DOCUMENT RESUME

ED 066 854 24 EC 042 969

AUTHOR Sachs, David A.

TITLE The Effects of Differential Reinforcement Conditions and the Conditioned Emotional Response on Discrimination Learning. Final Report.

INSTITUTION New Mexico State Univ., Las Cruces.
SPONS AGENCY Office of Education (DHEW), Washington, D.C. Bureau of Educational Research and Development.
PUB DATE Aug 72
CONTRACT OEC-6-71-0540(509)
NOTE 130p.

EDRS PRICE MF-$0.65 HC-$6.58
DESCRIPTORS *Conditioned Response; *Discrimination Learning; *Exceptional Child Research; *Handicapped Children; *Positive Reinforcement; Reactive Behavior; Reinforcement; Research Methodology

ABSTRACT

Three studies, using handicapped children, investigated: effects of three different reinforcement contingencies (positive reinforcement, removal of positive reinforcement, and combination of positive reinforcement and removal of positive reinforcement) on a steady-state discrimination task; effect of a conditioned emotional response procedure on a steady-state discrimination task; and effect of a conditioned emotional response procedure on rate of words emitted. Results of the three studies indicated: percent of correct discriminations was highest for removal of positive reinforcement; no significant differences were found in response latencies for any of the three reinforcement conditions; conditioned emotional response procedures had no effect on response latency or percent correct discriminations; conditioned emotional response procedures had no effect on rate of words emitted. Major implications of studies were discussed. (Author)

1-F-088
TB 21
EC

ED 066854

Final Report

Project No. 1F088
Contract No. OEC-6-71-0540-(509)

David A. Sachs
New Mexico State University
Las Cruces, New Mexico 88001

THE EFFECTS OF DIFFERENTIAL REINFORCEMENT CONDITIONS AND THE CONDITIONED EMOTIONAL RESPONSE ON DISCRIMINATION LEARNING

August, 1972

U.S. DEPARTMENT OF HEALTH, EDUCATION
AND WELFARE

Office of Education

Bureau of Research

EC 042 969E

Final Report

Project No. 1F088

Contract No. OEC-6-71-0540-(509)

THE EFFECTS OF DIFFERENTIAL REINFORCEMENT CONDITIONS AND THE CONDITIONED EMOTIONAL RESPONSE ON DISCRIMINATION LEARNING

David A. Sachs

New Mexico State University

Las Cruces, New Mexico

August, 1972

U.S. DEPARTMENT OF
HEALTH, EDUCATION, AND WELFARE

Office of Education

Bureau of Research

Abstract

The present series of three studies, using handicapped children, investigated:

a) the effects of three different reinforcement contingencies (i.e. positive reinforcement, removal of positive reinforcement, and the combination of positive reinforcement and removal of positive reinforcement) on a steady-state discrimination task;

b) the effect of a conditioned emotional response procedure on a steady-state discrimination task; and

c) the effect of a conditioned emotional response procedure on rate of words emitted.

The results of the three studies indicated:

1) percent of correct discriminations was highest for removal of positive reinforcement;

2) no significant differences were found in response latencies for any of the three reinforcement conditions;

3) Conditioned Emotional Response procedures had no effect on response latency or percent correct discriminations;

4) Conditioned Emotional Response procedures had no effect of rate of words emitted.

The major implications of these studies, relative to previous literature, was discussed. Suggestions are made for considering the difference between reinforcement contingencies in terms of 1) the total availability of reinforcement within the child's environment and 2) differentiating between response acquisition and steady-state behavior.

Table of Contents

List of Tables

List of Figures

Introduction to the Final Report

The present report contains three experimental studies. Each of the studies will be written as a separate chapter, with its own brief literature review, procedure, results and discussion section. The final chapter will be devoted to the conclusions and implications of the three studies considered as an entity.

Chapter I

Study I: The Effects of Positive Reinforcement, Removal of Positive Reinforcement, and Positive Reinforcement and Removal of Positive Reinforcement on Discrimination Learning with Handicapped Children.

Academic programs geared to specialized educational programs typically minimize stressful manipulations. Skinner (1953) has long argued that most of our educational system has been based on avoidance of aversive consequences rather than on obtaining positive reinforcement. Despite Skinner's (1948) pleas for a Walden II type of environment, evidence exists that stressful manipulations may have a facilitative effect on behavior and a positive effect on learning.

Eugene Levitt, in his book "The Psychology of Anxiety" (1967) devotes a chapter to anxiety and learning. In reviewing the work of Spence (1960), Yerkes & Dodson (1908), and Wood and Hokanson (1965), the evidence for anxiety having both facilitating and debilitating effects, depending on both the nature of the learning task and the magnitude of stress, is clearly presented.

In applying the principles of contingency manipulation, reliance solely on the delivery of positive reinforcement has not been typical of most manipulative environments. While primary reinforcement is the major operative factor, most environments have procedures calling for 1) loss of primary reinforcement (i.e. fines) and 2) time-out from positive reinforcement (Ayllon & Azrin, 1968; Fargo, Behrns, and Nolen, 1970). The utility of presenting aversive stimuli, contingent upon a given response, as a means of diminishing the probability of that response, has been well documented in the literature (Estes, 1944; Appel, 1963; Azrin and Holz, 1966; Church, 1966). Sidowski, Wyckoff, and Tabory (1956) reported that strong shock produces more rapid learning than weak shock.

Timmons (1959), in a study of different types of contingencies on verbal conditioning with college students compared 1) omission of verbal reinforcement (extinction); 2) saying "wrong" to previous correct responses; 3) omission of verbal reinforcement for previous correct responses and reinforcing a new response class; and 4) saying "wrong" to the previous response class and reinforcing a new response class. He reported that the maximally effective paradigm was the combination of "wrong" with reinforcement of the new response class.

Tramontana and Harris (1972) investigated the effects of positive reinforcement, response cost, or both on discrimination performance with retarded children, ages 6-9. They compared borderline retardates (mean IQ = 74) and moderate retardates (mean IQ = 47) on acquisition of a two-choice visual discrimination problem. Reinforcement consisted of delivery of candy and response cost consisted of removal of candy. The dependent variable was trials to criteria. Tramontana and Harris reported that "for both retarded groups the combined condition was slightly but not significantly more effective than the response cost condition and for both groups combined both the combination and cost alone condition were significantly more effective than positive reinforcement alone" (pg. 7).

Method

Subjects.--The subjects for the present study initially consisted of 8 children who were enrolled in a behavior modification class, supported by the Las Cruces Public School System and operated on the campus of New

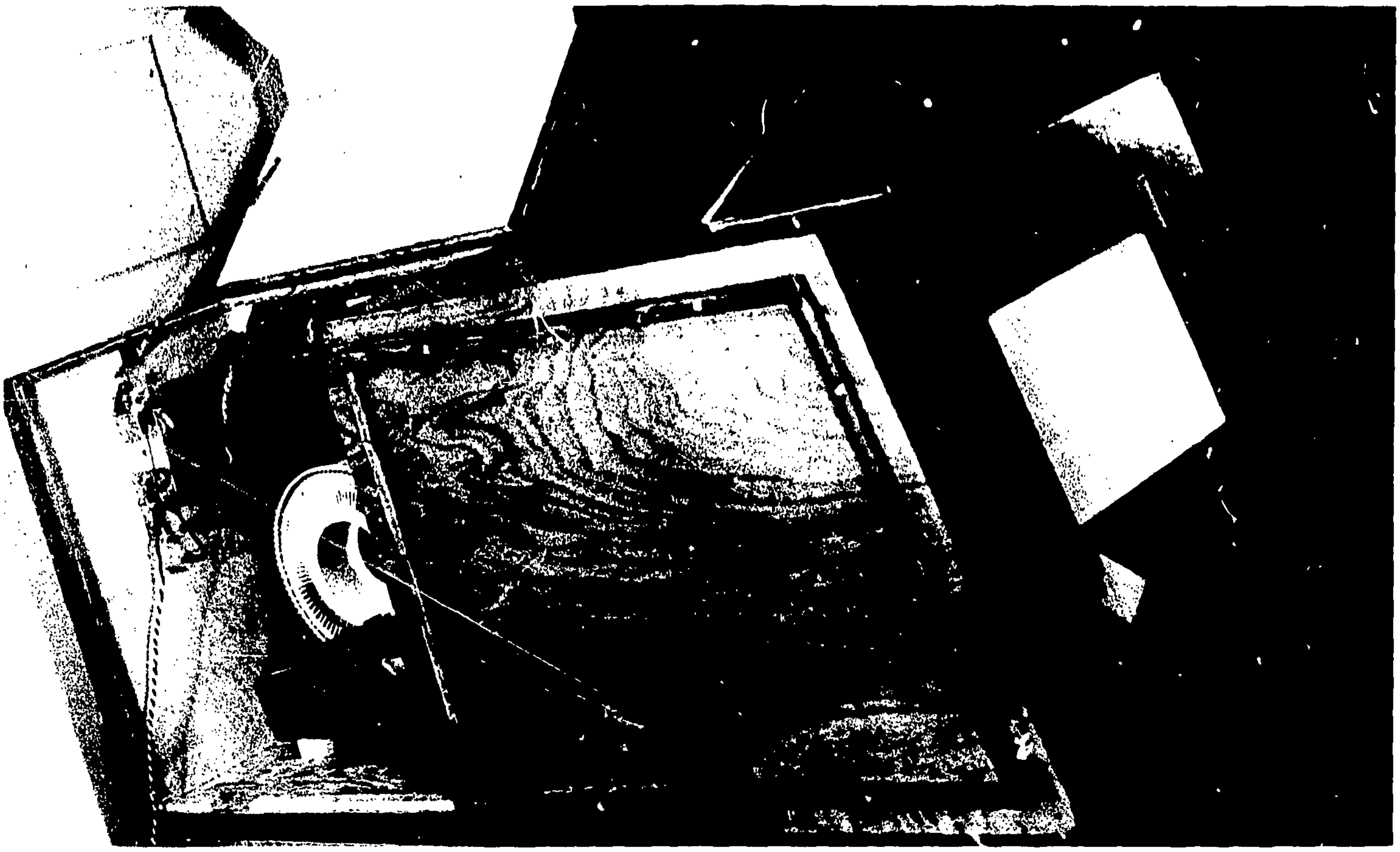
Mexico State University. The population of the class was drawn from grades 1-3. The class was operated as a token economy and all of the children were familiar with tokens as reinforcers. At the conclusion of each school day children exchanged their tokens for back-up reinforcers. Participants in the class were referred because of academic, emotional or physical "handicaps" from their district schools.

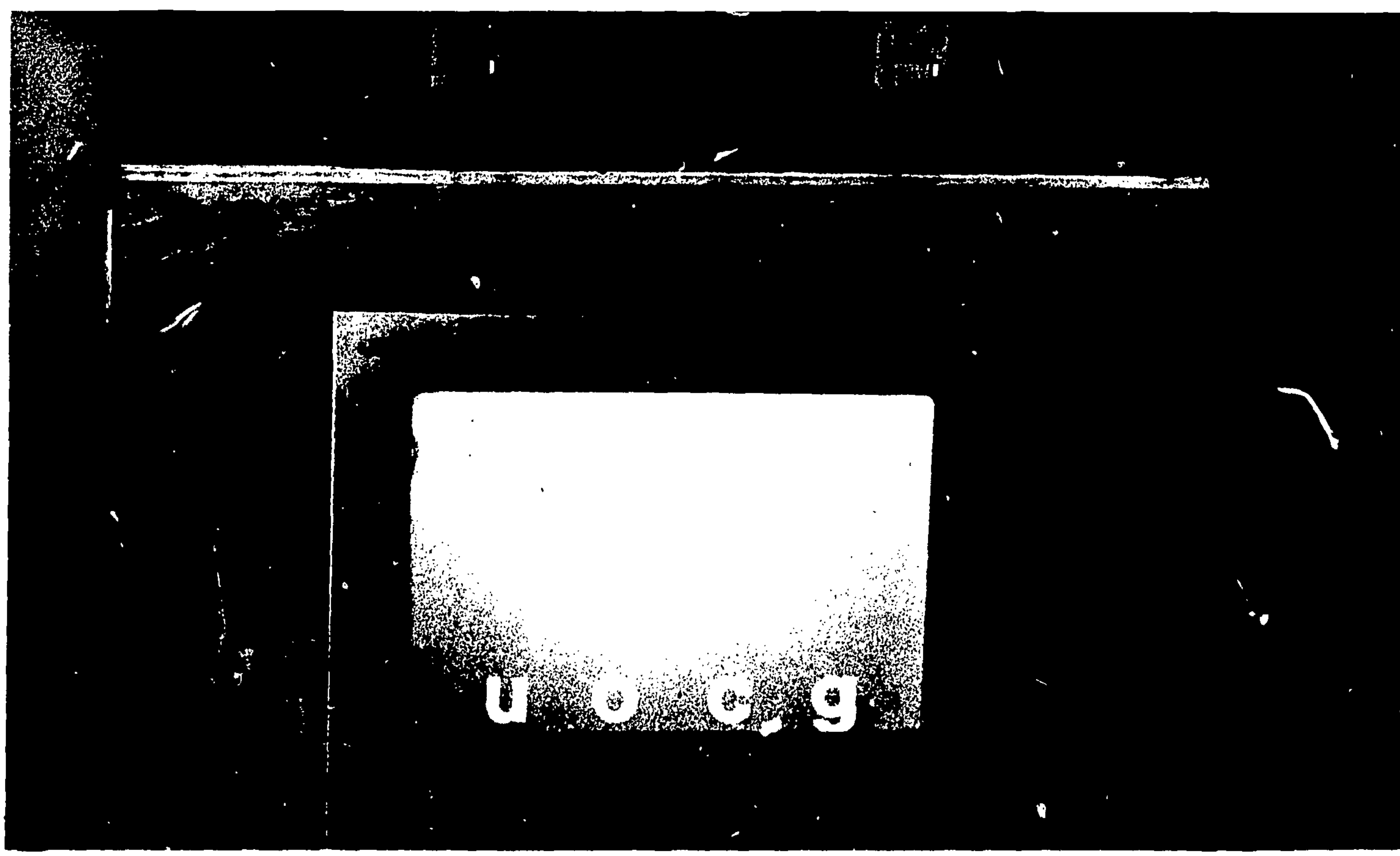
The eight subjects consisted of 5 boys and 3 girls. However, to maintain the counterbalanced experimental design it was necessary to exclude, by random selection within an order, two subjects from the data analysis. The remaining sample consisted of 3 boys and 3 girls. The IQ range of the sample was 51 to 89 with a mean IQ of 69. The age range of the children was 7 to 11, with a mean age of 8 years.

Apparatus:

The apparatus consisted of an automated stimulus presentation devise, electromechanical timers, counters, print-out counters, switching equipment, and slides. Front and side views of automated stimulus presentation devise are illustrated in figure 1. The dimensions of the apparatus were 40" x 23 1/4" x 19 1/8". The screen dimensions were 11" x 7 1/2". The apparatus housed a Sawyers Rotomatic 707 AQ Slide Projector which presented visual stimuli to a rear projection screen. Each stimulus slide contained a discrimination problem and 4 alternative answers, each of which appeared above a push-button response switch. A correct response would change slides, during which time a green light would illuminate the screen. Incorrect responses would result in a 1 sec. darkening of the screen and the incorrect problem would reappear.

Fig. 1. Front and side views of the automated stimulus presentation devise showing the placement of the stimulus problem and solutions above the response keys and the housing of the slide projector stimulus





Electromechanical equipment was used to program for response latency and record incorrect and correct responses. Latencies were recorded to 1/10 sec., and were timed from the onset of the stimulus until the occurrence of the response (e.g. button-push). Latencies and errors were recorded for each trial on a Lehigh Valley print-out counter. Programing apparatus was housed in a soundproof chamber.

Visual discrimination materials consisted of slides on which a problem and 4 possible solutions were present. Problems consisted of arithmetic problems in addition and subtraction, letter discriminations and word discriminations. Slides were prepared with materials relevant to class materials.

Procedure:

Each child worked with the automated stimulus presentation devise for 20 minutes per day in a room adjacent to the child's classroom. Stimulus materials were changed periodically when the child had mastered the current materials. Each child was exposed to each of the three contingencies in a predetermined sequence such that the 3 conditions were counterbalanced to control for sequence effects for the sample.

Prior to the initiation of a contingency, the procedure was explained to the child. Each child was run on only one contingency at a time, until his error rate stabilized for 3 consecutive sessions. Stability was defined as 3 consecutive sessions during which the percent of correct responses for each day was within 5% of the percentage for the 3 day total.

The three conditions were:

1.--Positive Reinforcement: R+ For each correct response, a point was added to a counter mounted on a green panel on the left corner of the stimulus presentation devise. At the conclusion of each session, the child was awarded 1 token for each 10 points. Odd points were not carried forward to the next day.

2.--Removal of Positive Reinforcement: (R-) For each incorrect response, a point was added to a counter mounted on a red panel at the right corner of the stimulus presentation devise. At the conclusion of each session, the child lost 1 token (earned in class) for each 5 points.

3.--Positive Reinforcement and Removal of Positive Reinforcement: ($R^{\pm}$) During this condition, both correct response and incorrect response counters were operative. At the end of each session, the child was awarded tokens or lost tokens on the combined accounting of the respective counters.

Results

Latency:

The mean response latency for each of the three conditions is presented in figure 2. Although response latency appears slightly less variable for the $R^{\pm}$ condition, no significant treatment effect was noted.

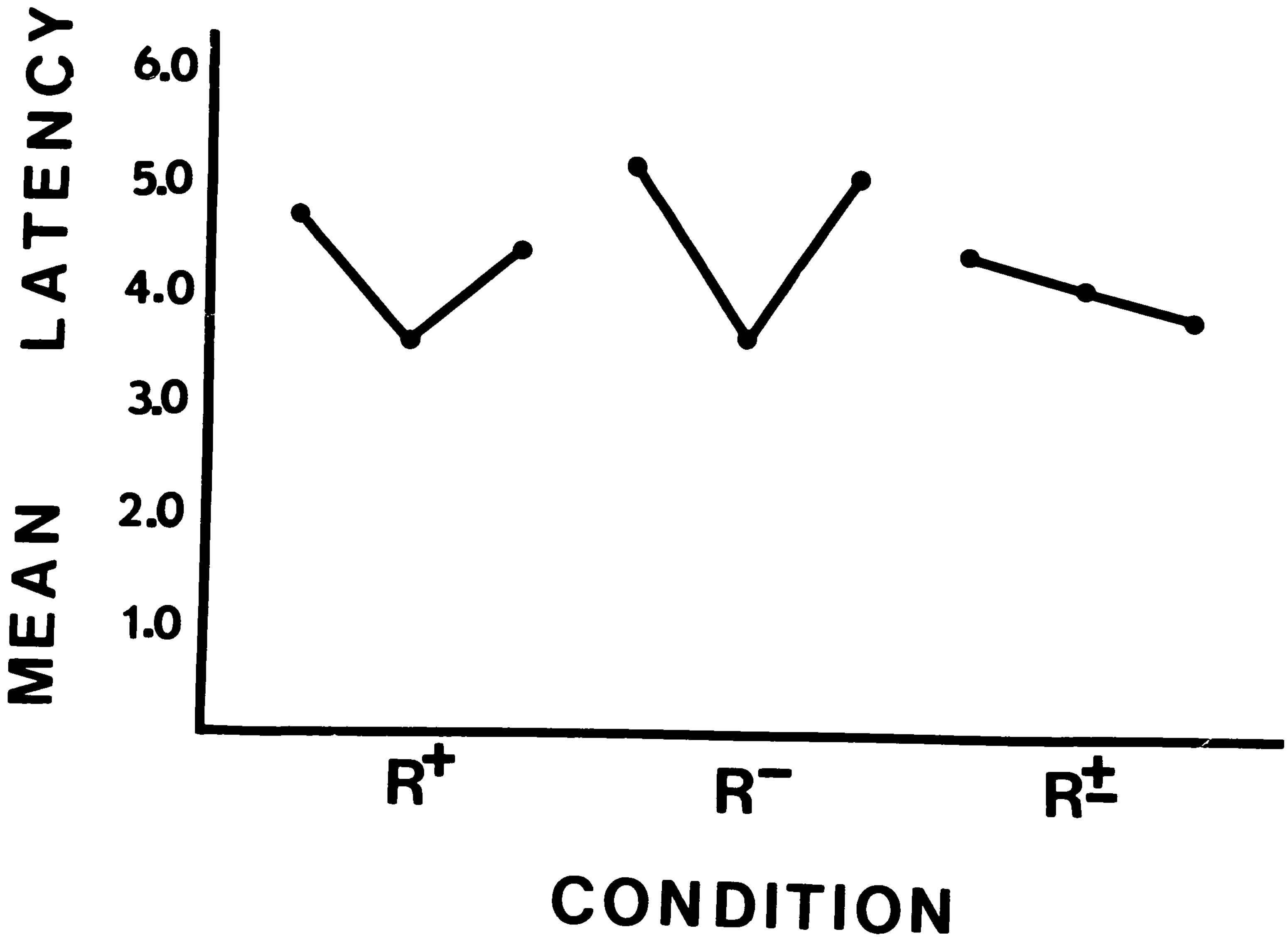
Latency data was analyzed using a Latin-Rectangle ANOVA. No significance was obtained for treatments but subjects differed significantly ($F(5,8) = 33.430$ $p < .01$) in their response latencies. The ANOVA for response latency is presented in table 1.

Table 1

ANOVA for Response Latency

Source	df	M.S.	F
Subjects	5	1056.62	33.430
Sessions	2	95.10	3.009
Treatments	2	10.17	0.322
Error	8	31.61	

Fig. 2. Mean response latency for conditions of positive reinforcement (R+), removal of positive reinforcement (R-), and positive reinforcement and removal of positive reinforcement ($R^{\pm}$). The three data points per condition represent the last three days in which response rate stabilized.


MEAN LATENCY
6.0
5.0
4.0
3.0
2.0
1.0
R+
R−
R±
CONDITION

Percent Correct:

Figure 3 illustrates the results for percent correct for each of the three contingency conditions. For each of the conditions, Ss responded at greater than 80% correct. Inspection of figure 2 indicates that the removal of positive reinforcement condition (R-) resulted in relatively fewer errors than the other two conditions.

The ANOVA for percent correct is presented in table 2. Both subjects

Table 2

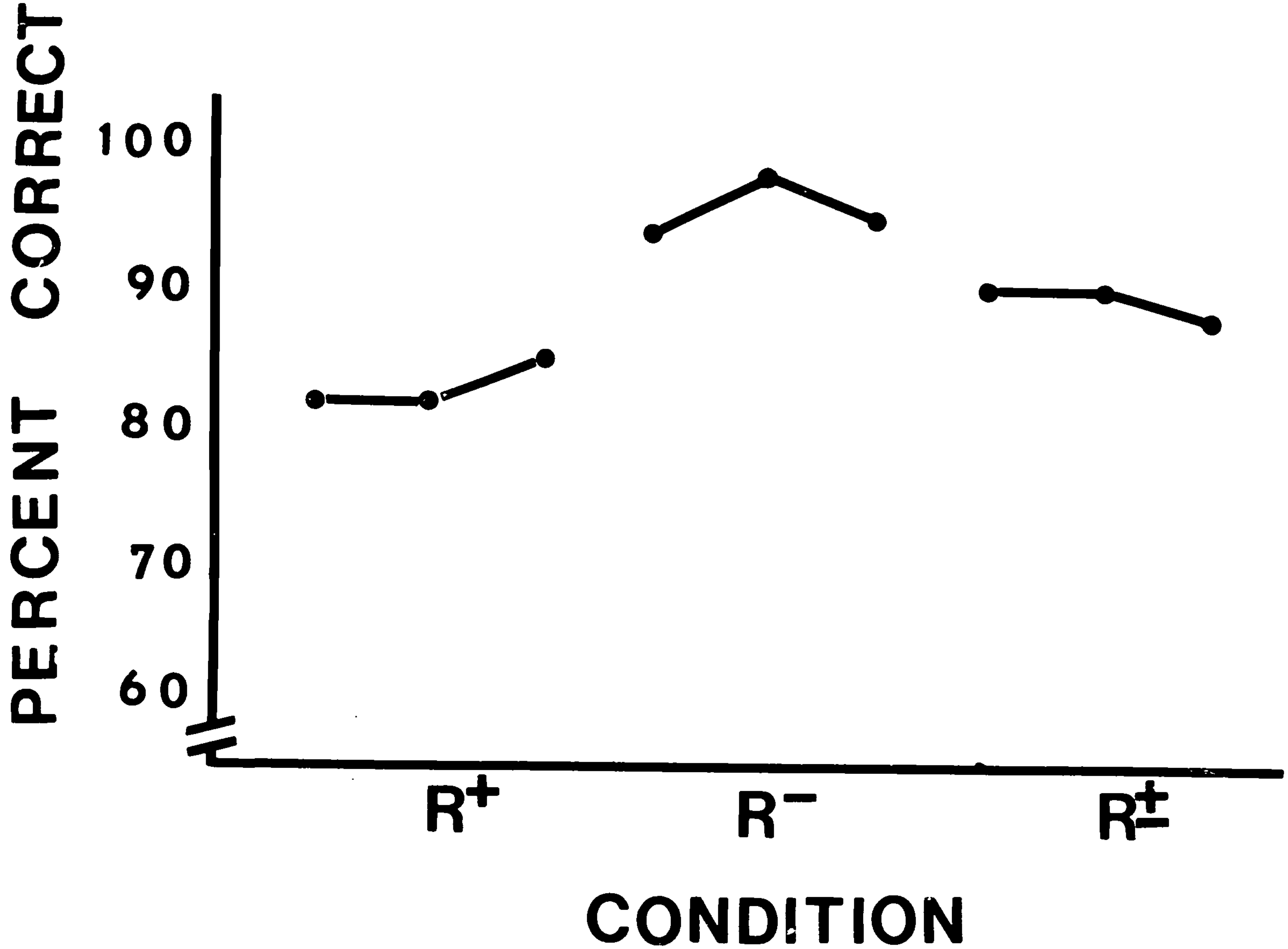
ANOVA for Percent Correct

Source	df	M.S.	F
Subjects	5	.0211	4.047
Sessions	2	.0047	0.907
Treatments	2	.0238	4.553
Error	8	.0052	4.553

($F(5,8) = 4.047$ $p < .01$ and treatments ($F(2,8) = 4.553$ $p < .025$) were significant. A Duncan Multiple Range test indicated that R- was significantly different for R+ and $R^{\pm}$, and these latter two treatments did not differ from each other.

Although the present study examined the effects of various reinforcement contingencies on steady state behavior, an analysis was conducted to determine whether any differences were present due to treatment and order effects in the number of trials required to reach steady-state criteria. In that only one subject was run per order, a Latin Square ANOVA was not feasible. Therefore, one-way ANOVA's were run for treatment and order main effects.

Fig. 3. Percent correct discriminations for conditions of positive reinforcement (R+), removal of positive reinforcement (R−) and positive reinforcement and removal of positive reinforcement ($R^{\pm}$). The three data points per condition represent the percent correct discriminations for the last three days in which response rate stabilized.


PERCENT CORRECT
100
90
80
70
60
R+
R−
R±
CONDITION

Neither treatment ($F(2,10) = .834$) nor order ($F(2,10) = .725$) were significant but subject effects were significant ($F(2,10) = 7.99$ $p < .01$ and ($F(2,10) = 7.88$ $p < .01$. Tables 3 and 4 present the ANOVAS for treatments and order.

