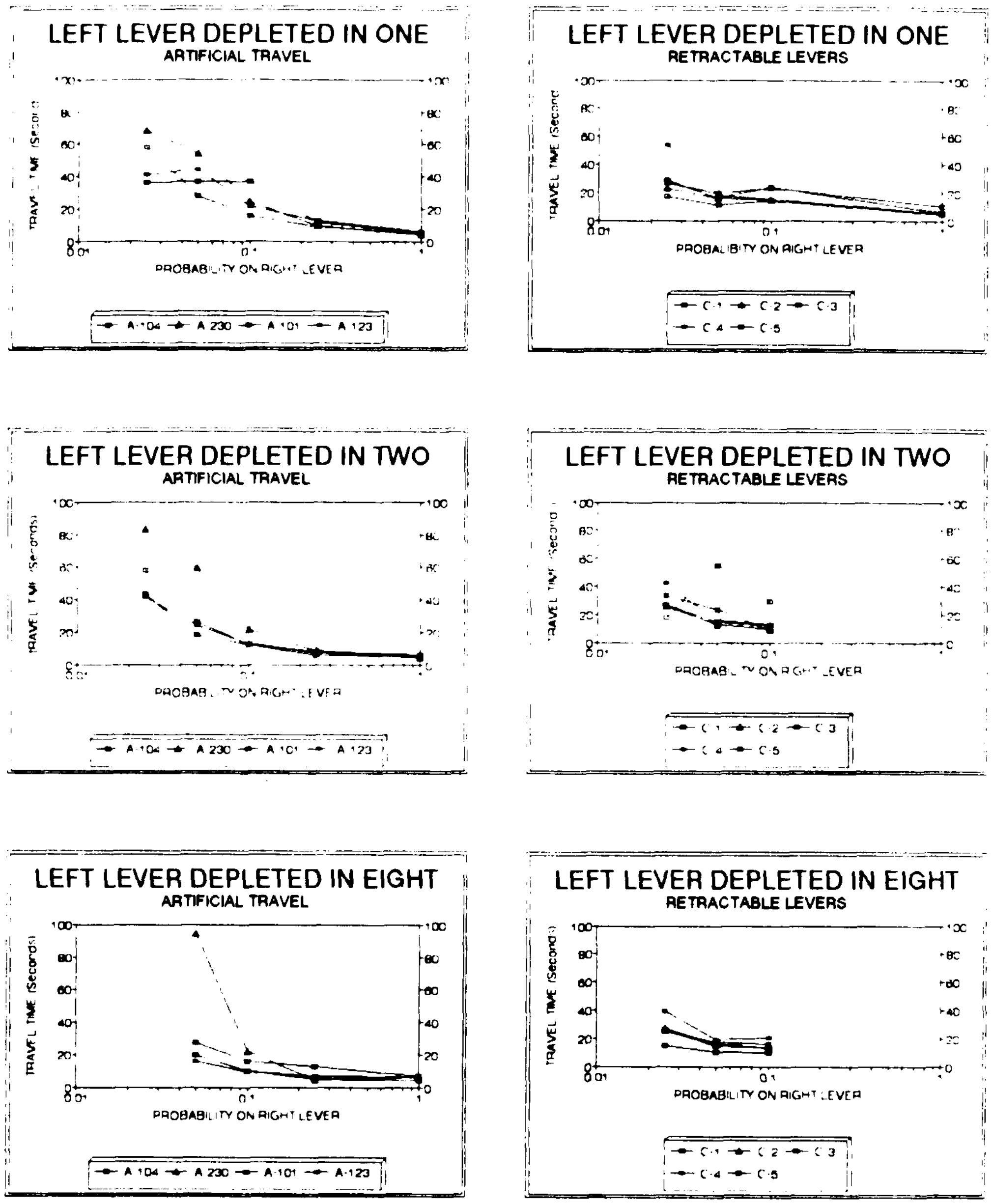

35cm
Lever

Figure 2. The experimental situation adapted to run the natural travel condition.

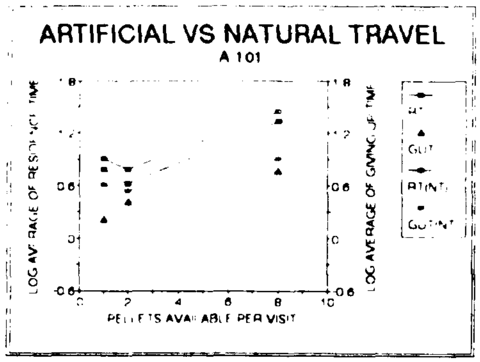

W 51cm

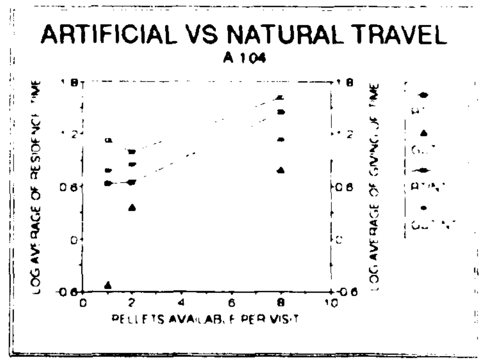
Figure 3. The BWMs of travel time (Y-axis) against the reset-probabilities on the right lever (logarithmic X-axis) for the depleted in 1-, 2-, and 8-prey conditions. The left-hand panels show results of Experiment 1, and the right-hand panels results of Experiment 2. The subjects are indicated by different symbols.

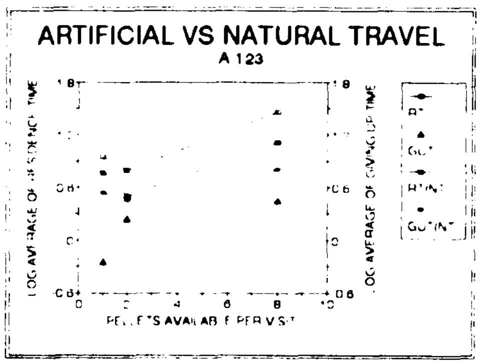

LEFT LEVER DEPLETED IN ONE
ARTIFICIAL TRAVEL
PROBABILITY ON RIGHT LEVER
A-104 A-230 A-101 A-123
LEFT LEVER DEPLETED IN ONE
RETRACTABLE LEVERS
TRAVEL TIME (Seconds)
PROBABILITY ON RIGHT LEVER
C-1 C-2 C-3
C-4 C-5
LEFT LEVER DEPLETED IN TWO
ARTIFICIAL TRAVEL
A-104 A-230 A-101 A-123
LEFT LEVER DEPLETED IN TWO
RETRACTABLE LEVERS
C-1 C-2 C-3
C-4 C-5
LEFT LEVER DEPLETED IN EIGHT
ARTIFICIAL TRAVEL
TRAVEL TIME (Seconds)
PROBABILITY ON RIGHT LEVER
A-104 A-230 A-101 A-123
LEFT LEVER DEPLETED IN EIGHT
RETRACTABLE LEVERS
TRAVEL TIME (Seconds)
PROBABILITY ON RIGHT LEVER
C-1 C-2 C-3
C-4 C-5

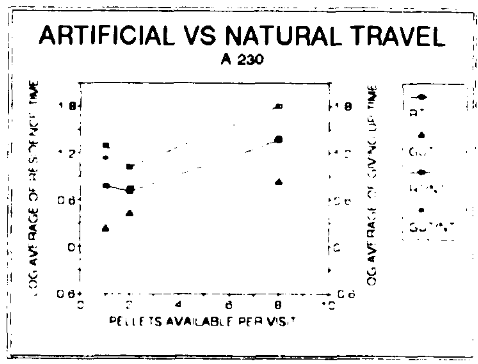
3

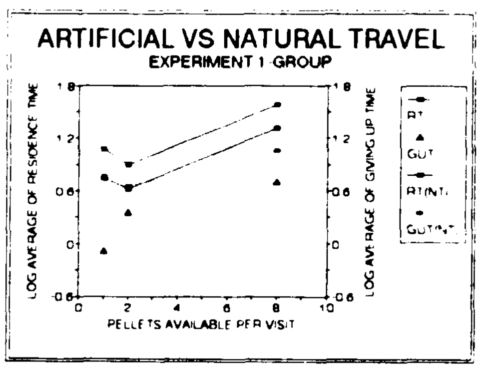
Figure 4. The arithmetic means of residence and giving-up times (Y-axes) against the number of available pellets in the patch (X-axis). The filled squares indicate the residence times produced by artificial travel requirements. The empty squares represent residence times produced by the natural travel condition. The filled triangles symbolize the giving-up times produced by the artificial travel conditions. The asterisks represent the giving-up times produced by the natural travel condition. The bottom panel shows the data averaged across subjects.


ARTIFICIAL VS NATURAL TRAVEL
A 101


ARTIFICIAL VS NATURAL TRAVEL
A 104

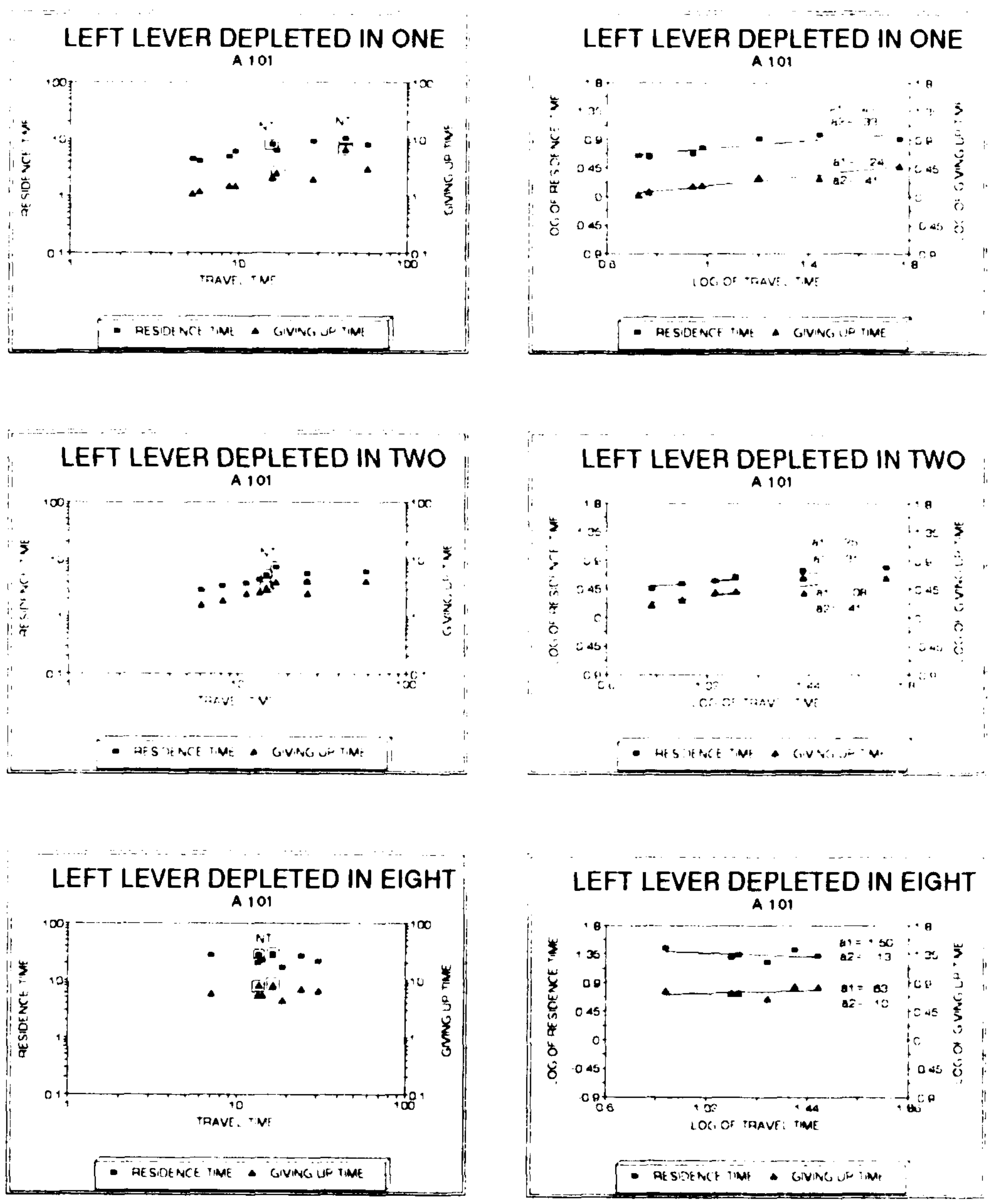

ARTIFICIAL VS NATURAL TRAVEL
A 123


ARTIFICIAL VS NATURAL TRAVEL
A 230


ARTIFICIAL VS NATURAL TRAVEL
EXPERIMENT 1 GROUP
LOG AVERAGE OF RESIDENCE TIME
LOG AVERAGE OF GIVING UP TIME
PELLETS AVAILABLE PER VISIT

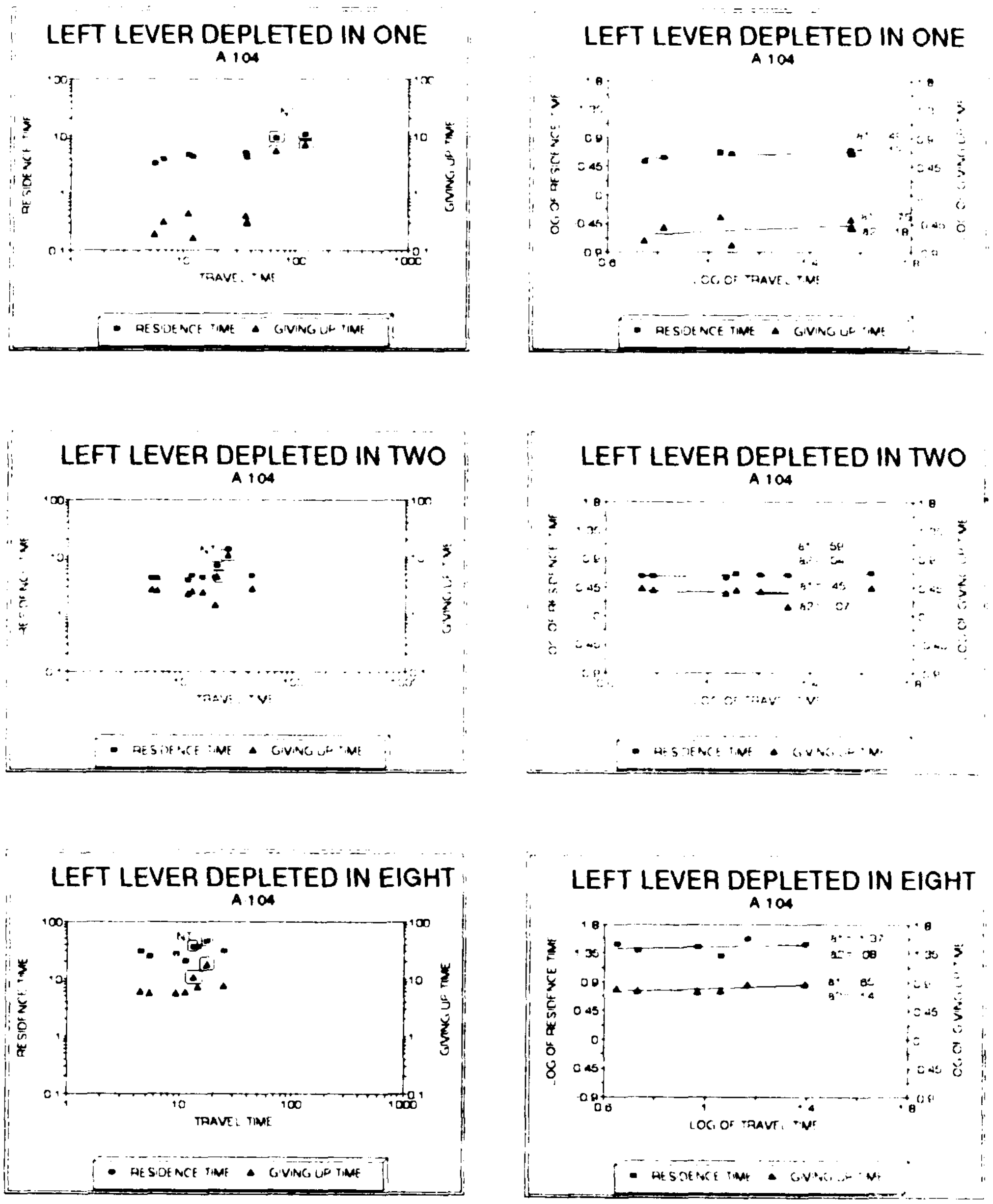
4

Figure 5. For subject A-101, the left-hand panels show the residence and giving-up times (logarithmic Y-axes) against the travel times (logarithmic X-axis). The natural travel results are enclosed in boxes. The right-hand panels show the regression lines for residence and giving-up times. The logarithmic values of residence and giving-up times (Y-axes) are plotted against those of travel times (X-axis). The filled squares indicate residence times, and filled triangles giving-up times. The coefficients a1 (Y-intercept), and a2 (slope) are included near each regression line. Results from the natural travel condition are not included.


LEFT LEVER DEPLETED IN ONE
A 101
TRAVEL TIME
RESIDENCE TIME
GIVING UP TIME
LEFT LEVER DEPLETED IN ONE
A 101
LOG OF TRAVEL TIME
RESIDENCE TIME
GIVING UP TIME
LEFT LEVER DEPLETED IN TWO
A 101
LEFT LEVER DEPLETED IN TWO
A 101
LEFT LEVER DEPLETED IN EIGHT
A 101
RESIDENCE TIME
GIVING UP TIME
TRAVEL TIME
RESIDENCE TIME
GIVING UP TIME
LEFT LEVER DEPLETED IN EIGHT
A 101
LOG OF RESIDENCE TIME
LOG OF GIVING UP TIME
LOG OF TRAVEL TIME
RESIDENCE TIME
GIVING UP TIME

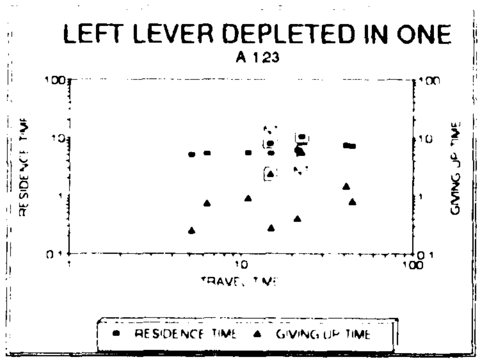
5

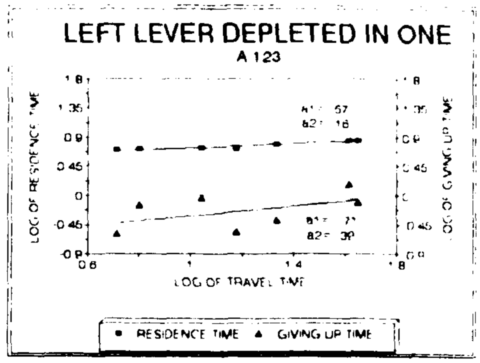
Figure 6. For subject A-104, the left-hand panels show the residence and giving-up times (logarithmic Y-axes) against the travel times (logarithmic X-axis). The natural travel results are enclosed in boxes. The right-hand panels show the regression lines for residence and giving-up times. The logarithmic values of residence and giving-up times (Y-axes) are plotted against those of travel times (X-axis). The filled squares indicate residence times, and filled triangles giving-up times. The coefficients a1 (Y-intercept), and a2 (slope) are included near each regression line. Results from the natural travel condition are not included.

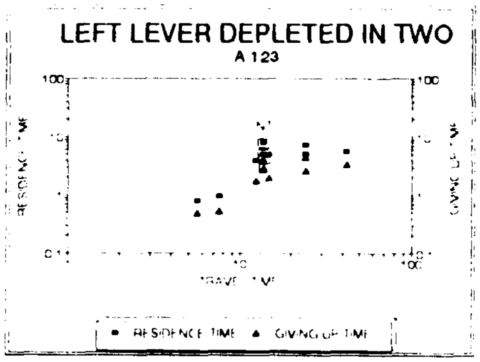

LEFT LEVER DEPLETED IN ONE
A 104
TRAVEL TIME
RESIDENCE TIME
GIVING UP TIME
LEFT LEVER DEPLETED IN ONE
A 104
LOG OF TRAVEL TIME
LEFT LEVER DEPLETED IN TWO
A 104
LEFT LEVER DEPLETED IN TWO
A 104
LEFT LEVER DEPLETED IN EIGHT
A 104
TRAVEL TIME
RESIDENCE TIME
GIVING UP TIME
LEFT LEVER DEPLETED IN EIGHT
A 104
LOG OF RESIDENCE TIME
LOG OF TRAVEL TIME

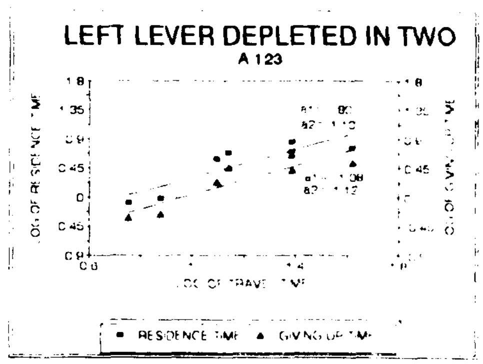
6

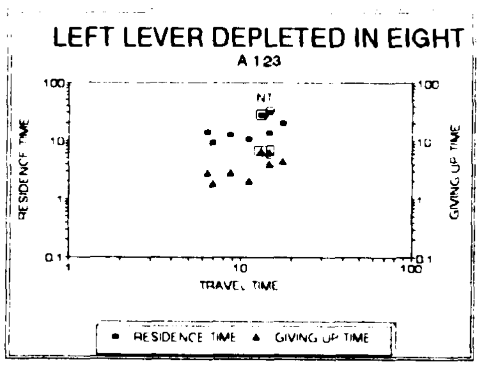
Figure 7. For subject A-123, the left-hand panels show the residence and giving-up times (logarithmic Y-axes) against the travel times (logarithmic X-axis). The natural travel results are enclosed in boxes. The right-hand panels show the regression lines for residence and giving-up times. The logarithmic values of residence and giving-up times (Y-axes) are plotted against those of travel times (X-axis). The filled squares indicate residence times, and filled triangles giving-up times. The coefficients a1 (Y-intercept), and a2 (slope) are included near each regression line. Results from the natural travel condition are not included.

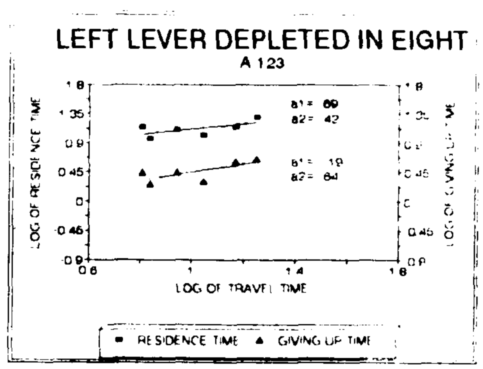

LEFT LEVER DEPLETED IN ONE
A 123
RESIDENCE TIME
GIVING UP TIME


LEFT LEVER DEPLETED IN ONE
A 123
LOG OF TRAVEL TIME
RESIDENCE TIME
GIVING UP TIME


LEFT LEVER DEPLETED IN TWO
A 123

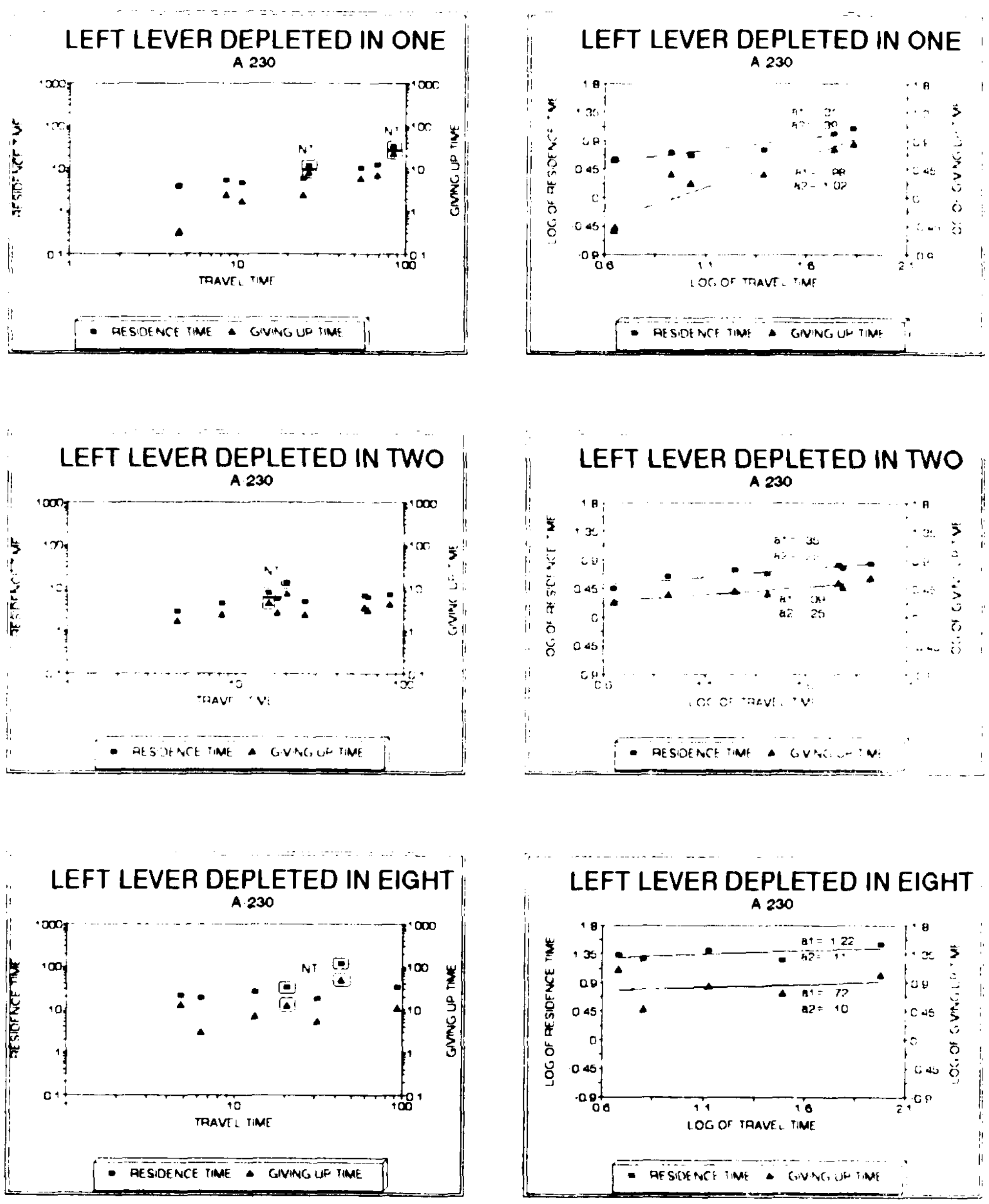

LEFT LEVER DEPLETED IN TWO
A 123
RESIDENCE TIME


LEFT LEVER DEPLETED IN EIGHT
A 123
TRAVEL TIME
RESIDENCE TIME
GIVING UP TIME


LEFT LEVER DEPLETED IN EIGHT
A 123
LOG OF TRAVEL TIME
LOG OF RESIDENCE TIME
RESIDENCE TIME
GIVING UP TIME

7

Figure 8. For subject A-230, the left-hand panels show the residence and giving-up times (logarithmic Y-axes) against the travel times (logarithmic X-axis). The natural travel results are enclosed in boxes. The right-hand panels show the regression lines for residence and giving-up times. The logarithmic values of residence and giving-up times (Y-axes) are plotted against those of travel times (X-axis). The filled squares indicate residence times, and filled triangles giving-up times. The coefficients a1 (Y-intercept), and a2 (slope) are included near each regression line. Results from the natural travel condition are not included.


LEFT LEVER DEPLETED IN ONE
A 230
TRAVEL TIME
RESIDENCE TIME
GIVING UP TIME
LEFT LEVER DEPLETED IN ONE
A 230
LOG OF RESIDENCE TIME
LOG OF TRAVEL TIME
RESIDENCE TIME
GIVING UP TIME
LEFT LEVER DEPLETED IN TWO
A 230
RESIDENCE TIME
GIVING UP TIME
LEFT LEVER DEPLETED IN TWO
A 230
LOG OF RESIDENCE TIME
RESIDENCE TIME
LEFT LEVER DEPLETED IN EIGHT
A 230
RESIDENCE TIME
GIVING UP TIME
TRAVEL TIME
RESIDENCE TIME
GIVING UP TIME
LEFT LEVER DEPLETED IN EIGHT
A 230
LOG OF RESIDENCE TIME
LOG OF TRAVEL TIME
RESIDENCE TIME
GIVING UP TIME

8

Figure 9. The logarithmic residuals of residence and giving-up time for natural travel divided by the standard errors of residence and giving-up time estimated for artificial travel requirements (Y-axes) against the number of available pellets per visit (X-axis). The Y-axis shows the number of standard error units that residence and giving-up time deviated from estimates based on the regression analysis. The filled squares indicate residence times, the triangles giving-up times, the empty squares re-determinations of residence time, and the Xs re-determinations of giving-up time.

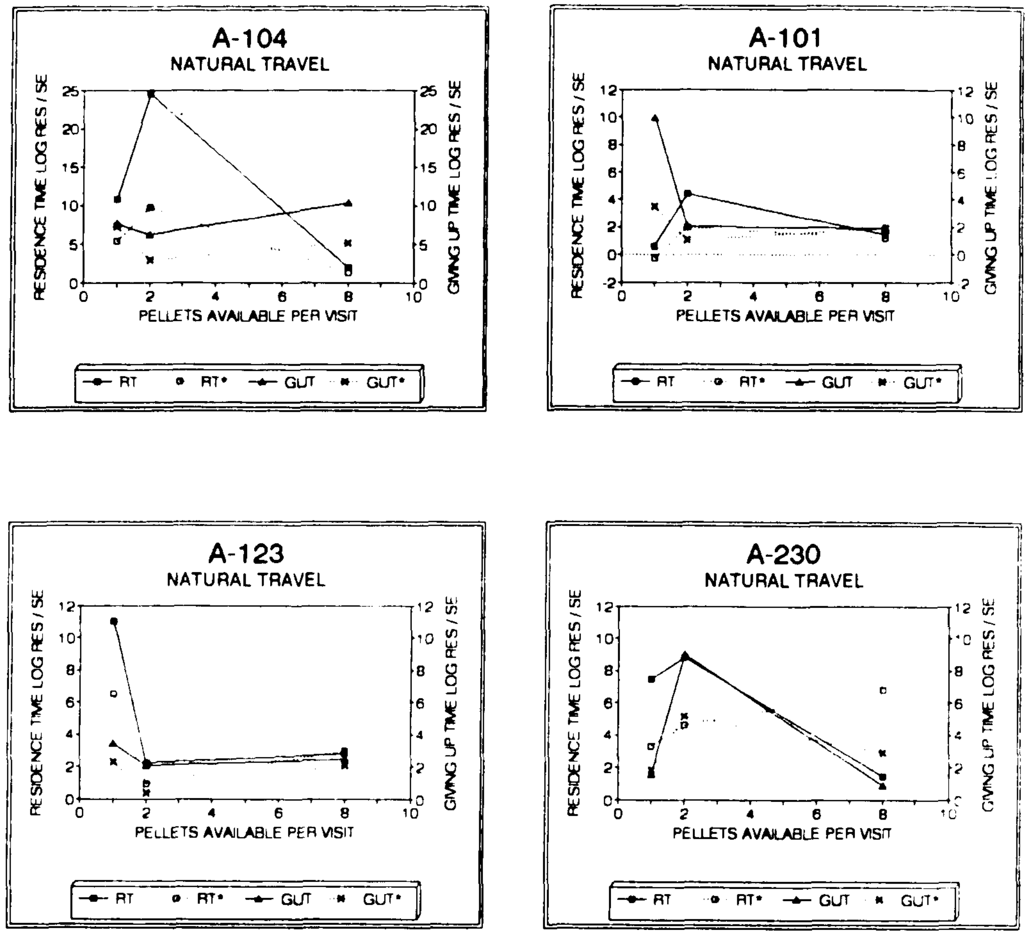
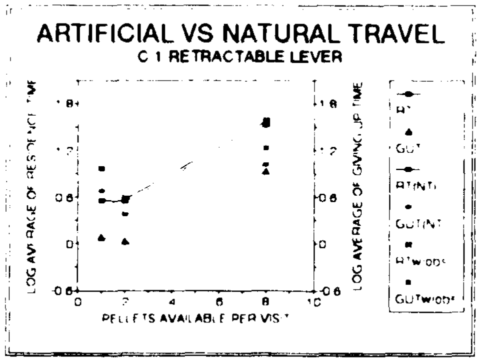
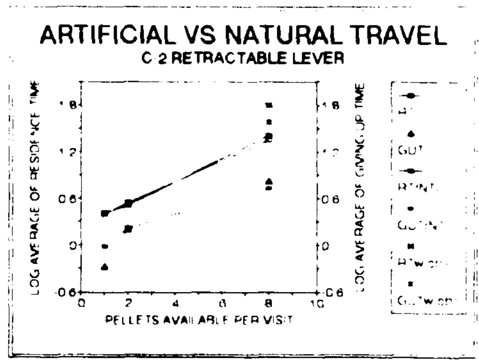
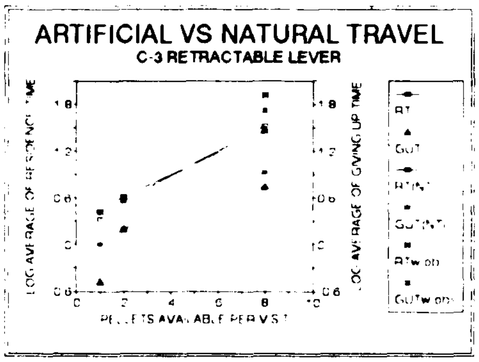
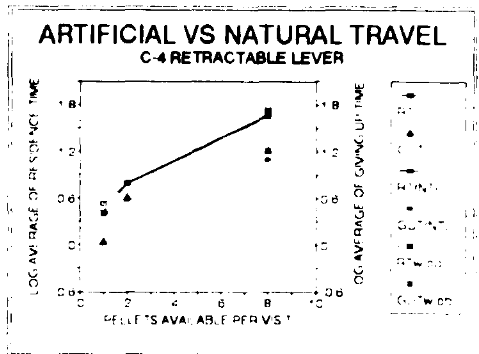

A-104
NATURAL TRAVEL
RESIDENCE TIME LOG RES / SE
GIVING UP TIME LOG RES / SE
PELLETS AVAILABLE PER VISIT
RT
RT*
GUT
GUT*
A-101
NATURAL TRAVEL
A-123
NATURAL TRAVEL
A-230
NATURAL TRAVEL

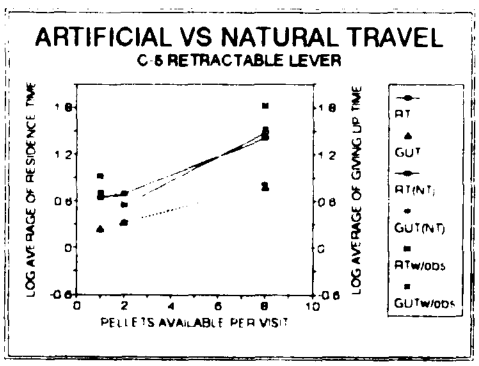
Figure 10. The arithmetic means of residence and giving-up times (Y-axes) against the number of available pellets in the patch (X-axis). The filled squares indicate the residence times produced by artificial travel requirements. The empty squares represent residence times produced by the natural travel condition. The filled triangles symbolize the giving-up times produced by the artificial travel conditions. The asterisks represent the giving-up times produced by the natural travel condition. The Xs indicate residence and giving-up times produced by natural travel with obstacles. The right-hand bottom panel shows the data averaged across subjects.

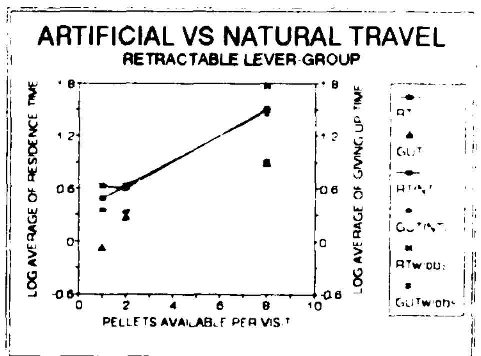

ARTIFICIAL VS NATURAL TRAVEL
C-1 RETRACTABLE LEVER
PELLETS AVAILABLE PER VISIT


ARTIFICIAL VS NATURAL TRAVEL
C-2 RETRACTABLE LEVER
LOG AVERAGE OF RESIDENCE TIME
PELLETS AVAILABLE PER VISIT
LOG AVERAGE OF GIVING UP TIME


ARTIFICIAL VS NATURAL TRAVEL
C-3 RETRACTABLE LEVER
LOG AVERAGE OF GIVING UP TIME

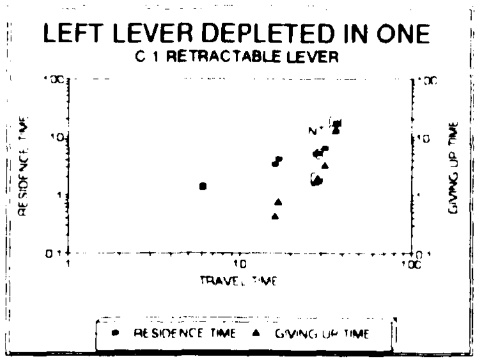

ARTIFICIAL VS NATURAL TRAVEL
C-4 RETRACTABLE LEVER
PELLETS AVAILABLE PER VISIT

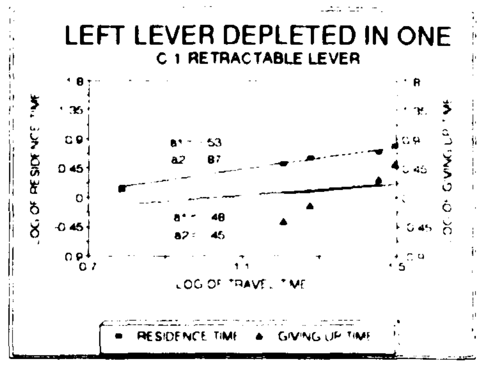

ARTIFICIAL VS NATURAL TRAVEL
C-5 RETRACTABLE LEVER
LOG AVERAGE OF RESIDENCE TIME
1.8
1.2
0.6
0
-0.6
0
2
4
6
8
10
PELLETS AVAILABLE PER VISIT
1.8
1.2
0.6
0
-0.6
LOG AVERAGE OF GIVING UP TIME
RT
GUT
RT(NT)
GUT(NT)
RTw/obs
GUTw/obs

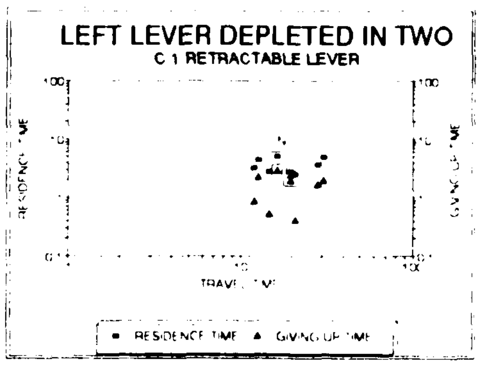

ARTIFICIAL VS NATURAL TRAVEL
RETRACTABLE LEVER GROUP
LOG AVERAGE OF RESIDENCE TIME
1.2
0.6
0
-0.6
0
2
4
6
8
10
PELLETS AVAILABLE PER VISIT
0.6
0
-0.6
LOG AVERAGE OF GIVING UP TIME
RTw/obs

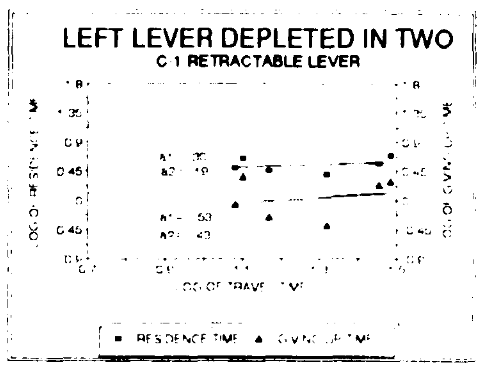
10

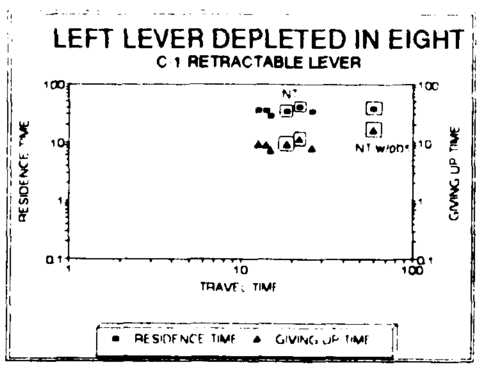
Figure 11. For subject C-1, the left-hand panels show the residence and giving-up times (logarithmic Y-axes) against the travel times (logarithmic X-axis). The natural travel results are enclosed in boxes. The right-hand panels show the regression lines for residence and giving-up times. The logarithmic values of residence and giving-up times (Y-axes) are plotted against those of travel times (X-axis). The filled squares indicate residence times, and filled triangles giving-up times. The coefficients a1 (Y-intercept), and a2 (slope) are included near each regression line. Results from the natural travel condition are not included.

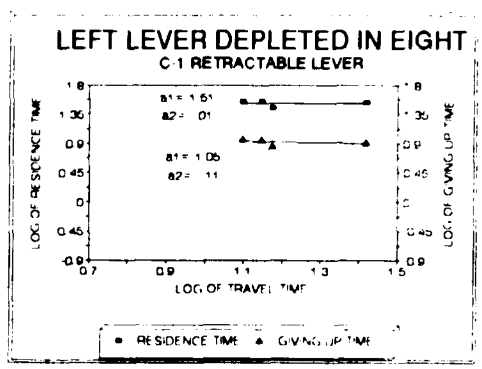

LEFT LEVER DEPLETED IN ONE
C 1 RETRACTABLE LEVER
RESIDENCE TIME
GIVING UP TIME
TRAVEL TIME
RESIDENCE TIME ▲ GIVING UP TIME


LEFT LEVER DEPLETED IN ONE
C 1 RETRACTABLE LEVER
LOG OF RESIDENCE TIME
LOG OF GIVING UP TIME
LOG OF TRAVEL TIME
RESIDENCE TIME ▲ GIVING UP TIME


LEFT LEVER DEPLETED IN TWO
C 1 RETRACTABLE LEVER
RESIDENCE TIME ▲ GIVING UP TIME

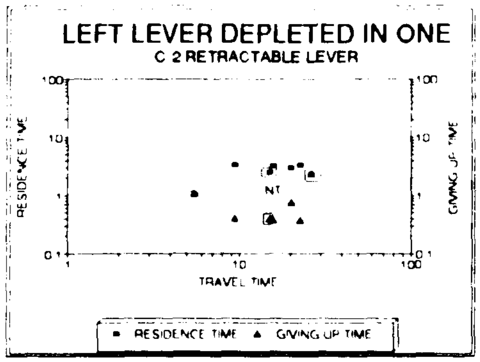

LEFT LEVER DEPLETED IN TWO
C 1 RETRACTABLE LEVER
RESIDENCE TIME ▲ GIVING UP TIME

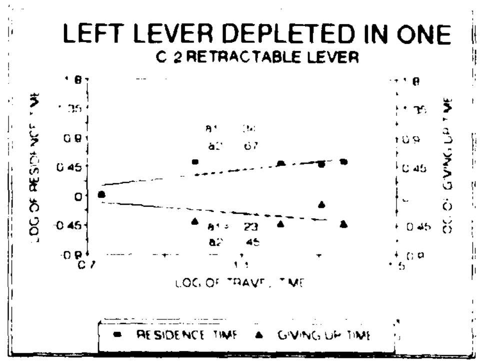

LEFT LEVER DEPLETED IN EIGHT
C 1 RETRACTABLE LEVER
RESIDENCE TIME
GIVING UP TIME
TRAVEL TIME
RESIDENCE TIME ▲ GIVING UP TIME

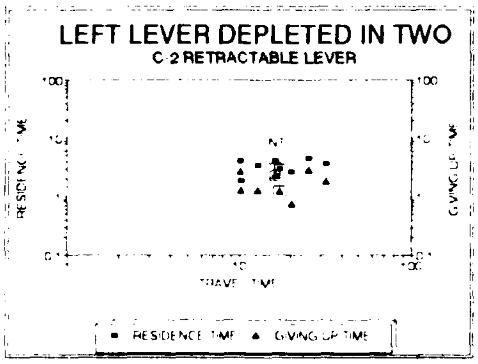

LEFT LEVER DEPLETED IN EIGHT
C 1 RETRACTABLE LEVER
LOG OF RESIDENCE TIME
LOG OF GIVING UP TIME
LOG OF TRAVEL TIME
RESIDENCE TIME ▲ GIVING UP TIME

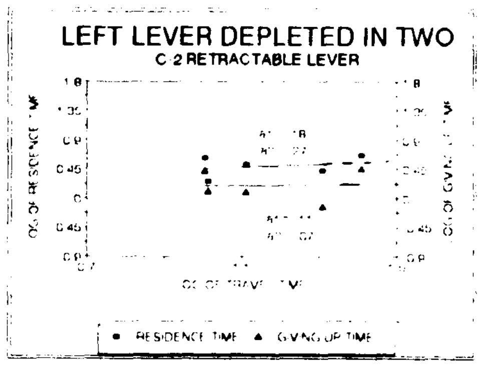
11

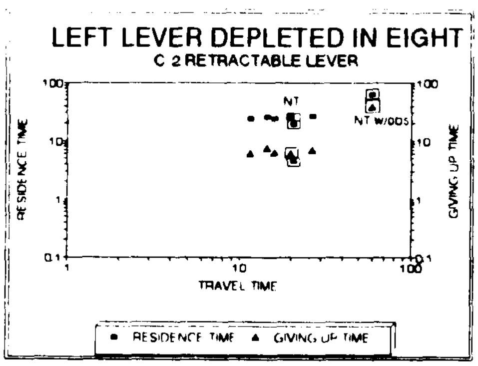
Figure 12. For subject C-2, the left-hand panels show the residence and giving-up times (logarithmic Y-axes) against the travel times (logarithmic X-axis). The natural travel results are enclosed in boxes. The right-hand panels show the regression lines for residence and giving-up times. The logarithmic values of residence and giving-up times (Y-axes) are plotted against those of travel times (X-axis). The filled squares indicate residence times, and filled triangles giving-up times. The coefficients a1 (Y-intercept), and a2 (slope) are included near each regression line. Results from the natural travel condition are not included.

