Running Head: WITHIN-SESSION PATTERNS OF RESPONDING

Rate of a Maintained Operant as a Function of Temporal Position Within a Session

William L. Palya and Donald E. Walter

Department of Psychology

Jacksonville State University

256-782-5641

palya@sebac.jsu.edu

Abstract

The Abstract begins a new page. It should be short, but informative. It is used in the Psychological Abstracts, so it should be self-contained. The Abstract covers what the original questions were, what the answer was, and the conclusion drawn. Summarize the general procedure and the major findings in no more than 100-150 words. Avoid uninformative sentences such as "An explanation of the data was discussed." Do not use abbreviations in this section. In summary, this section should contain statements of the problem, method, results and conclusions.

Abstract

McSweeney and her colleagues (e.g., McSweeney, Hatfield, & Allen, 1990) have demonstrated reliable, large magnitude rate changes in maintained operants within daily sessions under a wide variety of reinforcement schedules. The present paper examined the role of schedule of reinforcement, reinforcement rate, and total amount of food access in determining those within-session rate changes. If median rates across birds were considered, then all procedures resulted in a brief period of an increasing rate, followed by a modest rate loss across the major portion of the session. However, not all individuals exhibited that pattern. When the amount of food access per session was limited by lower reinforcement rates, shorter sessions, or shorter reinforcement durations, then the magnitude of the within-session rate change was reduced from that occurring without those constraints. Additionally, under the conditions that produced strong within-session rate changes, the magnitude of the within-session rate loss was correlated with the bird's body weight. These effects are consistent with what is typically labeled satiation.

Introduction

The Introduction section begins on a new page and is not labeled introduction.

The paragraphs of the sample introduction contain examples of the format used for citations and are not necessarily intended to make sense.

Start with something everyone will agree with. Address yourself to psychologists who have a good general knowledge of introductory psychology, but who may not remember all the exact details. Be impersonal in style. Do not use interrogatory sentences or question marks. Use declarative statements and periods instead.

The Introduction section answers the WHY questions surrounding the research. This section gives the reader enough background to understand the relevance, the point, and the meaning of the research question. It also develops a case for the appropriateness and the necessity of the procedures used to answer the research question.

Develop how your research fits into the field of psychology as a Euclidean proof. Initially present the overall subject matter and its relevance. Then develop how your research question evolved historically. Review the issue which originally raised the problem. Present the succession of answers and subsequent questions revolving around the problem. Demonstrate the importance and significance of your research question by pointing out the impact that various possible results would have. Be careful to maintain the continuity of the developing issue, and to provide adequate contact with the literature (i.e., references).

Make a case for why the procedure that you intend to use is the most appropriate method for demonstrating or determining the effect. Also develop a case for why the actual independent variable and dependent variable are acceptable models for the inferred independent and dependent variables if you do not discuss them in their own terms. Note that the procedure must not be unnecessarily complex, and that the ensuing results must not be subject to alternative explanations.

`Rate of a Maintained Operant as a Function of Temporal Position Within a Session

McSweeney and her colleagues (McSweeney, Hatfield & Allen, 1990; McSweeney & Hinson, 1992; McSweeney, Roll & Weatherly, 1994) have documented systematic changes in operant responding as a function of temporal position within each daily exposure to a schedule of reinforcement (i.e., a session). Their extensive functional analyses have typically indicated a relatively short duration period during which the response rate increases followed by a generally decreasing rate throughout the remainder of the session. This bitonic rate change is of importance for three reasons. First, to the degree that it is reliable, it must be studied if a coherent and complete understanding of schedule control, and a general understanding of behavior, is to be accomplished. Second, a changing rate across the session would mean that any single index of behavior collapsed across a session can correctly represent only that, or larger quantal units, rather than behavior in general. Finally, if behavior systematically changes across a session, then any within-session experimental treatment confounds that treatment with the bitonic effect. There would be important ramifications of this confound with respect to our body of accumulated knowledge (McSweeney, 1992).

However, the literature suggests that the bitonic within-session effect may not be ubiquitous. Examination of cumulative records in Ferster and Skinner (1957) do not suggest a rate change on the order of 450% across a session, as was obtained by McSweeney, Hatfield, and Allen (1990). The current practice of collapsing data across a session into a single index indicates that the bitonic effect had either not been noticed, or had not been considered significant by most researchers before McSweeney's 1992 observation. Moreover, studies explicitly depicting behavior as a function of time in the session have not always shown the bitonic effect (McSweeney et al., 1990; Palya, 1992).

