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THE UNIVERSITY OF OKLAHOMA

GRADUATE COLLEGE

DRIVE AND REINFORCEMENT ANALOGS
IN CONVERSATION

A DISSERTATION

SUBMITTED TO THE GRADUATE FACULTY

in partial fulfillment of the requirements for the

degree of

DOCTOR OF PHILOSOPHY

By

DAYLE ALDRIDGE DENTON

Norman, Oklahoma

1975

DRIVE AND REINFORCEMENT ANALOGS

IN CONVERSATION

APPROVED BY:

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DISSERTATION COMMITTEE

DEDICATION

To my husband Love Denton, Jr.

No greater Love have I

ACKNOWLEDGMENTS

My sincere appreciation

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TABLE OF CONTENTS

Drive and Reinforcement Analogs

in Conversation

Dayle Aldridge Denton

University of Oklahoma

Abstract

Subjects participating in an experiment of conversational behavior modeled on discrete-trials instrumental escape conditioning respond at a level comparable to the magnitude of reinforcement they receive, shifts in the magnitude of reinforcement, and levels of drive. A significant Drive x Magnitude of Reinforcement interaction was found for high drive subjects, but not for low drive subjects. The results were found in a 2 (Drive) x 2 (constant Magnitudes of Reinforcement) x 2 (shifted Magnitudes of Reinforcement) design employing 160 subjects. The results were discussed in terms of the Weber-Fechner law (the effects of drive reduction) as it applied in this investigation of conversational behavior.

DRIVE AND REINFORCEMENT ANALOGS IN CONVERSATION

Dayle Aldridge Denton

University of Oklahoma

In recent years, Weiss and his companions have conducted several studies on conversational behavior such as the effects of disagreement-induced effectance drive (Lombardo, Libkuman & Weiss, 1972), effects of speaking in reply (Weiss, Lombardo, Warren & Kelley, 1971; Weiss, Boyer, Colwick & Moran, 1971), and the reinforcing effects of yielding (Lombardo, Weiss & Buchanan, 1972). These studies have employed, and the results have given support to, the effectance motive (Byrne & Clore, 1967) which is a learned drive elicited by failure to be logical, consistent and accurate in interpreting the stimulus world. By employing a discrete-trials instrumental escape conditiong paradigm, Weiss et al. have been very successful in predicting and explaining conversational behavior.

The present experiment employed as its basis the results of the Weiss studies cited above to investigate the combined relationship of drive and magnitude of reinforcement in an instrumental escape conditioning paradigm of conversational behavior.

Since the late 1950s, when Kenneth Spence (1954, 1956) proposed an additive relationship between drive and magnitude of reinforcement, which conflicted with Hull's (1951, 1952) multiplicative relationship, much attention has been devoted to the combination of drive and magnitude of reinforcement; some in support of Hull's formulation, but most of the literature is in support of the additive relationship proposed by Spence. In addition, the bulk of the literature is in instrumental reward conditioning. Only a few studies (e.g., Matthews, 1971; Vogel & Spear, 1966; Ayres, 1968; Franchina, 1969) have been within the discrete-trials instrumental escape conditioning paradigm, in which reinforcement was the termination of a noxious drive, contingent upon the instrumental response. In that the present experiment is within the escape conditioning paradigm, the variation of drive and magnitude of reinforcement has relevance to the additive/ multiplicative controversy.

Hull-Spence learning theory also makes explicit predictions concerning the effects of shifts in the magnitude of reinforcement. Variations in magnitude of reinforcement are reflected by variations in instrumental responding, e.g., magnitude of reinforcement influences acquisition of a task, with larger reinforcements facilitating learning (Schrier & Harlow, 1956). In addition, subjects adjust rapidly to shifts in magnitude (Howe, 1961). The effects of shifts in magnitude have also been extended to studies of contrast effects.

It is possible to note the effects of the reinforcement magnitude in an experimental design in which the magnitudes of reinforcement are shifted, and the performance of the shifted groups is analyzed in comparison with their nonshifted controls. This procedure is employed in studies of contrast effects. The negative contrast effect (NCE) of reward magnitude, in which subjects which receive large reward, are shifted to a small reward, and as a consequence run slower than subjects who receive only the small reward, has been widely reported. However, positive contrast effects (PCE) (subjects receiving small reward then shifted to large reward, run faster than subjects receiving only the large reward) have been, until recently, only rarely reported (see Dunham, 1968). Most of the PCEs reported employed delay of reinforcement to prevent a ceiling effect (Bower, 1961; Mellgren, 1972).

The purpose of the present experiment was to investigate the relationship of drive and reinforcement magnitude and contrast effects in conversational behavior. The present experiment was modeled on discrete-trials instrumental escape conditioning, in which reinforcement was the termination of a noxious drive. The drive manipulation employed here was identical to the drive manipulation used by Weiss, Lombardo, Warren and Kelley (1971) in their fourth experiment. Weiss *et al* employed two sets of tape recordings to manipulate drive. One set presented a formidable "other person" whose statements were sophisticated, logical, and contained factual information. This should lead to a higher drive state than the other tapes. The other set of tapes presented weaker statements of the calibre usually made by the average college freshman.

More specifically then, the purposes of this experiment were to (a) determine the relationship holding between drive and magnitude of reinforcement in conversational behavior, (b) determine the effects of shifts in magnitude (including possible contrast effects) in conversation, and (c) extend the existing literature on discrete-trials instrumental escape conditioning that investigate the relationship between drive and magnitude of reinforcement.

Method

Subjects and Design

The subjects were 160 students at the University of Oklahoma. Twenty subjects were each randomly assigned to one of eight groups.

Care was taken to equate the number of males and females per group.

Half the subjects were run in the high drive (HD) condition and the other half in the low drive (LD) condition. For each level of drive there were four reinforcement magnitude conditions. Two of the conditions were large or small reinforcement throughout training, with the other two conditions being shifts either from large to small or small to large magnitudes of reinforcement. The two constant conditions served as controls for the shift conditions. The subjects in the shift conditions were shifted from yielding (Y) to agreement (A), or from agreement to yielding. The four shifted groups will subsequently be referred to by the following abbreviations: HDY-A, HDA-Y, LDY-A, and LDA-Y. The four constant groups were: HDY, HDA, LDY, and LDA.

Twelve trials were given, 6 in preshift and 6 in postshift phase. For all groups, each trial was begun by a confederate of the experimenter (always the same sex as the subjects) reading a topic and commenting on it. In the agree (A) and disagree (D) conditions, the confederate commented, but never stated a final opinion. In the Y condition, the confederate made an initial disagreeing statement to the subject's opinion. The subject then made the instrumental response and stated his opinion on the topic. The confederate then either yielded to, agreed or disagreed with the subject, depending upon the particular condition. Further, for the HD conditions, the confederate gave logical, clear arguments throughout the twelve trials; and for the LD conditions, the arguments were weak and illogical.

Previous research (Lombardo, Weiss, & Buchanan, 1972) indicated that subjects become suspicious when they receive more than 50%

yielding, agreement or disagreement. Therefore, a 50% partial reinforcement schedule was employed, and subjects were yielded to and agreed with on items of high interest to the subjects on half the trials, and disagreed with on low interest items on the remaining half.

Apparatus

The experiment was carried out in two separate rooms, the subject's room, and the control room. On the table in the subject's room was a headset and microphone, a list of the topics for discussion, and a control module. The module had several signals and switches. The signals were (a) "listen", (2) "throw switch to comment", (3) "talk", and (4) "indicate final opinion". Each signal had a corresponding light to indicate to te subject which signal followed in the sequence. Signals 2, 3, and 4 each had switches for the subject to operate.

The control room contained an intercom for monitoring the subject's comments, a microphone, and a digital stop clock (Lafayette 5720, 1/100 digital readout stop clock). The clock measured the subject's response latency to .01 seconds (the time between the signal "throw switch to comment" and the time the circuit was broken by the switch being thrown). The last signal on the subject's module, "indicate final opinion" was the masking task and was attached to a synchronous motor which drove a matching dial in the control room. This enabled the experimenter to determine when the subject had completed the masking task and was ready for the next trial to begin.

Deception and Masking Task

Prior to the experiment, each subject was told that the purpose of the study was that of opinion change: "We are interested in how your opinions may be affected by what someone else says; how your opinions may be affected by what you yourself say; and how what you say may affect the opinions of someone else." Following the sequence of the confederate reading and commenting the subject indicated whether his opinion had grown stronger, weaker, or remained the same by pressing one of the three buttons at the bottom of his module.

Materials

At the beginning of the semester, all prospective subjects were given a 35-item opinion survey on topics of current interest to college students. The students indicated the degree of agreement or disagreement for each of the topics on a 6-point scale ranging from strongly agree to strongly disagree. In addition, students listed the ten most interesting topics and the ten least interesting topics by the item number. Thus, prior to reporting for the experiment, the subject's opinions on the topics and the item interest were known by the confederate. The confederate could then follow one of the five schedules of item interest and determine the topics to be discussed by referring to the subject's survey form. In the yielding condition, the confederate would read the topic and make an initial disagreeing statement. From the opinion survey, the confederate had the subject's opinion, and was therefore able to disagree in the initial statement.

Procedure

Drive manipulation. Weiss, Lombardo, Warren and Kelley (1971, Experiment IV), investigated the performance of subjects when the "other person" was a more formidable conversationalist than the "average subject" conversations employed in their first three experiments. The formidable "other person" employed logic, phrasing and factual basis for the opinions. This manipulation was based on effectance theory which lead Weiss et al to assume that "if the other person tapes arouse effectance by questioning the subject's beliefs, then the sharp (formidable) tapes should be more effectance arousing than the standard tapes." The assumption was based on Byrne's (1971) statement that "Disagreement from a competent stranger would be more punishing than disagreement from an incompetent stranger." It would therefore follow that if the formidable tape induced a higher level of drive than the standard tape and the reply produced a constant amount of drive reduction, then the standard tape group should perform better than the formidable tape group. Weiss et al established that performance was superior in the standard tape condition, and over the last 5 of the 12 trials, there was a significant difference between the formidable and standard tape conditions.

Confederates of the experimenter employed either standard or formidable comments as the drive manipulation. During earlier pilot research, a conversation script was compiled of formidable and average statements, and for agreeing, disagreeing, and yielding statements (see excerpt from script in Appendix C). The drive manipulation requires some prior experience. All three confederates were practiced in the use of the script from this and other conversation studies. In the HD condition, the confederate used logical statements containing factual information in all trials. In the LD condition, the confederates gave the weaker, opinionated statements that are usually made by the average subject.

Preshift phase. In studies of incentive contrast, there are several trials employing one magnitude of reinforcement, then there is a shift to either a higher or lower magnitude of reinforcement. In the present study, for example, to test for PCE, two shifted and two constant groups had agreement on high interest items as a small reinforcement. Since magnitude of reinforcement was being manipulated by the confederate's yielding serving as the large magnitude and agreement as small magnitude of reinforcement, and the subject would receive either yielding or agreement, but not a mixture, it was necessary to have some neutral or interpolated trials to make up the remaining 50%. In order to minimize drive arousal on the neutral trials, the subjects were disagreed with on low interest items, and were agreed with and yielded to on high interest items. This technique has been used before and is simple to apply (Limbardo, Weiss, & Buchanan, 1972; Lombardo, Tator, & Weiss, 1972).

The schedule for high or low interest items for all 12 trials was determined by randomly selecting from one of five schedules. All five schedules differed with the exception of trials 1, 2, 11, and 12. T_1 and T_{11} were always agree or yield trials and T_2 and T_{12} were always disagree trials. It was assumed that disagreement on T_2 would assure some arousal from T_3 through T_{12}. It was further assumed that agreement and disagreement on T_1 and T_2 should create a set for increased creditability of the situation.

Results

Drive and magnitude of reinforcement effects. There were marked magnitude of reinforcement effects on the measure of response speeds for the HD groups, but not for the LD groups. Groups which received the same treatment (HD) over T_1-T_6 were collapsed and compared to groups receiving the other treatment (LD) to make full use of available data. This analysis revealed a significant Trials effect ($\underline{F}(5,780) = 2.376$, $\underline{p} < .05$). There was no main effect for Magnitude or Drive, however, there was a significant interaction of Drive x Magnitude of Reinforcement ($\underline{F}(1,156) = 7.072$, $\underline{p} > .005$). This interaction appears to be due to the speeds of the HDY subjects which were faster than the other three groups as shown in Figure 1. Also significant was the

Insert Figure 1 about here

Magnitude of Reinforcement x Trials effect ($\underline{F}(5,780) = 3.211$, $\underline{p} < .005$) and the Drive x Magnitude of Reinforcement x Trials effect ($\underline{F}(5,780) = 2.251$, $\underline{p} < .05$). Magnitude effects at HD and LD can be further identified from subanalyses, taking the data separately.