Table 3

ANOVA for Treatments

Source	df	M.S.	F
Total	17	290.44	
Ss	5	118.44	7.99
Tmts	2	11.885	.834
Error	10	14.82	

Table 4

ANOVA for Order

Source	df	M.S.	F
Total	17	290.44	
Ss	5	118.44	7.88
Order	2	10.89	.725
Error	10	15.02	

Discussion

The results of the present study suggest that the removal of positive reinforcement improved the accuracy of the subjects discriminations relative to either positive reinforcement or combined positive reinforcement and removal of positive reinforcement. It is interesting to note that none of the procedures produced a significant effect on response latency. One might speculate that since there was no difference in response latency, and that percent correct improved only when incorrect responses were punished, that the subjects had in their behavioral reportoire the capacity to emit correct responses when they did not do so.

The nature of the punishment contingency in the present study must be considered in relation to the total availability of reinforcement in the child's environment. Under the combined condition of positive reinforcement and removal of positive reinforcement, all of the children earned positive reinforcement at the end of each session. Only when participation produce a debit in the child's token account was performance improved.

Tramontana & Harris (1972) concluded that the combined procedure of positive reinforcement and response cost was maximally effective in the acquisition of a two-choice discrimination task. It should be noted that within their experimental design, an incorrect response conveyed a similar quantity of information as a correct response. Deese and Hulse (1967), in discussing punishment, state that "punishment does an exemplary job of telling the organism what not to do, but it carries no information by itself which tells an organism what particular cause of behavior should be followed" (p. 236). However, in a two-choice discrimination problem punishment does tell what behavior should be followed. Deese and Hulse conclude, "Punishment can be equally useful in helping along the learning process - particularly when it is used as an information carrying cue and when it is combined with reward for some other kind of behavior" (p.249).

In considering the conclusions of Deese and Hulse with the evidence provided by Timmons (1959) and Tramontana and Harris (1972) and the results of the present study, the superiority of combining response cost with positive reinforcement appears present in a response acquisition task (i.e. trials to criterion measurements and verbal conditioning tasks). However, in the case of steady state behavior, the combination of response cost and positive reinforcement may not be superior. It would appear that the decision to pair response cost with positive reinforcement should consider 1) whether the task is a steady-state behavior or a behavior to be acquired; and 2) the "real" response cost involved in selecting the magnitude of reinforcement lost by incorrect responses.

Chapter II

Study II: Conditioned Emotional Response and Discrimination Learning

Estes and Skinner (1941) demonstrated that a stable operant response could be interrupted by the presentation of a conditioned stimulus (CS) which had been repeatedly paired with an aversive unconditioned stimulus (UCS). The presentation of the CS-UCS is noncontingent on the operant response. The procedures described by Estes and Skinner have been well replicated and the behavioral phenomenon has been used as an experimental analog of anxiety (Brady, 1962). Brady and Hunt (1950) have labeled the disruption of ongoing behavior "conditioned emotional response" (CER), while Stein, Sidman, and Brady (1958) have referred to it as "conditioned suppression." Although the CER is a reliable phenomenon with infrahumans, human CER research has indicated a less marked, more variable behavioral effect.

With one exception (May and Sachs, 1969) all human CER studies have used college students. Edelman (1965), Sachs and May (1967, 1969a, b) Sachs and Keller (1972), and Lebenta and Lyon (1972) have reported weak experimental effects with a large amount of intersubject variability. Relative to infrahumans, humans show greater intersubject variability regarding the presence of the CER, and for those individuals who show a CER, the magnitude of the response is quantitatively smaller.

In a study of the CER with retarded children, May and Sachs (1969) were unable to obtain measurable response suppression, although several of the children demonstrated a total avoidance response to the experimental situation. These authors stated that the failure to obtain the CER with the retardate population may have been due to the complexity of the task relative to the abilities of the children.

Method

Subjects.--The subjects for Study II were drawn from the pool of those subjects who participated in study I. A total of 6 Ss were used in study II.

Apparatus:

The apparatus for the discrimination task is identical to that described in study I, consisting of the automated visual presentation devise, electromechanical programing equipment, and slides. In addition to the equipment used in study I, interval clocks were used to time pre and post-CS intervals. Programing apparatus was located in a room adjacent to that in which the Ss worked.

The UCS was a 1 second 95 db noise produced by a 24 volt electronic horn, model number 145-50N manufactured by Sparton Corporation. The horn was enclosed in a foam packed case which provided necessary attenuation to 95 db and was located above and in front of the subject on top of the stimulus presentation devise. The CS consisted of a 100 watt white bulb centered on top of the automated stimulus presentation devise.

Procedure:

Each child worked at the stimulus presentation devise for 20 minutes per day in a room adjacent to the child classroom. For each correct response a point was added to a counter mounted on a green panel on the left corner of the stimulus presentation devise. At the end of each session, 1 token was awarded for every 20 points earned.

The following conditions were run:

1) Baseline: Prior to the introduction of experimental manipulations,

it was necessary for response rate to stabilize. Five probes were taken daily with each probe consisting of two successive 30 sec. intervals. (The first interval is considered a pre-CS period and the successive interval a post-CS period. If response rate is stable, the difference between pre and post should approximate zero). Response rate was defined as stable when the mean daily suppression ratio of $\frac{\text{pre-post}}{\text{pre+post}}$ was within $\pm.10$.

2) Pseudoconditioning: Pseudoconditioning consisted of presenting the CS without pairing it with the UCS. This condition was continued until the subject's response rate returned to baseline.

3) CER: CER training consisted of pairing the CS with the UCS. Five CER trials were run per session. Each subject received at least 5 sessions of CER training. The CS was presented continuously for the 30 second duration with CS offset being paired with UCS onset.

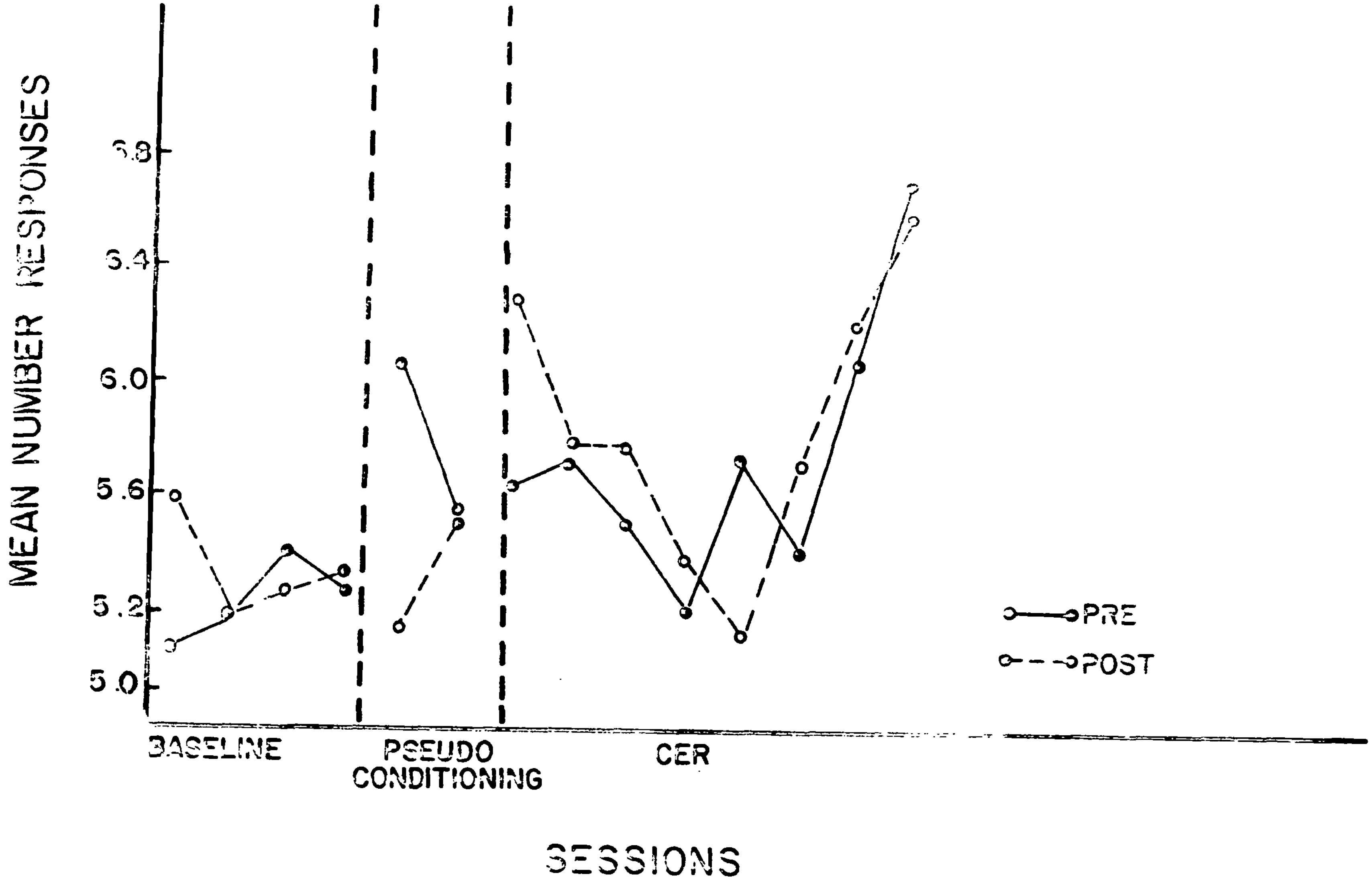
Results

Two dependent variables were utilized in the study: response rate and percent correct discriminations. Each of these dependent measures will be considered separately.

Response Rate:

In that the dependent measures were sampled in 30 second intervals, response rate was used as a measure of speed of discrimination problem solving. Figure 4 presents the mean number of responses across trials per session for the 6 subjects for each condition. During baseline, the difference in response rate between pre and post responding was -.11 response (i.e. pre-post). The initial day of pseudoconditioning produced a marked difference between pre and post response rates, but this difference

Fig. 4. Mean number of responses for the group of 6 subjects for each session per condition. Response rate per session represents the average number of responses in each trial per session. Pre refers to the first 30 second interval and post refers to the second 30 second interval.


MEAN NUMBER RESPONSES
6.8
6.4
6.0
5.6
5.2
5.0
BASELINE
PSEUDO CONDITIONING
CER
SESSIONS
PRE
POST

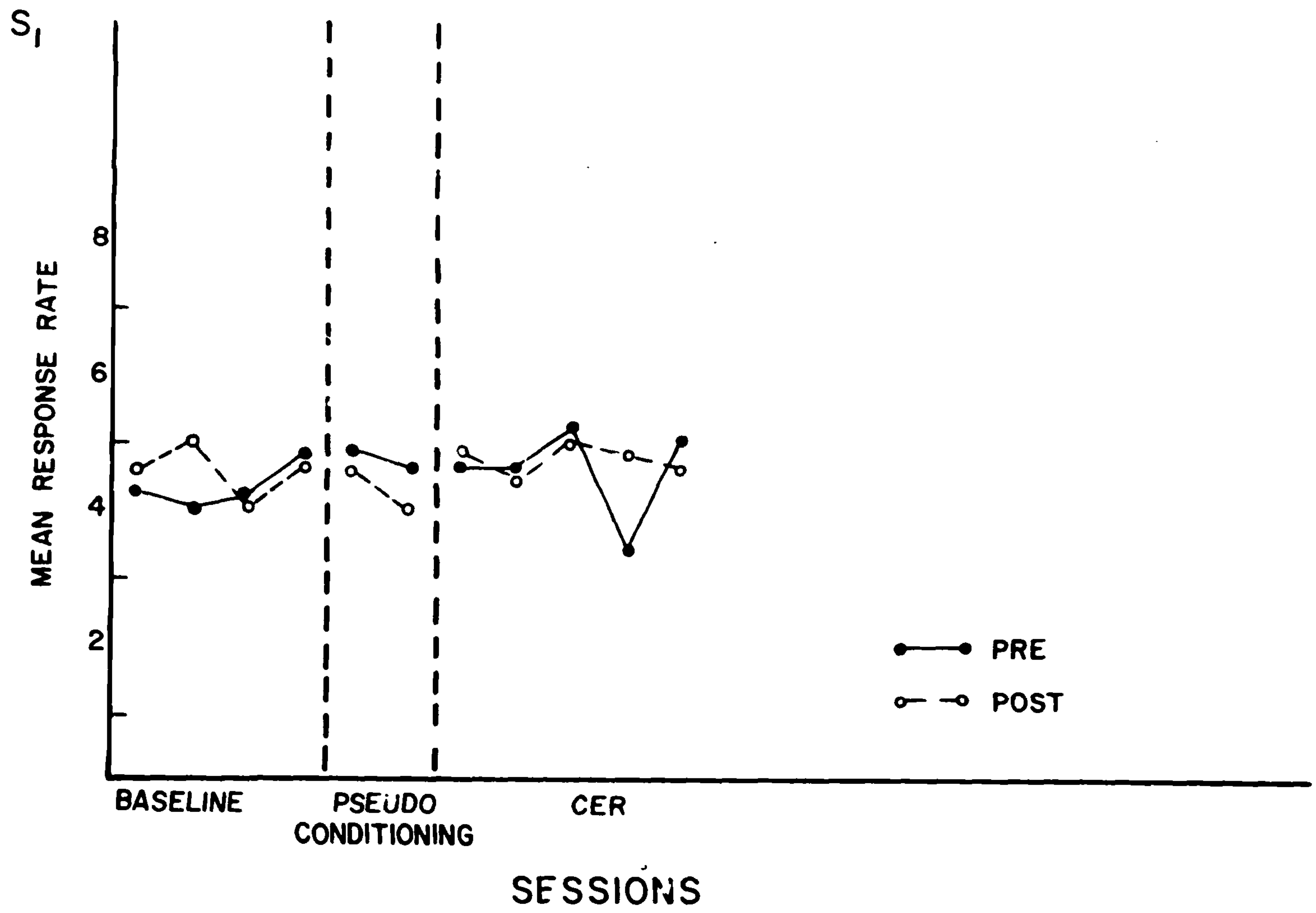
was no longer present with repeated presentation of the CS. Introduction of CER training produced a slight trend in the direction of response facilitation. A one-way repeated measures ANOVA for conditions of baseline, pseudoconditioning, and CER was significant ($F(3,15) = 5.42$ $p < .01$). A Duncan's Multiple Range test indicated that the pseudoconditioning treatment differed significantly from baseline and CER. However, the last session of pseudoconditioning indicated response stability so a t-test was used to compare pre-post differences between baseline and CER. The resulting $t = .0574$ with 10 df was not significant.

Figures 5 thru 10 present the mean response rate across trials per session for each condition for each of the individual Ss. For each subject, a t-test was computed between pre-post difference scores. Only for S3 was the obtained t value significant ($t(10df) = 1.81$ $p < .05$). Inspection of fig. 7 indicates that relative to baseline, S3 showed a slight response facilitation.

Pre and post responses for each subject for the last session of baseline and all sessions of pseudoconditioning and CER training are presented in figures 11 thru 16. No consistent patterns were noted during CER training, for any of the sessions which would warrant a generalized conclusion.

Traditionally, differences between pre and post CS responding within a CER paradigm have been presented in the form of a suppression ratio (i.e. $\frac{\text{pre-post}}{\text{pre+post}}$). Figure 17 presents the mean suppression ratio per session for the total sample, and figures 18-23 present the ratios for each trial for each condition for individual Ss. For the combined sample (fig. 17), ratios ranged from -.032 to +.072. Generally, ratios with $\pm .10$ are considered

Fig. 5. Mean number of response per session for conditions of baseline, pseudoconditioning and CER for S1. Pre denotes the first 30 second interval and post denotes the second 30 second interval. Data represent the mean per trial within session.



S1
MEAN RESPONSE RATE
8
6
4
2
BASELINE
PSEUDO CONDITIONING
CER
SESSIONS
PRE
POST

Fig. 6. Mean number of responses per session for conditions of baseline, pseudoconditioning, and CER for S2. Pre denotes the first 30 second interval and post denotes the second 30 second interval. Data represent the mean per trial with each session.

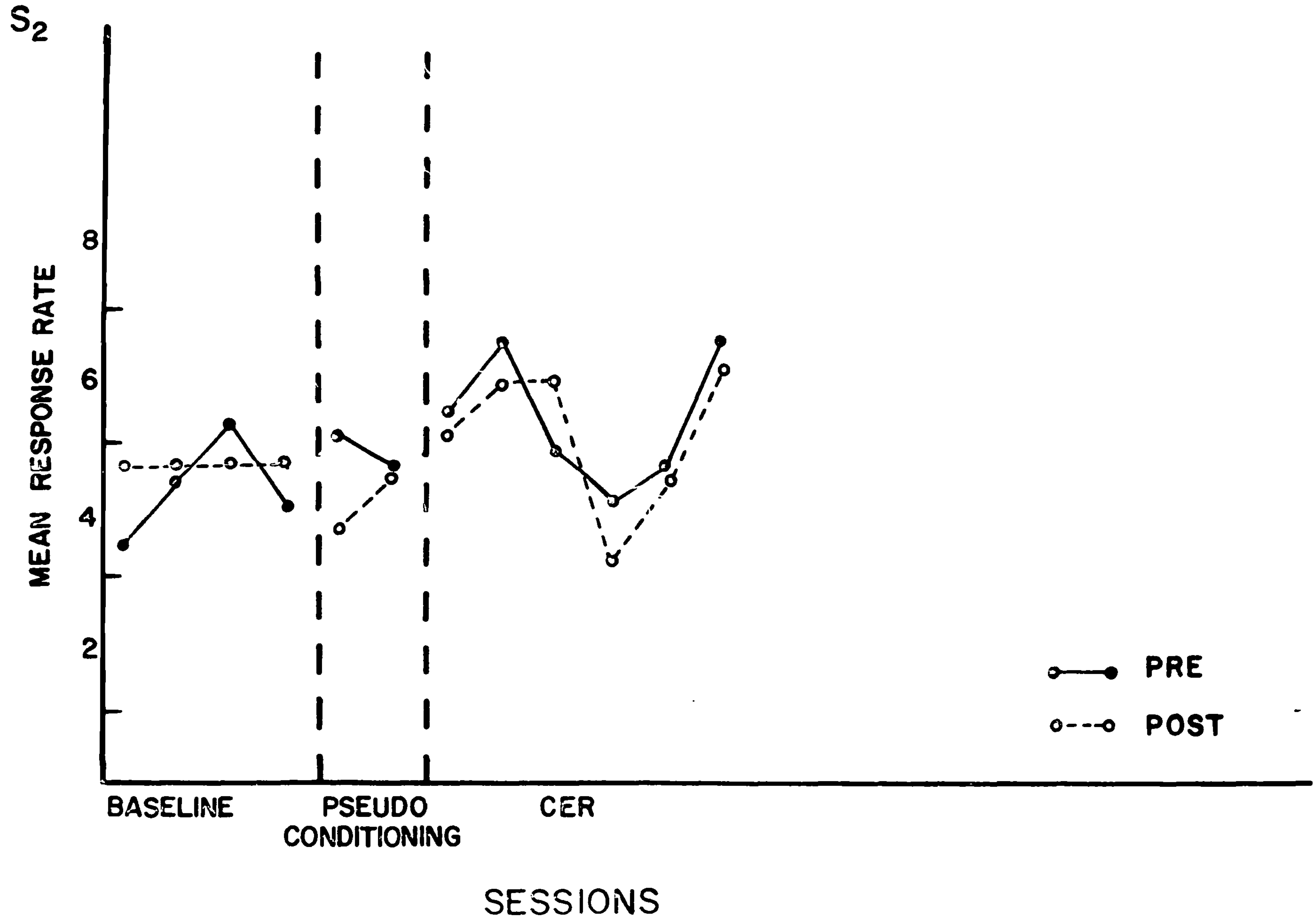

S2
MEAN RESPONSE RATE
8
6
4
2
BASELINE
PSEUDO CONDITIONING
CER
SESSIONS
PRE
POST

Fig. 7. Mean number of responses per session for conditions of baseline, pseudoconditioning, and CER for S3. Pre denotes the first 30 second interval and post denotes the second 30 second interval. Data represent the mean per trial within each session.

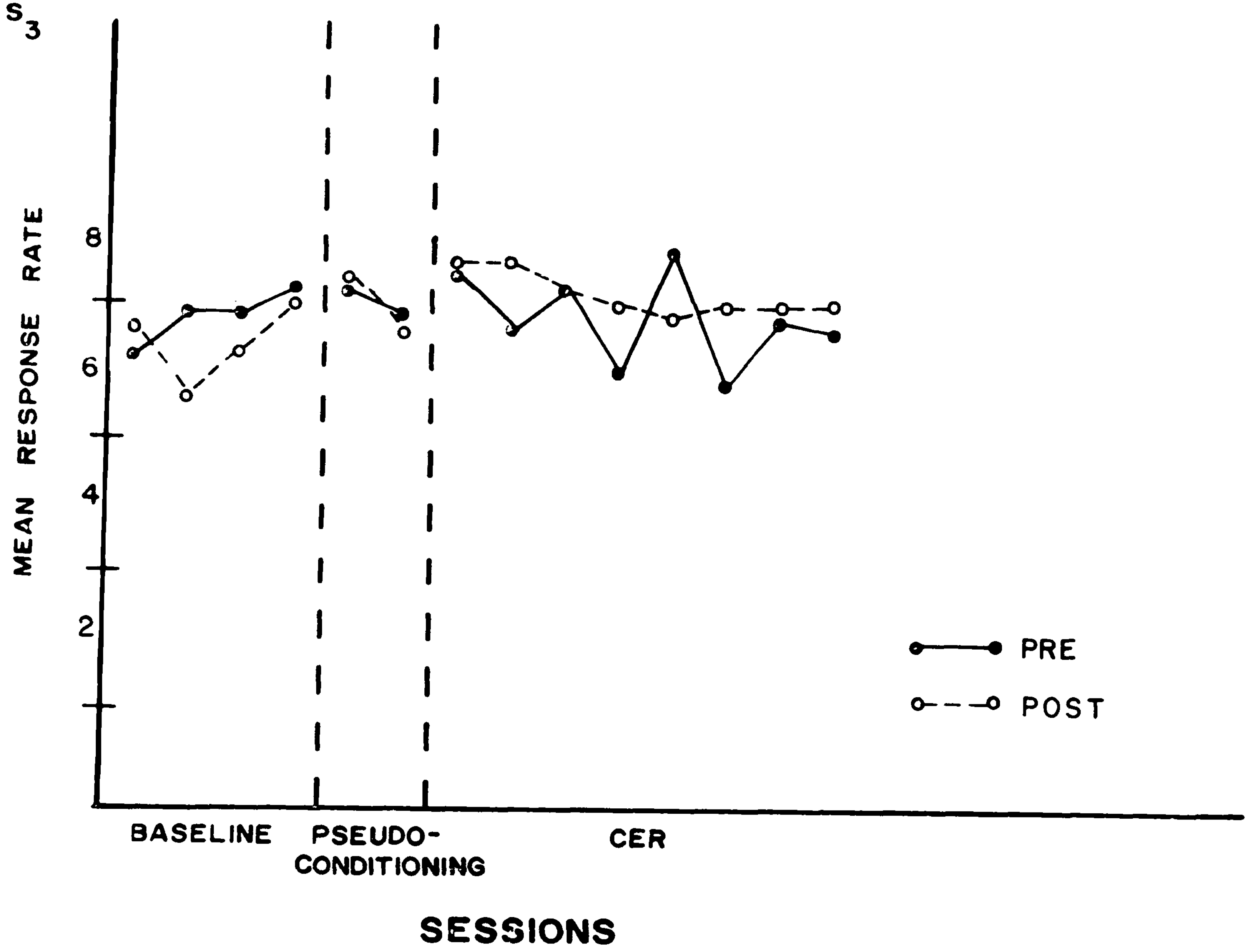

S3
MEAN RESPONSE RATE
8
6
4
2
BASELINE
PSEUDO-CONDITIONING
CER
SESSIONS
PRE
POST

Fig. 8. Mean number of responses per session for conditions of baseline, pseudoconditioning and CER for S4. Pre denotes the first 30 second interval and post denotes the second 30 second interval. Data represent the mean per trial within each session.