Method

The Method section consists of the Subjects, Apparatus, and Procedure sections. It tells the reader precisely how the experiment was conducted and all the information necessary to recognize confounds. Include everything necessary to replicate and obtain the same results and nothing that is unnecessary. Include the relevant, exclude the irrelevant. There is no introduction following the word Method. The first line of the section is the title of the Subjects section.

Subjects

Include how many, what species, the population from which they were selected, and any other pertinent details concerning the subjects in particular. Provide the information necessary to replicate the study with respect to subjects. The information should enable the reader to realize any confounds or inability to generalize because of special property of the subjects.

Apparatus

Describe the apparatus sufficiently enough that someone could replicate your study with respect to apparatus or setting. When a "standard" apparatus is used, name it and then go on to describe it.

Describe the apparatus only insofar as it interacts with the subject. Describe the properties not what it did or what it was used for. If it was not used, do not describe it unless it was of overshadowing importance. Do not describe the way the apparatus interacts with the experimenter unless it has a direct bearing on the procedure or the results. Provide all the information necessary to allow the reader to realize any confounds or inability to generalize because of some special property of the apparatus or setting. You must use the Standard International System of Units.

Method

Subjects

Twelve adult, experimentally naive pigeons obtained from a local supplier, were used. They were housed under a 19:5 hr light:dark cycle in individual cages with free access to water. All were maintained with pelletized laying mash. As determined by each bird's presession body weight, the number of reinforcers in a session was adjusted from its typical value of 50, so that each bird would be at 80% of its free-feeding weight at the beginning of the next session.

Apparatus

Five experimental chambers were used. The interior of each was a 30 cm cube painted white. A stimulus panel served as one wall of the chamber. It had a feeder aperture medially located 8 cm above the grid floor. Three symmetrically positioned response keys, 2 cm in diameter, were located 9 cm apart, 19 cm above the grid floor. They required approximately 0.15 N to operate. The translucent Plexiglas keys could be transilluminated lime green by a stimulus projector containing a Rosco theatrical color filter. Two houselights were located on the stimulus panel 28 cm above the grid floor and 9 cm apart. Ventilation was provided by an exhaust fan mounted on the outside of the chamber.

Stimulus events were controlled and key pecks were recorded by a computer system (Palya & Walter, 1993). The computer archived the time of each stimulus and response event in 1-ms "ticks." Subsequent data extraction and analysis routines provided the resulting behavioral indices. Complete raw data event logs of all research are maintained for 10 years and are available via internet upon request (see Authors' Note).

Procedure

The reader must know everything that happened to the subject, all of the information necessary to replicate the study. Procedures are written in terms of a sequence of events. Give an overall view then a detailed description. Include instructions, maintenance schedule, how the independent variable was administered, and how the dependent variable was recorded. If there were instructions given to the subjects you would quote them in this section if necessary, or refer the reader to an appendix. Provide all of the information necessary to realize any confounds or inability to generalize because of some special property of the procedure. If data cannot be replicated through your procedure section your contribution cannot be considered a fact, and is of little use. The actual controlling variable was obviously unspecified.

Results

First briefly present the main trend of the findings with respect to the main procedural manipulation. Then logically present the relevant results of the procedure. Order your presentation with respect to categories of results. Summarize your data, avoid presenting raw data. Present or show data to justify your assessment of the major trends. You MUST prove your points and not just state them. Provide quantitative measures. Present evidence supporting the reliability of the data, and the amount of variance your descriptions will account for. Additionally provide information which will allow the reader to realize the magnitude of the effect which would be necessary before it was reported as reliable. Do not introduce theory or interpretations in this section. This is a data section. Keep in mind that your topic is Psychology and that the behavior of the organism (not the organism itself) is the dependent measure. Describe the behavior, not the organism. A handy rule of thumb is "you should avoid altogether any reference to the subject (the organism) in the results and discussion sections. For example, "the response rate increased ...." rather than "the pigeon pecked faster".