In T_1-T_6 there was a significant Magnitude of Reinforcement main effect for HD subjects ($\underline{F}(1,78) = 6.467$, $\underline{p} < .01$) shown graphically in Figure 2, whereas for L subjects, the magnitude effect was not significant. By the same token, HD subjects showed a significant

Insert Figure 2 about here

Trials effect and a significant Magnitude of Reinforcement x Trials effect ($\underline{F}(5,390) = 3.633$, $\underline{p} < .005$) and ($\underline{F}(5,390) = 2.615$, $\underline{p} < .01$, respectively). The HDY subjects acquired faster than their LD counterparts with greater speeds exhibited across all 12 trials. The LD subjects did not obtain a significant trials effect.

In the postshift phase (T_7-T_{12}), when like subjects in the constant and shifted groups were compared, the analysis was collapsed. Again, the HD subjects yielded a significant magnitude effect ($\underline{F}(1,78) = 5.398$, $\underline{p} < .01$). The LD subjects did not obtain this result. The performance on the constant and shifted groups in the postshift phase is shown in Figures 3a-3d. These results are

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Insert Figures 3a, 3b, 3c, and 3d about here

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further supported even with a smaller number of subjects by examining the results of the constant groups only, in T_1-T_6, and across all 12 trials. In the T_1-T_{12} analysis for HD subjects, there was a significant Magnitude of Reinforcement main effect ($\underline{F}(1,38) = 4.369$, $\underline{p} < .05$), which is indicative of a Drive x Magnitude of Reinforcement interaction. For LD subjects, there was no main effect for magnitude of reinforcement. For none of the groups in this analysis was there a significant main effect for drive. Also for the constant groups magnitude of reinforcement caused a larger effect for HD subjects than for LD subjects in the predicted direction, i.e., there were relatively greater speeds for the higher magnitudes in the HD groups.

During the first six trials for all subjects, a Drive x Magnitude of Reinforcement interaction, and a Drive x Magnitude of Reinforcement x Trials interaction ($\underline{F}(3,152) = 2.711$, $\underline{p} < .05$ and $\underline{F}(15,760) = 1.624$, $\underline{p} < .05$, respectively) were significant. Drive x Magnitude was significant in accordance with expectations that HD subjects acquire faster with a larger magnitude of reinforcement. Thus, the magnitude effect worked for HD subjects and not for LD subjects. Over all 12 trials for LD subject, there was a significant Trials effect ($\underline{F}(11,418) = 5.876$, $\underline{p} < .01$.

Reinforcement magnitude shifts. In the HD condition there were magnitude effects, and the shifts in magnitude resulted in shifts in performance. An overall analysis including the shifted groups across all 12 trials yielded a significant Magnitude of Reinforcement x Trials interaction ($\underline{F}(33,1672) = 1.665$, $\underline{p} < .01$), which appears to result from the HD subjects acquiring faster than the LD subjects altogether, regardless of the shift circumstances (see Figure 1). In addition, there was a Drive x Magnitude of Reinforcement x Trials interaction that approached significance ($\underline{F}(33,1672) = 1.334$, $\underline{p} < .05$). The HDY-A subjects showed no consistent acquisition as compared to HDA subjects through the 12 trials. The overall analysis revealed that this Magnitude x Trials effect was significant ($\underline{F}(11,418) = 2.892$, $\underline{p} < .001$). A similar interaction did not reach significance for the HDA-Y compared to HDY subjects. As may be seen in Figure 4a, the HDA=Y group shifted upward, near the HDY group, and HDY-A shifted downward (Figure 4b) near the HDA group. The LD subjects, shifted Y-A or A-Y, failed to differ,

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Insert Figures :a and :b about here

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in terms of their acquisition, from the LD control subjects. That the LD subjects did not differ indicates that these groups failed to make the shift.

In no instance did the experimental subjects show incentive contrast, i.e., subjects shifted from A-Y did not exceed speed for subjects held on Y for 12 trials. Similarly, subjects shifted from Y-A did not fall below subjects maintained on A throughout the 12 trials.

The LDA-Y subjects responded faster than the LDY subjects across all 12 trials, before and after the shift; however, the effect was not significant. Figures 5a, b, c and d graphically demonstrate the performance of the shifted groups in comparison with the constant groups.

Insert Figures 5a, b, c, and d about here

Discussion

Black (1965) in a review of the literature has proposed that Hull's multiplicative and Spence's additive relationship between drive and magnitude of reinforcement are not necessarily opposing views. A number of studies involving a factorial design with two levels of drive and two levels of reinforcement have been included in the review. Black reports that an interaction between drive and reinforcement has been obtained when one level of drive was zero but not when higher levels were employed. Black proposes that the strength of the goal response (R_G) and, hence, its conditioned anticipatory form (r_g), the basis of the effect of magnitude of reinforcement, depends on drive as well as on reinforcement variables. The greater the drive, the greater is the value of magnitude. With zero relevant drive, R_G would not occur, and would thus yield a zero value of incentive (K), regardless of the presence of a potentially adequate reinforcement. Therefore, either zero relevant drive or zero reinforcement would yield a zero value of incentive.

The consequences of these considerations is that, even though drive and reinforcement magnitude combine additively, an interaction would be predicted in the usual 2 x 2 factorial design when one level of drive or reinforcement is zero. With higher drive and reinforcement values, no interaction would be predicted with the additive hypothesis. Black's (1965) summary was based on a review of the instrumental reward conditioning literature.

Campbell and Kraeling (1953) performed three experiments in instrumental escape conditioning which also demonstrate the importance of a zero value of drive or reinforcement magnitude for the D x K interaction to be obtained. According to Campbell and Kraeling, drive stimuli should follow the same laws as other stimuli, a characteristic of which is the Weber-Fechner law. At high drive levels, varying the amount of shock reduction, led to differential performance of the groups consistent with the drive reduction. At HD, reducing the shock to zero led to faster response speeds than intermediate or low levels of shock reduction.

In three experiments, Campbell and Kraeling have determined that (a) a reduction in shock (e.g., 100 volts) is less reinforcing at high levels of initial shock than at low levels; (b) subjects ran faster with increasing shock reduction, (i.e., acquisition curves showed that the running speeds varied systematically with the amount of drive reduction through training at the end of performance); (c) greater amounts of shock reduction from various initial shock levels to zero do not influence the final running speeds, but the rate of acquisition, and the difference between zero and 100 volts in the goal box is not an important change. Both Black (1965), in review of instrumental reward conditioning literature, and Campbell and Kraeling (1953), in studies of instrumental escape conditioning, have determined that reducing drive or magnitude of reinforcement (Black) or reducing drive to zero (Campbell & Kraeling), the D x K interaction proposed by Hull (1951, 1952) should be obtained.

Weiss, Lombardo, Warren, and Kelley (1971) and Lombardo, Weiss, and Buchanan (1972) have clearly demonstrated that (a) it is a relatively small amount of reinforcement for subjects to have the opportunity to speak in reply; (b) for subjects to have the opportunity to reply and, in addition, be agreed with, is an even larger magnitude of reinforcement; (c) the most reinforcing event evidenced in studies of conversational behavior is for a subject to speak in reply, then to be yielded to. Thus, yielding should result in greater reduction in drive than both agreement and speaking in reply.

Campbell and Kraeling (1953) did not include in the three experiments, a group with various levels of drive and various levels of shock reduction as was the design of the present experiment. Therefore, the groups performance could not be directly analogous to the findings of Campbell and Kraeling. It could however, logically follow from the existing data that a large magnitude of reinforcement reduces much of the drive so that at HD, the large magnitude reduces much of the drive so that at HD, the large magnitude reduces that drive to or near zero (see Figure 1) resulting in faster response speeds. The LD groups should have exhibited faster response speeds than the HD groups if the assumption could be made that the drive was reduced to or near zero. At LD, the large reinforcement of yielding should reduce much of the drive, but the weak statements made by the confederates induced a very low level of drive. In addition a weak yielding statement does not provide a large enough magnitude of reinforcement to reduce the drive sufficiently. Agreement was sufficient to cause a slight reduction in drive level, though the difference between LDA and LDY was very slight and not significant. For the HDA subjects, the small magnitude was not sufficient to reduce the higher drive level to zero, but the small magnitude did reduce the drive of the LDA subjects. As reported in the results section, there are shifts in performance that occur systematically with shifts in the magnitude of reinforcement. Also, for HD subjects, the Y groups responded faster than the A groups. This finding supports the Weiss et al finding that Y is a larger magnitude of reinforcement than is agreement. Being yielded to results in more drive reduction than listening to an agreeing statement.

Much of the available data is on shifts in performance due to shifts in reinforcement magnitude (e.g., Campbell & Kraeling, 1053; Campbell, 1968; Howe, 1961; Myers, 1969, but there is much less data available relating contrast effects arising from magnitude shifts in negative reinforcement. From the existing studies, neither the PCE or the NCE has been found. Bower, Fowler and Trapold (1959) shifted subjects from large to small and small to large magnitudes of reinforcement and found that subjects adjusted their running speeds to the new magnitude quite rapidly, but no contrast effects were evidenced. In the present study, no contrast effects were observed, but subjects did adjust their response speeds to the new magnitudes of reinforcement.

Prior to the present experiment, a pilot study was done which had the same basic design as the present research, with the addition of three levels of delay. The design was a 2 (HD and LD) x 2 (Y and A) x 3 (0-, 3-, and 9-second delay). Only for the 3-second delay group was there marked PCEs and NCEs for the HD groups. Again the LD groups did not make the shifts. The basis for doing a pilot study in which delay was also a variable was the findings by Mellgren (1972) in which the rarely found PCE was obtained with the delay. It was thought that PCE was difficult to find because the subjects reached a ceiling in performance prior to making the shift (Bower, 1961). Therefore, it is assumed that by employing the inhibiting delay variable, subjects will not perform at their asymptote before being shifted to a larger reward.

It would be desirable to extend the design of the present research to (a) include delay in a full scale study to test for the elusive PCE and the NCE in instrumental escape conditioning, (b) vary the point at which the shift in magnitude of reinforcement occurs to further investigate the proposal that drive is reduced at differential rates in the context of conversational behavior.

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Figure Captions

Figure 1. Acquisition curves of response speeds of the HD and LD constant groups across trials 1-12, plotted in rolling blocks of two.

Figure 2. Acquisition curves of response speeds of the HDY and HDA groups on T_1-T_6.

Figure 3. Figures 3a, 3b, 3c, and 3d depict the acquisition curves of shifted group and the constant group which has the same magnitude of reinforcement during the 6 trials of the preshift phase. The preshift response speeds for the two groups are combined on T_1-T_6 and the shifted group appears separately from the constant group in the postshift phase. The response speeds are plotted in rolling blocks of two.

3a. Group HDY-A compared to HDY.

3b. Group HDA-Y compared to HDA.

3c. Group LDY-A compared to LDY.

3d. Group LDA-Y compared to LDA.

Figure 4a. Acquisition curves of response speeds of the HDA-Y and the HDY subjects, plotted in rolling blocks of two.

Figure 4b. Acquisition curves of response speeds of the HDY-A and the HDA subjects, plotted in rolling blocks of two.

Figure 5a. Acquisition curves of the HDY-A shifted condition and the HDY and HDA constant conditions, plotted in rolling blocks of two.

Figure 5b. Acquisition curves of the HDA-Y shifted condition and the HDY and HDA constant conditions, plotted in rolling blocks of two.

Figure 5c. Acquisition curves of the LDY-A shifted condition and the LDY and LDA constant conditions, plotted in rolling blocks of two.

Figure 5d. Acquisition curves of the LDA-Y shifted condition and the LDY and LDA conditions, plotted in rolling blocks of two.