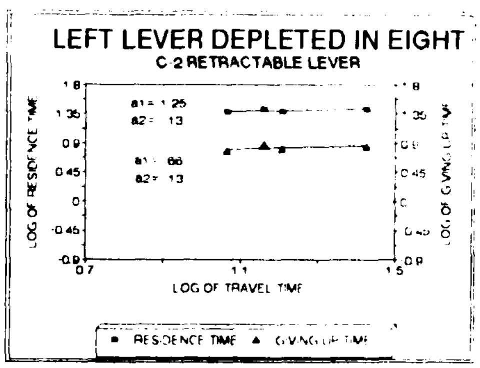

LEFT LEVER DEPLETED IN ONE
C-2 RETRACTABLE LEVER
NT
TRAVEL TIME
RESIDENCE TIME
GIVING UP TIME


LEFT LEVER DEPLETED IN ONE
C-2 RETRACTABLE LEVER
LOG OF RESIDENCE TIME
LOG OF TRAVEL TIME
RESIDENCE TIME
GIVING UP TIME


LEFT LEVER DEPLETED IN TWO
C-2 RETRACTABLE LEVER
NT
RESIDENCE TIME
GIVING UP TIME

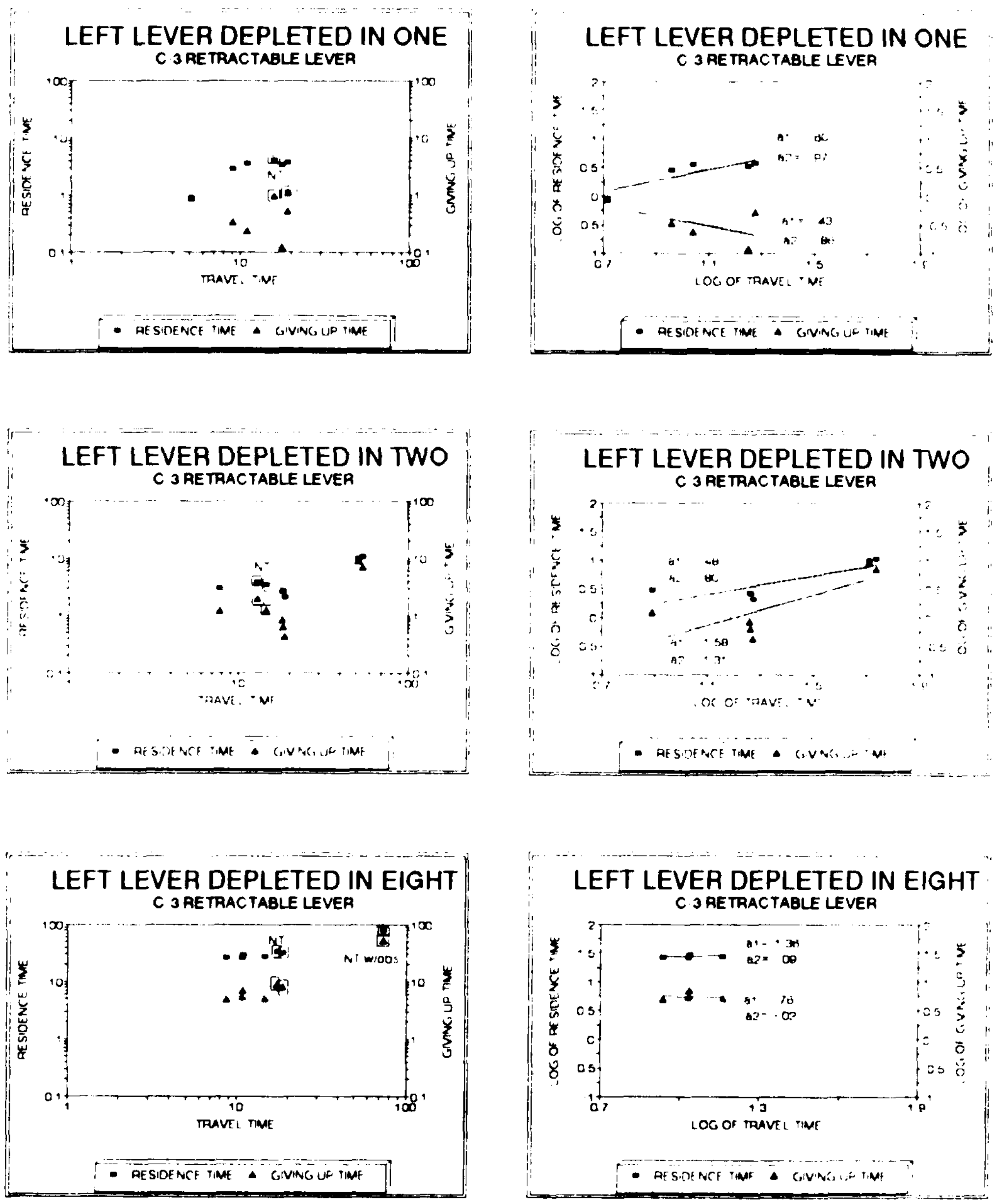

LEFT LEVER DEPLETED IN TWO
C-2 RETRACTABLE LEVER
RESIDENCE TIME
GIVING UP TIME


LEFT LEVER DEPLETED IN EIGHT
C-2 RETRACTABLE LEVER
NT
NT W/ODS
RESIDENCE TIME
GIVING UP TIME
TRAVEL TIME
RESIDENCE TIME
GIVING UP TIME


LEFT LEVER DEPLETED IN EIGHT
C-2 RETRACTABLE LEVER
LOG OF RESIDENCE TIME
LOG OF GIVING UP TIME
LOG OF TRAVEL TIME
RESIDENCE TIME
GIVING UP TIME

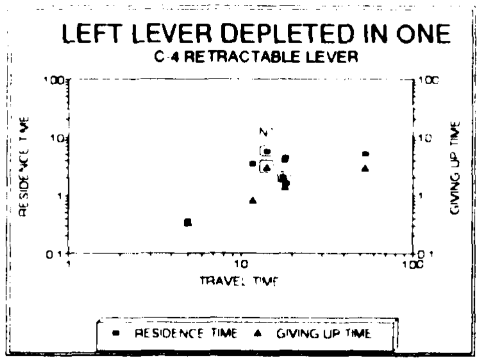
12

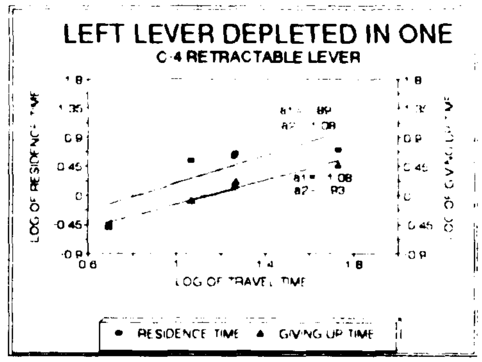
Figure 13. For subject C-3, the left-hand panels show the residence and giving-up times (logarithmic Y-axes) against the travel times (logarithmic X-axis). The natural travel results are enclosed in boxes. The right-hand panels show the regression lines for residence and giving-up times. The logarithmic values of residence and giving-up times (Y-axes) are plotted against those of travel times (X-axis). The filled squares indicate residence times, and filled triangles giving-up times. The coefficients a1 (Y-intercept), and a2 (slope) are included near each regression line. Results from the natural travel condition are not included.

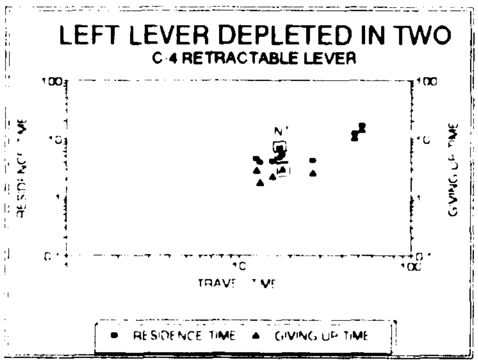

LEFT LEVER DEPLETED IN ONE
C 3 RETRACTABLE LEVER
TRAVEL TIME
RESIDENCE TIME
GIVING UP TIME
LEFT LEVER DEPLETED IN ONE
C 3 RETRACTABLE LEVER
LOG OF TRAVEL TIME
RESIDENCE TIME
GIVING UP TIME
LEFT LEVER DEPLETED IN TWO
C 3 RETRACTABLE LEVER
TRAVEL TIME
RESIDENCE TIME
GIVING UP TIME
LEFT LEVER DEPLETED IN TWO
C 3 RETRACTABLE LEVER
LOG OF TRAVEL TIME
RESIDENCE TIME
GIVING UP TIME
LEFT LEVER DEPLETED IN EIGHT
C 3 RETRACTABLE LEVER
TRAVEL TIME
RESIDENCE TIME
GIVING UP TIME
NT W/ODS
LEFT LEVER DEPLETED IN EIGHT
C 3 RETRACTABLE LEVER
LOG OF TRAVEL TIME
LOG OF RESIDENCE TIME
LOG OF GIVING UP TIME
RESIDENCE TIME
GIVING UP TIME

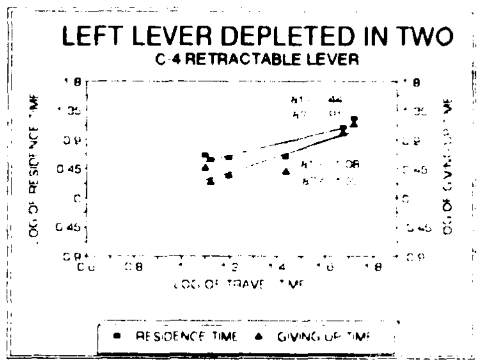
13

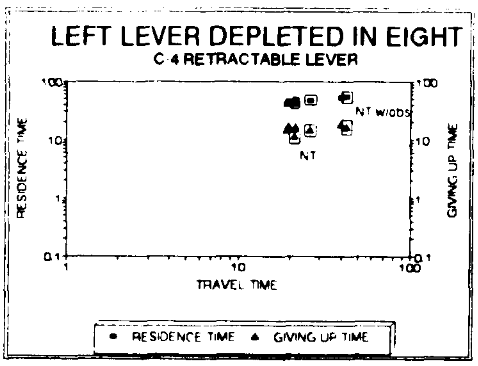
Figure 14. For subject C-4, the left-hand panels show the residence and giving-up times (logarithmic Y-axes) against the travel times (logarithmic X-axis). The natural travel results are enclosed in boxes. The right-hand panels show the regression lines for residence and giving-up times. The logarithmic values of residence and giving-up times (Y-axes) are plotted against those of travel times (X-axis). The filled squares indicate residence times, and filled triangles giving-up times. The coefficients a1 (Y-intercept), and a2 (slope) are included near each regression line. Results from the natural travel condition are not included.

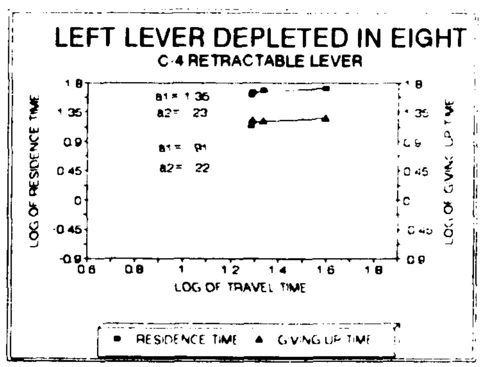

LEFT LEVER DEPLETED IN ONE
C-4 RETRACTABLE LEVER
100
10
1
0.1
10
100
TRAVEL TIME
GIVING UP TIME
RESIDENCE TIME ▲ GIVING UP TIME


LEFT LEVER DEPLETED IN ONE
C-4 RETRACTABLE LEVER
LOG OF RESIDENCE TIME
LOG OF TRAVEL TIME
RESIDENCE TIME ▲ GIVING UP TIME


LEFT LEVER DEPLETED IN TWO
C-4 RETRACTABLE LEVER
100
RESIDENCE TIME ▲ GIVING UP TIME

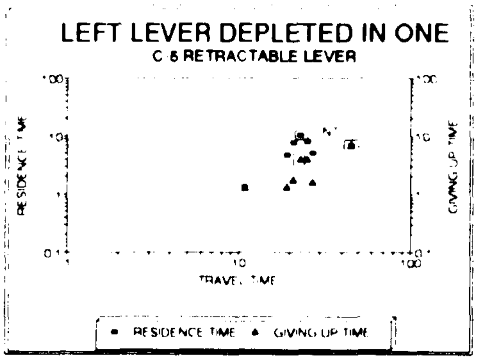

LEFT LEVER DEPLETED IN TWO
C-4 RETRACTABLE LEVER
RESIDENCE TIME ▲ GIVING UP TIME

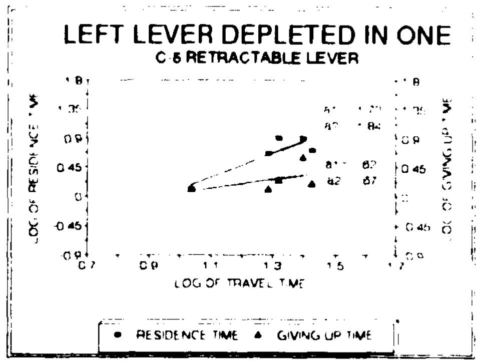

LEFT LEVER DEPLETED IN EIGHT
C-4 RETRACTABLE LEVER
100
10
1
0.1
NT W/ODS
NT
RESIDENCE TIME
GIVING UP TIME
TRAVEL TIME
RESIDENCE TIME ▲ GIVING UP TIME

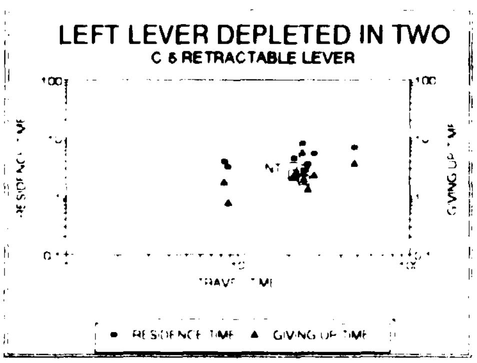

LEFT LEVER DEPLETED IN EIGHT
C-4 RETRACTABLE LEVER
B1 = 1.36
B2 = 23
B1 = .91
B2 = 22
LOG OF RESIDENCE TIME
LOG OF TRAVEL TIME
RESIDENCE TIME ▲ GIVING UP TIME

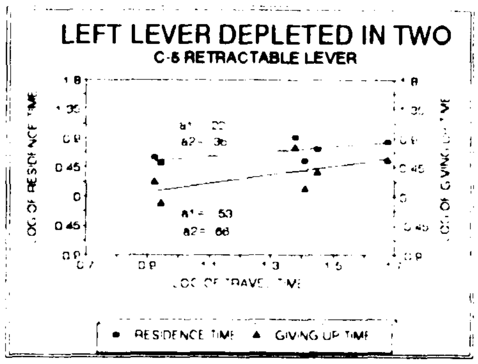
14

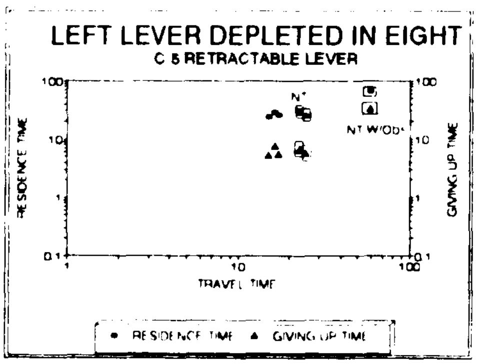
Figure 15. For subject C-5, the left-hand panels show the residence and giving-up times (logarithmic Y-axes) against the travel times (logarithmic X-axis). The natural travel results are enclosed in boxes. The right-hand panels show the regression lines for residence and giving-up times. The logarithmic values of residence and giving-up times (Y-axes) are plotted against those of travel times (X-axis). The filled squares indicate residence times, and filled triangles giving-up times. The coefficients a1 (Y-intercept), and a2 (slope) are included near each regression line. Results from the natural travel condition are not included.

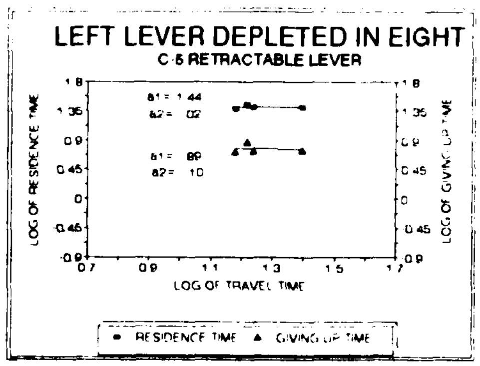

LEFT LEVER DEPLETED IN ONE
C-5 RETRACTABLE LEVER
RESIDENCE TIME
GIVING UP TIME
TRAVEL TIME


LEFT LEVER DEPLETED IN ONE
C-5 RETRACTABLE LEVER
LOG OF RESIDENCE TIME
LOG OF GIVING UP TIME
LOG OF TRAVEL TIME
RESIDENCE TIME
GIVING UP TIME


LEFT LEVER DEPLETED IN TWO
C-5 RETRACTABLE LEVER
RESIDENCE TIME
GIVING UP TIME

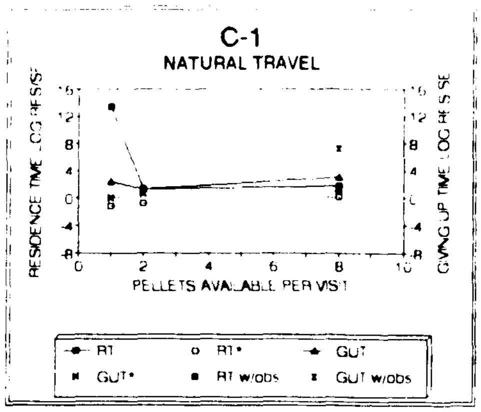

LEFT LEVER DEPLETED IN TWO
C-5 RETRACTABLE LEVER
LOG OF RESIDENCE TIME
RESIDENCE TIME
GIVING UP TIME

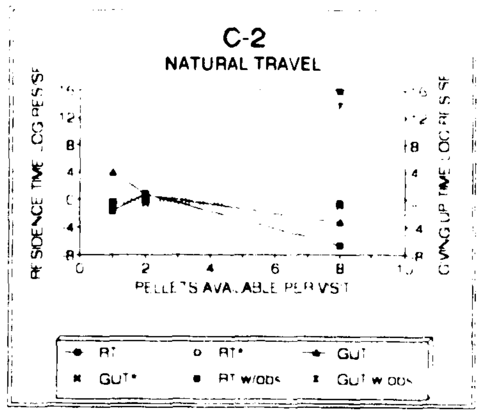

LEFT LEVER DEPLETED IN EIGHT
C-5 RETRACTABLE LEVER
RESIDENCE TIME
GIVING UP TIME
TRAVEL TIME
RESIDENCE TIME
GIVING UP TIME

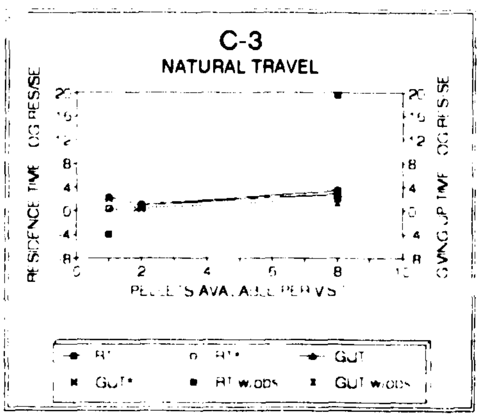

LEFT LEVER DEPLETED IN EIGHT
C-5 RETRACTABLE LEVER
LOG OF RESIDENCE TIME
LOG OF GIVING UP TIME
LOG OF TRAVEL TIME
RESIDENCE TIME
GIVING UP TIME

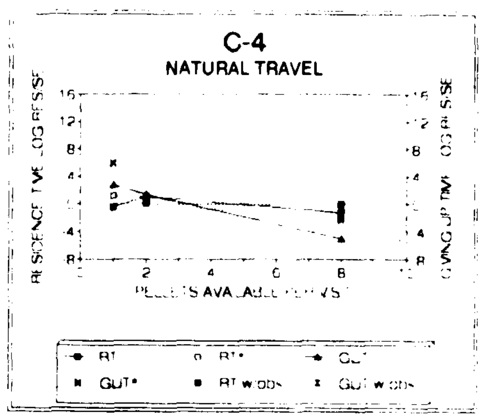
15

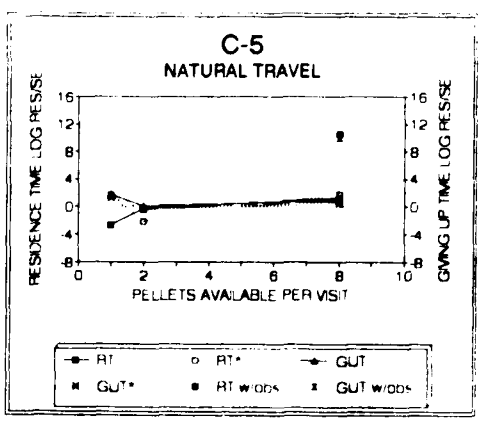
Figure 16. The logarithmic residuals of residence and giving-up time for natural travel divided by the standard errors of residence and giving-up time estimated for artificial travel requirements (Y-axes) against the number of available pellets per visit (X-axis). The Y-axis shows the number of standard error units that residence and giving-up time deviated from estimates based on the regression analysis. The filled squares indicate residence times, the triangles giving-up times, the empty squares re-determinations of residence time, and the X re-determinations of giving-up time. The results of natural travel with obstacles are indicated with different symbols.


C-1
NATURAL TRAVEL
RT
RT*
GUT
GUT*
RT w/obs
GUT w/obs


C-2
NATURAL TRAVEL

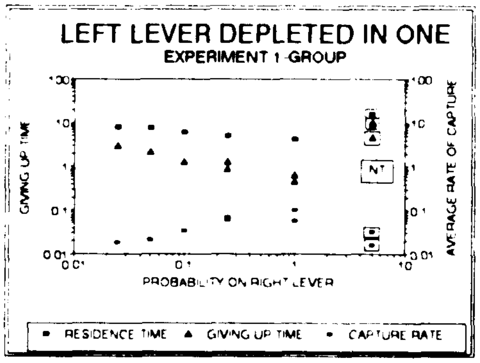

C-3
NATURAL TRAVEL

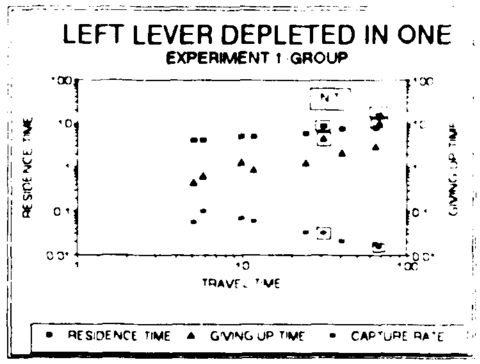

C-4
NATURAL TRAVEL

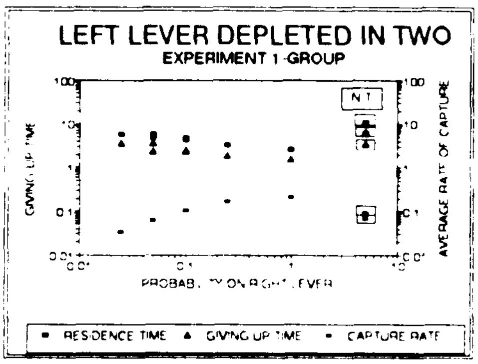

C-5
NATURAL TRAVEL
RESIDENCE TIME LOG RES/SE
GIVING UP TIME LOG RES/SE
PELLETS AVAILABLE PER VISIT
RT
RT*
GUT
GUT*
RT w/obs
GUT w/obs

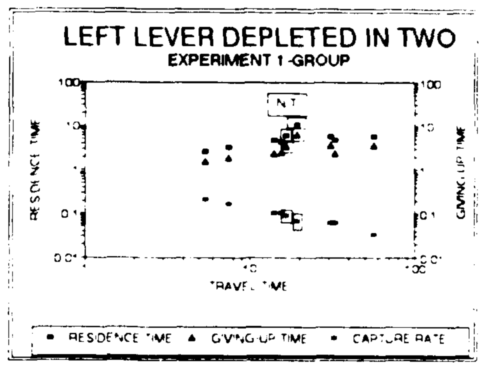
16

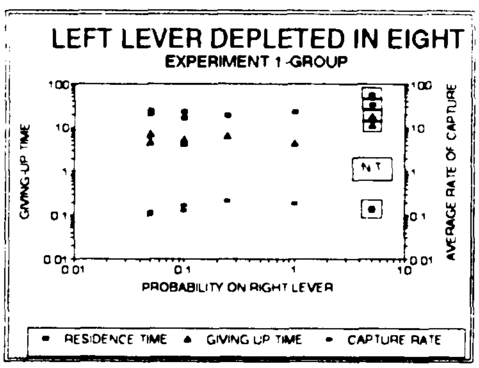
Figure 17. In the right-hand graphs, for Experiment 1 the group means of residence time, giving-up time, and average rate of capture (Y-axes) are plotted against the group mean of travel time (X-axis). The filled squares represent the group means of residence time, the triangles the group means of giving-up time, and the asterisks the group means of the average rate of capture. Natural travel results are enclosed in boxes. In the left-hand panels, the group means of residence time, giving-up time, and average rate of capture (Y-axes) are plotted against the probability on the right lever (X-axis) to facilitate comparisons between natural travel and artificial travel requirements.

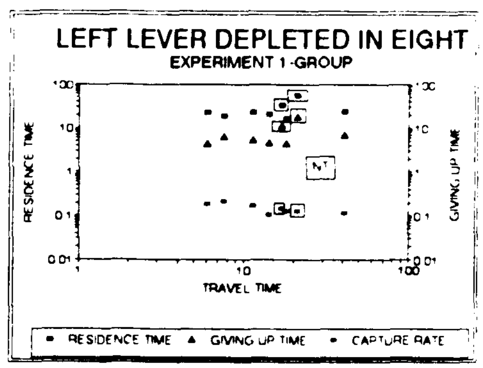

LEFT LEVER DEPLETED IN ONE
EXPERIMENT 1 -GROUP
GIVING UP TIME
AVERAGE RATE OF CAPTURE
N T
PROBABILITY ON RIGHT LEVER
RESIDENCE TIME
GIVING UP TIME
CAPTURE RATE


LEFT LEVER DEPLETED IN ONE
EXPERIMENT 1 GROUP
RESIDENCE TIME
GIVING UP TIME
N T
TRAVEL TIME
RESIDENCE TIME
GIVING UP TIME
CAPTURE RATE


LEFT LEVER DEPLETED IN TWO
EXPERIMENT 1 -GROUP
GIVING UP TIME
AVERAGE RATE OF CAPTURE
N T
PROBABILITY ON RIGHT LEVER
RESIDENCE TIME
GIVING UP TIME
CAPTURE RATE

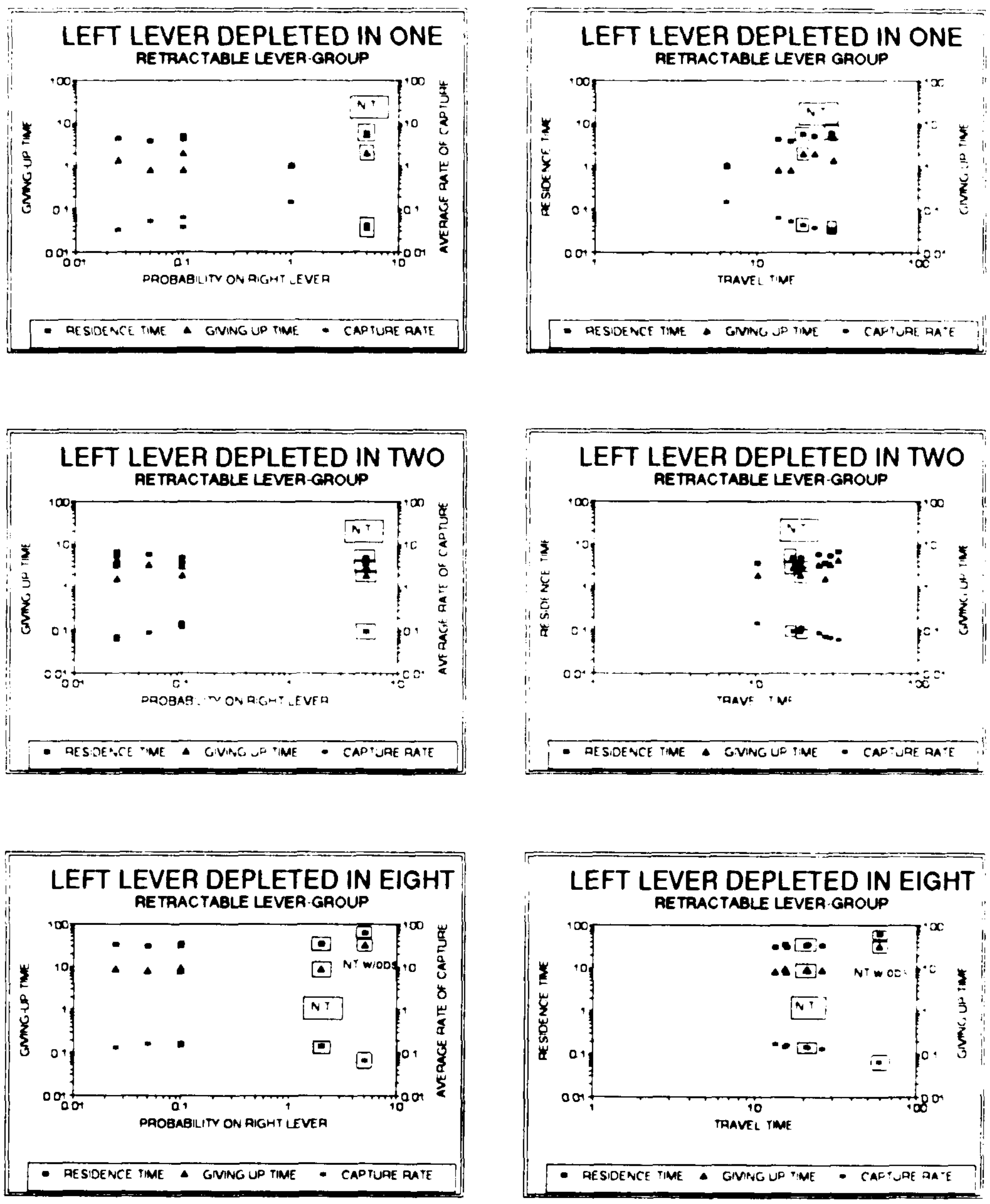

LEFT LEVER DEPLETED IN TWO
EXPERIMENT 1 -GROUP
RESIDENCE TIME
GIVING UP TIME
N T
TRAVEL TIME
RESIDENCE TIME
GIVING UP TIME
CAPTURE RATE


LEFT LEVER DEPLETED IN EIGHT
EXPERIMENT 1 -GROUP
GIVING-UP TIME
AVERAGE RATE OF CAPTURE
N T
PROBABILITY ON RIGHT LEVER
RESIDENCE TIME
GIVING UP TIME
CAPTURE RATE


LEFT LEVER DEPLETED IN EIGHT
EXPERIMENT 1 -GROUP
RESIDENCE TIME
GIVING UP TIME
N T
TRAVEL TIME
RESIDENCE TIME
GIVING UP TIME
CAPTURE RATE

17

Figure 18. In the right-hand graphs, for Experiment 2 the group means of residence time, giving-up time, and average rate of capture (Y-axes) are plotted against the group mean of travel time (X-axis). The filled squares represent the group means of residence time, the triangles the group means of giving-up time, and the asterisks the group means of the average rate of capture. Natural travel results are enclosed in boxes. In the left-hand panels, the group means of residence time, giving-up time, and average rate of capture (Y-axes) are plotted against the probability on the right lever (X-axis) to facilitate comparisons between natural travel and artificial travel requirements.


LEFT LEVER DEPLETED IN ONE
RETRACTABLE LEVER-GROUP
GIVING UP TIME
AVERAGE RATE OF CAPTURE
PROBABILITY ON RIGHT LEVER
NT
RESIDENCE TIME
GIVING UP TIME
CAPTURE RATE
LEFT LEVER DEPLETED IN ONE
RETRACTABLE LEVER GROUP
RESIDENCE TIME
GIVING UP TIME
TRAVEL TIME
LEFT LEVER DEPLETED IN TWO
RETRACTABLE LEVER-GROUP
LEFT LEVER DEPLETED IN TWO
RETRACTABLE LEVER-GROUP
LEFT LEVER DEPLETED IN EIGHT
RETRACTABLE LEVER-GROUP
NT W/ODS
PROBABILITY ON RIGHT LEVER
LEFT LEVER DEPLETED IN EIGHT
RETRACTABLE LEVER-GROUP
TRAVEL TIME

18

Table 1 Patch depleted in one prey, initial probability on left lever = .10

SUBJECT	CONDITION	PROBABILITY ON RIGHT LEVER	BISQUARE WEIGHTED MEANS TRAVEL TIME	RESIDENCE TIME	GIVING UP TIME	CAPTURE ACCURACY	ORDER	SESSIONS
A-104	NT	1.00	122.72	10.68	6.78	93%	1	10
		0.10	36.49	4.23	0.31	98%	2	14
		0.05	36.93	4.48	0.30	98%	3	16
		0.25	12.42	4.46	0.16	99%	4	16
	NT*	1.00	66.98	9.36	5.35	99%	5	16
		0.025	36.32	5.12	0.40	99%	6	16
	*	0.25	11.12	4.66	0.45	99%	7	10
		1.00	6.64	3.91	0.31	98%	8	10
	**	1.00	5.58	3.33	0.19	52%	9	11
A 230	NT	1.00	85.02	33.02	22.39	98%	1	10
		0.10	24.55	5.71	2.37	98%	2	14
		0.05	54.37	10.08	5.77	96%	3	16
		0.25	10.65	4.51	1.67	99%	4	16
	NT*	1.00	26.50	11.73	7.94	100%	5	16
		0.025	68.23	12.47	6.98	99%	6	16
	*	0.25	8.52	5.27	2.34	100%	7	10
		1.00	4.44	3.78	0.30	98%	8	10
	**	1.00	4.49	3.95	0.34	50%	9	11
A 101	NT	1.00	43.01	10.04	6.61	98%	1	10
		0.10	15.82	8.00	2.00	99%	2	14
		0.05	27.93	9.40	1.97	97%	3	16
		0.25	9.52	5.95	1.47	100%	4	16
	NT*	1.00	16.93	6.39	2.53	100%	5	16
		0.025	57.85	8.03	3.04	100%	6	16
	*	0.25	8.74	4.80	1.46	100%	7	10
		1.00	5.86	4.13	1.17	100%	8	10
	**	1.00	5.32	4.45	1.06	53%	9	11
A-123	NT	1.00	22.53	10.17	5.32	99%	1	10
		0.10	21.58	6.09	0.40	99%	2	14
		0.05	44.60	6.94	0.77	97%	3	16
		0.25	15.00	5.25	0.27	100%	4	16
	NT*	1.00	14.71	7.72	2.29	100%	5	16
		0.025	41.12	7.04	1.44	94%	6	16
	*	0.25	11.04	5.42	0.90	100%	7	10
		1.00	6.35	5.18	0.71	99%	8	10
	**	1.00	5.14	4.99	0.25	54%	9	11

* Re-determinations, **left lever from .10 went to .05 and then to 0

Table 2 Patch depleted in two preys. Initial probability on left lever = 1.0 (went to zero in steps of .5)

SUBJECT	CONDITION	PROBABILITY ON RIGHT LEVER	BISQUARE-WEIGHTED MEANS TRAVEL TIME	RESIDENCE TIME	GIVING UP TIME	CAPTURE ACCURACY	ORDER	SESSIONS
A-104		1.00	5.48	4.26	2.68	97%	1	10
		0.25	6.09	4.22	2.57	94%	2	10
		0.10	11.69	3.97	2.22	95%	3	10
		0.05	16.11	4.42	2.39	98%	4	10
	NT	1.00	26.38	13.92	10.67	100%	5	10
	*	0.05	20.57	4.29	1.41	100%	6	10
	*	0.10	12.92	4.74	2.53	98%	7	10
	NT*	1.00	21.34	6.84	4.56	100%	8	10
		0.025	43.38	4.63	2.73	100%	9	10
A 230		1.00	4.47	2.85	1.68	91%	1	10
		0.25	8.27	4.39	2.28	100%	2	10
		0.10	25.94	4.82	2.32	100%	3	10
		0.05	58.02	6.50	3.50	100%	4	10
	NT	1.00	20.22	13.59	7.32	100%	5	10
	*	0.05	61.18	5.95	2.93	100%	6	10
	*	0.10	17.77	5.50	2.62	97%	7	10
	NT*	1.00	15.67	7.68	4.36	100%	8	10
		0.025	83.10	6.87	4.09	100%	9	10
A 101		1.00	6.09	2.83	1.56	95%	1	10
		0.25	8.20	3.42	1.91	97%	2	10
		0.10	11.32	3.86	2.50	98%	3	10
		0.05	26.18	5.54	4.13	100%	4	10
	NT	1.00	17.11	7.10	3.93	98%	5	10
	*	0.05	26.36	4.02	2.46	100%	6	10
	*	0.10	13.70	4.41	2.55	100%	7	10
	NT*	1.00	15.05	5.17	3.09	100%	8	10
		0.025	58.14	6.09	4.13	100%	9	10
A 123		1.00	5.66	0.81	0.48	69%	1	10
		0.25	7.55	0.97	0.53	70%	2	10
		0.10	13.88	4.97	2.86	95%	3	10
		0.05	24.26	7.10	4.47	95%	4	10
	NT	1.00	13.87	7.98	4.12	97%	5	10
	*	0.05	24.25	5.04	2.58	100%	6	10
	*	0.10	12.49	3.92	1.73	100%	7	10
	NT*	1.00	14.87	4.83	1.98	100%	8	10
		0.025	41.99	5.65	3.32	97%	9	10

* Re-determinations

Table 3 . Patch depleted in eight preys. initial probability on left lever = 1.0 (went to zero in steps of .125)

SUBJECT	CONDITION	PROBABILITY ON RIGHT LEVER	BISQUARE-WEIGHTED MEANS TRAVEL TIME	RESIDENCE TIME	GIVING UP TIME	CAPTURE ACCURACY	ORDER	SESSIONS
A-104		1.00	4.50	30.26	6.04	79%	1	10
		0.10	11.54	20.79	5.77	67%	2	10
		0.25	5.38	24.61	5.65	83%	3	10
		0.05	24.83	30.29	7.40	88%	4	10
	NT	1.00	17.79	44.78	17.39	91%	5	10
	*	0.10	9.34	28.24	5.53	77%	6	10
	*	0.05	14.66	36.99	7.09	91%	7	10
	NT*	1.00	13.34	37.22	10.48	91%	8	10
A-230		1.00	6.37	18.57	3.00	63%	1	10
		0.10	31.09	18.04	5.38	55%	2	10
		0.25	4.81	21.88	12.83	80%	3	10
		0.05	94.29	32.04	10.38	95%	4	10
	NT	1.00	20.50	32.08	12.41	86%	5	10
	*	0.10	13.28	25.67	6.93	76%	6	10
**	NT*	1.00	42.90	120.40	48.10	87%	8	10
A-101		1.00	7.06	27.99	5.85	71%	1	10
		0.10	18.73	16.97	4.41	56%	2	10
		0.25	13.37	19.91	5.33	79%	3	10
		0.05	30.55	21.02	6.62	77%	4	10
	NT	1.00	16.49	28.87	8.10	88%	5	10
	*	0.10	14.23	21.87	5.42	82%	6	10
	*	0.05	24.38	26.35	6.94	86%	7	10
	NT*	1.00	13.56	28.11	7.99	91%	8	10
A-123		1.00	6.40	14.03	2.76	48%	1	10
		0.10	11.15	10.47	2.01	36%	2	10
		0.25	6.87	9.17	1.83	42%	3	10
		0.05	14.79	13.88	4.01	59%	4	10
	NT	1.00	13.31	27.75	6.57	97%	5	10
	*	0.10	8.71	12.78	2.77	49%	6	10
	*	0.05	17.76	20.20	4.49	68%	7	10
	NT*	1.00	14.75	30.39	6.34	84%	8	10

* Re-determinations, **A-230 sick (condition 7 miss).

Table 4 Patch depleted in one prey, initial probability on left lever = .10, retractable levers

SUBJECT	CONDITION	PROBABILITY ON RIGHT LEVER	BISQUARE-WEIGHTED MEANS TRAVEL TIME	RESIDENCE TIME	GIVING UP TIME	CAPTURE ACCURACY	ORDER	SESSIONS
		1.00	6.13	1.42	1.37	100%	1	10
C-1	NT	1.00	36.64	17.17	13.66	100%	2	18
		0.10	16.84	4.06	0.73	100%	3	10
	NT*	1.00	27.66	5.05	1.63	100%	4	15
	*	0.10	31.19	6.22	3.21	100%	5	19
		0.05	16.06	3.24	0.42	100%	6	10
		0.025	28.39	5.00	1.90	100%	7	10
C-2		1.00	5.47	1.06	1.05	100%	1	10
	NT	1.00	26.57	2.34	2.32	100%	2	18
		0.10	9.51	3.32	0.40	99%	3	10
	NT*	1.00	15.17	2.52	0.39	100%	4	15
	*	0.10	20.24	3.00	0.74	99%	5	19
		0.05	15.92	3.13	0.37	99%	6	10
		0.025	23.08	3.34	0.37	100%	7	10
C-3		1.00	5.17	0.89	0.87	100%	1	10
	NT	1.00	19.19	1.08	1.06	100%	2	18
		0.10	9.08	2.88	0.33	100%	3	10
	NT*	1.00	15.91	4.08	0.98	100%	4	15
	*	0.10	19.00	3.66	0.51	100%	5	19
		0.05	11.02	3.59	0.23	98%	6	10
		0.025	17.73	3.31	0.12	100%	7	10
C-4		1.00	4.99	0.35	0.33	100%	1	10
	NT	1.00	17.81	2.05	2.03	100%	2	18
		0.10	11.69	3.45	0.81	98%	3	10
	NT*	1.00	14.31	5.64	3.00	100%	4	15
	*	0.10	18.25	3.96	1.39	100%	5	19
		0.05	18.35	4.41	1.60	100%	6	10
		0.025	53.47	5.06	2.91	100%	7	10
C-5		1.00	10.89	1.30	1.28	100%	1	10
	NT	1.00	45.03	6.88	6.86	100%	2	18
		0.10	20.91	7.73	1.77	100%	3	10
	NT*	1.00	23.27	10.24	3.93	100%	4	15
	*	0.10	25.13	7.86	3.97	100%	5	19
		0.05	19.45	4.64	1.30	100%	6	10
		0.025	26.94	5.09	1.55	100%	7	10

* Re-determinations.

