

THE UNIVERSITY OF MANITOBA

AN INVESTIGATION OF SUBJECT - EXPERIMENTER
RATIOS: VERBAL TRAINING SESSIONS WITH ONE RETARDED
CHILD AND WITH TWO SIMULTANEOUSLY

by

JOHN R. BIBERDORF

A THESIS

SUBMITTED TO THE FACULTY OF GRADUATE STUDIES
IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE DEGREE
OF DOCTORATE OF PHILOSOPHY

DEPARTMENT OF PSYCHOLOGY

WINNIPEG, MANITOBA

October, 1974

AN INVESTIGATION OF SUBJECT - EXPERIMENTER
RATIOS: VERBAL TRAINING SESSIONS WITH ONE RETARDED
CHILD AND WITH TWO SIMULTANEOUSLY

by

JOHN R. BIBERDORF

A dissertation submitted to the Faculty of Graduate Studies of
the University of Manitoba in partial fulfillment of the requirements
of the degree of

DOCTOR OF PHILOSOPHY

© 1975

Permission has been granted to the LIBRARY OF THE UNIVER-
SITY OF MANITOBA to lend or sell copies of this dissertation, to
the NATIONAL LIBRARY OF CANADA to microfilm this
dissertation and to lend or sell copies of the film, and UNIVERSITY
MICROFILMS to publish an abstract of this dissertation.

The author reserves other publication rights, and neither the
dissertation nor extensive extracts from it may be printed or other-
wise reproduced without the author's written permission.

ACKNOWLEDGEMENTS

I would first of all like to thank my wife, Edie, without whose help and encouragement this research would have been impossible. I would also like to thank my advisor Dr. J. J. Pear and the other members of my committee for their guidance during the running of this research and their helpful comments during its write-up. Finally, I would like to thank Sister Bauman and all the other staff at St. Amant for their patience and assistance during the experiment.

TABLE OF CONTENTS

Chapter	Page
I. INTRODUCTION.....	3
1. Elimination of undesirable behavior..	4
2. Training in self-help skills.....	6
3. Training in academic skills.....	9
II. STATEMENT OF THE PROBLEM.....	15
III. EXPERIMENT I.....	23
Subjects.....	23
Apparatus and Materials.....	26
Preliminary Training.....	27
General Procedures.....	32
Specific Procedures.....	39
Results.....	46
Discussion.....	94
IV. EXPERIMENT II.....	98
Rationale.....	98
Specific Procedures.....	99
Results.....	103
Discussion.....	124
GENERAL DISCUSSION.....	126
VI SUMMARY.....	132
REFER NCES.....	134

ABSTRACT

The training of two retarded children simultaneously on a picture-naming task was investigated as a possible alternative procedure to the more traditional one involving a one-to-one subject-experimenter ratio.

In Experiment I, there were two conditions. Under the Simultaneous Condition, incorrect responses, omissions, and ten-second intervals of inattention were followed by the experimenter switching to the other subject. Under the Individual Condition, errors, omissions, and inattention were ignored. In both conditions every correct response was reinforced with a "Good boy" or "Good girl" and every fifth correct response was reinforced with an edible reinforcer. Proportionally to the subject-experimenter ratio (2:1 vs 1:1), all subjects initiated more trials, emitted a larger number of correct responses, spent less time in inattentive behavior, and learned more words in the Simultaneous Condition than in the Individual Condition. Results from Experiment I also suggested that the subjects learned some of their partner's pictures as well as their own, thus indicating a further advantage of the Simultaneous Condition over

the Individual Condition.

In Experiment II, the two conditions were equated except for the presence of another subject performing at the picture-naming task. The results of this manipulation demonstrated that the increased rate of responding found in Experiment I was probably due to the presence of the other subject. Experiment II also demonstrated quite conclusively that the subjects were learning some of their partner's words as well as their own.

It would appear, therefore, that a Simultaneous Condition procedure is a viable alternative to the traditional one-to-one subject-experimenter ratio. More research on group vs. individual training in this and in other applied areas appears warranted given the efficiency of this procedure.

Chapter I

Introduction

President Kennedy's panel on mental retardation estimated that, in North America, three percent of the population could be described as falling into the mentally retarded range (see Edgerton, 1967, p.1). Such being the case, one can reliably estimate that there are over seven and one-half million individuals in North America that are mentally retarded. Added to this is an even larger number (sixteen and three-quarter million) borderline individuals who may or may not be considered mentally retarded dependent upon the degree of adaptive behaviors they possess (see Grossman, 1973, p.18). Given the enormity and severity of this problem, a great many operant conditioners are turning their attention to the training of this population. Most of their research in this field has concerned itself with three main areas:

1. elimination of undesirable behaviors (e.g. eliminating tantrum behavior);
2. training in self-help skills - personal, vocational and social (e.g. teaching a child to dress himself); and

3. training in "academic" skills (e.g. teaching a child to speak).

Elimination of Undesirable Behavior

The majority of the earliest works in behavior modification dealt with the elimination of undesirable behavior in schizophrenic and mentally defective patients. For example, as early as the late 1950's, Ayllon and Michael (1959) successfully eliminated the "disruptive" behaviors of frequent visits to the nurses' office, psychotic talk, violent behavior, refusal to eat and hoarding of paper and rubbish. They accomplished this by using the nurses' attention as reinforcement and the withdrawal of this attention as punishment.

With this impetus, other operant conditioners soon began to use the same behavior modification principles and techniques with the mentally retarded. Wolf, Birnbrauer, Williams, and Lawler (1965), for example, successfully eliminated classroom vomiting through the use of extinction and the positive reinforcement of alternative, appropriate behaviors. Within 30 class days, the vomiting behavior declined to a zero level as did the other behaviors that occurred with every

vomiting episode - screaming, clothes tearing, and destruction of property. It was also noted that productive classroom behavior and responsiveness to the teacher's requests improved markedly.

Another undesirable behavior that has received considerable attention by operant conditioners is self-injurious behavior. Tate and Baroff (1966), for example, successfully used response contingent electric shock with a nine-year-old blind boy residing in an institution for the mentally retarded. The boy emitted a variety of self-injurious behaviors including head-banging, face slapping, punching his face and head with his fist, hitting his shoulder with his chin and kicking himself. As a result of the high frequency of such behaviors (2 per minute) the child spent most of his time restrained in bed. With the initiation of response contingent shock, the number of self-injurious behaviors dropped to .06 per minute the first day, and to .03 per minute the second day. The subject was then continued on the program for an additional 165 days, with no self-injurious behaviors observed during the last 20 days.

Hamilton, Stephens and Allen (1967) used a combination of time out (the withdrawal of the opportunity of obtaining reinforcement) and physical restraint in a program to eliminate a variety of aggressive and destructive behaviors in five severely and profoundly retarded adolescents and adults. Following the occurrence of the target behavior, the subject was placed in a time-out area from 30 to 120 minutes, during which time she was either restrained to a padded chair bolted to the floor or, with one subject, restrained to her bed. Such undesirable behaviors as high frequency head and back banging, window breaking, body-slammings, clothes tearing and abusive aggressive behavior were quickly eliminated using this procedure.

Using similar procedures as those outlined above, a great many other undesirable behaviors have been reduced or eliminated. These include refusing to eat properly, rectal digging, sexual misconduct, hyperactivity, stealing, dangerous climbing and a myriad of others. (See Gardner, 1969, for a review.)

Training in Self-Help Skills

With the advent of the token economy in the mid-

sixties, emphasis in behavior modification changed from one of eliminating undesirable behavior to that of generating more appropriate behaviors. Using conditioned reinforcers which are only occasionally backed up with primary reinforcement, operant conditioners began ward-wide programs to teach self-care skills, vocational skills, and pro-social behavior. Examples of self-care programs have been provided by Bensberg, Colwell and Cassel (1965); Whitney and Barnard (1966); Peterson (1967); Roos (1965); and Karen and Maxwell (1967). An excellent example of this type of work is provided by Minge and Ball (1967) who devised a detailed step by step program for shaping up dressing behavior. The steps included behaviors such as attending, coming to the trainer, sitting down, remaining seated, and removing and putting on various articles of clothing. Six girls with an average I.Q. of 16, none of whom were toilet trained nor used words to communicate or made any effort at dressing themselves, were studied. Food was used as the reinforcer. Training occurred twice a day for fifteen minutes. At the beginning, gestures, tugs, and other prompts in addition to a verbal request were given. To obtain reinforcement, the girls had to respond correctly to prompts which

were reduced over time. After only two months, significant progress was observed.

A wide variety of self-care skills has been generated thus far. These include toilet training, dressing, shoe tying, shaving, eating properly, washing, talking, teeth brushing, hair combing and showering. (For major reviews in this area, see Watson, 1967; Gardner, 1971; and Thompson and Grabrowski, 1972.)

Many people have also benefited from the use of operant techniques in vocational training. Kliebhan (1966) and Evans and Spradlin (1966) are recent authors who pointed out that in a workshop situation, retardates are responsive to induced expectancies, modeling, and monetary rewards. In large scale token economies, for example, the residents have been taught to make beds, do house-keeping chores, work in the laundry and kitchen, sew, and do wood-working, clerical duties and numerous other meaningful jobs. (See, for example, Zimmerman, Stuckey, Garlick, and Miller, 1969.)

Finally, a great deal of attention has recently turned to the generation of more "sociable" behavior

such as playing together, co-operation, imitation, and the reduction of "apathetic" or "institutionalized" behavior. Studies reported by Bensberg et al. (1965); Wiesen and Watson (1967); Gorton and Hollis (1965), and Girardeau and Spradlin (1964) are excellent examples of training the retardate in the development of socialization skills.

Training in "Academic" Skills

In recent years, a major focus of attention by behavior modifiers in mental retardation has concentrated on the classroom situation and the acquisition of responses taught therein.

The first problem encountered in any classroom is getting the pupils to emit certain pro-social behaviors as necessary, albeit not sufficient, conditions for education. These behaviors may be called "attending", or "self-control", and typically involve sitting at a desk quietly and looking at the teacher. Birnbrauer (1967) described the application of behavioral concepts to a classroom of twenty boys with I.Q.'s of less than 44. The teacher used tangible reinforcers, then token reinforcers, and finally symbolic and social reinforcement.

Time out from reinforcement, such as removal of the opportunity to earn tokens in the classroom, was also used. Doubros (1966) reported on individual therapy situations to ameliorate disruptive behavior in retarded children and replace this with appropriate attending behaviors, while Santostefano and Stayton (1967) trained mothers who in turn trained their children to deploy attention selectively, actively and appropriately.

Once the child has been prepared for the classroom situation, the next matter is the operation of the classroom itself. Birnbrauer, Bijou, Wolf and Kidder (1965) and Birnbrauer, Wolf, Kidder and Tague (1965) described a classroom in which irrelevant and disruptive behavior was extinguished and appropriate behaviors or approximations were reinforced.

The content of instruction in such classrooms has varied greatly from study to study, but a large portion of the research has dealt with the modification of speech behavior. Typically, this research has concentrated in three main areas.

The first area in which behavior modification of speech has concentrated is in the reduction or elimination of

inappropriate or undesirable verbal behavior. Time out (as previously defined) has been the main tool in accomplishing this reduction. Such undesirable behavior as talking out in class, verbal jargon and echolalia have all been reduced successfully using this procedure (Barton 1970; Hall, Fox, Willard, Goldsmith, Emerson, Owen, Davis and Porcia, 1971; Risley and Wolf, 1967; McReynolds, 1969).

The second main area of research in behavior modification of speech has dealt with the improvement of the quality of existing speech. Such examples as teaching the use of plural nouns (Guess, Sailor, Rutherford and Baer, 1968; Guess, 1969; Sailor, 1971), adjectival inflections (Baer and Guess, 1971), verb inflections (Schumaker and Sherman, 1970), prepositions (Sailor and Taman, 1972) and syntax (Garcia, Guess and Byrnes, 1973) have all been researched. Others have taught the retardate to speak in whole sentences as opposed to an incomplete "telegraphic" sentence pattern (Wheeler and Sulzer, 1970), to ask questions appropriately (Twardosz and Baer, 1973), to answer questions on current events (Keilitz, Tucker and Horner, 1973), and to speak in the appropriate conversational speech form (Garcia, 1974).

The third and final area of research in verbal behavior has dealt with the acquisition of language in

those who have never spoken or have spoken very little. Kerr, Meyerson and Michael (1965), for example, shaped vocalizations in a mute three-year-old retarded girl using juggling and singing as reinforcers. Eventually the child could exhibit the precursor to imitative verbal behavior; namely, to make a sound within a short interval after the experimenter had made a sound. Risley and Wolf (1967), on the other hand, taught functional speech to echolalic children using a picture naming task. This involved the use of positive reinforcement to increase the children's imitation of object names and then bringing the imitation so strengthened under the control of the appropriate pictures.

Two recurring problems in studies of this sort have been those of inattention and incorrect responses. That is, typically in such tasks, the subject may not attend to the pictures being presented or, if he does attend, he may frequently incorrectly name them. Several procedures have been used to reduce these undesirable behaviors but, unfortunately, each has several disadvantages associated with it.