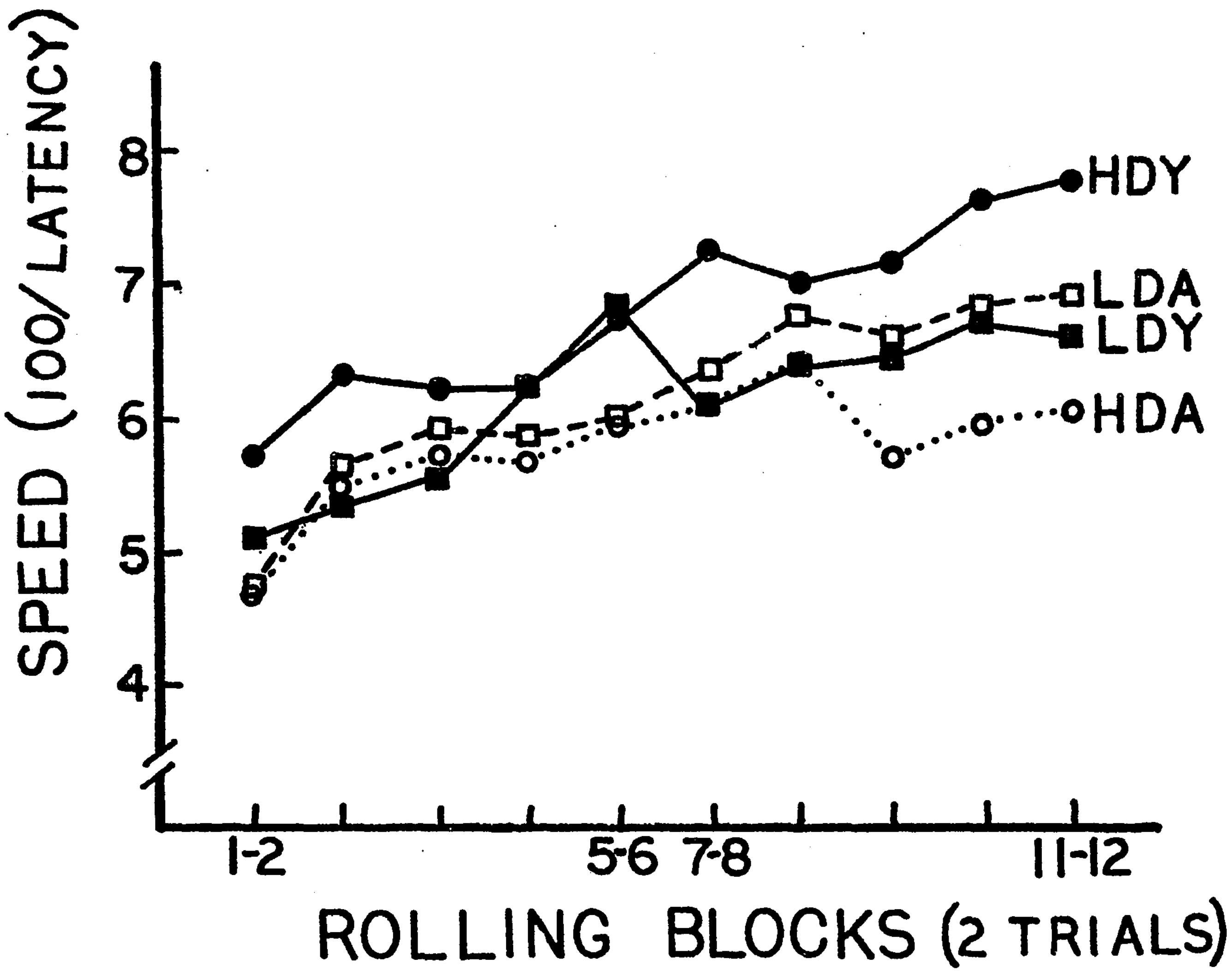

SPEED (100/LATENCY)
8
7
6
5
4
HDY
LDA
LDY
HDA
1-2
5-6
7-8
11-12
ROLLING BLOCKS (2 TRIALS)