Table 5. Patch depleted in two preys, initial probability on left lever = 1.0 (to 0 in steps of .5), retractable levers

SUBJECT	CONDITION	PROBABILITY ON RIGHT LEVER	BISQUARE WEIGHTED MEANS TRAVEL TIME	RESIDENCE TIME	GIVING UP TIME	CAPTURE ACCURACY	ORDER	SESSIONS
C-1		0.10	12.71	4.42	2.24	97%	1	10
	*	0.10	12.10	3.12	0.86	98%	2	22
		0.05	14.79	2.82	0.53	99%	3	15
		0.025	20.92	2.47	0.41	97%	4	10
**	NT	1.00	16.45	4.94	2.85	100%	5	10
**	*	0.025	28.61	3.69	1.70	100%	6	13
**	NT*	1.00	19.92	2.82	1.93	100%	7	7
**	*	0.025	30.68	4.87	1.93	99%	8	9
C 2		0.10	10.33	1.86	1.28	95%	1	10
	*	0.10	10.11	4.10	2.64	98%	2	22
		0.05	12.94	3.37	1.25	99%	3	15
		0.025	20.38	2.64	0.74	99%	4	10
**	NT	1.00	16.35	4.14	2.33	100%	5	10
**	*	0.025	25.67	4.53	2.84	100%	6	13
**	NT*	1.00	17.24	2.99	1.22	100%	7	7
**	*	0.025	32.26	3.63	1.80	100%	8	9
C 3		0.10	7.73	2.95	1.20	96%	1	10
	*	0.10	51.48	9.76	8.96	96%	2	22
		0.05	55.04	10.40	6.82	96%	3	15
		0.025	18.85	2.13	0.42	98%	4	10
**	NT	1.00	12.95	3.84	1.96	99%	5	10
**	*	0.025	18.22	2.71	0.82	99%	6	13
**	NT*	1.00	14.53	3.38	1.24	100%	7	7
**	*	0.025	18.29	2.59	0.64	100%	8	9
C 4		0.10	12.60	4.52	2.92	97%	1	10
	*	0.10	13.22	3.93	1.77	96%	2	22
		0.05	15.73	4.15	2.26	99%	3	15
		0.025	27.26	4.29	2.56	99%	4	10
**	NT	1.00	17.44	6.95	4.80	100%	5	10
**	*	0.025	47.47	12.33	10.12	100%	6	13
**	NT*	1.00	18.00	5.17	2.95	100%	7	7
**	*	0.025	52.36	16.84	14.19	100%	8	9
C 5		0.10	8.39	3.97	1.72	99%	1	10
	*	0.10	8.75	3.17	0.78	99%	2	22
		0.05	23.98	8.02	5.66	100%	3	15
		0.025	47.97	6.87	3.73	100%	4	10
**	NT	1.00	21.54	4.51	2.32	100%	5	10
**	*	0.025	25.78	3.58	1.32	99%	6	13
**	NT*	1.00	24.61	2.74	1.92	100%	7	7
**	*	0.025	28.23	5.38	2.34	99%	8	9

*Re-determinations **conducted at the end of the experiment (after the depleted in eight set of conditions)

Table 6 Patch depleted in eight preys, initial probability on left lever = 1.0 (to 0 in steps of .125), retractable levers

SUBJECT	CONDITION	PROBABILITY ON RIGHT LEVER	BISQUARE WEIGHTED MEANS TRAVEL TIME	RESIDENCE TIME	GIVING UP TIME	CAPTURE ACCURACY	ORDER	SESSIONS
		0.10	14.00	35.54	8.85	84%	1	10
C-1	NT	1.00	22.01	40.50	11.53	94%	2	10
	*	0.10	12.55	34.94	9.22	87%	3	12
		0.05	14.95	28.44	7.24	88%	4	10
		0.025	26.21	34.18	8.12	96%	5	10
	NT*	1.00	18.54	34.10	9.13	96%	6	10
	NT w/obst	1.00	59.22	38.29	16.49	97%	7	11
C-2		0.10	14.53	26.19	7.53	88%	1	10
	NT	1.00	20.66	19.57	4.65	92%	2	10
	*	0.10	11.62	23.67	5.97	88%	3	12
		0.05	16.15	24.26	6.19	94%	4	10
		0.025	26.59	26.74	7.01	97%	5	10
	NT*	1.00	20.13	25.74	6.13	97%	6	10
	NT w/obst	1.00	59.98	62.83	38.44	94%	7	11
C-3		0.10	10.89	29.55	6.86	82%	1	10
	NT	1.00	17.27	33.99	9.10	98%	2	10
	*	0.10	8.64	26.91	4.93	91%	3	12
		0.05	10.81	27.14	5.48	92%	4	10
		0.025	14.57	28.21	5.00	95%	5	10
	NT*	1.00	18.56	32.10	7.87	97%	6	10
	NT w/obst	1.00	74.08	80.76	52.38	95%	7	11
C-4		0.10	21.60	48.36	16.30	88%	1	10
	NT	1.00	21.28	41.50	11.18	93%	2	10
	*	0.10	19.19	41.35	14.27	93%	3	12
		0.05	19.52	45.58	16.59	94%	4	10
		0.025	39.57	51.93	18.08	99%	5	10
	NT*	1.00	26.35	46.46	14.28	91%	6	10
	NT w/obst	1.00	42.37	53.43	16.38	91%	7	11
C-5		0.10	16.54	28.57	7.43	87%	1	10
	NT	1.00	23.4	28.88	6.75	89%	2	10
	*	0.10	15.17	24.13	5.23	80%	3	12
		0.05	17.37	25.58	5.48	86%	4	10
		0.025	24.97	25.28	5.59	85%	5	10
	NT*	1.00	23.01	30.43	6.52	90%	6	10
	NT w/obst	1.00	58.93	66.37	33.14	94%	7	11

*Re-determinations

Table 7. Experiment 1, regression for artificial travel conditions.

	SUBJECTS			
Regression Output:	A 104	A 230	A 101	A 123
Constant	0.49	0.31	0.42	[illegible]
Std Err of Y Est	0.05	0.06	0.08	0.02
R Squared	0.48	0.92	0.76	0.90
No. of Observations	[illegible]	[illegible]	7	[illegible]
Degrees of Freedom	5	5	5	5
X Coefficient(s)	0.12	0.39	0.33	0.16
Std Err of Coef	0.05	0.05	0.08	0.02

*IV= LOG TT, DV= LOG RES T, LL = .10.

Table 8. Experiment 1, regression for artificial travel conditions.

	SUBJECTS			
Regression Output:	A 104	A 230	A 101	A 123
Constant	0.59	0.35	0.25	-0.80
Std Err of Y Est	0.02	0.05	0.05	0.20
R Squared	0.23	0.86	0.83	0.76
No. of Observations	[illegible]	7	[illegible]	[illegible]
Degrees of Freedom	5	5	5	5
X Coefficient(s)	0.04	0.25	0.31	1.10
Std Err of Coef	0.03	0.05	0.06	0.27

*IV= LOG TT, DV= LOG RES T, LL DEPLETED IN TWO.

Table 9. Experiment 1, regressions for artificial travel conditions

	SUBJECTS			
Regression Output	A 104	A 230	A 101	A 123
Constant	1.37	1.22	1.50	0.69
Std Err of Y Est	0.09	0.10	0.06	0.10
R Squared	0.06	0.33	0.13	0.40
No. of Observations	6	5	6	6
Degrees of Freedom	4	3	4	4
X Coefficient(s)	0.05	0.11	0.13	0.42
Std Err of Coef	0.15	0.09	[illegible]	0.26

*IV= LOG TT, DV= LOG RES T, LL DEPLETED IN EIGHT

Table 10. Experiment 1, regression for artificial travel.

	SUBJECTS			
Regression Output	A 104	A 230	A 101	A 123
Constant	0.75	0.98	[illegible]	[illegible]
Std Err of Y Est	0.16	0.23	0.04	[illegible]
R Squared	0.15	0.85	0.98	[illegible]
No. of Observations	7	[illegible]	[illegible]	[illegible]
Degrees of Freedom	5	5	5	5
X Coefficient(s)	0.18	1.02	0.41	0.39
Std Err of Coef	0.19	0.19	0.04	0.30

*IV= LOG TT, DV= LOG GUT, LL = .10

Table 11. Experiment 1, regression for artificial travel conditions

	SUBJECTS			
Regression Output:	A 104	A 230	A 101	A 123
Constant	0.45	0.09	0.08	1.08
Std Err of Y Est	0.11	0.05	0.06	0.20
R Squared	0.05	0.85	[illegible]	[illegible]
No. of Observations	[illegible]	[illegible]	[illegible]	[illegible]
Degrees of Freedom	5	5	5	5
X Coefficient(s)	[illegible]	0.25	0.41	[illegible]
Std Err of Coef	0.14	0.05	0.10	0.26

*IV= LOG TT, DV= LOG GUT, LL DEPLETED IN TWO.

Table 12. Experiment 1, regressions for artificial travel conditions

	SUBJECTS			
Regression Output:	A 104	A 230	A 101	A 123
Constant	0.65	[illegible]	0.63	[illegible]
Std Err of Y Est	0.04	[illegible]	[illegible]	[illegible]
R Squared	[illegible]	[illegible]	[illegible]	[illegible]
No. of Observations	6	5	6	6
Degrees of Freedom	4	3	4	4
X Coefficient(s)	0.14	0.10	0.10	[illegible]
Std Err of Coef	0.07	0.27	0.15	0.30

*IV= LOG TT, DV= LOG GUT, LL DEPLETED IN EIGHT

Table 13. Experiment 2: retractable levers, artificial travel condition

	SUBJECTS				
Regression Output:	C 1	C 2	C 3	C 4	C 5
Constant	0.54	0.34	0.60	0.49	[illegible]
Std Err of Y Est	0.03	0.15	0.25	[illegible]	0.16
R Squared	0.99	0.62	[illegible]	0.69	0.80
No. of Observations	5	5	5	5	5
Degrees of Freedom	3	3	3	3	3
X Coefficient(s)	[illegible]	[illegible]	[illegible]	1.08	[illegible]
Std Err of Coef.	0.05	0.29	0.34	0.42	0.53

*IV = travel time, DV = residence time, left lever depleted in one prey

Table 14. Experiment 2: retractable levers, artificial travel condition

	SUBJECTS				
Regression Output:	C 1	C 2	C 3	C 4	C 5
Constant	0.30	0.18	-0.48	-0.44	0.22
Std Err of Y Est	0.12	0.15	0.19	0.14	0.13
R Squared	0.09	0.16	0.70	0.81	0.46
No. of Observations	6	6	6	6	6
Degrees of Freedom	4	4	4	4	4
X Coefficient(s)	0.19	0.27	0.80	0.91	0.36
Std Err of Coef.	0.32	0.32	0.2	0.22	0.20

*IV = travel time, DV = residence time, left lever depleted in two preys

Table 15. Experiment 2: retractable levers, artificial travel condition

	SUBJECTS				
Regression Output:	C 1	C 2	C 3	C 4	C 5
Constant	[illegible]	1.25	[illegible]	[illegible]	[illegible]
Std Err of Y Est	0.05	0.02	0.02	0.03	0.03
R Squared	0.00	0.56	[illegible]	[illegible]	[illegible]
No. of Observations	4	4	4	4	4
Degrees of Freedom	2	2	2	2	2
X Coefficient(s)	[illegible]	0.15	0.09	[illegible]	0.07
Std Err of Coef.	0.22	0.08	0.13	[illegible]	[illegible]

*IV = travel time, DV = residence time, patch depleted in eight preys

Table 16. Experiment 2: retractable levers, artificial travel condition

	SUBJECTS				
Regression Output:	C 1	C 2	C 3	C 4	C 5
Constant	0.48	0.23	0.45	1.08	[illegible]
Std Err of Y Est	0.37	0.20	0.40	0.08	0.20
R Squared	0.14	0.31	[illegible]	0.96	[illegible]
No. of Observations	5	5	5	[illegible]	[illegible]
Degrees of Freedom	3	3	3	3	3
X Coefficient(s)	0.45	0.45	0.46	0.93	[illegible]
Std Err of Coef.	0.66	0.39	0.65	[illegible]	[illegible]

*IV = TT, DV = [illegible], left lever depleted in one prey

Table 17. Experiment 2: retractable levers, artificial travel condition

	SUBJECTS				
Regression Output:	C 1	C 2	C 3	C 4	C 5
Constant	-0.53	0.11	1.54	[illegible]	0.53
Std Err of Y Est	0.34	0.25	0.42	[illegible]	[illegible]
R Squared	0.06	0.02	[illegible]	[illegible]	[illegible]
No. of Observations	6	6	6	6	6
Degrees of Freedom	4	4	4	4	4
X Coefficient(s)	0.43	[illegible]	[illegible]	[illegible]	[illegible]
Std Err of Coef.	[illegible]	0.52	[illegible]	0.29	0.40

*IV = travel time, DV = giving up time, left lever depleted in two preys.

Table 18. Experiment 2: retractable levers, artificial travel condition

	SUBJECTS				
Regression Output:	C 1	C 2	C 3	C 4	C 5
Constant	[illegible]	0.66	[illegible]	0.91	0.89
Std Err of Y Est	0.05	0.05	0.08	[illegible]	0.08
R Squared	[illegible]	0.18	0.00	0.60	0.02
No. of Observations	4	4	4	4	4
Degrees of Freedom	2	2	2	2	2
X Coefficient(s)	[illegible]	[illegible]	0.07	0.22	0.10
Std Err of Coef.	0.22	0.20	0.50	[illegible]	[illegible]

*IV = travel time, DV = giving up time, patch depleted in eight preys

APPENDIX A

Figure A1, Experiment 1, shows clusters selected from conditions in which the patch provided 8 pellets. This condition was selected from the exploratory data analysis to show the typical performance of rats responding on standard levers. The giving-up times (logarithmic Y-axis) are plotted against the travel times (logarithmic X-axis). The first and last sessions are indicated by arrows. The legends (bottom) indicate the subjects' number. Figure A1 illustrates that giving-up times varied proportionally to travel times. For travel times the range of variation was approximately from 10 to 38 seconds. For giving-up times the range was approximately from 3 to 10 seconds. However, A-104 in the natural condition produced giving-up times of about 80 seconds. Occasionally, giving-up times changed from one session to another and stood out of range in one or two sessions (see left-hand middle panel). There were conditions in which giving-up times stood out of range in the last three sessions (see left-hand top and middle panels and right-hand bottom panel in Figure A1).

Figure A2, Experiment 2, shows clusters from conditions in which the patch was depleted in two pellets. This condition was selected from the exploratory data analysis to show the typical performance of rats responding on retractable levers. The arithmetic means of giving-up time (logarithmic Y-axis) are plotted against those of travel time (logarithmic X-axis). The first and last sessions are indicated with arrows. Figure A2 illustrates that travel and giving-up times generally did not vary in a wide range. For giving-up times the range was approximately from .2 to 3 seconds. For travel times, the range was approximately from 13 to 20 seconds. Usually, when travel times stood out of range, the first and last responses were located within the same range. Giving-up times rarely stood out of range.

Based on observations of these clusters, I decided to include all sessions into the analysis, rather than to include only the last three sessions of each condition.

To compare travel times produced by reset-probabilities with those produced by natural travel, in Figures A3 to A7, the BWMs of travel time (logarithmic Y-axis) are plotted against the probability on the right lever (logarithmic X-axis). With the exception of Figure A7 that shows results for one rat, each Figure shows results for two rats. The natural travel results are enclosed in boxes.

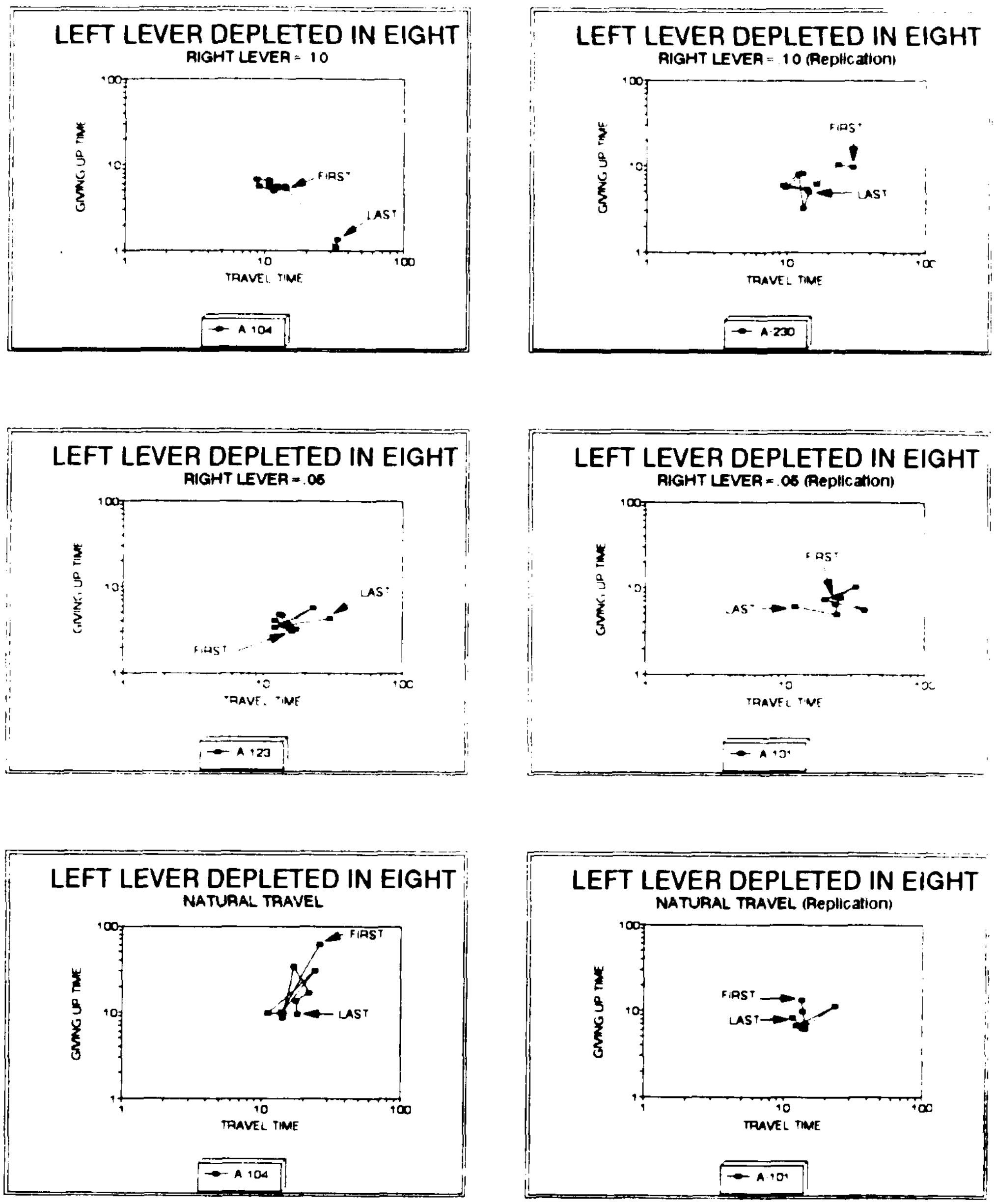
In general, Figures A3 to A7 show that travel durations for the .10 reset-probability were close to travel durations for the natural condition without obstacles. Travel durations for .25 and 1.0 reset-probabilities were shorter than those rats made by running the long distance without obstacles. However, rats responding to the .05 and .025 reset-probabilities, usually made longer travel durations than those they produced by running in the natural condition without obstacles. However, the natural travel with obstacles produced the longest travel durations (see bottom panels of Figures A5 to A7).

In Experiments 1 and 2, for each condition the variability in travel, residence, and giving-up times was estimated. The MAD was added to or subtracted from the BWM values, to represent with two values the range of variability in these measurements. The BWM plus its MAD was called the BWM^+ value. The BWM minus its MAD was called the BWM^- value. In Tables B19 to B24 (Appendix B) the BWMs appear in the center columns. The numbers to the right and left are BWM^+ and BWM^- values. The BWM, BWM^+, and BWM^- values were utilized to determine areas in the plot in which travel, residence, and giving-up times overlapped. Figures A21 to A38 show the BWM, BWM^+, and BWM^- values for travel, residence, and giving-up times. In each group of points the middle point represents the BWM (X and Y coordinates). Points around the BWM represent the variability expressed in BWM^+ and BWM^- values. The open squares indicate results with natural travel. Different reset-probabilities were indicated by different symbols.

Figures A21 to A26 show that travel times produced by low reset-probabilities overlapped travel times caused by natural travel. Residence and giving-up times produced by natural travel fell within the range of residence and giving-up times caused by low reset-probabilities, but see A-104 (Figures A21-A26). In Figures A27 to A29, residence times (Y-axis) are plotted against giving-up times (X-axis). Overlap was again observed. Natural travel produced values on both measurements that fell within the range of times produced by low reset-probabilities. However, there were some instances in which overlapping between points of natural and artificial requirements was not observed. Sometimes residence and giving-up times for natural travel were out of range, did not overlap with artificial results. Often subjects A-104, A-230, and A-123 in the natural condition, produced longer residence and giving-up times than in the artificial conditions (see Figures A27 to A29). Residence times varied less than giving-up times (rectangles wider than high in Figures A27-A29).

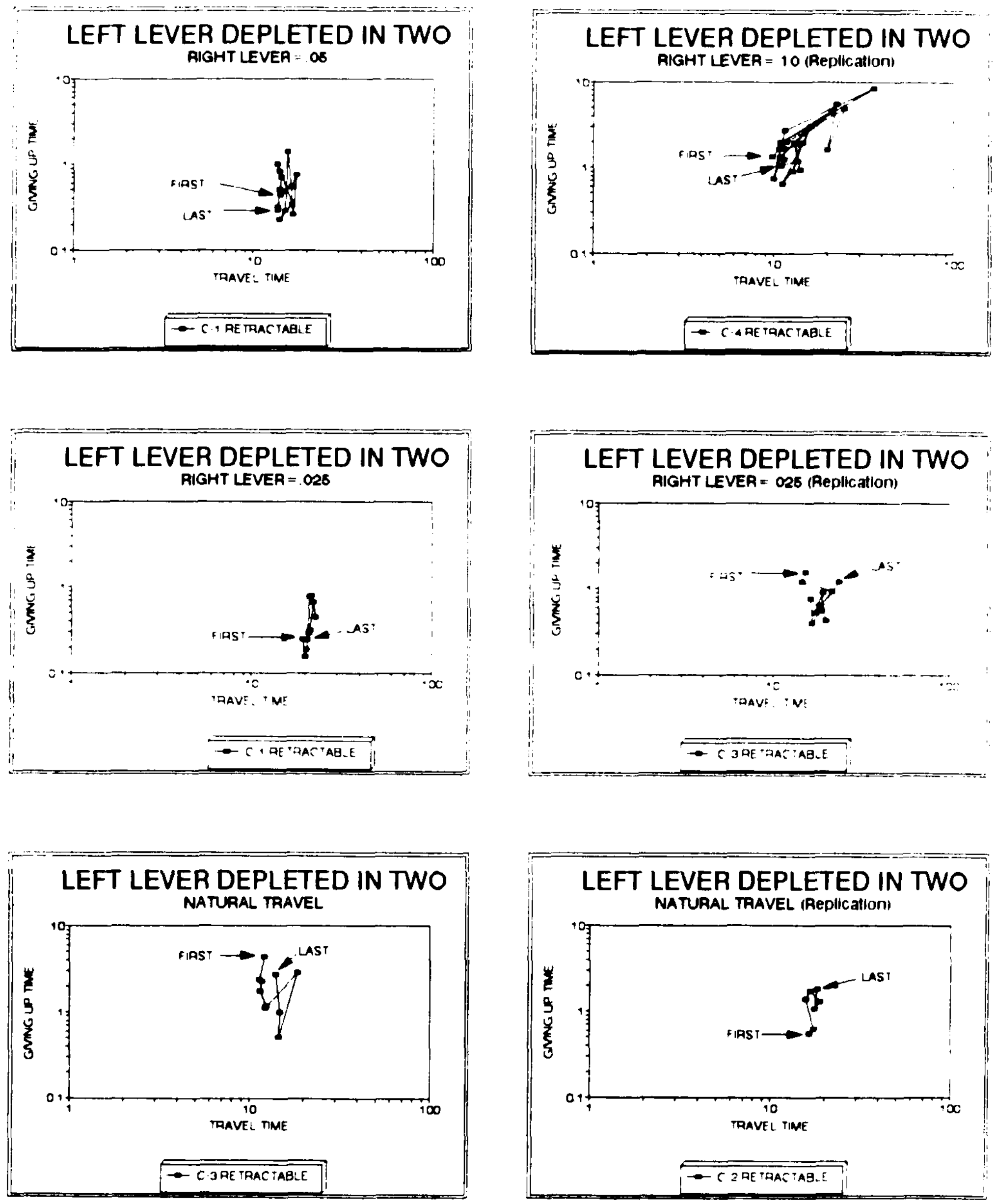
In Experiment 2, when the patch was depleted in 1 pellet (Figure A30), low reset-probabilities on the right produced travel times that overlapped those generated by natural travel at the high end of the range. When the patch was depleted in 2 pellets (Figure A31) travel times produced by low probabilities were generally longer than those produced by natural travel. Generally, travel times produced by the natural requirement fell between those caused by reset-probabilities of.05 and .025. With exception of subject C-3, when the patch was depleted in 8 pellets (Figure A32) always travel times produced by the natural condition fell between those caused by reset-probabilities of .05 and .025. The longest travel times were produced by natural travel with obstacles. Except for C-1 in one condition (Figure A36), low reset-probabilities produced residence and giving-up times similar to those caused by the natural travel requirement (Figures A36-A38). That is, residence and giving-up times produced by natural travel fell within the range of residence and giving-up times caused by low reset-probabilities. However, natural travel with obstacles produced the longest residence and giving-up times (Figure A38). Residence times varied less than giving-up times (most rectangles wider than high in Figures A36-A38). The natural travel with obstacles produced giving-up times that varied over a relatively wide range (Figure A38).

Figure A1. Clusters selected from conditions in which the patch was depleted in 8 pellets. This condition was selected from the exploratory data analysis to show the typical performance of rats responding on standard levers. The giving-up times (logarithmic Y-axis) are plotted against the travel times (logarithmic X-axis). The first and last sessions are indicated by arrows. The legends (bottom) indicate the subjects' number.


LEFT LEVER DEPLETED IN EIGHT
RIGHT LEVER = 10
GIVING UP TIME
TRAVEL TIME
FIRST
LAST
A 104
LEFT LEVER DEPLETED IN EIGHT
RIGHT LEVER = 10 (Replication)
FIRST
LAST
A 230
LEFT LEVER DEPLETED IN EIGHT
RIGHT LEVER = .05
FIRST
LAST
A 123
LEFT LEVER DEPLETED IN EIGHT
RIGHT LEVER = .05 (Replication)
FIRST
LAST
LEFT LEVER DEPLETED IN EIGHT
NATURAL TRAVEL
FIRST
LAST
A 104
LEFT LEVER DEPLETED IN EIGHT
NATURAL TRAVEL (Replication)
FIRST
LAST

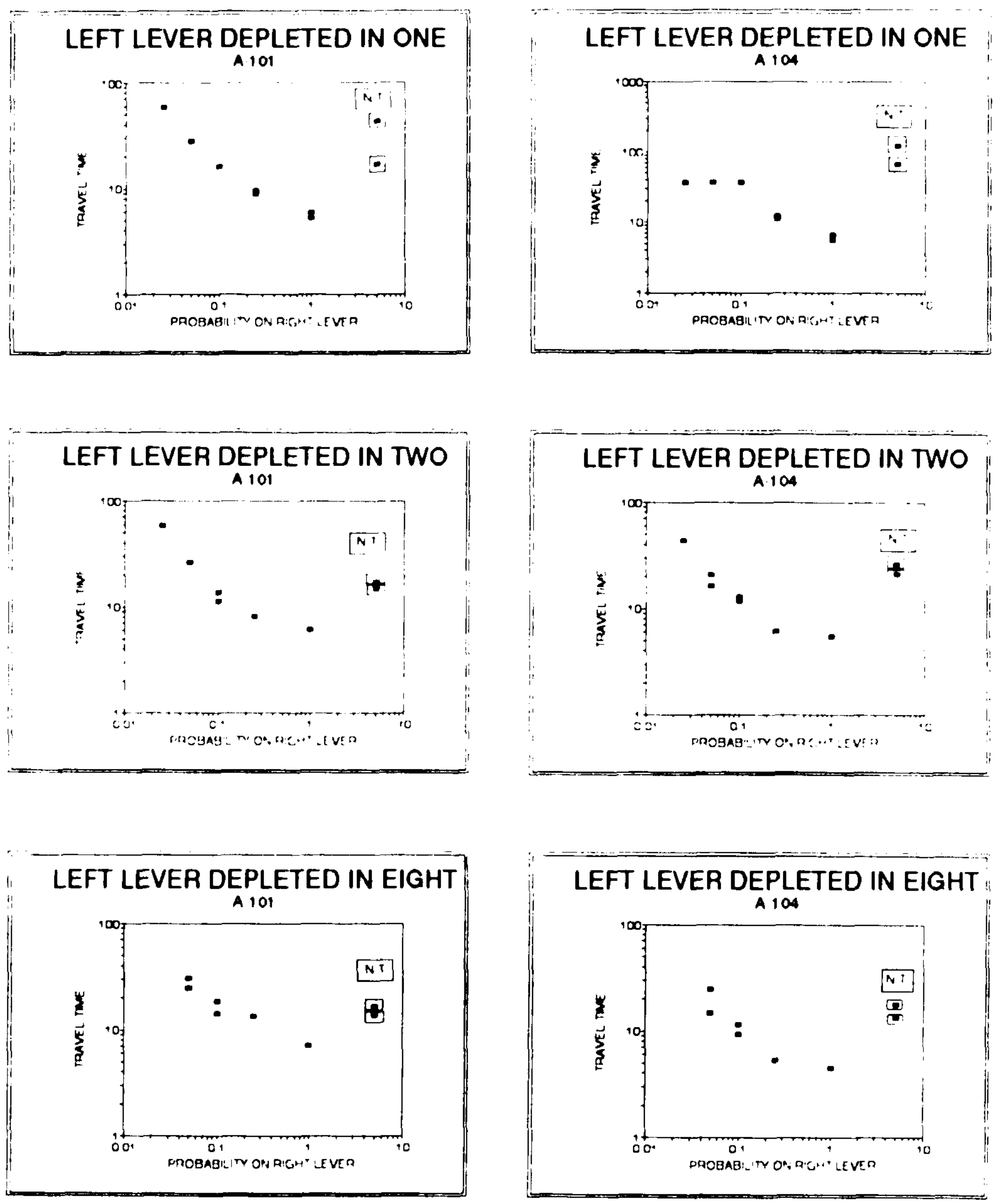
A1

Figure A2. Clusters selected from conditions in which the patch was depleted in two pellets. This condition was selected from the exploratory data analysis to show the typical performance of rats responding on retractable levers. The arithmetic means of giving-up time (logarithmic Y-axis) are plotted against those of travel time (logarithmic X-axis). The first and last sessions are indicated with arrows. The legends (bottom) indicate the subjects' number.


LEFT LEVER DEPLETED IN TWO
RIGHT LEVER = .05
GIVING UP TIME
TRAVEL TIME
FIRST
LAST
C-1 RETRACTABLE
LEFT LEVER DEPLETED IN TWO
RIGHT LEVER = 1.0 (Replication)
GIVING UP TIME
TRAVEL TIME
FIRST
LAST
C-4 RETRACTABLE
LEFT LEVER DEPLETED IN TWO
RIGHT LEVER = .025
GIVING UP TIME
FIRST
LEFT LEVER DEPLETED IN TWO
RIGHT LEVER = .025 (Replication)
GIVING UP TIME
LEFT LEVER DEPLETED IN TWO
NATURAL TRAVEL
GIVING UP TIME
TRAVEL TIME
FIRST
LAST
C-3 RETRACTABLE
LEFT LEVER DEPLETED IN TWO
NATURAL TRAVEL (Replication)
GIVING UP TIME
TRAVEL TIME
FIRST
LAST
C-2 RETRACTABLE

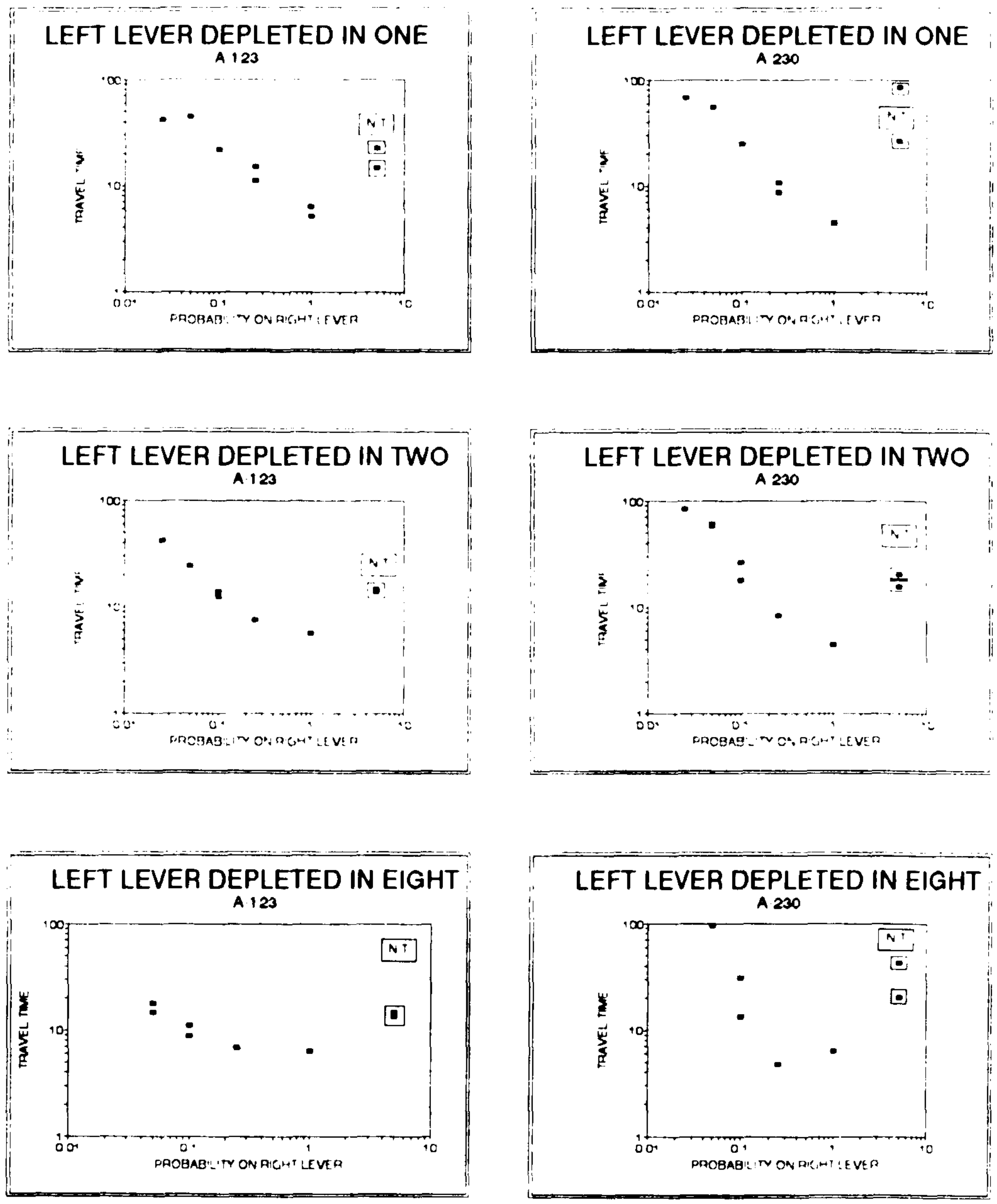
A2

Figure A3. The BWMs of travel time (logarithmic Y-axis) are plotted against the probability on the right lever (logarithmic X-axis). The left-hand panels show results for subject A-101, and the right-hand panels for A-104. The natural travel results are enclosed in boxes.


LEFT LEVER DEPLETED IN ONE
A 101
LEFT LEVER DEPLETED IN ONE
A 104
LEFT LEVER DEPLETED IN TWO
A 101
LEFT LEVER DEPLETED IN TWO
A 104
LEFT LEVER DEPLETED IN EIGHT
A 101
LEFT LEVER DEPLETED IN EIGHT
A 104
TRAVEL TIME
PROBABILITY ON RIGHT LEVER
N T

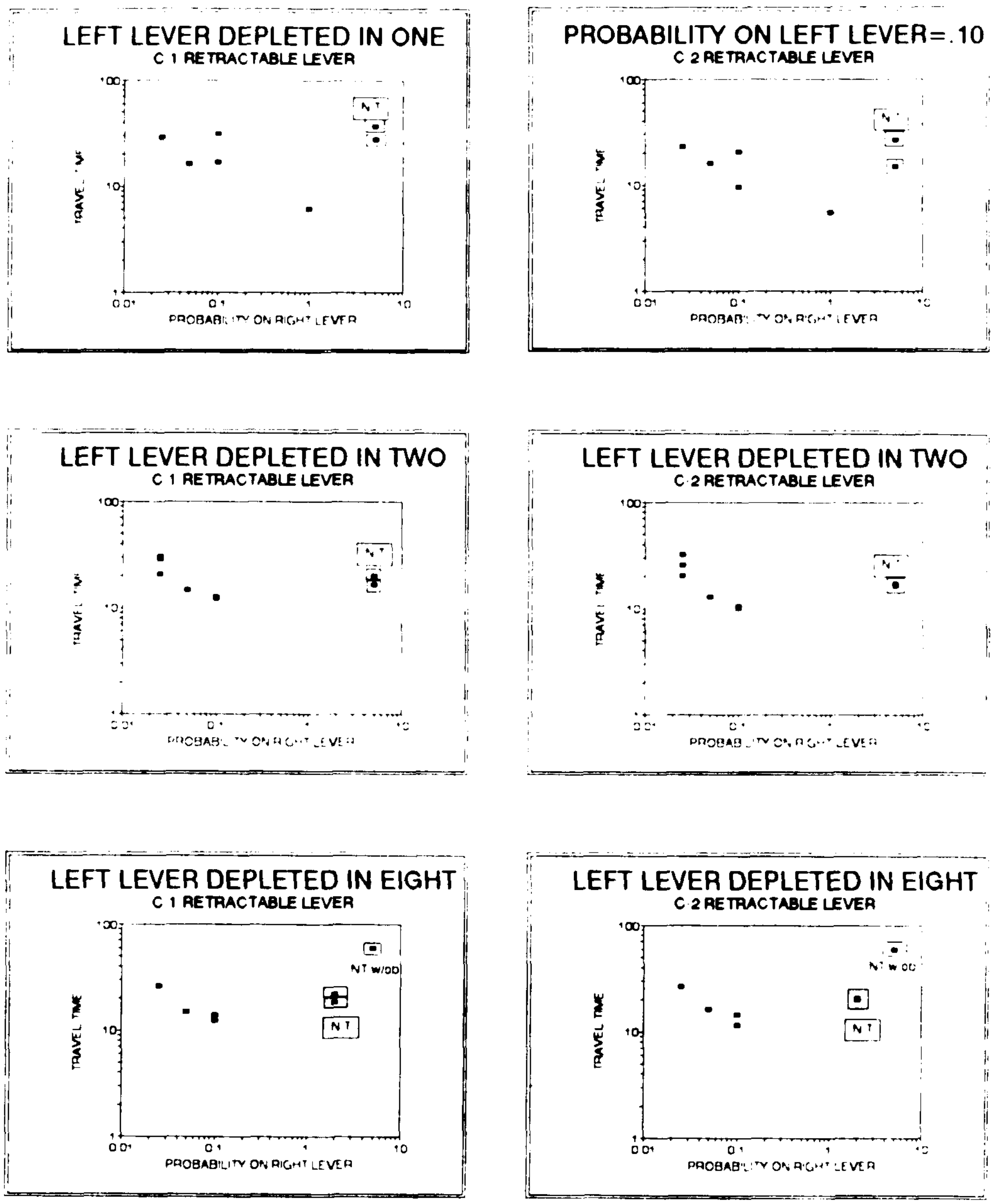
A3

Figure A4. The BWMs of travel time (logarithmic Y-axis) are plotted against the probability on the right lever (logarithmic X-axis). The left-hand panels show results for subject A-123, and the right-hand panels for A-230. The natural travel results are enclosed in boxes.


LEFT LEVER DEPLETED IN ONE
A 123
LEFT LEVER DEPLETED IN ONE
A 230
LEFT LEVER DEPLETED IN TWO
A 123
LEFT LEVER DEPLETED IN TWO
A 230
LEFT LEVER DEPLETED IN EIGHT
A 123
TRAVEL TIME
PROBABILITY ON RIGHT LEVER
LEFT LEVER DEPLETED IN EIGHT
A 230
TRAVEL TIME

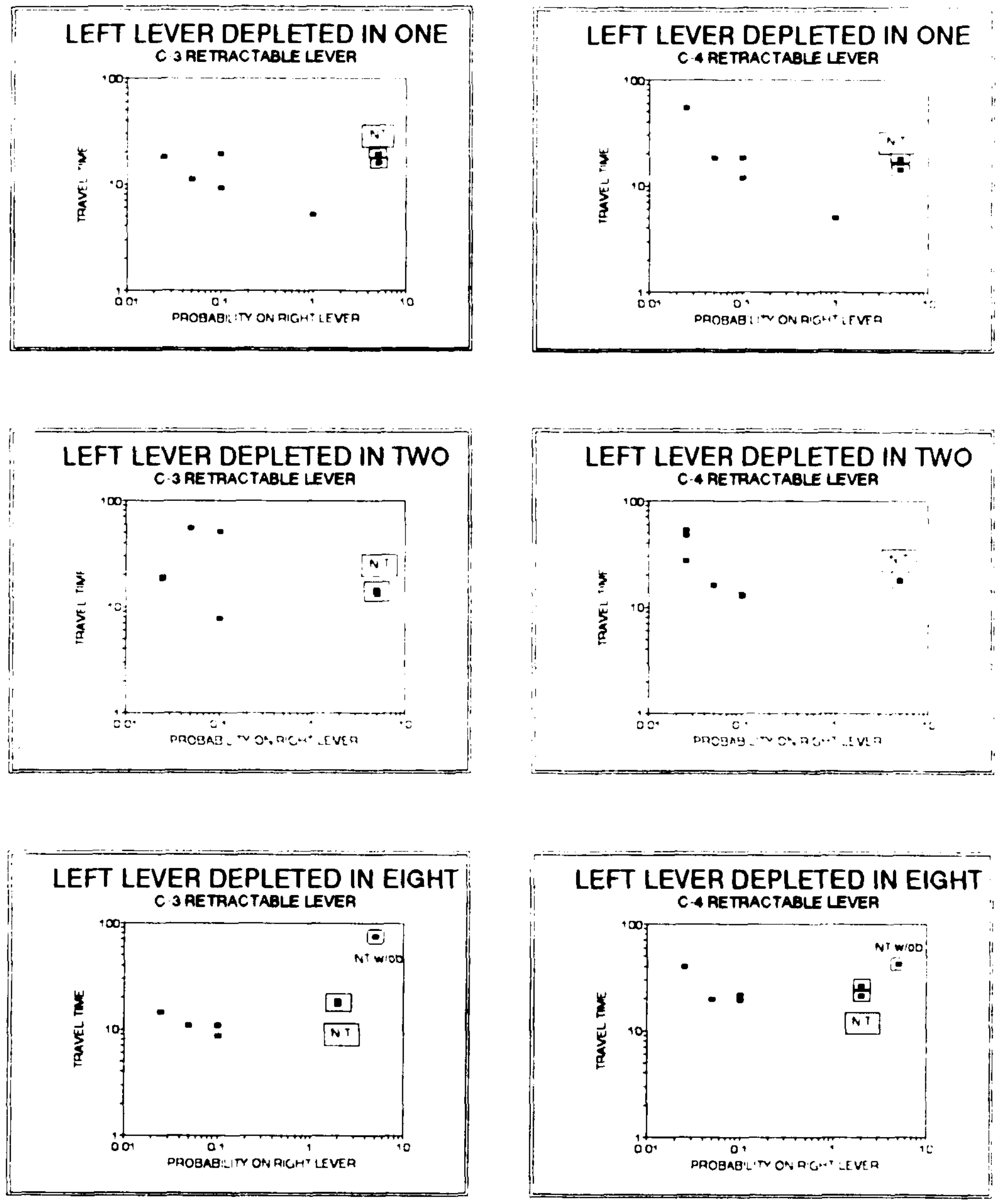
A4

Figure A5. The BWMs of travel time (logarithmic Y-axis) are plotted against the probability on the right lever (logarithmic X-axis). The left-hand panels show results for subject C-1, and the right-hand panels for C-2. The natural travel results with and without obstacles are enclosed in boxes.


LEFT LEVER DEPLETED IN ONE
C 1 RETRACTABLE LEVER
PROBABILITY ON LEFT LEVER=.10
C 2 RETRACTABLE LEVER
LEFT LEVER DEPLETED IN TWO
C 1 RETRACTABLE LEVER
LEFT LEVER DEPLETED IN TWO
C 2 RETRACTABLE LEVER
LEFT LEVER DEPLETED IN EIGHT
C 1 RETRACTABLE LEVER
NT w/OD
NT
TRAVEL TIME
PROBABILITY ON RIGHT LEVER
LEFT LEVER DEPLETED IN EIGHT
C 2 RETRACTABLE LEVER
NT

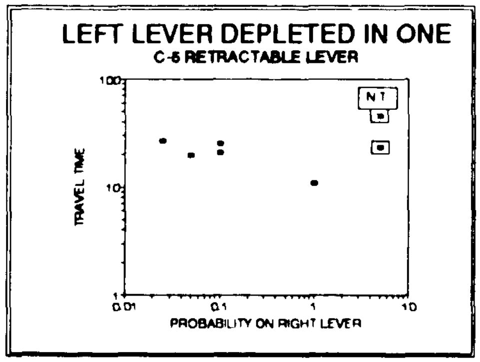
A5

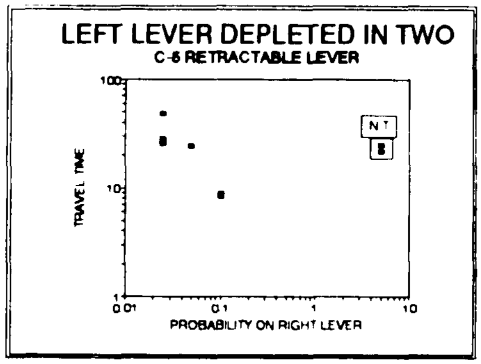
Figure A6. The BWMs of travel time (logarithmic Y-axis) are plotted against the probability on the right lever (logarithmic X-axis). The left-hand panels show results for subject C-3, and the right-hand panels for C-4. The natural travel results with and without obstacles are enclosed in boxes.