Time out has been one common technique used in the

past for reducing inattention and incorrect responses (Barton, 1970; McReynolds, 1969; Risley and Wolf, 1967). This procedure, however, may have the disadvantage of subtracting from the time available for training. Also, at least one study has shown that time out may, in fact, be reinforcing for some subjects (Steeves, Martin and Pear, 1970).

Response cost (the withdrawal of positive reinforcement following an error or inattention) is another procedure used to reduce these undesirable behaviors. Typically this procedure involves the removal of conditioned reinforcers, such as points or tokens, but some investigators have used the withdrawal of primary reinforcers such as candy or cartoons (Sailor, Guess, Rutherford and Baer, 1968; Hamilton, Stephens and Allen, 1967). But it has been suggested (e.g., Gardner, 1969) that such a withdrawal of reinforcement may unfortunately produce several undesirable side effects such as disruptive emotional states and aggression.

Perhaps the most frequently used punishment paradigm for errors and inattention has been that of presenting an aversive stimulus such as a sharp "No", a slap on the hand, or an electric shock (Kircher, Pear and Martin,

1971, and Martin, England, Kaprowy, Kilgour and Pilek, 1968). With the use of such procedures, however, there is always the possibility that the experimenter may in fact punish the desired verbal responses when they occur in close temporal proximity with the undesirable behavior. Also, as with response cost, it has been suggested that the use of punishment involving presentation of aversive stimuli may generate escape and avoidance behaviors, aggression, a reduction in the reinforcing powers of the experimenter, and other undesirable side effects.

As well as all the above disadvantages, it should be pointed out that all these punishment procedures are far from being totally effective. Some have reduced the amount of inattention of the subjects by only a few seconds per session or reduced only minimally the number of errors emitted (see, for example, Kircher et al, 1971). The problem remains, then, of how to teach retarded children appropriate verbal behavior while at the same time effectively reducing both the amount of time spent in inattention and the number of errors emitted.

Chapter II

Statement of the Problem

The present study was directed towards an important problem facing those who use operant techniques to teach verbal behavior to severely and profoundly retarded children. In many of the studies cited in the introduction, the initial training of speech acquisition with severe and profound retardates is done with a one-to-one subject-experimenter ratio. As mentioned previously, such sessions are plagued by the problems of inattention and errors emitted by the subject. One possible solution is to have the experimenter work with two subjects at one time. The straightforward question we were asking in the present research was therefore this: Is it more efficient in terms of performance of the children on a picture-naming task for an experimenter to work in sessions of a specified duration with one subject, giving that subject his (the experimenter's) exclusive and continuous attention? Or, is it more efficient for an experimenter to work in sessions of the same length with two subjects, teaching each a different picture and dividing his (the experimenter's) attention between the two sub-

jects such that if one subject is not attending or makes an error, the experimenter will switch to the other subject and vice versa?

Intuitively, it would seem that the probability of both children being inattentive at a given time is lower than that of one child alone. This, then, should reduce the time wasted while a given child is inattentive. By switching to the other subject following an error we are, in effect, administering a time-out period without the loss of valuable working time. This should reduce the number of errors.

There may be other beneficial effects, as well. Some research relevant to this possibility comes from the social psychology literature on "social facilitation". Primarily, this research has demonstrated that the performance of an individual subject is facilitated by the presence of others, whether they be passive spectators or peers working on the same task. (Bergum and Lehr, 1963; Dashiell, 1930; Allport, 1920). For example, Travis (1925) presented twenty-two college undergraduates with a revolving disc on which there was a small circular target. They were given flexible pointers with which to follow the rotating target as long as

possible. The apparatus, called the pursuit rotor, was wired so that when the pointer was held on the target for one complete revolution, the subject obtained a score of ten. The scores for the first few days were all around 150 per session, but then they began to rise, at first rapidly, then at a slower rate and finally levelled off completely. When the subject reached a stable level, he was considered to have mastered the task, and training was concluded.

The following day the subject was called to the laboratory and given five trials. After completing them, he was told that "a number of individuals wished to observe him follow the target!" This audience, consisting of from four to eight upperclassmen and graduate students, had been instructed to watch the subject quietly but attentively. Ten trials were administered to all subjects in the presence of this audience.

In analyzing the results, Travis compared the subjects' performance while working in the presence of the audience with their prior performance in two ways. First, the average of the ten audience trials was compared with the highest ten consecutive scores that each subject received dur-

ing training. The average of the highest ten consecutive "alone" scores was 172.26, while the average of all the audience trials was 177.42. Second, the highest score that each subject received during training was compared with the highest score he reached during his audience performance. The average of the former was 184.68 and of the latter 188.86. Both comparisons show that the subjects' performance in the presence of an audience surpassed their performance while working alone.

However, not all studies involving more than one person have found a facilitative effect on performance. Ader and Tatum (1963), for example, confronted graduate and medical students with the following situation. The subjects, upon entering the laboratory in pairs and alone, were seated at a table and shock electrodes were attached to their legs. They were asked not to smoke, speak, get up from the chair, or touch the electrodes. The table, otherwise quite ordinary, was equipped with a red button. After placing the subject in position, the experimenter left the room without any further instruction. Now the individual would receive a shock for a period of one-half second every ten seconds unless he pressed the red

button. Pressing the red button automatically delayed the shock for a period of ten seconds. Note that the experimenter said nothing to his subjects about the purpose of the experiment, about the significance of the button, or about what they were expected to do.

In one condition the subjects worked alone; in another they were brought to the room in pairs and seated across from each other. The subject (or the pair) was considered to have learned the task if he (or they) did not receive more than five shocks in a period of five minutes. The authors report that the individually conditioned subjects required, on the average, eleven minutes and thirty-five seconds to reach this criterion of learning. Of the twelve pairs in Ader and Tatum's experiment, only two eventually learned the avoidance response. These two pairs required forty-six minutes and forty seconds and sixty-eight minutes and forty seconds to reach the criterion of learning.

Similarly, Pessin (1933) found that when college students were required to learn a list of nonsense syllables with several spectators present, learning was slower than when learned alone. Husband (1931) also found that

the presence of others disturbed and interfered with the learning of a finger maze.

Researchers in this area have attempted to resolve this discrepancy by stating that coaction and the presence of others facilitates the emission of well-learned responses but impairs the acquisition of new responses. (For example, see Zajonc, 1966.)

Although the social facilitation literature sheds some light on the possible outcome of the proposed comparison, the present research was necessary for at least three reasons. One reason was the fact that a large portion of this social facilitation literature with human subjects was based on results with college students working on tasks totally unrelated to a picture-naming task with retarded children. The second main reason for conducting the study was the above-mentioned distinction made by Zajonc (1966) between acquisition and maintenance. In a picture-naming task, the subject is not only rehearsing well-learned responses, but is also acquiring new responses. Finally, with the presentation of different pictures to each subject, there was the possibility that this would interfere with each subject learning to

identify his own pictures.

One study relating to this issue is that by Borus, Greenfield, Spiegel and Daniels (1973). In this study, a team of three adults worked with four children as a group using operant techniques to establish imitative language behavior in children who had language deficits and behavior disturbances. Although no subjects were worked with individually to provide a comparison of groups with individual training, results of the study appeared to indicate that the four subjects progressed at a rate approximately equal to that of children receiving similar therapy individually in other studies. The authors, therefore, conclude that "the advantages of group therapy, as seen in the experiences with this group, combined with the enormous costs of a team approach when only one child receives therapy at a time, certainly suggest the need for research in this area and consideration of group therapy for children with similar problems (p.540)".

The present study attempted to provide a more precise test of whether a procedure involving teaching two severely retarded simultaneously results in substantial savings when compared with teaching them individually.

In addition, the present research attempted to isolate factors responsible for the savings which resulted.

Chapter III

Experiment ISubjects

The subjects for this study were seven retarded children (two females and five males) at the St. Amant Wards of the St. Vital Hospital, Winnipeg, Manitoba. All were chosen because of their ability to mimic a number of words when presented with a prompt. That is, all seven subjects were able to mimic a few words after the experimenter had just said the word. The subjects did not have very much other appropriate verbal behavior. Three of the subjects had previous experience with the picture-naming procedure but none of them had been taught with the equipment used in this study. Only four subjects were involved in the study at any one time.

Alex, a mongoloid boy who was seven years old when the study began, rarely displayed spontaneous verbal behavior other than a few incoherent grunts when someone talked to him. Rather, he typically communicated by pointing or similar gestures. He was considered to be a hyperactive child with awkward motor movements.

Rodney was a nine-year-old mongoloid boy who participated twice in the experiment. He was Alex's partner in the beginning of the experiment, but when Alex returned to school in the fall, he became Broderick's partner. The majority of Rodney's time was spent in self-stimulatory behavior such as flapping his arms, internal squinting, and excessive laughing. He did, however, frequently attempt to verbalize but most of the time his speech was incoherent.

Broderick was a nine-year-old mongoloid boy who had previously participated in a picture-naming task but whose enunciation was quite poor. For example, he would say "cah" for "cat", "bah" for "ball", etc. He was quite an aggressive boy who would rarely follow even the simplest instructions. When he did not get his own way, he would sit on the floor and cry.

Joey was a five-year-old mongoloid boy when the study began. At that time he was assessed by the hospital's psychologist as functioning at a little under fifty percent of normalcy. He exhibited a little verbal behavior, but most of this was very quiet whispering. When reprimanded he would frequently cease whatever he was

doing and just sit quietly.

Allan was a five-year-old boy who showed no etiological reason for his retardation. He served as a subject twice in this experiment, first as a partner to Joey and later as a partner to Gracie. He exhibited several repetitive and unusual behaviors such as spinning around on his seat, flapping his arms, and frequent head posturing. As with Broderick, Allan's enunciation was quite poor but he did know the words to a few nursesey rhymes and would attempt to imitate whatever he heard.

Gracie was a six-year-old hydrocephalic girl who had a shunt inserted at the age of four months. She, too, participated twice in this experiment, first as a partner to Allan and then when Allan returned home for a summer vacation, as a partner to Claudette. She was assessed as functioning at fifty percent of normalcy. Her speech was echolalic, parroting various phrases and songs she heard on television or from the ward staff.

Claudette was an eight-year-old hydrocephalic mingo-

loid girl who had a shunt inserted at the age of one year. She was a well-behaved child who exhibited a great deal of speech but rarely following a prompt. Most of the prompts which she would imitate had to be broken up into syllables; e.g., "cah-tuh" for "cat".

Apparatus and Materials

The experiment was conducted in one of the cubicles of the Psychology Research Room of the St. Vital Hospital. In this cubicle was a child-sized desk close to one wall and three small chairs, two of which were placed in such a fashion as to inhibit the subjects from leaving the chairs. On the desk were two rectangular metal boxes (the subjects' response panels) containing a set of stimulus lights and two levers, only one of which was operative on each apparatus in this study. Each lever was connected to a master control panel operated by the experimenter. The control panel was attached to a digital-logic system (manufactured by DRT Associates, Winnipeg, Manitoba) in an adjoining room. Also, a variety of reinforcers ("Smarties", chocolate-coated raisins and peanuts, soda pop and potato chips), a stop-watch, data sheets and a number of Peabody picture cards were present on the table. The Peabody cards contained realistic

pictures of single objects, animals and people, so that they were readily describable by single words.

Preliminary Training

Prior to an investigation into the effectiveness of teaching two children a picture-naming task simultaneously, it was first of all necessary to conduct a number of preliminary sessions.

Picture naming. The subjects were first trained to respond verbally when presented with pictures and asked, "What's that?" Since appropriate responses were reinforced, the presentation of a picture was a conditioned reinforcer.

Lever training. Lever training consisted of teaching the subjects to press a lever to have a picture card presented. This response, designated as the "attending" response, was used in order to avoid the possibility of experimenter bias which may exist when attending is defined as either "eye contact" or "head orientation".

At the start of these training sessions, the experimenter started the equipment which illuminated a blue

light and a red light on the subject's response panel, and started a timer in the adjoining room. In order to have a picture presented to him, the subject was required to emit one lever press. This response stopped the timer and turned off the red light for a period of seven seconds, at which time the experimenter immediately presented a picture. This seven second period allowed sufficient time for the subject to respond to the picture. The onset of the red light marked the beginning of each trial.

Inattention time, which was automatically recorded by the timer, was defined as the total amount of session time in which the red light was illuminated. The offset of this red light and the presentation of a picture were the only consequences of lever pressing. It should be noted from the preceding that the number of picture presentations or trials per session was determined by the subject. Lever presses when the red light was off had no scheduled effects.

This response of lever pressing was established through the technique of "shaping" whereby closer and closer approximations to lever pressing were differenti-

ally reinforced. Initially, each subject was prompted to press the lever to have a card presented and then gradually the prompts were reduced. After a number of sessions, it was observed that the child often pressed the lever when the red light was illuminated and rarely pressed it when the light was not illuminated. In addition, it was observed that when the subject had pressed the lever he or she also tended to emit some response to the subsequently presented picture. Instances in which the subject pressed the lever and did not respond to the picture were very infrequent. These informal observations suggested that the attending light and picture presentations exerted adequate control over the attending response.