Figure 1

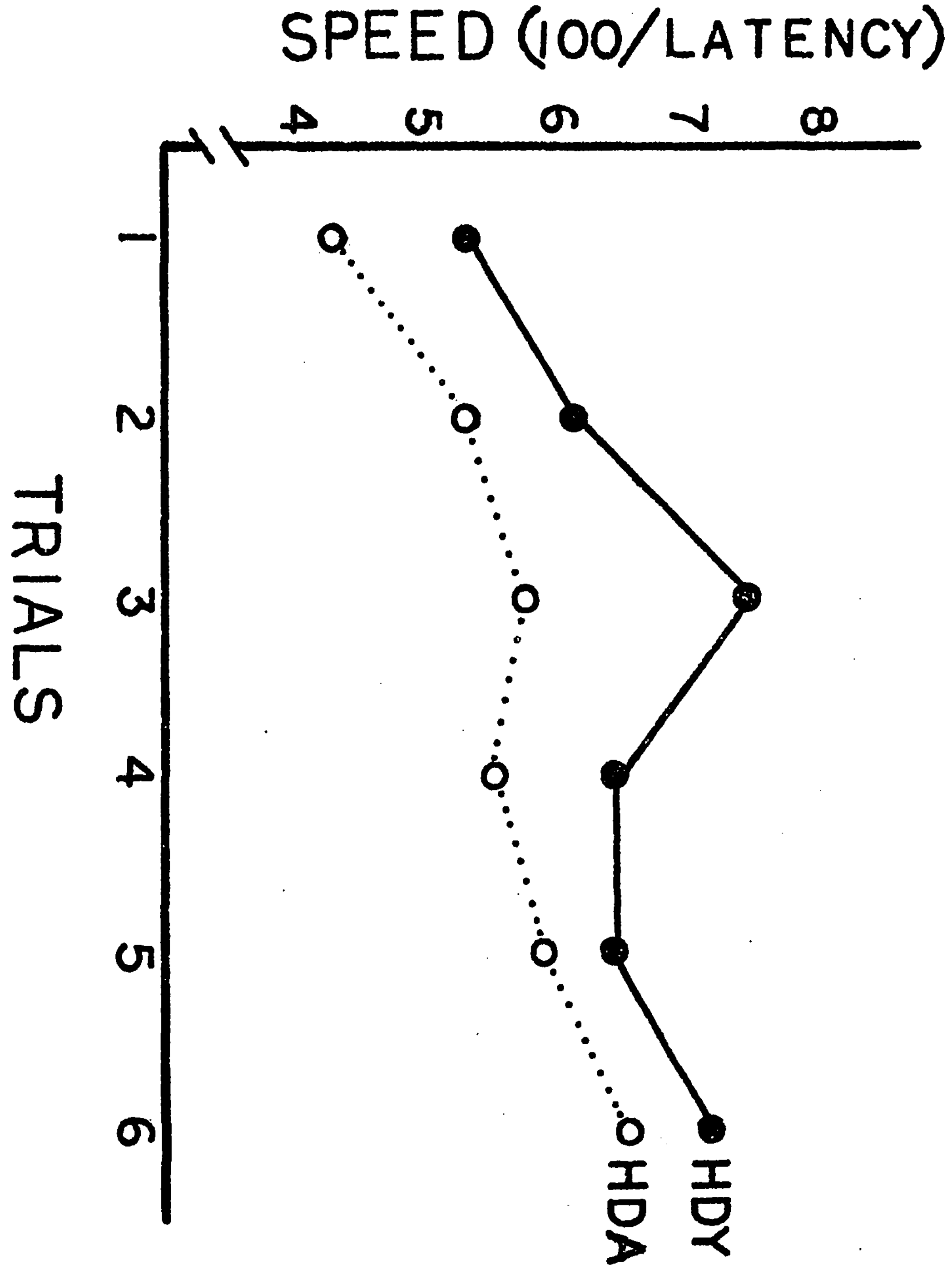


Figure 2

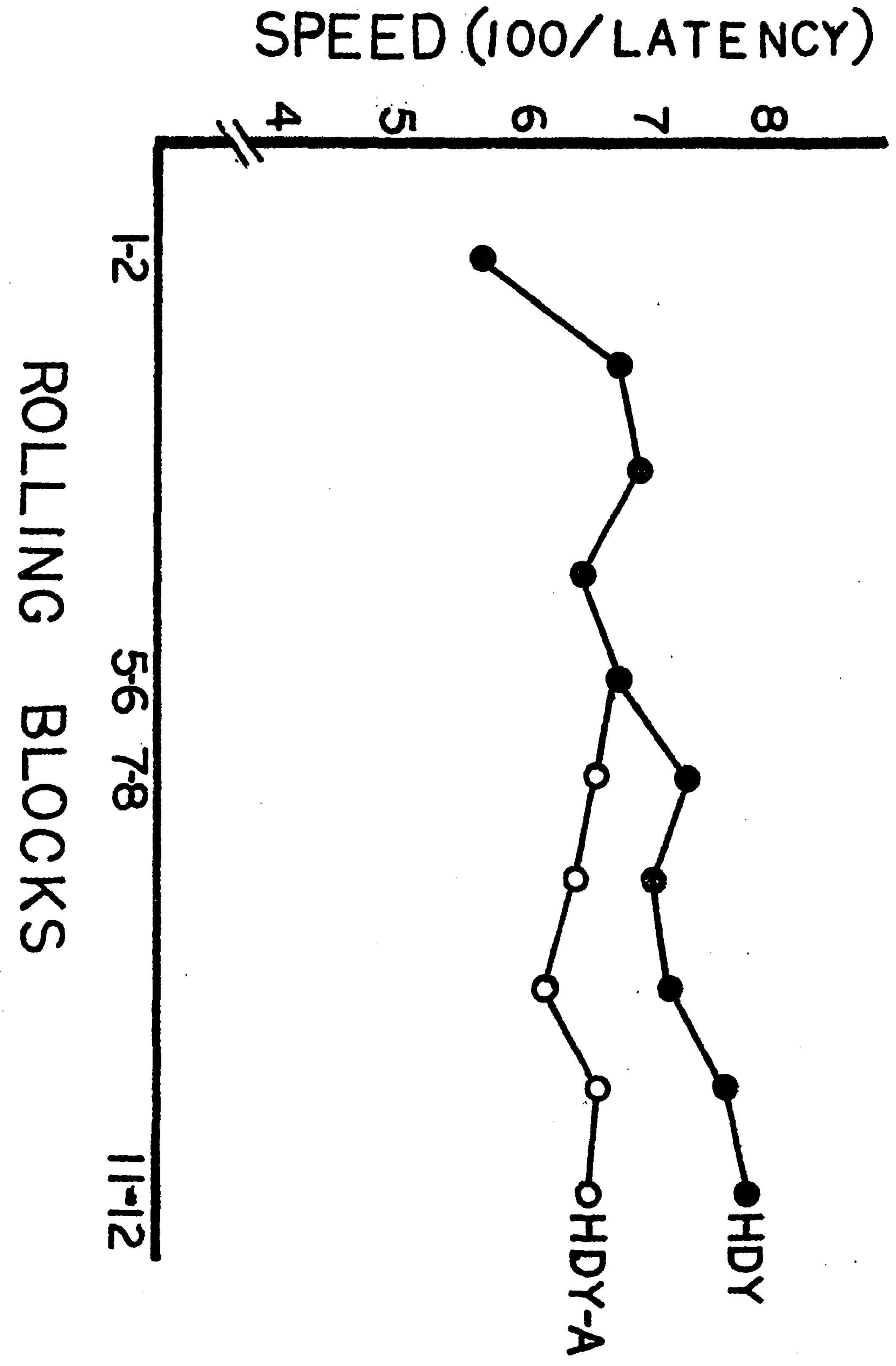

SPEED (100/LATENCY)
4
5
6
7
8
ROLLING BLOCKS
1-2
5-6
7-8
11-12
HDY
HDY-A

Figure 3a

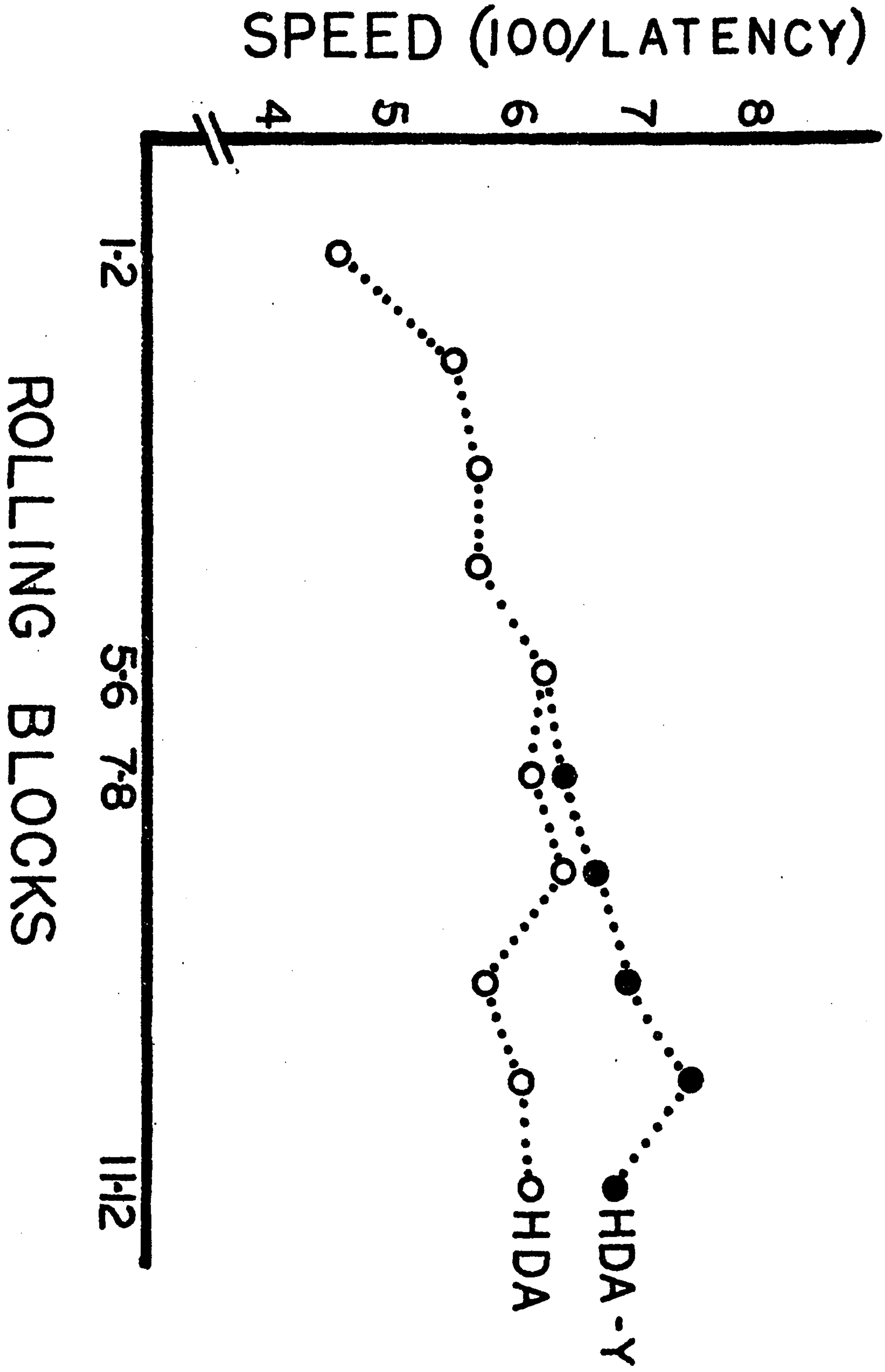

SPEED (100/LATENCY)
4
5
6
7
8
1-2
5-6
7-8
11-12
ROLLING BLOCKS
HDA
HDA-Y

Figure 3b

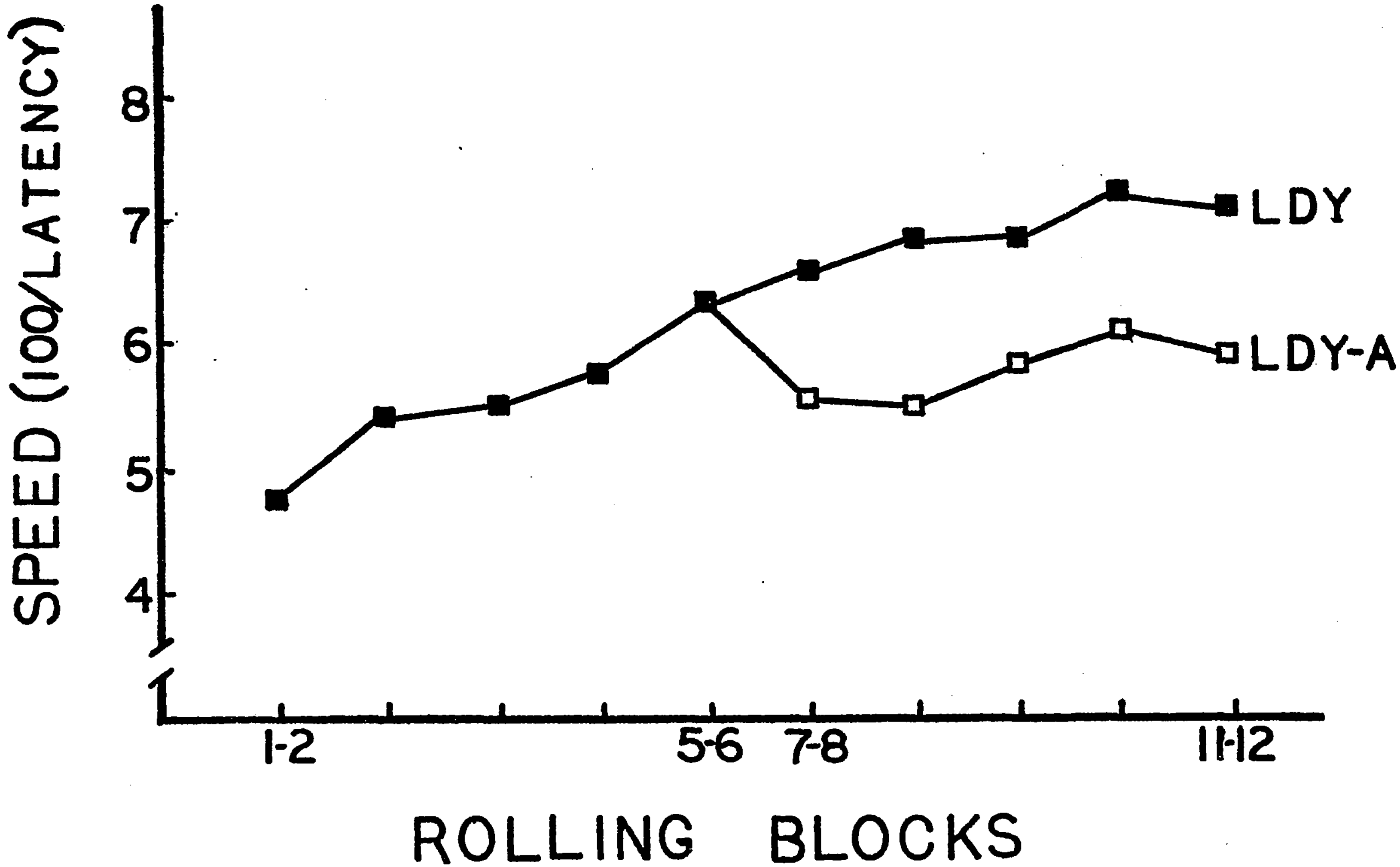

SPEED (100/LATENCY)
8
7
6
5
4
LDY
LDY-A
1-2
5-6
7-8
11-12
ROLLING BLOCKS

Figure 3c

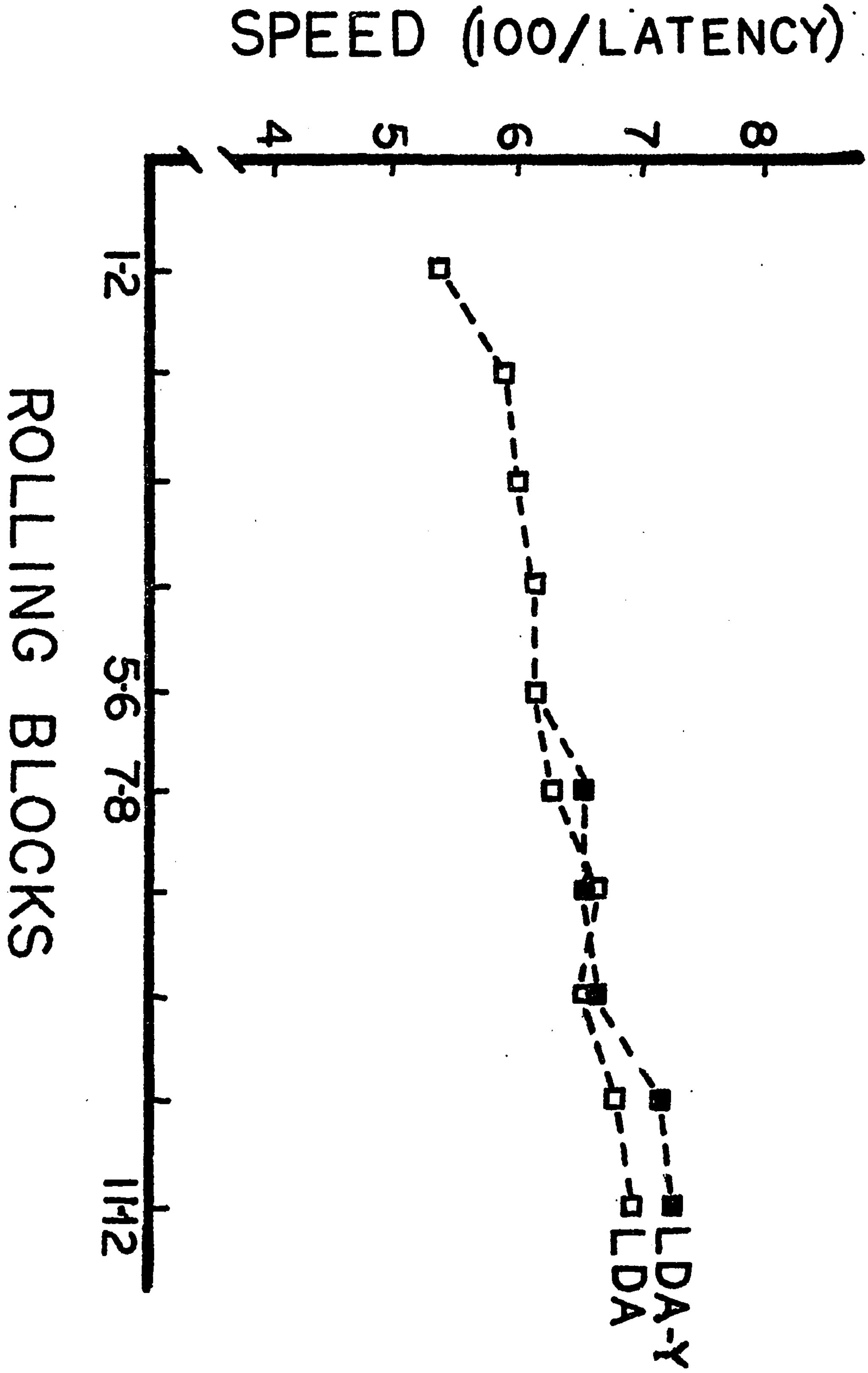

SPEED (100/LATENCY)
4
5
6
7
8