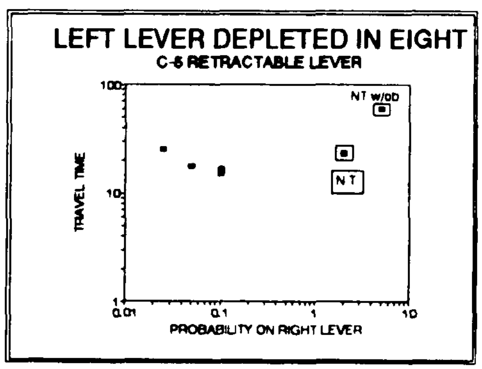

LEFT LEVER DEPLETED IN ONE
C-3 RETRACTABLE LEVER
TRAVEL TIME
PROBABILITY ON RIGHT LEVER
LEFT LEVER DEPLETED IN ONE
C-4 RETRACTABLE LEVER
TRAVEL TIME
PROBABILITY ON RIGHT LEVER
LEFT LEVER DEPLETED IN TWO
C-3 RETRACTABLE LEVER
N T
TRAVEL TIME
PROBABILITY ON RIGHT LEVER
LEFT LEVER DEPLETED IN TWO
C-4 RETRACTABLE LEVER
TRAVEL TIME
PROBABILITY ON RIGHT LEVER
LEFT LEVER DEPLETED IN EIGHT
C-3 RETRACTABLE LEVER
NT w/oD
N T
TRAVEL TIME
PROBABILITY ON RIGHT LEVER
LEFT LEVER DEPLETED IN EIGHT
C-4 RETRACTABLE LEVER
NT w/oD
N T
TRAVEL TIME
PROBABILITY ON RIGHT LEVER

A6

Figure A7. The BWMs of travel time (logarithmic Y-axis) are plotted against the probability on the right lever (logarithmic X-axis). The panels show results for subject C-5. The natural travel results with and without obstacles are enclosed in boxes.

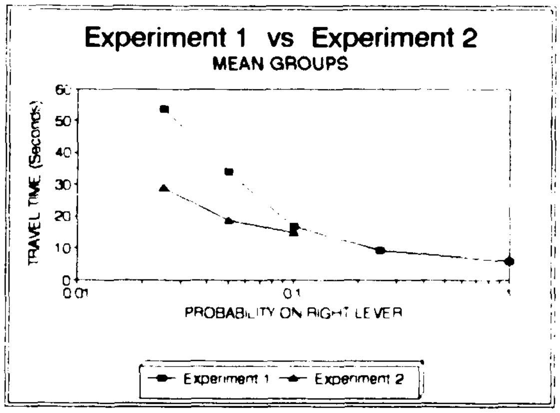

LEFT LEVER DEPLETED IN ONE
C-5 RETRACTABLE LEVER
NT
TRAVEL TIME
PROBABILITY ON RIGHT LEVER


LEFT LEVER DEPLETED IN TWO
C-5 RETRACTABLE LEVER
NT
TRAVEL TIME
PROBABILITY ON RIGHT LEVER


LEFT LEVER DEPLETED IN EIGHT
C-5 RETRACTABLE LEVER
NT w/ob
NT
TRAVEL TIME
PROBABILITY ON RIGHT LEVER

A7

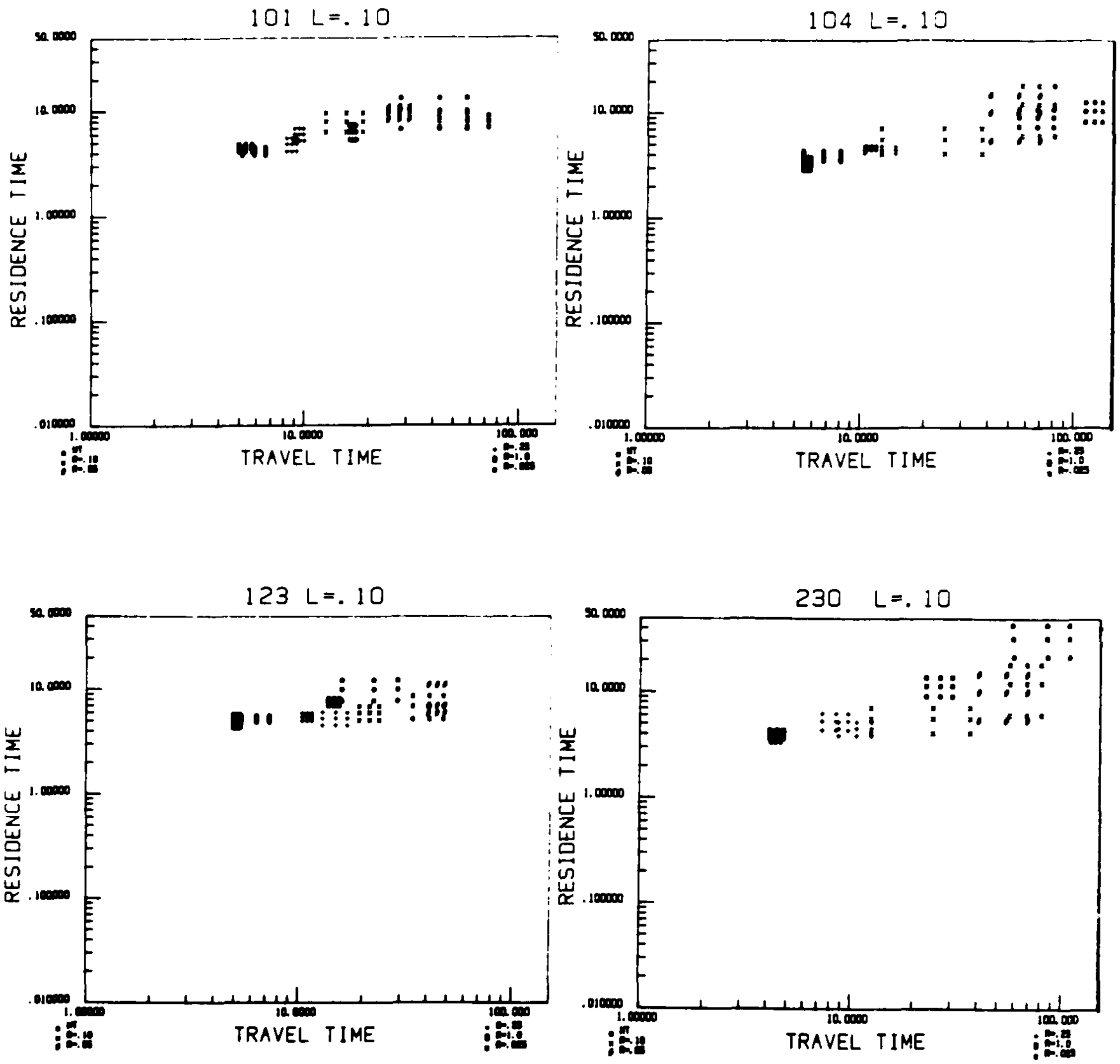
Figure A8. The group means of travel times (Y-axis) is plotted against the reset-probability on the right lever (X-axis). The filled squares represent the group means of artificial travel times for Experiment 1, and the triangles the group means for Experiment 2.



Experiment 1 vs Experiment 2
MEAN GROUPS
TRAVEL TIME (Seconds)
PROBABILITY ON RIGHT LEVER
Experiment 1
Experiment 2

A8

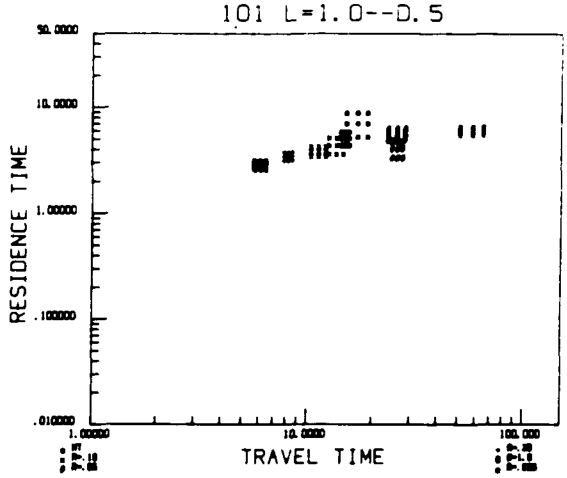
Figure A21. For the depleted in 1-prey condition, the BWM, BWM^+, and BWM^- values for residence time and travel time were used to construct this figure. The residence times (Y-axis) are plotted against travel times (X-axis). In each group of points the middle point represents the BWMs of these variables on the X and Y axes. Points around the BWM represent variability expressed in BWM^+ and BWM^- values. Each panel show results for one subject. The open squares indicate results with natural travel. The reset-probabilities are indicated by different symbols.


101 L=.10
104 L=.10
123 L=.10
230 L=.10
RESIDENCE TIME
TRAVEL TIME
50.0000
10.0000
1.00000
.100000
.010000
1.00000
10.0000
100.000

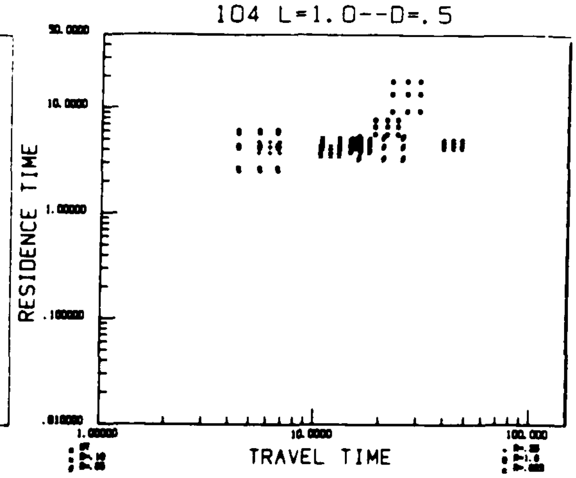
A21

Figure A22. For the depleted in 2-prey condition, the BWM, BWM^+, and BWM^- values for residence time and travel time were used to construct this figure. The residence times (Y-axis) are plotted against travel times (X-axis). In each group of points the middle point represents the BWMs of these variables on the X and Y axes. Points around the BWM represent variability expressed in BWM^+ and BWM^- values. Each panel show results for one subject. The open squares indicate results with natural travel. The reset-probabilities are indicated by different symbols.

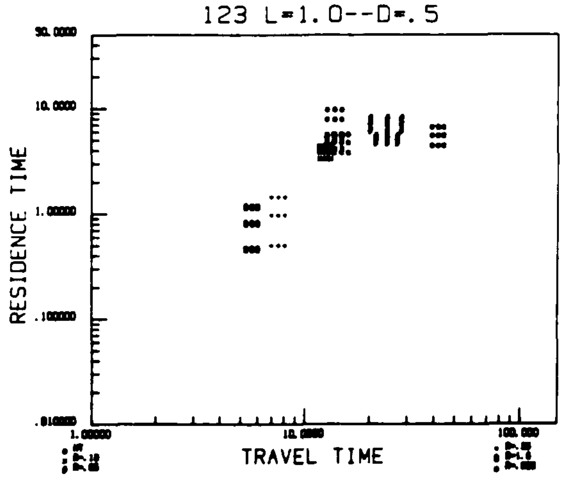
101 L=1.0--D.5



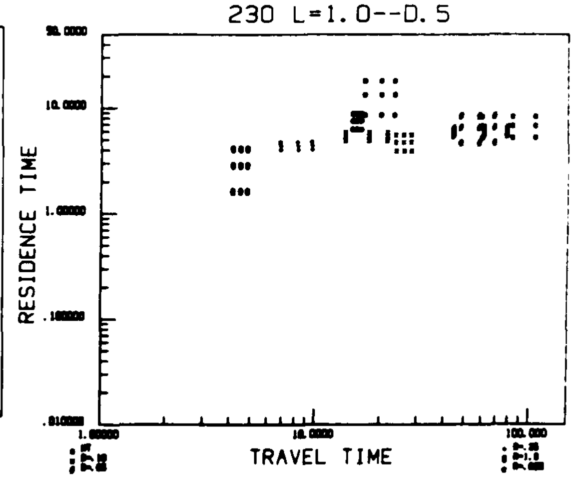
104 L=1.0--D=.5



123 L=1.0--D=.5

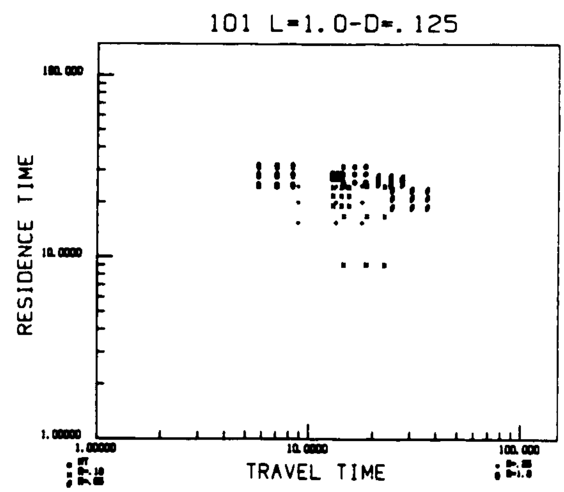


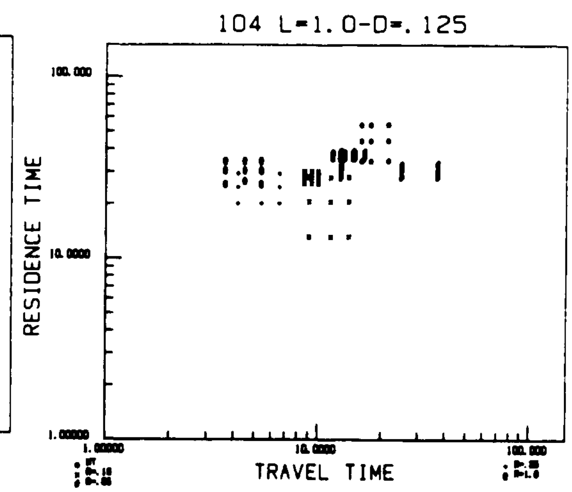
230 L=1.0--D.5

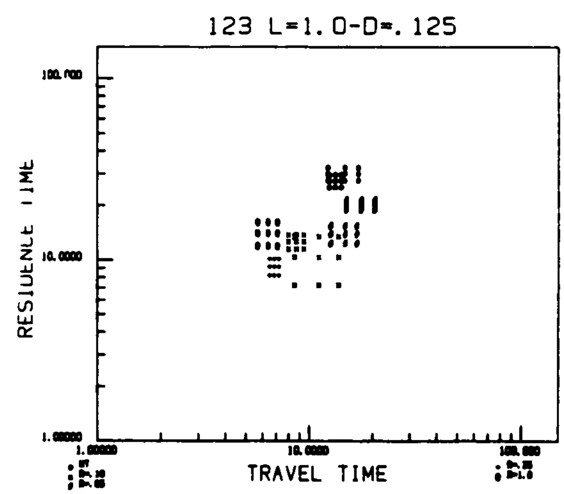


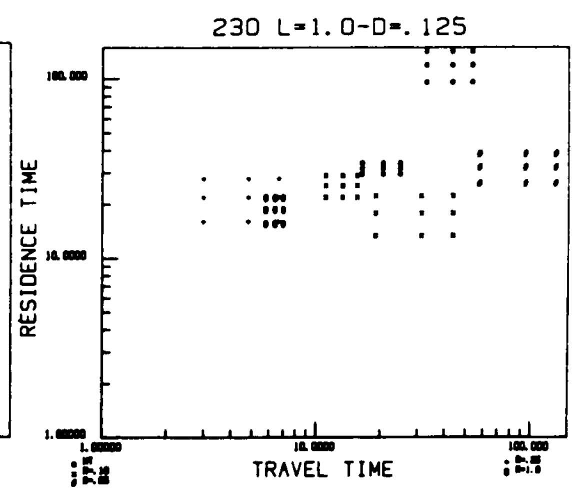
A22

Figure A23. For the depleted in 8-prey condition, the BWM, BWM^+, and BWM^- values for residence time and travel time were used to construct this figure. The residence times (Y-axis) are plotted against travel times (X-axis). In each group of points the middle point represents the BWMs of these variables on the X and Y axes. Points around the BWM represent variability expressed in BWM^+ and BWM^- values. Each panel show results for one subject. The open squares indicate results with natural travel. The reset-probabilities are indicated by different symbols.


101 L=1.0-D=.125
RESIDENCE TIME
TRAVEL TIME
100.000
10.0000
1.00000

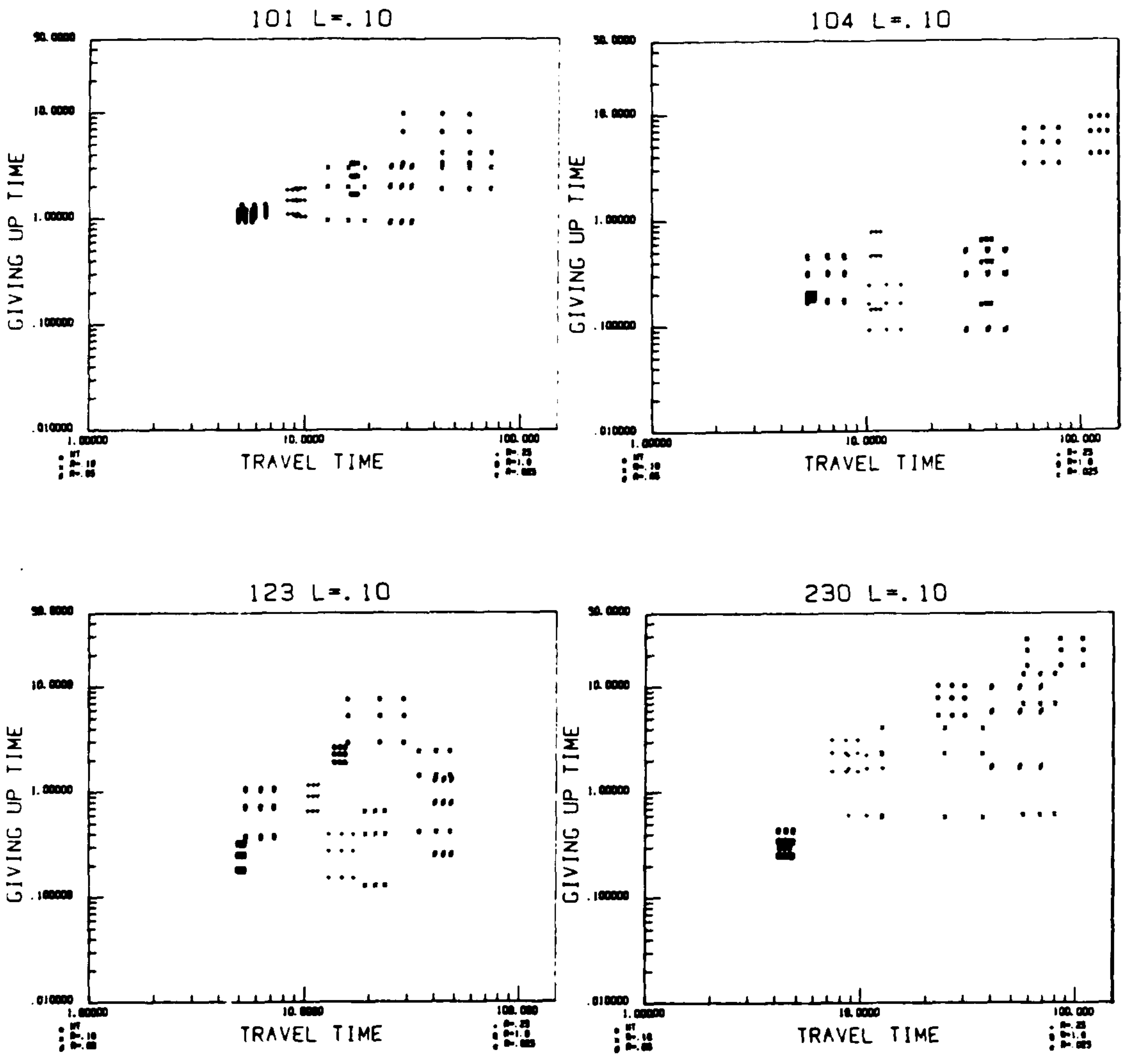

104 L=1.0-D=.125
RESIDENCE TIME
TRAVEL TIME
100.000
10.0000
1.00000


123 L=1.0-D=.125
RESIDENCE TIME
TRAVEL TIME
10.0000
1.00000


230 L=1.0-D=.125
RESIDENCE TIME
TRAVEL TIME
100.000
10.0000
1.00000

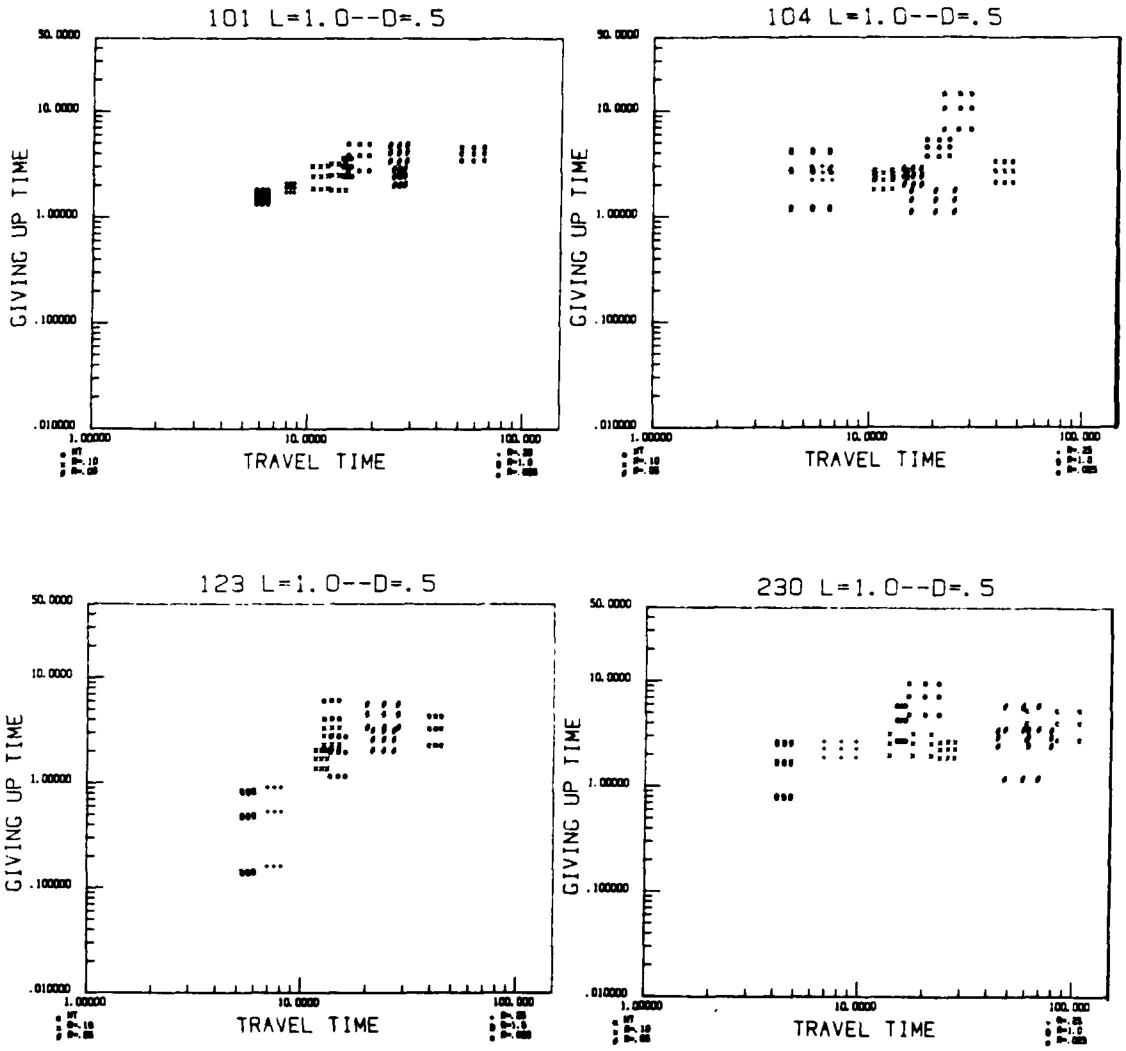
A23

Figure A24. For the depleted in 1-prey condition, the BWM, BWM^+, and BWM^- values for giving-up time and travel time were used to construct this figure. The giving-up times (Y-axis) are plotted against travel times (X-axis). In each group of points the middle point represents the BWMs of these variables on the X and Y axes. Points around the BWM represent variability expressed in BWM^+ and BWM^- values. Each panel show results for one subject. The open squares indicate results with natural travel. The reset-probabilities are indicated by different symbols.



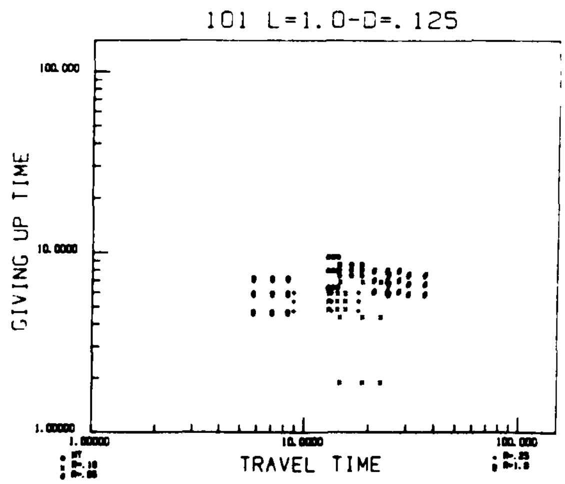
A24

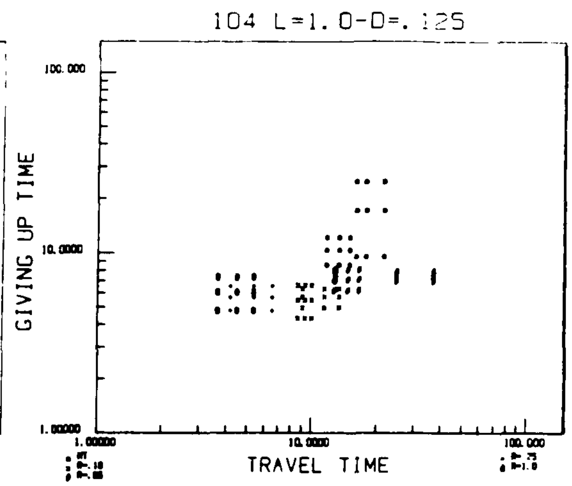
Figure A25. For the depleted in 2-prey condition, the BWM, BWM^+, and BWM^- values for giving-up time and travel time were used to construct this figure. The giving-up times (Y-axis) are plotted against travel times (X-axis). In each group of points the middle point represents the BWMs of these variables on the X and Y axes. Points around the BWM represent variability expressed in BWM^+ and BWM^- values. Each panel show results for one subject. The open squares indicate results with natural travel. The reset-probabilities are indicated by different symbols.

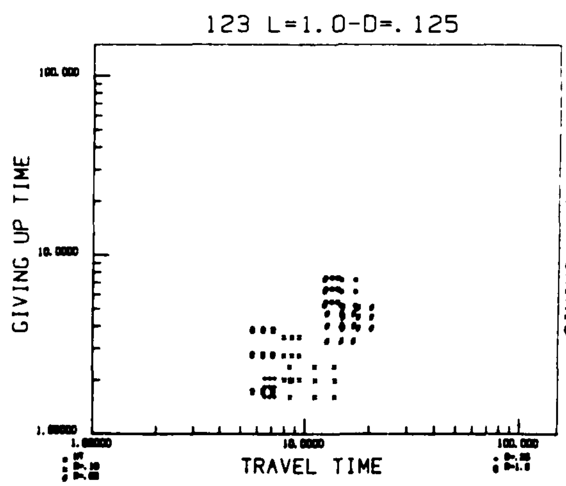

101 L=1.0--D=.5
104 L=1.0--D=.5
123 L=1.0--D=.5
230 L=1.0--D=.5
GIVING UP TIME
TRAVEL TIME
50.0000
10.0000
1.00000
.100000
.010000
1.00000
10.0000
100.000

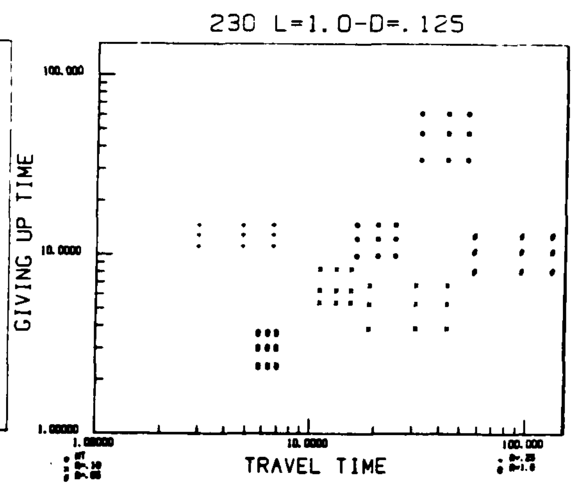
A25

Figure A26. For the depleted in 8-prey condition, the BWM, BWM^+, and BWM^- values for giving-up time and travel time were used to construct this figure. The giving-up times (Y-axis) are plotted against travel times (X-axis). In each group of points the middle point represents the BWMs of these variables on the X and Y axes. Points around the BWM represent variability expressed in BWM^+ and BWM^- values. Each panel show results for one subject. The open squares indicate results with natural travel. The reset-probabilities are indicated by different symbols.


101 L=1.0-D=.125
GIVING UP TIME
TRAVEL TIME

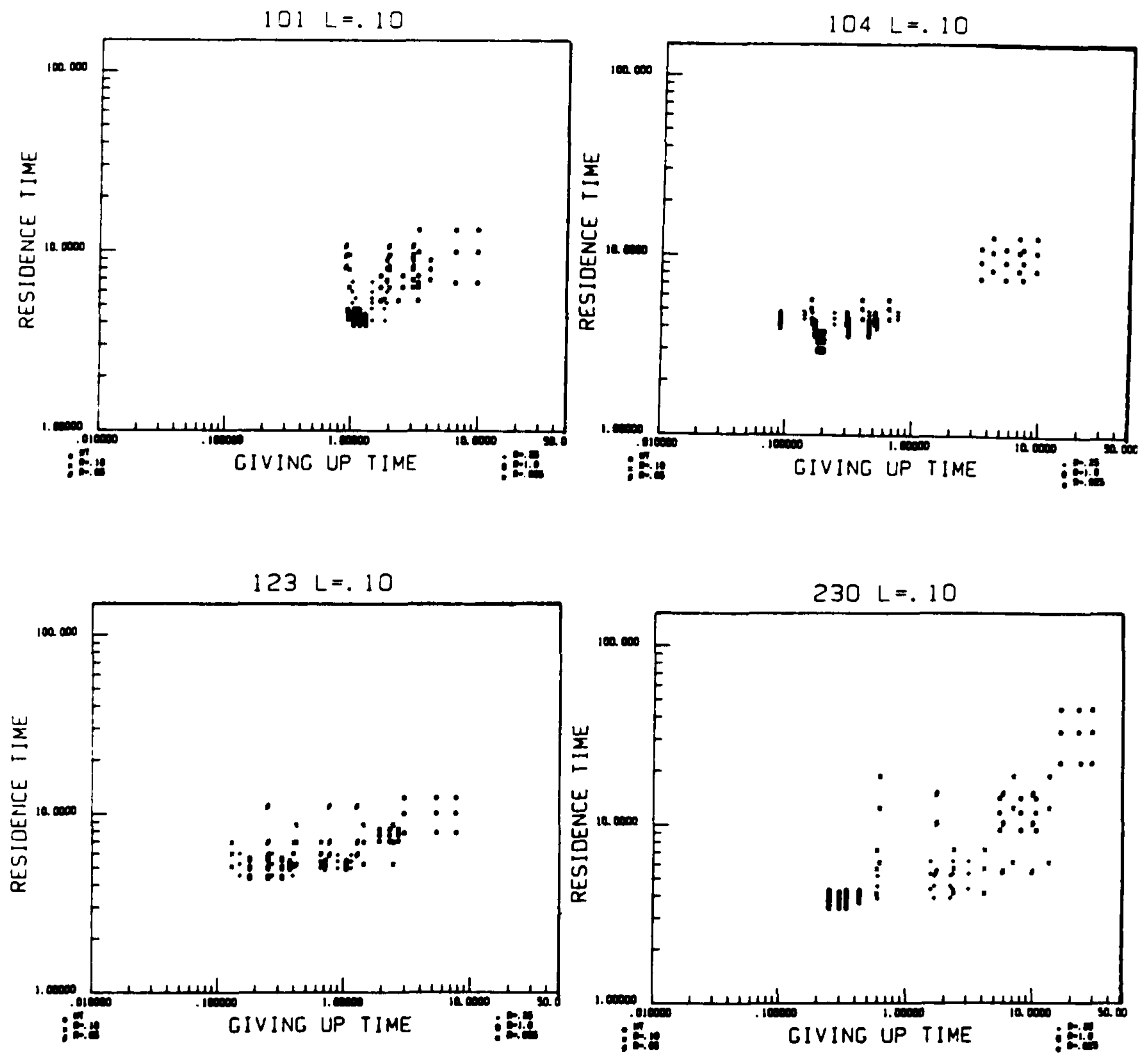

104 L=1.0-D=.125
GIVING UP TIME
TRAVEL TIME


123 L=1.0-D=.125
GIVING UP TIME
TRAVEL TIME


230 L=1.0-D=.125
GIVING UP TIME
TRAVEL TIME

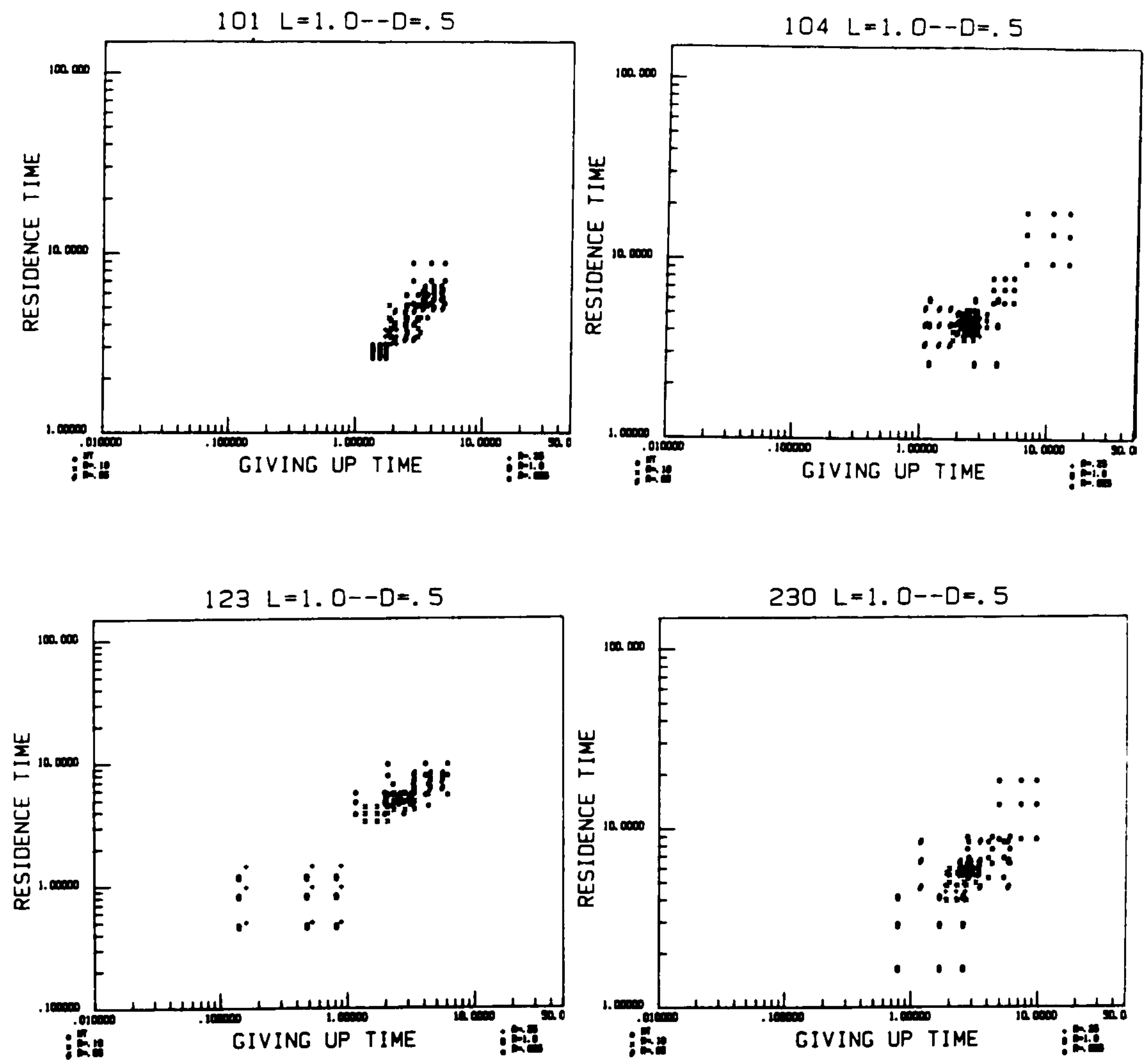
A26

Figure A27. For the depleted in 1-prey condition, the BWM, BWM^+, and BWM^- values for residence time and giving-up time were used to construct this figure. The residence times (Y-axis) are plotted against giving-up times (X-axis). In each group of points the middle point represents the BWMs of these variables on the X and Y axes. Points around the BWM represent variability expressed in BWM^+ and BWM^- values. Each panel show results for one subject. The open squares indicate results with natural travel. The reset-probabilities are indicated by different symbols.



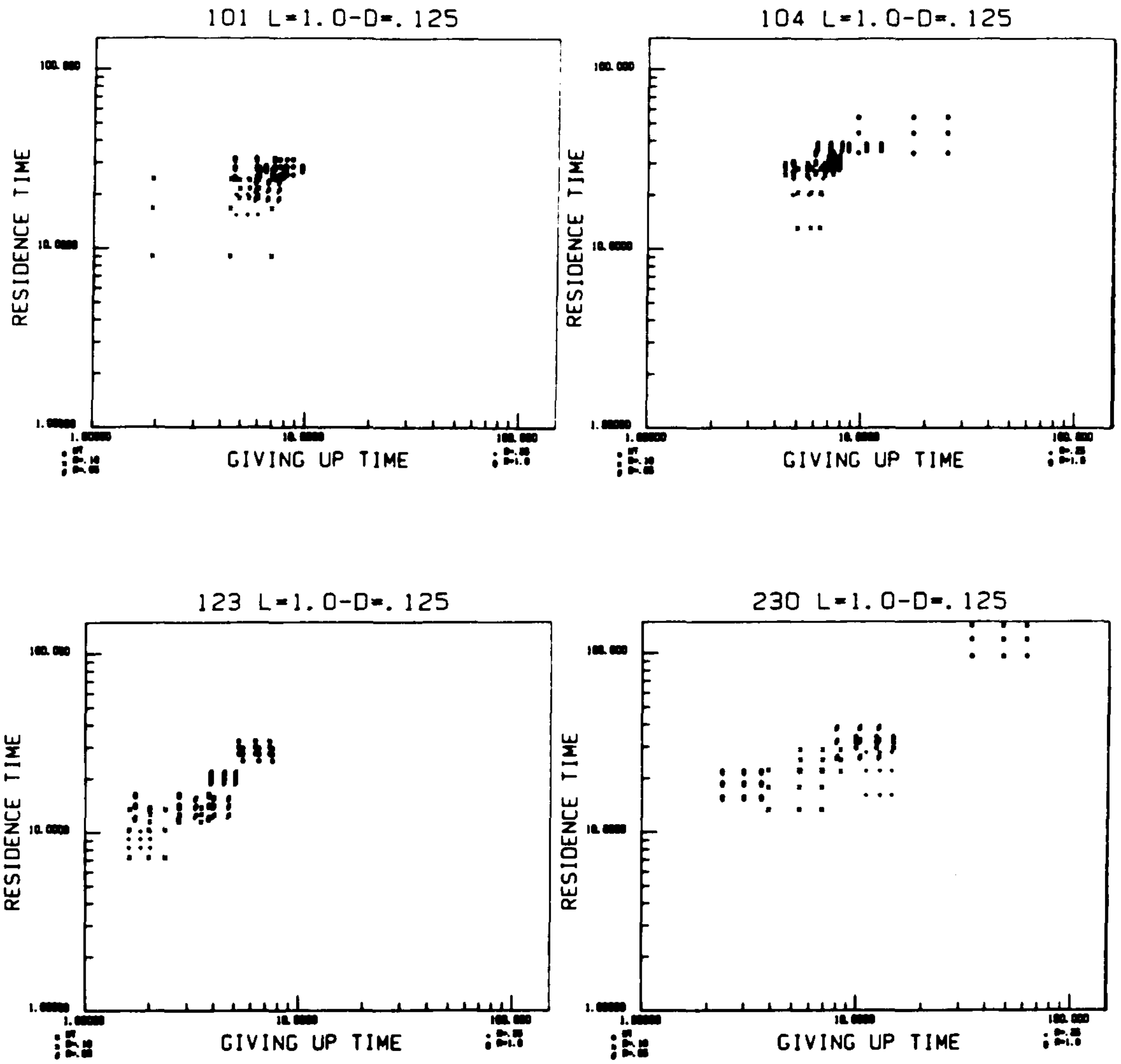
A27

Figure A28. For the depleted in 2-prey condition, the BWM, BWM^+, and BWM^- values for residence time and giving-up time were used to construct this figure. The residence times (Y-axis) are plotted against giving-up times (X-axis). In each group of points the middle point represents the BWMs of these variables on the X and Y axes. Points around the BWM represent variability expressed in BWM^+ and BWM^- values. Each panel show results for one subject. The open squares indicate results with natural travel. The reset-probabilities are indicated by different symbols.


101 L=1.0--D=.5
104 L=1.0--D=.5
123 L=1.0--D=.5
230 L=1.0--D=.5
RESIDENCE TIME
GIVING UP TIME

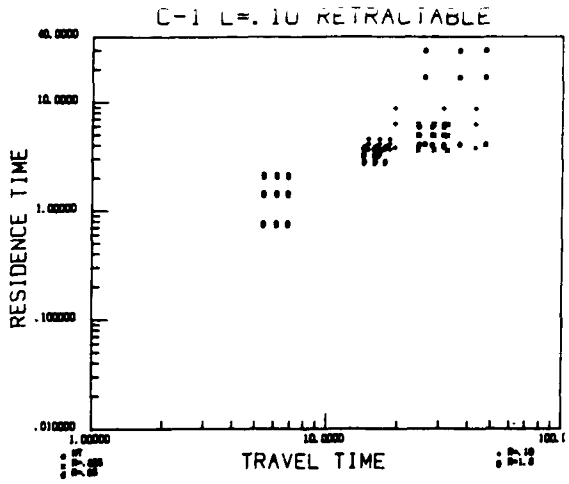
A28

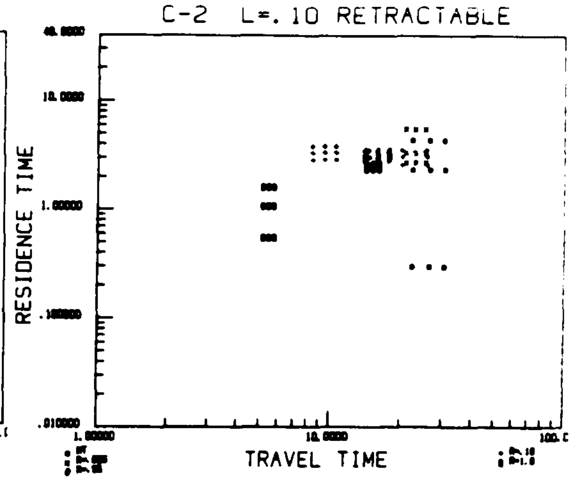
Figure A29. For the depleted in 8-prey condition, the BWM, BWM^+, and BWM^- values for residence time and giving-up time were used to construct this figure. The residence times (Y-axis) are plotted against giving-up times (X-axis). In each group of points the middle point represents the BWMs of these variables on the X and Y axes. Points around the BWM represent variability expressed in BWM^+ and BWM^- values. Each panel show results for one subject. The open squares indicate results with natural travel. The reset-probabilities are indicated by different symbols.