Procedure

Each bird was exposed to a series of variable ratio (VR) schedules of differing requirements. These schedules provided a 3-sec reinforcer for the first key peck following a variable number of key pecks with the specified mean. A 20-element Fleshler-Hoffman series (Fleshler & Hoffman, 1962) was used to generate the distribution of response requirements for the VR schedule. In separate phases, each bird also received VI schedules and VI+ schedules (McDowell & Kessel, 1979) yoked to the reinforcement rate obtained under its VR procedures. A VI+ schedule is a synthetic schedule that reinforces the first response after a temporal interval which itself is a function of the average interresponse time (IRT) for that interreinforcement interval (IRI). Because of the way it was scheduled, a bird's VI+ schedule necessarily had the same mean reinforcement rate as the VR to which it was yoked. Each bird also received a VI schedule yoked to its reinforcement rate under the VR. Note that for ease of designating the appropriate schedule value for comparison, and for ease of labeling the VI and VI+ values for the 12 birds under the 15 conditions, those schedule values were specified as the VR value to which they were yoked. For example, a VI which was yoked to a VR 100 (i.e., a VI prime schedule or VI' 100) had the same IRI as that bird's VR 100. Across birds, the mean IRI for the VI' 10, 50, 100, 200 and 400 schedules were 5, 24, 50, 103 and 218 s, respectively. This simple labeling convention eliminated the need to specify 60 different VI schedule values and the tables indicating which VI value corresponded to which VR values for each bird.

Results

Description of Behavior. Overall, the procedures of Experiment 1 resulted in only a modest decline in rate across the session. None of the reinforcement rates or schedules of reinforcement resulted in large within-session rate changes when

References, Figures, and Tables

Present figures and tables if appropriate. You may never include figures or tables without referring to them in the manuscript text. The most important points brought out in the table or figure must also be stated in the results section. Put the actual figures or tables at the end of the paper.

total amount of food access was held constant by adjusting the session length. Based on single, straight-line, least squares characterizations, the three schedules and the five reinforcement rates all had similar slopes. An analysis of variance (11 subjects x 3 schedules x 5 reinforcement rates) indicated that the obtained slope differences due to schedules and reinforcement rates were not significant (p<0.99 and 0.94, respectively). The median slope varied from -0.07 to -0.19 for schedules (collapsed across reinforcement rates and birds) and from -0.01 to -0.48 for reinforcement rates (collapsed across schedules and birds). Collapsed across schedules, reinforcement rates and birds, the median slope was -0.06. Lastly, while many functions (as characterized by 20-s bins) showed atypical responding immediately following the beginning of the session, many other functions appeared, for the most part, relatively linear throughout the session.

Several important characteristics of the findings are depicted in Figure 1. The two frames in the upper left provide the best fit slopes for the first and second segment, respectively. If time in the session controls two distinct processes, then the parameters of a two-straight-line fit could be used as a relatively powerful but conceptually simple analytical technique to identify the general characteristics of those two processes. The first and second segment slopes were subjected to an analysis of variance (11 subjects x 3 schedules x 5 reinforcement rates). The first segment slopes did not differ as a function of schedule or reinforcement rate (p<0.66 and 0.18, respectively). The second segment slopes did differ as a function of schedule (p < 0.04), but not as a function of reinforcement rate (p<0.84). The interaction was also significant (p<0.01). In order to better understand the source of that interaction and the marginal significance of the schedule effect, an additional ANOVA of the second segment slopes which excluded the highest reinforcement rate was carried out. It was not significant (p<0.18 and 0.92 for schedules and reinforcement rates,

Discussion

The Discussion section answers the question "SO WHAT?" or "WHAT OF IT?" It discusses what the results of the research mean. Open this section with a clear statement of support or lack of support of the original hypothesis presented in the Introduction. Discuss the questions which were asked in the introduction, what the answers were, and in what sense the data answered these questions. Recap data to prove the answer to the question regardless of whether they were affirmative or negative. Recap the reliability and generality of your results. It is necessary to nonstatistically substantiate your results and their reliability and generality by citing other similar or related studies and their findings. Point out similarities and differences between your findings and other findings and relate those differences to the procedural differences. Cite examples of other similar results. Discuss how your findings are similar to other kinds of research. Help substantiate your conclusions by pointing out functional similarities and the relevance to your conclusions.

The data will answer some questions more than others. Talk about the conclusions which can be made from the data, e.g., "it may be concluded that this drug has the effect of increasing the rate of ....." Make partial conclusions. State the limitations, qualifications, and generalizations of your statements. If necessary, describe the limitations in detail. A potential limitation is that the results may be peculiar to the procedure.

Discuss the certainty with which the data answer the various questions. Use "but" and "however" type sentences, e.g., "these data suggest this, however, such and such may not have been controlled. What other alternative interpretations are there? Rule them out with evidence or explore their potential. In the end you may have discovered a better question rather than a better answer. If that is the case discuss exactly that.

This section is your conclusion and not your results. It is what you think about your results and what they mean, not just a repeat of the results section. Remember that your data are real and not hypothetical. It is assumed that you have thought about the ramifications and implications of your research more than anyone else, however never be final or eternal about your conclusions. Never end a discussion with an appeal for more research to be done.

respectively). Table 1 presents the median within-session rate change indices and variance accounted for by body weight for the procedures of Experiment 2.