ROLLING BLOCKS
1-2
5-6
7-8
11-12
LDA-Y
LDA

Figure 3d

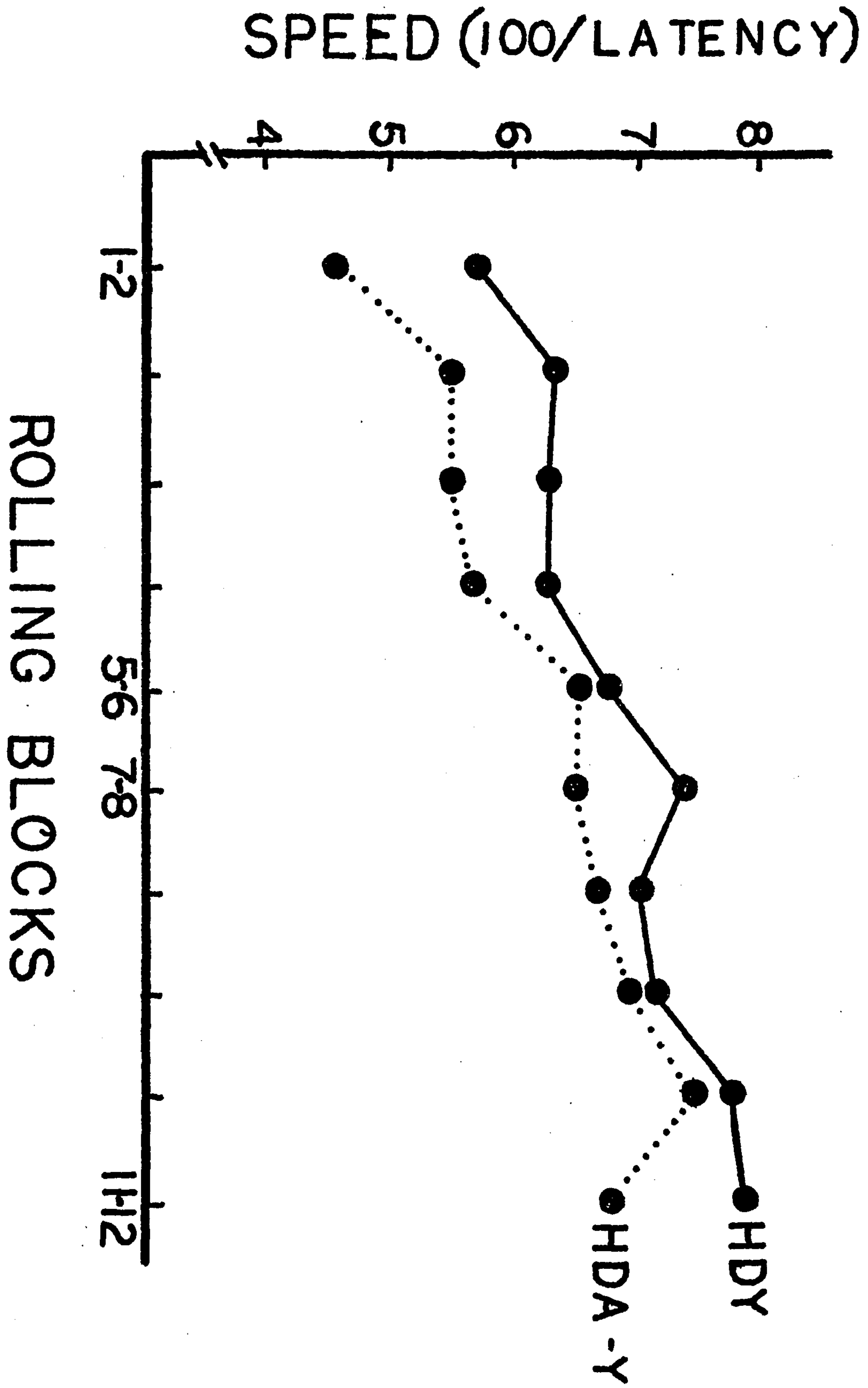

SPEED (100/LATENCY)
4
5
6
7
8
ROLLING BLOCKS
1-2
5-6
7-8
11-12
HDY
HDA-Y

Figure 4a

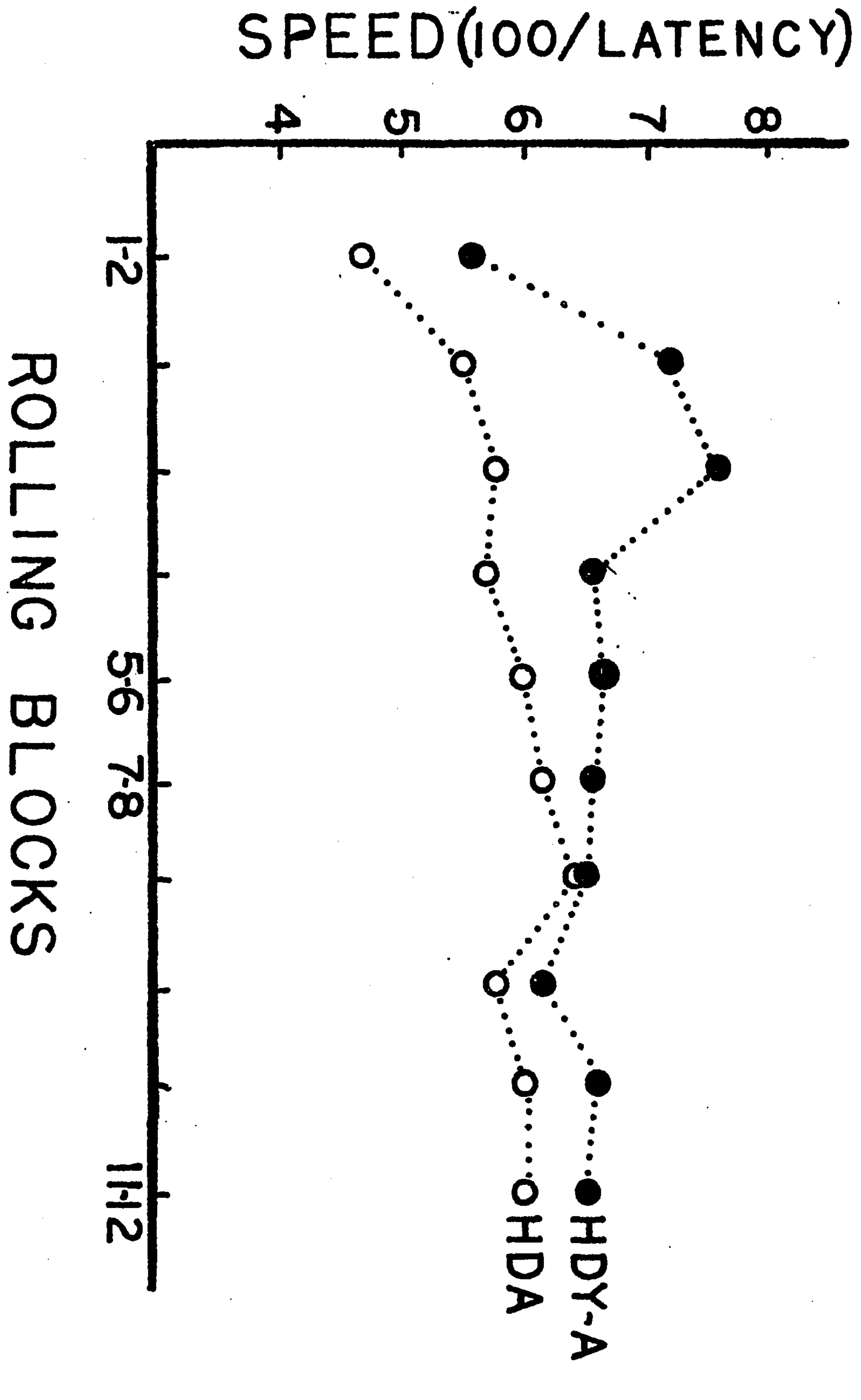

SPEED (100/LATENCY)
4
5
6
7
8
ROLLING BLOCKS
1-2
5-6
7-8
11-12
HDY-A
HDA

Figure 4b

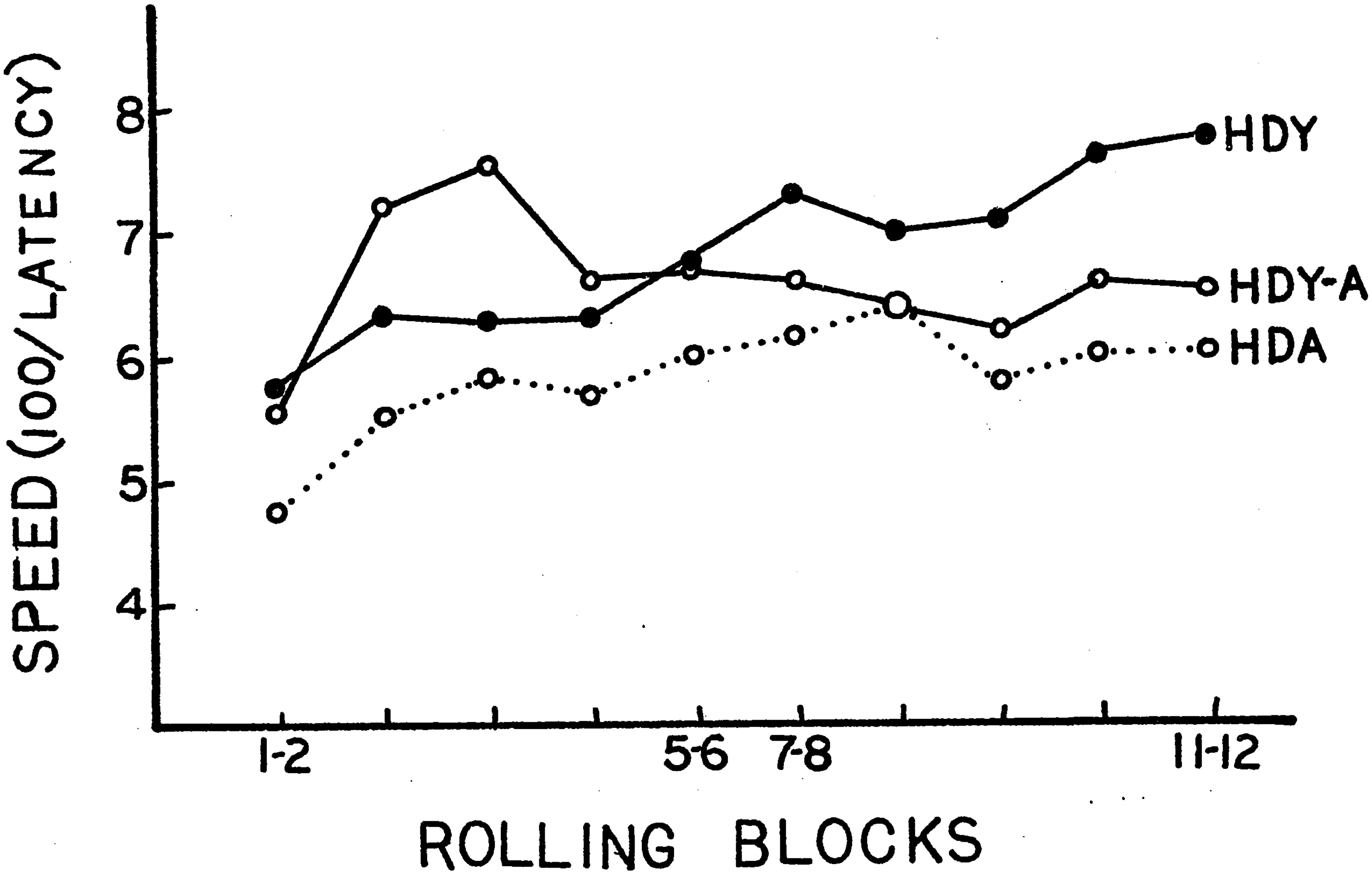

SPEED (100/LATENCY)
8
7
6
5
4
HDY
HDY-A
HDA
1-2
5-6
7-8
11-12
ROLLING BLOCKS

Figure 5a

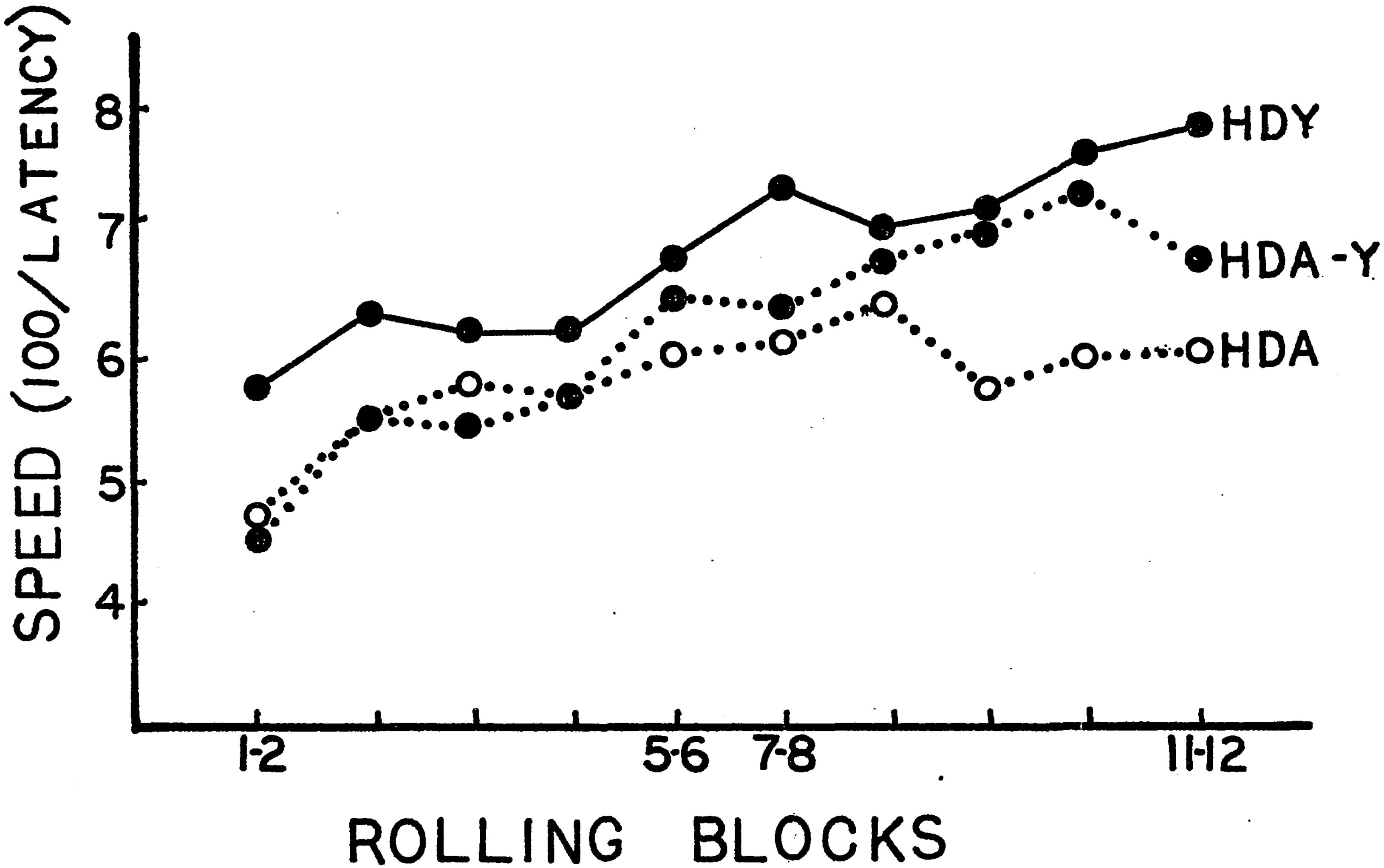
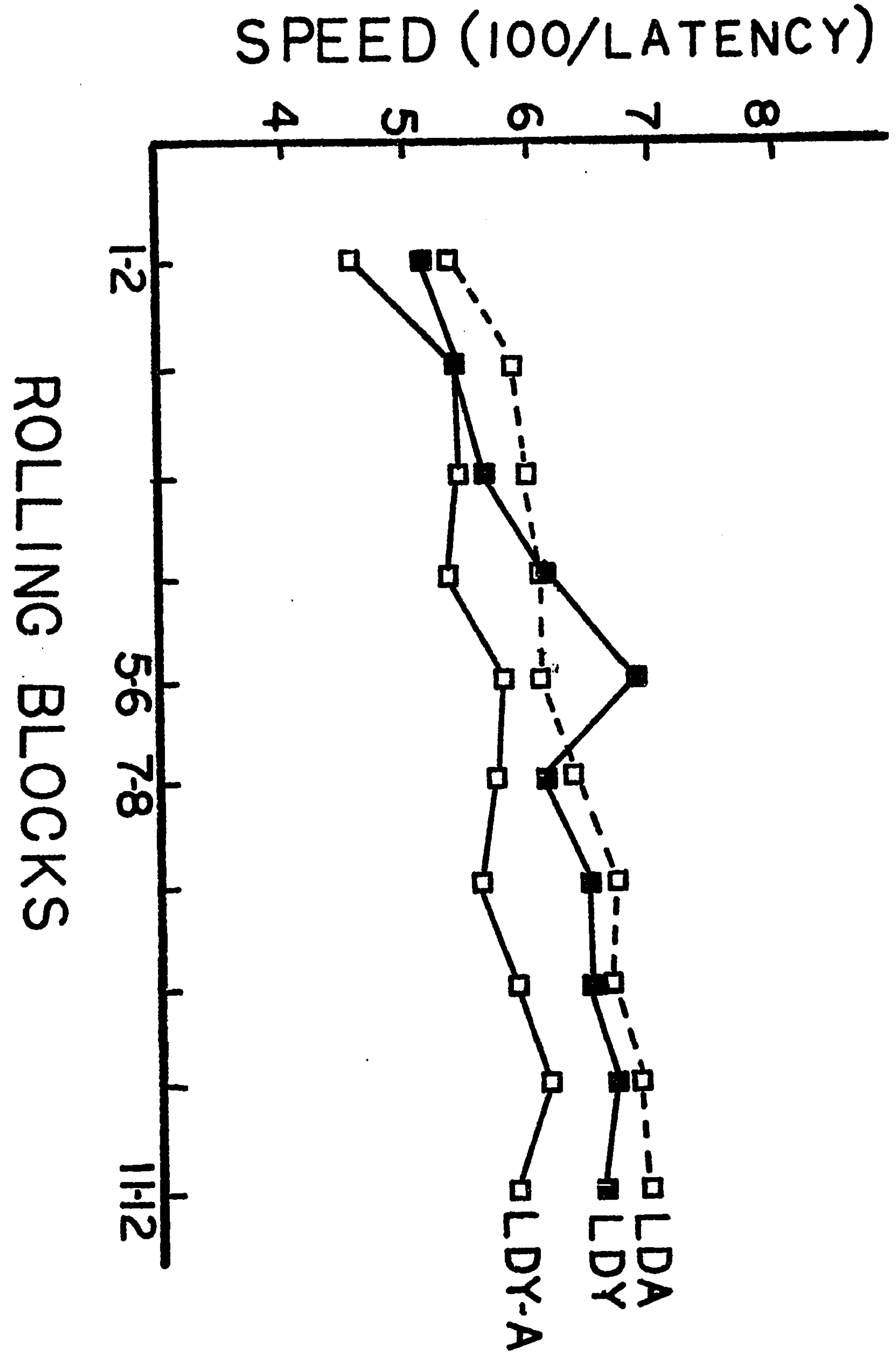