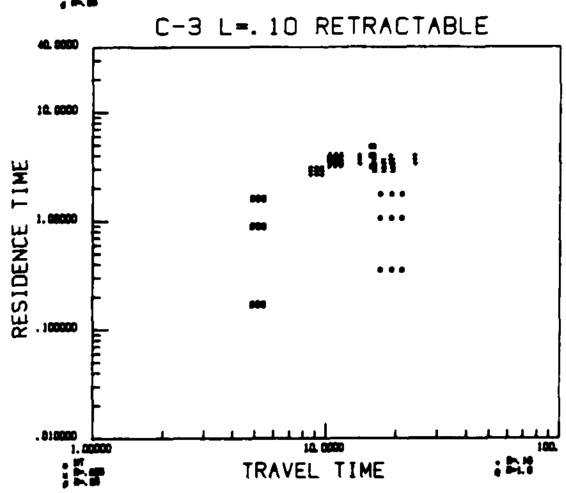

101 L=1.0-D=.125
RESIDENCE TIME
GIVING UP TIME
104 L=1.0-D=.125
RESIDENCE TIME
GIVING UP TIME
123 L=1.0-D=.125
RESIDENCE TIME
GIVING UP TIME
230 L=1.0-D=.125
RESIDENCE TIME
GIVING UP TIME

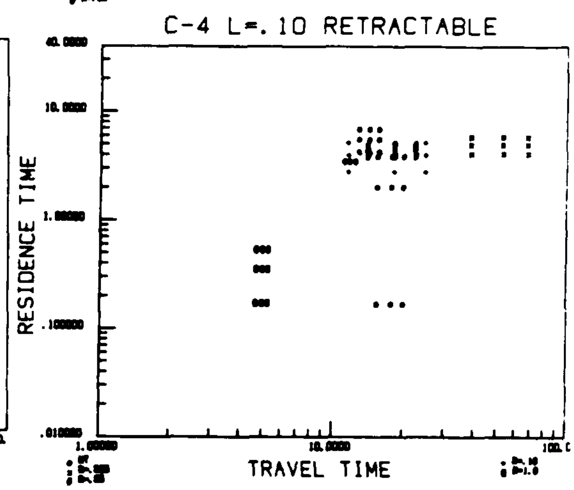
A29

Figure A30. For the depleted in 1-prey condition, the BWM, BWM^+, and BWM^- values for residence time and travel time were used to construct this figure. The residence times (Y-axis) are plotted against travel times (X-axis). In each group of points the middle point represents the BWMs of these variables on the X and Y axes. Points around the BWM represent variability expressed in BWM^+ and BWM^- values. Each panel show results for one subject. The open squares indicate results with natural travel. The reset-probabilities are indicated by different symbols.


C-1 L=.10 RETRACTABLE
RESIDENCE TIME
TRAVEL TIME


C-2 L=.10 RETRACTABLE
RESIDENCE TIME
TRAVEL TIME


C-3 L=.10 RETRACTABLE
RESIDENCE TIME
TRAVEL TIME


C-4 L=.10 RETRACTABLE
RESIDENCE TIME
TRAVEL TIME

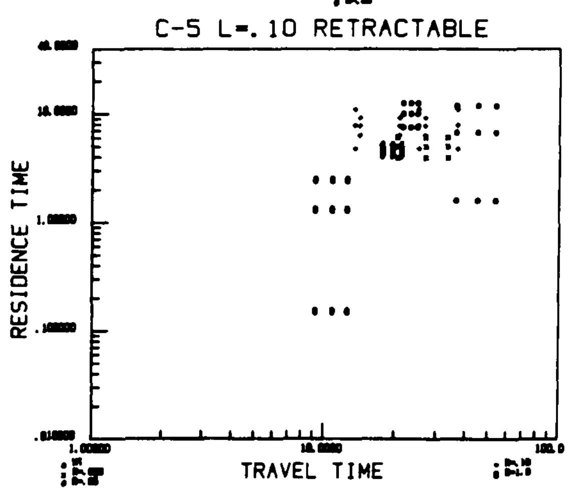
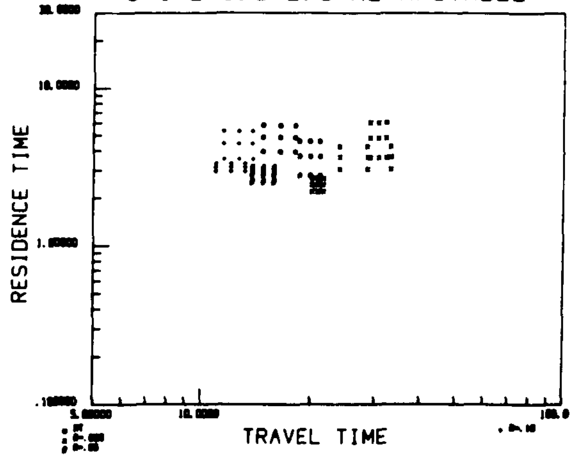
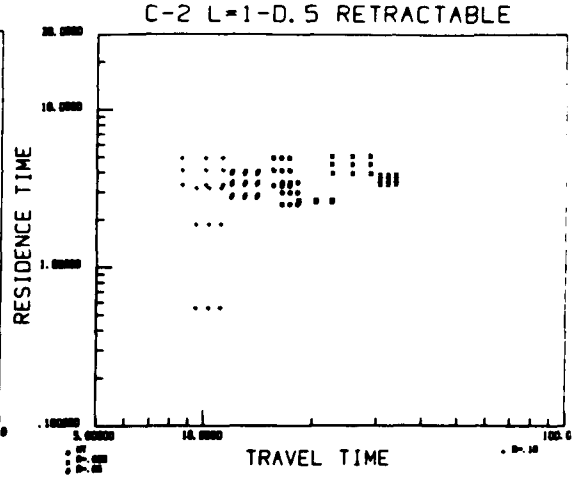

C-5 L=.10 RETRACTABLE
RESIDENCE TIME
TRAVEL TIME

Figure A31. For the depleted in 2-prey condition, the BWM, BWM^+, and BWM^- values for residence time and travel time were used to construct this figure. The residence times (Y-axis) are plotted against travel times (X-axis). In each group of points the middle point represents the BWMs of these variables on the X and Y axes. Points around the BWM represent variability expressed in BWM^+ and BWM^- values. Each panel show results for one subject. The open squares indicate results with natural travel. The reset-probabilities are indicated by different symbols.

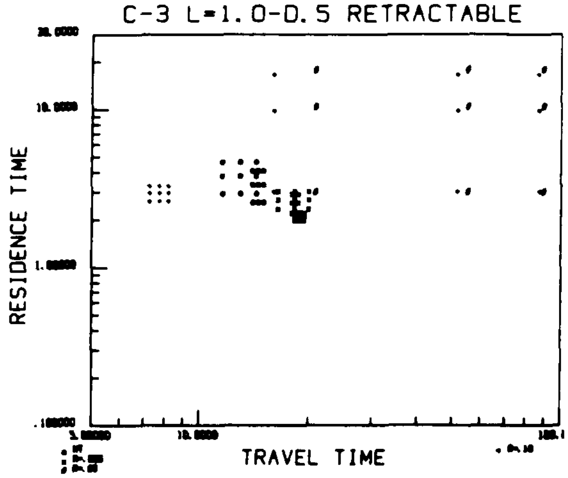
C-1 L=1.0-D.5 RETRACTABLE



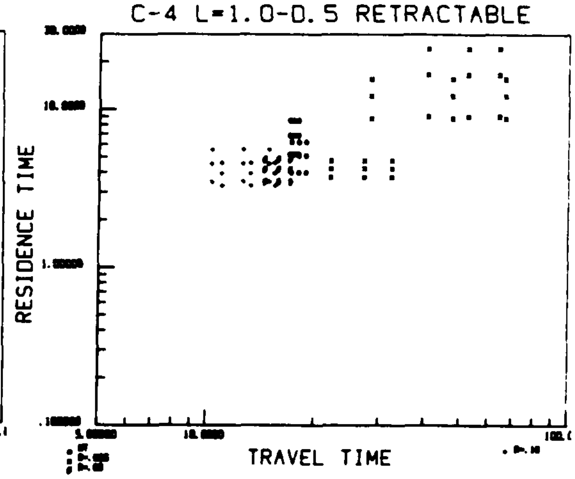
C-2 L=1-D.5 RETRACTABLE



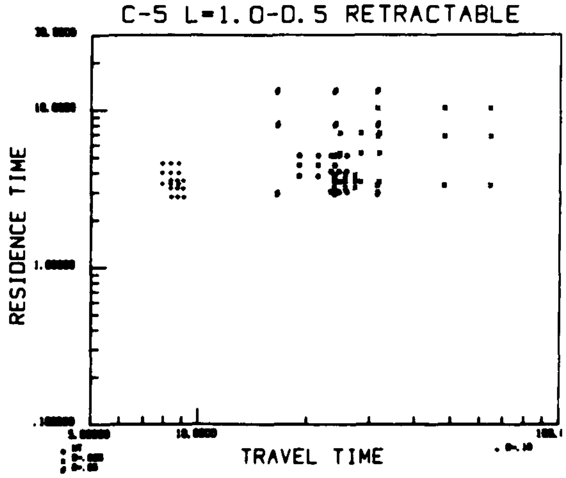
C-3 L=1.0-D.5 RETRACTABLE



C-4 L=1.0-D.5 RETRACTABLE



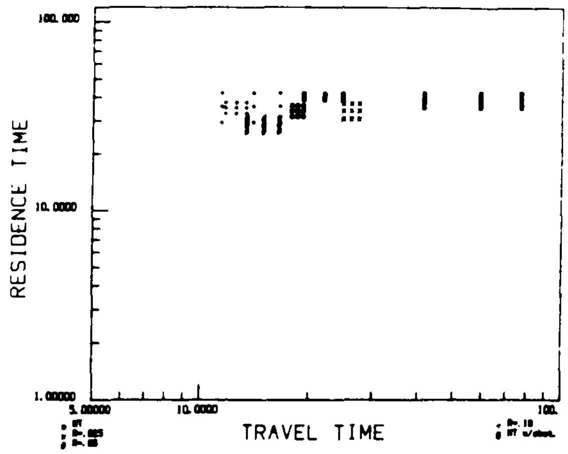
C-5 L=1.0-D.5 RETRACTABLE



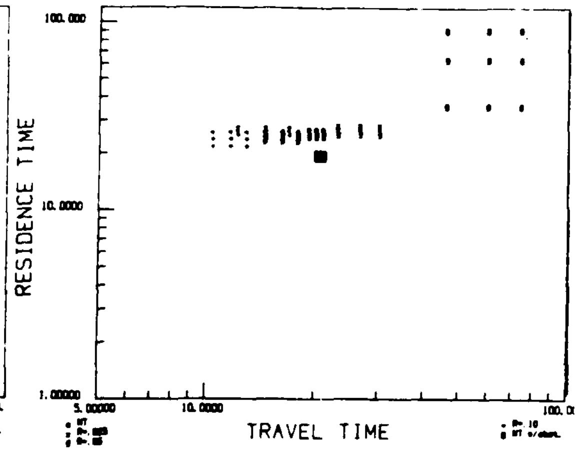
A31

Figure A32. For the depleted in 8-prey condition, the BWM, BWM^+, and BWM^- values for residence time and travel time were used to construct this figure. The residence times (Y-axis) are plotted against travel times (X-axis). In each group of points the middle point represents the BWMs of these variables on the X and Y axes. Points around the BWM represent variability expressed in BWM^+ and BWM^- values. Each panel show results for one subject. The open squares indicate results with natural travel. The reset-probabilities are indicated by different symbols.

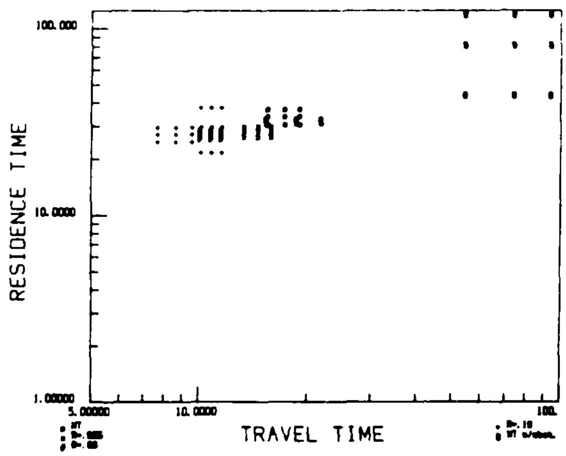
C-1 L=1.0--0.125 RETRACTABLE



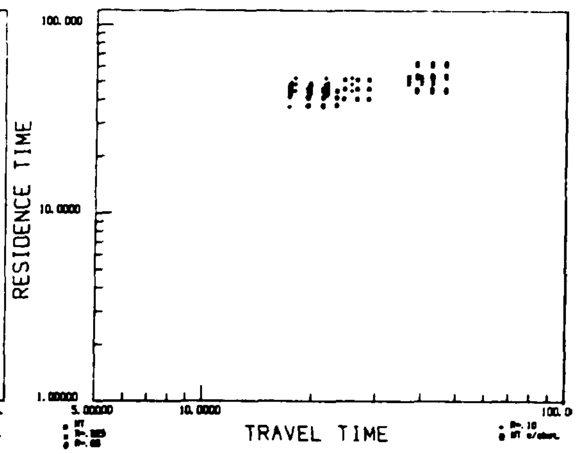
C-2 L=1.0--0.125 RETRACTABLE



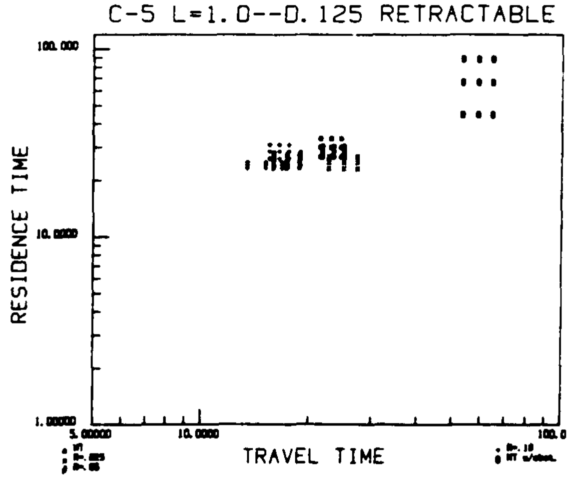
C-3 L=1.0--0.125 RETRACTABLE



C-4 L=1.0--0.125 RETRACTABLE



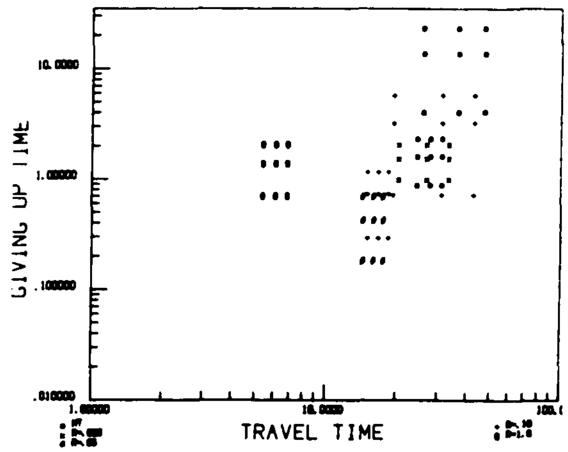
C-5 L=1.0--0.125 RETRACTABLE



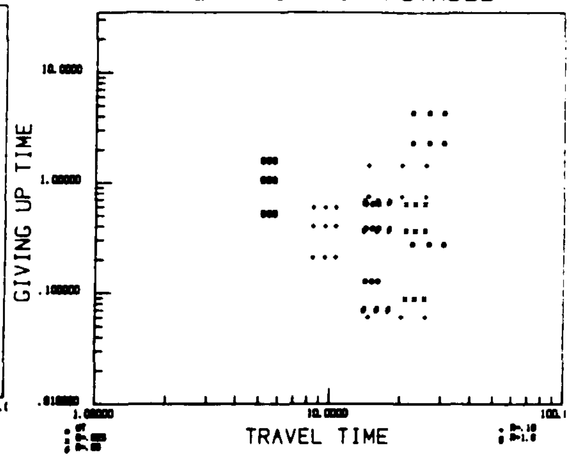
A32

Figure A33. For the depleted in 1-prey condition, the BWM, BWM^+, and BWM^- values for giving-up time and travel time were used to construct this figure. The giving-up times (Y-axis) are plotted against travel times (X-axis). In each group of points the middle point represents the BWMs of these variables on the X and Y axes. Points around the BWM represent variability expressed in BWM^+ and BWM^- values. Each panel show results for one subject. The open squares indicate results with natural travel. The reset-probabilities are indicated by different symbols.

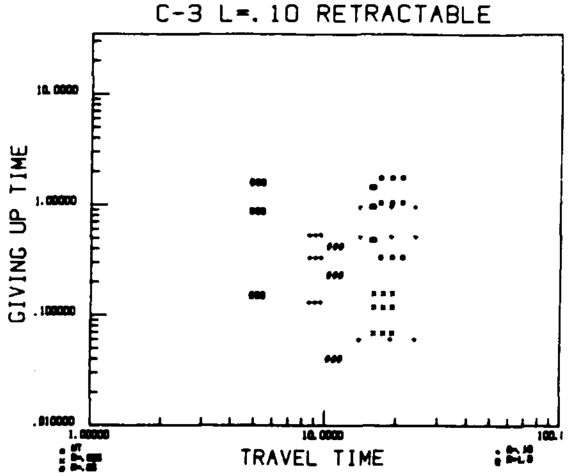
C-1 L=.10 RETRACTABLE



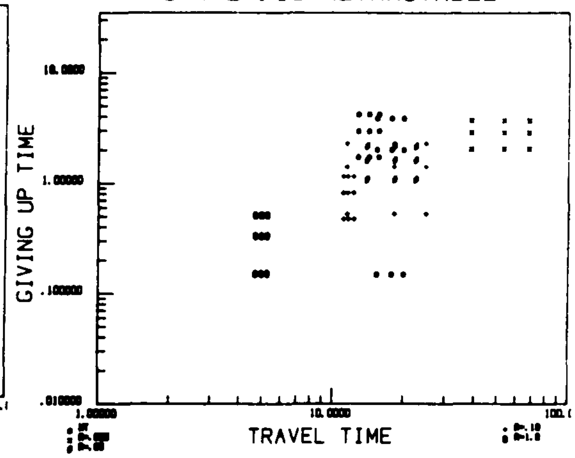
C-2 L=.10 RETRACTABLE



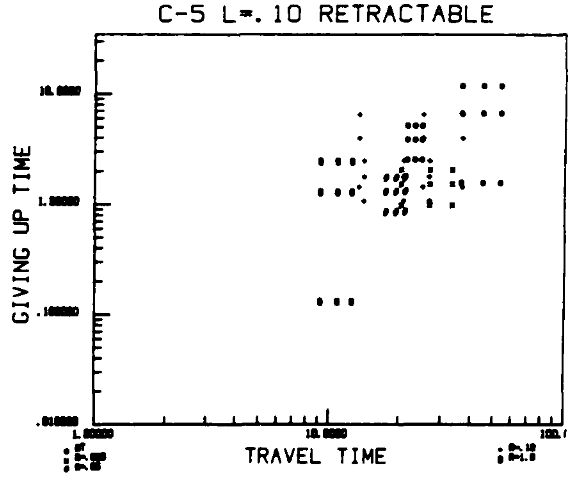
C-3 L=.10 RETRACTABLE



C-4 L=.10 RETRACTABLE

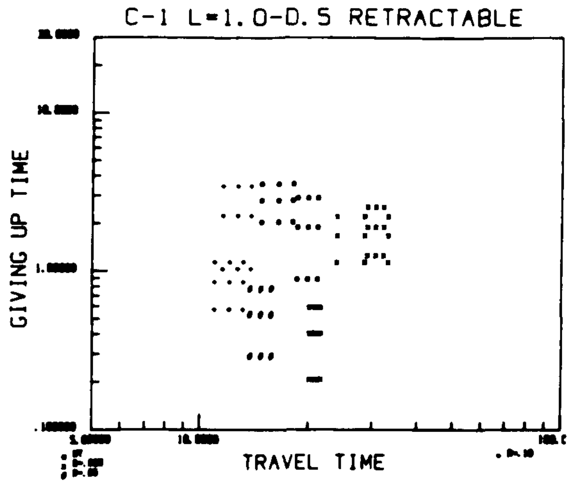


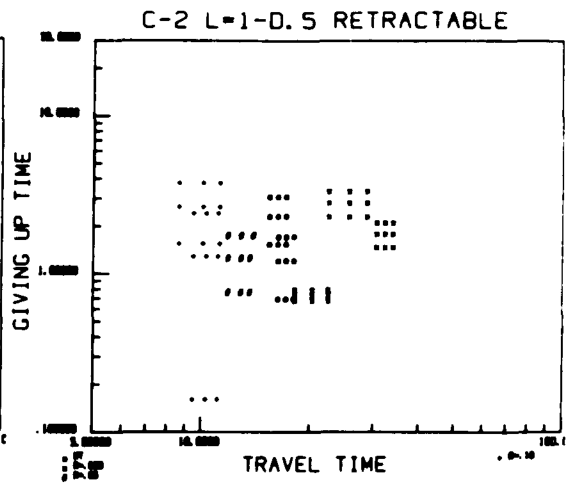
C-5 L=.10 RETRACTABLE

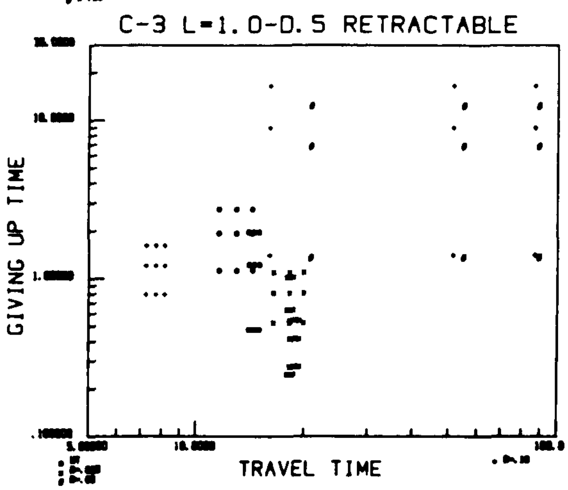


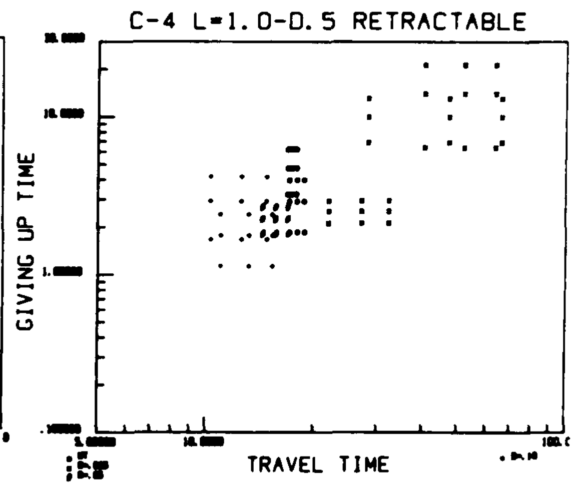
A33

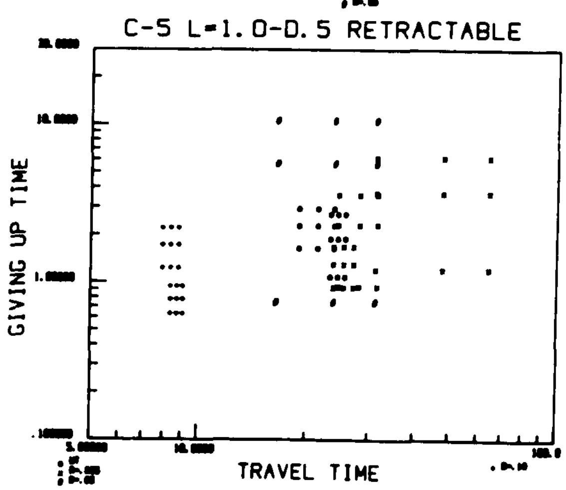
Figure A34. For the depleted in 2-prey condition, the BWM, BWM^+, and BWM^- values for giving-up time and travel time were used to construct this figure. The giving-up times (Y-axis) are plotted against travel times (X-axis). In each group of points the middle point represents the BWMs of these variables on the X and Y axes. Points around the BWM represent variability expressed in BWM^+ and BWM^- values. Each panel show results for one subject. The open squares indicate results with natural travel. The reset-probabilities are indicated by different symbols.


C-1 L=1.0-D.5 RETRACTABLE
GIVING UP TIME
TRAVEL TIME


C-2 L=1-D.5 RETRACTABLE
GIVING UP TIME
TRAVEL TIME


C-3 L=1.0-D.5 RETRACTABLE
GIVING UP TIME
TRAVEL TIME

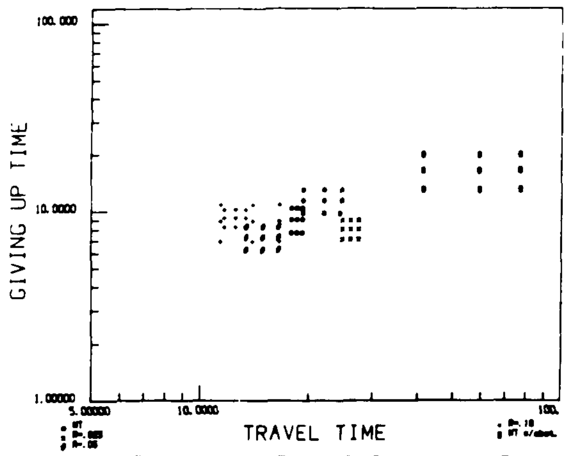

C-4 L=1.0-D.5 RETRACTABLE
GIVING UP TIME
TRAVEL TIME


C-5 L=1.0-D.5 RETRACTABLE
GIVING UP TIME
TRAVEL TIME

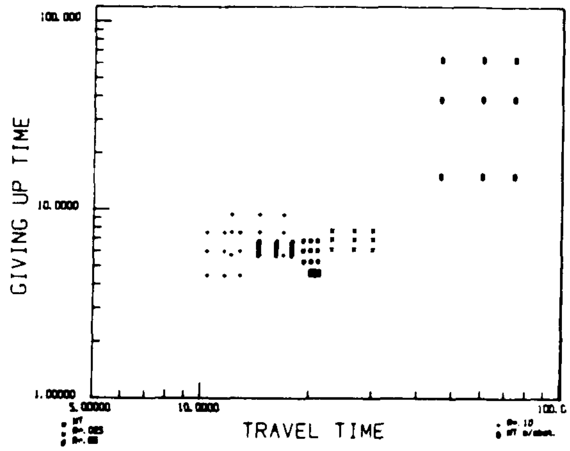
A34

Figure A35. For the depleted in 8-prey condition, the BWM, BWM^+, and BWM^- values for giving-up time and travel time were used to construct this figure. The giving-up times (Y-axis) are plotted against travel times (X-axis). In each group of points the middle point represents the BWMs of these variables on the X and Y axes. Points around the BWM represent variability expressed in BWM^+ and BWM^- values. Each panel show results for one subject. The open squares indicate results with natural travel. The reset-probabilities are indicated by different symbols.

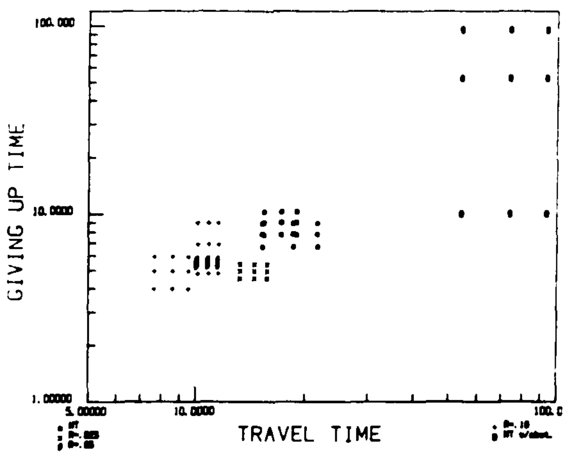
C-1 L=1.0--D.125 RETRACTABLE



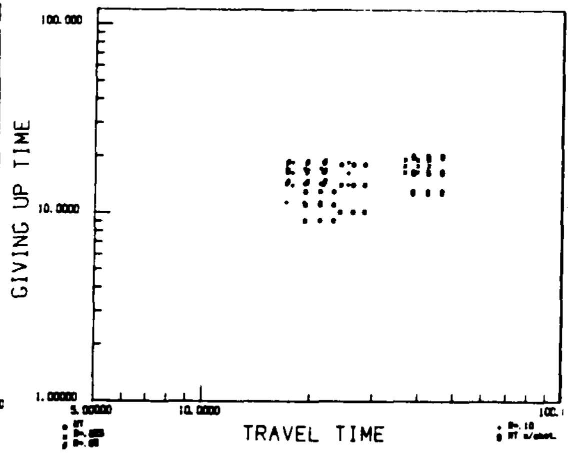
C-2 L=1.0--D.125 RETRACTABLE



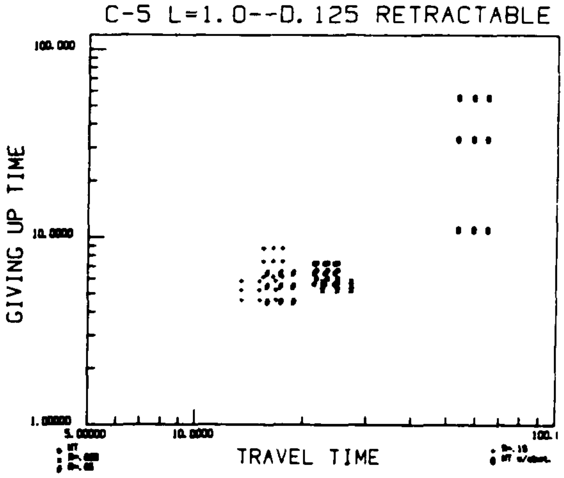
C-3 L=1.0--D.125 RETRACTABLE



C-4 L=1.0--D.125 RETRACTABLE

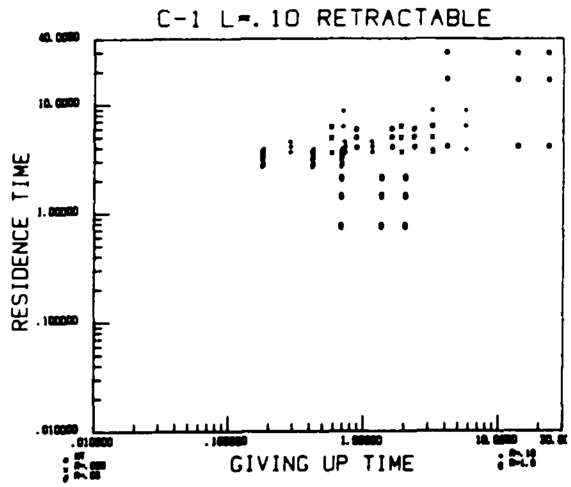


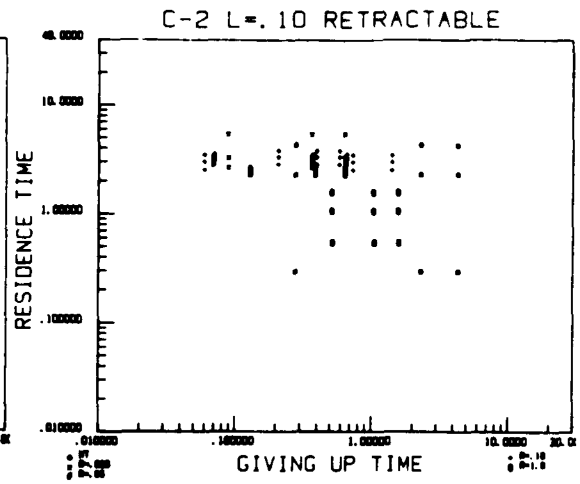
C-5 L=1.0--D.125 RETRACTABLE

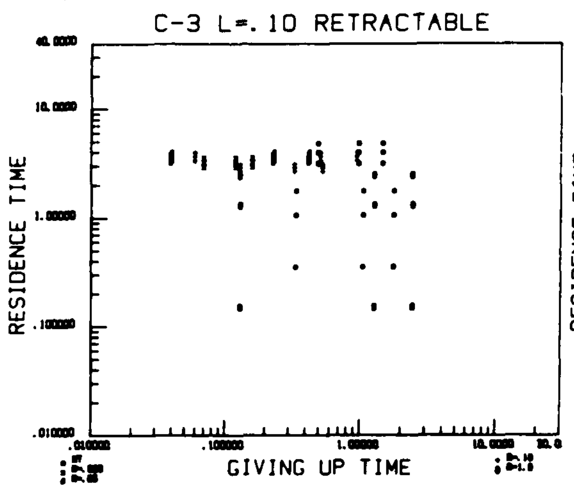


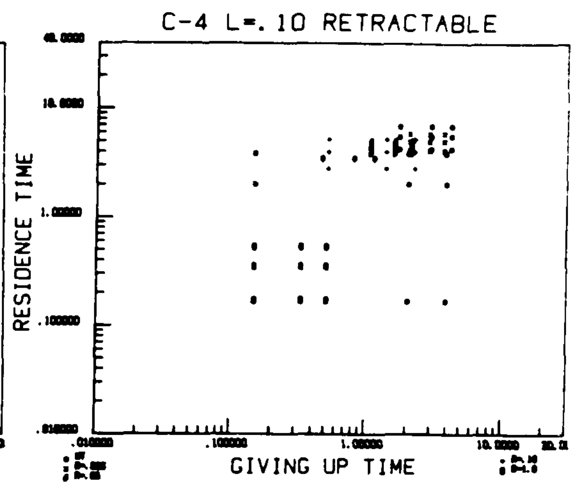
A35

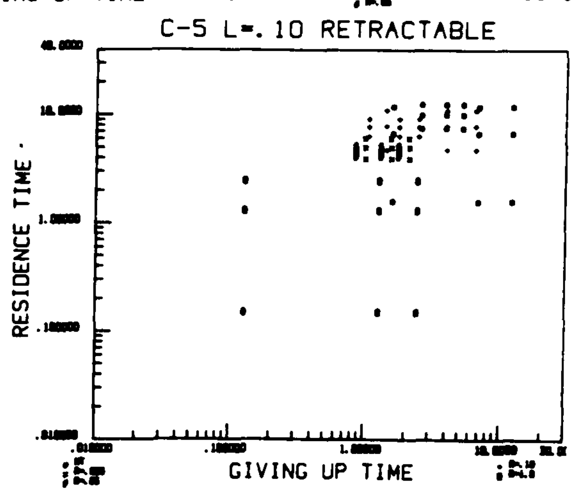
Figure A36. For the depleted in 1-prey condition, the BWM, BWM^+, and BWM^- values for residence time and giving-up time were used to construct this figure. The residence times (Y-axis) are plotted against giving-up times (X-axis). In each group of points the middle point represents the BWMs of these variables on the X and Y axes. Points around the BWM represent variability expressed in BWM^+ and BWM^- values. Each panel show results for one subject. The open squares indicate results with natural travel. The reset-probabilities are indicated by different symbols.


C-1 L=.10 RETRACTABLE
RESIDENCE TIME
GIVING UP TIME


C-2 L=.10 RETRACTABLE
RESIDENCE TIME
GIVING UP TIME


C-3 L=.10 RETRACTABLE
RESIDENCE TIME
GIVING UP TIME

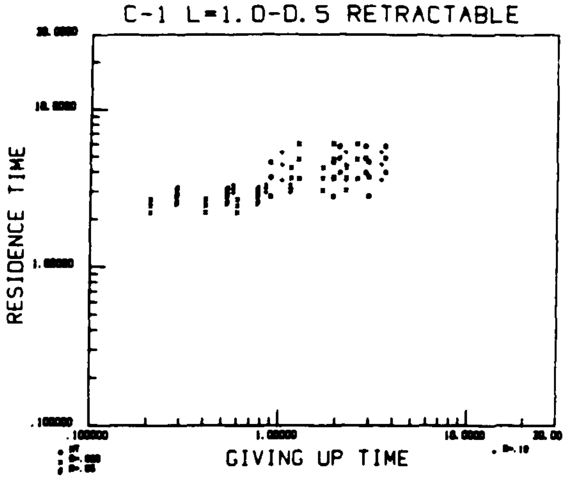

C-4 L=.10 RETRACTABLE
RESIDENCE TIME
GIVING UP TIME


C-5 L=.10 RETRACTABLE
RESIDENCE TIME
GIVING UP TIME

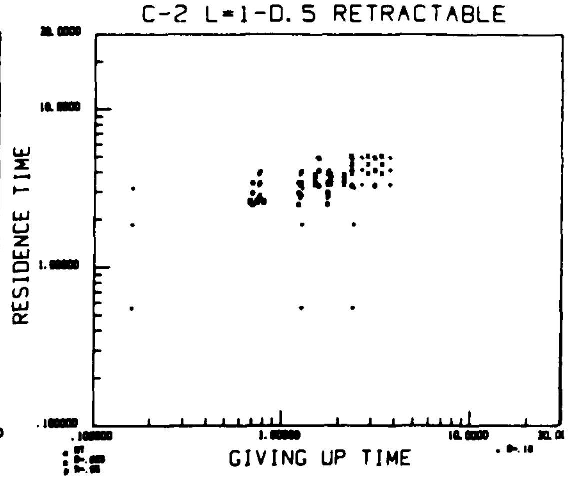
A36

Figure A37. For the depleted in 2-prey condition, the BWM, BWM^+, and BWM^- values for residence time and giving-up time were used to construct this figure. The residence times (Y-axis) are plotted against giving-up times (X-axis). In each group of points the middle point represents the BWMs of these variables on the X and Y axes. Points around the BWM represent variability expressed in BWM^+ and BWM^- values. Each panel show results for one subject. The open squares indicate results with natural travel. The reset-probabilities are indicated by different symbols.

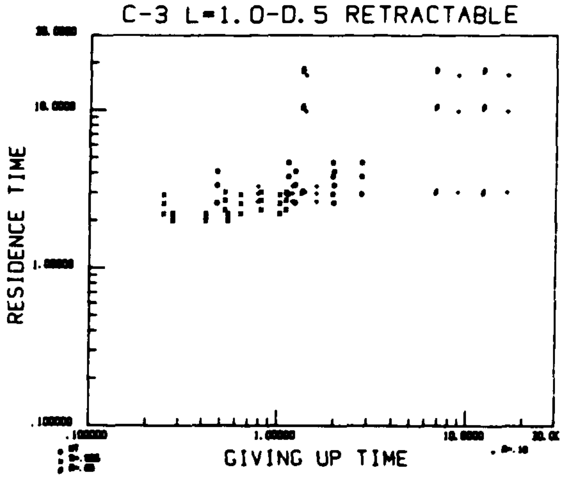
C-1 L=1.0-D.5 RETRACTABLE



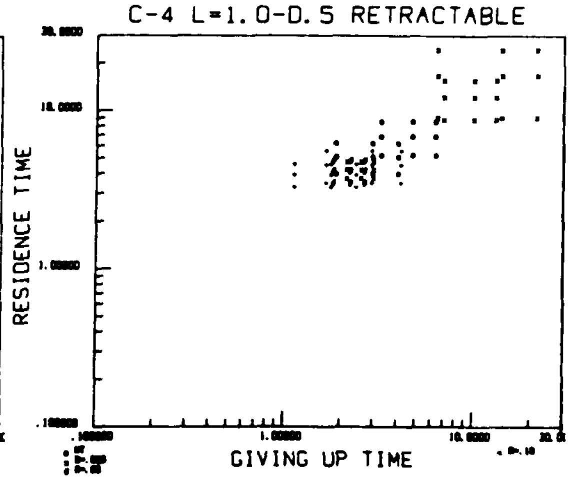
C-2 L=1-D.5 RETRACTABLE



C-3 L=1.0-D.5 RETRACTABLE



C-4 L=1.0-D.5 RETRACTABLE



C-5 L=1.0-D.5 RETRACTABLE

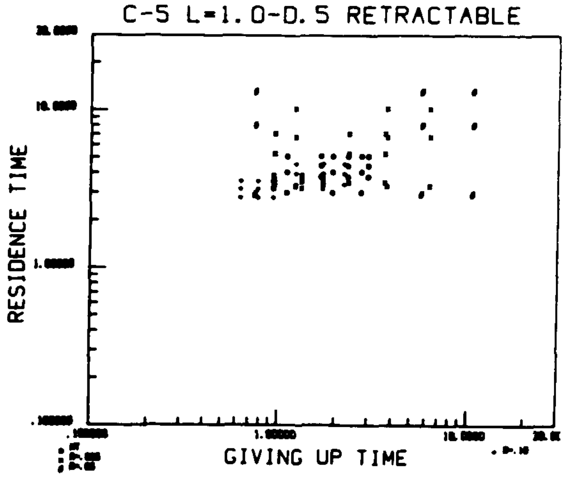
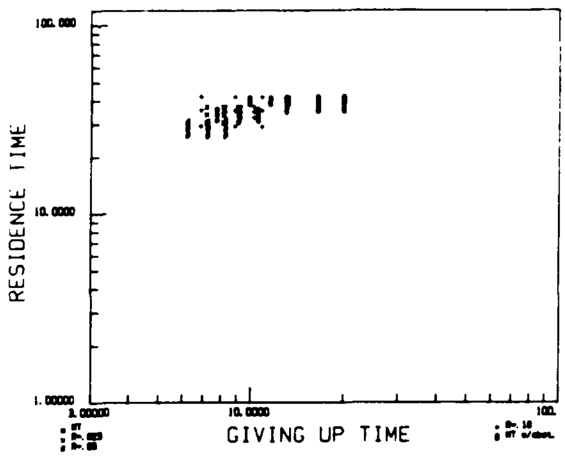
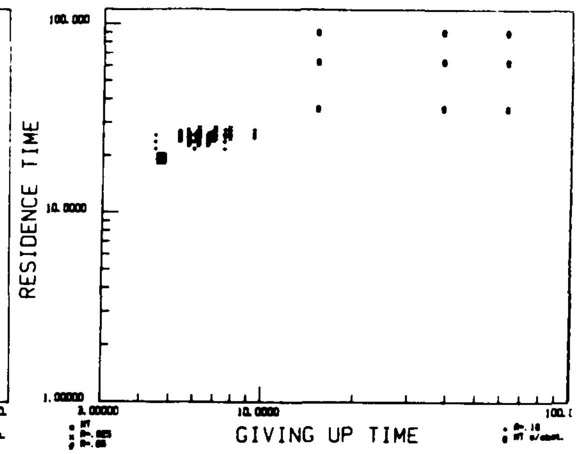


Figure A38. For the depleted in 8-prey condition, the BWM, BWM^+, and BWM^- values for residence time and giving-up time were used to construct this figure. The residence times (Y-axis) are plotted against giving-up times (X-axis). In each group of points the middle point represents the BWMs of these variables on the X and Y axes. Points around the BWM represent variability expressed in BWM^+ and BWM^- values. Each panel show results for one subject. The open squares indicate results with natural travel. The reset-probabilities are indicated by different symbols.