Word pool selection. Since the picture-identification task required that the words be unknown, yet clearly pronounceable, by the subject, the following procedure was used to determine exactly which words each subject could mimic and which pictures each could identify.

1. The first card in a stack of thirty or forty was placed in front of the subject face down. When the subject pressed the lever, the experimenter turned

the card over while saying, "What's that?" Five seconds were allotted for a response to occur.

2. If a correct response occurred, it was reinforced with a "Good boy" or "Good girl" and backed up with a primary reinforcer after every fifth correct response.

3. If no response occurred within the five seconds or if an incorrect response occurred, the experimenter gave a prompt by saying, "That's a (name of object). What's that?"

4. If a correct response occurred for this prompt, it was recorded as a 1 and reinforced with a "Good boy/girl" which was backed up with a primary reinforcer after every fifth correct response. If parts of the word were correct, the word was then broken up into syllables and given as prompts. Thus, for example, the word "cat" would be broken into "cah" and "tuh". Correct responses to these prompts were recorded as a 2 and reinforced the same way as a 1 above (with only one reinforcer given for the entire word).

5. If an error occurred to the prompt or if no response

occurred after five seconds, the next picture was presented.

6. After all the pictures had been presented once, the procedure was repeated twice again with all pictures.

7. Those words that were correct three times in succession without prompts were considered to be "known" words. Those words that were correct three times in succession with prompts, but which were never correct without prompts, were considered to be "new" words. All other words were discarded from the experiment.

The new words were then divided randomly into two word pools for each subject with each pool containing an equal number of words. Randomization consisted of drawing the words from a container one at a time without replacement and placing them in two separate word pools. One word pool was for use in the Individual Condition, the other in the Simultaneous Condition (see below). The known words were treated in the same fashion.

Different words were used in the pools of the two

members of each pair of subjects in the Simultaneous Condition so that there would be no possibility of a subject learning words from one of his own pools by being exposed to the training of the other subject.

General Procedures

Experiment I was designed to compare the effects of sessions in which two children are taught to name pictures simultaneously (the Simultaneous Condition) with those in which they are taught individually (the Individual Condition). An attempt was made to equate these two conditions except for the independent variable under investigation. Thus, for both subjects, there were two twenty minute sessions, one in each condition, for any given experimental day with ten to thirty minute breaks dividing the two sessions. In both conditions, the same reinforcers were used as well as the same room, the same equipment, etc. To control for possible order effects, the order of the conditions was alternated every day.

In both conditions, the subjects were seated behind their respective panels and the experimenter was seated on the other side of the table, behind the master control panel. A red stimulus light and a blue stimulus light on one of the subject's panel were on at the be-

ginning of each session. The blue stimulus light indicated which subject could press his lever to have a picture presented. When both of these lights were on, the digital logic system in the adjoining room was recording, in seconds, both the total time the experimenter spent with that particular subject as well as that subject's inattention. When the subject pressed the lever, the red stimulus light turned off for a period of seven seconds during which time the counter on the digital logic system stopped recording inattention. Also, during this time, the experimenter turned over a card which was selected from that subject's word pool for that specific condition and said, "What's that? That's a (name of object). What's that?" This first step was called a prompt trial. If this new word was recorded as a 1 on the baseline, then the prompt was not broken up. If, however, the word was recorded as a 2 during baseline, then the prompt was broken up. (See Word pool selection above.)

If the subject correctly mimicked the prompt, then on the next trial the experimenter pointed to the picture and asked, "What's that?" This was called a question trial. Correct responses to either the prompt or the question trials were reinforced with "Good boy" or

"Good girl". Incorrect responses and omissions on a prompt or question trial resulted in a repeat of the prompt trial. This continued until the subject responded correctly to the question trial.

Step 2 was then carried out for a randomly selected known word and then again for the new word. The question trials for the new and known words were then alternated until the subject made four successive correct responses.

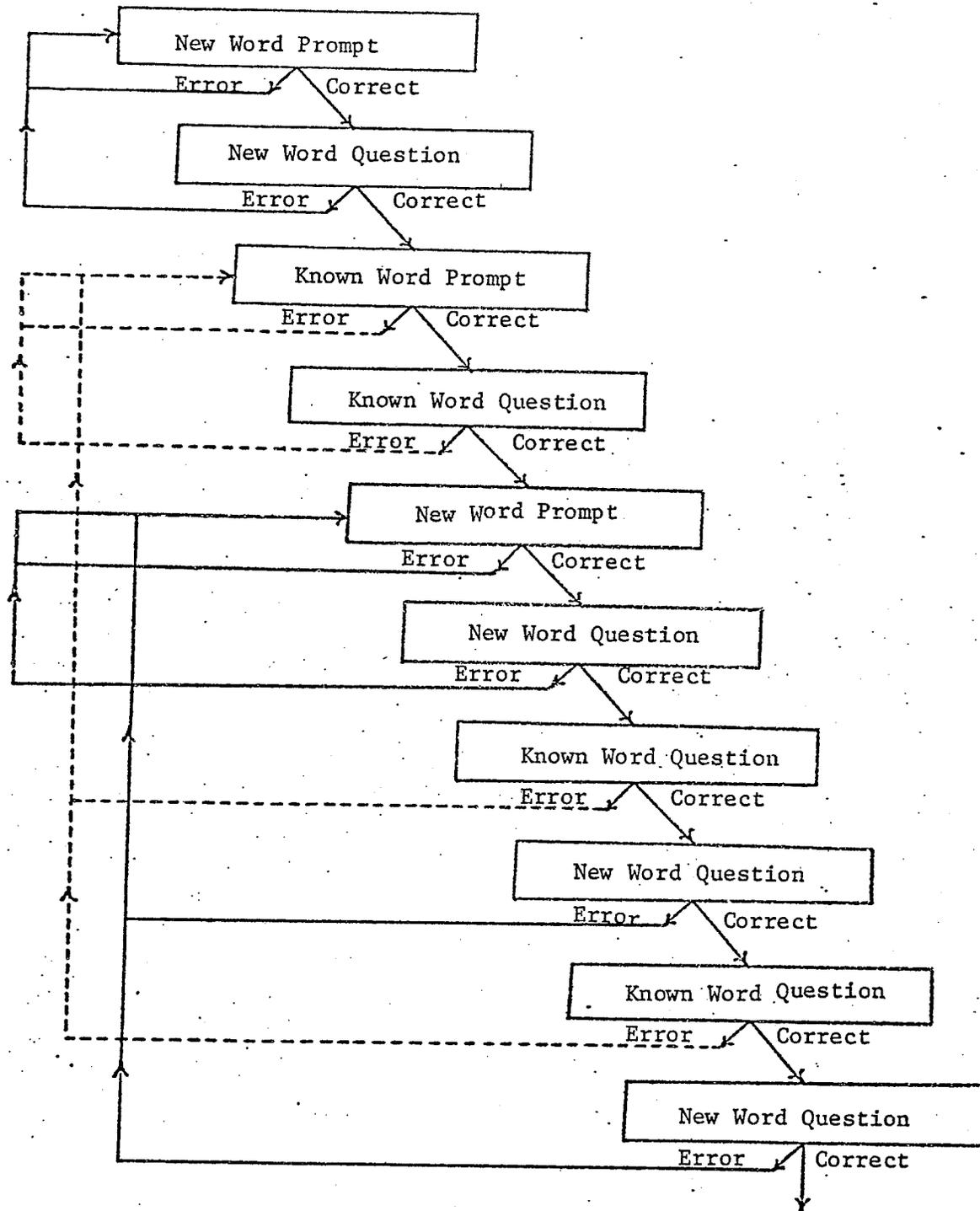
Step 3 involved repeating steps 1 and 2 with a second known word and then again with a third known word.

Throughout this procedure, when the subject had responded correctly five times, he would then receive a single primary reinforcer. That is, while every correct response was followed by a "Good boy" or "Good girl", it was only every fifth correct response that was followed by the back-up reinforcer.

When steps 1 to 3 were completed for a new word, that word was said to have reached criterion. When a word had reached this criterion, it was tested once at the

beginning of the next three sessions of the same condition or until it was incorrectly recalled. If it was incorrectly recalled at the beginning of any of the next three sessions, it was returned to step 1. However, if it was correctly recalled at the beginning of each of these three sessions, it was called a "learned" word and was eligible to be used as a known word. If a word had not reached criterion after six sessions, or upon reaching criterion for the first time was not learned after six sessions, it was discarded.

Figure 1 shows schematically the procedure used for the picture-naming task and Figure 2 gives an example of a typical daily data sheet using this procedure. Figure 3 shows an example of a cumulative data sheet which was used to record the pertinent data over sessions. As can be seen from this figure, on November 3, it was Broderick's 25th session in the Simultaneous Condition. He made 63 correct responses and 15 errors on the new word, tent, and had 120 seconds of inattention out of a total working time of 486 seconds. In the same session, he began the new word egg. On November 4, it was the 26th session and Broderick made 54 correct responses and 2 errors on the words egg and



This whole procedure is repeated with another known word and then again with another.

Fig. 1. A schematic representation of the picture-naming task.

Date: Aug.25 Condition: Sim.				Date: Aug.25 Condition: Ind.			
New Word: Tree				New Word: Corn			
Subject: Rodney				Subject: Rodney			
	K.W.1	K.W.2	K.W.3		K.W.1	K.W.2	K.W.3
N. W. P.	1	1	1	N. W. P.	11		
N. W. Q.	1	1	1	N. W. Q.	X1		
K. W. P.	1	1	1	K. W. P.	1		
K. W. Q.	1	1	1	K. W. Q.	1		
N. W. P.	1	11	1	N. W. P.	111		
N. W. Q.	1	11	1	N. W. Q.	X11		
K. W. Q.	1	11	1	K. W. Q.	11		
N. W. Q.	1	X1	1	N. W. Q.	X1		
K. W. Q.	1	1	1	K. W. Q.	1		
N. W. Q.	1	1	1	N. W. Q.	1		

Fig. 2. An example of a typical daily recording sheet used to retain all the pertinent information during the picture-naming procedure. Column 2 (K.W.2) is given below as presented to the subject.

N.W.P.	What's that?	That's a Tree.	What's that?	Subject answers	Tree
N.W.Q.	What's that?				Tree
K.W.P.	What's that?	That's a Phone.	What's that?	Subject answers	Phone
K.W.Q.	What's that?				Phone
N.W.P.	What's that?	That's a Tree.	What's that?	Subject answers	Tree
N.W.Q.	What's that?				Tree
K.W.Q.	What's that?				Phone
N.W.Q.	What's that?				See

(The correct response here would be Tree. Since the subject made an error, the procedure was repeated beginning with N.W.P.)

N.W.P.	What's that?	That's a Tree.	What's that?	Subject answers	Tree
N.W.Q.	What's that?				Tree
K.W.Q.	What's that?				Phone
N.W.Q.	What's that?				Tree
K.W.Q.	What's that?				Phone
N.W.Q.	What's that?				Tree

Subject: Broderick

Condition: Simultaneous

Date	#	✓	X	New Words	Reached Criterion	Criterion Wds. Test	Words Learned	T.T.	Inatt
Nov 3	25	63	15	Tent Egg	Tent			486	120
Nov 4	26	54	2	Egg Horse	Egg	Tent (1)		460	190
Nov 5	27	59	8	Horse Eye	Horse	Tent(2) Egg(1)		512	136
Nov 6	28	61	13	Eye Key	Eye	Tent(3) Egg(2) Horse (1)	Tent	457	126

Fig. 3. An example of a cumulative recording sheet used to record all the pertinent information of the picture-naming task over sessions.

horse. Egg reached criterion in this session but horse did not. Also, the word that had reached criterion the session before (tent) was tested for the first time and Broderick responded correctly. Total working time for this session was 460 seconds and inattention was 190 seconds. On November 5, horse was the first word taught since it had not reached criterion the session before. The second word was eye. The criterion words tested were tent for the second time and egg for the first time. There were 59 correct responses and 8 errors in this session as well as 512 seconds of working time and 136 seconds of inattention. On November 6, the new words taught were eye and key. Eye reached criterion, key did not. Tent was tested for the third time and therefore became a "learned" word. Egg was tested for the second time and horse for the first time.

Specific Procedures

The Individual Condition. The Individual Condition proceeded according to the following steps.

1. The subject was seated behind a subject's response panel while the other panel was placed out of reach

and made inoperative.

2. While sitting opposite the subject, the experimenter activated the equipment by depressing a switch on the master control panel which illuminated a blue light and a red light on the subject's response panel and started the two timers in the adjoining room. One timer recorded the total time (always 20 minutes in the Individual Condition) the experimenter spent with that subject during the session (i.e., the total time the blue light was on) while the other timer recorded the subject's inattention (i.e., the total time the red light was on). The blue light remained on for the duration of the Individual Condition session.

3. When the subject pressed his or her lever, this turned off the red attending light and stopped the inattention timer for a period of seven seconds. Immediately, the experimenter presented a picture from the Individual Condition word pool for that subject and proceeded with the picture-naming procedure outlined above.

4. A correct response to either a prompt or a question trial was reinforced with a "Good boy" or "Good

girl" and recorded on the daily data sheet. Every fifth correct response was also reinforced with the back-up reinforcement. After seven seconds the subject's red attending light and inattention counter again turned on until the next lever press.