SPEED (100/LATENCY)
8
7
6
5
4
1-2
5-6
7-8
11-12
ROLLING BLOCKS
HDY
HDA-Y
HDA

Figure 5b


SPEED (100/LATENCY)
4
5
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8
ROLLING BLOCKS
1-2
5-6
7-8
11-12
LDA
LDY
LDY-A

Figure 5c

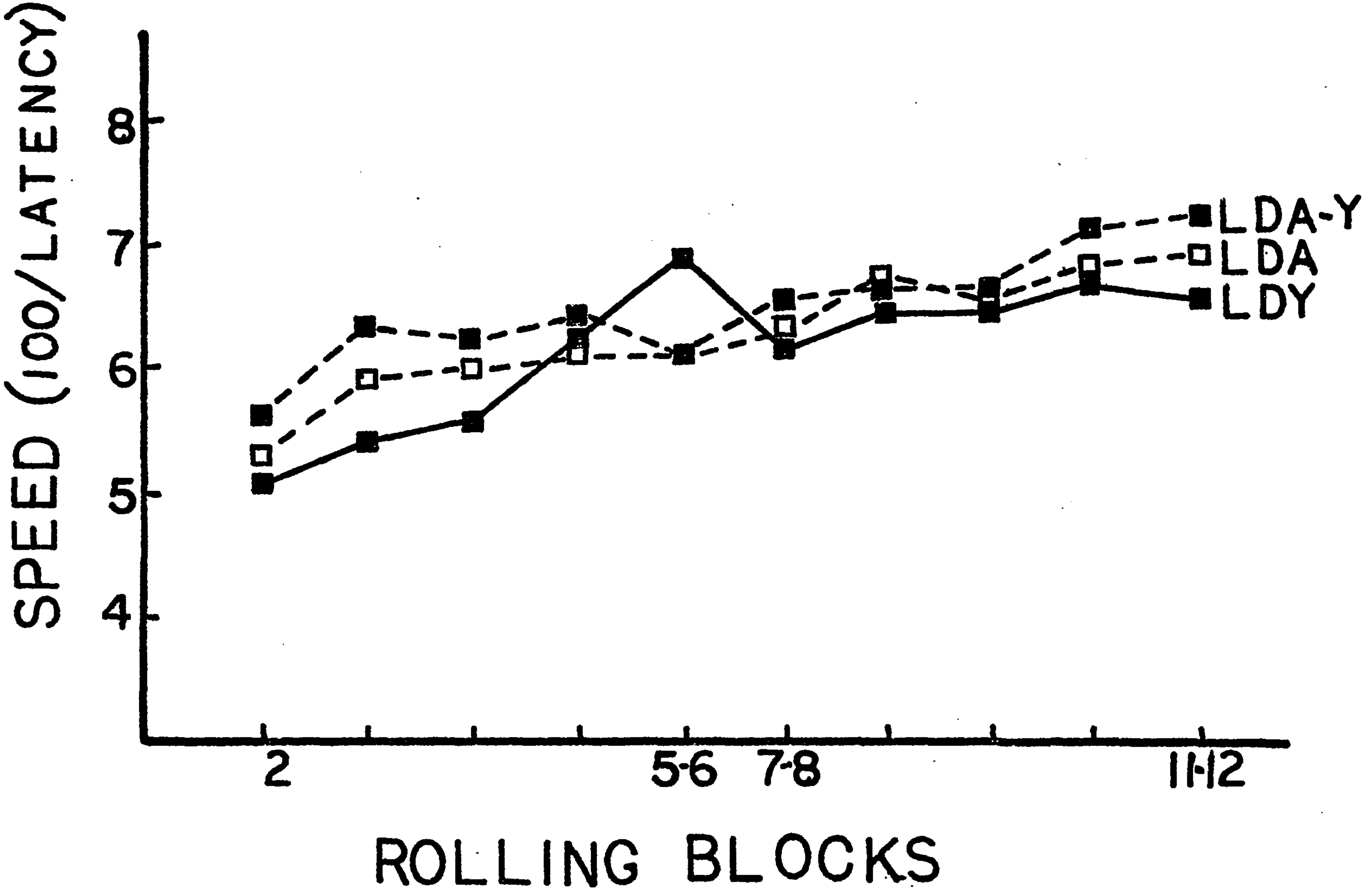
SPEED (100/LATENCY)
8
7
6
5
4
2
5-6
7-8
11-12
ROLLING BLOCKS
LDA-Y
LDA
LDY

Figure 5d

APPENDIX A

A REVIEW OF THE SELECTED LITERATURE IN WHICH SHIFTS IN MAGNITUDE OF REINFORCEMENT OCCURRED

PROSPECTUS

A REVIEW OF THE SELECTED LITERATURE IN WHICH SHIFTS IN MAGNITUDE OF REINFORCEMENT OCCURRED

A vast amount of research has been conducted to examine the relationship holding between the theoretical variables drive and magnitude of reinforcement. Most of the literature is supportive of Spence's (1954, 1956) proposal of an additive relationship between drive and magnitude of reinforcement. Some literature is however, in support of Hull's multiplicative formulation (1951, 1952). In studying the variables of drive and magnitude of reinforcement, most investigators have maintained their subjects on a single magnitude of reinforcement throughout the experiment. The literature reviewed here are studies in which there were two or more levels of drive, and the reinforcement magnitudes were shifted to a level different from the original one; or the subjects were shifted from a magnitude of reinforcement to satiation or extinction. The literature is also reviewed in terms of instrumental reward conditioning and instrumental escape conditioning. Perhaps by discussing the literature in the terms stated above, it will be possible to determine the effects of increasing, decreasing or omitting reinforcements.

Instrumental reward conditioning

Magnitude of reinforcement shifts

Food as reinforcement. Spence (1956) theoretically asserts that following a decrement of reward, the magnitude of the negative contrast effect should be greater under high drive than under low drive.

Clelland, Williams and DiLollo (1969) tested this assumption in a design in which there were two levels of drive (6 and 22 hours deprivation) and two levels of reinforcement (1 or 10 40-mg. pellets). The reward was later shifted to 1 pellet for all subjects. The group that received 1 pellet previously, served as the control for the group shifted from 10 pellets to 1 pellet. Following a decrement in the amount of reward, both shifted groups showed a corresponding decrement in performance. The high drive (HD), high reward (HR) group reached the levels of the controls in the start and run sections of the alley, while the low drive (LD) and HR group ran slightly faster than the controls. The HDHR group did show negative contrast effects, but only in the goal section of the alley. Enrenfreund (1971) also performed a contrast study, expecting both positive and negative contrast effects. He found no positive contrast effects, but did obtain significant negative contrast effects, and like Clelland <u>et al</u> study, only under HD. The most important generalization from these data and similar investigations is the consistent finding that drive has a powerful effect on successive incentive shifts.

It has been demonstrated that HD can also have a detremental effect on performance, especially when the task is complex. Bruning, Schmeck, and Silver (1971) examined the effects of competing responses on performance in the T-maze. They hypothesized that frustrative nonreward would increase the general drive level of the subject leading to occurrences of a competing response high in the animal's response hierarchy. During the first phase of training, subjects received two pellet reinforcements. In the second phase, subjects received 100% reinforcement. In testing, half the subjects were shifted from 100% to 50% reinforcement while the other half remained on 100% reinforcement. Rewards were shifted between the two arms of the maze for the frustrated group, and rewards were always in the same arm for the nonfrustrated group. In terms of the number of errors made by each subject, all groups differed significantly. The frustrated group made more errors (2.80) than the nonfrustrated group (1.60) and the control group (nonshifted) made less errors (.9).

Intracranial stimulation as reinforcement. Magnitude of reinforcement has also been shifted in studies of intracranial stimulation (ICS). Johnson, Lobdell, and Levy (1969) tested the generality of time-based performance decrements with ICS with the use of the frustration paradigm proposed by Amsel and Roussel (1952). In the Amsel and Roussel study, food reward was greatest at the 10 second confinement time and continued to be significant for 30 seconds. MacKinnon and Amsel (1967) reported a maximum confinement time of 15 seconds with dissipation after 90 seconds. Johnson et al found that with ICS as the reinforcer, the reinforcing effects dissipate completely in 15 seconds and become a reverse effect after 25 seconds. The reinforcing effects of food reward was measured in terms of running speed to goal box number 2 when subjects found no reinforcement and were confined in goal box number 1. Therefore, the magnitude of reinforcement effects resulting from ICS are very brief and apparently lack generalizability of the effects.

Another study of OCS was conducted by Phillips and Olds (1969) to discern whether a subjects' activity changes were correlated with the expectant states and poses assumed by the subject while waiting for food and water, and if they differed. Rats were trained to remain motionless for 2 seconds prior to receiving reinforcement. Half the subjects were on food and half on water deprivation. In testing, after remaining motionless for 2 seconds, subjects had the opportunity to make an instrumental response the reinforcement of which was either food or water, depending on which of these the animal had been deprived, and the reinforcement would be presented to the subject. After one second of the two second period, one tone signalled that the reinforcement would be water and a different tone signalled that the reinforcement would be food. Therefore, there was a one second period in which the animal could expect a particular reinforcement. An apparatus monitored any movement during the two second period. It was found that the highest activity was associated with tones announcing the reinforcement for which the subject was most strongly motivated. Thus, for a hungry subject, the most activity was evident when the tone for food was sounded.

In addition to motor activity, it is important to realize that there is activity in the brain following a CS even when motor activity is prohibited. Baum and Bindra (1968), in a study of spontaneous behavior (SB) found different responses to different reinforcements. In their first experiment, they observed trial-by-trial changes in SB to study the progressive development of incentive motivation. When subjects were on a 48-hour water deprivation schedule, there was not a noticeable change in behavior to a water or sucrose reinforcer.

<u>Alcohol and water as reinforcement</u>. King, McGill, Pierson, & Schaeffer (1972) studied schedule-induced polydipsia in an effort to get the subjects to drink equal amounts of alcohol and water. They found that even when alcohol drinking led to a large reward, and water led to no reward, subjects would continue to drink much more water than alcohol. Only when water was completely removed would subjects drink the alcohol, but never in comparable amounts to the amount of water consummed. One of the reasons for failure, beside the obvious inebriating effects of the alcohol, could be due to the result obtained by Freed and Hymowitz (1972), that the larger the magnitude of reinforcement they employed, the less water the subjects consummed. If water is the preferred reinforcer and less is consummed in the face of an increase in reinforcement magnitude, it seems safe to assume that with an increase in the magnitude of reinforcement, a decrease in the less preferred alcohol reinforcer may be expected.