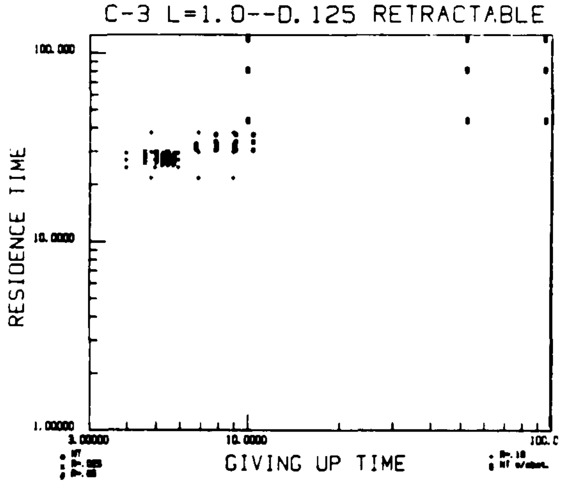
C-1 L=1.0--D.125 RETRACTABLE



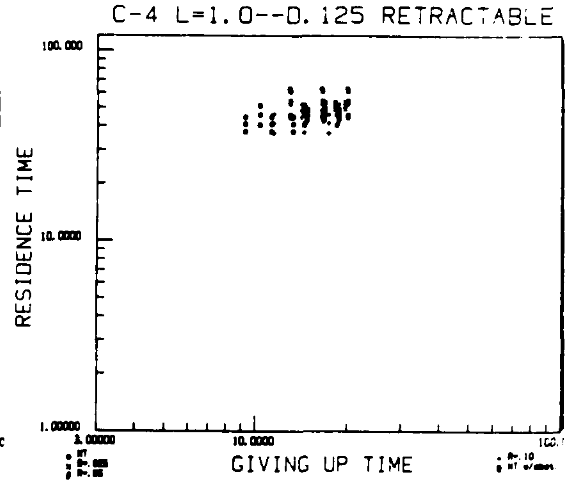
C-2 L=1.0--D.125 RETRACTABLE



C-3 L=1.0--D.125 RETRACTABLE



C-4 L=1.0--D.125 RETRACTABLE



C-5 L=1.0--D.125 RETRACTABLE

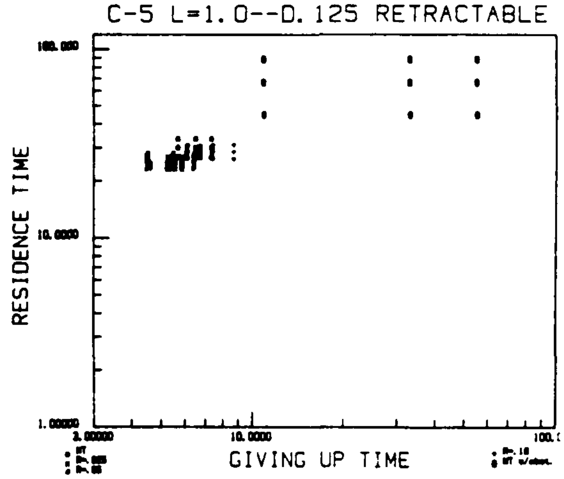
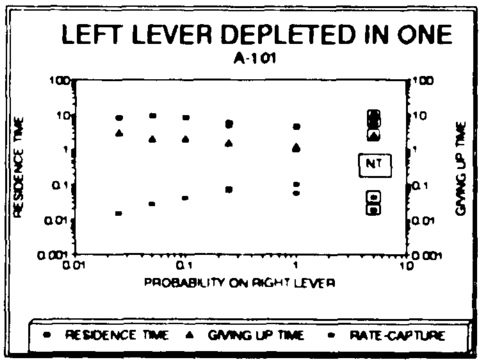
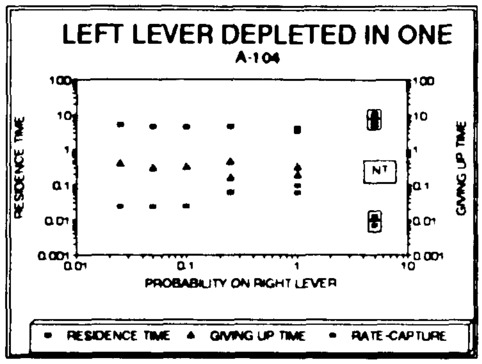
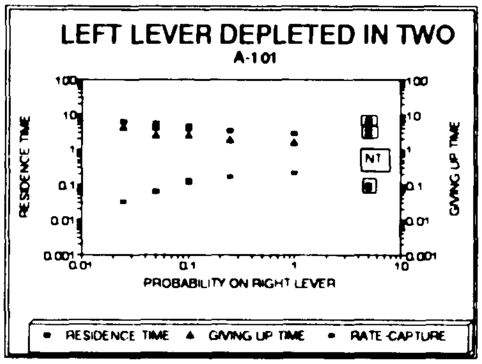
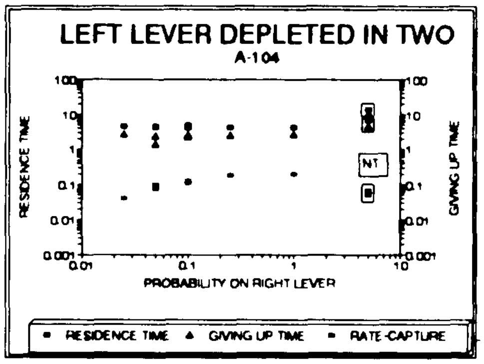


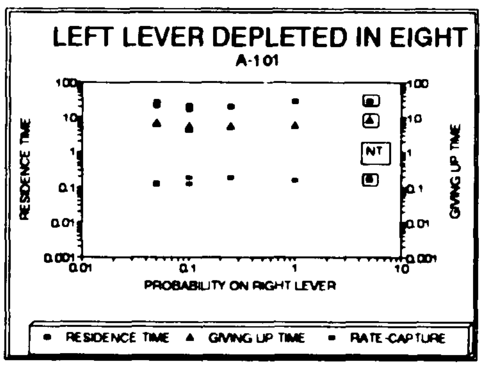
Figure A39. The means of residence time, giving-up time, and average rate of capture (Y-axes) are plotted against the probability on the right lever (X-axis). The filled squares represent the means of residence time, the triangles the means of giving-up time, and the asterisks the means of the average rate of capture. Natural travel results are enclosed in boxes. The left-hand graphs show results for subject A-101, and the right-hand panels results for subject A-104.

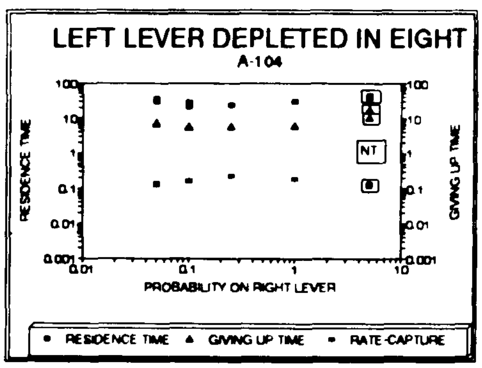

LEFT LEVER DEPLETED IN ONE
A-101
PROBABILITY ON RIGHT LEVER
RESIDENCE TIME
GIVING UP TIME
NT
RESIDENCE TIME ▲ GIVING UP TIME ▪ RATE-CAPTURE


LEFT LEVER DEPLETED IN ONE
A-104
PROBABILITY ON RIGHT LEVER
RESIDENCE TIME
GIVING UP TIME
NT
RESIDENCE TIME ▲ GIVING UP TIME ▪ RATE-CAPTURE


LEFT LEVER DEPLETED IN TWO
A-101
PROBABILITY ON RIGHT LEVER
RESIDENCE TIME
GIVING UP TIME
NT
RESIDENCE TIME ▲ GIVING UP TIME ▪ RATE-CAPTURE

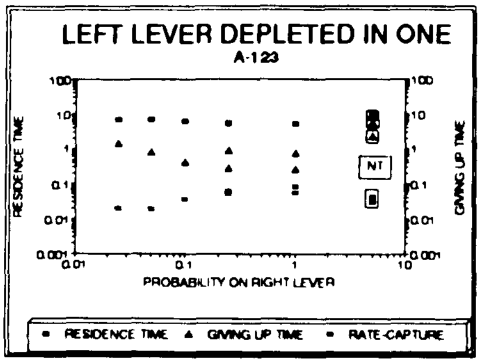

LEFT LEVER DEPLETED IN TWO
A-104
PROBABILITY ON RIGHT LEVER
RESIDENCE TIME
GIVING UP TIME
NT
RESIDENCE TIME ▲ GIVING UP TIME ▪ RATE-CAPTURE

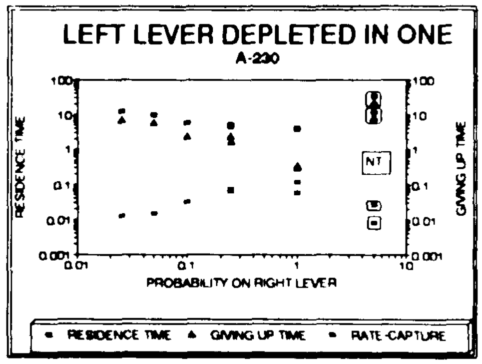

LEFT LEVER DEPLETED IN EIGHT
A-101
PROBABILITY ON RIGHT LEVER
RESIDENCE TIME
GIVING UP TIME
NT
RESIDENCE TIME ▲ GIVING UP TIME ▪ RATE-CAPTURE

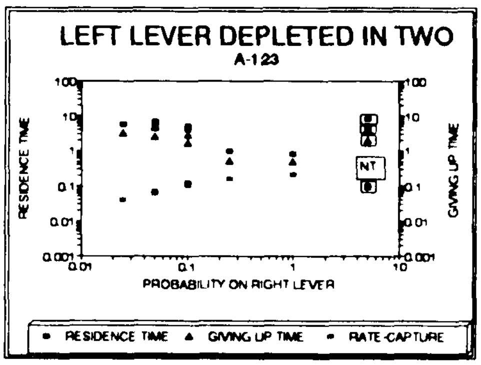

LEFT LEVER DEPLETED IN EIGHT
A-104
PROBABILITY ON RIGHT LEVER
RESIDENCE TIME
GIVING UP TIME
NT
RESIDENCE TIME ▲ GIVING UP TIME ▪ RATE-CAPTURE

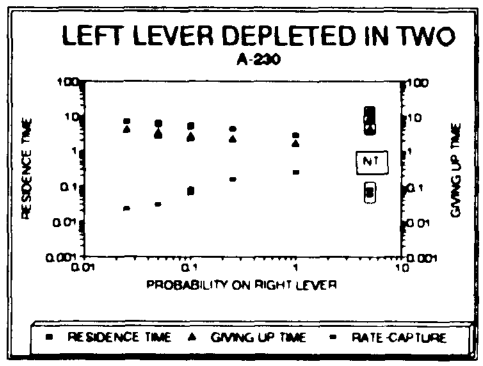
A39

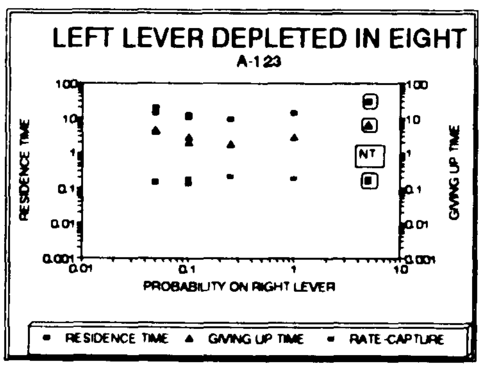
Figure A40. The means of residence time, giving-up time, and average rate of capture (Y-axes) are plotted against the probability on the right lever (X-axis). The filled squares represent the means of residence time, the triangles the means of giving-up time, and the asterisks the means of the average rate of capture. Natural travel results are enclosed in boxes. The left-hand graphs show results for subject A-123, and the right-hand panels for subject A-230.

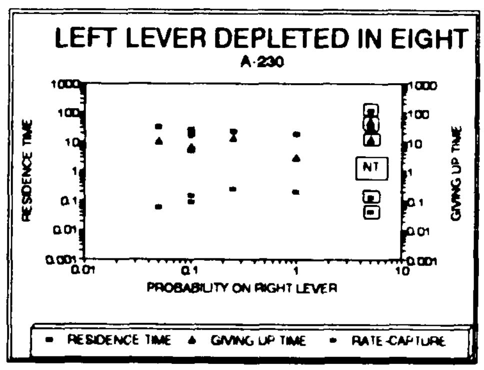

LEFT LEVER DEPLETED IN ONE
A-123
RESIDENCE TIME
GIVING UP TIME
PROBABILITY ON RIGHT LEVER
NT
RESIDENCE TIME ▲ GIVING UP TIME ■ RATE-CAPTURE


LEFT LEVER DEPLETED IN ONE
A-230
RESIDENCE TIME
GIVING UP TIME
PROBABILITY ON RIGHT LEVER
NT
RESIDENCE TIME ▲ GIVING UP TIME ■ RATE-CAPTURE


LEFT LEVER DEPLETED IN TWO
A-123
RESIDENCE TIME
GIVING UP TIME
PROBABILITY ON RIGHT LEVER
NT
RESIDENCE TIME ▲ GIVING UP TIME ■ RATE-CAPTURE

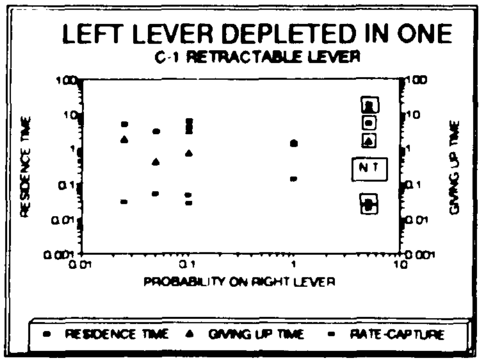

LEFT LEVER DEPLETED IN TWO
A-230
RESIDENCE TIME
GIVING UP TIME
PROBABILITY ON RIGHT LEVER
NT
RESIDENCE TIME ▲ GIVING UP TIME ■ RATE-CAPTURE

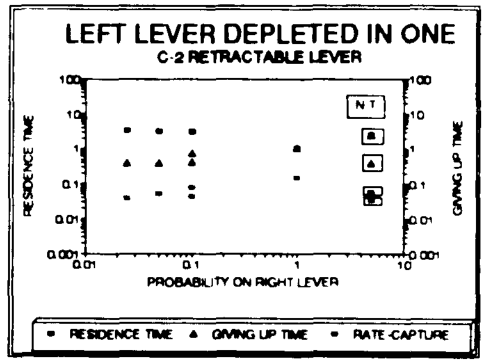

LEFT LEVER DEPLETED IN EIGHT
A-123
RESIDENCE TIME
GIVING UP TIME
PROBABILITY ON RIGHT LEVER
NT
RESIDENCE TIME ▲ GIVING UP TIME ■ RATE-CAPTURE

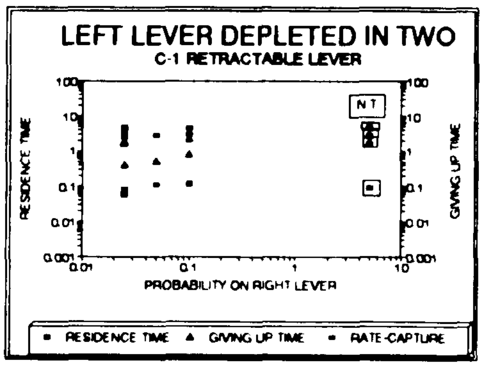

LEFT LEVER DEPLETED IN EIGHT
A-230
RESIDENCE TIME
GIVING UP TIME
PROBABILITY ON RIGHT LEVER
NT
RESIDENCE TIME ▲ GIVING UP TIME ■ RATE-CAPTURE

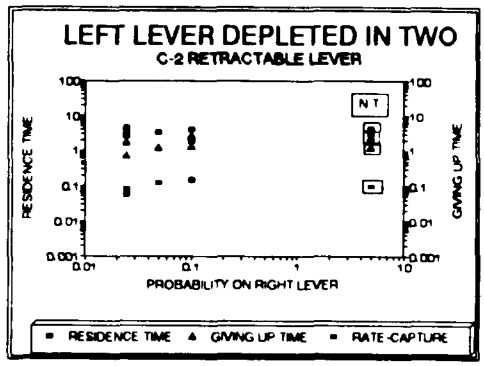
A40

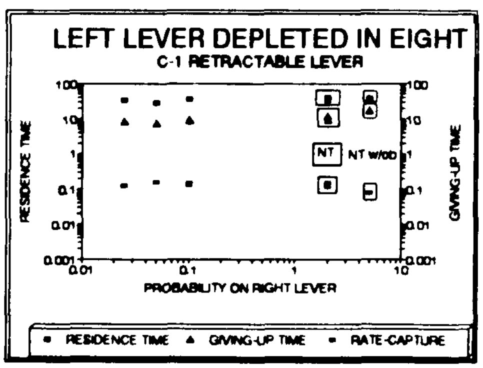
Figure A41. The means of residence time, giving-up time, and average rate of capture (Y-axes) are plotted against the probability on the right lever (X-axis). The filled squares represent the means of residence time, the triangles the means of giving-up time, and the asterisks the means of the average rate of capture. Natural travel results with and without obstacles are enclosed in boxes. The left-hand graphs show results for subject C-1, and the right-hand panels results for subject C-2.

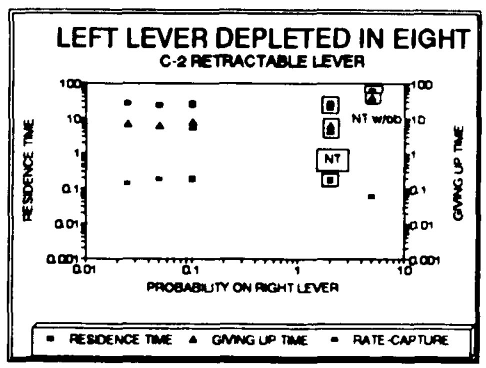

LEFT LEVER DEPLETED IN ONE
C-1 RETRACTABLE LEVER
RESIDENCE TIME
GIVING UP TIME
PROBABILITY ON RIGHT LEVER
NT
RESIDENCE TIME GIVING UP TIME RATE-CAPTURE


LEFT LEVER DEPLETED IN ONE
C-2 RETRACTABLE LEVER
RESIDENCE TIME
GIVING UP TIME
PROBABILITY ON RIGHT LEVER
NT
RESIDENCE TIME GIVING UP TIME RATE-CAPTURE


LEFT LEVER DEPLETED IN TWO
C-1 RETRACTABLE LEVER
RESIDENCE TIME
GIVING UP TIME
PROBABILITY ON RIGHT LEVER
NT
RESIDENCE TIME GIVING UP TIME RATE-CAPTURE

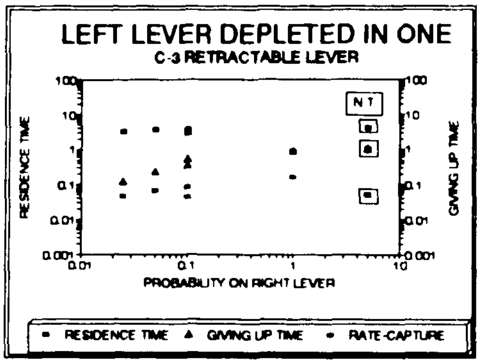

LEFT LEVER DEPLETED IN TWO
C-2 RETRACTABLE LEVER
RESIDENCE TIME
GIVING UP TIME
PROBABILITY ON RIGHT LEVER
NT
RESIDENCE TIME GIVING UP TIME RATE-CAPTURE

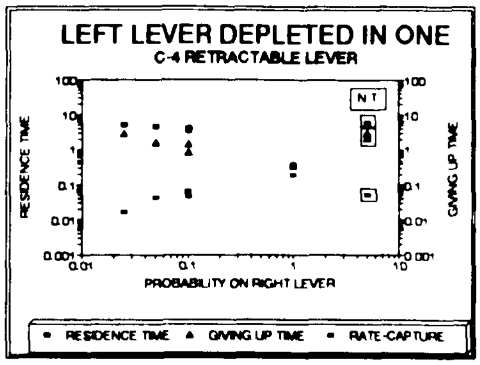

LEFT LEVER DEPLETED IN EIGHT
C-1 RETRACTABLE LEVER
RESIDENCE TIME
GIVING UP TIME
PROBABILITY ON RIGHT LEVER
NT
NT w/od
RESIDENCE TIME GIVING-UP TIME RATE-CAPTURE

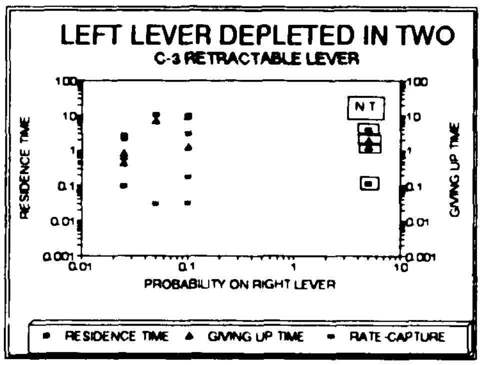

LEFT LEVER DEPLETED IN EIGHT
C-2 RETRACTABLE LEVER
RESIDENCE TIME
GIVING UP TIME
PROBABILITY ON RIGHT LEVER
NT
NT w/od
RESIDENCE TIME GIVING UP TIME RATE-CAPTURE

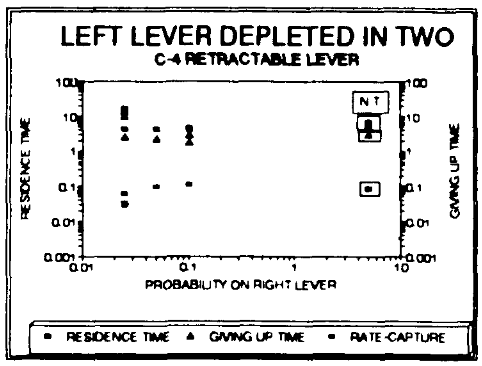
A41

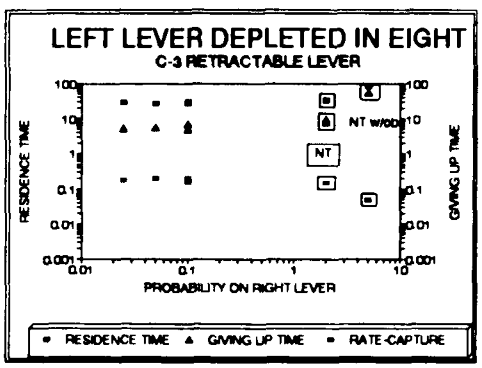
Figure A42. The means of residence time, giving-up time, and average rate of capture (Y-axes) are plotted against the probability on the right lever (X-axis). The filled squares represent the means of residence time, the triangles the means of giving-up time, and the asterisks the means of the average rate of capture. Natural travel results with and without obstacles are enclosed in boxes. The left-hand graphs show results for subject C-3, and the right-hand panels results for C-4.

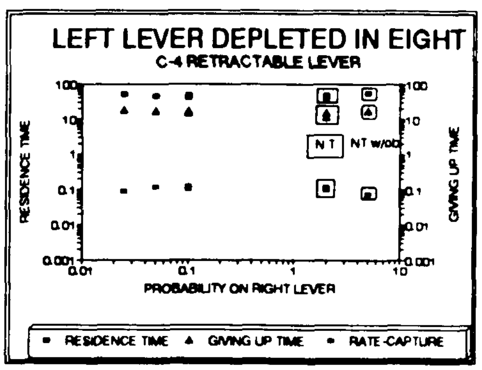

LEFT LEVER DEPLETED IN ONE
C-3 RETRACTABLE LEVER
RESIDENCE TIME
GIVING UP TIME
PROBABILITY ON RIGHT LEVER
NT
RESIDENCE TIME ▲ GIVING UP TIME ▪ RATE-CAPTURE


LEFT LEVER DEPLETED IN ONE
C-4 RETRACTABLE LEVER
RESIDENCE TIME
GIVING UP TIME
PROBABILITY ON RIGHT LEVER
NT
RESIDENCE TIME ▲ GIVING UP TIME ▪ RATE-CAPTURE


LEFT LEVER DEPLETED IN TWO
C-3 RETRACTABLE LEVER
RESIDENCE TIME
GIVING UP TIME
PROBABILITY ON RIGHT LEVER
NT
RESIDENCE TIME ▲ GIVING UP TIME ▪ RATE-CAPTURE

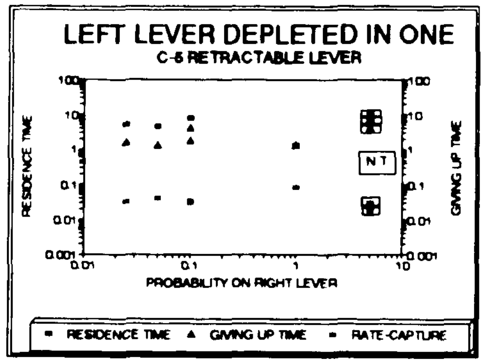

LEFT LEVER DEPLETED IN TWO
C-4 RETRACTABLE LEVER
RESIDENCE TIME
GIVING UP TIME
PROBABILITY ON RIGHT LEVER
NT
RESIDENCE TIME ▲ GIVING UP TIME ▪ RATE-CAPTURE


LEFT LEVER DEPLETED IN EIGHT
C-3 RETRACTABLE LEVER
RESIDENCE TIME
GIVING UP TIME
PROBABILITY ON RIGHT LEVER
NT
NT w/ob
RESIDENCE TIME ▲ GIVING UP TIME ▪ RATE-CAPTURE

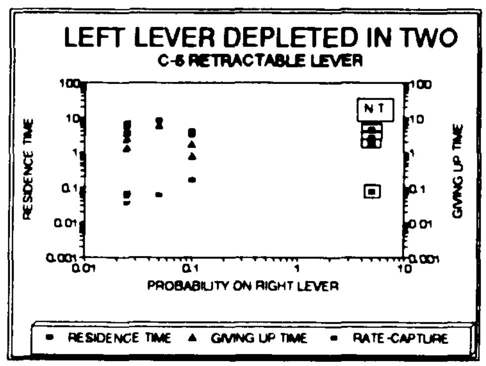

LEFT LEVER DEPLETED IN EIGHT
C-4 RETRACTABLE LEVER
RESIDENCE TIME
GIVING UP TIME
PROBABILITY ON RIGHT LEVER
NT
NT w/ob
RESIDENCE TIME ▲ GIVING UP TIME ▪ RATE-CAPTURE

A42

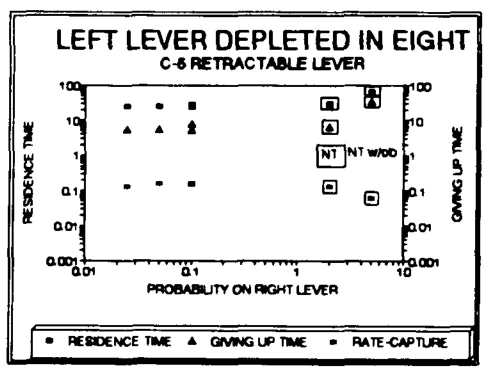
Figure A43. For subject C-5, the means of residence time, giving-up time, and average rate of capture (Y-axes) are plotted against the probability on the right lever (X-axis). The filled squares represent the means of residence time, the triangles the means of giving-up time, and the asterisks the means of the average rate of capture. Natural travel results with and without obstacles are enclosed in boxes.



LEFT LEVER DEPLETED IN ONE
C-6 RETRACTABLE LEVER
RESIDENCE TIME
GIVING UP TIME
PROBABILITY ON RIGHT LEVER
N T
RESIDENCE TIME ▲ GIVING UP TIME ▪ RATE-CAPTURE



LEFT LEVER DEPLETED IN TWO
C-6 RETRACTABLE LEVER
RESIDENCE TIME
GIVING UP TIME
PROBABILITY ON RIGHT LEVER
N T
RESIDENCE TIME ▲ GIVING UP TIME ▪ RATE-CAPTURE



LEFT LEVER DEPLETED IN EIGHT
C-6 RETRACTABLE LEVER
RESIDENCE TIME
GIVING UP TIME
PROBABILITY ON RIGHT LEVER
NT
NT w/oo
RESIDENCE TIME ▲ GIVING UP TIME ▪ RATE-CAPTURE

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Table A34. Experiment 1, patch depleted in one prey.

A-104 Linear Equation n = 7

a1 = 3.849
a2 = 0.022

x	y	x*y	x^2	y calc	% error
36.32	5.12	185.96	1319.14	4.66	0.09
36.93	4.48	165.45	1363.82	4.67	-0.04
36.49	4.23	154.35	1331.52	4.66	-0.10
12.42	4.46	55.39	154.26	4.13	0.07
11.12	4.66	51.82	123.65	4.10	0.12
6.64	3.91	25.96	44.09	4.00	-0.02
5.58	3.33	18.58	31.14	3.97	-0.19
145.50	30.19	657.51	4367.62		

A-230 Linear Equation n = 7

a1 = 3.322
a2 = 0.128

x	y	x*y	x^2	y calc	% error
68.23	12.47	850.83	4655.33	12.09	0.03
54.37	10.08	548.05	2956.10	10.31	-0.02
24.55	5.71	140.18	602.70	6.48	-0.13
10.65	4.51	48.03	113.42	4.69	-0.04
8.52	5.27	44.90	72.59	4.42	0.16
4.44	3.78	16.78	19.71	3.89	-0.03
4.49	3.95	17.74	20.16	3.90	0.01
175.25	45.77	1666.51	8440.02		

A-101 Linear Equation n = 7

a1 = 4.984
a2 = 0.075

x	y	x*y	x^2	y calc	% error
57.85	8.03	464.54	3346.62	9.34	-0.16
27.93	9.40	262.54	780.08	7.09	0.25
15.82	8.00	126.56	250.27	6.18	0.23
9.52	5.95	56.64	90.63	5.70	0.04
8.74	4.80	41.95	76.39	5.64	-0.18
5.86	4.13	24.20	34.34	5.43	-0.31
5.32	4.45	23.67	28.30	5.39	-0.21
131.04	44.76	1000.11	4606.64		

*IV= TT, DV= RES-T.

A-123 Linear Equation n = 7

a1 = 4.770
a2 = 0.052

x	y	x*y	x^2	y calc	% error
41.12	7.04	289.48	1690.85	6.90	0.02
44.60	6.94	309.52	1989.16	7.09	-0.02
21.58	6.09	131.42	465.70	5.89	0.03
15.00	5.25	78.75	225.00	5.55	-0.06
11.04	5.42	59.84	121.88	5.34	0.01
6.35	5.18	32.89	40.32	5.10	0.02
5.14	4.99	25.65	26.42	5.04	-0.01
144.83	40.91	927.56	4559.33		

*IV= TT, DV= RES-T, L=.10

*Note: TT=travel time, RES=residence time.

Table A34 (continued), BWM values transformed to logarithmic numbers.

A-104 Linear Equation n = 7 a1 = 0.492

a2 = 0.116

log x	log y	x*y	x^2	y calc	% error
1.56	0.71	1.11	2.43	0.67	0.05
1.57	0.65	1.02	2.46	0.67	-0.03
1.56	0.63	0.98	2.44	0.67	-0.07
1.09	0.65	0.71	1.20	0.62	0.05
1.05	0.67	0.70	1.09	0.61	0.08
0.82	0.59	0.49	0.68	0.59	0.01
0.75	0.52	0.39	0.56	0.58	-0.11
8.40	4.42	5.39	10.86		

*IV= TT, DV= RES-T, L=.10

A-230 Linear Equation n = 7 a1 = 0.309

a2 = 0.395

log x	log y	x*y	x^2	y calc	% error
1.83	1.10	2.01	3.36	1.03	0.06
1.74	1.00	1.74	3.01	0.99	0.01
1.39	0.76	1.05	1.93	0.86	-0.13
1.03	0.65	0.67	1.06	0.71	-0.09
0.93	0.72	0.67	0.87	0.68	0.06
0.65	0.58	0.37	0.42	0.56	0.02
0.65	0.60	0.39	0.43	0.57	0.05
8.22	5.41	6.91	11.07		

*IV=TT, DV= RES-T, L=.10

A-101 Linear Equation n = 7 a1 = 0.419

a2 = 0.328

log x	log y	x*y	x^2	y calc	% error
1.76	0.90	1.59	3.11	1.00	-0.10
1.45	0.97	1.41	2.09	0.89	0.08
1.20	0.90	1.08	1.44	0.81	0.10
0.98	0.77	0.76	0.96	0.74	0.04
0.94	0.68	0.64	0.89	0.73	-0.07
0.77	0.62	0.47	0.59	0.67	-0.09
0.73	0.65	0.47	0.53	0.66	-0.01
7.82	5.50	6.43	9.60		

*IV= TT, DV= RES-T, L=1.0

A-123 Linear Equation n = 7 a1 = 0.573

a2 = 0.160

log x	log y	x*y	x^2	y calc	% error
1.61	0.85	1.37	2.61	0.83	0.02
1.65	0.84	1.39	2.72	0.84	0.01
1.33	0.78	1.05	1.78	0.79	-0.00
1.18	0.72	0.85	1.38	0.76	-0.06
1.04	0.73	0.77	1.09	0.74	-0.01
0.80	0.71	0.57	0.64	0.70	0.02
0.71	0.70	0.50	0.51	0.69	0.02
8.33	5.34	6.48	10.73		

*IV= TT, DV= RES-T, L=.10

Table A35. Experiment 1, patch depleted in two prey.

A-104 Linear Equation n = 7 a1 = 4.196 a2 = 0.010

x	y	x*y	x^2	y calc	% error
43.38	4.63	200.85	1881.82	4.63	0.00
16.11	4.42	71.21	259.53	4.36	0.01
20.57	4.29	88.25	423.12	4.40	-0.03
11.69	3.97	46.41	136.66	4.31	-0.09
12.92	4.74	61.24	166.93	4.32	0.09
6.09	4.22	25.70	37.09	4.26	-0.01
5.48	4.26	23.34	30.03	4.25	0.00
116.24	30.53	517.00	2935.18		

A-230 Linear Equation n = 7 a1 = 3.793 a2 = 0.040

x	y	x*y	x^2	y calc	% error
83.10	6.87	570.90	6905.61	7.11	-0.03
58.02	6.50	377.13	3366.32	6.11	0.06
61.18	5.95	364.02	3742.99	6.24	-0.05
25.94	4.82	125.03	672.88	4.83	-0.00
17.77	5.50	97.74	315.77	4.50	0.18
8.27	4.39	36.31	68.39	4.12	0.06
4.47	2.85	12.74	19.98	3.97	-0.39
258.75	36.88	1583.86	15091.95		

A-101 Linear Equation n = 7 a1 = 3.133 a2 = 0.055

x	y	x*y	x^2	y calc	% error
58.14	6.09	354.07	3380.26	6.33	-0.04
26.18	5.54	145.04	685.39	4.57	0.17
26.36	4.02	105.97	694.85	4.58	-0.14
11.32	3.86	43.70	128.14	3.75	0.03
13.70	4.41	60.42	187.69	3.89	0.12
8.20	3.42	28.04	67.24	3.58	-0.05
6.09	2.83	17.23	37.09	3.47	-0.23
149.99	30.17	754.47	5180.66		

A-123 Linear Equation n = 7 a1 = 1.498 a2 = 0.138

x	y	x*y	x^2	y calc	% error
41.99	5.65	237.24	1763.16	7.30	-0.29
24.26	7.10	172.25	588.55	4.85	0.32
24.25	5.04	122.22	588.06	4.85	0.04
13.88	4.97	68.98	192.65	3.42	0.31
12.49	3.92	48.96	156.00	3.22	0.18
7.55	0.97	7.32	57.00	2.54	-1.62
5.66	0.81	4.58	32.04	2.28	-1.81
130.08	28.46	661.56	3377.46		

*IV= TT, DV= RES-T, L=1.0-D.5

*Note: TT=travel time, RES-T=residence time.

Table A35 (continued). BWM values transformed to logarithmic numbers.

A-104 **Linear Equation** n = 7 — a1 = 0.594; a2 = 0.040

log x	log y	x*y	x^2	y calc	% error
1.64	0.67	1.09	2.68	0.66	0.01
1.21	0.65	0.78	1.46	0.64	0.00
1.31	0.63	0.83	1.72	0.65	-0.02
1.07	0.60	0.64	1.14	0.64	-0.06
1.11	0.68	0.75	1.23	0.64	0.06
0.78	0.63	0.49	0.62	0.63	-0.00
0.74	0.63	0.46	0.55	0.62	0.01
7.86	4.47	5.05	9.40		

*IV= TT, DV= RES-T, L=1.0--D.5

A-230 **Linear Equation** n = 7 — a1 = 0.355; a2 = 0.254

log x	log y	x*y	x^2	y calc	% error
1.92	0.84	1.61	3.68	0.84	-0.01
1.76	0.81	1.43	3.11	0.80	0.01
1.79	0.77	1.38	3.19	0.81	-0.04
1.41	0.68	0.97	2.00	0.71	-0.04
1.25	0.74	0.93	1.56	0.67	0.09
0.92	0.64	0.59	0.84	0.59	0.09
0.65	0.45	0.30	0.42	0.52	-0.14
9.70	4.95	7.20	14.81		

*IV= TT, DV= RES-T, L=1.0--D.5

A-101 **Linear Equation** n = 7 — a1 = 0.247; a2 = 0.309

log x	log y	x*y	x^2	y calc	% error
1.76	0.78	1.38	3.11	0.79	-0.01
1.42	0.74	1.05	2.01	0.68	0.08
1.42	0.60	0.86	2.02	0.69	-0.13
1.05	0.59	0.62	1.11	0.57	0.02
1.14	0.64	0.73	1.29	0.60	0.07
0.91	0.53	0.49	0.84	0.53	0.01
0.78	0.45	0.35	0.62	0.49	-0.08
8.49	4.35	5.49	11.00		

*IV= TT, DV= RES-T, L=1.0--D.5

A-123 **Linear Equation** n = 7 — a1 = -0.798; a2 = 1.098

log x	log y	x*y	x^2	y calc	% error
1.62	0.75	1.22	2.63	0.98	-0.31
1.38	0.85	1.18	1.92	0.72	0.15
1.38	0.70	0.97	1.92	0.72	-0.03
1.14	0.70	0.80	1.31	0.46	0.34
1.10	0.59	0.65	1.20	0.41	0.31
0.88	-0.01	-0.01	0.77	0.17	13.59
0.75	-0.09	-0.07	0.57	0.03	1.32
8.26	3.49	4.74	10.31		

*IV= TT, DV= RES-T, L=1.0--D.5

Table A36. Experiment 1, patch depleted in eight prey.

A-104 Linear Equation n = 6 a1 = 25.907 a2 = 0.224

x	y	x*y	x^2	y calc	% error
24.83	30.29	752.10	616.53	31.47	0.04
14.66	36.99	542.27	214.92	29.19	0.21
11.54	20.79	239.92	133.17	28.49	-0.37
9.34	28.24	263.76	87.24	28.00	0.01
5.38	24.61	132.40	28.94	27.11	-0.10
4.50	30.26	136.17	20.25	26.92	0.11
70.25	171.18	2066.62	1101.05		

A-230 Linear Equation n = 5 a1 = 19.691 a2 = 0.118

x	y	x*y	x^2	y calc	% error
94.29	32.04	3021.05	8890.60	30.86	0.04
31.09	18.04	560.86	966.59	23.37	-0.30
13.28	25.67	340.90	176.36	21.26	0.17
4.81	21.88	105.24	23.14	20.26	0.07
6.37	18.57	118.29	40.58	20.45	-0.10
149.84	116.20	4146.35	10097.26		

A-101 Linear Equation n = 6 a1 = 24.580 a2 = -0.123

x	y	x*y	x^2	y calc	% error
30.55	21.02	642.16	933.30	20.81	0.01
24.38	26.35	642.41	594.38	21.57	0.18
18.73	16.97	317.85	350.81	22.27	-0.31
14.23	21.87	311.21	202.49	22.82	-0.04
13.37	19.91	266.20	178.76	22.93	-0.15
7.06	27.99	197.61	49.84	23.71	0.15
108.32	134.11	2377.44	2309.59		

A-123 Linear Equation n = 6 a1 = 6.724 a2 = 0.612

x	y	x*y	x^2	y calc	% error
14.79	13.88	205.29	218.74	15.77	-0.14
17.76	20.20	358.75	315.42	17.59	0.13
11.15	10.47	116.74	124.32	13.55	-0.29
8.71	12.78	111.31	75.86	12.05	0.06
6.87	9.17	63.00	47.20	10.93	-0.19
6.40	14.03	89.79	40.96	10.64	0.24
65.68	80.53	944.88	822.51		

*IV = TT, DV = RES-T, L=1.0-D.125

*Note: TT=travel time, RES-T=residence time.

Table A36 (continued), BWM values transformed to logarithmic numbers.

A-104 Linear Equation n = 6 a1 = 1.373
a2 = 0.076

log x	log y	x*y	x ^ 2	y calc	% error
1.39	1.48	2.07	1.95	1.48	0.00
1.17	1.57	1.83	1.36	1.46	0.07
1.06	1.32	1.40	1.13	1.45	-0.10
0.97	1.45	1.41	0.94	1.45	0.00
0.73	1.39	1.02	0.53	1.43	-0.03
0.65	1.48	0.97	0.43	1.42	0.04
5.98	8.69	8.69	6.34		

*IV= TT, DV= RES-T, L=1.0--D.125

A-230 Linear Equation n = 5 a1 = 1.219
a2 = 0.112

log x	log y	x*y	x ^ 2	y calc	% error
1.97	1.51	2.97	3.90	1.44	0.04
1.49	1.26	1.88	2.23	1.39	-0.10
1.12	1.41	1.58	1.26	1.35	0.05
0.68	1.34	0.91	0.47	1.30	0.03
0.80	1.27	1.02	0.65	1.31	-0.03
6.08	6.78	8.37	8.50		

*IV= TT, DV= RES-T, L=1.0--D=.125

A-101 Linear Equation n = 6 a1 = 1.500
a2 = -0.130

log x	log y	x*y	x ^ 2	y calc	% error
1.49	1.32	1.96	2.21	1.31	0.01
1.39	1.42	1.97	1.92	1.32	0.07
1.27	1.23	1.56	1.62	1.34	-0.09
1.15	1.34	1.55	1.33	1.35	-0.01
1.13	1.30	1.46	1.27	1.35	-0.04
0.85	1.45	1.23	0.72	1.39	0.04
7.27	8.06	9.74	9.07		

*IV= TT, DV= RES-T, L=1.0--D=.125

A-123 Linear Equation n = 6 a1 = 0.694
a2 = 0.416

log x	log y	x*y	x ^ 2	y calc	% error
1.17	1.14	1.34	1.37	1.18	-0.03
1.25	1.31	1.63	1.56	1.21	0.07
1.05	1.02	1.07	1.10	1.13	-0.11
0.94	1.11	1.04	0.88	1.09	0.02
0.84	0.96	0.81	0.70	1.04	-0.08
0.81	1.15	0.92	0.65	1.03	0.10
6.05	6.68	6.81	6.26		

*IV= TT, DV= RES-T, L=1.0--D.125

Table A37. Experiment 1, left lever depleted in one prey.

A-104 Linear Equation n = 7 a1 = 0.257 a2 = 0.002

x	y	x*y	x^2	y calc	% error
36.32	0.40	14.53	1319.14	0.34	0.16
36.93	0.30	11.08	1363.82	0.34	-0.13
36.49	0.31	11.31	1331.52	0.34	-0.09
12.42	0.16	1.99	154.26	0.28	-0.78
11.12	0.45	5.00	123.65	0.28	0.37
6.64	0.31	2.06	44.09	0.27	0.12
5.58	0.19	1.06	31.14	0.27	-0.42
145.50	2.12	47.03	4367.62		

*IV= TT, DV= GUT.

A-230 Linear Equation n = 7 a1 = 0.392 a2 = 0.097

x	y	x*y	x^2	y calc	% error
68.23	6.98	476.25	4655.33	7.02	-0.01
54.37	5.77	313.71	2956.10	5.67	0.02
24.55	2.37	58.18	602.70	2.78	-0.17
10.65	1.67	17.79	113.42	1.43	0.15
8.52	2.34	19.94	72.59	1.22	0.48
4.44	0.30	1.33	19.71	0.82	-1.74
4.49	0.34	1.53	20.16	0.83	-1.44
175.25	19.77	888.72	8440.02		

*IV= TT, DV= GUT.

A-101 Linear Equation n = 7 a1 = 1.096 a2 = 0.034

x	y	x*y	x^2	y calc	% error
57.85	3.04	175.86	3346.62	3.08	-0.01
27.93	1.97	55.02	780.08	2.05	-0.04
15.82	2.00	31.64	250.27	1.64	0.18
9.52	1.47	13.99	90.63	1.42	0.03
8.74	1.46	12.76	76.39	1.40	0.04
5.86	1.17	6.86	34.34	1.30	-0.11
5.32	1.06	5.64	28.30	1.28	-0.21
131.04	12.17	301.78	4606.64		

*IV= TT, DV= GUT.

A-123 Linear Equation n = 7 a1 = 0.361 a2 = 0.015

x	y	x*y	x^2	y calc	% error
41.12	1.44	59.21	1690.85	0.99	0.31
44.60	0.77	34.34	1989.16	1.04	-0.35
21.58	0.40	8.63	465.70	0.69	-0.73
15.00	0.27	4.05	225.00	0.59	-1.19
11.04	0.90	9.94	121.88	0.53	0.41
6.35	0.71	4.51	40.32	0.46	0.36
5.14	0.25	1.29	26.42	0.44	-0.76
144.83	4.74	121.97	4559.33		

*IV= TT, DV=GUT.

Note: TT=travel time, GUT=giving-up time.

Table A37 (continued), BWM values transformed to logarithmic numbers.

A-104 Linear Equation n = 7 a1 = -0.753 a2 = 0.175

log x	log y	x*y	x ^ 2	y calc	% error
1.56	-0.40	-0.62	2.43	-0.48	-0.21
1.57	-0.52	-0.82	2.46	-0.48	0.08
1.56	-0.51	-0.79	2.44	-0.48	0.06
1.09	-0.80	-0.87	1.20	-0.56	0.29
1.05	-0.35	-0.36	1.09	-0.57	0.64
0.82	-0.51	-0.42	0.68	-0.61	-0.20
0.75	-0.72	-0.54	0.56	-0.62	0.14
8.40	-3.80	-4.43	10.86		

* IV= TT, DV= GUT, LL=.10

A-230 Linear Equation n = 7 a1 = -0.977 a2 = 1.024

log x	log y	x*y	x ^ 2	y calc	% error
1.83	0.84	1.55	3.36	0.90	-0.07
1.74	0.76	1.32	3.01	0.80	-0.05
1.39	0.37	0.52	1.93	0.45	-0.19
1.03	0.22	0.23	1.06	0.08	0.66
0.93	0.37	0.34	0.87	-0.02	1.06
0.65	-0.52	-0.34	0.42	-0.31	0.40
0.65	-0.47	-0.31	0.43	-0.31	0.34
8.22	1.58	3.32	11.07		

IV= TT, DV= GUT, LL= .10

A-101 Linear Equation n = 7 a1 = -0.238 a2 = 0.405

log x	log y	x*y	x ^ 2	y calc	% error
1.76	0.48	0.85	3.11	0.48	0.01
1.45	0.29	0.43	2.09	0.35	-0.18
1.20	0.30	0.36	1.44	0.25	0.18
0.98	0.17	0.16	0.96	0.16	0.05
0.94	0.16	0.15	0.89	0.14	0.13
0.77	0.07	0.05	0.59	0.07	-0.07
0.73	0.03	0.02	0.53	0.06	-1.22
7.82	1.50	2.03	9.60		

* IV= TT, DV= GUT, LL=.10

A-123 Linear Equation n = 7 a1 = -0.712 a2 = 0.392

log x	log y	x*y	x ^ 2	y calc	% error
1.61	0.16	0.26	2.61	-0.08	1.50
1.65	-0.11	-0.19	2.72	-0.07	0.42
1.33	-0.40	-0.53	1.78	-0.19	0.52
1.18	-0.57	-0.67	1.38	-0.25	0.56
1.04	-0.05	-0.05	1.09	-0.30	-5.62
0.80	-0.15	-0.12	0.64	-0.40	-1.67
0.71	-0.60	-0.43	0.51	-0.43	0.28
8.33	-1.72	-1.73	10.73		

* IV= TT, VD= GUT, LL= .10

Table A38. Experiment 1, left lever depleted in two prey.