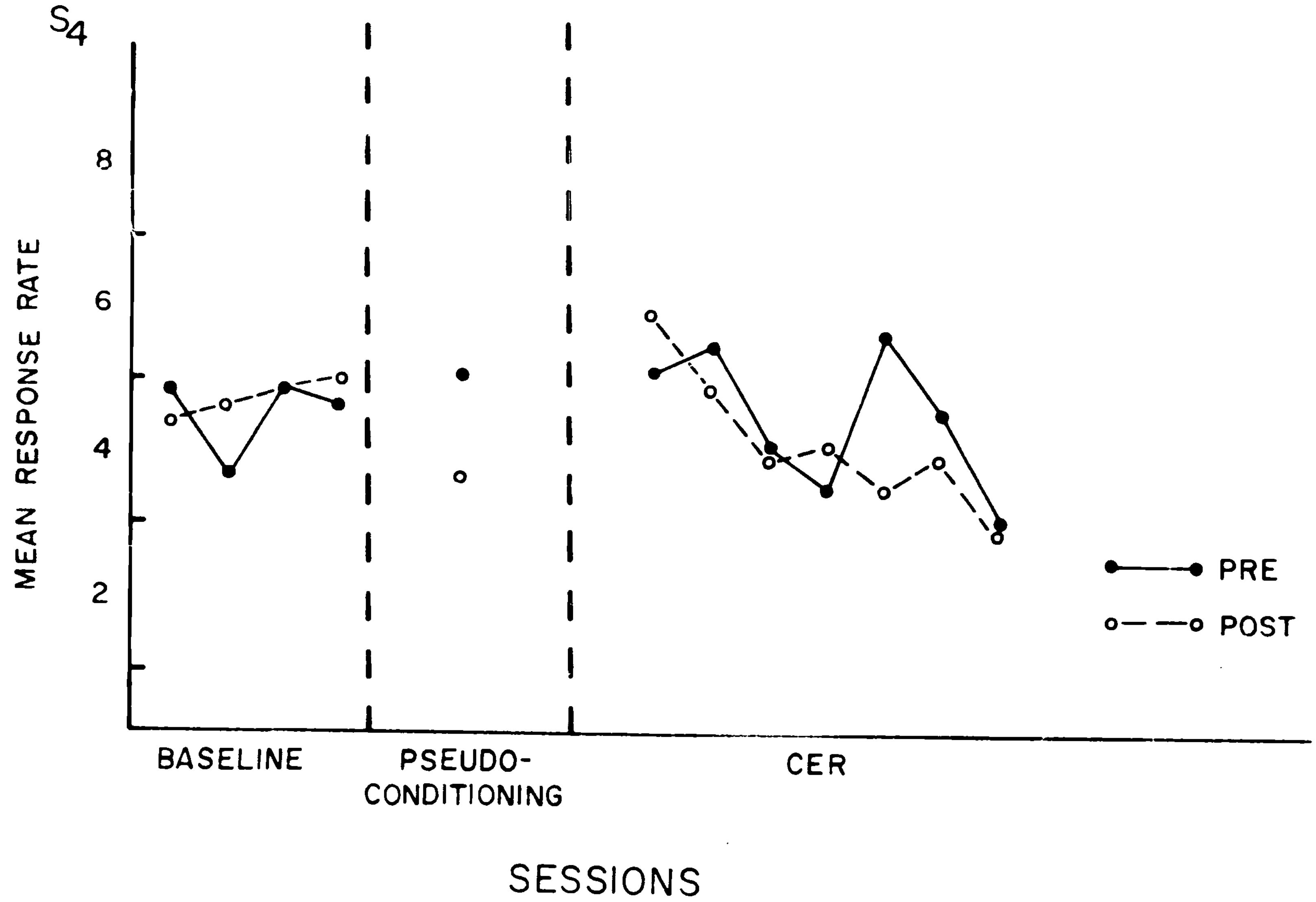
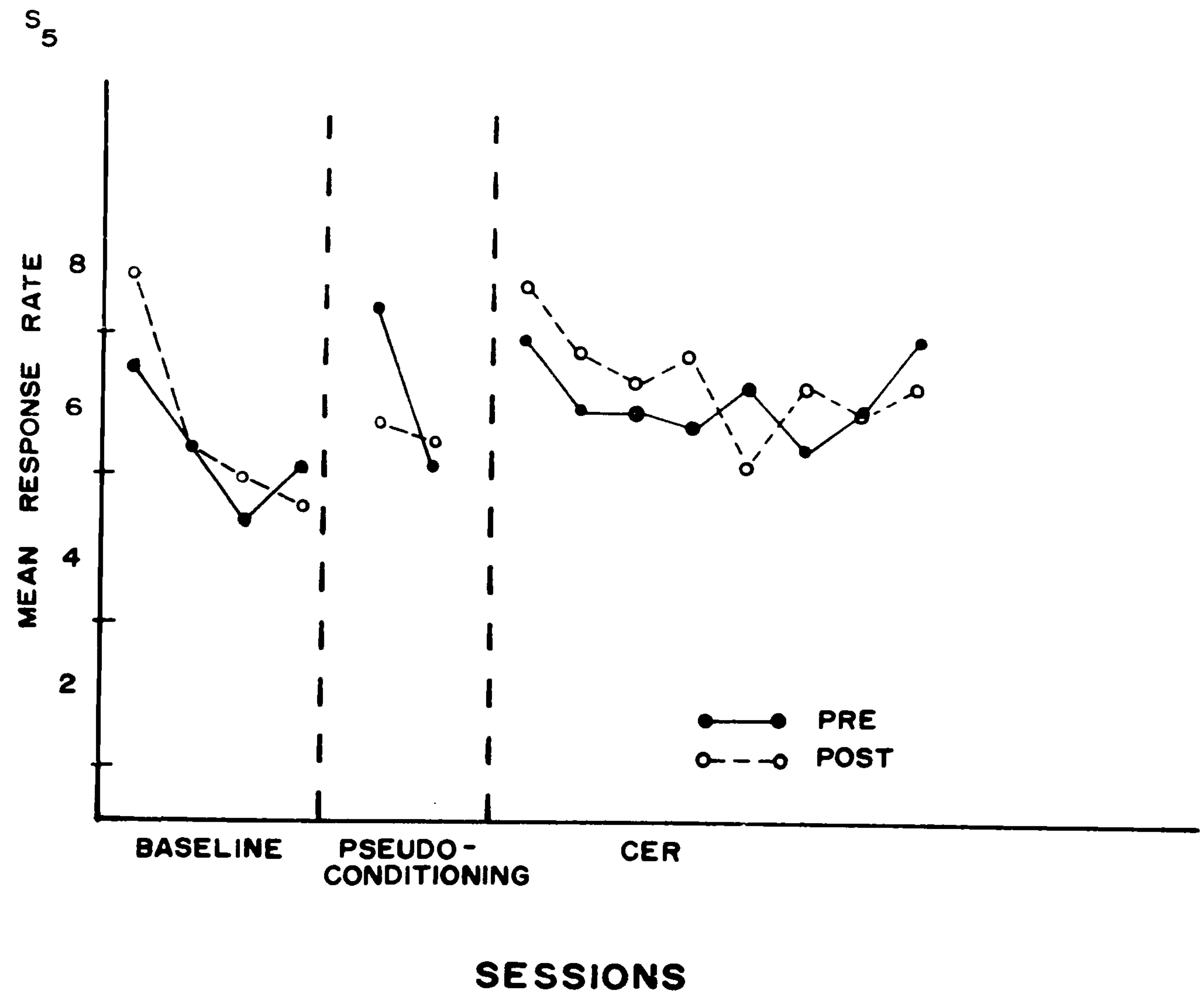

S4
MEAN RESPONSE RATE
8
6
4
2
BASELINE
PSEUDO-
CONDITIONING
CER
SESSIONS
PRE
POST

Fig. 9. Mean number of responses per session for conditions of baseline, pseudoconditioning, and CER for $S5$. Pre denotes the first 30 second interval and post denotes the second 30 second interval. Data represent the mean per trial within each session.



S_5
MEAN RESPONSE RATE
8
6
4
2
BASELINE
PSEUDO-
CONDITIONING
CER
PRE
POST
SESSIONS

Fig. 10. Mean number of responses per session for conditions of baseline, pseudoconditioning, and CER for S6. Pre denotes the first 30 second interval and post denotes the second 30 second interval.

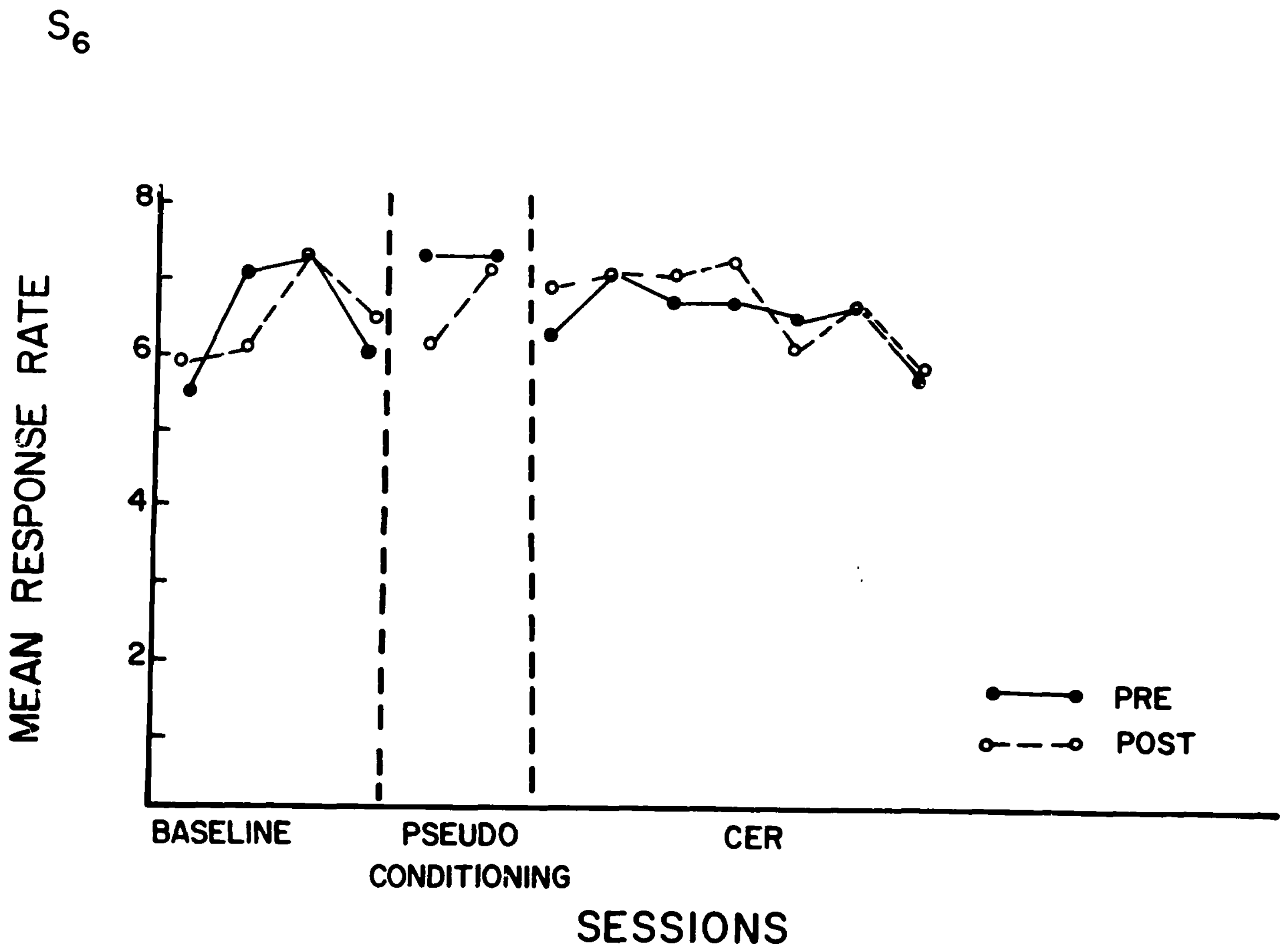

S6
MEAN RESPONSE RATE
8
6
4
2
BASELINE
PSEUDO CONDITIONING
CER
SESSIONS
PRE
POST

Fig. 11. Number of responses for pre and post 30 second intervals for the last session of baseline and for all sessions of pseudoconditioning and CER for S1.

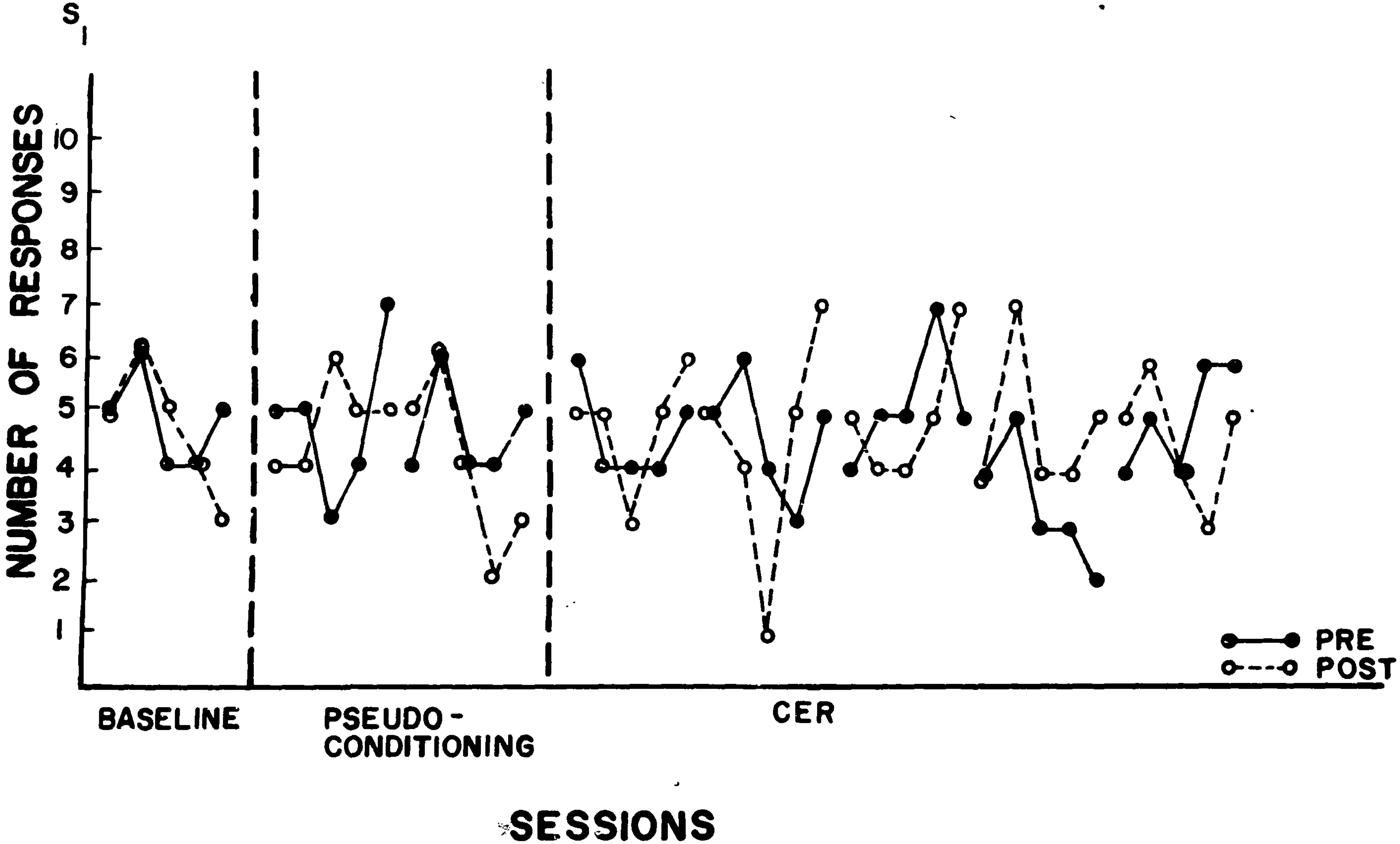
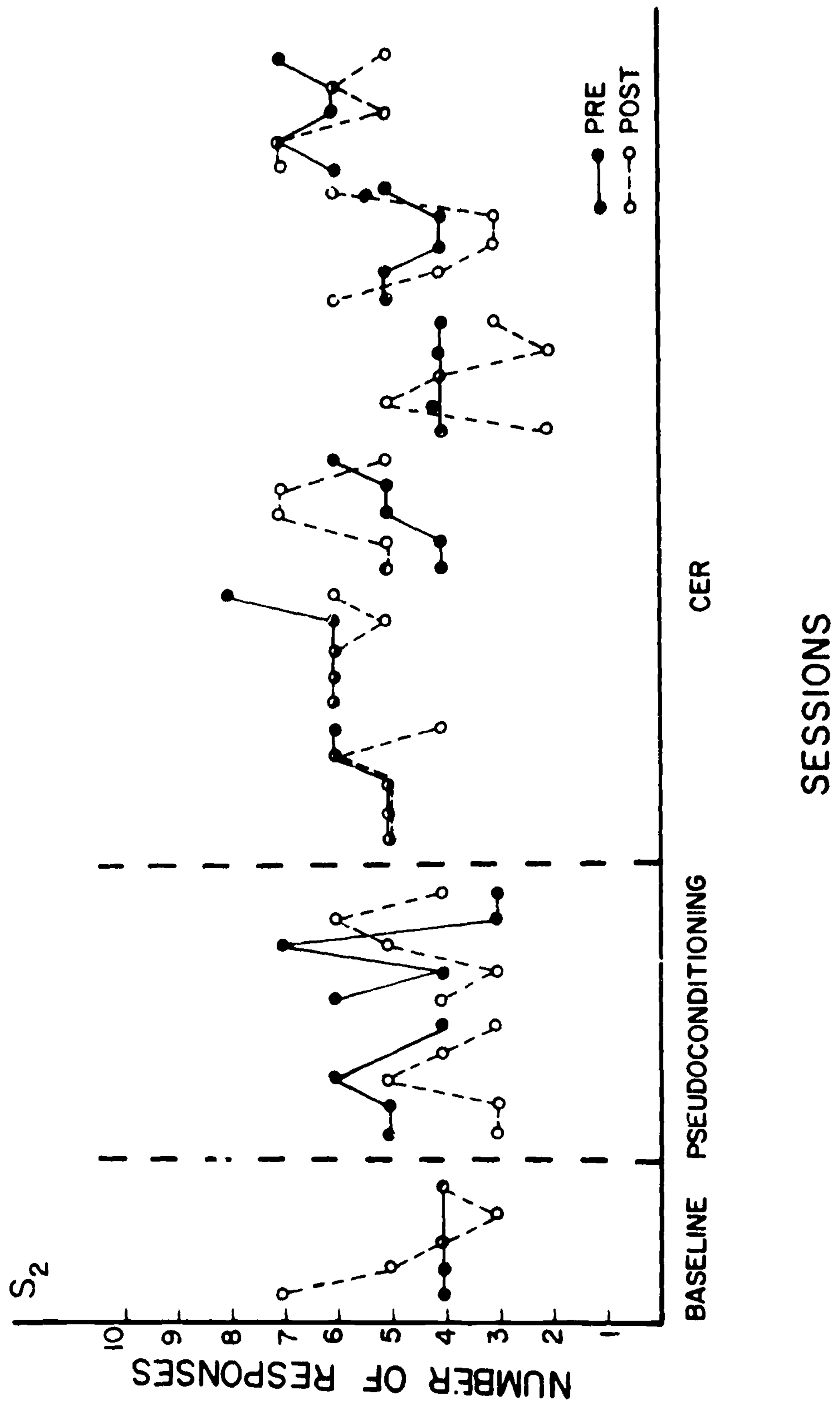

S1
NUMBER OF RESPONSES
1
2
3
4
5
6
7
8
9
10
BASELINE
PSEUDO-CONDITIONING
CER
PRE
POST
SESSIONS

Fig. 12. Number of responses for pre and post 30 second intervals for the last session of baseline and for all sessions of pseudoconditioning and CER for S2.



S2
NUMBER OF RESPONSES
1
2
3
4
5
6
7
8
9
10
BASELINE
PSEUDOCONDITIONING
CER
SESSIONS
PRE
POST

Fig. 13. Number of responses for pre and post 30 second intervals for the last session of baseline and for all sessions of pseudoconditioning and CER for S3.

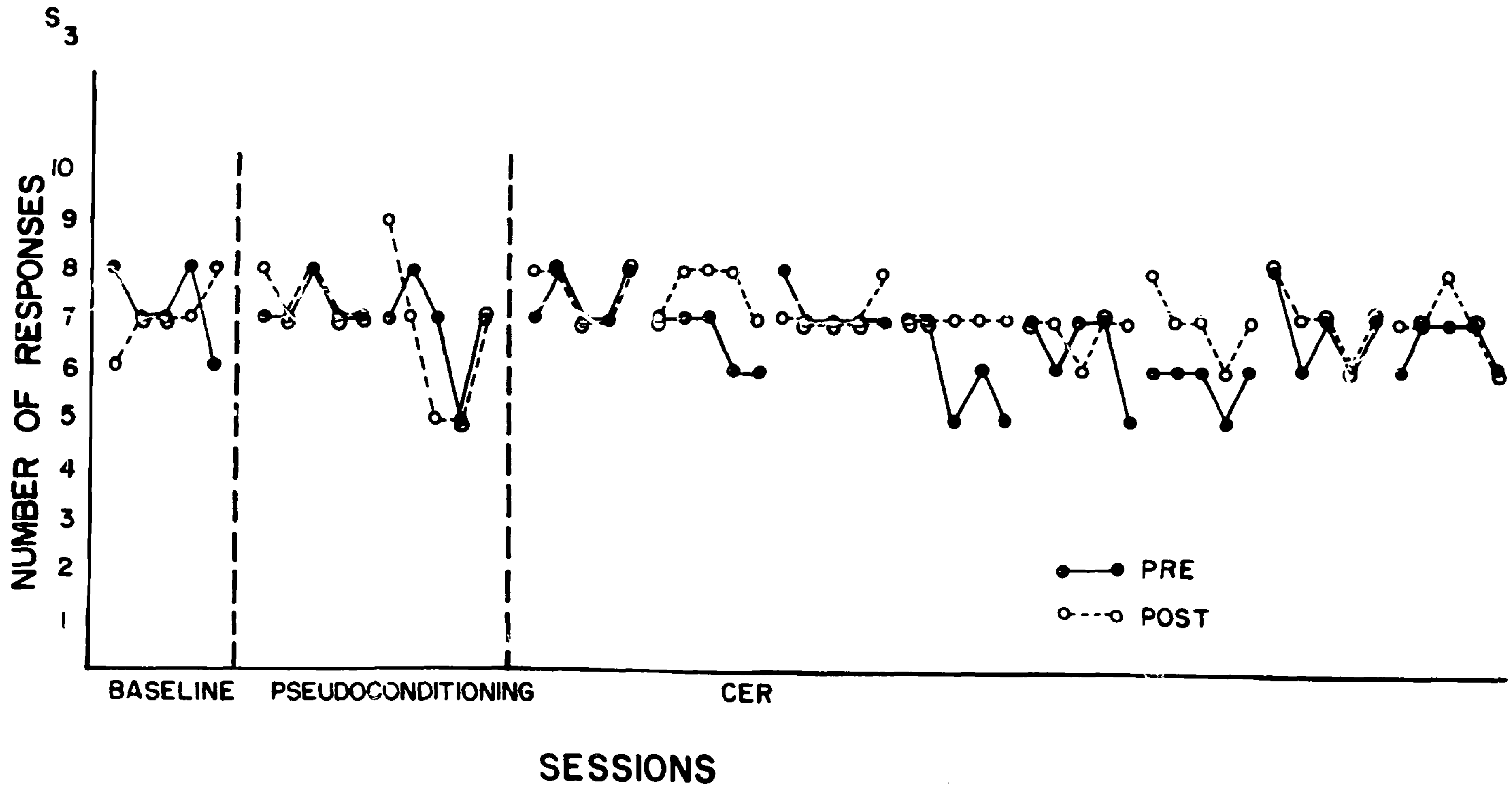

S 3
NUMBER OF RESPONSES
10
9
8
7
6
5
4
3
2
1
BASELINE
PSEUDOCONDITIONING
CER
SESSIONS
PRE
POST

Fig. 14. Number of responses for pre and post 30 second intervals for the last session of baseline and for all sessions of pseudoconditioning and CER for S4.

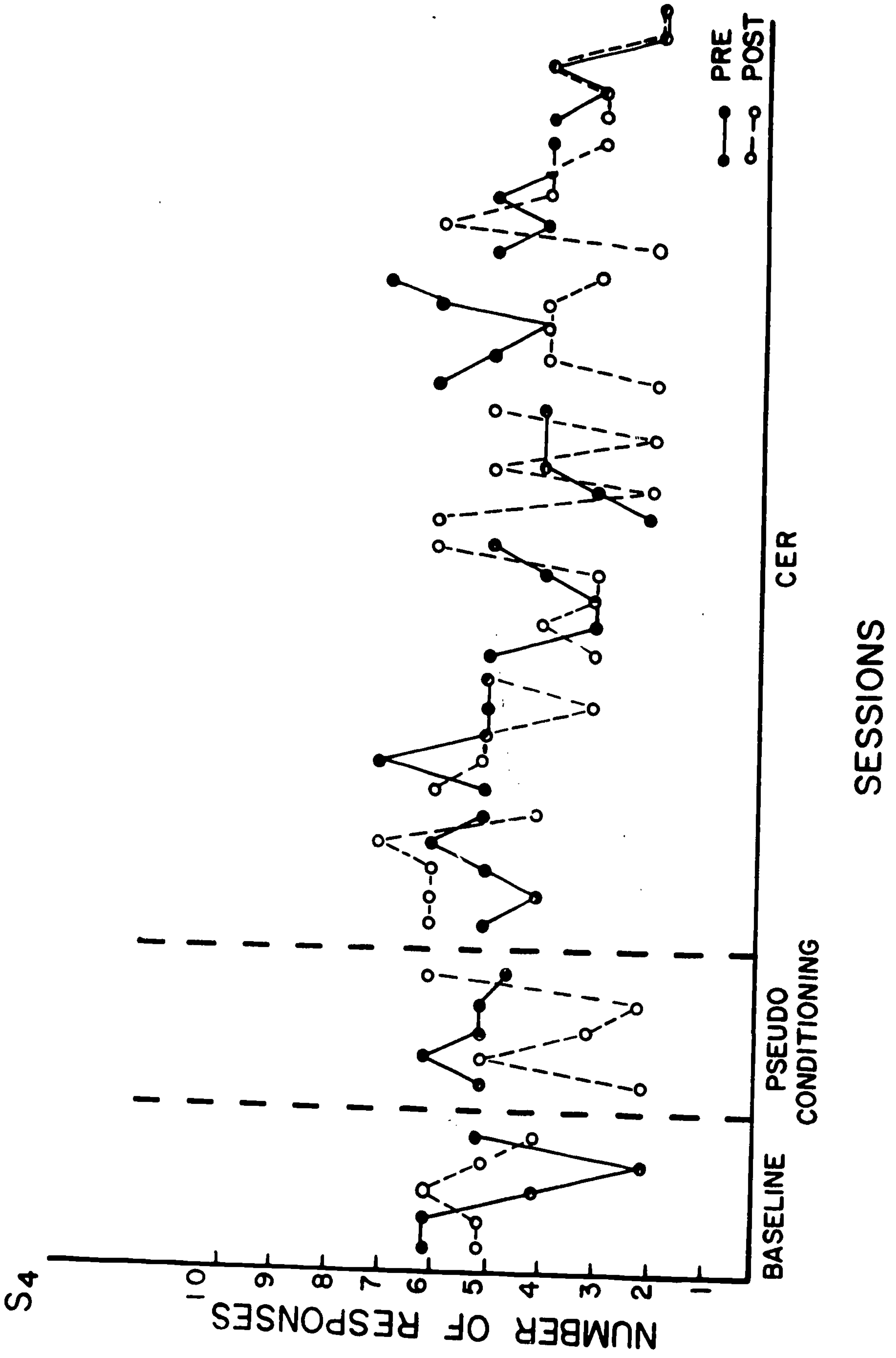
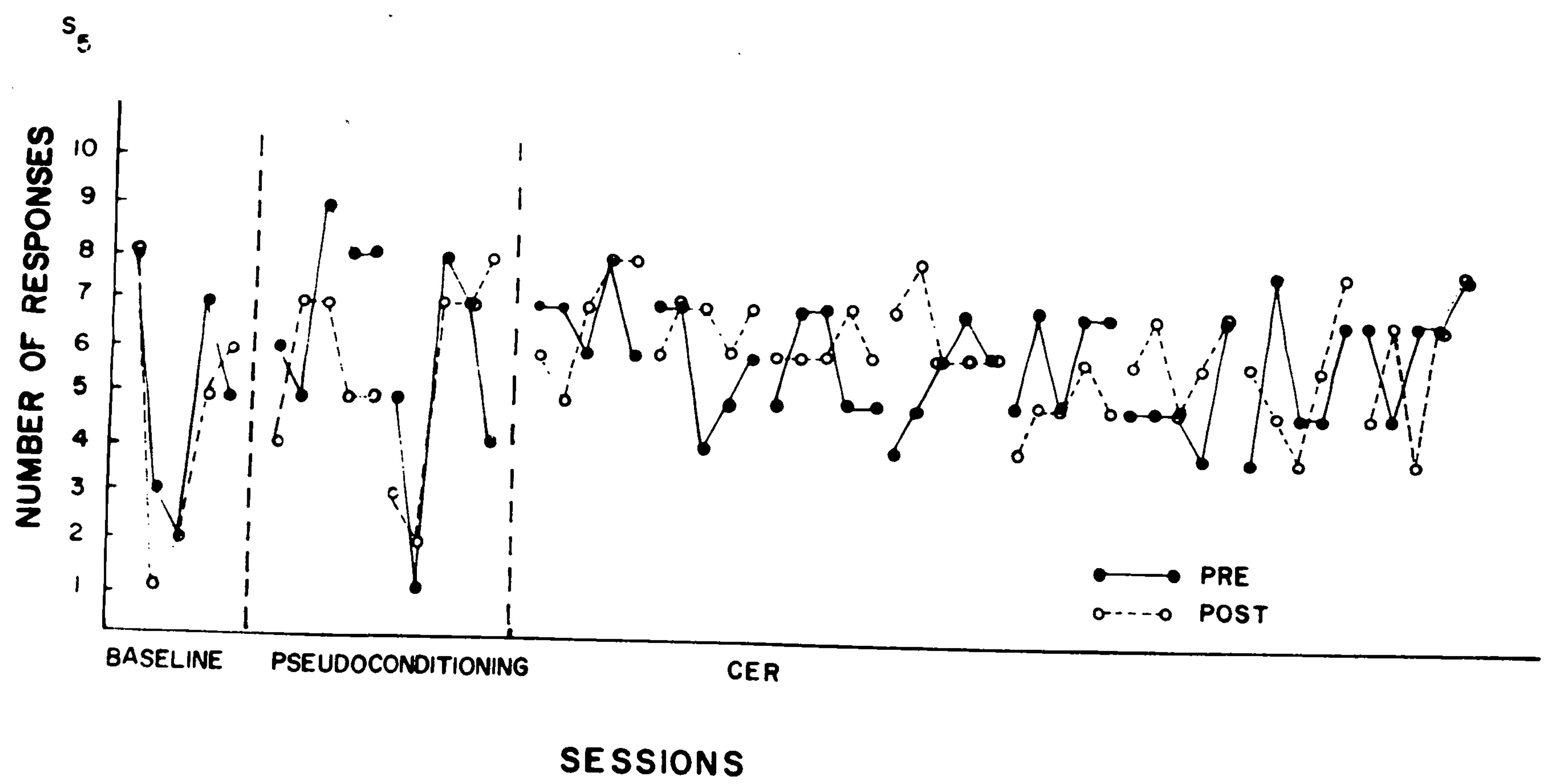

S4
NUMBER OF RESPONSES
1
2
3
4
5
6
7
8
9
10
BASELINE
PSEUDO CONDITIONING
CER
SESSIONS
PRE
POST

Fig. 15. Number of responses for pre and post 30 second intervals for the last session of baseline and for all sessions of pseudoconditioning and CER for S5.