<u>Saline solutions as reinforcement</u>. A study that offers support to the assumption that animals have strong preferences as to the reinforcer they receive as evidenced in the above study, Myer and van Hemel (1969) explored the incentive value of saline as a function of thirst using a wider range of saline concentration than previously employed in other studies. Subjects were reduced to 80% of their ad libitum weight, then shifted to either 90% or 70% of their weight by water deprivation. There were increases in response rates to the water reinforcer more so than to any of the saline solutions. Saline was a poorer reinforcer than water for rats at both 70% and 90% water deprivation weights. In Experiment II, Myer and van Hemel found that when saline was substituted for water, the saline did not

satiate thirst when available ad libitum, it functions as diluted water and is less reinforcing and less satiating than water.

Shifts from percentage of reinforcement to extinction

A number of studies have investigated the effects on extinction behavior when levels of drive and reinforcement magnitude are varied. The findings of these studies are reported below.

Effects of drive level in PRF and CRF in extinction. One of the most common variables that effect extinction is partial reinforcement (PRF). The PRF group extinguishes less rapidly than the continuous reinforcement (CRF) group. Dunlap and Dachowski (1970) had two levels of drive and two levels of reinforcement then shifted the reinforcement to zero in extinction while maintaining the previous levels of drive. Their findings were that (a) groups trained with CRF showed within-day extinction effects due to drive level; (b) there were minimal extinction effects with the PRF groups; (c) the overall PRE (continuing to respond in the face of extinction) was relatively insensitive to either drive level employed.

The effect of runway performance was investigated by Jones (1971) to determine if runway performance also affected postgoal competing responses consistently when subjects received PRF or CRF. Jones (1970) found that time spent at the food cup before turning away was a reliable measure which was correlated with competing responses in the runway, and the same variable was applied here. There were two percentages of reinforcement (PRF 50% and CRF), two reinforcements (1 and 20 pellets) and two drive levels (6 and 21½ hours deprivation). The conclusions of the study were that (a) PRF subjects do not learn to remain at the goal cup on nonreinforced acquisition trials, (b) the effects of large amounts of reinforcement (20) is to decrease postgoal turn latencies, and (c) the effect of deprivation (21½ hour subjects) was to increase the postgoal turn latencies; HD subjects remained at the food cup longer than LD subjects.

For CRF subjects however, drive effects have been shown to influence extinction behavior. Marx (1967) employed high drive (HD) and low drive (LD) combined factorially with high reinforcement (HR) and low reinforcement (LR). Group LDHR extinguished least rapidly and group HDHR extinguished most rapidly. Drive effects were significant. A response which is learned under strong drive and reinforcement conditions is less resistant to extinction (Rn) than a response learned under weaker motivation and strong reinforcement. Marx (1971) added support to these findings in his attempt to relate performance in extinction to food deprivation and incentive motivations conditions where the incentive manipulations were in terms of percentage of sucrose concentration in water rather than amount of food. He found that in the HD groups, there was a consistent increment in performance from 8% to 64% sucrose concentrations, and the opposite effect occurred for the LD groups, with 64% sucrose concentration producing fewer responses.

<u>Effects of PRF and CRF of satiated subjects in extinction</u>. Spence (1956) has been interpreted by Black (1965) as suggesting that incentive motivation is a summary term for the motivational aspects of rg-sg which is conditioned to cues in the runway as a result of the subject's consummatory response (R_G). If the subjects fail to eat in the goal

box (due to satiation), rg-sg will not be conditioned to the runway cues and no more incentive will develop. Black and Black (1967) performed an experiment to investigate the combination of drive and incentive motivation with deprivation and satiation while complying with Spence's (1956) theoretical requirements for developing incentive motivation prior to testing under satiation. Food deprived subjects received either large or small reinforcements and were subsequently shifted to satiation which should produce immediate decrement in performance due to drive reduction. The results indicated that there was an immediate reduction in performance of both groups following satiation. Also, a significant decline in running speed did occur over the satiation days. The gradual and reliable decline in running speed was thought to reflect the progressive weakening or extinction of incentive motivation. There was however, a nonsignificant Drive x Incentive interaction as well as no significant magnitude effects, which make the interaction suspect.

Gragg and Black (1967) performed another experiment with the same basic structure, but with the intent to increase ratios of reinforcement magnitude increased in an attempt to produce a significant magnitude effect in acquisition. Half the subjects in each reinforcement group were given a reversal in the magnitude received during testing under relative satiation. These reversals represented an attempt to determine whether shifts in reinforcement magnitude would result in rapid changes in performance under satiation such as those reported under conditions of deprivation (e.g., Crespi, 1942). This time, there was a significant magnitude effect. Again the Drive x Magnitude of Reinforcement effect was not significant which confirmed the Black and Black (1967) suggestion of the additive relationship. Those groups for which the reinforcement magnitude was shifted during satiation showed a much greater response decrement than nonreversed subjects.

The decremental operations of satiation were further studied in a design to examine the effects of satiation in PRF and CRF. Subjects were reduced to 80% and 90% of their ad libitum body weight with half of each group receiving either 50% or 100% reinforcement. Later, the subjects in the 50% groups received the 100% reinforcement and the CRF groups were maintained on 100% reinforcement. In the presatiation phase of their study, Haas, Shessel, Willner, and Rescorla (1970) found that HD subjects ran slower than LD subjects, though not significantly. In the satiation phase, all speeds dropped as a function of weight before satiation. The HD group was significantly faster than the LD subjects. PRF groups were faster than the CRF groups. Thus, PRF subjects are more Rn to decremental effects of satiation than are the CRF subjects.

Another study employing sucrose concentrations as reinforcements was performed by Bech (1967), but for the purpose of determining whether a rat that responds equally for all sucrose reinforcements will respond differentially during extinction in a state of hunger than when it is satiated. Differential reinforcement effects produced by the sucrose concentrations were found only for the food deprived subjects. Water deprived subjects showed no reinforcement differences in training or extinction. Therefore, differences among sucrose reinforcements are seemingly irrelevant to the rat when thirsty, but relevant when hungry.

Wong and Jelliffe (1972) reversed the usual procedure of shifting subjects from some PRF to satiation in an experiment which investigated the effects of shifting satiated subjects to a much smaller reinforcement magnitude. Subjects were either handled (H) in pretraining or not handled (NH). The authors proposed that handling may facilitate the association processes of the rat. If handling does have such an effect, it would facilitate the choice behavior of the rat. H rats should prefer sensory-activity incentives more than NH rats. In the food deprivation phase of the experiment, H rats should prefer food more than the sensory-activity of the maze. Results confirmed the prediction that satiated H rats would prefer the maze more than the NH rats and that food deprived H rats chose the food incentive more often than did the NH rats. Subjects were later shifted back to satiation and the data were remarkably similar to the first satiation phase.

Effects of delay in the runway on extinction. The manipulations carried out in training are also very influential in extinction. Wike, Mellgren and Wike (1968) performed two experiments, with Experiment I using spaced trails and Experiment II using massed trials, to determine the effects of the percentage of delayed reinforcements in training, percentage of confinement trials in extinction and the interaction effects in extinction. Subjects were delayed for 20 seconds on 0, 33, 67 or 100% of the runway and extinction trials. In training, 0, 33 and 67% did not differ from each other, but were significantly faster than the 100% group. In extinction, the same results were found. The percentage of the delays in extinction led to slower running, e.g., when the delays were decreased, faster running resulted in spaced trials.

In massed trials, training resulted in the same ordering as in Experiment I, but in extinction, the 67% group was faster than the 100% and 0% delay groups. Therefore, the second experiment showed that an increasing percentage of delay from training to extinction results in faster extinction while a decreasing percentage results in slower extinction. Variables that affect runway performance also affect extinction behavior.

The overlearning extinction effect (OEE). There appears, from the evidence cited, that drive, reinforcement magnitude and training interact to determine extinction performance. The overlearning extinction effect (OEE) is an inverse relation between training trials and Rn, and is thought to be characteristic of extensive large reward training. If this is so, then the CRF and large reinforcement magnitude combination should be more likely to produce OEE; it is also more likely to occur if training is under HD if as Black (1965) proposed, drive contributes to reinforcement magnitude. Traupmann (1972) studied the effect of drive on OEE and the interaction of drive with training and reinforcement. He found a significant Drive x Magnitude of Reinforcement x Training x Extinction effect in the start, run and goal sections of the runway, demonstrating the interaction. The order from most to least Rn of the groups were HDLR, LDLR, LDHR and HDHR. Therefore, OEE tends to be characteristic of rats given LR training when training is under HR.

Instrumental escape conditioning

Effects of shock. Vogel and Spear (1966), attempted to find a simple procedure sensitive to variations in reinforcement magnitude. Three variations of methods were reported. The procedure was such that it should measure the extent to which the presentation of a

stimulus, previously associated with shock, leads to a disruption of an ongoing response (R_G). A tone was paried with shock in pre-training. During testing, the subjects were allowed to lick at the reinforcement 100 times then the tone came on and the experimenter measured the time to complete 10 licks in the presence of the tone. The amount of suppression produced by the stimulus was greater for the small magnitude group than for the large magnitude group.
In Experiment II, the tone-shock pairings were increased to two and the results were the same as for Experiment I. Experiment III added an intermediate level of reinforcement, but it did not differ in performance from the small magnitude.

A second study investigated the effects of food reward on suppression by shock. Renner (1967) proposed that if early food deprivation increased the incentive value of food, then it is assumed that food deprived subjects as infants should, as adults, learn a response faster than the nondeprived infants. In addition, prior food deprivation should result in a food rewarded response having greater resistance to suppression by shock. Infant food deprived subjects acquired the correct response significantly faster. All food deprived infants continued to select the side of an alley which delivered both food and shock while the nondeprived subjects consistently choose the no shock-no food side. The drive level of the food deprived subjects was reduced by placing them on 21½ hours ad libitum food, they immediately shifted their preference to the no shock-no food side. These data are in perfect agreement with earlier work on temporal integration (Renner, 1964) in which drive level was shown to change both the height of the temporal gradient of reward and the utility of the food reward.

Ayres (1968) also investigated suppression as a function of shock and incentive. Half the subjects received a CS+ which was 8% or 32% sucrose solution and the other half received a CS- which was one of three levels of shock. Subjects suppressed more to CS+ than to CS- and suppression in general was rather weak; neither the main effects of shock or sucrose nor the interactions were significant. While shock intensity affects both differentially conditioned suppression and suppression to CS+, the effects of sucrose concentration on the measures, if real at all, are very small in view of the profound concomitant effects of sucrose on response rates.

The effects of shock intensity on escape training have traditionally been evaluated with comparisons between groups of subjects, each group being trained with a different shock intensity (e.g., Trapold & Fowler, 1960). It is suggested that experience with one shock intensity might influence performance at another intensity in a within-subject approach, but not in a between-groups approach. Subjects in both the between and within conditions jumped hurdles as a direct function of shock intensity. Performance at each shock level was higher for subjects receiving varied shock levels than their corresponding constant shock subjects. Within-subject variation in shick intensity produced higher asymptotic performance than did repeated experience with a single shock intensity alone.

Nonshock aversive conditioning. Matthews (1971) performed an experiment in instrumental escape conditioning employing aversive thermal levels as drive, and changing thermal levels to the "preferred" setting was the reinforcement.

Matthews was the first study to employ an apparatus which both cooled and heated the experimental setting. Subjects bar pressed (bp) in the presence of drive conditions to cause the termination of drive and the onset of the reinforcer. Drive intensity and reinforcer duration were manipulated. Response probability increased as a function of the amount of time the subject was exposed to the drive. Overall reinforcement duration effects were negligible. Experiment II was to determine whether the usual result of increase in response latency with increase in reinforcer intensity can be extended to the intensity parameter of reinforcer magnitude. The results indicated a strong influence of drive temperature on response latency. There was no effect of reinforcement intensity. Like reinforcement duration, reinforcement intensity was unrelated to response latency. Thus, duration and intensity of reinforcement from Matthews (1971) results, do not appear to influence the rate of occurrence of thermally motivated instrumental behavior. Finally, the author decided to give one extreme thermal motivation and have the drive reduction be in terms of the opposite extreme thermal motivation. Only in this third experiment were response speeds slower than for the neutral thermal settings. Response also increased when the duration of the reinforcer was decreased. The final analysis seems to be that the relationship of response latency to reinforcement magnitude occurs only when the reinforcing temperatures are not on the same side of neutrality as the drive condition.

Summary

1. High drive has been demonstrated to contribute to incentive motivation to make for more effective results when the two variables are varied simultaneously. HD can also exhibit a detremental effect on performance when the task is complex. This effect has been demonstrated in conversational behavior by Lombardo, Libkuman and Weiss (1971). Lombardo et al induced drive effects by disagreement on high interest items then subjects were placed in either a simple or complex task. HD subjects' performance was poorer than LD subjects on the complex task, but better on the simple task. This finding was consistent with the proposal by Zajonc that HD facilitates performance on an easy task and impedes performance on a complex task.

2. Subjects have strong preferences as to the reinforcer they receive. In the face of deprivation, subjects will consume less of the least desired reinforcer than the preferred one when relatively satiated.

3. Partial reinforcement subjects extinguish less rapidly than do CRF subjects. When drive is also a variable for PRF and CRF subjects, there is not a significant drive effect for either group.

4. Delay serves to inhibit responding and therefore causes extinction to occur much faster than for a group that would not receive delay. Also, satiation serves to inhibit performance. When satiation occurs in training, there is a severe response decrement, especially relative to food deprived subjects' performance.