5. Incorrect responses or omissions to the prompt or question trials were recorded on the data sheet and the subject was ignored until the red attending light again turned on and the subject again pressed the lever.

The Simultaneous Condition. The Simultaneous Condition proceeded according to the following steps.

1. Both subjects were seated behind his or her own response panel while the experimenter sat directly opposite them beside the master control panel.

2. The experimenter depressed a switch on the master control panel which activated the equipment and illuminated a blue light and a red light on one of the response panels as well as turning on two timers in the adjoining room. These two timers recorded (in seconds) both the total time the experimenter spent with that

subject during the session (i.e., the total time that the subject's blue light was on) and that subject's inattention (i.e., the total time that subject's red light was on).

3. When the subject whose panel lights were illuminated pressed the lever, the red attending light and the inattention timer turned off for a period of seven seconds. During this time the experimenter presented a picture from the Simultaneous Condition word pool for that subject and proceeded with the picture-naming procedure. The other subject's panel, which was not illuminated, was inoperative at this time.

4. A correct response to either the prompt or question trials was reinforced with a "Good boy" or "Good girl" and recorded on the daily data sheet for that subject. After seven seconds, that subject's red attending light and inattention timer again turned on.

5. Each response followed by a primary reinforcer (i.e., every fifth correct response) and each incorrect response, omission, and ten second period of inattention in which there was no lever press by the subject resulted in that subject's panel being made inoperative. By pressing a button on the master control panel the

experimenter turned off the red and blue stimulus lights and the two timers recording total time and inattention. Concurrently, the other subject's panel was activated which illuminated the red and blue stimulus lights of his/her response panel and turned on two additional timers in the adjoining room. These two timers recorded the total time the experimenter spent with this second subject as well as his or her inattention.

6. Steps 3, 4 and 5 were then repeated for this second subject.

Test for incidental learning. Several studies have shown that learning can take place directly from observing others being reinforced (Bandura, 1971; Hill, 1960; Kanfer, 1965). Since this possibility existed in the Simultaneous Condition, a test was administered to the last four subjects of Experiment I to determine if any of them had learned some of his or her partner's new words through incidental learning. The subjects were asked to identify three lists of pictures:

1. new words that they learned;
 2. their partner's new words that the partner learned;
- and,
3. a similar list of words that neither subject was taught.

Dependent variables. The following dependent variables were examined in the experiment.

1. Total trials per session. This measure consists of the total number of trials each subject initiated per session in the two conditions.
2. Number of correct responses per session. This measure consists of the total number of correct responses on both prompt and question trials (i.e., the total number of correct imitative and naming responses).
3. Number of errors per session. This measure consists of the total number of incorrect responses plus the total number of omissions on both the prompt and question trials.
4. Percent correct. This measure consists of the percentage of trials (picture presentations) on which correct responses were emitted.
5. Inattention time per trial. This measure is the average amount of time per trial between the onset of the red attending light and the execution of an attending response. This could also be called the average "latency of the response", which is the term generally used in other discrete

trial procedures.

6. Number of picture names learned. This indicates the number of picture names learned by each child according to the previously described criterion for a learned picture.

Interobserver reliability. Since the decisions regarding the correctness of a subject's verbal responses were open to bias, interobserver reliability measures were used to check the accuracy of these. To do this, a second person listened to a number of taped recordings of the various sessions and recorded the number of agreements and disagreements he had with those judgements of the experimenter. This was done prior to the observer hearing the experimenter's decision regarding each response. The reliability coefficient was calculated using the formula:

$$R = \frac{\text{number of agreements}}{\text{total number of responses}} \times 100$$

Of the thirty-six sessions on which reliability checks were given, the overall measure of reliability averaged out to: Simultaneous Condition - 97%; Individual Condition - 98%.

Results

There were several ways the data could have been analyzed to determine the effectiveness of the Simultaneous Condition, both with respect to the experimenter's time and with respect to the subjects' performance. The method of analysis chosen was to examine the ratio of each dependent variable in the Simultaneous Condition to that of the same variable in the Individual Condition. These ratios were then compared to the .50 level which would have been expected if there was no difference between the two conditions. That is, since two subjects were worked with in the Simultaneous Condition during the same amount of time as one subject was worked with in the Individual Condition, one would expect that the subjects would, on the average, engage in one-half the number of trials, one-half the number of errors, one-half the amount of inattention, etc. if there were no differences between the procedures. The ratios thus show the relative effectiveness of the Simultaneous Condition in comparison to the Individual Condition. The ratios for each dependent variable will be presented separately, combining the data from all the pairs of subjects into one section for each dependent variable.

Total trials in the Simultaneous Condition/Total trials in the Individual Condition. Figure 4 shows the ratio of total trials in the Simultaneous Condition over total trials in the Individual Condition for Alex and Rodney. As can be seen from this figure, both of the subjects initiated more trials (relative to the number expected if there were no differences between conditions) in the Simultaneous Condition than in the Individual Condition in most of the sessions. Rodney was especially active in the Simultaneous Condition sessions, sometimes engaging in more trials in this condition than in the Individual Condition even though the experimenter spent less time with him in this condition.

Figure 5 shows the total trials ratios for Joey and Allan. Although not consistently showing the effect as clearly as the previous pair, here too the majority of the sessions for both subjects showed a larger relative number of trials initiated in the Simultaneous Condition. At one point, however, Joey stopped responding for a few sessions in the Individual Condition which resulted in an undefined ratio.

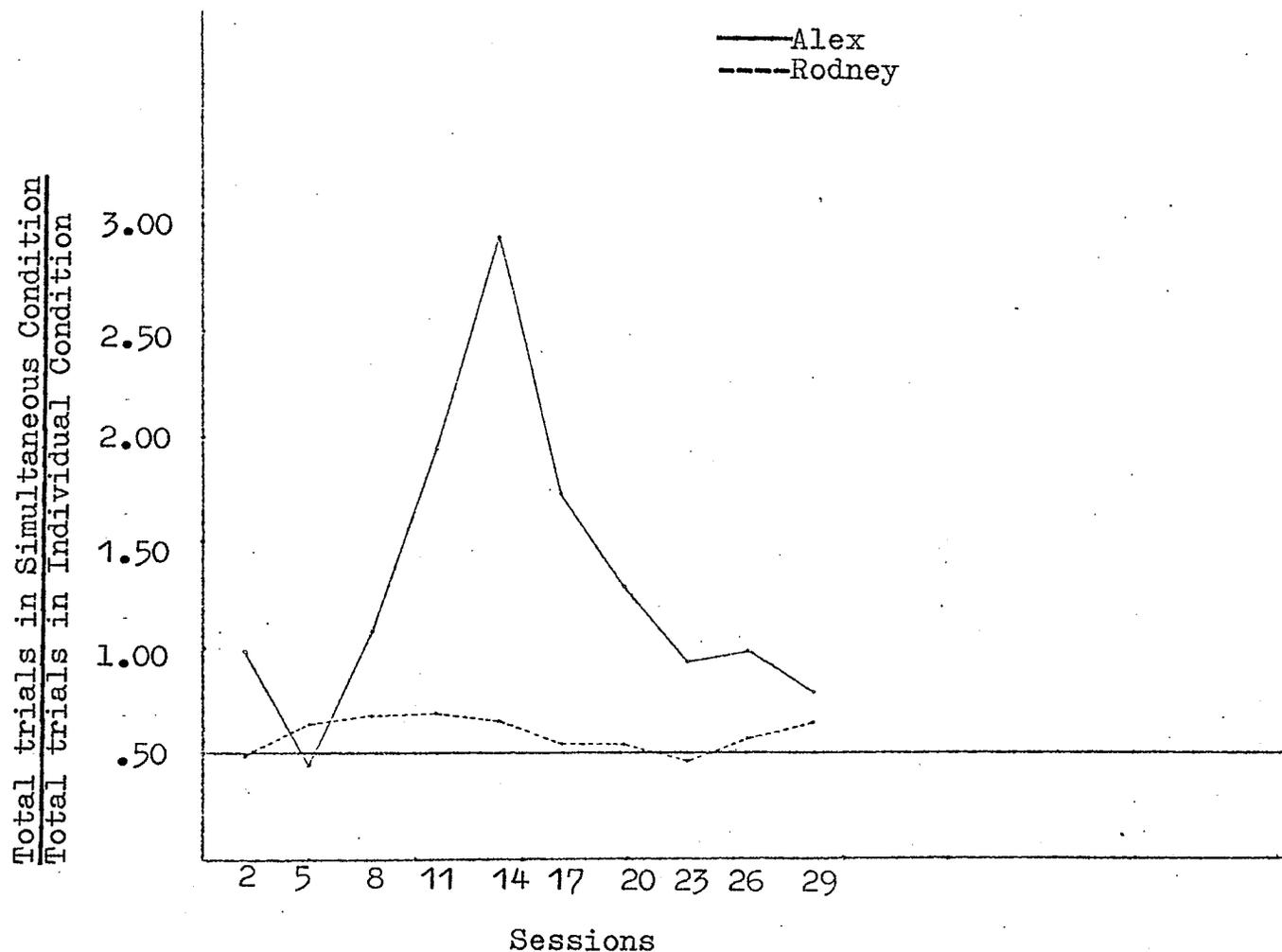


Fig. 4. The ratio of the total number of trials Alex and Rodney initiated in the Simultaneous Condition in blocks of three sessions over the total number of trials they initiated in the Individual Condition during the corresponding three-session blocks. The .50 line indicates the average ratio that would be expected if there were no differences between the two conditions.

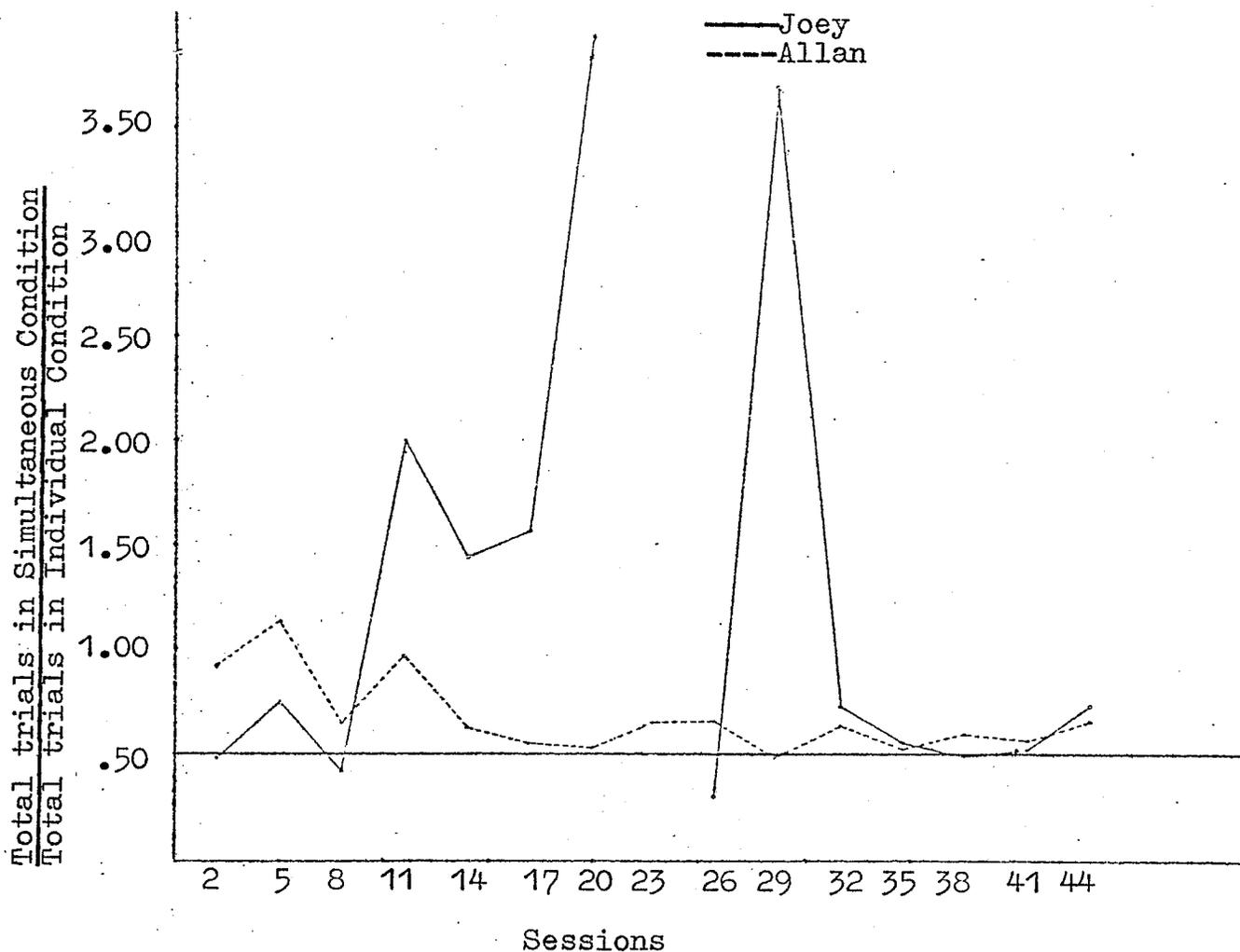


Fig. 5. The ratio of the total number of trials Joey and Allan initiated in the Simultaneous Condition in blocks of three sessions over the total number of trials they initiated in the Individual Condition during the corresponding three-session blocks. The .50 line indicates the average ratio that would be expected if there were no differences between the two conditions. Between sessions 20 and 25, Joey stopped responding in the Individual Condition which resulted in an undefined ratio.