S_5
NUMBER OF RESPONSES
10
9
8
7
6
5
4
3
2
1
BASELINE
PSEUDOCONDITIONING
CER
PRE
POST
SESSIONS

Fig. 16. Number of responses for pre and post 30 second intervals for the last session of baseline and for all sessions of pseudoconditioning and CER for S6.

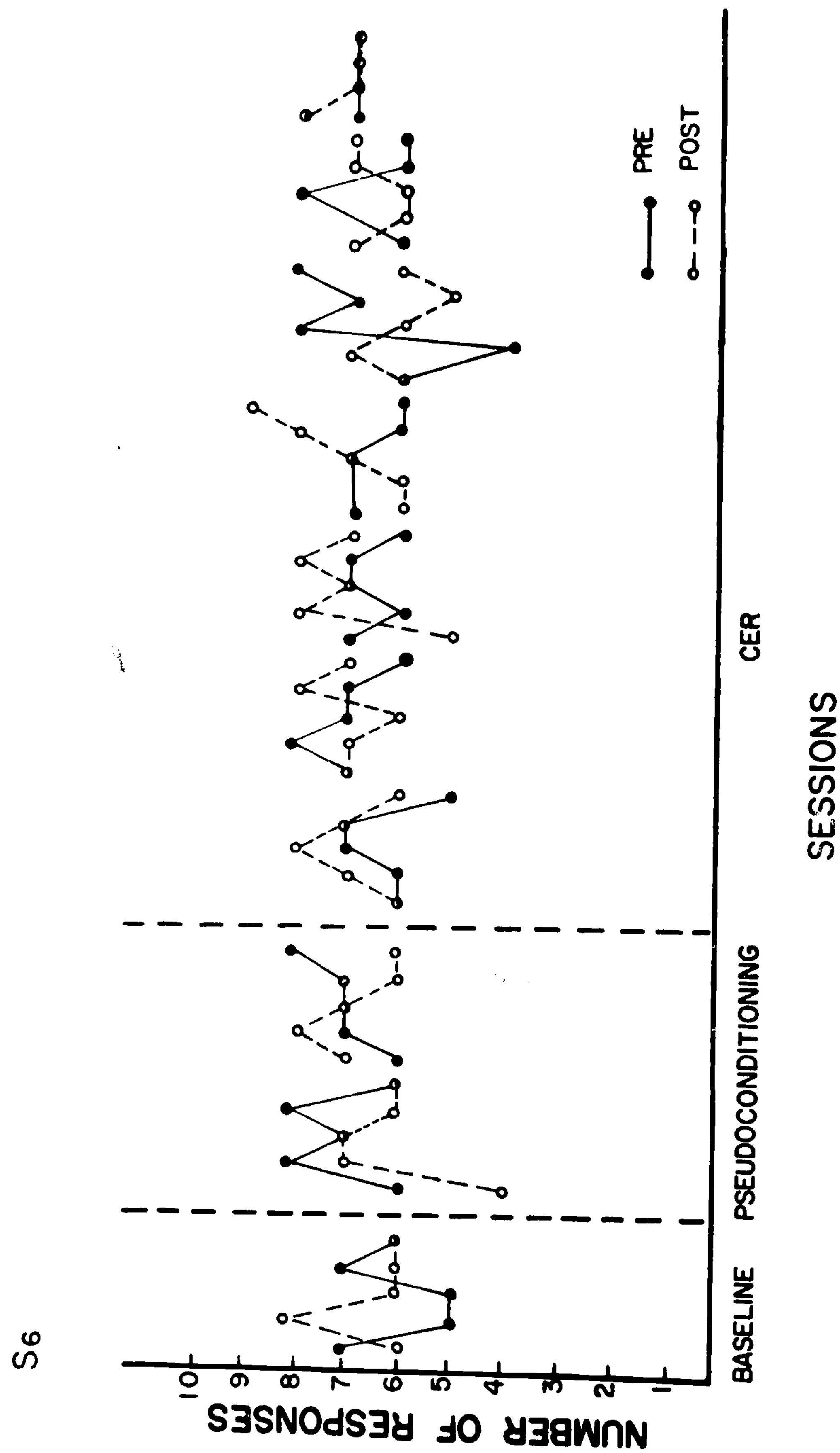

S6
NUMBER OF RESPONSES
10
9
8
7
6
5
4
3
2
1
BASELINE
PSEUDOCONDITIONING
CER
SESSIONS
PRE
POST

Fig. 17. Mean suppression ratios per session for the sample of 6 Ss for conditions of baseline, pseudoconditioning and CER. (Suppression ratios were computed by the formula $\frac{pre-post}{pre+post}$. Negative ratios indicate more responses occurred during the post-CS interval and positive ratios indicate fewer responses occurred during the post-CS interval).

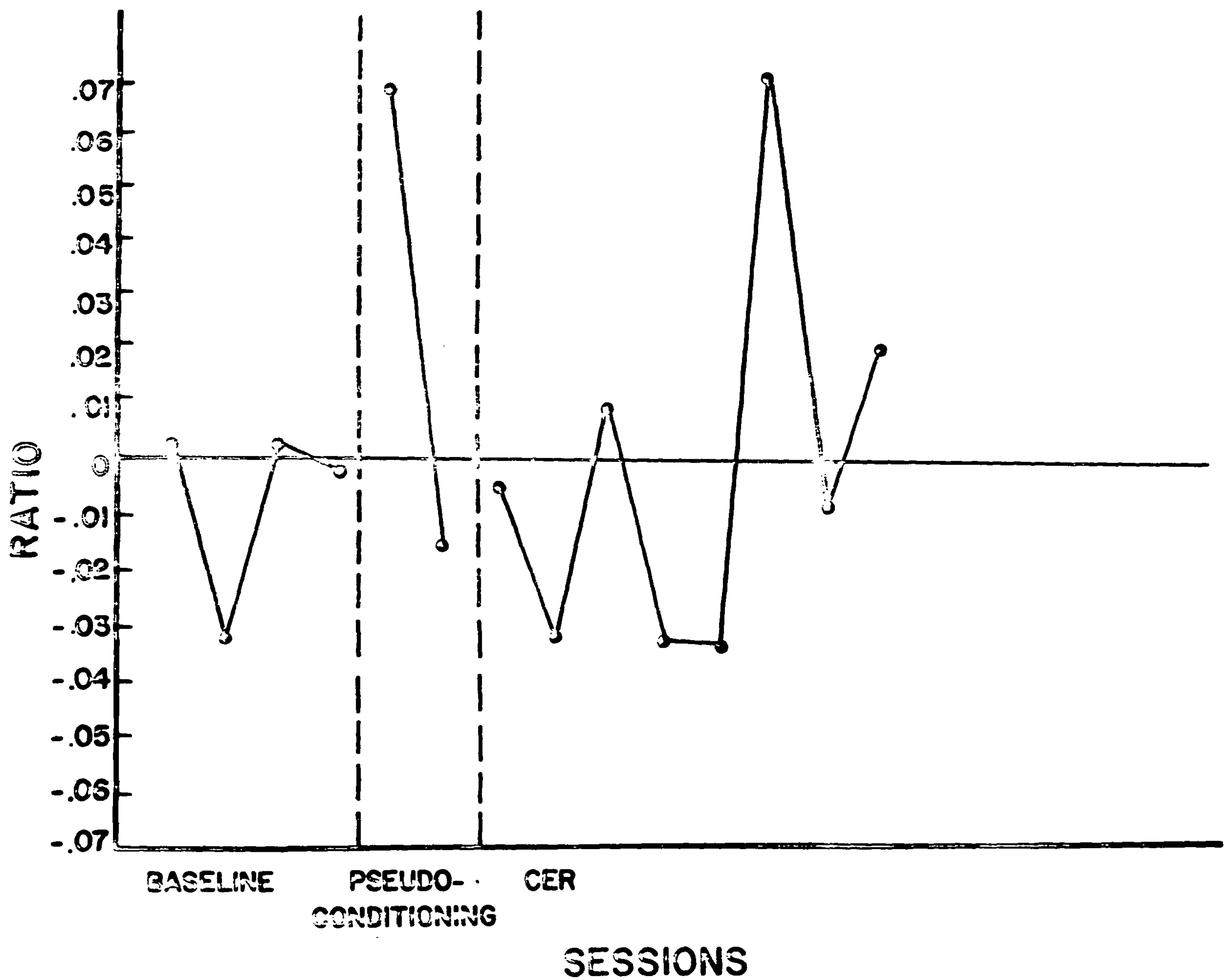
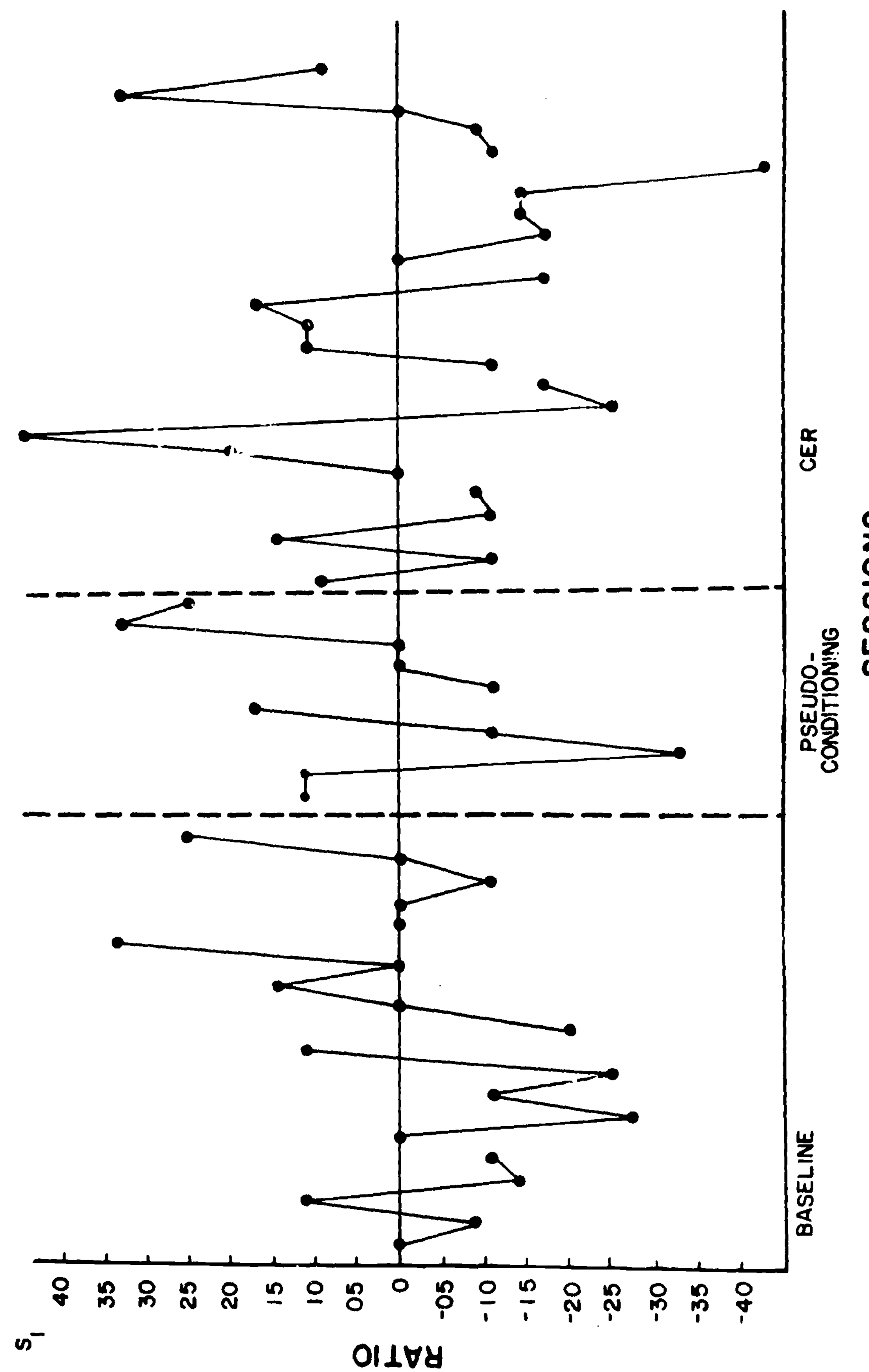

RATIO
.07
.06
.05
.04
.03
.02
.01
0
-.01
-.02
-.03
-.04
-.05
-.06
-.07
BASELINE
PSEUDO-CONDITIONING
CER
SESSIONS

Fig. 18. Mean suppression ratio per trial for conditions of baseline, pseudoconditioning, and CER for S1. (Suppression ratios were computed by the formula $\frac{\text{pre-post}}{\text{pre+post}}$. Negative ratios indicate more responses occurred during the post-CS interval and positive ratios indicate fewer response occurred during the post-CS interval).



S1
RATIO
40 35 30 25 20 15 10 05 0 -05 -10 -15 -20 -25 -30 -35 -40
BASELINE
PSEUDO-CONDITIONING
CER
SESSIONS

Fig. 19. Mean suppression ratio per trial for conditions of baseline, pseudoconditioning, and CER for S2. (Suppression ratios were computed by the formula $\frac{\text{pre-post}}{\text{pre+post}}$. Negative ratios indicate more responses occurred during the post-CS interval and positive ratios indicate fewer responses occurred during the post-CS interval).

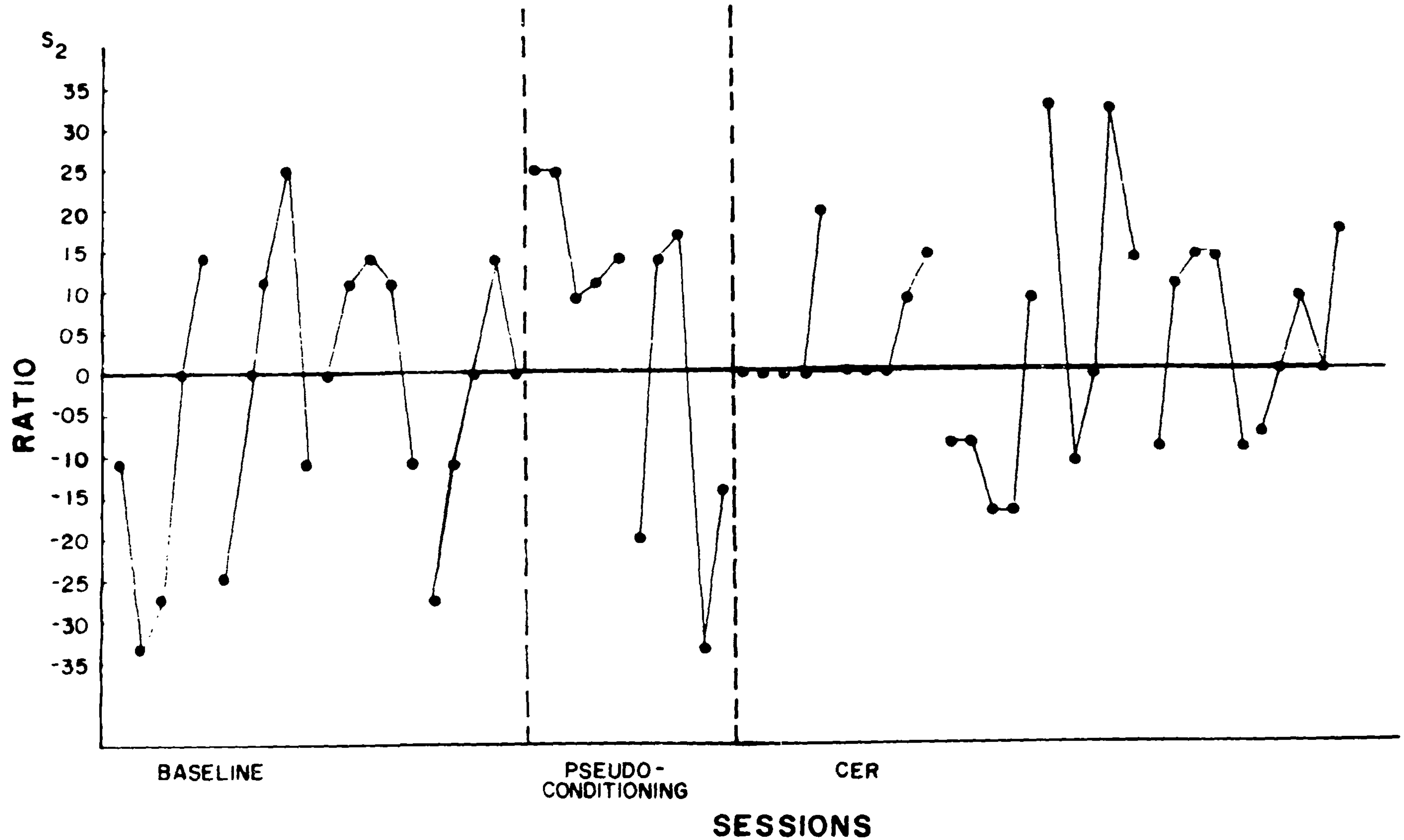
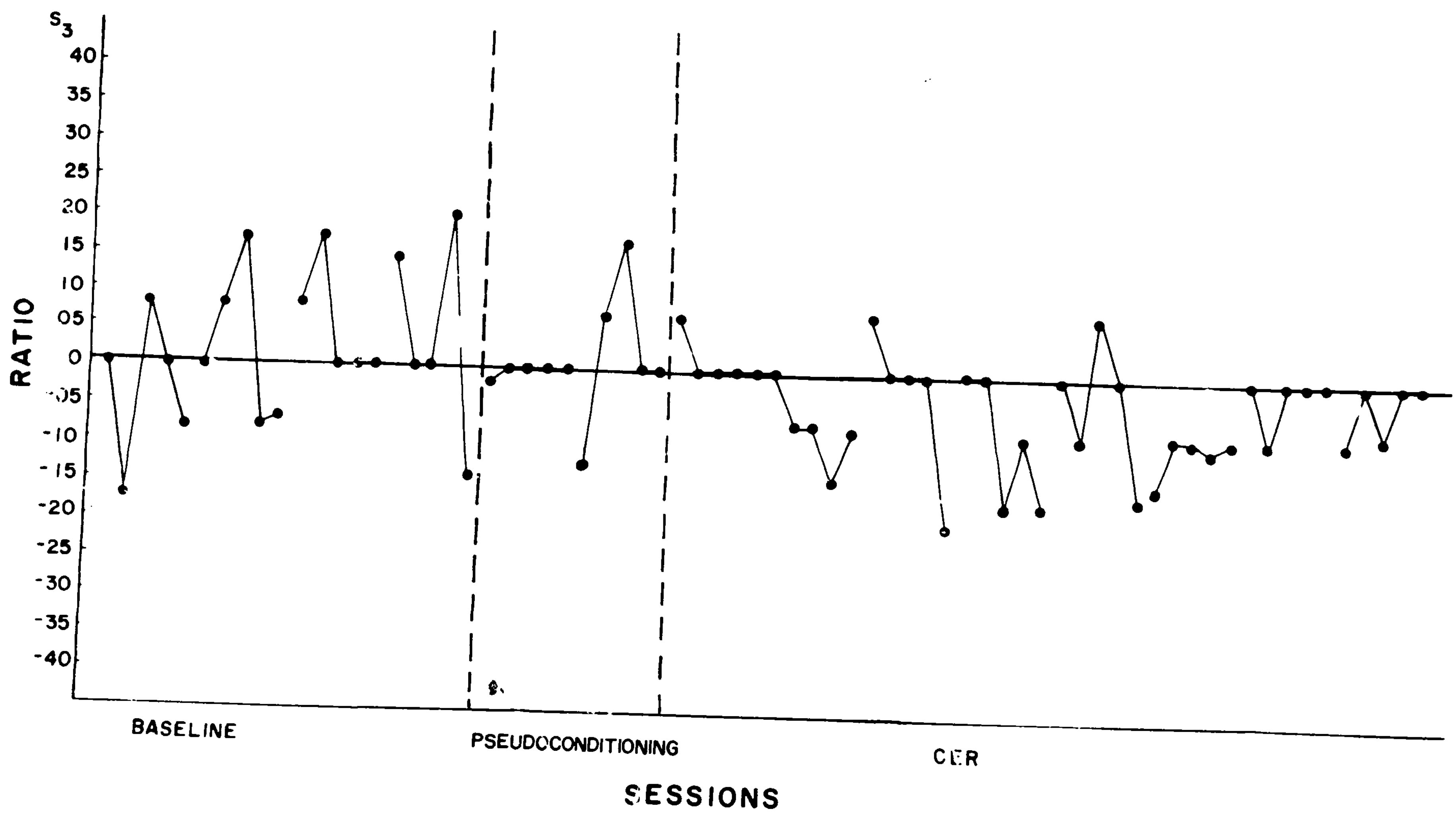

S2
35
30
25
20
15
10
05
0
-05
-10
-15
-20
-25
-30
-35
RATIO
BASELINE
PSEUDO-
CONDITIONING
CER
SESSIONS

Fig. 20. Mean suppression ratio per trial for conditions of baseline, pseudoconditioning, and CER for *S*3. (Suppression ratios were computed by the formula $\frac{\text{pre-post}}{\text{pre+post}}$. Negative ratios indicate more responses occurred during the post-CS interval and positive ratios indicate fewer responses occurred during the post-CS interval).



S_3
RATIO
40
35
30
25
20
15
10
05
0
-05
-10
-15
-20
-25
-30
-35
-40
BASELINE
PSEUDOCONDITIONING
CER
SESSIONS

Fig. 21. Mean suppression ratio per trial for conditions of baseline, pseudoconditioning, and CER for S4. (Suppression ratios were computed by the formula $\frac{\text{pre-post}}{\text{pre+post}}$. Negative ratios indicate more responses occurred during the post-CS interval and positive values indicate fewer responses occurred during the post-CS interval).