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APPENDIX B

BIBLIOGRAPHY OF LITERATURE ON POSITIVE AND NEGATIVE INCENTIVE CONTRAST EFFECTS

APPENDIX B

Bibliography on positive and negative incentive contrast effects

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APPENDIX C

EXCERPT OF CONVERSATION STUDY SCRIPT

Excerpt of Conversation Script

Note: The comments by Subject A are based on those given most by all subjects taking part in the experiment. Only rarely did a subject not respond in a like manner.

Formidable

Topic: Voting is not worth the trouble. Most subjects disagreed with this statement.

<u>Yield</u>

Confederate: I don't think voting is worth the trouble. It only serves to ease the conscience because most candidates are selected without any input from the people, but rather by party bosses, e.g. Mayor Daily of Chicago.

Subject: I think it worth the trouble. It is a right that we all have and we should exercise that right. Even if the vote doesn't do a lot of good, you can't complain if you didn't vote.

Confederate: You brought up a point I'm sure a lot of us have forgotten. Voting is our right. Our history has shown the pains and efforts many have taken to gain that right, e.g., women's sufferage, civil rights, etc. That in itself is reason enough to exercise the right to vote.

<u>Agree</u>

Confederate: Perhaps voting is worth the trouble. I think the issue has been clouded by the recent political scandals. Just not sure.

Subject: (Same as above).

Confederate: I agree. The vote is the people's voice. Everyone of our local elections have had less than 58% of the eligible voters go to the polls. Yet, when the elected candidate doesn't carry out his promises, there is 100% dissatisfaction.

Disagree

Confederate: (Same as agree).

Subject: (Same as yield and agree).

Confederate: People seem to misunderstand the purpose of the vote. It was not intended to merely pacify the public. The vote once was effective. In our present political system, the vote does very little. The candidates are selected by party bosses and political party heads. We only cast a ballot for someone elses choice. The presidential election is a popularity contest, as the electoral college really puts a president in office. It would make a lot more sense to get involved in more basic politics, long before election day.

Weak

Yield

Confederate: I don't think it's really worth the trouble. Half the time, I don't know anything about the candidate, never heard of him before now.

Subject: (Same as in Formidable section).

Confederate: Maybe you're right. Like when we had student elections. Not very many people voted, but everybody griped about the outcome.

Agree

Confederate: I just got legal voting age. Haven't thought about it much yet.

Subject: (Same)

Confederate: I go along with that. It makes sense to exercise your right. Since I just became 18, my main concern has been with class elections, etc.

Disagree

Confederate: (Same as agree)

Subject: (Same)

Confederate: I just can't see voting for the sake of voting. If you're going to go through the hassle of registering and voting, it should be worth the trouble, and right now, I can't see that it is.

APPENDIX D

INSTRUCTIONS TO THE SUBJECT

Instructions to the Subject

This experiment deals with controversial attitudes and opinions and is a study of opinion change. We are interested in how your opinions may be affected by what someone else says, how your opinions may be affected by what you yourself say, and how what you say may affect the opinions of someone else.

You will participate in this experiment with another subject. Because of the nature of this experiment you will not meet, nor will you be referred to by name, but instead, by letters of the alphabet, such as Subject A and Subject B. You will know which subject you are by the letter on the corner of your table. You have been placed in separate rooms to insure confidentiality of your opinions on the topics to be discussed. This is particularly important since many of the topics used here are quite controversial.

Subject B has been given a list of topics. Subject B, a randomly chosen number will light up on your panel. When this happens, locate that number on the list of topics and read the topic aloud so that Subject A can hear you. When you have finished reading, you may then state your opinion on the topic. After stating your opinion, Subject A will then state his opinion. When Subject A has stated his opinion, you, Subject B will then have a second opportunity to comment on the topic. After Subject B makes his final comment, you will both indicate whether your opinion has grown stronger, remained the same, or grown weaker. We will now go through the sequence again allowing you to watch the signals and to operate the controls.

You will first get this signal, Subject A. (Experimenter, press "listen" switch). You now have the "listen" signal, and Subject B, you have a "talk" signal. Now Subject B, you will read the topic indicated and comment on it. When Subject B has commented on the topic he will press his "finish" switch which gives you, Subject A the signal to state your opinion. Now Subject B, please press "finish". (Experimenter, press "talk" switch). Subject A, you now have the signal to comment. In order to comment, you must press the comment switch. Please, press it now. (Experimenter, watch for light). At this point, you will state your opinion on the topic. When you have finished commenting on the topic, you will press your "finish" button. Please, press it now. (Experimenter, watch for light). As you see, when Subject A presses his "finish" button, he again gets the "listen" signal, and you, Subject B, get the "talk" signal, at which time you will make your final comment on the topic. When Subject B has finished commenting the second time, he presses his "finish" switch. Both of you will then get the signal to indicate your final opinion on that topic by pressing one of the three buttons on your console. Please, press one now.

This has been a typical cycle. Again we are interested in how conversation affects opinions, how what each one of you says may affect both your own and another person's opinion. Again, everything you say will be kept strictly confidential.

(Experimenter, check subjects for questions.)

APPENDIX E

SUMMARY TABLES

Summary Table of Acquisition (T_1-T_{12}) Trials of Shifted and Constant Groups All HD and LD

Source	MS	DF	F-ratio	P
Total	0.086	1919		
Between	0.258	159		
A (Drive)	0.345	1	1.3715	0.2417
B (Magnitude)	0.295	3	1.1721	0.3221
AB (Drive/Magnitude)	0.518	3	2.0621	0.1062
Between Error	0.251	152		
Within	0.070	1760		
C (Trials)	0.517	11	7.8389	0.0000
AC (Drive/Trials)	0.107	11	1.6215	0.0862
BC (Magnitude/Trials)	0.110	33	1.6654	0.0105
ABC (Drive/Magnitude/ Trials)	0.088	33	1.3334	0.0984
Within Error	0.066	1672		

Summary Table of Preshift (T_1-T_6) Phase of HDY Compared to HDA

Source	MS	DF	F-ratio	P
Total	0.110	479		
Between	0.165	79		
A (Magnitude)	0.999	1	6.4672	0.0125
Between Error	0.155	78		
Within	0.100	400		
B (Trials	0.344	5	3.6333	0.0035
AB (Magnitude/Trials)	0.247	5	2.6146	0.0240
Within Error	0.095	390		

Summary Table of Preshift (T_1-T_6) Phase of All HD Subjects Compared to All LD Subjects

Source	MS	DF	F-ratio	P
Total	0.079	959		
Between	0.112	159		
A (Drive)	0.238	1	2.2407	0.1325
B (Magnitude)	0.299	1	2.8129	0.0915
AB (Drive/Magnitude)	0.751	1	7.0718	0.0085
Between Error	0.106	156		
Within	0.073	800		
C (Trials)	0.166	5	2.3765	0.0369
AC (Drive/Trials)	0.193	5	2.7597	0.0175
BC (Magnitude/Trials)	0.225	5	3.2105	0.0073
ABC (Drive/Magnitude/ Trials)	0.158	5	2.2512	0.0469
Within Error	0.070	780		

Summary Table of Postshift Phase (T_7-T_{12}) of All HDY (response speeds) Compared to All HDA Response Speeds

Source	MS	DF	F-ratio	P
Total B	0.104	479		
Between	0.171	79		
A (Drive)	0.874	1	5.3981	0.0215
Between Error	0.162	78		
Within	0.091	400		
B (Magnitude)	0.047	5	0.5184	0.7647
AB (Drive/Magnitude)	0.151	5	1.6749	0.1386
Within Error	0.090	390		

Summary Tables of Preshift (T_1-T_6) of HD Constant Group Compared to LD Constant Group

Source	MS	DF	F-ratio	P
Total	0.079	959		
Between	0.139	159		
A (Drive)	0.242	1	1.8104	0.1771
B (Magnitude)	0.129	3	0.9642	0.5871
AB (Drive/Magnitude)	0.362	3	2.7106	0.0461
Between Error	0.134	152		
Within	0.068	800		
C (Trials)	0.551	5	8.9721	0.0000
AC (Drive/Trials)	0.143	5	2.3230	0.0409
BC (Magnitude/Trials)	0.166	15	2.7107	0.0007
ABC (Drive/Magnitude/ Trials)	0.100	15	1.6242	0.0617
Within Error	0.061	760		

Summary Table of Acquisition (T_1-T_{12}) Trials of LDY Compared to LDA

Source	MS	DF	F-ratio	P
Total	0.067	479		
Between	0.191	39		
A (Magnitude)	0.002	1	0.0089	0.9222
Between Error	0.196	38		
Within	0.056	440		
B (Trials)	0.293	11	5,8759	0.0000
AB (Magnitude/Trials)	0.065	11	1.2986	0.2218
Within Error	0.050	418		

Summary Table of Acquisition (T_1-T_{12}) Trials of HDY Compared to HDA

Source	MS	DF	F-ratio	P
Total	0.075	479		
Between	0.335	39		
A (Magnitude)	1.349	1	4.3602	0.0409
Between Error	0.309	38		
Within	0.052	440		
B (Trials)	0.155	11	3.1387	0.0006
AB (Magnitude/Trials)	0.044	11	0.8829	0.5577
Within Error	0.049	418		

Summary Table of Acquisition (T_1-T_{12}) Trials of HDY-A Compared to HDA

Source	MS	DF	F-ratio	P
Total	0.126	479		
Between	0.346	39		
A (Magnitude)	0.654	1	1.9345	0.1691
Between Error	0.338	38		
Within	0.106	440		
B (Trials)	0.155	11	1.5418	0.1135
AB (Magnitude/Trials)	0.290	11	2.8923	0.0014
Within Error	0.100	418		

APPENDIX F

TABLE OF MEANS

Summary Table of Means for Each Group Across 12 Trials

Shifted	Pre-shift						Post-shift					
Group	T_1	T_2	T_3	T_4	T_5	T_6	T_7	T_8	T_9	T_{10}	T_{11}	T_{12}
HDY-A	5.165	6.035	8.383	6.744	6.345	7.073	6.193	6.972	5.897	6.221	7.026	5.888
HDA-Y	3.887	5.357	5.682	5.389	6.069	6.853	6.366	6.502	6.625	7.173	7.536	5.955
LYD-A	3.876	5.300	5.400	5.489	5.175	6.347	6.083	5.302	5.924	5.871	6.322	5.454
LDA-Y	4.884	6.595	5.916	6.407	6.457	5.748	6.516	6.573	6.689	6.414	7.736	6.648
Control												
HDY	5.346	6.210	6.361	5.991	6.490	7.187	7.421	7.108	6.906	7.221	8.261	7.308
HDA	4.514	5.086	5.892	5.637	5.747	6.268	5.442	6.732	6.072	5.603	6.397	5.695
LDY	4.822	5.375	5.446	5.753	6.636	7.215	6.318	5.903	6.832	5.875	7.517	5.599
LDA	4.315	5.253	5.960	5.742	5.973	6.064	6.142	6.448	6.868	6.205	7.296	6.567

APPENDIX G

THE OPINION SURVEY

<u>OPINION SURVEY</u>

1. Money is the most important goal in life.
2. Despite its benefits, birth control remains morally wrong.
3. People should not be discriminated against because of long hair, beards, clothes, etc.
4. Police are justified in using any degree of force during disorders.
5. Any woman having an illegitimate child should be sterilized.
6. Divorce is never justifiable.
7. Socialism would be the best economic system for the United States.
8. Family size should be regulated by the government.
9. Police should ignore drug users and concentrate on the dealers.
10. The president has a right to refuse to submit subpoenaed material if he feels the material is vital to national security.
11. Revival preaching on campus is a public nuisance and should be stopped.
12. Marijuana should be legalized.
13. Voting is not worth the trouble.
14. Police should be given increased search and seizure powers.
15. College students should have a say in deciding if a professor is given tenure.
16. There should be increased emphasis on vocational training and decreased emphasis on college education.
17. Dorms should be established allowing coed roomates.
18. Any society which spends as much time and money on spectator sports as the U.S. does must be sick.

19. A truly moral person should refuse to engage in any war, no matter what the consequences might be for his country.
20. Integration in public schools is necessary and should be promoted even if bussing is involved to achieve it.
21. The American way of life is not the best.
22. There is nothing wrong with premarital sex relations.
23. The Democratic party is by far the best party.
24. Sex education should be taught in the public schools.
25. I feel great admiration for people who do their own thing.
26. The U.S. should have completely socialized health care, regulated by the government.
27. All collegiate athletic scholarships should be discontinued.
28. An employer is entitled to deny employment to members of racial, religious, or political groups of which he disapproves.
29. Colleges should forbid students to join fraternities and sororities.
30. Blacks should receive preferential treatment in applying for jobs to compensate for past discrimination against them.
31. Capital punishment should be reinstated to help prevent crime.
32. The U.S. Government should give food to any country to prevent famine no matter what the consequences for the American people.
33. Federal officials should be able to use any means necessary to preserve the national security.
34. There should be monetary restrictions regarding campaign spending.
35. The age at which a person is allowed to drink alcoholic beverages is the concern of his parents, not the state.