Figure 6 presents the ratio of total trials for Allan and Gracie. Once again, a large portion of the sessions show more trials, relative to the expenditure of the experimenter's time, were initiated in the Simultaneous Condition for both subjects. At one point, Gracie stopped responding in the Individual Condition resulting in an undefined ratio.

Figures 7 and 8 present the ratios of total trials in the Simultaneous Condition over total trials in the Individual Condition for the last two pairs of subjects, Broderick and Rodney, and Gracie and Claudette. Here, too, the data indicate that all four subjects responded more in the Simultaneous Condition than in the Individual Condition, relative to the expenditure of the experimenter's time.

Figures 4 to 8 would thus seem to indicate that, in general, there is a comparatively larger relative number of self-initiated trials in the Simultaneous Condition than in the Individual Condition. Indeed, in quite a few instances, the absolute number of trials in the Simultaneous Condition equalled or even surpassed the number of trials in the Individual Condition. This was the case even though the time spent with each subject

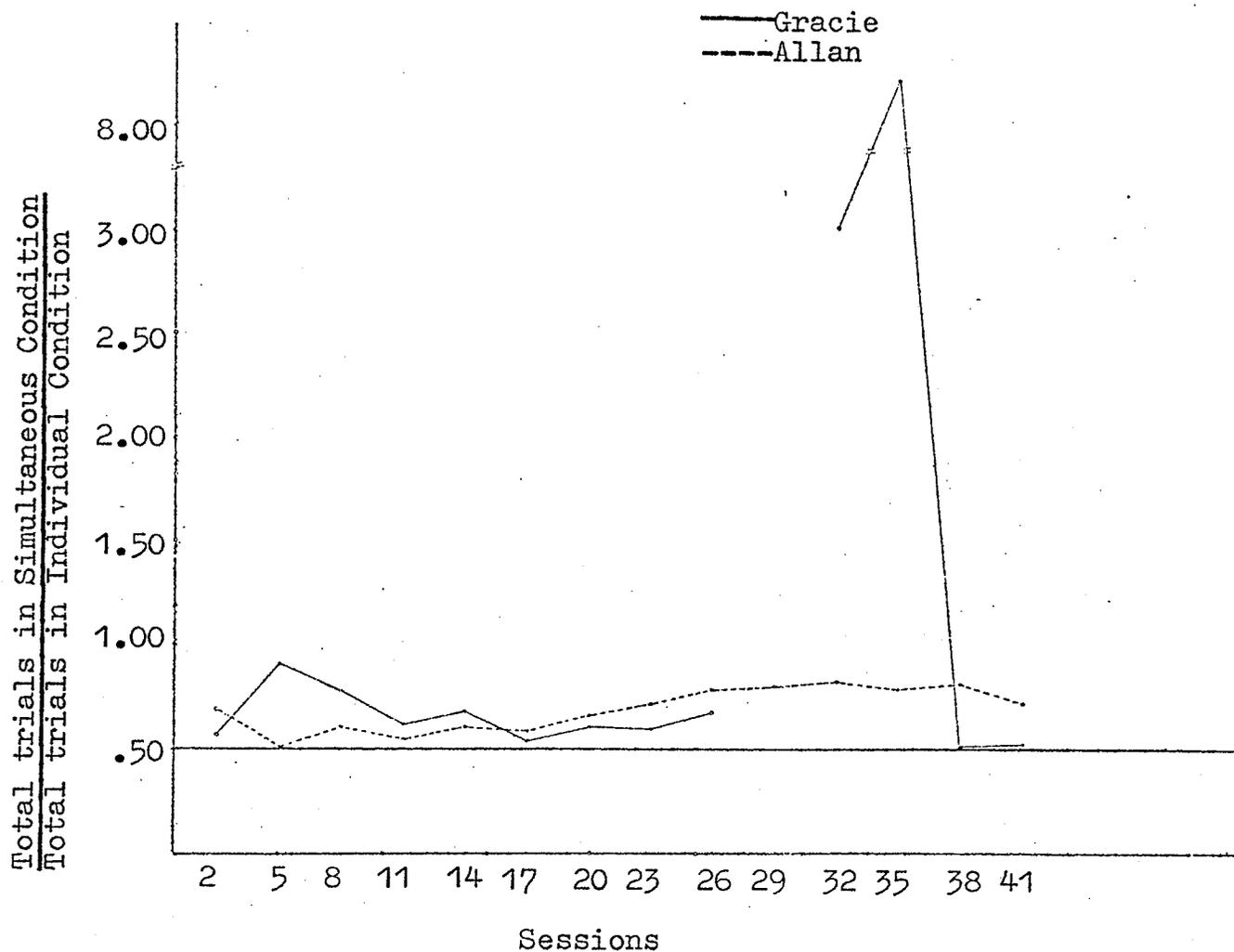


Fig. 6. The ratio of the total number of trials Gracie and Allan initiated in the Simultaneous Condition in blocks of three sessions over the total number of trials they initiated in the Individual Condition during the corresponding three-session blocks. The .50 line indicates the average ratio that would be expected if there were no differences between the two conditions. Between sessions 26 and 31, Gracie stopped responding in the Individual Condition which resulted in an undefined ratio.

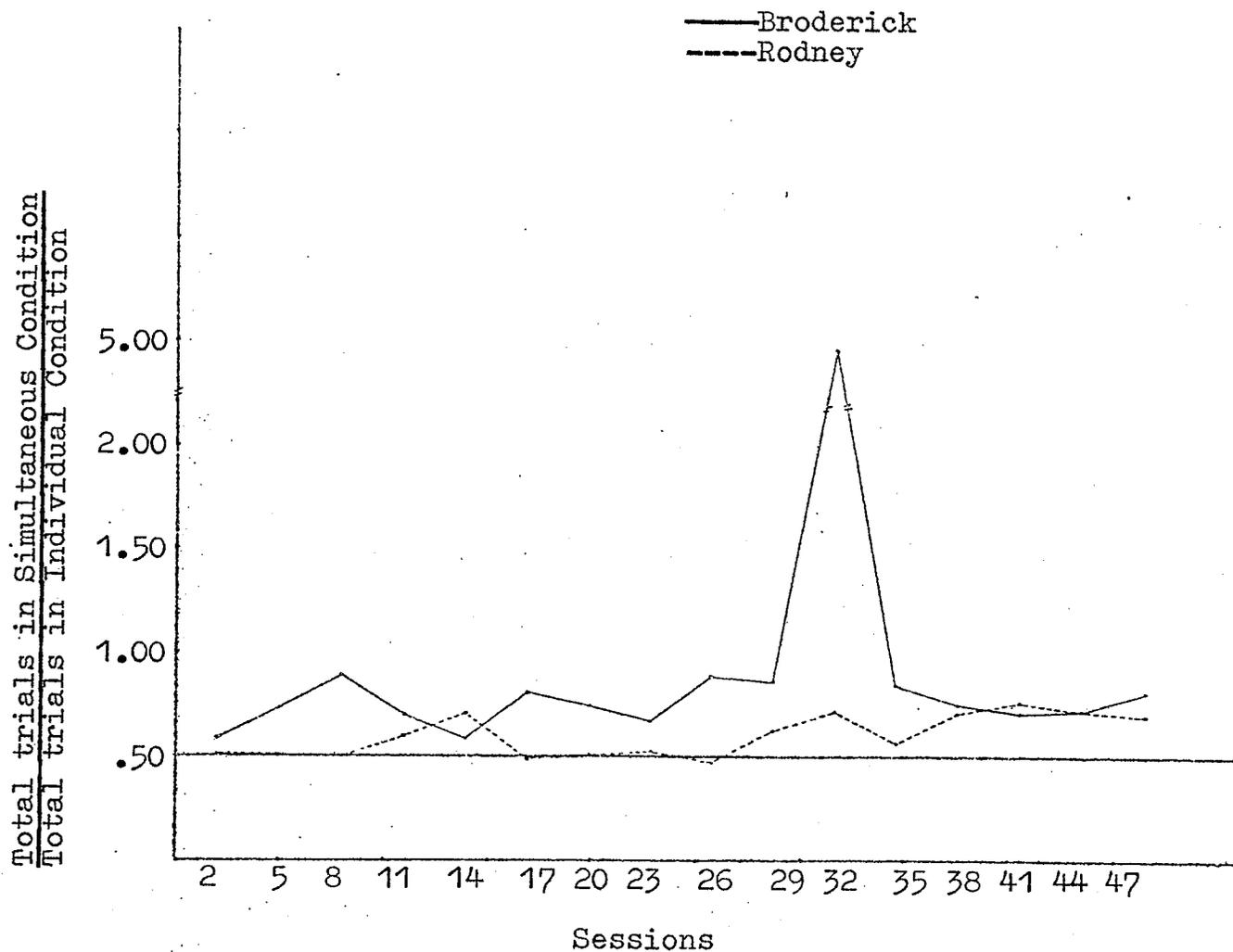


Fig. 7. The ratio of the total number of trials Broderick and Rodney initiated in the Simultaneous Condition in blocks of three sessions over the total number of trials they initiated in the Individual Condition during the corresponding three-session blocks. The .50 line indicates the average ratio that would be expected if there were no differences between the two conditions.

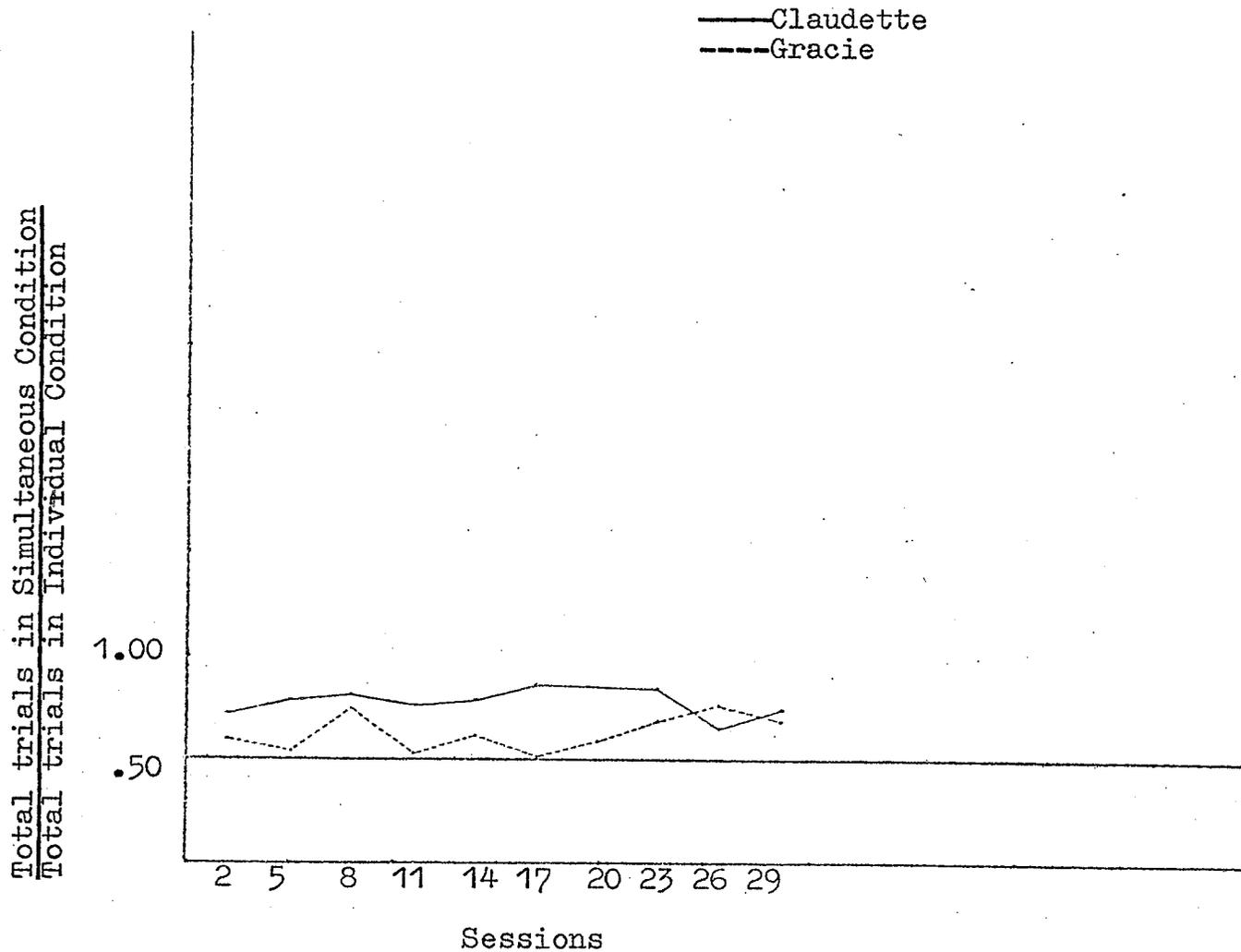


Fig. 8. The ratio of the total number of trials Claudette and Gracie initiated in the Simultaneous Condition in blocks of three sessions over the total number of trials they initiated in the Individual Condition during the corresponding three-session blocks. The .50 line indicates the average ratio that would be expected if there were no differences between the two conditions.

in the Simultaneous Condition was considerably less than the time spent with that subject in the Individual Condition.