A-104 Linear Equation n = 7 a1 = 2.355 a2 = 0.000

x	y	x*y	x^2	y calc	% error
43.38	2.73	118.43	1881.82	2.37	0.13
16.11	2.39	38.50	259.53	2.36	0.01
20.57	1.41	29.00	423.12	2.36	-0.68
11.69	2.22	25.95	136.66	2.36	-0.06
12.92	2.53	32.69	166.93	2.36	0.07
6.09	2.57	15.65	37.09	2.36	0.08
5.48	2.68	14.69	30.03	2.36	0.12
116.24	16.53	274.91	2935.18		

*IV= TT, DV= GUT

A-230 Linear Equation n = 7 a1 = 1.860 a2 = 0.025

x	y	x*y	x^2	y calc	% error
83.10	4.09	339.88	6905.61	3.92	0.04
58.02	3.50	203.07	3366.32	3.30	0.06
61.18	2.93	179.26	3742.99	3.38	-0.15
25.94	2.32	60.18	672.88	2.50	-0.08
17.17	2.62	44.99	294.81	2.29	0.13
8.27	2.28	18.86	68.39	2.07	0.09
4.47	1.68	7.51	19.98	1.97	-0.17
258.15	19.42	853.74	15070.99		

*IV=TT, DV= GUT.

A-101 Linear Equation n = 7 a1 = 1.777 a2 = 0.045

x	y	x*y	x^2	y calc	% error
58.14	4.13	240.12	3380.26	4.41	-0.07
26.18	4.13	108.12	685.39	2.96	0.28
26.36	2.46	64.85	694.85	2.97	-0.21
11.32	2.50	28.30	128.14	2.29	0.08
13.70	2.55	34.94	187.69	2.40	0.06
8.20	1.91	15.66	67.24	2.15	-0.12
6.09	1.56	9.50	37.09	2.05	-0.32
149.99	19.24	501.48	5180.66		

*IV= TT, DV= GUT.

A-123 Linear Equation n = 7 a1 = 0.701 a2 = 0.085

x	y	x*y	x^2	y calc	% error
41.99	3.32	139.41	1763.16	4.27	-0.29
24.26	4.47	108.44	588.55	2.76	0.38
24.25	2.58	62.57	588.06	2.76	-0.07
13.88	2.86	39.70	192.65	1.88	0.34
12.49	1.73	21.61	156.00	1.76	-0.02
7.55	0.53	4.00	57.00	1.34	-1.53
5.66	0.48	2.72	32.04	1.18	-1.46
130.08	15.97	378.44	3377.46		

*IV= TT, DV= GUT.

*Note: TT=travel time, GUT=giving-up time.

Table A38 (continued), BWM values transformed to logarithmic numbers.

A-104 Linear Equation n = 7 a1 = 0.447 a2 = -0.074

log x	log y	x*y	x^2	y calc	% error
1.64	0.44	0.71	2.68	0.33	0.25
1.21	0.38	0.46	1.46	0.36	0.05
1.31	0.15	0.20	1.72	0.35	-1.35
1.07	0.35	0.37	1.14	0.37	-0.06
1.11	0.40	0.45	1.23	0.37	0.09
0.78	0.41	0.32	0.62	0.39	0.05
0.74	0.43	0.32	0.55	0.39	0.08
7.86	2.55	2.82	9.40		

*DV= TT, IV= GUT, LL=1.0--D=.5

A-230 Linear Equation n = 7 a1 = 0.085 a2 = 0.247

log x	log y	x*y	x^2	y calc	% error
1.92	0.61	1.17	3.68	0.56	0.09
1.76	0.54	0.96	3.11	0.52	0.04
1.79	0.47	0.83	3.19	0.53	-0.13
1.41	0.37	0.52	2.00	0.43	-0.19
1.23	0.42	0.52	1.52	0.39	0.07
0.92	0.36	0.33	0.84	0.31	0.13
0.65	0.23	0.15	0.42	0.25	-0.09
9.69	2.99	4.48	14.78		

DV= TT, IV= GUT, LL=1.0--D=.5

A-101 Linear Equation n = 7 a1 = -0.085 a2 = 0.412

log x	log y	x*y	x^2	y calc	% error
1.76	0.62	1.09	3.11	0.64	-0.04
1.42	0.62	0.87	2.01	0.50	0.19
1.42	0.39	0.56	2.02	0.50	-0.28
1.05	0.40	0.42	1.11	0.35	0.12
1.14	0.41	0.46	1.29	0.38	0.06
0.91	0.28	0.26	0.84	0.29	-0.04
0.78	0.19	0.15	0.62	0.24	-0.23
8.49	2.90	3.81	11.00		

DV= TT, IV= GUT, LL=1.0--D=.5

A-123 Linear Equation n = 7 a1 = -1.082 a2 = 1.121

log x	log y	x*y	x^2	y calc	% error
1.62	0.52	0.85	2.63	0.74	-0.41
1.38	0.65	0.90	1.92	0.47	0.28
1.38	0.41	0.57	1.92	0.47	-0.14
1.14	0.46	0.52	1.31	0.20	0.57
1.10	0.24	0.26	1.20	0.15	0.38
0.88	-0.28	-0.24	0.77	-0.10	0.64
0.75	-0.32	-0.24	0.57	-0.24	0.25
8.26	1.68	2.62	10.31		

DV= TT, IV= GUT, LL=1.0--D=.5

Table A39. Experiment 1, left lever depleted in eight prey.

A-104 Linear Equation n = 6 a1 = 5.210 a2 = 0.089

x	y	x*y	x^2	y calc	% error
24.83	7.40	183.74	616.53	7.41	0.00
14.66	7.09	103.94	214.92	6.51	0.08
11.54	5.77	66.59	133.17	6.23	-0.08
9.34	5.53	51.65	87.24	6.04	-0.09
5.38	5.65	30.40	28.94	5.69	-0.01
4.50	6.04	27.18	20.25	5.61	0.07
70.25	37.48	463.49	1101.05		

*IV = TT, DV = GUT.

A-230 Linear Equation n = 5 a1 = 6.825 a2 = 0.029

x	y	x*y	x^2	y calc	% error
94.29	10.38	978.73	8890.60	9.59	0.08
31.09	5.38	167.26	966.59	7.74	-0.44
13.28	6.93	92.03	176.36	7.21	-0.04
4.81	12.83	61.71	23.14	6.97	0.46
6.37	3.00	19.11	40.58	7.01	-1.34
149.84	38.52	1318.85	10097.26		

*IV = TT, DV = GUT

A-101 Linear Equation n = 6 a1 = 4.761 a2 = 0.055

x	y	x*y	x^2	y calc	% error
30.55	6.62	202.24	933.30	6.45	0.03
24.38	6.94	169.20	594.38	6.11	0.12
18.73	4.41	82.60	350.81	5.80	-0.32
14.23	5.42	77.13	202.49	5.55	-0.02
13.37	5.33	71.26	178.76	5.50	-0.03
7.06	5.85	41.30	49.84	5.15	0.12
108.32	34.57	643.73	2309.59		

A-123 Linear Equation n = 6 a1 = 0.842 a2 = 0.195

x	y	x*y	x^2	y calc	% error
14.79	4.01	59.31	218.74	3.73	0.07
17.76	4.49	79.74	315.42	4.31	0.04
11.15	2.01	22.41	124.32	3.02	-0.50
8.71	2.77	24.13	75.86	2.54	0.08
6.87	1.83	12.57	47.20	2.18	-0.19
6.40	2.76	17.66	40.96	2.09	0.24
65.68	17.87	215.82	822.51		

* IV = TT, DV = GUT, LL = 1.0--D = .125

* Note: TT = travel time, GUT = giving-up time.

Table A39 (continued), BWM values transformed to logarithmic numbers.

A-104 **Linear Equation** **n** = 6 **a1** = 0.651 **a2** = 0.143

log x	log y	x*y	x^2	y calc	% error
1.39	0.87	1.21	1.95	0.85	0.02
1.17	0.85	0.99	1.36	0.82	0.04
1.06	0.76	0.81	1.13	0.80	-0.05
0.97	0.74	0.72	0.94	0.79	-0.06
0.73	0.75	0.55	0.53	0.75	-0.00
0.65	0.78	0.51	0.43	0.74	0.05
5.98	4.76	4.79	6.34		

*DV= TT, IV= GUT, LL=1.0--D=.125

A-230 **Linear Equation** **n** = 5 **a1** = 0.715 **a2** = 0.098

log x	log y	x*y	x^2	y calc	% error
1.97	1.02	2.01	3.90	0.91	0.11
1.49	0.73	1.09	2.23	0.86	-0.18
1.12	0.84	0.94	1.26	0.83	0.02
0.68	1.11	0.76	0.47	0.78	0.29
0.80	0.48	0.38	0.65	0.79	-0.66
6.08	4.17	5.18	8.50		

*IV= TT, DV= GUT, LL=1.0--D=.125

A-101 **Linear Equation** **n** = 6 **a1** = 0.632 **a2** = 0.102

log x	log y	x*y	x^2	y calc	% error
1.49	0.82	1.22	2.21	0.78	0.05
1.39	0.84	1.17	1.92	0.77	0.08
1.27	0.64	0.82	1.62	0.76	-0.18
1.15	0.73	0.85	1.33	0.75	-0.02
1.13	0.73	0.82	1.27	0.75	-0.03
0.85	0.77	0.65	0.72	0.72	0.06
7.27	4.53	5.52	9.07		

*IV= TT, DV= GUT, LL=1.0--D=.5

A-123 **Linear Equation** **n** = 6 **a1** = -0.191 **a2** = 0.637

log x	log y	x*y	x^2	y calc	% error
1.17	0.60	0.71	1.37	0.55	0.08
1.25	0.65	0.81	1.56	0.60	0.07
1.05	0.30	0.32	1.10	0.48	-0.57
0.94	0.44	0.42	0.88	0.41	0.08
0.84	0.26	0.22	0.70	0.34	-0.30
0.81	0.44	0.36	0.65	0.32	0.27
6.05	2.70	2.83	6.26		

* IV= TT, DV= GUT, LL=1.0--D=.125

Table A40. Experiment 2, retractable levers, patch depleted in one prey.

C-1 Linear Equation n = 5 a1 = 0.411 a2 = 0.178

x	y	x*y	x ^ 2	y calc	% error
28.39	5.00	141.95	805.99	5.46	-0.09
16.06	3.24	52.03	257.92	3.27	-0.01
18.84	4.06	76.49	354.95	3.76	0.07
31.19	6.22	194.00	972.82	5.96	0.04
6.13	1.42	8.70	37.58	1.50	-0.06
100.61	19.94	473.18	2429.25		

C-2 Linear Equation n = 5 a1 = 1.426 a2 = 0.091

x	y	x*y	x ^ 2	y calc	% error
23.08	3.34	77.09	532.69	3.52	-0.05
15.92	3.13	49.83	253.45	2.87	0.08
9.51	3.32	31.57	90.44	2.29	0.31
20.24	3.00	60.72	409.66	3.26	-0.09
5.47	1.06	5.80	29.92	1.92	-0.81
74.22	13.85	225.01	1316.15		

C-3 Linear Equation n = 5 a1 = 0.981 a2 = 0.152

x	y	x*y	x ^ 2	y calc	% error
17.73	3.31	58.69	314.35	3.68	-0.11
11.02	3.59	39.56	121.44	2.66	0.26
9.08	2.88	26.15	82.45	2.36	0.18
19.00	3.66	69.54	361.00	3.87	-0.06
5.17	0.89	4.60	26.73	1.77	-0.99
62.00	14.33	198.54	905.97		

C-4 Linear Equation n = 5 a1 = 1.964 a2 = 0.069

x	y	x*y	x ^ 2	y calc	% error
53.47	5.06	270.56	2859.04	5.68	-0.12
18.35	4.41	80.92	336.72	3.24	0.27
11.69	3.45	40.33	136.66	2.78	0.20
18.25	3.96	72.27	333.06	3.23	0.18
4.99	0.35	1.75	24.90	2.31	-5.60
106.75	17.23	465.83	3690.38		

C-5 Linear Equation n = 5 a1 = -1.363 a2 = 0.324

x	y	x*y	x ^ 2	y calc	% error
26.94	5.09	137.12	725.76	7.35	-0.44
19.45	4.64	90.25	378.30	4.93	-0.06
20.91	7.73	161.63	437.23	5.40	0.30
25.13	7.86	197.52	631.52	6.77	0.14
10.89	1.30	14.16	118.59	2.16	-0.66
103.32	26.62	600.69	2291.40		

*IV= TT, DV= RES-T, L=.10, RETRACTABLE

*Note: TT=travel time, RES-T=residence time.

Table A40 (continued), BWM values transformed to logarithmic numbers.

C-1 Linear Equation n = 5 a1 = -0.533

a2 = 0.874

log x	log y	x*y	x ^ 2	y calc	% error
1.45	0.70	1.02	2.11	0.74	-0.05
1.21	0.51	0.62	1.45	0.52	-0.02
1.28	0.61	0.78	1.63	0.58	0.05
1.49	0.79	1.19	2.23	0.77	0.03
0.79	0.15	0.12	0.62	0.15	-0.02
6.22	2.76	3.71	8.04		

*IV= TT, DV= RES-T, L=.10 RETRACTABLE

C-2 Linear Equation n = 5 a1 = -0.339

a2 = 0.669

log x	log y	x*y	x ^ 2	y calc	% error
1.36	0.52	0.71	1.86	0.57	-0.09
1.20	0.50	0.60	1.44	0.47	0.06
0.98	0.52	0.51	0.96	0.32	0.39
1.31	0.48	0.62	1.71	0.53	-0.12
0.74	0.03	0.02	0.54	0.15	-5.11
5.59	2.04	2.46	6.51		

*IV= TT, DV= RES-T, L=.10, RETRACTABLE

C-3 Linear Equation n = 5 a1 = -0.603

a2 = 0.966

log x	log y	x*y	x ^ 2	y calc	% error
1.25	0.52	0.65	1.56	0.60	-0.16
1.04	0.56	0.58	1.09	0.40	0.27
0.96	0.46	0.44	0.92	0.32	0.30
1.28	0.56	0.72	1.64	0.63	-0.12
0.71	-0.05	-0.04	0.51	0.09	2.70
5.24	2.05	2.35	5.71		

*IV= TT, DV= RES-T, P=.10, RETRACTABLE

C-4 Linear Equation n = 5 a1 = -0.892

a2 = 1.078

log x	log y	x*y	x ^ 2	y calc	% error
1.73	0.70	1.22	2.99	0.97	-0.38
1.26	0.64	0.81	1.60	0.47	0.27
1.07	0.54	0.57	1.14	0.26	0.52
1.26	0.60	0.75	1.59	0.47	0.22
0.70	-0.46	-0.32	0.49	-0.14	0.69
6.02	2.03	3.04	7.80		

*IV= Tf, DV= RES-T, L=.10, RETRACTABLE

C-5 Linear Equation n = 5 a1 = -1.728

a2 = 1.839

log x	log y	x*y	x ^ 2	y calc	% error
1.43	0.71	1.01	2.05	0.90	-0.28
1.29	0.67	0.86	1.66	0.64	0.04
1.32	0.89	1.17	1.74	0.70	0.21
1.40	0.90	1.25	1.96	0.85	0.05
1.04	0.11	0.12	1.08	0.18	-0.57
6.48	3.27	4.41	8.49		

*IV= TT, DV= RES-T, L=.10, RETRACTABLE

Table A41. Experiment 2, retractable levers, patch depleted in two prey.

C-1 Linear Equation n = 6 a1 = 2.652 a2 = 0.046

x	y	x*y	x^2	y calc	% error
20.92	2.47	51.67	437.65	3.61	-0.46
28.61	3.69	105.57	818.53	3.96	-0.07
30.68	4.87	149.41	941.26	4.05	0.17
14.79	2.82	41.71	218.74	3.33	-0.18
12.71	4.42	56.18	161.54	3.23	0.27
12.10	3.12	37.75	146.41	3.21	-0.03
119.81	21.39	442.29	2724.14		

C-2 Linear Equation n = 6 a1 = 2.594 a2 = 0.041

x	y	x*y	x^2	y calc	% error
20.38	2.64	53.80	415.34	3.43	-0.30
25.67	4.53	116.29	658.95	3.64	0.20
32.26	3.63	117.10	1040.71	3.91	-0.08
12.94	3.37	43.61	167.44	3.12	0.07
10.33	1.85	19.11	106.71	3.02	-0.63
10.11	4.10	41.45	102.21	3.01	0.27
111.69	20.12	391.36	2491.37		

C-3 Linear Equation n = 6 a1 = -0.246 a2 = 0.189

x	y	x*y	x^2	y calc	% error
18.85	2.13	40.15	355.32	3.31	-0.55
18.22	2.71	49.38	331.97	3.19	-0.18
18.29	2.59	47.37	334.52	3.21	-0.24
55.04	10.40	572.42	3029.40	10.14	0.02
7.73	2.95	22.80	59.75	1.21	0.59
51.48	9.76	502.44	2650.19	9.47	0.03
169.61	30.54	1234.56	6761.16		

C-4 Linear Equation n = 6 a1 = -0.575 a2 = 0.294

x	y	x*y	x^2	y calc	% error
27.26	4.29	116.95	743.11	7.43	-0.73
47.47	12.33	585.31	2253.40	13.36	-0.08
52.36	16.84	881.74	2741.57	14.80	0.12
15.73	4.15	65.28	247.43	4.04	0.03
12.60	4.52	56.95	158.76	3.12	0.31
13.22	3.93	51.95	174.77	3.31	0.16
168.64	46.06	1758.18	6319.04		

C-5 Linear Equation n = 6 a1 = 3.207 a2 = 0.082

x	y	x*y	x^2	y calc	% error
47.97	6.87	329.55	2301.12	7.15	-0.04
25.78	3.58	92.29	664.61	5.32	-0.49
28.23	5.38	151.88	796.93	5.52	-0.03
23.98	8.02	192.32	575.04	5.18	0.35
8.39	3.97	33.31	70.39	3.90	0.02
8.75	3.17	27.74	76.56	3.93	-0.24
143.10	30.99	827.09	4484.66		

*IV= TT, DV= RES-T, L=1.0-D.5, RETRACTABLE

*Note: TT=travel time, RES-T=residence time.

Table A41 (continued), BWM values transformed to logarithmic numbers.

C-1 Linear Equation n = 6 a1 = 0.299 a2 = 0.189

log x	log y	x*y	x ^ 2	y calc	% error
1.32	0.39	0.52	1.74	0.55	-0.40
1.46	0.57	0.83	2.12	0.57	-0.01
1.49	0.69	1.02	2.21	0.58	0.16
1.17	0.45	0.53	1.37	0.52	-0.16
1.10	0.65	0.71	1.22	0.51	0.21
1.08	0.49	0.54	1.17	0.50	-0.02
7.62	3.24	4.14	9.84		

*IV= TT, DV= RES-T, L=1.0-D.5, RETRACTABLE

C-2 Linear Equation n = 6 a1 = 0.182 a2 = 0.265

log x	log y	x*y	x ^ 2	y calc	% error
1.31	0.42	0.55	1.71	0.53	-0.26
1.41	0.66	0.92	1.99	0.56	0.15
1.51	0.56	0.84	2.28	0.58	-0.04
1.11	0.53	0.59	1.24	0.48	0.10
1.01	0.27	0.27	1.03	0.45	-0.69
1.00	0.61	0.62	1.01	0.45	0.27
7.36	3.05	3.79	9.25		

*IV= TT, DV= RES-T, L=1.0-D.5, RETRACTABLE

C-3 Linear Equation n = 6 a1 = -0.479 a2 = 0.802

log x	log y	x*y	x ^ 2	y calc	% error
1.28	0.33	0.42	1.63	0.54	-0.65
1.26	0.43	0.55	1.59	0.53	-0.23
1.26	0.41	0.52	1.59	0.53	-0.29
1.74	1.02	1.77	3.03	0.92	0.10
0.89	0.47	0.42	0.79	0.23	0.50
1.71	0.99	1.69	2.93	0.89	0.10
8.14	3.65	5.37	11.56		

*IV= TT, DV= RES-T, L=1.0-D.5, RETRACTABLE

C-4 Linear Equation n = 6 a1 = -0.444 a2 = 0.907

log x	log y	x*y	x ^ 2	y calc	% error
1.44	0.63	0.91	2.06	0.86	-0.36
1.68	1.09	1.83	2.81	1.08	0.01
1.72	1.23	2.11	2.95	1.11	0.09
1.20	0.62	0.74	1.43	0.64	-0.04
1.10	0.66	0.72	1.21	0.55	0.15
1.12	0.59	0.67	1.26	0.57	0.04
8.25	4.82	6.97	11.73		

*IV= TT, DV= RES-T, L=1.0-D.5, RETRACTABLE

C-5 Linear Equation n = 6 a1 = 0.215 a2 = 0.364

log x	log y	x*y	x ^ 2	y calc	% error
1.68	0.84	1.41	2.83	0.83	0.01
1.41	0.55	0.78	1.99	0.73	-0.32
1.45	0.73	1.06	2.10	0.74	-0.02
1.38	0.90	1.25	1.90	0.72	0.21
0.92	0.60	0.55	0.85	0.55	0.08
0.94	0.50	0.47	0.89	0.56	-0.11
7.79	4.13	5.52	10.57		

*IV= TT, DV= RES-T, L=1.0-D.5, RETRACTABLE

Table A42. Experiment 2, retractable levers, patch depleted in eight prey.

C-1 Linear Equation n = 4 a1 = 32.694 a2 = 0.034

x	y	x*y	x^2	y calc	% error
26.21	34.18	895.86	686.96	33.59	0.02
14.95	28.44	425.18	223.50	33.21	-0.17
14.00	35.54	497.56	196.00	33.17	0.07
12.55	34.94	438.50	157.50	33.12	0.05
67.71	133.10	2257.09	1263.97		

C-2 Linear Equation n = 4 a1 = 22.333 a2 = 0.167

x	y	x*y	x^2	y calc	% error
26.59	26.74	711.02	707.03	26.78	-0.00
16.15	24.26	391.80	260.82	25.04	-0.03
14.53	26.19	380.54	211.12	24.76	0.05
11.62	23.67	275.05	135.02	24.28	-0.03
68.89	100.86	1758.40	1314.00		

C-3 Linear Equation n = 4 a1 = 25.876 a2 = 0.185

x	y	x*y	x^2	y calc	% error
14.57	28.21	411.02	212.28	28.57	-0.01
10.81	27.14	293.38	116.86	27.88	-0.03
10.89	29.55	321.80	118.59	27.89	0.06
8.64	26.91	232.50	74.65	27.47	-0.02
44.91	111.81	1258.71	522.38		

C-4 Linear Equation n = 4 a1 = 37.458 a2 = 0.375

x	y	x*y	x^2	y calc	% error
39.57	51.93	2054.87	1565.78	52.28	-0.01
19.52	45.58	889.72	381.03	44.77	0.02
21.60	48.38	1045.01	466.56	45.55	0.06
19.19	41.35	793.51	368.26	44.65	-0.08
99.88	187.24	4783.11	2781.63		

C-5 Linear Equation n = 4 a1 = 26.843 a2 = -0.051

x	y	x*y	x^2	y calc	% error
24.97	25.28	631.24	623.50	25.56	-0.01
17.37	25.58	444.32	301.72	25.95	-0.01
16.54	28.57	472.55	273.57	25.99	0.09
15.17	24.13	366.05	230.13	26.06	-0.08
74.05	103.56	1914.17	1428.92		

*IV = TT, DV = RES-T, L = 1.0-D.125, RETRACTABLE

*Note: TT = travel time, RES-T = residence time.

Table A42 (continued), BWM values transformed to logarithmic numbers.

C-1 Linear Equation n = 4 a1 = 1.508 a2 = 0.011

log x	log y	x*y	x^2	y calc	% error
1.42	1.53	2.18	2.01	1.52	0.01
1.17	1.45	1.71	1.38	1.52	-0.05
1.15	1.55	1.78	1.31	1.52	0.02
1.10	1.54	1.70	1.21	1.52	0.02
4.84	6.08	7.36	5.91		

*IV= TT, DV= RES-T, L=1.0-D.125, RETRACTABLE

C-2 Linear Equation n = 4 a1 = 1.248 a2 = 0.126

log x	log y	x*y	x^2	y calc	% error
1.42	1.43	2.03	2.03	1.43	-0.00
1.21	1.38	1.67	1.46	1.40	-0.01
1.16	1.42	1.65	1.35	1.39	0.02
1.07	1.37	1.46	1.13	1.38	-0.01
4.86	5.60	6.82	5.98		

*IV= TT, DV= RES-T, L=1.0-D.125, RETRACTABLE

C-3 Linear Equation n = 4 a1 = 1.357 a2 = 0.085

log x	log y	x*y	x^2	y calc	% error
1.16	1.45	1.69	1.35	1.46	-0.00
1.03	1.43	1.48	1.07	1.45	-0.01
1.04	1.47	1.53	1.08	1.45	0.02
0.94	1.43	1.34	0.88	1.44	-0.01
4.17	5.78	6.03	4.37		

*IV= TT, DV= RES-T, L=1.0-D.125, RETRACTABLE

C-4 Linear Equation n = 4 a1 = 1.351 a2 = 0.231

log x	log y	x*y	x^2	y calc	% error
1.60	1.72	2.74	2.55	1.72	-0.00
1.29	1.66	2.14	1.67	1.65	0.01
1.33	1.68	2.25	1.78	1.66	0.02
1.28	1.62	2.07	1.65	1.65	-0.02
5.51	6.68	9.20	7.64		

*IV= TT, DV= RES-T, L=1.0-D.125, RETRACTABLE

C-5 Linear Equation n = 4 a1 = 1.444 a2 = -0.025

log x	log y	x*y	x^2	y calc	% error
1.40	1.40	1.96	1.95	1.41	-0.00
1.24	1.41	1.75	1.54	1.41	-0.00
1.22	1.46	1.77	1.48	1.41	0.03
1.18	1.38	1.63	1.39	1.41	-0.02
5.04	5.65	7.11	6.37		

*IV= TT, DV= RES-T, L=1.0-D.125, RETRACTABLE

Table 15.

Table A43. Experiment 2, retractable levers, patch depleted in one prey.

C-1 Linear Equation n = 5 a1 = 0.045 a2 = 0.075

x	y	x*y	x ^ 2	y calc	% error
28.39	1.90	53.94	805.99	2.18	-0.15
16.06	0.42	6.75	257.92	1.25	-1.98
16.84	0.73	12.29	283.59	1.31	-0.79
31.19	3.21	100.12	972.82	2.39	0.26
6.13	1.37	8.40	37.58	0.51	0.63
98.61	7.63	181.50	2357.89		

C-2 Linear Equation n = 5 a1 = 0.900 a2 = -0.021

x	y	x*y	x ^ 2	y calc	% error
23.08	0.37	8.54	532.69	0.41	-0.11
15.92	0.37	5.89	253.45	0.56	-0.52
9.51	0.40	3.80	90.44	0.70	-0.75
20.24	0.74	14.98	409.66	0.47	0.36
5.47	1.05	5.74	29.92	0.78	0.25
74.22	2.93	38.96	1316.15		

C-3 Linear Equation n = 5 a1 = 0.746 a2 = -0.027

x	y	x*y	x ^ 2	y calc	% error
17.73	0.12	2.13	314.35	0.27	-1.24
11.02	0.23	2.53	121.44	0.45	-0.95
9.08	0.33	3.00	82.45	0.50	-0.52
19.00	0.51	9.69	361.00	0.23	0.54
5.17	0.87	4.50	26.73	0.61	0.30
62.00	2.06	21.85	905.97		

C-4 Linear Equation n = 5 a1 = 0.332 a2 = 0.050

x	y	x*y	x ^ 2	y calc	% error
53.47	2.91	155.60	2859.04	3.03	-0.04
18.35	1.60	29.36	336.72	1.26	0.21
11.69	0.81	9.47	136.66	0.92	-0.14
18.25	1.39	25.37	333.06	1.25	0.10
4.99	0.33	1.65	24.90	0.58	-0.77
106.75	7.04	221.44	3690.38		

C-5 Linear Equation n = 5 a1 = 0.174 a2 = 0.087

x	y	x*y	x ^ 2	y calc	% error
26.94	1.55	41.76	725.76	2.51	-0.62
19.95	1.30	25.94	398.00	1.90	-0.46
20.91	1.77	37.01	437.23	1.99	-0.12
25.13	3.97	99.77	631.52	2.35	0.41
10.89	1.28	13.94	118.59	1.12	0.13
103.82	9.87	218.41	2311.10		

*IV= TT, DV= GUT, L=.10 RETRACTABLE

*Note: TT=travel time, GUT=giving-up time.

Table A43 (continued), BWM values transformed to logarithmic numbers.

C-1 Linear Equation n = 5 a1 = -0.479 a2 = 0.455

log x	log y	x*y	x ^ 2	y calc	% error
1.45	0.28	0.41	2.11	0.18	0.35
1.21	-0.38	-0.45	1.45	0.07	1.18
1.23	-0.14	-0.17	1.50	0.08	1.57
1.49	0.51	0.76	2.23	0.20	0.60
0.79	0.14	0.11	0.62	-0.12	1.89
6.17	0.41	0.65	7.92		

*IV= TT, DV= GUT, L=.10 RETRACTABLE

C-2 Linear Equation n = 5 a1 = 0.228 a2 = -0.450

log x	log y	x*y	x ^ 2	y calc	% error
1.36	-0.43	-0.59	1.86	-0.38	0.11
1.20	-0.43	-0.52	1.44	-0.31	0.28
0.98	-0.40	-0.39	0.96	-0.21	0.47
1.31	-0.13	-0.17	1.71	-0.36	-1.75
0.74	0.02	0.02	0.54	-0.10	5.89
5.59	-1.37	-1.65	6.51		

*IV= TT, DV= GUT, L=.10 RETRACTABLE

C-3 Linear Equation n = 5 a1 = 0.427 a2 = -0.864

log x	log y	x*y	x ^ 2	y calc	% error
1.25	-0.92	-1.15	1.56	-0.65	0.29
1.04	-0.64	-0.67	1.09	-0.47	0.26
0.96	-0.48	-0.46	0.92	-0.40	0.17
1.28	-0.29	-0.37	1.64	-0.68	-1.32
0.71	-0.06	-0.04	0.51	-0.19	-2.13
5.24	-2.39	-2.69	5.71		

*IV= TT, DV= GUT, L=.10 RETRACTABLE

C-4 Linear Equation n = 5 a1 = -1.077 a2 = 0.935

log x	log y	x*y	x ^ 2	y calc	% error
1.73	0.46	0.80	2.99	0.54	-0.16
1.26	0.20	0.26	1.60	0.10	0.49
1.07	-0.09	-0.10	1.14	-0.08	0.13
1.26	0.14	0.18	1.59	0.10	0.29
0.70	-0.48	-0.34	0.49	-0.42	0.12
6.02	0.24	0.81	7.80		

* IV= TT, DV= GUT, L=.10 RETRACTABLE

C-5 Linear Equation n = 5 a1 = -0.618 a2 = 0.670

log x	log y	x*y	x ^ 2	y calc	% error
1.43	0.19	0.27	2.05	0.34	-0.79
1.30	0.11	0.15	1.69	0.25	-1.22
1.32	0.25	0.33	1.74	0.27	-0.08
1.40	0.60	0.84	1.96	0.32	0.46
1.04	0.11	0.11	1.08	0.08	0.28
6.49	1.26	1.70	8.52		

*IV= TT, DV= GUT, L=.10 RETRACTABLE

Table A44. Experiment 2, retractable levers, patch depleted in two prey.

C-1 Linear Equation n = 6 a1 = 0.671 a2 = 0.030

x	y	x*y	x^2	y calc	% error
20.92	0.41	8.58	437.65	1.31	-2.18
28.61	1.70	48.64	818.53	1.54	0.09
30.68	1.93	59.21	941.26	1.60	0.17
14.79	0.53	7.84	218.74	1.12	-1.11
12.71	2.24	28.47	161.54	1.06	0.53
12.10	0.85	10.29	146.41	1.04	-0.22
119.81	7.66	163.02	2724.14		

C-2 Linear Equation n = 6 a1 = 1.499 a2 = 0.014

x	y	x*y	x^2	y calc	% error
20.38	0.74	15.08	415.34	1.78	-1.41
25.67	2.84	72.90	658.95	1.86	0.35
32.26	1.80	58.07	1040.71	1.95	-0.08
12.94	1.25	16.18	167.44	1.68	-0.34
10.33	1.28	13.22	106.71	1.64	-0.28
10.11	2.64	26.69	102.21	1.64	0.38
111.69	10.55	202.14	2491.37		

C-3 Linear Equation n = 6 a1 = -1.848 a2 = 0.177

x	y	x*y	x^2	y calc	% error
18.85	0.42	7.92	355.32	1.48	-2.52
18.22	0.82	14.94	331.97	1.37	-0.67
18.29	0.64	11.71	334.52	1.38	-1.16
55.04	6.82	375.37	3029.40	7.87	-0.15
7.73	1.20	9.28	59.75	-0.48	1.40
51.48	8.95	460.75	2650.19	7.24	0.19
169.61	18.85	879.96	6761.16		

C-4 Linear Equation n = 6 a1 = -2.169 a2 = 0.278

x	y	x*y	x^2	y calc	% error
27.26	2.56	69.79	743.11	5.40	-1.11
47.47	10.12	480.40	2253.40	11.01	-0.09
52.36	14.19	742.99	2741.57	12.37	0.13
15.73	2.25	35.39	247.43	2.20	0.02
12.60	2.92	36.79	158.76	1.33	0.54
13.22	1.77	23.40	174.77	1.50	0.15
168.64	33.81	1388.75	6319.04		

C-5 Linear Equation n = 6 a1 = 1.142 a2 = 0.061

x	y	x*y	x^2	y calc	% error
47.97	3.73	178.93	2301.12	4.06	-0.09
25.78	1.32	34.03	664.61	2.71	-1.05
28.23	2.34	66.06	796.93	2.86	-0.22
23.98	5.66	135.73	575.04	2.60	0.54
8.39	1.72	14.43	70.39	1.65	0.04
8.75	0.78	6.83	76.56	1.67	-1.15
143.10	15.55	436.00	4484.66		

*IV= TT, DV= GUT, L=1.0-D.5 RETRACTABLE

*Note: TT=travel time, GUT=giving-up time.

Table A44 (continued), BWM values transformed to logarithmic numbers.

C-1 Linear Equation n = 6 a1 = -0.528 a2 = 0.433

log x	log y	x*y	x^2	y calc	% error
1.32	-0.39	-0.51	1.74	0.04	1.11
1.46	0.23	0.34	2.12	0.10	0.55
1.49	0.29	0.42	2.21	0.12	0.59
1.17	-0.28	-0.32	1.37	-0.02	0.92
1.10	0.35	0.39	1.22	-0.05	1.14
1.08	-0.07	-0.08	1.17	-0.06	0.16
7.62	0.13	0.24	9.84		

*IV= TT, DV= GUT, L=1.0-D.5 RETRACTABLE

C-2 Linear Equation n = 6 a1 = 0.109 a2 = 0.075

log x	log y	x*y	x^2	y calc	% error
1.31	-0.13	-0.17	1.71	0.21	2.58
1.41	0.45	0.64	1.99	0.21	0.53
1.51	0.26	0.39	2.28	0.22	0.13
1.11	0.10	0.11	1.24	0.19	-0.98
1.01	0.11	0.11	1.03	0.18	-0.72
1.00	0.42	0.42	1.01	0.18	0.56
7.36	1.20	1.49	9.25		

*IV= TT, DV= GUT, L=1.0-D.5 RETRACTABLE

C-3 Linear Equation n = 6 a1 = -1.576 a2 = 1.311

log x	log y	x*y	x^2	y calc	% error
1.28	-0.38	-0.48	1.63	0.10	1.25
1.26	-0.09	-0.11	1.59	0.08	1.88
1.26	-0.19	-0.24	1.59	0.08	1.40
1.74	0.83	1.45	3.03	0.70	0.15
0.89	0.08	0.07	0.79	-0.41	6.21
1.71	0.95	1.63	2.93	0.67	0.30
8.14	1.21	2.32	11.56		

*IV= TT, DV= GUT, L=1.0-D.5 RETRACTABLE

C-4 Linear Equation n = 6 a1 = -1.079 a2 = 1.225

log x	log y	x*y	x^2	y calc	% error
1.44	0.41	0.59	2.06	0.68	-0.66
1.68	1.01	1.69	2.81	0.97	0.03
1.72	1.15	1.98	2.95	1.03	0.11
1.20	0.35	0.42	1.43	0.39	-0.10
1.10	0.47	0.51	1.21	0.27	0.42
1.12	0.25	0.28	1.26	0.29	-0.19
8.25	3.63	5.46	11.73		

*IV= TT, DV= GUT, L=1.0-D.5 RETRACTABLE

C-5 Linear Equation n = 6 a1 = -0.532 a2 = 0.659

log x	log y	x*y	x^2	y calc	% error
1.68	0.57	0.96	2.83	0.58	-0.01
1.41	0.12	0.17	1.99	0.40	-2.30
1.45	0.37	0.54	2.10	0.42	-0.15
1.38	0.75	1.04	1.90	0.38	0.50
0.92	0.24	0.22	0.85	0.08	0.67
0.94	-0.11	-0.10	0.89	0.09	1.82
7.79	1.94	2.82	10.57		

*IV= TT, DV= GUT, L=1.0-D.5 RETRACTABLE

Table A45. Experiment 2, retractable levers, patch depleted in eight prey.

C-1 Linear Equation n = 4 a1 = 9.106 a2 = -0.044

x	y	x*y	x^2	y calc	% error
26.21	8.12	212.83	686.96	7.95	0.02
14.95	7.24	108.24	223.50	8.44	-0.17
14.00	8.85	123.90	196.00	8.49	0.04
12.55	9.22	115.71	157.50	8.55	0.07
67.71	33.43	560.67	1263.97		

C-2 Linear Equation n = 4 a1 = 5.958 a2 = 0.042

x	y	x*y	x^2	y calc	% error
26.59	7.01	186.40	707.03	7.06	-0.01
16.15	6.19	99.97	260.82	6.63	-0.07
14.53	7.53	109.41	211.12	6.56	0.13
11.62	5.97	69.37	135.02	6.44	-0.08
68.89	26.70	465.15	1314.00		

C-3 Linear Equation n = 4 a1 = 5.968 a2 = -0.036

x	y	x*y	x^2	y calc	% error
14.57	5.00	72.85	212.28	5.45	-0.09
10.81	5.48	59.24	116.86	5.58	-0.02
10.89	6.86	74.71	118.59	5.58	0.19
8.64	4.93	42.60	74.65	5.66	-0.15
44.91	22.27	249.39	522.38		

C-4 Linear Equation n = 4 a1 = 13.172 a2 = 0.126

x	y	x*y	x^2	y calc	% error
39.57	18.08	715.43	1565.78	18.14	-0.00
19.52	16.59	323.84	381.03	15.63	0.06
21.60	16.30	352.08	466.56	15.89	0.03
19.19	14.27	273.84	368.26	15.58	-0.09
99.88	65.24	1665.18	2781.63		

C-5 Linear Equation n = 4 a1 = 6.666 a2 = -0.040

x	y	x*y	x^2	y calc	% error
24.97	5.59	139.58	623.50	5.68	-0.02
17.37	5.48	95.19	301.72	5.98	-0.09
16.54	7.43	122.89	273.57	6.01	0.19
15.17	5.23	79.34	230.13	6.06	-0.16
74.05	23.73	437.00	1428.92		

*IV= TT, DV= GUT, L=1.0-D.125 RETRACTABLE

*Note: TT=travel time, GUT=giving-up time.

Table A45 (continued), BWM values transformed to logarithmic numbers.

C-1 **Linear Equation** n = 4 a1 = 1.054 a2 = -0.110

log x	log y	x*y	x^2	y calc	% error
1.42	0.91	1.29	2.01	0.90	0.01
1.17	0.86	1.01	1.38	0.92	-0.07
1.15	0.95	1.09	1.31	0.93	0.02
1.10	0.96	1.06	1.21	0.93	0.03
4.84	3.68	4.45	5.91		

*IV = TT, DV = GUT, L = 1.0-D.125 RETRACTABLE

C-2 **Linear Equation** n = 4 a1 = 0.661 a2 = 0.133

log x	log y	x*y	x^2	y calc	% error
1.42	0.85	1.20	2.03	0.85	-0.01
1.21	0.79	0.96	1.46	0.82	-0.04
1.16	0.88	1.02	1.35	0.82	0.07
1.07	0.78	0.83	1.13	0.80	-0.03
4.86	3.29	4.01	5.98		

*IV = TT, DV = GUT, L = 1.0-D.125 RETRACTABLE

C-3 **Linear Equation** n = 4 a1 = 0.761 a2 = -0.019

log x	log y	x*y	x^2	y calc	% error
1.16	0.70	0.81	1.35	0.74	-0.06
1.03	0.74	0.76	1.07	0.74	-0.00
1.04	0.84	0.87	1.08	0.74	0.11
0.94	0.69	0.65	0.88	0.74	-0.07
4.17	2.97	3.09	4.37		

*IV = TT, DV = GUT, L = 1.0-D.125 RETRACTABLE

C-4 **Linear Equation** n = 4 a1 = 0.908 a2 = 0.220

log x	log y	x*y	x^2	y calc	% error
1.60	1.26	2.01	2.55	1.26	-0.00
1.29	1.22	1.57	1.67	1.19	0.02
1.33	1.21	1.62	1.78	1.20	0.01
1.28	1.15	1.48	1.65	1.19	-0.03
5.51	4.84	6.68	7.64		

IV = TT, DV = GUT, L = 1.0-D.125 RETRACTABLE

C-5 **Linear Equation** n = 4 a1 = 0.889 a2 = -0.095

log x	log y	x*y	x^2	y calc	% error
1.40	0.75	1.04	1.95	0.76	-0.01
1.24	0.74	0.92	1.54	0.77	-0.04
1.22	0.87	1.06	1.48	0.77	0.11
1.18	0.72	0.85	1.39	0.78	-0.08
5.04	3.08	3.87	6.37		

*IV = TT, DV = GUT, L = 1.0-D.125 RETRACTABLE

APPENDIX B

Table B19. Experiment 1, left lever depleted in one prey.

	TT			RES			GUT		
	X			Y			Y		
A-104	<MAD	BWM	MAD>	<MAD	BWM	MAD>	<MAD	BWM	MAD>
NT	111.83	122.72	133.61	8.44	10.68	12.91	4.20	6.78	9.36
NT*	54.61	66.98	79.34	7.56	9.36	11.16	3.41	5.35	7.30
R=1.0	5.36	6.64	7.93	3.60	3.91	4.23	0.17	0.31	0.45
R=1.0**	5.36	5.58	5.79	2.95	3.33	3.71	0.18	0.19	0.20
R=.25	10.33	12.42	14.50	4.13	4.46	4.80	0.09	0.16	0.24
R=.25*	10.55	11.12	11.69	4.44	4.66	4.88	0.14	0.45	0.76
R=.10	29.08	36.49	43.89	3.98	4.23	4.49	0.09	0.31	0.52
R=.05	29.04	36.93	44.82	4.20	4.48	4.76	0.09	0.30	0.50
R=.025	34.25	36.32	38.39	4.48	5.12	5.75	0.16	0.40	0.65
A-230									
NT	58.89	85.02	108.15	22.16	33.02	44.20	16.08	22.39	28.69
NT*	22.76	26.50	30.24	9.36	11.73	14.10	5.43	7.94	10.44
R=1.0	4.21	4.44	4.68	3.44	3.78	4.11	0.25	0.30	0.34
R=1.0**	4.15	4.49	4.83	3.70	3.95	4.20	0.25	0.34	0.43
R=.25	8.76	10.65	12.54	3.85	4.51	5.16	0.60	1.67	2.23
R=.25*	7.35	8.52	9.69	4.33	5.27	6.20	1.56	2.34	3.11
R=.10	12.49	24.55	36.61	4.16	5.71	7.26	0.59	2.37	4.14
R=.05	40.24	54.37	68.49	5.41	10.08	14.75	1.72	5.77	9.82
R=.025	56.51	68.23	79.95	6.20	12.47	18.74	0.62	6.98	13.34
A-101									
NT	28.36	43.01	57.65	6.75	10.04	13.32	3.36	6.61	9.86
NT*	16.34	16.93	17.52	5.38	6.39	7.40	1.71	2.53	3.35
R=1.0	5.14	5.86	6.58	3.90	4.13	4.36	1.05	1.17	1.30
R=1.0**	4.95	5.32	5.70	4.23	4.45	4.66	0.95	1.06	1.17
R=.25	9.06	9.52	9.98	5.16	5.95	6.75	1.03	1.47	1.91
R=.25*	8.27	8.74	9.21	4.11	4.80	5.48	1.09	1.46	1.84
R=.10	12.76	15.82	18.89	6.37	8.00	9.64	0.97	2.00	3.03
R=.05	24.78	27.93	31.07	8.13	9.40	10.66	0.91	1.97	3.03
R=.025	42.97	57.85	72.74	7.01	8.03	9.05	1.91	3.04	4.17
A-123									
NT	15.99	22.53	29.07	7.92	10.17	12.43	2.97	5.32	7.66
NT*	13.88	14.71	15.54	7.13	7.72	8.31	1.91	2.29	2.67
R=1.0	5.39	6.35	7.30	4.96	5.18	5.39	0.37	0.71	1.05
R=1.0**	4.95	5.14	5.33	4.40	4.99	5.57	0.18	0.25	0.32
R=.25	13.05	15.00	16.95	4.51	5.25	6.00	0.15	0.27	0.39
R=.25*	10.45	11.04	11.63	4.97	5.42	5.88	0.65	0.90	1.15
R=.10	19.30	21.58	23.86	5.16	6.09	7.03	0.13	0.40	0.66
R=.05	40.67	44.60	48.53	5.89	6.94	10.99	0.25	0.77	1.28
R=.025	34.33	41.12	47.91	5.29	7.04	8.79	0.42	1.44	2.45

*Re-determination, **L=.10--D.05-R=1.0

Table B20. Experiment 1, left lever depleted in two preys.