Discussion

The experiments of the present study demonstrated that: (1) none of the 15 combinations of schedules and reinforcement rates produced a large within-session response rate change when the number of reinforcers given in a session was restricted, (2) a high reinforcement rate with a long session length did result in a tendency toward a strongly bitonic rate change over a session, but that rate change was correlated with the bird's body weight, and finally, (3) the same long exposures to a reinforcement rate which had produced strongly bitonic rate changes with normal reinforcement durations did not result in large within-session rate changes if the bird's access to food was limited to one bite per reinforcer.

Taken together these findings suggest that the degree of within-session rate change is a function of some factor correlated with the amount of food access in a session per unit of body weight. Such a process is consistent with what most researchers refer to when they use the term satiation. However, as McSweeney and her colleagues (McSweeney, Hinson, & Cannon, 1996; Roll, McSweeney, Johnson & Weatherly, 1995) have aptly pointed out, this is only a label for what is actually a poorly understood mechanism. For example, while the current usage of satiation comfortably fits the tendency for most birds to exhibit a rate loss across the session; the traditional meaning poorly fits the instances showing rate gains across the initial portion or even across the entire session.

McSweeney has argued that her theoretical approach is superior to the simple notion of satiation. Her position is that the initial rising portion of the within-session rate change is the result of sensitization and is best described by a positive hyperbola. The sustained rate loss across the major portion of a session

References

Begin this section on a separate page. The above examples cover the common types of entries. Pay very close attention to the format. Note that the titles of the journals are written out in full. Also note what is and what is not capitalized (e.g., in book titles, only the first letter of the first word is capitalized and also the first letter following a colon; in journals the first letter of each major word is capitalized). Book titles, names of journals, and volume numbers of journals are underlined.

The text should make adequate contact with relevant literature through references. You must provide the source of your information that interested readers can go to the original sources themselves to expand or confirm what you said. Science does not believe things just because someone said them, but because the facts have been substantiated by many independent investigators with "different axes to grind." Findings must be understandable and replicable to both people who agree with your interpretation and to those who disagree.

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Authors' Note

This section specifies the grant support, as required by most granting agencies. If parts of the research were presented at a meeting, state that information. Any acknowledgments are also indicated in this section. Finally, an address where reprints may be obtained is given.

Authors' Note

Portions of this paper were presented at the annual meeting of The Psychonomic Society, 1995. The authors gratefully acknowledge the contributions of Helen Bush and Josey Chu for running the animals; Robert Allan, Edmond Venator, and Robert Kessel for critical discussions; Peter Killeen and Frances McSweeney for comments on an earlier draft of this paper; and Elizabeth Palya for contributions in all phases of this research. Correspondence and requests for reprints should be sent to William L. Palya, Department of Psychology, Jacksonville State University, Jacksonville, AL 36265 (e-mail: palya@sebac.jsu.edu).

Tables

Center your tables horizontally and balance them vertically (slightly above center). Each table is set on a separate page. The table must have a brief explanatory title. Table information supplements but does not duplicate the text. The table should be able to stand alone without reference to the text. The text should highlight the information presented in the table. Tables appear after the reference list and there is no separate page for table captions because they are not used. Avoid using tables which are not necessary or which can be better done as figures.

Table 1

Median Within-Session Rate Change Indices and Variance Accounted for by Body Weight for the Procedures of Experiment 2

	One Line		**First**		**Second**		**McSweeney**	
Schedule	slope	r^2	slope	r^2	slope	r^2	"a"	r^2
VI 120	-0.10	-0.02	0.59	-0.02	-0.07	-0.01	0.31	-0.02
VI 60	-0.09	0.08	0.35	-0.02	-0.06	0.05	0.30	0.01
VI 30	-0.11	-0.01	0.99	-0.02	-0.10	0.06	0.39	0.14
VI 15	-1.06	0.18	-0.27	-0.01	-1.26	0.11	0.98	0.15
VI 60	-0.06	-0.01	0.99	-0.02	-0.10	-0.01	0.30	-0.01
VI 15(1B)	-0.09	0.00	0.02	-0.02	-0.04	0.07	0.30	0.04

Figure Captions

Captions should be concise, but complete enough so that they can be understood without reference to the text. Captions should not unnecessarily duplicate information in the text. Note that the text must discuss the figure.