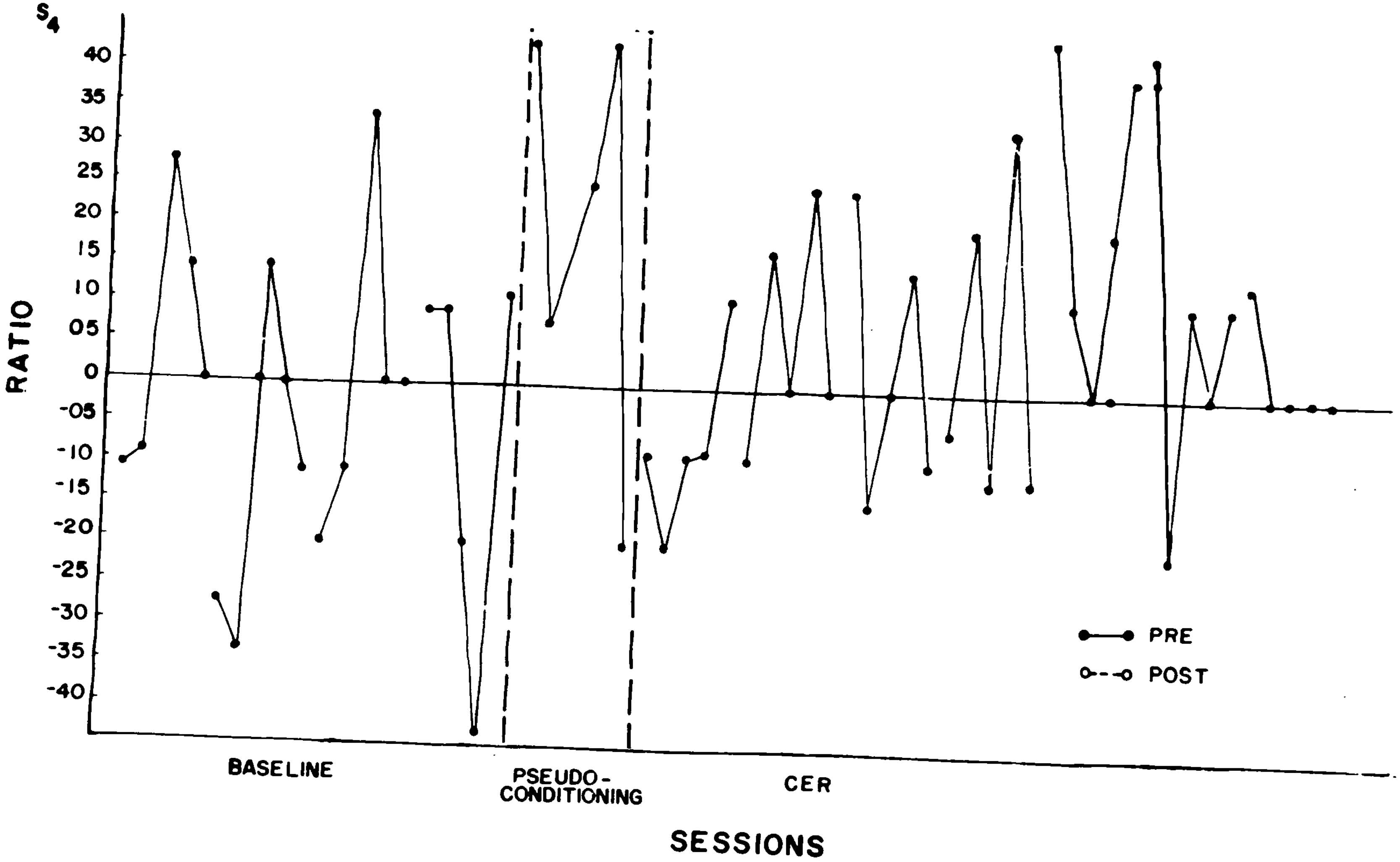
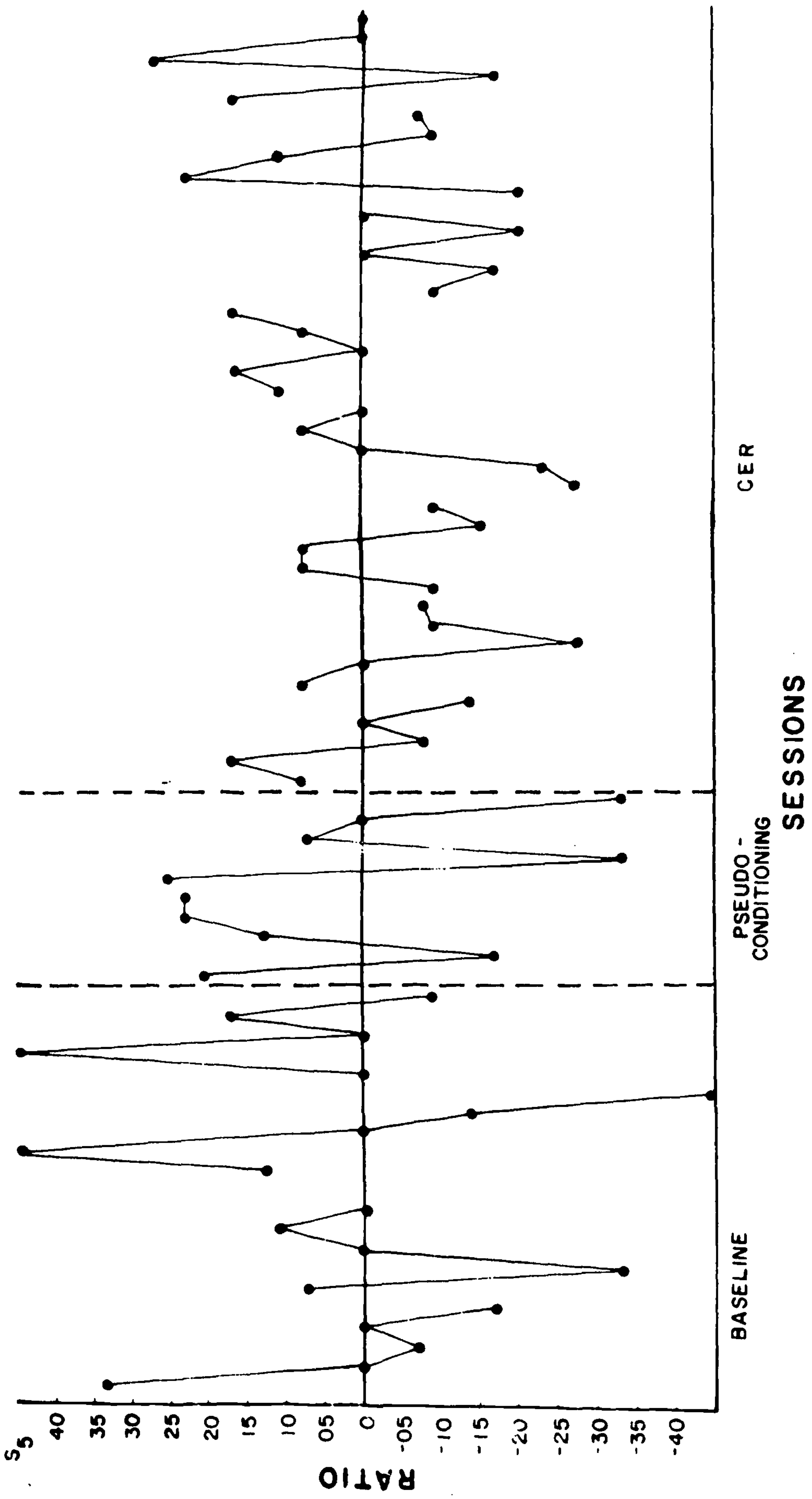

S4
RATIO
40
35
30
25
20
15
10
05
0
-05
-10
-15
-20
-25
-30
-35
-40
BASELINE
PSEUDO-
CONDITIONING
CER
SESSIONS
PRE
POST

Fig. 22. Mean suppression ratio per trial for conditions of baseline, pseudoconditioning, and CER for S5. (Suppression ratios were computed by the formula $\frac{\text{pre-post}}{\text{pre+post}}$. Negative ratios indicate more responses occurred during the post-CS interval and positive ratios indicate fewer responses occurred during the post-CS interval).



RATIO
S5
45
40
35
30
25
20
15
10
05
0
-05
-10
-15
-20
-25
-30
-35
-40
BASELINE
PSEUDO-CONDITIONING
CER
SESSIONS

Fig. 23. Mean suppression ratio per trial for conditions of baseline, pseudoconditioning, and CER for S6. (Suppression ratios were computed by the formula $\frac{\text{pre-post}}{\text{pre+post}}$. Negative ratios indicate more responses occurred during the post-CS interval and positive values indicate fewer responses occurred during the post-CS interval).

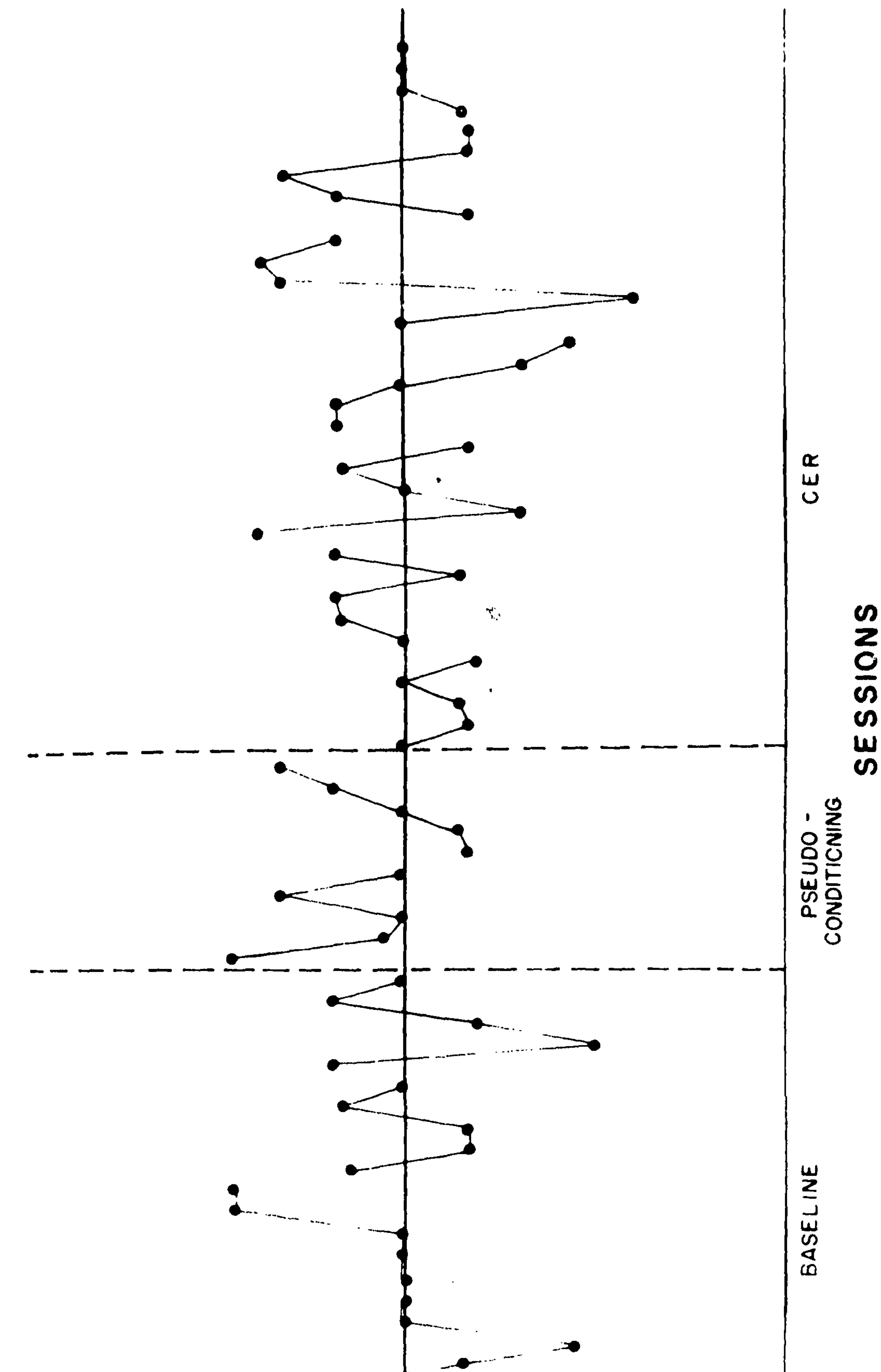

RATIO
SESSIONS
BASELINE
PSEUDO - CONDITICNING
CER
40
30
25
20
15
10
0
-05
-15
-20
-25
-40

Fig. 24. Mean percent correct for pre and post 30 second intervals for the total sample for each session per condition.

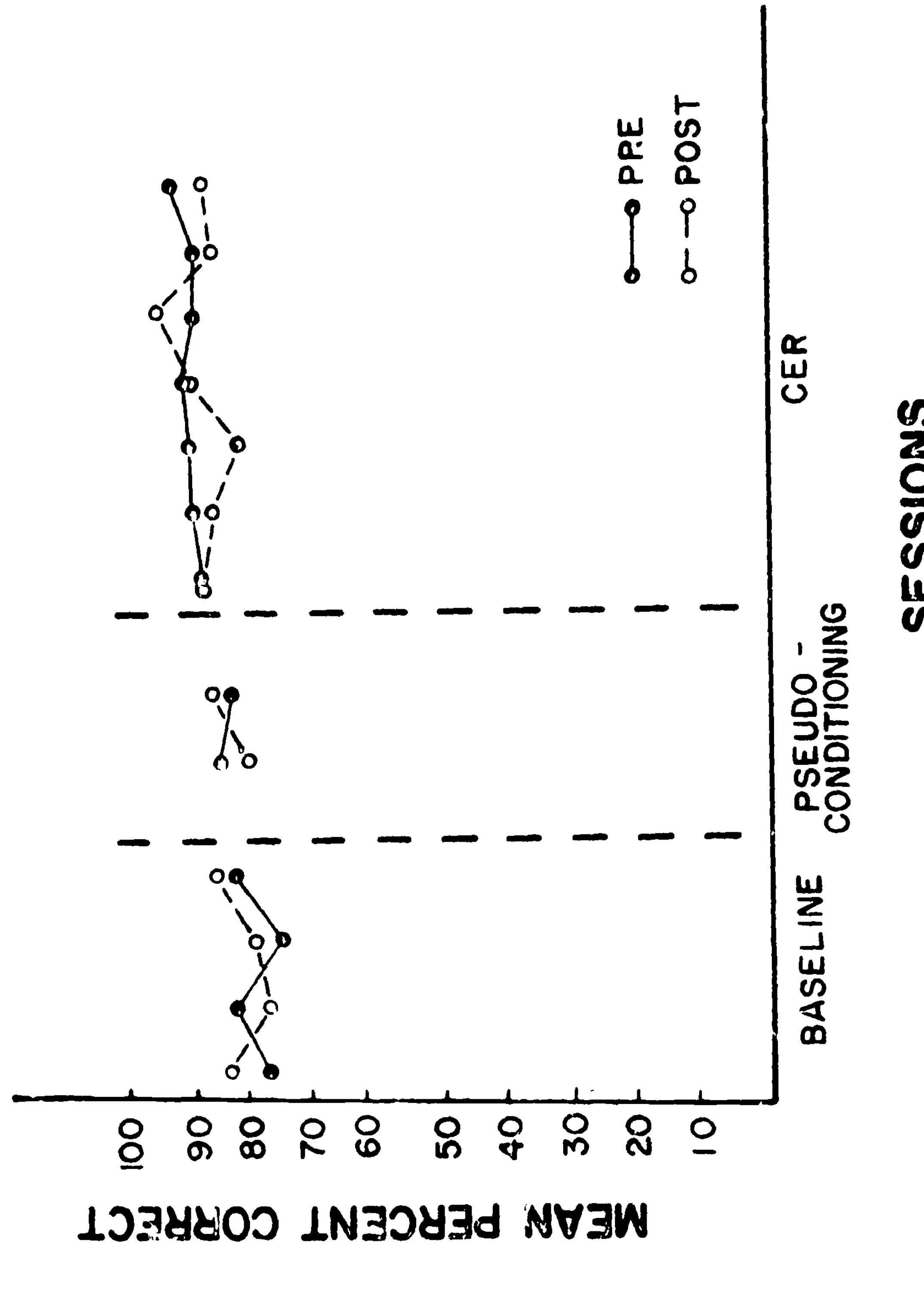

MEAN PERCENT CORRECT
100
90
80
70
60
50
40
30
20
10
BASELINE
PSEUDO - CONDITIONING
CER
SESSIONS
PRE
POST

Fig. 25. Mean percent correct for pre and post 30 second intervals for each session per condition for $\underline{S}1$.

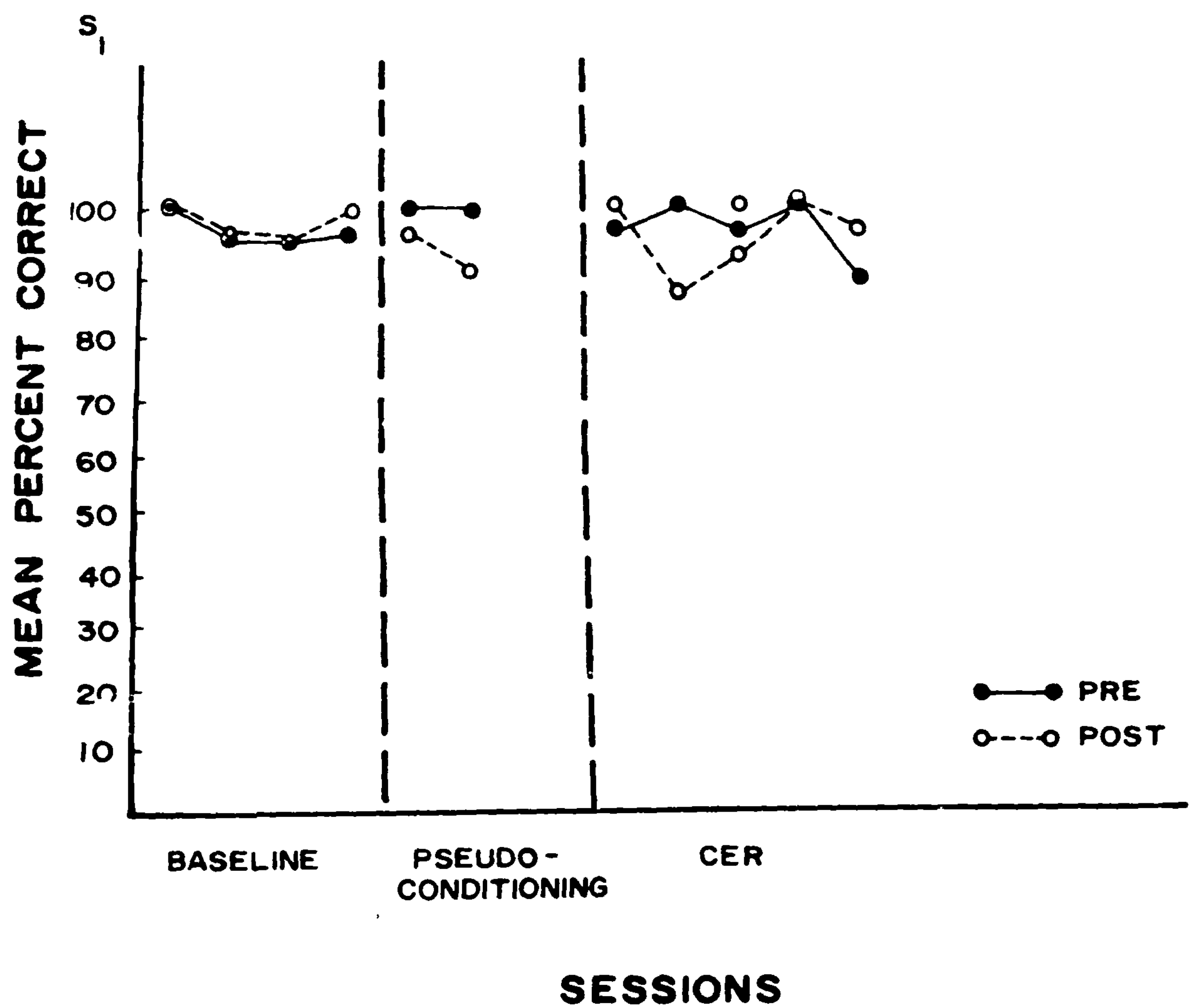
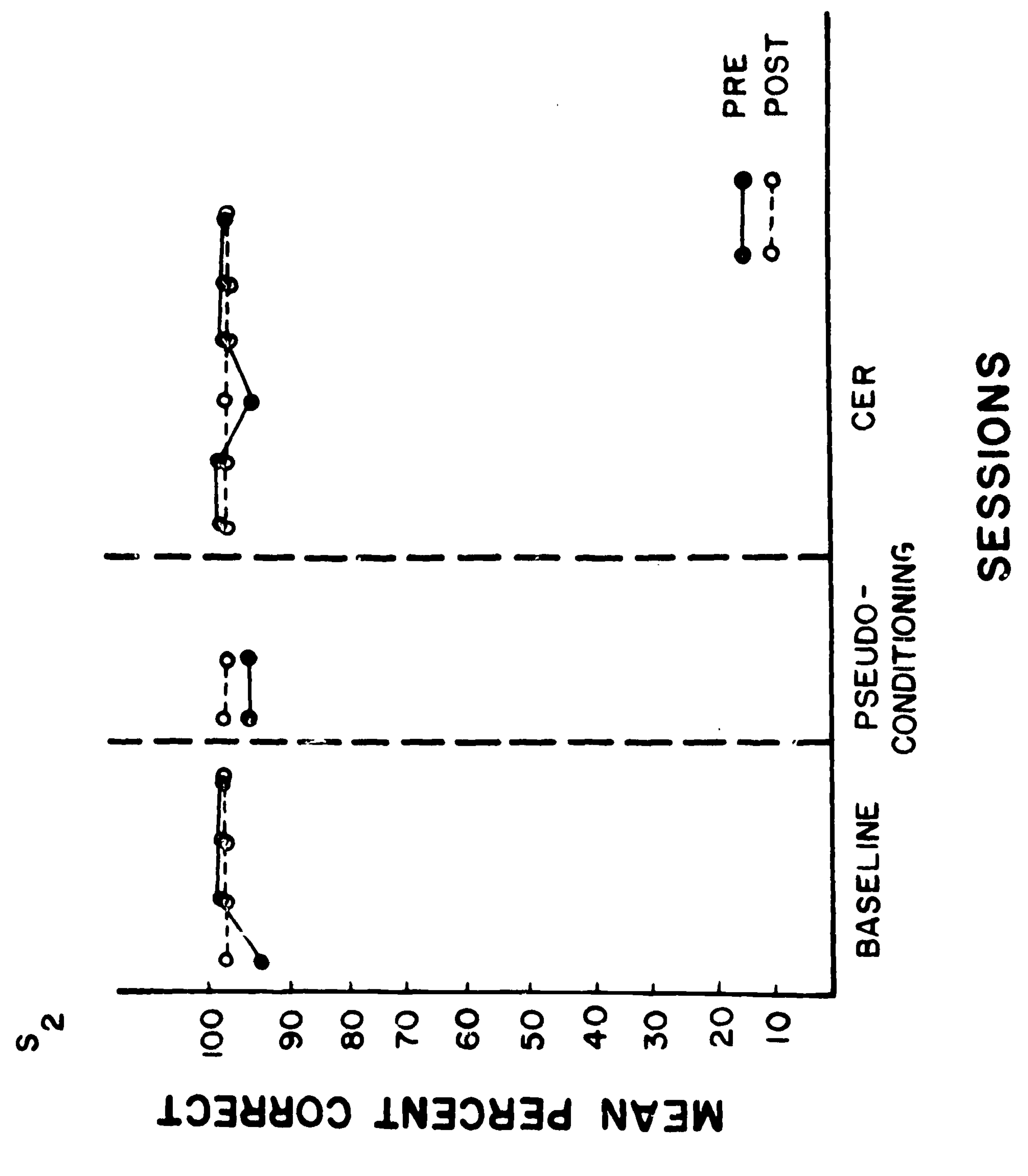
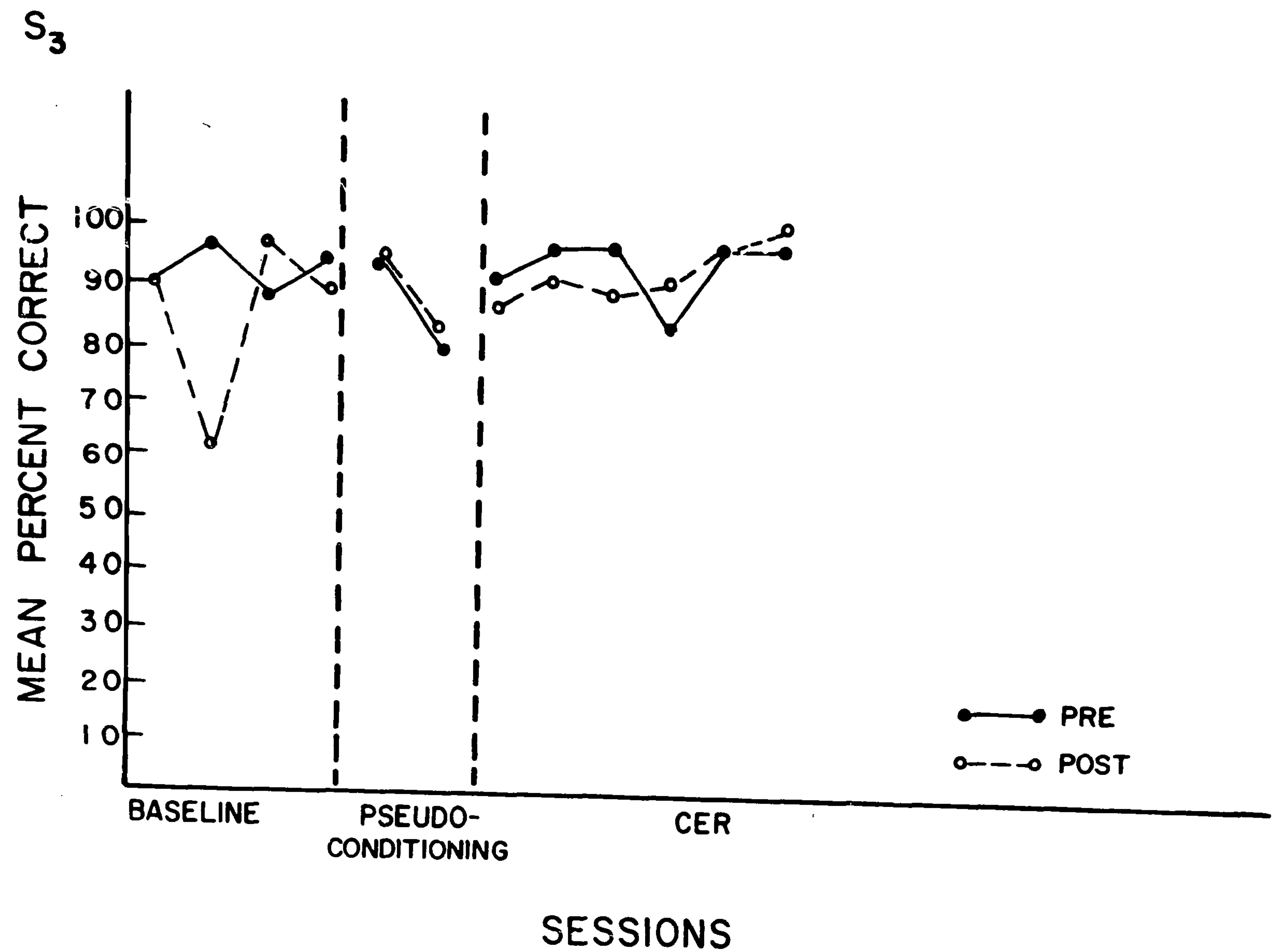

S1
MEAN PERCENT CORRECT
100
90
80
70
60
50
40
30
20
10
BASELINE
PSEUDO-
CONDITIONING
CER
PRE
POST
SESSIONS

Fig. 26. Mean percent correct for pre and post 30 second intervals for each session per condition for S2.



S2
MEAN PERCENT CORRECT
100
90
80
70
60
50
40
30
20
10
BASELINE
PSEUDO-CONDITIONING
CER
PRE
POST
SESSIONS

Fig. 27. Mean percent correct for pre and post 30 second intervals for each session per condition for S3.



S3
MEAN PERCENT CORRECT
100
90
80
70
60
50
40
30
20
10
BASELINE
PSEUDO-CONDITIONING
CER
PRE
POST
SESSIONS

Fig. 28. Mean percent correct for pre and post 30 second intervals for each session per condition for S4.

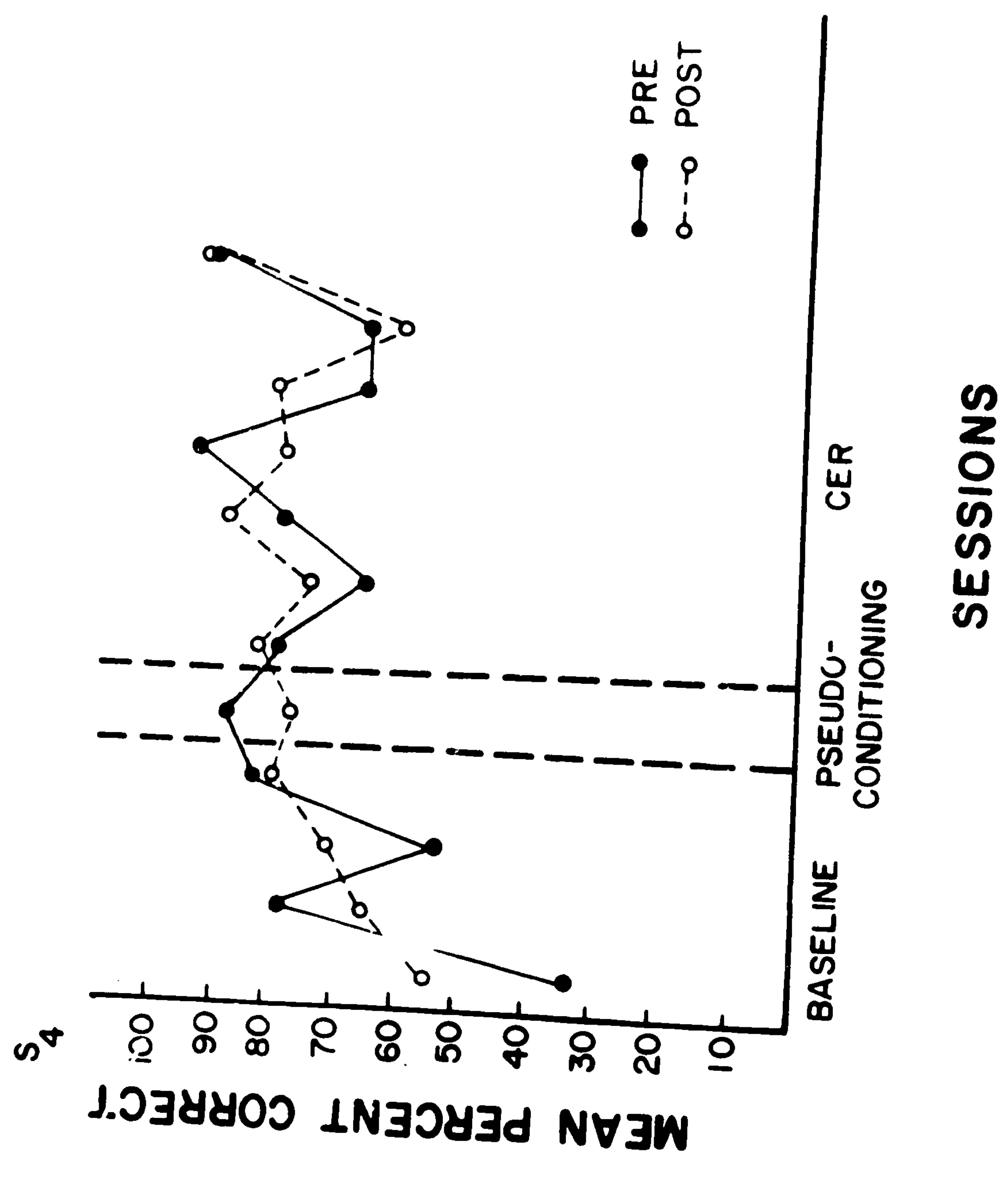

S4
MEAN PERCENT CORRECT
100
90
80
70
60
50
40
30
20
10
BASELINE
PSEUDO-CONDITIONING
CER
SESSIONS
PRE
POST

Fig. 29. Mean percent correct for pre and post 30 second intervals for each session per condition for S5.