Correct responses in the Simultaneous Condition/Correct responses in the Individual Condition. Figures 9 through 13 present the total number of correct responses each subject made in blocks of three sessions in the Simultaneous Condition sessions over the number of correct responses they made in the corresponding blocks of three sessions of the Individual Condition sessions. Figure 9 shows that for a large majority of the sessions Alex and Rodney made proportionally more correct responses in the Simultaneous Condition than in the Individual Condition, when the expenditure of the experimenter's time is equated. Figure 10 presents the same ratio for Allan and Joey. Once again, while not showing as clear an effect as Figure 9, the majority of the sessions show a superiority of the Simultaneous Condition. Both Allan and Gracie emitted more correct responses (relative to the number expected if there were no differences between conditions) in the Simultaneous Condition sessions than in the Individual Condition sessions. Figures 12 and 13 show a similar effect for Broderick and Rodney and for Gracie and Claudette, respectively. For all four of these sub-

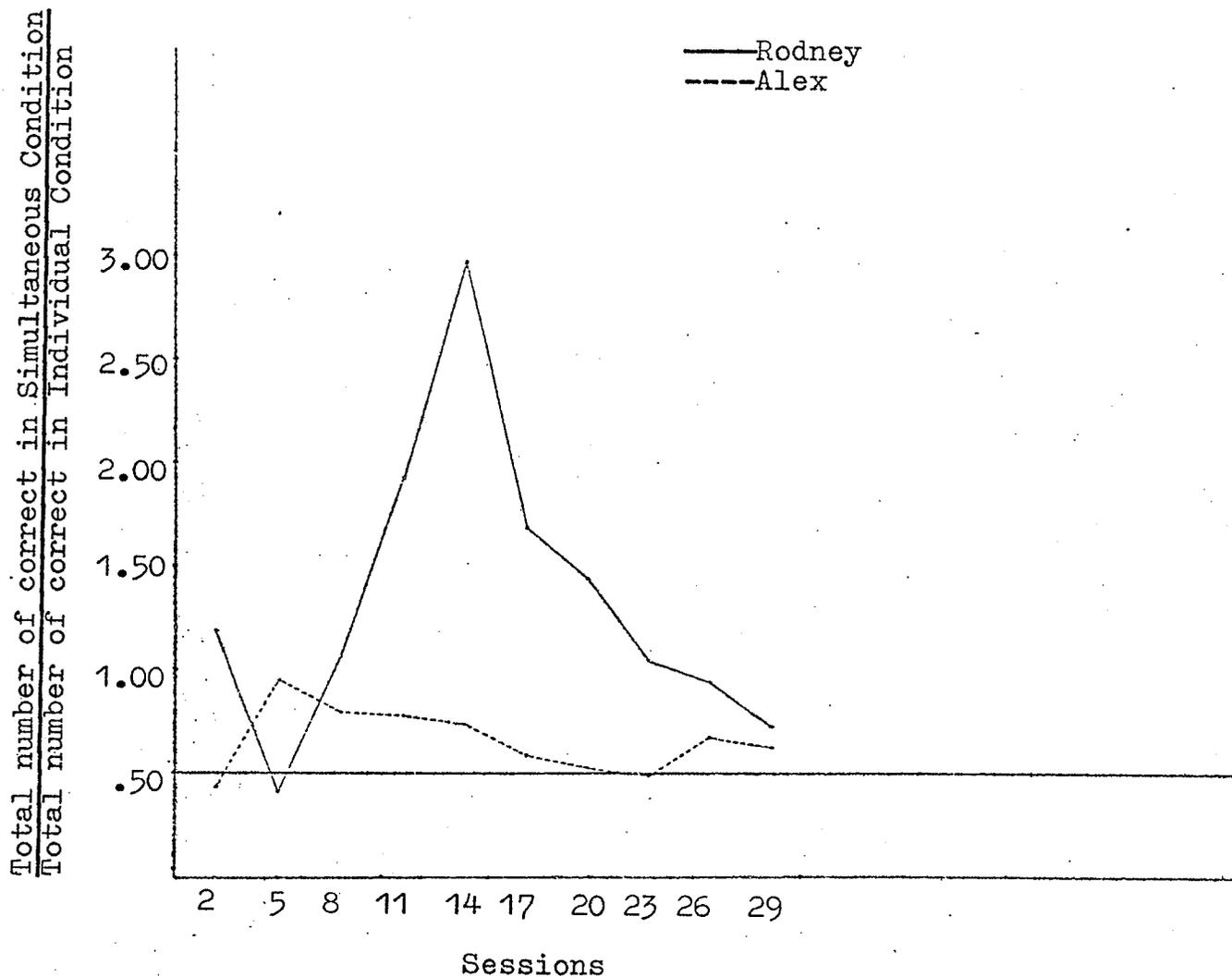


Fig. 9. The ratio of the total number of correct responses Alex and Rodney made in blocks of three sessions in the Simultaneous Condition over the total number of correct responses they made in the corresponding blocks of three sessions in the Individual Condition. The .50 level indicates the average ratio that would be expected if there were no differences between the two conditions.

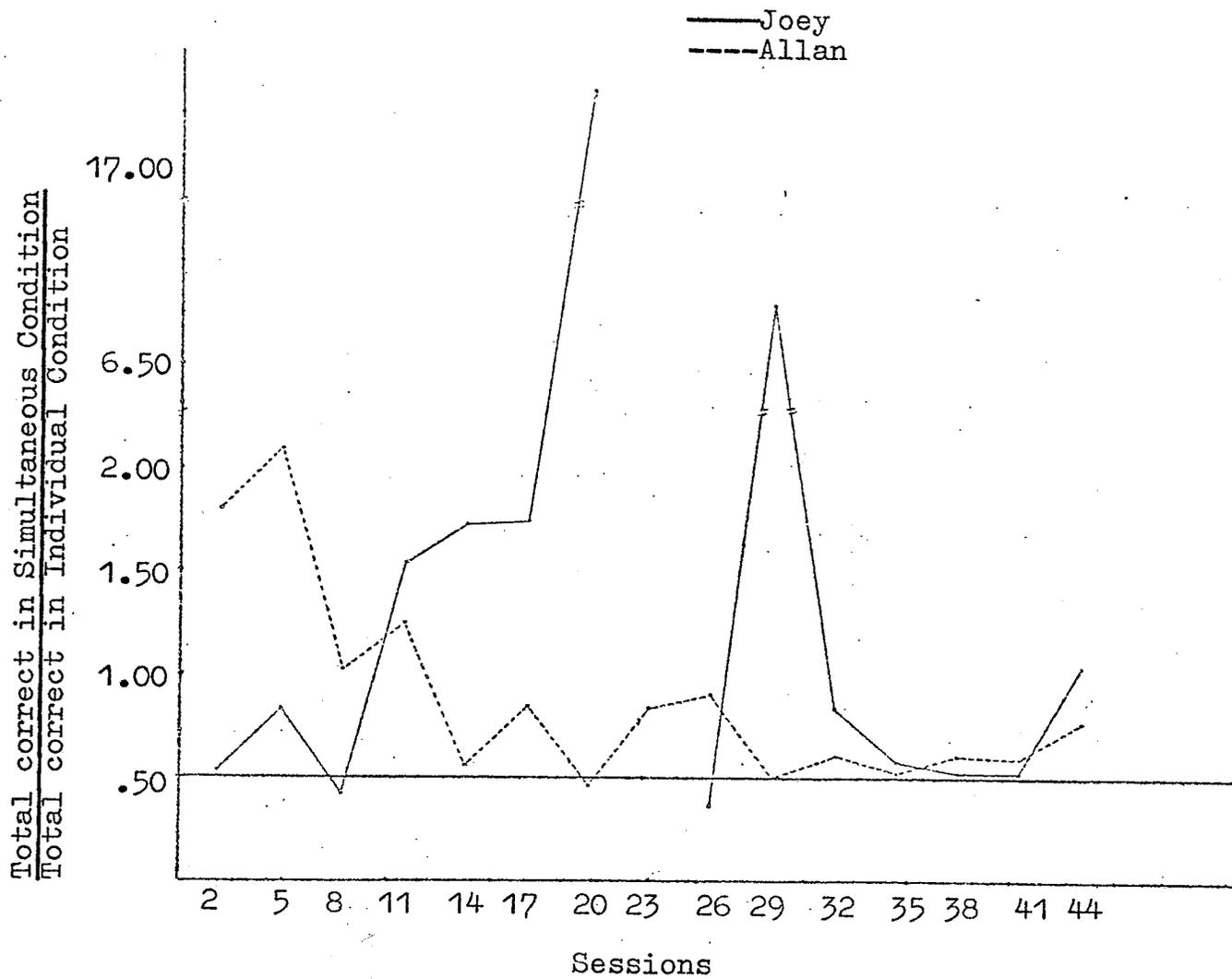


Fig. 10. The ratio of the total number of correct responses Joey and Allan made in blocks of three sessions in the Simultaneous Condition over the total number of correct responses they made in the corresponding blocks of three sessions in the Individual Condition. The .50 level indicates the average ratio that would be expected if there were no differences between the two conditions. Between sessions 20 and 25, Joey stopped responding in the Individual Condition which resulted in an undefined ratio.

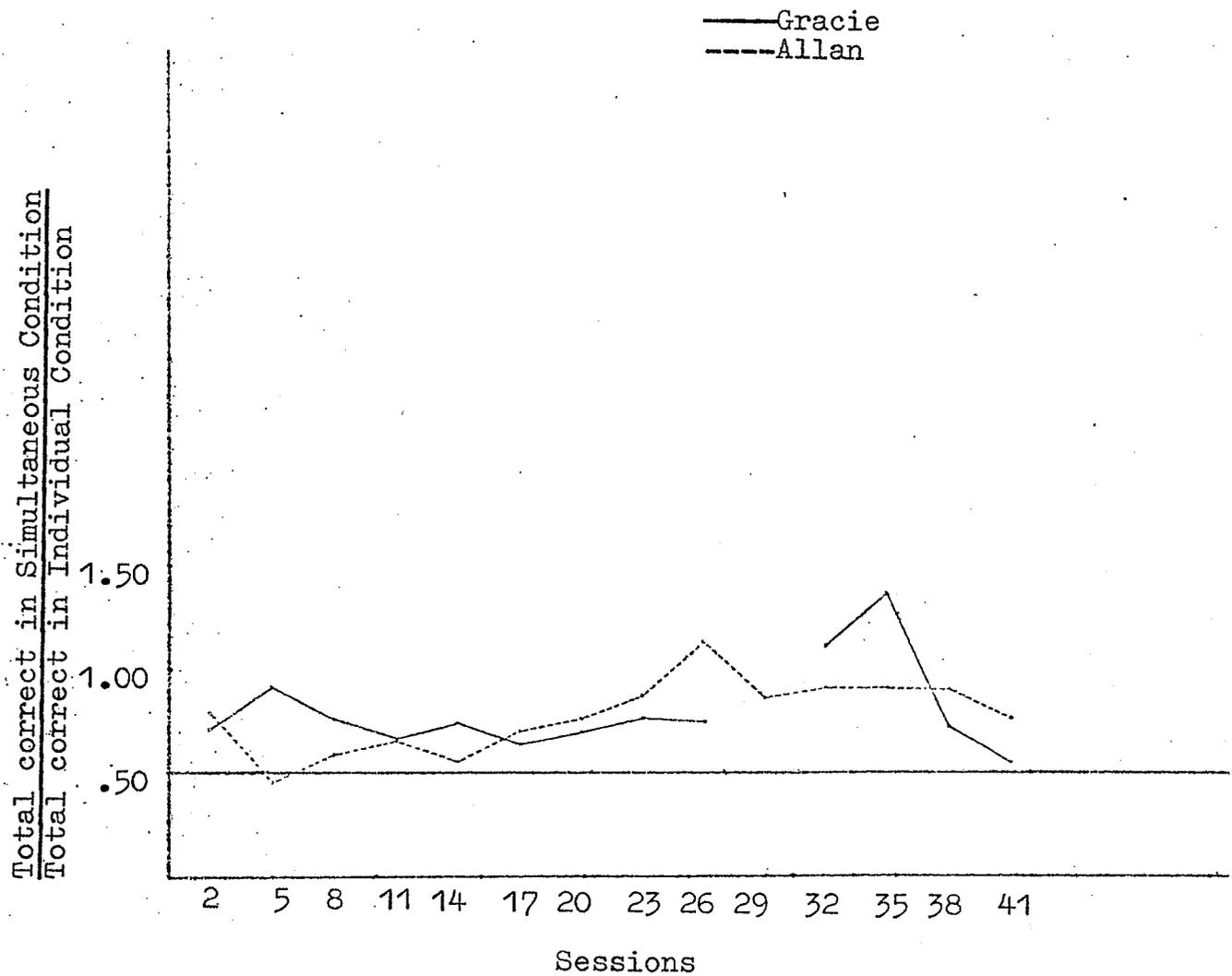


Fig. 11. The ratio of the total number of correct responses Gracie and Allan made in blocks of three sessions in the Simultaneous Condition over the total number of correct responses they made in the corresponding blocks of three sessions in the Individual Condition. The .50 level indicates the average ratio that would be expected if there were no differences between the two conditions. Between sessions 26 and 31, Gracie stopped responding in the Individual Condition which resulted in an undefined ratio.