Figure Captions

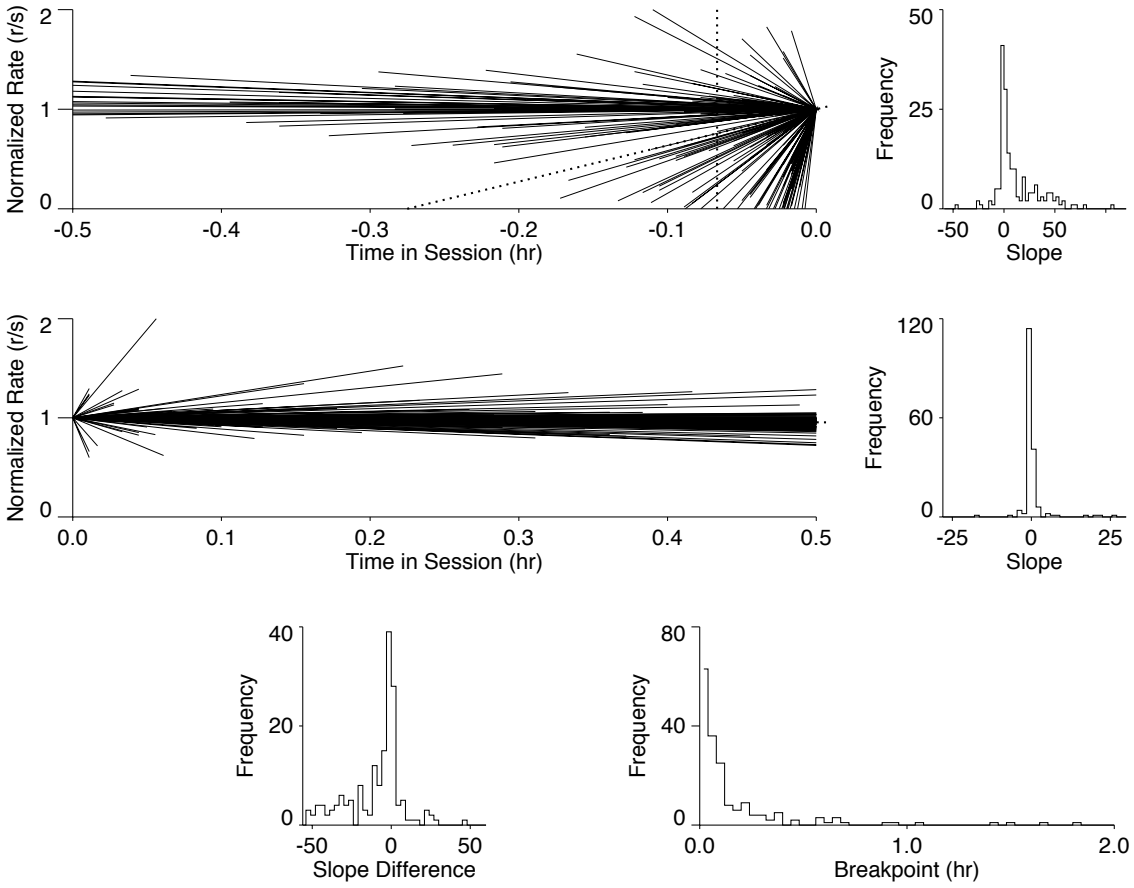
Figure 1. The upper left frame depicts the slopes of the first segment of the best two-line fit for each bird under each procedure. The upper right frame depicts the frequency distribution of those slopes. The center left frame presents the slopes of the second segment of the best two-line fit for each bird under each procedure. The center right frame presents the frequency distribution of second segment slopes. The lower left frame reports the frequency distribution of the difference in each bird's slopes, while the lower right frame presents the frequency distribution of the breakpoints.

Figure 2. Each frame depicts the rate of the operant as a function of time in the session for each of the 45 birds. The six frames depict the data from the six procedures. The consecutive procedures in the experiment are presented in consecutively lower frames.

Figures

Figures are variables set into meaningful space. Be careful about scales and axes. The horizontal axis (abscissa) is almost always the independent variable. The vertical axis (ordinate) is the dependent variable.

Stay within the same margins allowed for text pages. Be neat and accurate. Figures are virtually always black and white.


Normalized Rate (r/s)
2
1
0
-0.5
-0.4
-0.3
-0.2
-0.1
0.0
Time in Session (hr)
Frequency
50
25
0
-50
0
50
Slope
Normalized Rate (r/s)
2
1
0
0.0
0.1
0.2
0.3
0.4
0.5
Time in Session (hr)
Frequency
120
60
0
-25
0
25
Slope
Frequency
40
20
0
-50
0
50
Slope Difference
Frequency
80
40
0
0.0
1.0
2.0
Breakpoint (hr)