S_5

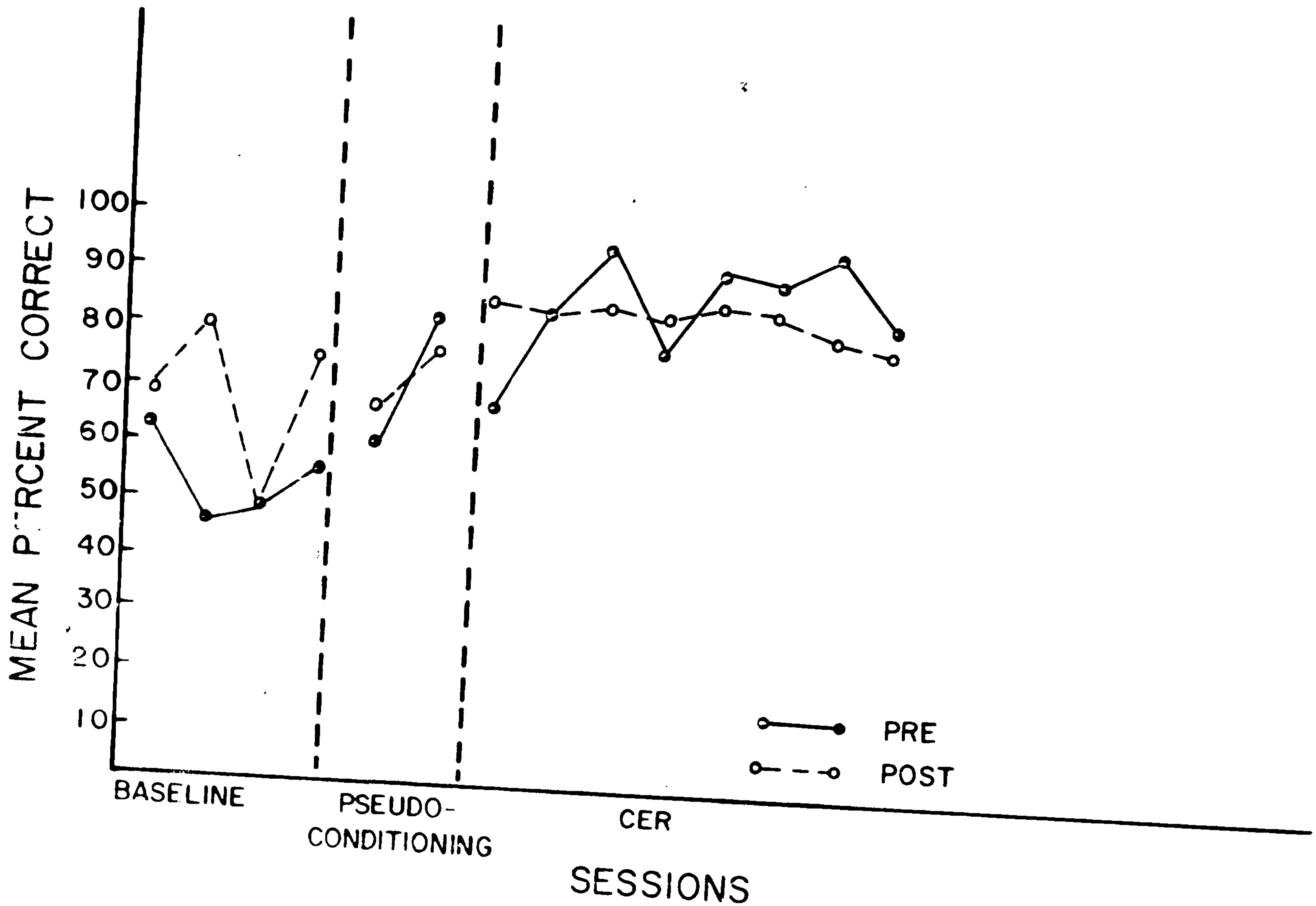
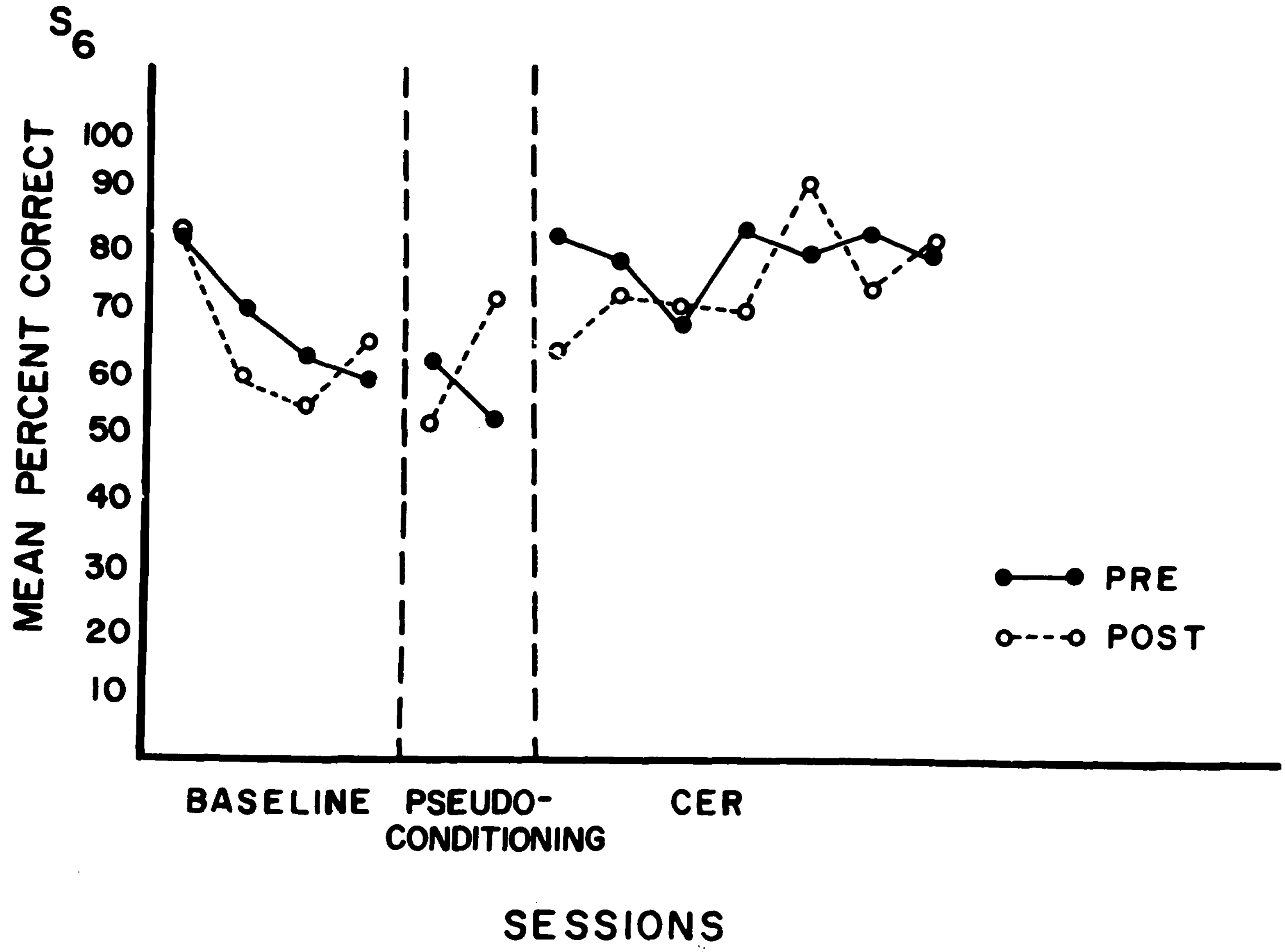

MEAN P·RCENT CORRECT
100
90
80
70
60
50
40
30
20
10
BASELINE
PSEUDO-
CONDITIONING
CER
SESSIONS
PRE
POST

Fig. 30. Mean percent correct for pre and post 30 second intervals for each session per condition for S6.



S6
MEAN PERCENT CORRECT
100
90
80
70
60
50
40
30
20
10
BASELINE
PSEUDO-
CONDITIONING
CER
PRE
POST
SESSIONS

within the range of stability and ratios in excess of $\pm.50$ are used to denote change. Ratios for individual Ss are larger in magnitude than group ratios but this appears due to the low rate of response in which a difference of two responses between pre and post could produce a ratio as large as $\pm.50$.

Percent Correct:

The second dependent variable, percent correct, was used to assess whether anticipation of the aversive stimulus would produce a decrement in the correctness with which subjects solved the discrimination problems. A t-test for pre-post differences between baseline and CER was not significant ($t(9df) = 1.607$). Group data showing mean percent correct across trials for each session per condition is presented in figure 24. Percent correct data for individual Ss are presented in figure 25 thru 30. Subject 1 and S2 (figs. 25 & 26) worked at approximately 100% correctness throughout the study. Subject 5 (fig. 29) showed a decrease in variability during the post-CS period for the CER condition. He is the only S showing any type of consistent change in percent correct responding during the post-CS condition for CER.

Discussion

The failure to obtain a consistent change in response rate due to anticipation of an aversive stimulus supports previous studies with humans (Sachs and May, 1967; 1969a; Lebenta and Lyon (1972). Although previous studies using shock have reported occassional changes, the use of an aversive auditory stimulus was unsuccessful in producing change in response rate in any of the subjects.

In a previous study with retarded children, May and Sachs (1969) reported that several children manifested a total avoidance of the experimental situation. None of the children in the present study showed any signs of avoiding the experimental situation. It may be that the presence of reinforcement had an overriding affect on any aversive qualities present. Lyon, in an informal communication, reported that subjects who remain in aversive (i.e. CER) situations tend to comply and not show any behavioral decrement. This has also been reported by Sachs and May (1967). Within the present study, the only significant effect was due to the introduction of the CS, which may have been due to the novelty of the stimulus. This pseudoconditioning effect quickly extinguished.

Chapter III

Study III: Conditioned Emotional Response and Verbal Rate

Kanfer (1958a), has published the only studies of the effect of the CER paradigm on free verbal response. His Ss, 78 college students, were instructed to "say separate words which came to mind, continuously, until told to stop." The experimental session lasted for 52 minutes. Following 6 minutes to allow for stabilization, Ss were given 6 baseline trials, 12 CER acquisition trials, and 6 extinction trials. The pre CS period was 30 seconds as was the post CS period. (Kanfer also recorded response rate for the 30 second period prior to the pre CS period and for a 30 second period following the occurrence of the UCS). The CS was a 375 Hz tone and the UCS was .5 second electric shock of approximately .9 to 1.3 ma.

Kanfer reported that the Ss demonstrated a response facilitation, that is, an increase in verbal rate following CS onset. Using group means, Kanfer reported an increase from 10 words/30 seconds to 12.5 words/30 seconds, significant at $p < .05$.

In a supplementary report. Kanfer (1958b) reported a replication of his first study with 12 Ss. However, in this second study, 9 experimental sessions were conducted rather than a single session. In addition to confirming the finding of response facilitation, Kanfer reported that the baserate of words emitted increased from 9.5/30 seconds on the first day to 15 8 words/30 seconds by day 6.

The present study is a partial replication of Kanfer's study using handicapped children.

Method

Subjects.--The 6 subjects who participated in Study II served as subjects in the present study.

Apparatus:

The apparatus consisted of a Grason-Stadler Voice-Operated Relay Model E-7300 A-1, a Sony model TC-110 tape recorder, electromechanical equipment for programing and counting, and a 100 watt green bulb. Programing apparatus was located in a room adjacent to the room in which the Ss worked.

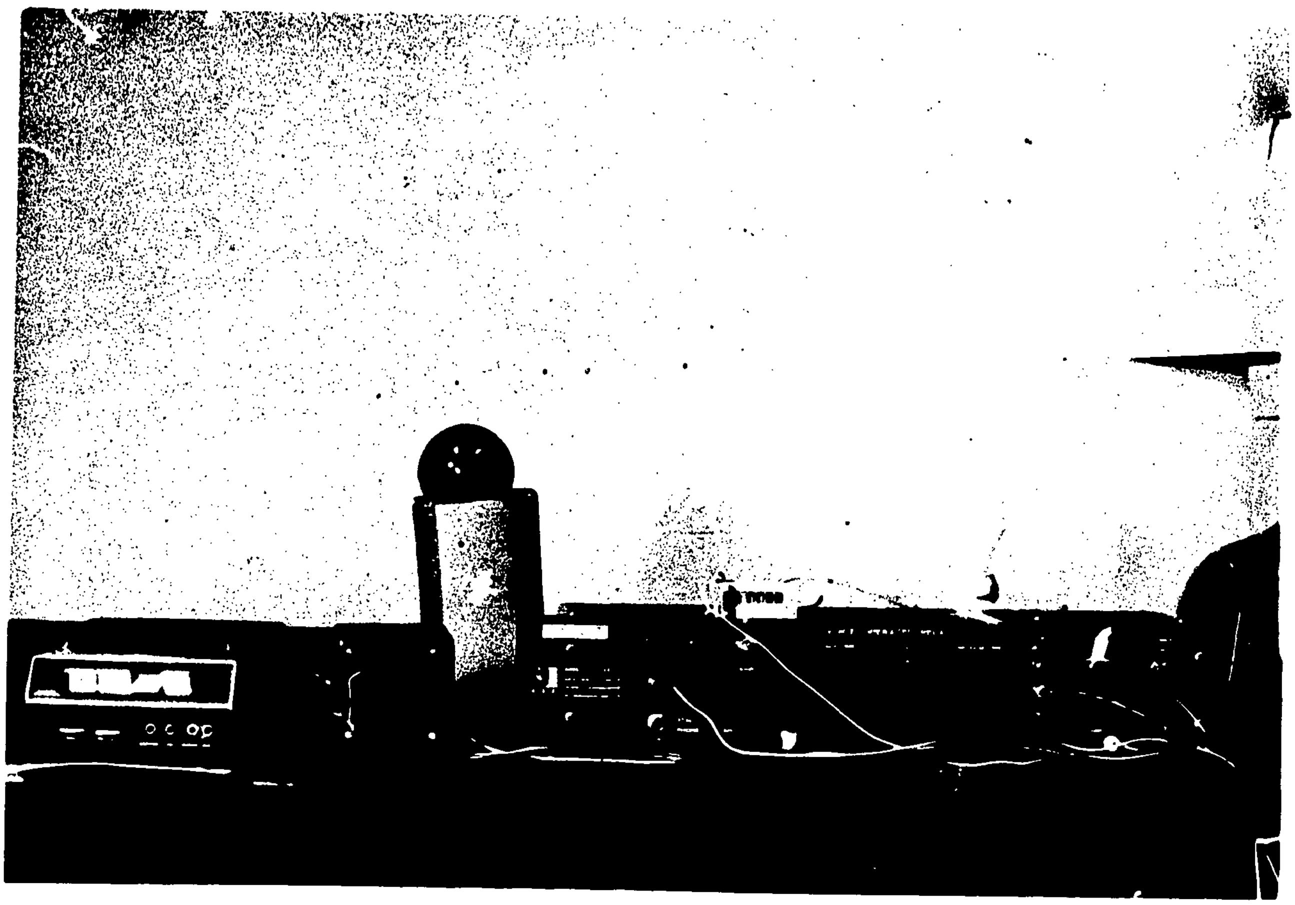
The CS was a 100 watt white bulb and the USC was a 1 second 95 db noise, produced by a 24 volt electronic horn, model number 145-50N, manufactured by Sparton Corporation. The horn was located 1 foot from the subject.

Procedure:

This study was conducted in a room adjacent to the childs classroom. Each subject sat at a table on which the voice-operated relay, the tape recorder, and a white light and a green light were located. The horn was located 18" to the right of the S. A counter was mounted on top of the voice-operated relay. Subjects were instructed to talk into the microphone and to "say as many different words as you can. Do not use sentences and try not to repeat words." The apparatus used in the present study is illustrated in fig. 31. Subjects were informed that for every 10 points accumulated on the counter, they would receive one token. The onset of the green light indicated a point was earred.

Ten trials were run daily, the duration of each trial being 60 seconds. A 15 second inter-trial interval was allowed between trials. The first 30

Fig. 31. Illustration of the apparatus used to record verbal rate and present the CS and UCS for Study III.



seconds of a trial constituted the pre-CS condition and the last 30 seconds constituted the post-CS condition.

The three conditions were run:

1) Baseline: During baseline, neither CS nor UCS was presented. Number of words emitted for each 30 second period was recorded. This procedure is referred to as a probe. Baseline was obtained for one day, during which 10 probes were obtained.

2) Pseudoconditioning: During pseudoconditioning, CS alone was presented on 5 randomly selected trials. In addition, 5 baseline probes were obtained. Pseudoconditioning was continued until no differences were noted between pre and post response rates.

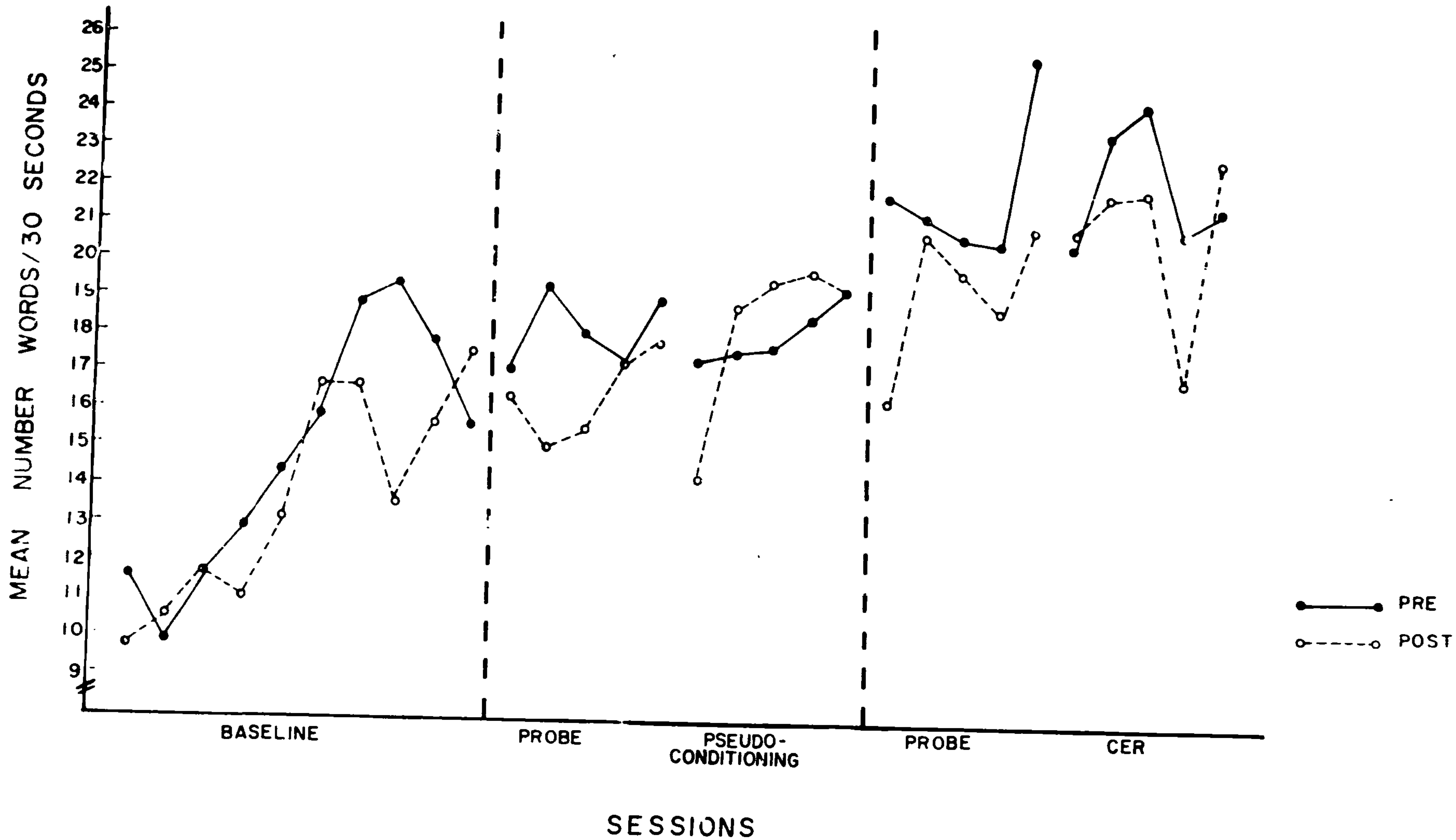
3) CER: CER training consisted of 5 trials during which CS offset was paired with UCS onset. Five probes were also obtained.

Results

The dependent measure in this study was the number of words emitted per 30 second interval. The children tended to use single syllable words and these were counted using the voice-operated relay (VOR). Tape recordings were used to double-check VOR counts and, if any discrepencies existed, the count obtained from the tape recording was used in the data analysis.

Figure 32 presents the group data for number of words emitted for conditions of baseline, the last session of pseudoconditioning, and CER as well as baseline probe data during the latter two conditions. It may be noted that the rate of words emitted increased during baseline and became stabilized at between 17 and 18 words per 30 second interval. By the

Fig. 32. Number of words emitted during pre and post 30 second intervals during baseline, baseline probes, pseudoconditioning and CER for the total sample.


MEAN NUMBER WORDS/30 SECONDS
26
25
24
23
22
21
20
15
18
17
16
15
14
13
12
11
10
9
BASELINE
PROBE
PSEUDO-CONDITIONING
PROBE
CER
SESSIONS
PRE
POST

last day, during which CER presentations occurred, the rate of verbalization averaged more than 20 words per 30 second period. The introduction of the CS-UCS pairings produced no marked change in number of words emitted. A repeated measures one-way ANOVA did not indicate a significant treatment effect ($F(2,10) = .8034$).

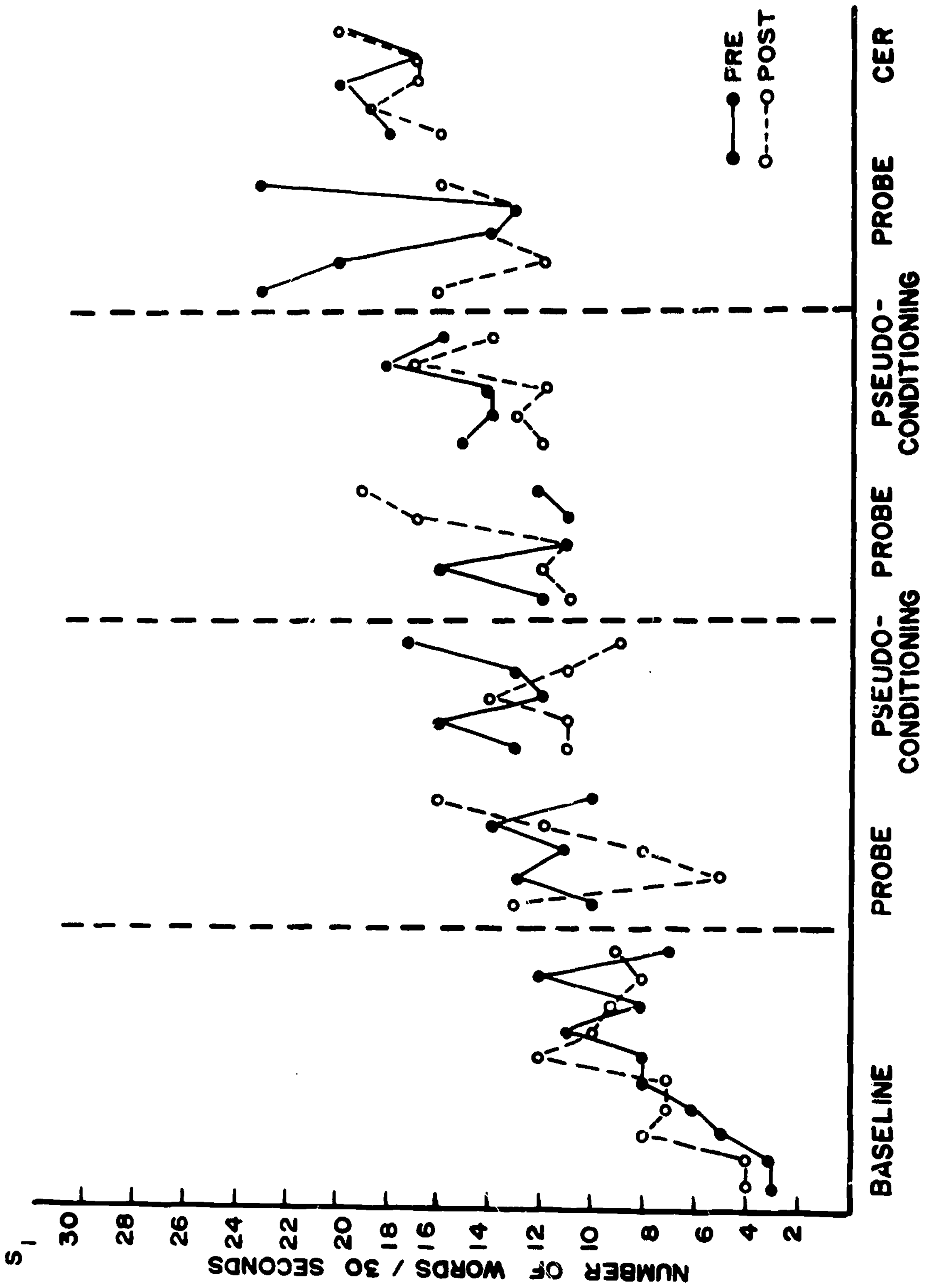
Figures 33 thru 38 present the number of words emitted per 30 seconds for each condition for each subject. Although subjects differed in their individual rates, the lowest rate, for S3 (fig. 35), was 12 words per 30 seconds. To evaluate the effect of CER procedures on individual Ss, matched-pair t-tests were computed between pre and post intervals during CER training. Only S2 showed a significant difference between rate of verbal response for pre and post periods ($t(4) = 2.813$, $p < .025$).