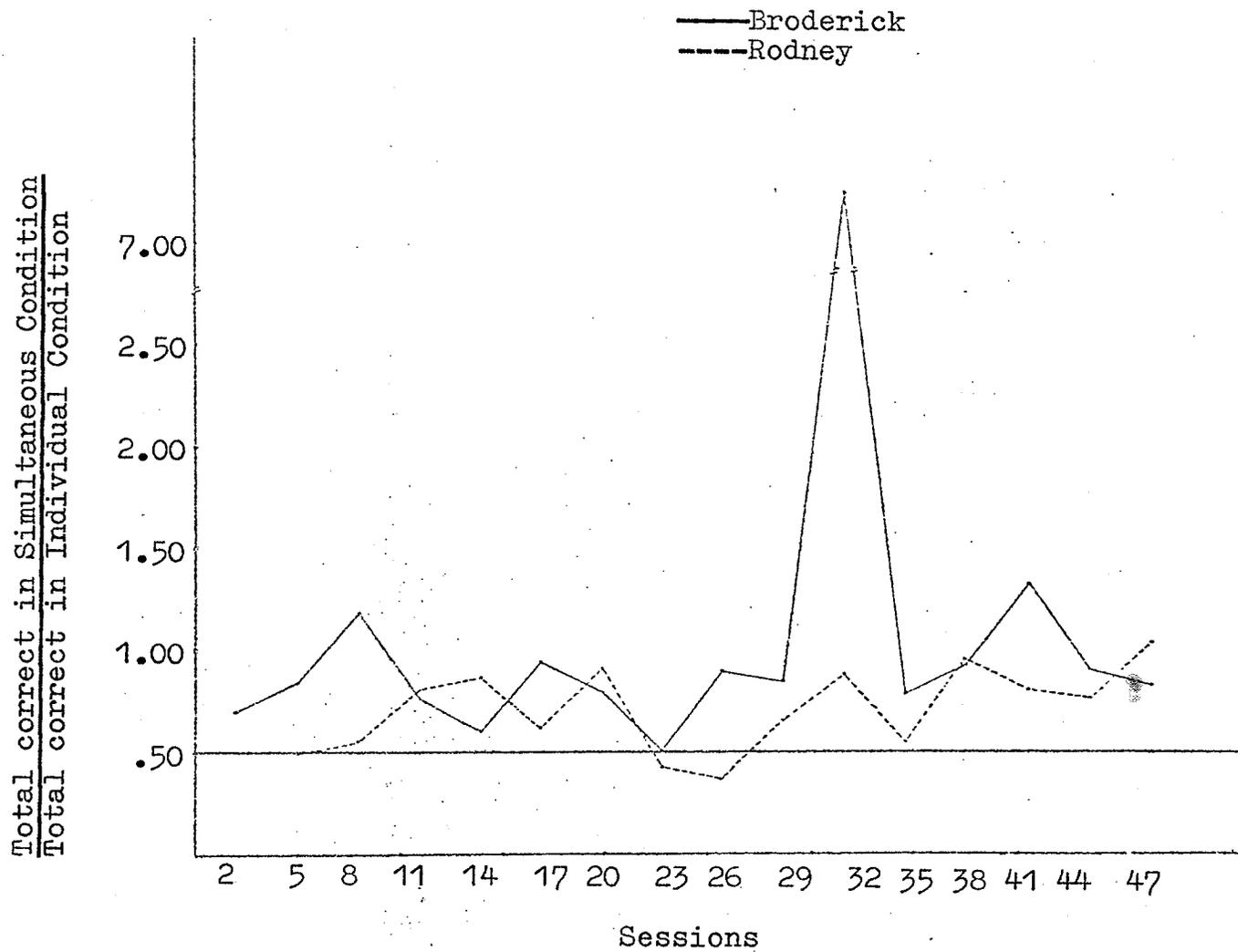


Fig. 12. The ratio of the total number of correct responses Broderick and Rodney made in blocks of three sessions in the Simultaneous Condition over the total number of correct responses they made in the corresponding blocks of three sessions in the Individual Condition. The .50 level indicates the average ratio that would be expected if there were no differences between the two conditions.

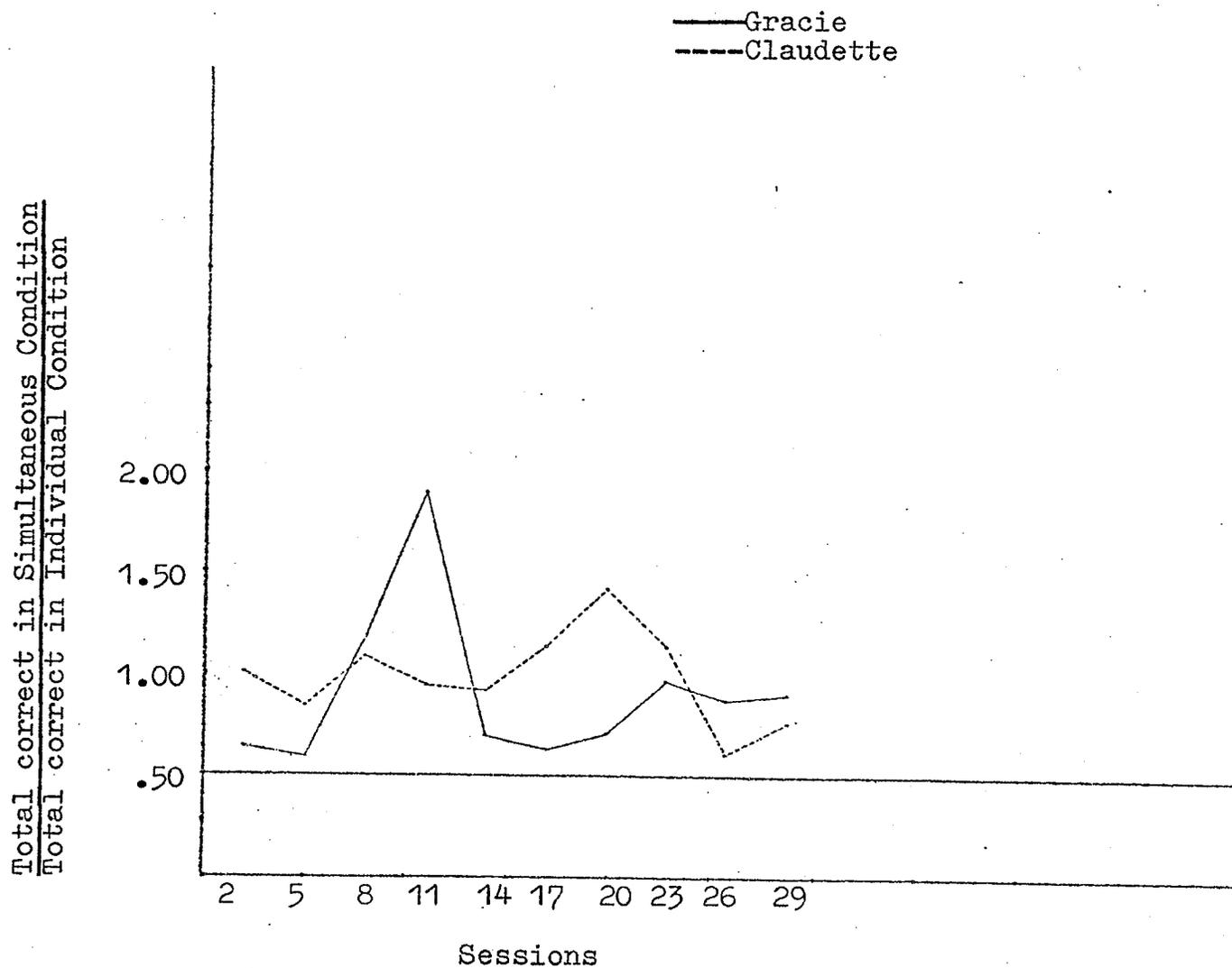


Fig. 13. The ratio of the total number of correct responses Gracie and Claudette made in blocks of three sessions in the Simultaneous Condition over the total number of correct responses they made in the corresponding blocks of three sessions in the Individual Condition. The .50 level indicates the average ratio that would be expected if there were no differences between the two conditions.

jects, the Simultaneous Condition sessions proved to contain more correct responses than the corresponding Individual Condition sessions when the two conditions were equated for session length (i.e., for expenditure of the experimenter's time).

These last five figures (Figures 9 through 13) would appear to indicate that not only did the subjects engage in a greater proportion of trials in the Simultaneous Condition, but also emitted a greater proportion of correct responses. Some instances, in fact, showed that the absolute number of correct responses in the Simultaneous Condition was greater than in the corresponding Individual Condition in spite of the lesser amount of time spent with those subjects in the Simultaneous Condition.

Total errors in the Simultaneous Condition/Total errors in the Individual Condition. Figures 14 through 18 compare the number of errors each subject emitted in the Simultaneous Condition with the number of errors they made in the Individual Condition. Figure 14 shows that the presence of another subject had little effect upon Alex's error rate, although it did affect Rodney's

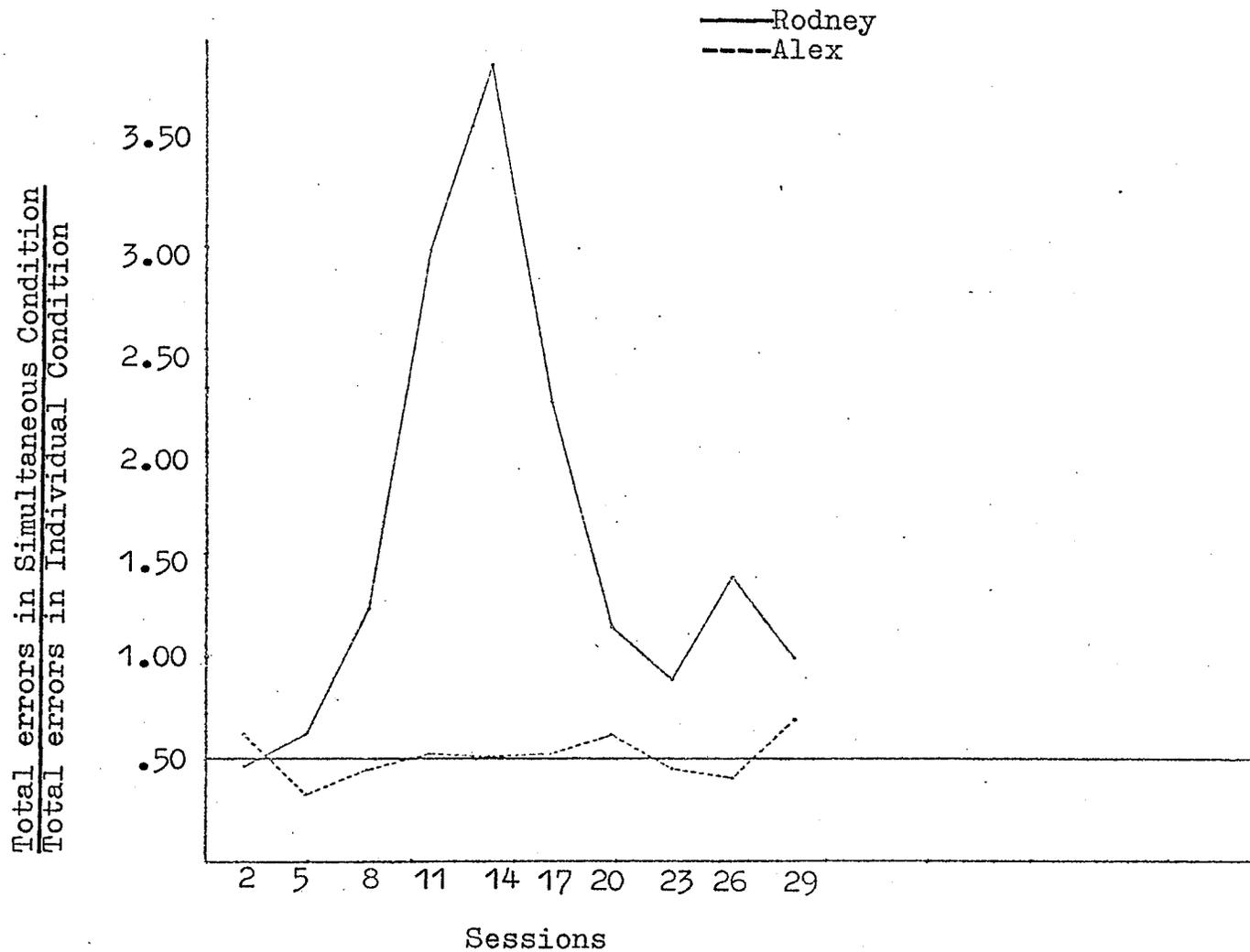


Fig. 14. The ratio of the total number of errors Alex and Rodney emitted in blocks of three sessions in the Simultaneous Condition over the total number of errors they emitted in the corresponding blocks of three sessions in the Individual Condition. The .50 level indicates the average ratio that would have been expected if there had been no difference between the conditions.