	TT X			RES Y			GUT Y		
A-104	<MAD	BWM	MAD>	<MAD	BWM	MAD>	<MAD	BWM	MAD>
NT	22.51	26.38	30.25	9.52	13.92	18.32	6.72	10.67	14.62
NT*	18.74	21.34	23.93	5.77	6.84	7.91	3.75	4.56	5.38
R=1.0	4.36	5.48	6.61	2.60	4.26	5.91	1.18	2.68	4.08
R=.25	5.43	6.09	6.74	3.72	4.22	4.72	2.18	2.57	2.95
R=.10	10.53	11.69	12.85	3.57	3.97	4.36	1.82	2.22	2.61
R=.10*	10.71	12.92	15.13	4.24	4.74	5.24	2.31	2.53	2.76
R=.05	14.58	16.11	17.64	3.87	4.42	4.97	1.97	2.39	2.80
R=.05*	15.82	20.57	25.32	3.32	4.29	5.27	1.09	1.41	1.73
R=.025	39.28	43.38	47.48	4.24	4.63	5.02	2.11	2.73	3.35
A-230									
NT	16.98	20.22	23.46	8.73	13.59	18.45	4.91	7.32	9.73
NT*	14.96	15.67	16.38	6.38	7.68	8.98	2.77	4.36	5.96
R=1.0	4.13	4.47	4.81	1.62	2.85	4.08	0.79	1.68	2.57
R=.25	6.87	8.27	9.67	4.01	4.39	4.76	1.88	2.28	2.67
R=.10	23.85	25.94	28.03	3.98	4.82	5.65	1.92	2.32	2.71
R=.10*	13.85	17.77	21.69	5.00	5.50	5.99	2.01	2.62	3.23
R=.05	47.68	58.02	68.36	4.64	6.50	8.36	1.19	3.50	5.81
R=.05*	44.11	61.18	78.24	5.45	5.95	6.44	2.43	2.93	3.43
R=.025	60.06	83.10	106.15	5.31	6.87	8.42	2.83	4.09	5.36
A-101									
NT	15.22	17.11	19.00	5.30	7.10	8.90	2.83	3.93	5.03
NT*	14.41	15.05	15.68	4.42	5.17	5.92	2.50	3.09	3.69
R=1.0	5.73	6.09	6.46	2.63	2.83	3.03	1.37	1.56	1.75
R=.25	7.85	8.20	8.55	3.11	3.42	3.74	1.72	1.91	2.10
R=.10	10.44	11.32	12.20	3.45	3.86	4.27	1.90	2.50	3.11
R=.10*	12.66	13.70	14.73	3.64	4.41	5.18	1.84	2.55	3.26
R=.05	23.84	26.18	28.52	4.90	5.54	6.18	3.41	4.13	4.85
R=.05*	24.85	26.36	27.87	3.30	4.02	4.73	2.04	2.46	2.88
R=.025	51.07	58.14	65.21	5.57	6.09	6.61	3.54	4.13	4.72
A-123									
NT	12.79	13.87	14.95	5.55	7.98	9.91	2.10	4.12	6.14
NT*	13.69	14.87	16.04	3.87	4.83	5.78	1.17	1.98	2.79
R=1.0	5.30	5.66	6.02	0.46	0.81	1.16	0.14	0.48	0.82
R=.25	7.00	7.55	8.10	0.50	0.97	1.44	0.16	0.53	0.90
R=.10	12.76	13.88	15.00	4.20	4.97	5.73	2.34	2.86	3.38
R=.10*	11.73	12.49	13.26	3.38	3.92	4.46	1.39	1.73	2.08
R=.05	20.25	24.26	28.27	6.13	7.10	8.08	3.36	4.47	5.57
R=.05*	21.45	24.25	27.06	4.66	5.04	5.43	2.02	2.58	3.14
R=.025	39.34	41.99	44.64	4.52	5.65	6.78	2.30	3.32	4.34

*Re-determination, TT=travel time, RES=residence time, GUT=giving-up time.

Table B21. Experiment 1, left lever depleted in eight preys.

	TT X			RES Y			GUT Y		
A-104	<MAD	BWM	MAD>	<MAD	BWM	MAD>	<MAD	BWM	MAD>
NT	16.05	17.79	21.52	34.67	44.78	54.89	9.64	17.39	25.14
NT*	11.77	13.34	14.91	35.59	37.22	38.84	8.66	10.48	12.30
R=1.0	3.64	4.50	5.36	26.51	30.26	34.02	4.76	6.04	7.31
R=.25	4.19	5.38	6.57	20.02	24.61	29.21	4.77	5.65	6.53
R=.10	9.08	11.54	13.99	13.25	20.79	28.31	5.02	5.77	6.39
R=.10*	8.63	9.34	10.04	26.12	28.24	30.36	4.38	5.53	6.69
R=.05	12.88	24.83	36.78	27.97	30.29	32.61	6.97	7.40	7.83
R=.05*	12.75	14.66	16.57	35.53	36.99	38.45	6.16	7.09	8.03
A-230									
NT	16.35	20.50	24.64	29.85	32.08	34.31	9.96	12.41	14.86
NT*	32.74	42.90	53.05	96.7	120.4	144	34.29	48.10	61.95
R=1.0	5.78	6.37	6.97	15.5	18.57	21.64	2.37	3.00	3.63
R=.25	2.99	4.81	6.63	15.98	21.88	27.78	11.09	12.83	14.56
R=.10	18.91	31.09	43.27	13.51	18.04	22.57	3.92	5.38	6.84
R=.10*	11.06	13.28	15.50	22.12	25.67	29.22	5.46	6.93	8.40
R=.05	57.34	94.29	131.24	26.04	32.04	38.04	8.05	10.38	12.70
A-101									
NT	14.50	16.49	18.48	26.04	28.87	31.7	7.52	8.10	8.65
NT*	12.83	13.56	14.29	27.09	28.11	29.13	6.45	7.99	9.53
R=1.0	5.77	7.06	8.35	24.62	27.99	31.35	4.61	5.85	7.09
R=.25	8.90	13.37	17.85	15.37	19.91	24.45	4.71	5.33	5.95
R=.10	14.65	18.73	22.81	9.156	16.97	24.78	1.91	4.41	6.91
R=.10*	12.95	14.23	15.52	19.31	21.87	24.43	4.87	5.42	5.97
R=.05	24.83	30.55	36.26	18.73	21.02	23.31	5.81	6.62	7.43
R=.05*	21.16	24.38	27.59	25.03	26.35	27.67	6.01	6.94	7.86
A-123									
NT	12.47	13.31	14.15	25.51	27.75	29.98	5.54	6.57	7.59
NT*	12.31	14.75	17.18	27.9	30.39	32.88	5.29	6.34	7.38
R=1.0	5.70	6.40	7.11	11.92	14.03	16.13	1.72	2.76	3.81
R=.25	6.52	6.87	7.22	8.198	9.168	10.14	1.61	1.83	2.04
R=.10	8.54	11.15	13.76	7.32	10.47	13.62	1.62	2.01	2.40
R=.10*	8.00	8.71	9.43	11.61	12.78	13.94	2.03	2.77	3.52
R=.05	12.68	14.79	16.89	12.33	13.88	15.42	3.30	4.01	4.71
R=.05*	15.00	17.76	20.52	18.95	20.2	21.45	3.89	4.49	5.09

* Re-determination.

Table B22. Experiment 2, left lever depleted in one prey, retractable levers.

	TT			RES			GUT		
		X			Y			Y	
C-1	<MAD	BWM	MAD>	<MAD	BWM	MAD>	<MAD	BWM	MAD>
NT	26.02	36.64	47.26	4.15	17.17	30.19	4.12	13.86	23.59
NT*	24.56	27.88	31.20	4.09	5.05	6.01	0.89	1.63	2.37
R=1.0	5.42	6.13	6.84	0.75	1.42	2.09	0.69	1.37	2.05
R=.10	15.14	16.84	18.53	3.61	4.06	4.51	0.29	0.73	1.16
R=.10*	19.46	31.19	42.91	3.77	6.22	8.67	0.71	3.21	5.71
R=.05	14.47	16.06	17.65	2.76	3.24	3.72	0.18	0.42	0.69
R=.025	24.36	28.39	32.42	3.67	5.00	6.33	0.58	1.90	3.22
C-2									
NT	22.49	26.57	30.65	0.30	2.34	4.38	0.28	2.32	4.36
NT*	14.24	15.17	16.10	2.33	2.52	2.71	0.13	0.39	0.65
R=1.0	5.17	5.47	5.78	0.54	1.06	1.58	0.52	1.05	1.58
R=.10	8.44	9.51	10.58	2.85	3.32	3.79	0.21	0.40	0.59
R=.10*	14.67	20.24	25.81	2.53	3.00	3.47	0.06	0.74	1.42
R=.05	14.06	15.92	17.78	2.88	3.13	3.39	0.07	0.37	0.66
R=.025	21.04	23.08	25.49	2.72	3.34	5.51	0.09	0.37	0.65
C-3									
NT	17.22	19.19	21.16	0.36	1.08	1.80	0.34	1.06	1.78
NT*	15.68	15.91	16.14	3.23	4.08	4.94	0.49	0.98	1.47
R=1.0	4.88	5.17	5.46	0.17	0.89	1.60	0.15	0.87	1.58
R=.10	8.57	9.08	9.59	2.66	2.88	3.10	0.13	0.33	0.53
R=.10*	14.03	19.00	23.97	3.34	3.66	3.98	0.06	0.51	0.95
R=.05	10.37	11.02	11.67	3.275	3.59	3.91	0.04	0.23	0.42
R=.025	16.16	17.73	19.30	2.98	3.31	3.64	0.07	0.12	0.16
C-4									
NT	15.49	17.81	20.04	0.17	2.05	3.92	0.15	2.03	3.90
NT*	12.89	14.31	15.73	4.31	5.64	6.98	1.74	3.00	4.25
R=1.0	4.70	4.99	5.28	0.17	0.35	0.53	0.15	0.33	0.51
R=.10	11.17	11.69	12.38	3.35	3.45	3.55	0.47	0.81	1.14
R=.10*	11.56	18.25	24.94	2.77	3.96	5.15	0.52	1.39	2.26
R=.05	14.08	18.35	22.62	3.87	4.41	4.95	1.07	1.60	2.14
R=.025	38.79	53.47	68.15	4.16	5.06	5.96	2.07	2.91	3.75
C-5									
NT	36.44	45.03	53.63	1.62	6.88	12.14	1.60	6.86	12.12
NT*	21.63	23.27	24.91	7.68	10.24	12.80	2.59	3.93	5.27
R=1.0	9.21	10.89	12.57	-0.15	1.30	2.45	0.13	1.28	2.43
R=.10	14.20	20.91	26.81	6.32	7.73	9.14	1.07	1.77	2.47
R=.10*	13.48	25.13	36.78	4.75	7.86	10.97	1.43	3.97	6.50
R=.05	17.64	19.45	21.26	4.12	4.64	5.15	0.85	1.30	1.74
R=.025	20.46	26.94	33.42	4.00	5.09	6.18	1.00	1.55	2.09

* Re-determination, TT=travel time, RES=residence time, GUT=giving-up time.

Table B23. Experiment 2, left lever depleted in two preys, retractable levers.

		TT			RES			GUT	
		X			Y			Y	
C-1	<MAD	BWM	MAD>	<MAD	BWM	MAD>	<MAD	BWM	MAD>
NT	14.80	16.45	18.10	4.00	4.94	5.88	2.08	2.85	3.62
NT*	18.63	19.92	21.20	2.82	3.74	4.66	0.90	1.93	2.96
R=.10	11.58	12.71	13.84	3.52	4.42	5.31	1.03	2.24	3.44
R=.10*	11.00	12.10	13.20	2.94	3.12	3.30	0.57	0.85	1.14
R=.05	13.80	14.79	15.78	2.53	2.82	3.11	0.29	0.53	0.77
R=.025	20.17	20.92	21.67	2.23	2.47	2.71	0.21	0.41	0.60
R=.025	24.00	28.61	33.23	3.08	3.69	4.30	1.15	1.70	2.25
R=.025*	29.10	30.68	32.27	3.65	4.87	6.10	1.27	1.93	2.58
C-2									
NT	15.50	16.35	17.20	3.31	4.14	4.97	1.55	2.33	3.10
NT*	16.40	17.24	18.09	2.52	2.99	3.47	0.70	1.22	1.73
R=.10	9.51	10.33	11.15	0.55	1.85	3.15	0.16	1.28	2.40
R=.10*	8.65	10.11	11.27	3.30	4.10	4.91	1.54	2.64	3.74
R=.05	11.91	12.94	13.98	2.79	3.37	3.95	0.76	1.25	1.74
R=.025	18.25	20.38	22.52	2.61	2.64	2.68	0.68	0.74	0.80
R=.025	22.54	25.67	28.80	3.96	4.53	5.10	2.32	2.84	3.37
R=.025*	30.60	32.26	33.93	3.38	3.63	3.88	1.48	1.80	2.12
C-3									
NT	11.62	12.99	14.36	2.97	3.84	4.71	1.14	1.96	2.78
NT*	14.03	14.53	15.03	2.61	3.38	4.14	0.48	1.24	1.99
R=.10	7.26	7.73	8.19	2.62	2.95	3.27	0.79	1.20	1.61
R=.10*	16.01	51.48	86.95	3.00	9.76	16.53	1.40	8.95	16.48
R=.05	20.87	55.04	89.21	3.00	10.40	17.79	1.35	6.82	12.29
R=.025	18.26	18.85	19.43	2.01	2.13	2.24	0.28	0.42	0.55
R=.025	16.45	18.22	19.99	2.36	2.71	3.06	0.53	0.82	1.11
R=.025*	17.91	18.29	18.68	2.23	2.59	2.94	0.25	0.64	1.03
C-4									
NT	16.95	17.44	17.94	5.29	6.95	8.62	3.28	4.80	6.32
NT*	17.15	18.00	18.84	4.04	5.17	6.30	1.88	2.95	4.03
R=.10	10.35	12.60	14.84	3.48	4.52	5.56	1.67	2.92	4.17
R=.10*	11.04	13.22	15.40	3.28	3.93	4.58	1.13	1.77	2.41
R=.05	14.46	15.73	17.00	3.47	4.15	4.82	1.82	2.25	2.68
R=.025	22.06	27.26	32.46	3.78	4.29	4.81	2.15	2.56	2.98
R=.025	28.34	47.47	66.60	8.88	12.33	15.77	6.99	10.12	13.25
R=.025*	40.68	52.36	64.03	9.15	16.84	24.54	6.47	14.19	21.61
C-5									
NT	19.10	21.54	23.98	3.84	4.51	5.19	1.67	2.32	2.97
NT*	23.42	24.61	25.80	3.05	4.12	5.19	1.10	1.92	2.74
R=.10	7.96	8.39	8.83	3.38	3.97	4.56	1.23	1.72	2.21
R=.10*	8.40	8.75	9.10	2.79	3.17	3.55	0.63	0.78	0.94
R=.05	16.55	23.98	31.41	2.93	8.02	13.11	0.75	5.66	10.58
R=.025	31.45	47.97	64.50	3.35	6.87	10.39	1.22	3.73	6.25
R=.025	23.93	25.58	27.23	3.25	3.58	3.91	0.94	1.32	1.71
R=.025*	24.70	28.23	31.76	3.53	5.38	7.22	0.95	2.34	3.63

* Re-determination, TT=travel time, RES=residence time, GUT=giving-up time.

Table B24. Experiment 2, left lever depleted in eight preys, retractable levers.

	TT X			RES Y			GUT Y		
C-1	<MAD	BWM	MAD>	<MAD	BWM	MAD>	<MAD	BWM	MAD>
NT	19.29	22.01	24.73	39.04	40.50	41.95	9.88	11.53	13.17
NT*	17.86	18.54	19.22	31.81	34.10	36.39	7.74	9.13	10.52
NT w/obs	41.42	59.22	77.01	35.53	38.29	41.05	12.99	16.49	19.99
R=.10	11.46	14.00	16.53	29.22	35.54	41.85	6.88	8.85	10.83
R=.10*	11.73	12.55	13.37	32.60	34.94	37.28	8.23	9.22	10.20
R=.05	13.43	14.95	16.47	26.18	28.44	30.69	6.23	7.24	8.25
R=.025	24.89	26.21	27.52	30.98	34.18	37.38	7.18	8.12	9.06
C-2									
NT	20.10	20.66	21.21	18.73	19.57	20.40	4.55	4.65	4.75
NT*	19.20	20.13	21.06	24.49	25.74	26.99	5.35	6.13	6.91
NT w/obs	46.10	59.98	73.86	35.58	62.83	90.08	15.00	38.44	62.33
R=.10	12.16	14.53	16.90	24.95	26.19	27.43	5.70	7.53	9.36
R=.10*	10.39	11.62	12.85	21.65	23.67	25.69	4.44	5.97	7.50
R=.05	14.46	16.15	17.84	23.07	24.26	25.65	5.74	6.19	6.64
R=.025	23.13	26.59	30.05	25.09	26.74	28.39	6.21	7.01	7.81
C-3									
NT	15.50	17.27	19.02	30.81	33.99	37.18	7.82	9.10	10.38
NT*	15.32	18.56	21.79	31.17	32.10	33.03	6.74	7.87	9.00
NT w/obs	54.30	74.08	93.86	43.50	80.76	118.02	9.96	52.38	94.81
R=.10	10.17	10.89	11.62	21.54	29.55	37.56	4.79	6.86	8.93
R=.10*	7.68	8.64	9.59	24.51	26.91	29.31	3.96	4.93	5.89
R=.05	10.08	10.81	11.54	25.64	27.14	28.64	5.24	5.48	5.71
R=.025	13.34	14.57	15.80	26.34	28.21	30.07	4.57	5.00	5.43
C-4									
NT	19.36	21.28	23.20	37.82	41.50	45.17	9.21	11.18	13.15
NT*	24.34	26.35	28.36	41.00	46.46	51.92	10.25	14.28	18.31
NT w/obs	38.42	42.37	46.32	44.94	53.43	61.92	12.86	16.38	19.91
R=.10	17.76	21.60	25.44	44.56	48.36	52.16	14.01	16.30	18.59
R=.10*	17.13	19.19	21.25	36.62	41.35	46.07	11.36	14.27	17.19
R=.05	17.22	19.52	21.82	43.05	45.58	48.12	14.59	16.59	18.59
R=.025	36.52	39.57	42.62	49.79	51.93	54.07	16.70	18.08	19.46
C-5									
NT	21.80	23.40	25.00	26.99	28.88	30.77	6.11	6.75	7.39
NT*	21.50	23.01	24.52	27.07	30.43	33.80	5.70	6.52	7.34
NT w/obs	53.37	58.93	64.49	44.62	66.37	88.11	10.94	33.14	55.34
R=.10	15.52	16.54	17.55	26.18	28.57	30.96	6.14	7.43	8.72
R=.10*	13.51	15.17	16.83	23.22	24.13	25.04	4.62	5.23	5.84
R=.05	15.93	17.37	18.81	23.55	25.58	27.61	4.52	5.48	6.44
R=.025	22.69	24.97	27.25	23.41	25.28	27.15	5.27	5.59	5.90

*Re-determinations, NT/obs=natural travel with obstacles.

Table B25. Experiment 1, residuals across conditions.

A-104	LL=.10	LL D in 2	LL D in 8
a1 for GUT	-0.753	0.447	0.651
a2 for GUT	0.175	-0.074	0.143
Std Err of Y Est for GUT	0.160	0.110	0.040
a1 for RT	0.492	0.594	1.373
a2 for RT	0.116	0.040	0.076
Std Err of Y EST for RT	0.050	0.020	0.090
LOG TT(NT)	2.090	1.420	1.250
LOG TT(NT) ~	1.830	1.330	1.130
LOG RT(NT)	1.270	1.140	1.650
LOG RT(NT) ~	0.970	0.840	1.570
LOG GUT(NT)	0.830	1.030	1.240
LOG GUT(NT) ~	0.730	0.660	1.020
a2 GUT * LOG TT(NT)	0.366	-0.105	0.179
a2 GUT * LOG TT(NT) ~	0.320	-0.098	0.162
a2 RT * LOG TT(NT)	0.242	0.057	0.095
a2 RT * LOG TT(NT) ~	0.212	0.053	0.086
Est1 GUT = a1 + (a2 * log TT[NT])	-0.387	0.342	0.830
Est2 GUT = a1 + (a2 * log TT[NT] ~)	-0.433	0.349	0.813
Est1 RT = a1 + (a2 * logTT[NT])	0.734	0.651	1.468
Est2 RT = a1 + (a2 * logTT[NT] ~)	0.704	0.647	1.459
log res1 GUT = log GUT(NT) - Est1 GUT	1.217	0.688	0.410
log res2 GUT = log GUT(NT) ~ - Est2 GUT	1.163	0.311	0.207
log res1 RT = log RT(NT) - Est1 RT	0.536	0.489	0.182
log res2 RT = log RT(NT) ~ - Est2 RT	0.266	0.193	0.111

~ Re-determination.

Table B26. Experiment 1, residuals across conditions.

A-230	LL=.10	LL D in 2	LL D in 8
a1 for GUT	-0.977	0.085	0.715
a2 for GUT	1.024	0.247	0.098
Std Err of Y Est for GUT	0.230	0.050	0.280
a1 for RT	0.309	0.355	1.219
a2 for RT	0.395	0.254	0.112
Std Err of Y EST for RT	0.060	0.050	0.100
LOG TT(NT)	1.930	1.310	1.310
LOG TT(NT) ~	1.420	1.200	1.630
LOG RT(NT)	1.520	1.130	1.510
LOG RT(NT) ~	1.070	0.890	2.080
LOG GUT(NT)	1.350	0.860	1.090
LOG GUT(NT) ~	0.900	0.640	1.680
a2 GUT * LOG TT(NT)	1.976	0.324	0.128
a2 GUT * LOG TT(NT) ~	1.454	0.296	0.160
a2 RT * LOG TT(NT)	0.762	0.333	0.147
a2 RT * LOG TT(NT) ~	0.561	0.305	0.183
Est1 GUT = a1 + (a2 * log TT[NT])	0.999	0.409	0.843
Est2 GUT = a1 + (a2 * log TT[NT] ~)	0.477	0.381	0.875
Est1 RT = a1 + (a2 * log TT[NT])	1.071	0.688	1.366
Est2 RT = a1 +(a2 * logTT[NT] ~)	0.870	0.660	1.402
log res1 GUT = log GUT(NT) - Est1 GUT	0.351	0.451	0.247
log res2 GUT = log GUT(NT) ~ - Est2 GUT	0.423	0.259	0.805
log res1 RT = log RT(NT) - Est1 RT	0.449	0.442	0.144
log res2 RT = log RT(NT) ~ - Est2 RT	0.200	0.230	0.678

~ Re-determination.

Table B27. Experiment 1, residuals across conditions.

A 101	LL=.10	LL D is 2	LL D is 8
a1 for GUT	-0.238	-0.085	0.632
a2 for GUT	0.405	0.412	0.102
Std Err of Y Est for GUT	0.040	0.080	0.080
a1 for RT	0.419	0.247	1.500
a2 for RT	0.328	0.309	-0.130
Std Err of Y EST for RT	0.080	0.050	0.080
LOG TT(NT)	1.630	1.230	1.220
LOG TT(NT) ~	1.230	1.180	1.130
LOG RT(NT)	1.000	0.850	1.460
LOG RT(NT) ~	0.810	0.710	1.450
LOG GUT(NT)	0.820	0.590	0.910
LOG GUT(NT) ~	0.400	0.490	0.900
a2 GUT * LOG TT(NT)	0.660	0.507	0.124
a2 GUT * LOG TT(NT) ~	0.498	0.486	0.115
a2 RT * LOG TT(NT)	0.535	0.380	-0.159
a2 RT * LOG TT(NT) ~	0.403	0.365	-0.147
Est1 GUT= a1 + (a2 * log TT[NT])	0.422	0.422	0.756
Est2 GUT= a1 + (a2 * log TT[NT] ~)	0.260	0.401	0.747
Est1 RT= a1 + (a2 * logTT[NT] ~)	0.954	0.627	1.341
Est2 RT= a1 + (a2 * logTT[NT] ~)	0.822	0.612	1.353
log res1 GUT=log GUT(NT) Est1 GUT	0.398	0.168	0.154
log res2 GUT= log GUT(NT) ~ - Est2 GU	0.140	0.089	0.153
log res1 RT=log RT(NT) - Est1 RT	0.046	0.223	0.119
log res2 RT=log RT(NT) ~ - Est2 RT	-0.012	0.098	0.097

~ Re-determinations.

Table B28. Experiment 1, residuals across conditions.

A-123	LL=.10	LL D is 2	LL D is 8
a1 for GUT	-0.712	-1.082	-0.191
a2 for GUT	0.392	1.120	0.637
Std Err of Y Est for GUT	0.270	0.200	0.120
a1 for RT	0.573	-0.798	0.694
a2 for RT	0.160	1.098	0.416
Std Err of Y EST for RT	0.020	0.200	0.100
LOG TT(NT)	1.350	1.140	1.120
LOG TT(NT) ~	1.170	1.170	1.170
LOG RT(NT)	1.010	0.900	1.440
LOG RT(NT) ~	0.890	0.680	1.480
LOG GUT(NT)	0.730	0.610	0.820
LOG GUT(NT) ~	0.360	0.300	0.800
a2 GUT * LOG TT(NT)	0.529	1.277	0.713
a2 GUT * LOG TT(NT) ~	0.459	1.310	0.745
a2 RT * LOG TT(NT)	0.216	1.252	0.466
a2 RT * LOG TT(NT) ~	0.187	1.285	0.487
Est1 GUT= a1 + (a2 * log TT[NT])	-0.183	0.195	0.522
Est2 GUT= a1 + (a2 * log TT[NT] ~)	-0.253	0.228	0.554
Est1 RT= a1 +(a2 * logTT[NT])	0.789	0.454	1.160
Est2 RT= a1 + (a2 * logTT[NT] ~)	0.760	0.487	1.181
log res1 GUT=log GUT(NT) - Est1 GUT	0.913	0.415	0.298
log res2 GUT= log GUT(NT) ~ - Est2 GU	0.613	0.072	0.246
log res1 RT=log RT(NT) - Est1 RT	0.221	0.446	0.280
log res2 RT=log RT(NT) ~ - Est2 RT	0.130	0.193	0.299

~ Re-determination.

Table B29. Experiment 2, residuals across conditions (retractable levers).

C-1	LL = 30	LL D in 2	LL D in 8
a1 for GUT	-0.479	-0.528	1.054
a2 for GUT	0.455	0.433	-0.110
Std Err of Y Est for GUT	0.370	0.340	0.050
a1 for RT	-0.533	0.299	1.500
a2 for RT	0.874	0.189	0.011
Std Err of Y EST for RT	0.030	0.120	0.050
LOG TT(NT)	1.560	1.220	1.340
LOG TT(NT) ~	1.450	1.300	1.270
LOG TT(NT) w/obs			1.77
LOG RT(NT)	1.230	0.690	1.610
LOG RT(NT) ~	0.700	0.450	1.530
LOG RT(NT) w/obs			1.58
LOG GUT(NT)	1.140	0.450	1.060
LOG GUT(NT) ~	0.210	0.290	0.960
LOG GUT(NT) w/obs			1.22
a2 GUT * LOG TT(NT)	0.710	0.528	-0.147
a2 GUT * LOG TT(NT) ~	0.660	0.563	-0.140
a2 GUT * LOG TT(NT) w/obs			-0.1947
a2 RT * LOG TT(NT)	1.363	0.231	0.015
a2 RT * LOG TT(NT) ~	1.267	0.246	0.014
a2 RT * LOG TT(NT) w/obs			0.01947
Est1 GUT= a1 + (a2 * log TT[NT])	0.231	0.000	0.907
Est2 GUT= a1 + (a2 * log TT[NT] ~)	0.181	0.035	0.914
Est3 GUT= a1 + (a2 * log TT[NT] w/obs)			0.8593
Est1 RT= a1 + (a2 * logTT[NT])	0.830	0.530	1.523
Est2 RT= a1 + (a2 * logTT[NT] ~)	0.734	0.545	1.522
Est3 RT= a1 + (a2 * logTT[NT] w/obs)			1.52747
log res1 GUT= log GUT(NT) - Est1 GUT	0.909	0.450	0.153
log res2 GUT= log GUT(NT) ~ - Est2 GUT	0.029	0.255	0.046
log res3 GUT= log GUT(NT) w/obs - Est3 GUT			0.3607
log res1 RT= log RT(NT) - Est1 RT	0.400	0.160	0.007
log res2 RT= log RT(NT) ~ - Est2 RT	-0.034	-0.095	0.008
log res3 RT = log RT(NT) w/obs - Est3 RT			0.05253

~ Re-determination, (NT)w/obs = natural travel with obstacles.

Table B30. Experiment 2, residuals across conditions (retractable levers).

C-2	LL = 30	LL D in 2	LL D in 8
a1 for GUT	0.228	0.109	0.661
a2 for GUT	-0.450	0.075	0.133
Std Err of Y Est for GUT	0.200	0.250	0.050
a1 for RT	-0.339	0.182	1.248
a2 for RT	0.669	0.265	0.133
Std Err of Y EST for RT	0.150	0.150	0.020
LOG TT(NT)	1.420	1.210	1.320
LOG TT(NT) ~	1.180	1.240	1.300
LOG TT(NT) w/obs			1.780
LOG RT(NT)	0.370	0.620	1.290
LOG RT(NT) ~	0.400	0.400	1.410
LOG RT(NT) w/obs			1.400
LOG GUT(NT)	0.370	0.370	0.670
LOG GUT(NT) ~	-0.410	0.090	0.790
LOG GUT(NT) w/obs			1.500
a2 GUT * LOG TT(NT)	-0.639	0.091	0.176
a2 GUT * LOG TT(NT) ~	-0.531	0.093	0.173
a2 GUT * LOG TT(NT) w/obs			0.237
a2 RT * LOG TT(NT)	0.950	0.321	0.176
a2 RT * LOG TT(NT) ~	0.709	0.329	0.173
a2 RT * LOG TT(NT) w/obs			0.237
Est1 GUT= a1 + (a2 * log TT[NT])	-0.411	0.200	0.837
Est2 GUT= a1 + (a2 * log TT[NT] ~)	-0.303	0.202	0.834
Est3 GUT= a1 + (a2 * log TT[NT] w/obs)			0.898
Est1 RT= a1 + (a2 * logTT[NT])	0.611	0.503	1.424
Est2 RT= a1 + (a2 * logTT[NT] ~)	0.450	0.511	1.421
Est3 RT= a1 + (a2 * logTT[NT] w/obs)			1.485
log res1 GUT= log GUT(NT) - Est1 GUT	0.781	0.170	-0.167
log res2 GUT= log GUT(NT) ~ - Est2 GUT	-0.107	-0.112	-0.044
log res3 GUT= log GUT(NT) w/obs - Est3 GUT			0.682
log res1 RT= log RT(NT) - Est1 RT	-0.241	0.117	-0.134
log res2 RT= log RT(NT) ~ - Est2 RT	-0.050	-0.031	-0.011
log res3 RT = log RT(NT) w/obs - Est3 RT			0.315

~ Re-determinations, (NT)w/obs = natural travel with obstacles.

Table B31. Experiment 2, residuals across conditions (retractable levers).

C-3	LL = 10	LL D in 2	LL D in 8
a1 for GUT	0.427	-1.576	0.761
a2 for GUT	-0.464	1.311	-0.019
Std Err of Y Est for GUT	0.300	0.410	0.000
a1 for RT	-0.603	-0.479	1.357
a2 for RT	0.966	0.802	0.065
Std Err of Y EST for RT	0.150	0.190	0.020
LOG TT(NT)	1.200	1.110	1.237
LOG TT(NT)~	1.200	1.160	1.268
LOG TT(NT) w/obs			1.869
LOG RT(NT)	0.033	0.500	1.530
LOG RT(NT)~	0.610	0.528	1.506
LOG RT(NT) w/obs			1.907
LOG GUT(NT)	0.030	0.290	0.959
LOG GUT(NT)~	-0.008	0.093	0.895
LOG GUT(NT) w/obs			1.719
a2 GUT * LOG TT(NT)	-1.106	1.455	-0.024
a2 GUT * LOG TT(NT)~	-1.037	1.521	-0.024
a2 GUT * LOG TT(NT) w/obs			-0.036
a2 RT * LOG TT(NT)	1.236	0.890	0.105
a2 RT * LOG TT(NT)~	1.159	0.930	0.108
a2 RT * LOG TT(NT) w/obs			0.159
Est1 GUT= a1 + (a2 * log TT[NT])	-0.679	-0.121	0.737
Est2 GUT= a1 + (a2 * log TT[NT]~)	-0.610	-0.055	0.737
Est3 GUT= a1 + (a2 * log TT[NT] w/obs)			0.725
Est1 RT= a1 + (a2 * logTT[NT])	0.633	0.411	1.462
Est2 RT= a1 + (a2 * logTT[NT]~)	0.556	0.451	1.465
Est3 RT= a1 + (a2 * logTT[NT] w/obs)			1.516
log res1 GUT= log GUT(NT) - Est1 GUT	0.709	0.411	0.222
log res2 GUT= log GUT(NT)~ - Est2 GUT	0.602	0.148	0.158
log res3 GUT= log GUT(NT) w/obs - Est3 GUT			0.994
log res1 RT= log RT(NT) - Est1 RT	-0.600	0.169	0.068
log res2 RT= log RT(NT)~ - Est2 RT	0.054	0.077	0.041
log res3 RT = log RT(NT) w/obs - Est3 RT			0.391

~ Re-determination, (NT) w/obs = natural travel with obstacles).

Table B32. Experiment 2, residuals across conditions (retractable levers).

C-4	LL = 10	LL D in 2	LL D in 8
a1 for GUT	-1.077	-1.079	0.908
a2 for GUT	0.935	1.225	0.220
Std Err of Y Est for GUT	0.080	0.180	0.030
a1 for RT	-0.892	-0.444	1.351
a2 for RT	1.078	0.907	0.231
Std Err of Y EST for RT	0.310	0.140	0.030
LOG TT(NT)	1.250	1.240	1.330
LOG TT(NT)~	1.160	1.260	1.420
LOG TT(NT) w/obs			1.630
LOG RT(NT)	0.310	0.840	1.620
LOG RT(NT)~	0.750	0.710	1.670
LOG RT(NT) w/obs			1.730
LOG GUT(NT)	0.310	0.600	1.050
LOG GUT(NT)~	0.480	0.470	1.150
LOG GUT(NT) w/obs			1.210
a2 GUT * LOG TT(NT)	1.169	1.519	0.293
a2 GUT * LOG TT(NT)~	1.085	1.544	0.312
a2 GUT * LOG TT(NT) w/obs			0.359
a2 RT * LOG TT(NT)	1.348	1.125	0.307
a2 RT * LOG TT(NT)~	1.250	1.143	0.328
a2 RT * LOG TT(NT) w/obs			0.377
Est1 GUT= a1 + (a2 * log TT[NT])	0.092	0.440	1.201
Est2 GUT= a1 + (a2 * log TT[NT]~)	0.008	0.465	1.220
Est3 GUT= a1 + (a2 * log TT[NT] w/obs)			1.267
Est1 RT= a1 + (a2 * logTT[NT])	0.456	0.681	1.658
Est2 RT= a1 + (a2 * logTT[NT]~)	0.358	0.699	1.679
Est3 RT= a1 + (a2 * logTT[NT] w/obs)			1.728
log res1 GUT= log GUT(NT) - Est1 GUT	0.218	0.240	-0.151
log res2 GUT= log GUT(NT)~ - Est2 GUT	0.472	0.005	-0.070
log res3 GUT= log GUT(NT) w/obs - Est3 GUT			-0.057
log res1 RT= log RT(NT) - Est1 RT	-0.146	0.159	-0.038
log res2 RT= log RT(NT)~ - Est2 RT	0.392	0.011	-0.009
log res3 RT = log RT(NT) w/obs - Est3 RT			0.002

~ Re-determination, (NT) w/obs = natural travel with obstacles.

Table B33. Experiment 2, residuals across conditions (retractable levers).

C-5	LL=.10	LL D in 2	LL D in 8
a1 for GUT	-0.618	-0.532	0.889
a2 for GUT	0.670	0.659	-0.095
Std Err of Y Est for GUT	0.200	0.270	0.080
a1 for RT	-1.772	0.215	1.444
a2 for RT	1.839	0.364	-0.025
Std Err of Y EST for RT	0.160	0.130	0.040
LOG TT(NT)	1.650	1.330	1.370
LOG TT(NT)~	1.370	1.390	1.360
LOG TT(NT) w/obs			1.770
LOG RT(NT)	0.840	0.650	1.460
LOG RT(NT)~	1.010	0.440	1.480
LOG RT(NT) w/obs			1.820
LOG GUT(NT)	0.840	0.370	0.830
LOG GUT(NT)~	0.590	0.280	0.810
LOG GUT(NT) w/obs			1.520
a2 GUT * LOG TT(NT)	1.106	0.876	-0.130
a2 GUT * LOG TT(NT)~	0.918	0.916	-0.129
a2 GUT * LOG TT(NT) w/obs			-0.168
a2 RT * LOG TT(NT)	3.034	0.484	-0.034
a2 RT * LOG TT(NT)~	2.519	0.506	-0.034
a2 RT * LOG TT(NT) w/obs			-0.044
Est1 GUT= a1 + (a2 * log TT[NT])	0.487	0.344	0.759
Est2 GUT= a1 + (a2 * log TT[NT]~)	0.300	0.384	0.760
Est3 GUT= a1 + (a2 * log TT[NT] w/obs)			0.721
Est1 RT= a1 + (a2 * logTT[NT])	1.262	0.699	1.410
Est2 RT= a1 + (a2 * logTT[NT]~)	0.747	0.721	1.410
Est3 RT= a1 + (a2 * logTT[NT] w/obs)			1.400
log res1 GUT= log GUT(NT) - Est1 GUT	0.353	0.026	0.071
log res2 GUT= log GUT(NT)~ - Est2 GUT	0.290	-0.104	0.050
log res3 GUT= log GUT(NT) w/obs - Est3 GUT			0.799
log res1 RT= log RT(NT) - Est1 RT	-0.422	-0.049	0.050
log res2 RT= log RT(NT)~ - Est2 RT	0.263	-0.281	0.070
log res3 RT = log RT(NT) w/obs - Est3 RT			0.420

~ Re-determination, (NT)w/obs= natural travel with obstacles.

APPENDIX C

Table C34. Logarithmic residuals divided by standard errors.

		Residence Time			Giving-up Time		
		Pellets			Pellets		
Subject		1	2	8	1	2	8
A-101		0.58	4.46	1.49	9.95	2.10	1.93
	*	-0.25	1.96	1.21	3.50	1.11	1.91
A-104		10.72	24.45	2.02	7.61	6.25	10.25
	*	5.32	9.65	1.23	7.27	2.83	5.18
A-123		11.05	2.23	2.80	3.38	2.08	2.48
	*	6.50	0.97	2.99	2.27	0.36	2.05
A-230		7.48	8.84	1.44	1.53	9.02	0.88
	*	3.33	4.60	6.78	1.84	5.18	2.88
Mean		5.59	7.14	2.50	4.67	3.62	3.44

* Redetermination.

Table C35. Experiment 2, logarithmic residuals divided by standard errors.

		Residence Time				Giving-up Time			
		Pellets				Pellets			
Subject		1	2	8	**	1	2	8	**
C-1		13.33	1.33	1.74	1.05	2.46	1.32	3.06	7.21
	*	-1.13	-0.79	0.16		0.08	0.75	0.92	
C-2		-1.61	0.78	-6.70	15.75	3.91	0.68	-3.34	13.64
	*	-0.33	-0.21	-0.55		-0.54	-0.45	-0.88	
C-3		-4.00	0.89	3.40	19.55	2.36	1.00	2.78	1.24
	*	0.36	0.41	2.05		2.01	0.36	1.98	
C-4		-0.47	1.14	-1.27	0.07	2.73	1.33	-5.03	-1.90
	*	1.26	0.08	-0.30		5.90	0.03	-2.33	
C-5		-2.64	-0.38	1.25	10.50	1.77	0.10	0.89	9.90
	*	1.64	-2.16	1.75		1.45	-0.39	0.63	
Mean		0.64	0.11	0.15	9.38	2.21	0.47	-0.13	6.02

* Redetermination, ** natural travel with obstacles.

Table C36. Experiment 1, average rate of prey captured

SUBJECT	PROBABILITY RIGHT LEVER	PELLETS PER VISIT 1	2	8
A-104	0.025	0.024	0.042	
	0.050	0.024	0.095	0.128
	* 0.05		0.080	0.141
	0.100	0.024	0.121	0.166
	* 0.10		0.111	0.164
	0.250	0.059	0.182	0.221
	* 0.25	0.063		
	1.00	0.093	0.199	0.182
	** 1.00	0.058		
	NT	0.007	0.050	0.116
	* NT	0.013	0.071	0.144
A-230	0.025	0.012	0.022	
	0.050	0.015	0.031	0.080
	* 0.05		0.030	
	0.100	0.032	0.065	0.090
	* 0.10		0.083	0.156
	0.250	0.065	0.158	0.240
	* 0.25	0.073		
	1.00	0.119	0.249	0.202
	** 1.00	0.059		
	NT	0.008	0.059	0.131
	* NT	0.026	0.086	0.043
A-101	0.025	0.015	0.031	
	0.050	0.026	0.063	0.119
	* 0.05		0.066	0.136
	0.100	0.042	0.129	0.125
	* 0.10		0.110	0.182
	0.250	0.065	0.167	0.190
	* 0.25	0.074		
	1.00	0.100	0.213	0.162
	** 1.00	0.054		
	NT	0.018	0.081	0.155
	NT*	0.043	0.099	0.175
A-123	0.025	0.020	0.041	
	0.050	0.019	0.061	0.165
	* 0.05		0.068	0.143
	0.100	0.036	0.101	0.133
	* 0.10		0.122	0.182
	0.250	0.049	0.164	0.209
	* 0.25	0.061		
	1.00	0.086	0.213	0.188
	** 1.00	0.053		
	NT	0.030	0.089	0.189
	* NT	0.045	0.101	0.149

* Redetermination.

Table C37 Experiment 2, average rate of prey captured

	PROBABILITY	PELLETS PER VISIT		
SUBJECT	RIGHT LEVER	1	2	8
C-1	0.025	0.030	0.083	0.127
	* 0.025		0.062	
	* 0.025		0.056	
	0.05	0.052	0.112	0.162
	0.10	0.048	0.113	0.136
	* 0.10	0.027	0.129	0.147
	1.00	0.132		
	NT	0.019	0.094	0.120
	* NT	0.030	0.088	0.146
	NT w/obs			0.080
C-2	0.025	0.038	0.086	0.146
	* 0.025		0.086	
	* 0.025		0.056	
	0.05	0.052	0.121	0.186
	0.10	0.077	0.156	0.173
	* 0.10	0.043	0.139	0.199
	1.00	0.153		
	NT	0.036	0.098	0.183
	* NT	0.057	0.099	0.169
	NT w/obs			0.061
C-3	0.025	0.048	0.093	0.178
	* 0.025		0.095	
	* 0.025		0.096	
	0.05	0.067	0.029	0.194
	0.10	0.084	0.180	0.162
	* 0.10	0.044	0.031	0.205
	1.00	0.165		
	NT	0.049	0.118	0.153
	* NT	0.050	0.112	0.153
	NT w/obs			0.049
C-4	0.025	0.017	0.063	0.087
	* 0.025		0.033	
	* 0.025		0.029	
	0.05	0.044	0.100	0.116
	0.10	0.085	0.113	0.101
	* 0.10	0.045	0.112	0.123
	1.00	0.187		
	NT	0.050	0.082	0.119
	* NT	0.060	0.086	0.100
	NT w/obs			0.076
C-5	0.025	0.031	0.036	0.135
	* 0.025		0.067	
	* 0.025		0.059	
	0.05	0.042	0.063	0.160
	0.10	0.036	0.160	0.154
	* 0.10	0.030	0.166	0.163
	1.00	0.082		
	NT	0.019	0.077	0.136
	* NT	0.030	0.073	0.135
	NT w/obs			0.060

* Redetermination.

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