Figures 39-44 present the ratios for baseline, pseudoconditioning and CER for individual Ss. During the CER condition, Ss 1-4 tended to respond at a slightly higher rate during the pre CS interval than during the post CS interval for both probe and CER conditions. This would suggest that these Ss tended to "run out" of words during the latter 30 seconds of a trial. The presence of "facilitation" during both CER and probe conditions indicates that no affect may be attributed to CER training.

Discussion

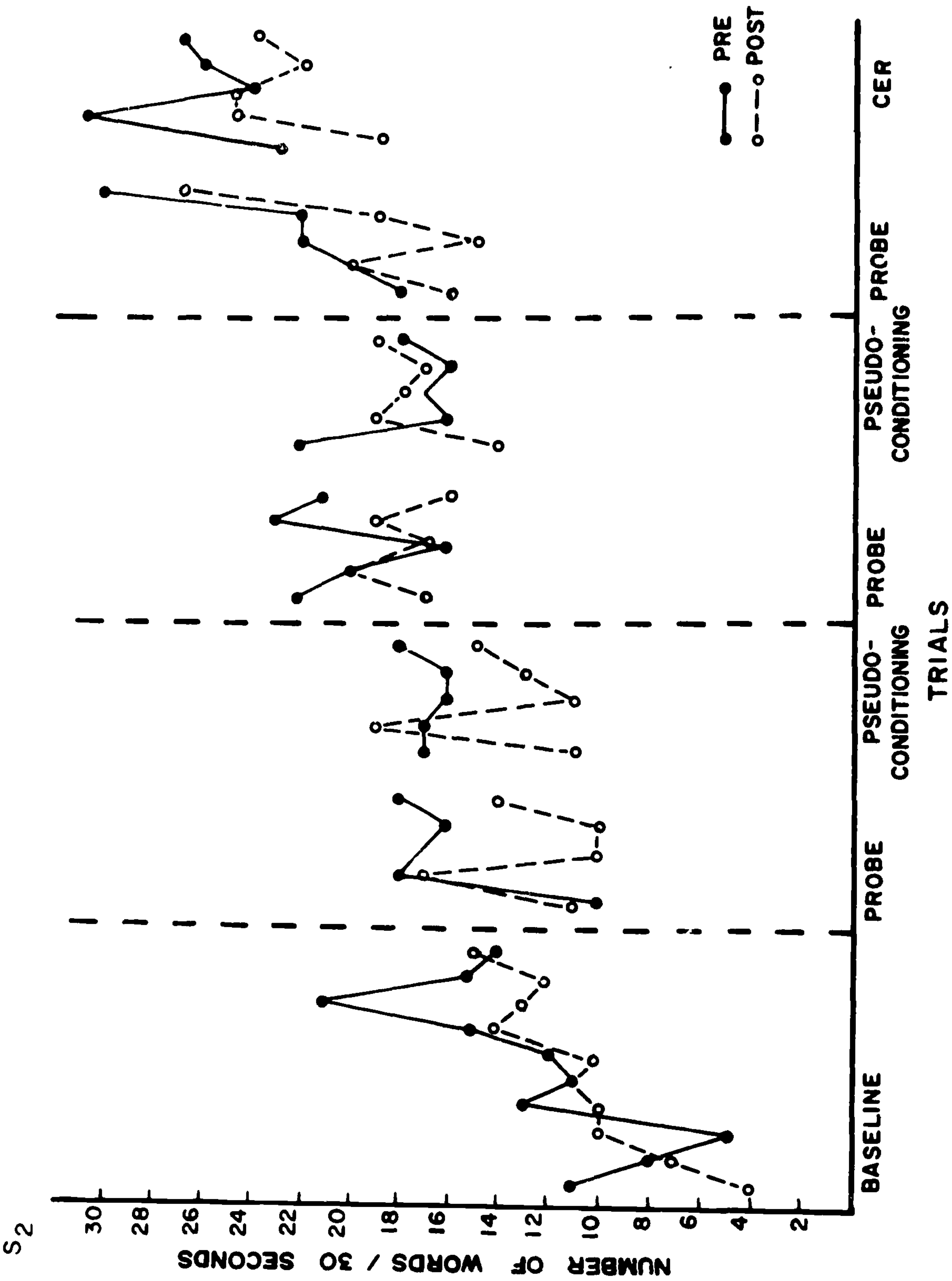
The results of the present study failed to confirm Kanfer's (1958 a, b) findings of response facilitation of verbal rate within a CER paradigm. Neither suppression nor facilitation was observed as a reliable effect. In Kanfer's study, baseline response rate was 10 words/30 seconds. In the present study, the lowest rate was 12 words/30 seconds and this was

Fig. 33. Number of words emitted during pre and post 30 second intervals per trial during baseline, baseline probes, pseudoconditioning and CER for $\underline{S}1$.



S1
NUMBER OF WORDS / 30 SECONDS
30
28
26
24
22
20
18
16
14
12
10
8
6
4
2
BASELINE
PROBE
PSEUDO-CONDITIONING
PROBE
PSEUDO-CONDITIONING
PROBE
CER
TRIALS
PRE
POST

Fig. 34. Number of words emitted during pre and post 30 second intervals per trial during baseline, baseline probes, pseudoconditioning and CER for S2.


S2
NUMBER OF WORDS / 30 SECONDS
30
28
26
24
22
20
18
16
14
12
10
8
6
4
2
BASELINE
PROBE
PSEUDO-
CONDITIONING
PROBE
PSEUDO-
CONDITIONING
PROBE
CER
TRIALS
PRE
POST

103

Fig. 35. Number of words emitted during pre and post 30 second intervals per trial during baseline, baseline probes, pseudoconditioning and CER for _S_3.

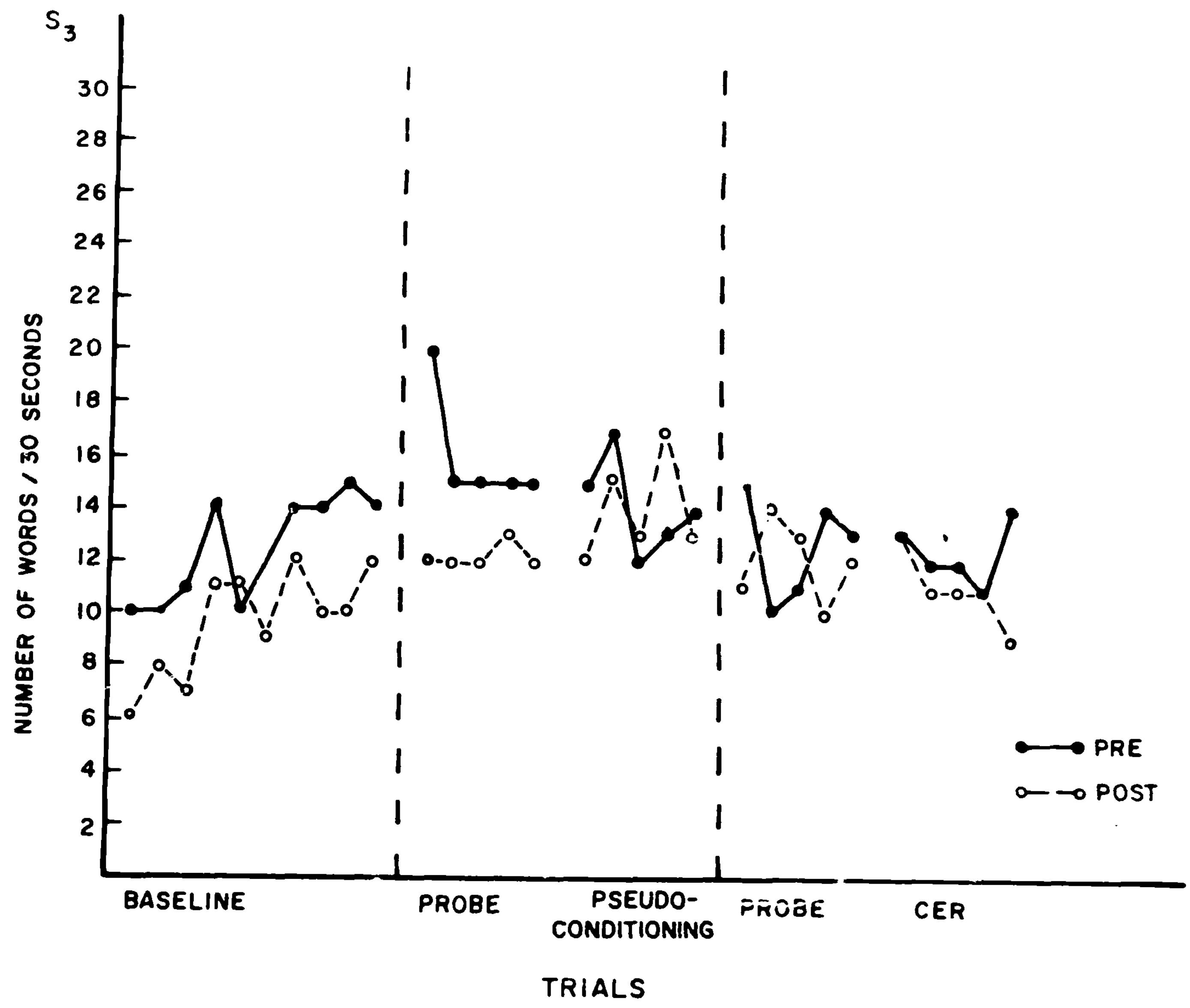

S3
NUMBER OF WORDS / 30 SECONDS
30
28
26
24
22
20
18
16
14
12
10
8
6
4
2
BASELINE
PROBE
PSEUDO-CONDITIONING
PROBE
CER
TRIALS
PRE
POST

Fig. 36. Number of words emitted during pre and post 30 second intervals per trial during baseline, baseline probes, pseudoconditioning and CER for S4.

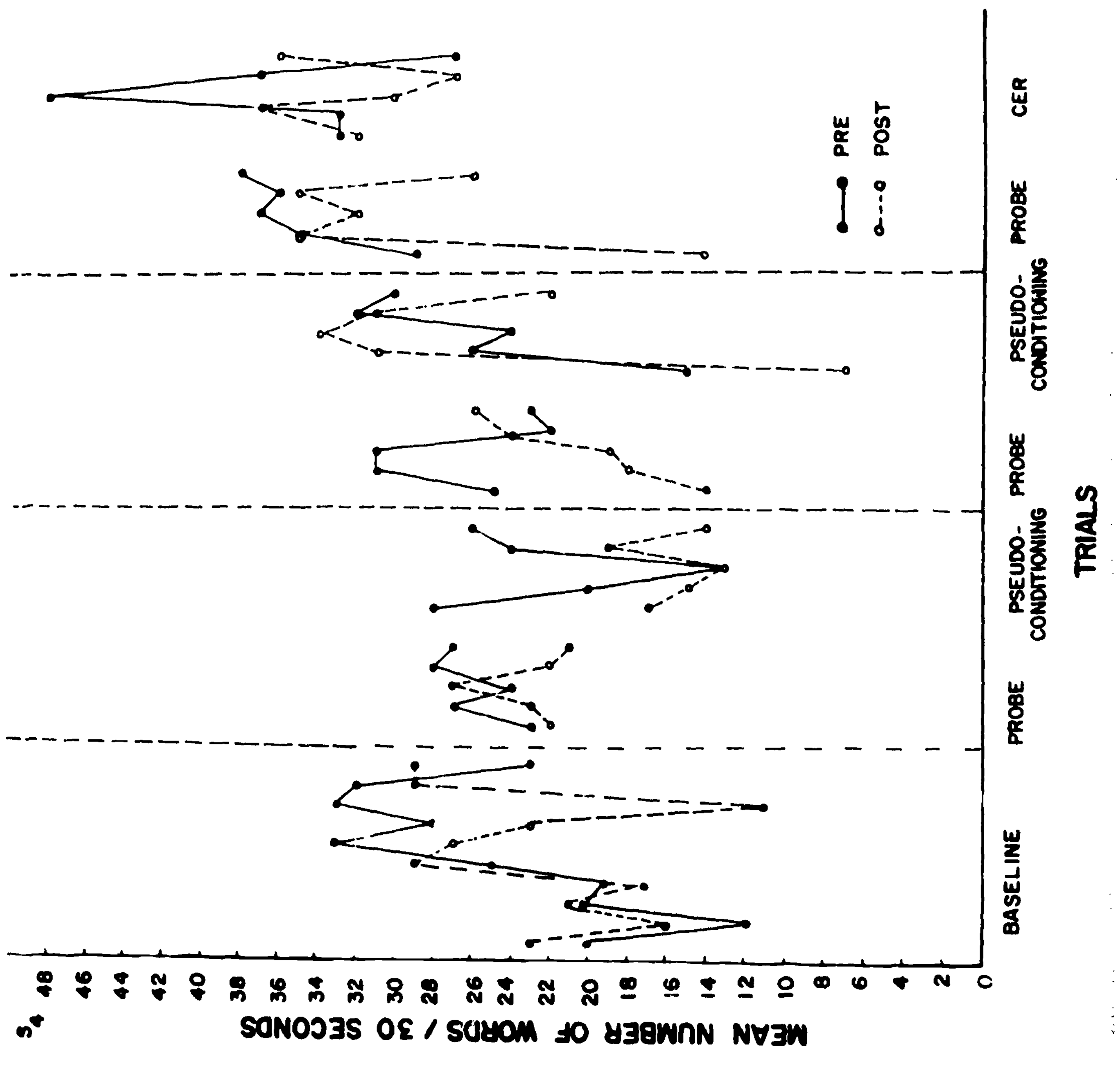

S4
MEAN NUMBER OF WORDS / 30 SECONDS
0
2
4
6
8
10
12
14
16
18
20
22
24
26
28
30
32
34
36
38
40
42
44
46
48
BASELINE
PROBE
PSEUDO-CONDITIONING
PROBE
PSEUDO-CONDITIONING
PROBE
CER
PRE
POST
TRIALS

Fig. 37. Number of words emitted during pre and post 30 second intervals per trial during baseline, baseline probes, pseudoconditioning and CER for S5.

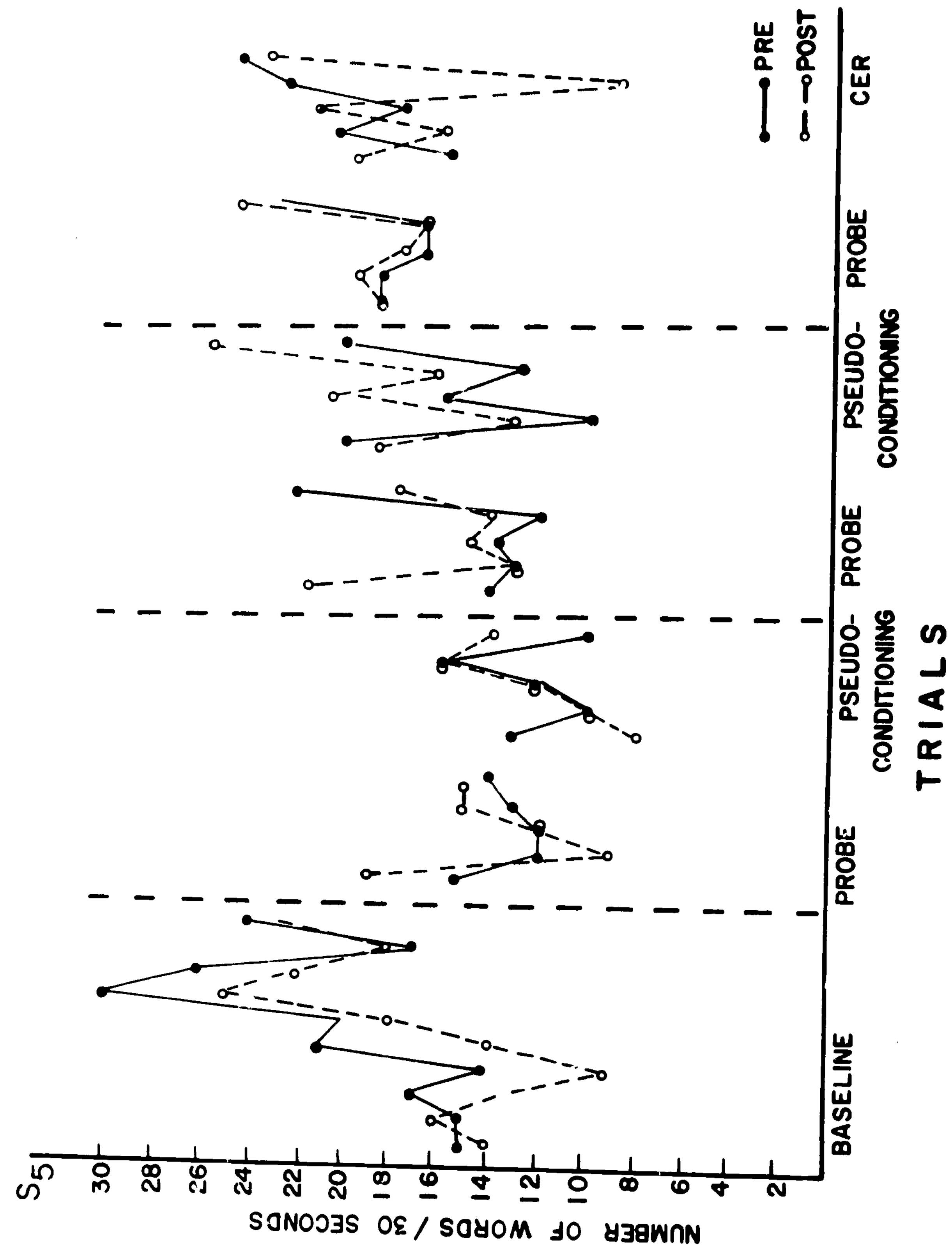


Fig. 38. Number of words emitted during pre and post 30 second intervals per trial during baseline, baseline probes, pseudoconditioning, and CER for S6.

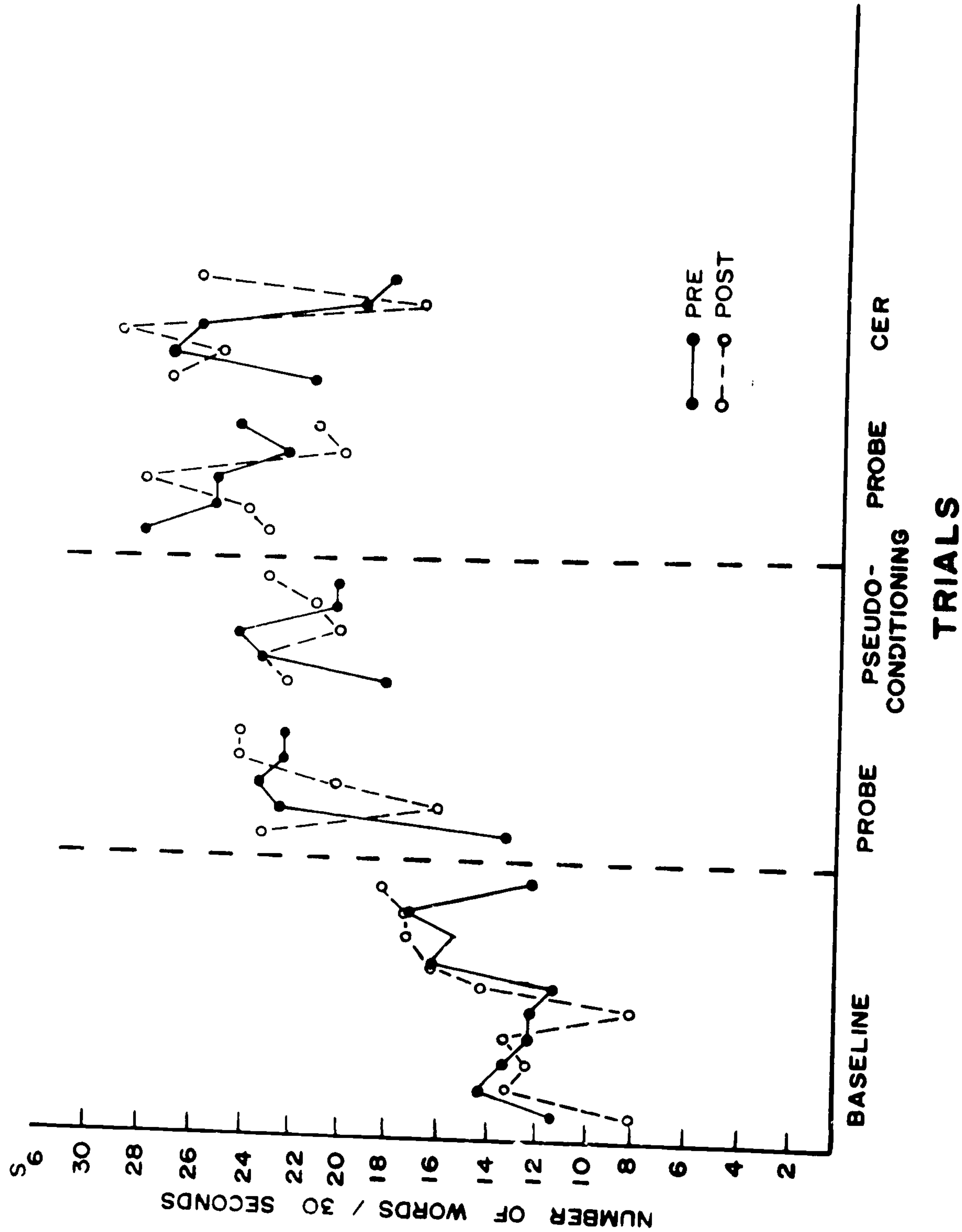

S6
NUMBER OF WORDS / 30 SECONDS
30
28
26
24
22
20
18
16
14
12
10
8
6
4
2
BASELINE
PROBE
PSEUDO-CONDITIONING
PROBE
CER
TRIALS
PRE
POST

Fig. 39. Suppression ratio per trial for number of wc:ds emitted for conditions of baseline, baseline probes, pseudoconditioning and CER for S1. (Ratios are computed using the formula $\frac{\text{pre-post}}{\text{pre+post}}$).

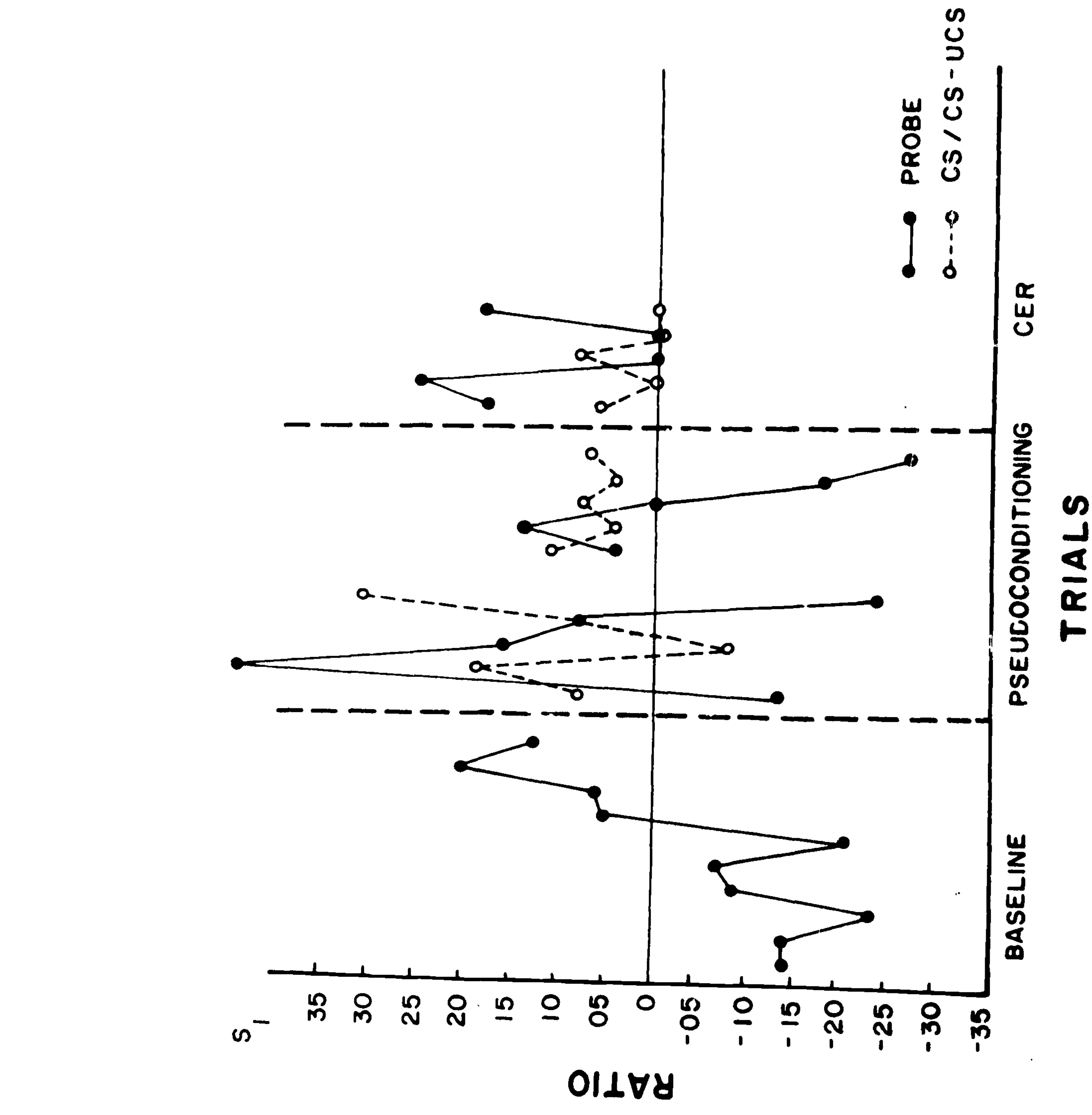
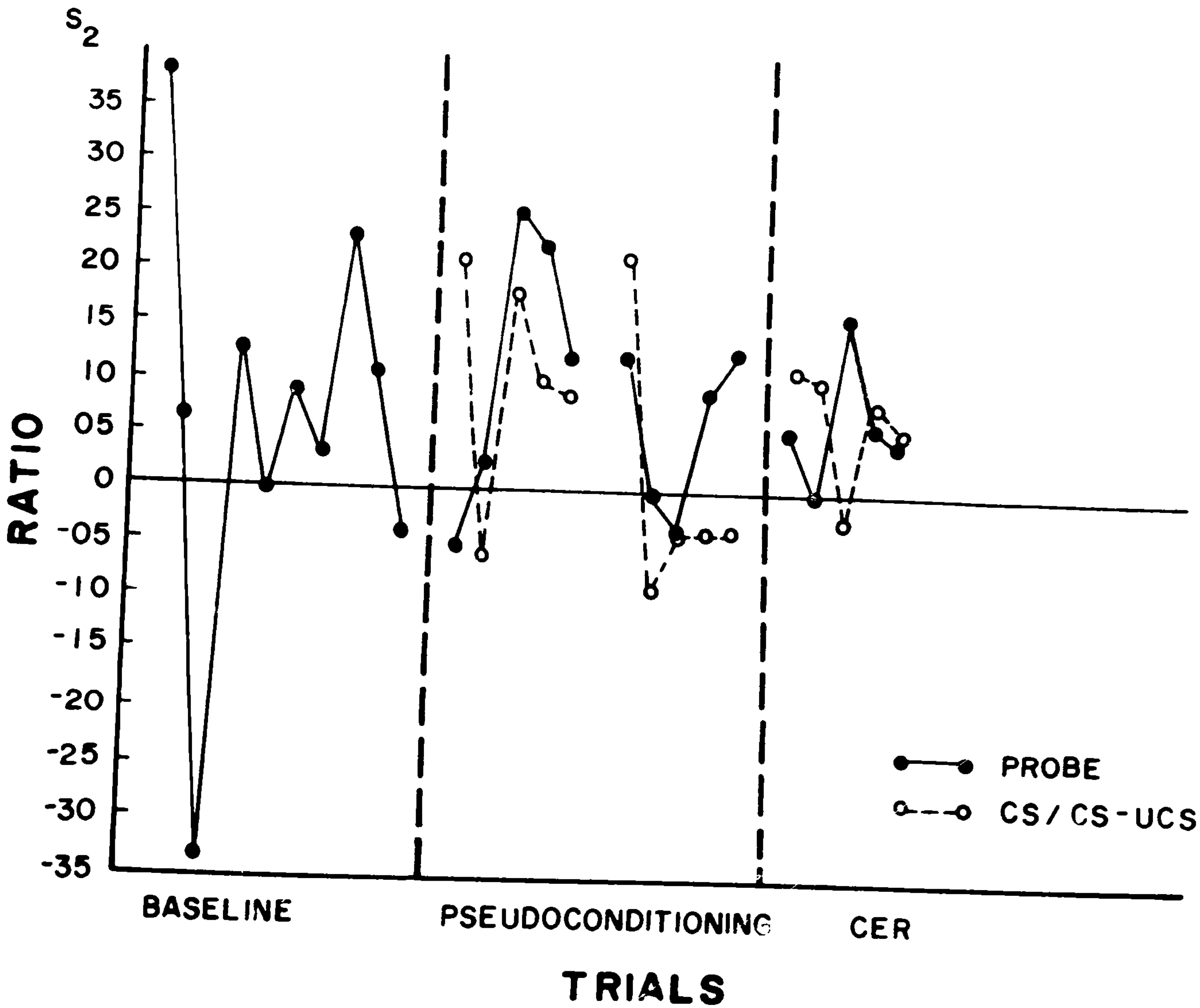

S1
RATIO
35
30
25
20
15
10
05
0
-05
-10
-15
-20
-25
-30
-35
BASELINE
PSEUDOCONDITIONING
CER
TRIALS
PROBE
CS / CS - UCS

Fig. 40. Suppression ratio per trial for number of words emitted for conditions of baseline, baseline probes, pseudoconditioning and CER for S2. (Ratios are computed using the formula $\frac{\text{pre-post}}{\text{pre+post}}$).



S2
RATIO
35
30
25
20
15
10
05
0
-05
-10
-15
-20
-25
-30
-35
BASELINE
PSEUDOCONDITIONING
CER
TRIALS
PROBE
CS/CS-UCS

Fig. 41. Suppression ratio per trial for number of words emitted for conditions of baseline, baseline probes, pseudoconditioning and CER for S3. (Ratios are computed using the formula $\frac{\text{pre-post}}{\text{pre+post}}$).

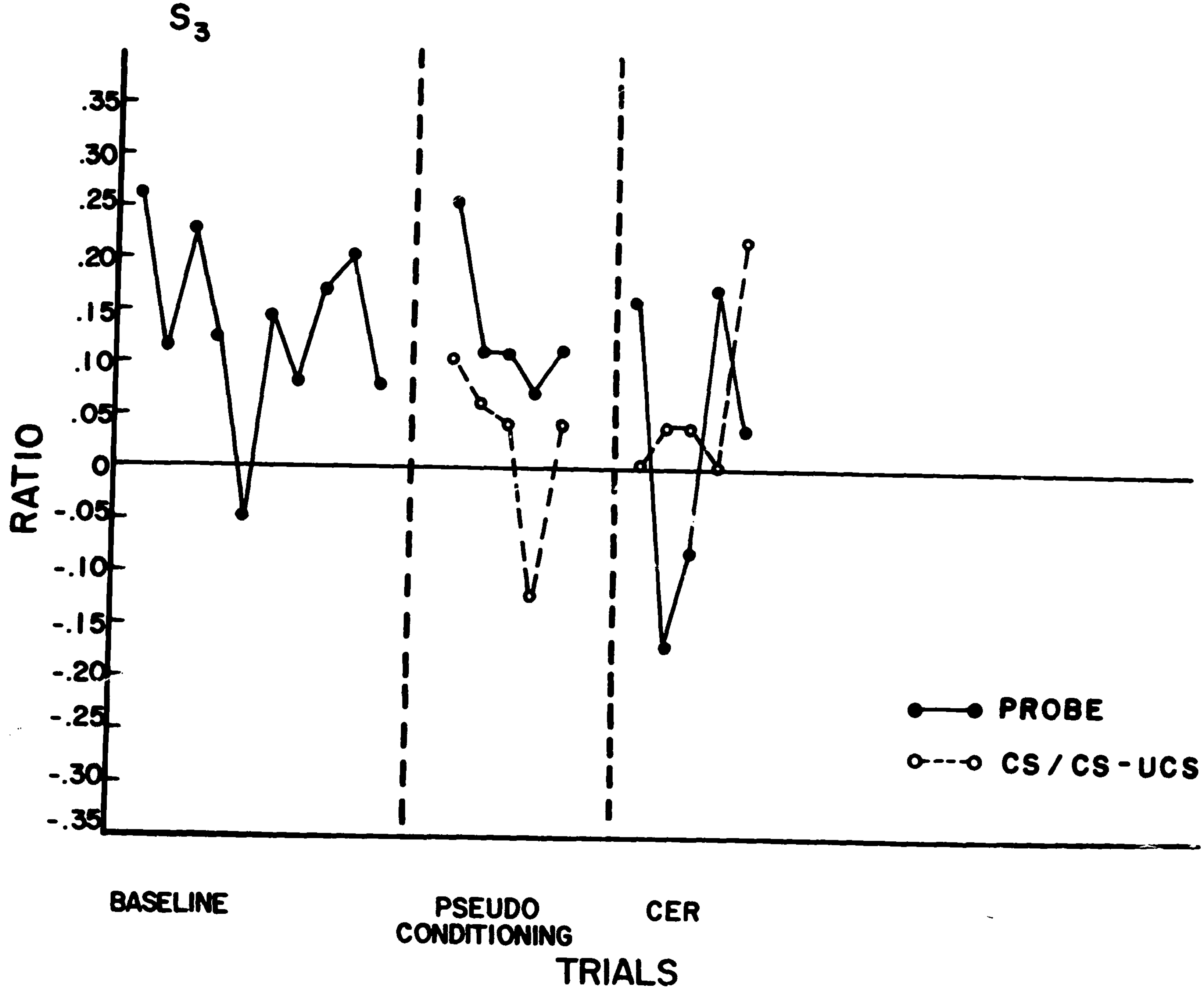

S3
RATIO
.35
.30
.25
.20
.15
.10
.05
0
-.05
-.10
-.15
-.20
-.25
-.30
-.35
BASELINE
PSEUDO CONDITIONING
CER
TRIALS
PROBE
CS / CS - UCS

Fig. 42. Suppression ratio per trial for number of words emitted for conditions of baseline, baseline probes, pseudoconditioning and CER for S4. (Ratios are computed using the formula $\frac{\text{pre-post}}{\text{pre+post}}$).

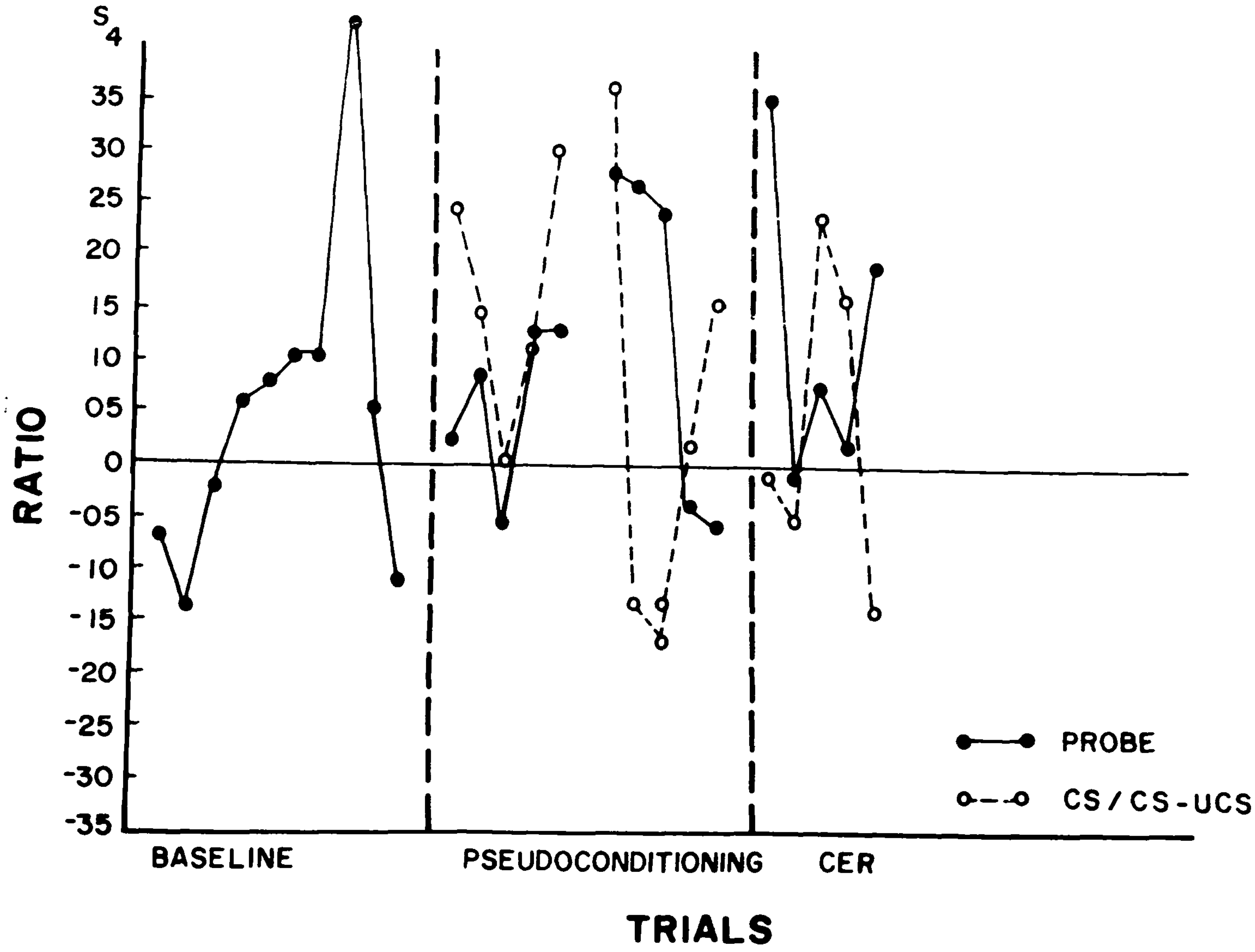

S4
35
30
25
20
15
10
05
0
-05
-10
-15
-20
-25
-30
-35
RATIO
BASELINE
PSEUDOCONDITIONING
CER
TRIALS
PROBE
CS / CS-UCS

Fig. 43. Suppression ratio per trial for number of words emitted for conditions of baseline, baseline probes, pseudoconditioning and CER for S5. (Ratios are computed using the formula $\frac{\text{pre-post}}{\text{pre+post}}$).

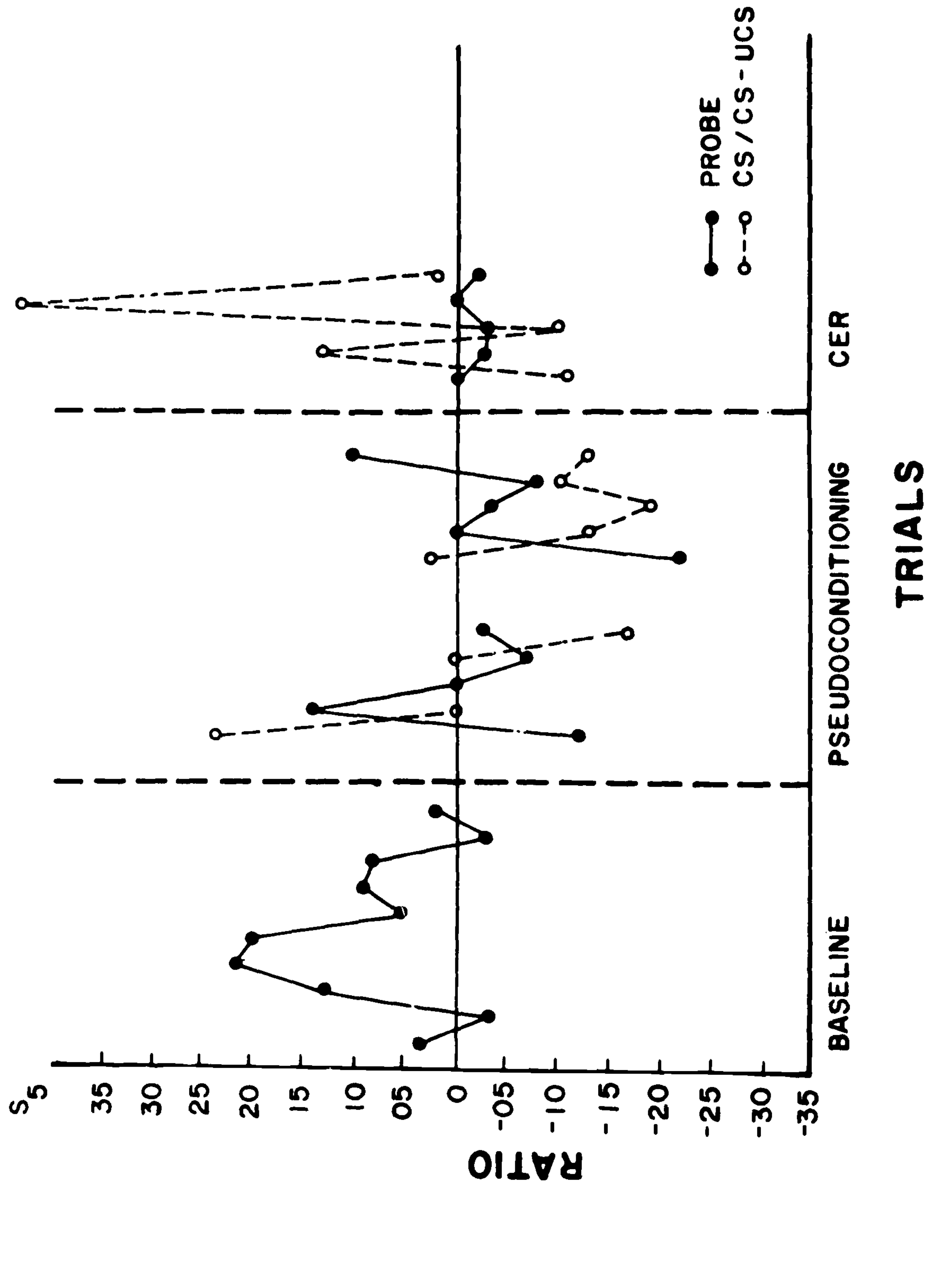
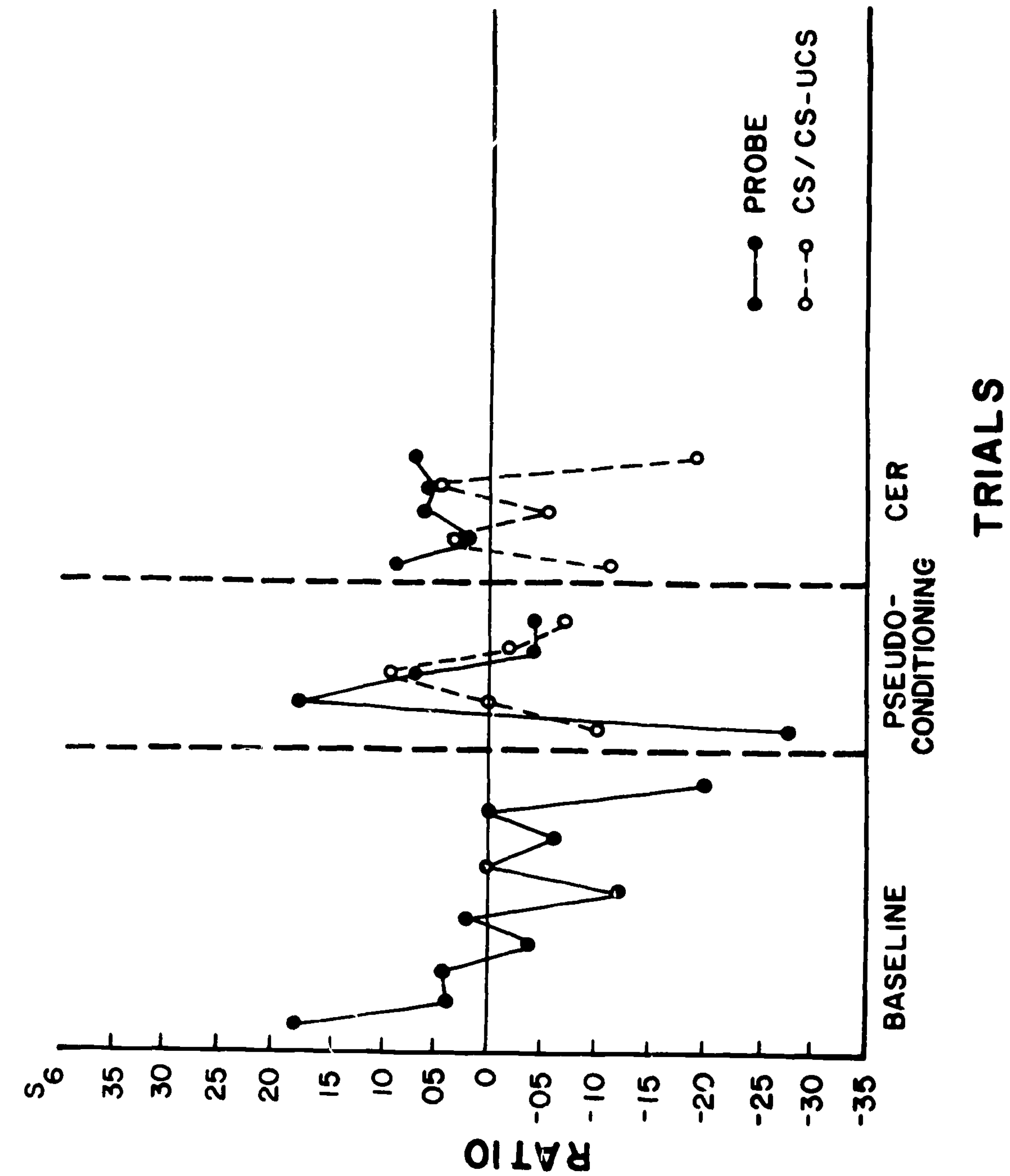

S5
RATIO
35
30
25
20
15
10
05
0
-05
-10
-15
-20
-25
-30
-35
BASELINE
PSEUDOCONDITIONING
CER
TRIALS
PROBE
CS/CS-UCS

Fig. 44. Suppression ratio per trial for number of words emitted for conditions of baseline, baseline probes, pseudoconditioning and CER for S6. (Ratios are computed using the formula $\frac{\text{pre-post}}{\text{pre+post}}$).



emitted by a child who was initially diagnosed as aphasic when referred to the class.

Major differences in the designs between Kanfer's study and the present study, other than the differences in age and intellectual abilities of the subjects, were 1) the use of reinforcement in the present study and 2) Kanfer's Ss were required to emit words continually for 52 minutes rather than in 1 minute trials. Whereas Ss in the present study may have been emitting words at close to their maximal rate, it would seem unlikely that this was true for the Ss in Kanfer's study. In Kanfer's supplementary report (1958b) he did indicate that verbal rate increased over days. The increase in verbal rate over days was also observed in the present study. However, Kanfer's Ss did not reach the rate maintained by Ss in the present study.

Chapter IV

Conclusions

The present series of 3 experiments may be dicotimized on the basis of whether the aversive stimuli were response contingent or were non-contingent. In both CER studies, the aversive stimuli was non-contingent. The introduction of non-contingent "stressors" into the child's environment produced no reliable changes in ongoing behavior. Although one subject produced a slight response facilitation and a second subject showed a decrease in response variability, these findings do not warrant any general conclusions.

For the sample used in study II the introduction of a novel stimulus (i.e. the white light CS during pseudoconditioning) initially produced a slight decrement in responding. However, this response decrement quickly extinguished with repeated presentation of the CS. Considering the results of the present study as well as previous literature (May and Sachs, 1969; Sachs and May, 1967; 1969a, b; Lebenta and Lyon, 1972), no major conclusions are warranted regarding prediction of individual behavior in the presence of non-contingent stress within a CER paradigm.

The introduction of contingent aversive consequences, as was present in Study I, does have an effect on the behavior of the individual. Although rate of behavior (i.e. response latency) was unaffected by the various contingencies, the correctness with which problems were solved was influenced by response contingencies. The failure of the experimental treatments to alter response latencies should not be surprising since no contingencies were directly introduced for response latency. Reinforcement and/or avoidance of loss of reinforcement was determined by correctness of the response and not, directly, by response latency. Response latency would contribute to the amount of reinforcement earned only if correct responses were emitted more quickly.

Studies of combining response cost with reinforcement have indicated that this combination of both procedures is more effective than either procedure separately. However, previous studies have investigated acquisition rather than steady-state behavior. In the present study, none of the treatment conditions had a significant effect on acquisition to criteria, but removal of positive reinforcement was maximally effective in maintaining correct responses.

Of major interest is the comparison of the results of the present study with those of Tramontana and Harris (1972). Within both populations of "handicapped" children, positive reinforcement was the least effective contingency for either acquisition of the discrimination task or maintainence of a maximum correct rate of responding in a steady-state task. Whereas Tramontana and Harris reported that the combination of positive reinforcement and response cost was the most efficient procedure, and this may favorably compare with Timmons (1962) conclusions, the results of the present study found removal of positive reinforcement as the most effective condition. It should be indicated that within the environment in which the present study was conducted, children received ample opportunity for positive reinforcement. The reader should not conclude that aversive consequences provide the most efficient means for maintaining behavior. Rather, given the positive reinforcement is sufficiently available, the use of aversive consequences appear justified as a technique for maintaining a high degree of the desired behavior. In using aversive consequences such as loss of reinforcement, it appears necessary to assess what the "real" response cost would be (i.e. the amount of reinforcement lost within the behavioral task relative to 1) availability of reinforcement within the behavioral task and 2) the availability of reinforcement within the total environment. It would appear that further research is needed in this latter area.

REFERENCES

Appel, J. B. Punishment and shock intensity, Science, 1963, 141, 528-529.

Ayllon, T. and Azrin, N. The Token Economy: A Motivational System for Therapy and Rehabilitation. New York: Appleton-Century-Crofts, 1968.

Azrin, H. H. and Holz, W. C. Punishment, in W. K. Honig (Ed.), Operant Behavior: Areas of Research and Application, New York: Appleton-Century-Croft, 1966.

Brady, J. B. Psychophysiology of emotional behavior. In A. J. Bachrach (Ed.) Experimental Foundations of Clinical Psychology. New York: Basic, 1962, Pp. 343-385.

Brady, J. V. and Hunt, H. F. An exploratory study of the effect of electro-convulsive shock on a CER. American Psychologist, 1950, 5, 245.

Church, R. M. The role of fear in punishment. Paper presented at American Psychological Association, New York, 1966.

Deese, J. and Hulse, S. H. The Psychology of Learning. New York: McGraw-Hill, 1967.

Edelman, R. Application of the conditioned suppression paradigm to human subjects unpublished MA thesis, Florida State University, 1965.

Estes, W. K. An experimental study of punishment. Psychological Monographs, 1944, 57, No. 26.

Estes, W. K. and Skinner, B. F. Some quantitative properties of anxiety. Journal of Experimental Psychology, 1941, 29, 390-400.

Fargo, G. A., Behrns, C., & Nolen, P. (Eds.) Behavior Modification in the Classroom, Belmont, California, Wadsworth: 1970.

Kanfer, F. H. Effects of a warning signed preceding a noxious stimulus on verbal rate and heart rate. Journal of Experimental Psychology, 1958, 55, 73-80.

Kanfer, F. H. Supplementary report: Stability of a verbal rate change in experimental anxiety. Journal of Experimental Psychology, 1958, 56, 182. (b)

Lebenta, D. V. and Lyon, D. O. The effects of non-contingent stimuli on rate of lever pressing using human subjects. Paper presented at RMPA, Albuquerque, New Mexico, 1972.

Levitt, E. E. The Psychology of Anxiety. New York. Bobs-Merrill: 1967.

May, J. G. and Sachs, D. A. Conditioned Anxiety Responses in Retarded Children. In Sachs, D. A. and May, J. G., Jr.: Conditioned Emotional Response: Performance Decrement in Humans as a Function of Task Complexity. OEG-1-7-070027-3540, Office of Education, 1969.

Sachs, D. A. and Keller, T. Intensity and Temporal Characteristics of the CER Paradigm with Humans. Journal of General Psychology, 1972, 86, 181-188.

Sachs, D. A. and May, J. G., Jr. Conditioned emotional response with humans: The effects of a variable interstimulus interval using a trace conditioning paradigm. Psychonomic Science, 1967, 9, 343-344.

Sachs, D. A. and May, J. G., Jr. The presence of a temporal discrimination in the conditioned emotional response with humans. Journal of the Experimental Analysis of Behavior, 1969, 12, 1003-1007. (a)

Sachs, D. A. and May, J. G., Jr. Conditioned Emotional Response. Performance decrement in humans as a function of task complexity, 1969. (b) Office of Education: OEG-1-7-070027-3540. (b)

Sidowski, J. B., Wyckoff, L. B., Tabory, L. Reinforcement and Punishment in a minimal social situation. Journal of Abnormal and Social Psychology, 1956, 52, 115-119.

Skinner, B. F. Walden two. New York: Macmillan, 1948.

Skinner, B. F. Science and Human Behavior, New York: Free Press, 1953.

Spence, K. W. Behavior theory and learning. Englewood Cliffs, N. J. Prentice-Hall, 1960.

Stein, L., Sidman, M., Brady, J. V. Some effects of two temporal variables on conditioned suppression. Journal of the Experimental Analysis of Behavior, 1958, 1, 153-162.

Timmons, E. O. Experiments in conditioning operant verbal behavior. Unpublished Ph.D. dissertation, Univ. of Tennessee, 1959. (cited by J. Greenspoon "verbal conditioning and clinical psychology"). In A. J. Bachrach (Ed.) Experimental Foundations of Clinical Psychology. New York: Basic Books, 1962.

Tramontana, J. and Harris, L. The effects of positive reinforcement, response cost, or both on discrimination performance of retarded children. Presented at SEPA, Atlanta, Ga. 1972.

Wood, C. G. and Hokanson, J. E. Effects of induced muscular tension on performance and the inverted U function. Journal of Personality and Social Psychology, 1965, 1, 506-510.

Yerkes, R. M. and Dodson, J. D. The relation of strength of stimulus to rapidity of habit-formation. Journal of Comparative Neurology and Psychology, 1908, 18, 459-482.