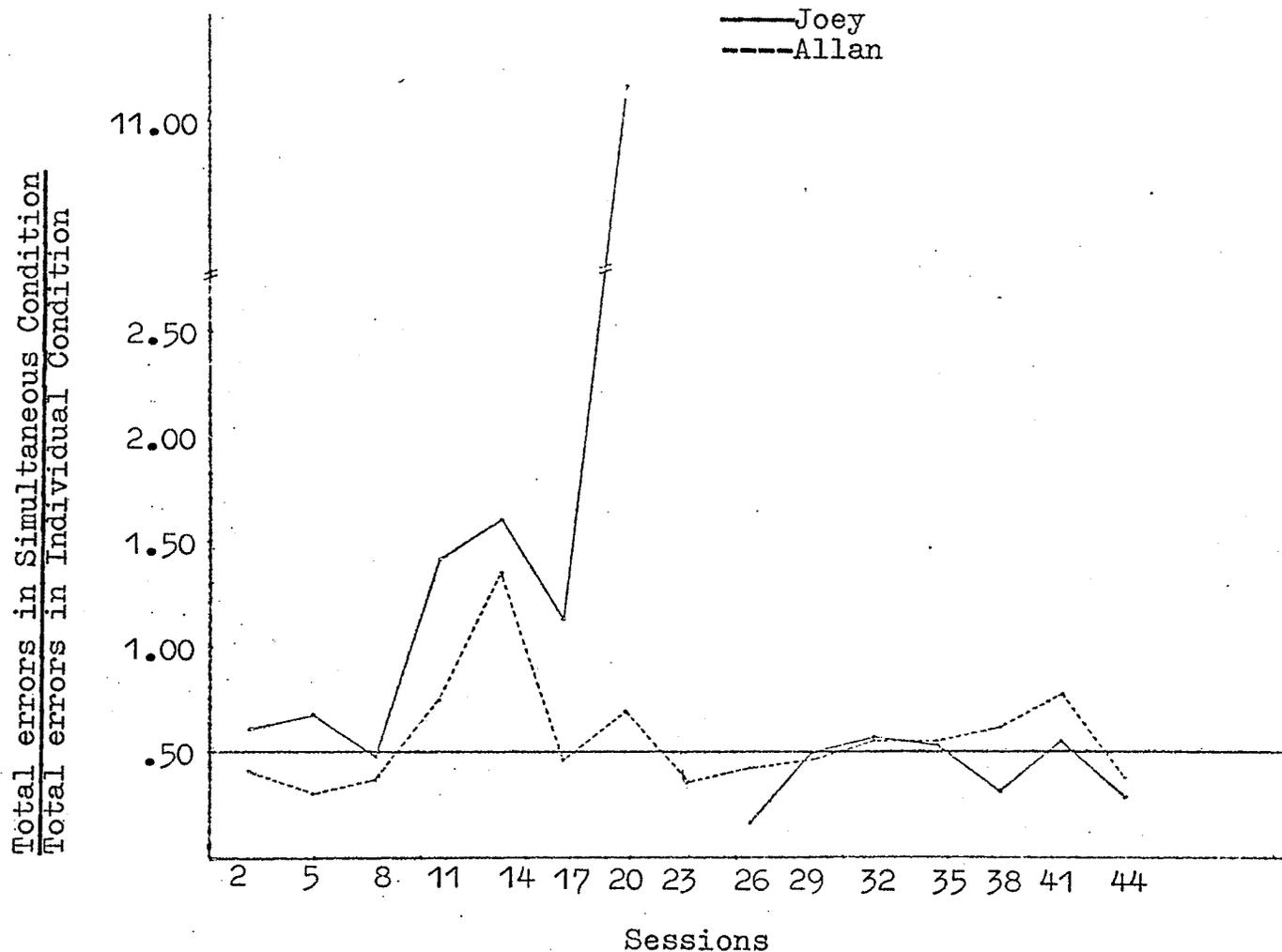


Fig. 15. The ratio of the total number of errors Joey and Allan emitted in blocks of three sessions in the Simultaneous Condition over the total number of errors they emitted in the corresponding blocks of three sessions in the Individual Condition. The .50 level indicates the average ratio that would have been expected if there had been no difference between the conditions. Between sessions 20 and 25, Joey stopped responding in the Individual Condition which resulted in an undefined ratio.

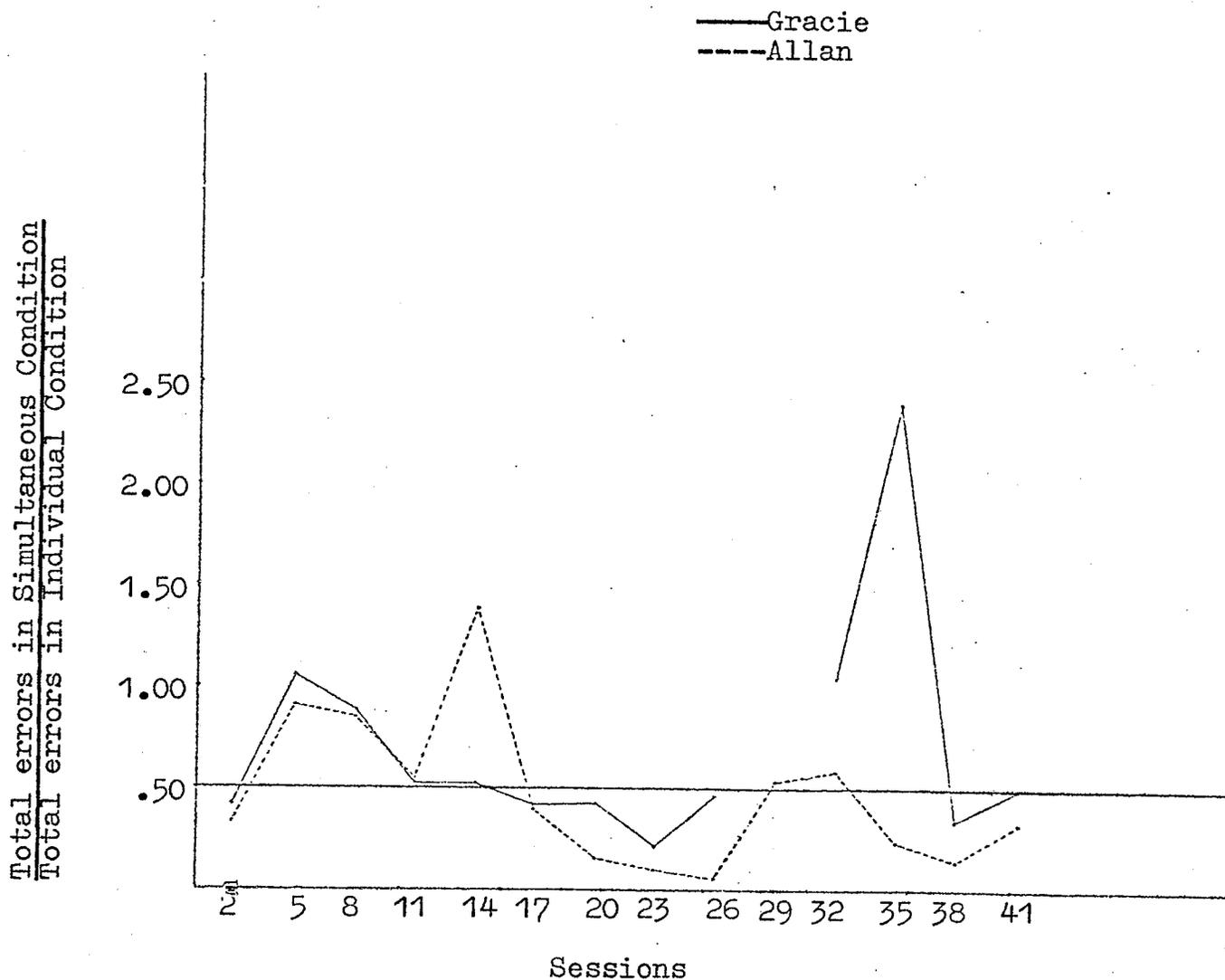


Fig. 16. The ratio of the total number of errors Gracie and Allan emitted in blocks of three sessions in the Simultaneous Condition over the total number of errors they emitted in the corresponding blocks of three sessions of the Individual Condition. The .50 level indicates the average ratio that would have been expected if there had been no difference between the conditions. Between sessions 26 and 31, Gracie stopped responding in the Individual Condition which resulted in an undefined ratio.

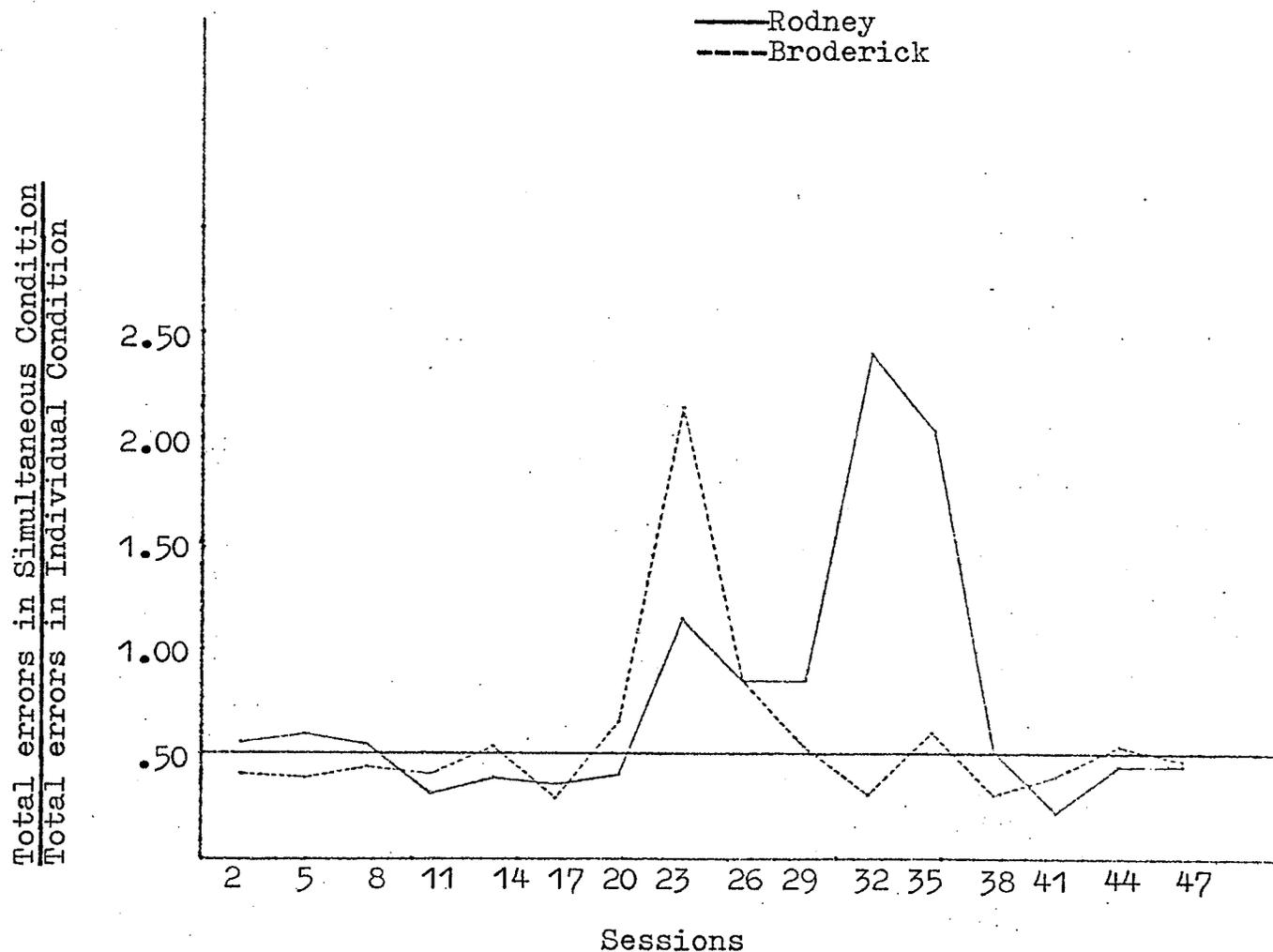


Fig. 17. The ratio of the total number of errors Rodney and Broderick emitted in blocks of three sessions in the Simultaneous Condition over the total number of errors they emitted in the corresponding blocks of three sessions in the Individual Condition. The .50 level indicates the average ratio that would have been expected if there had been no difference between the conditions.

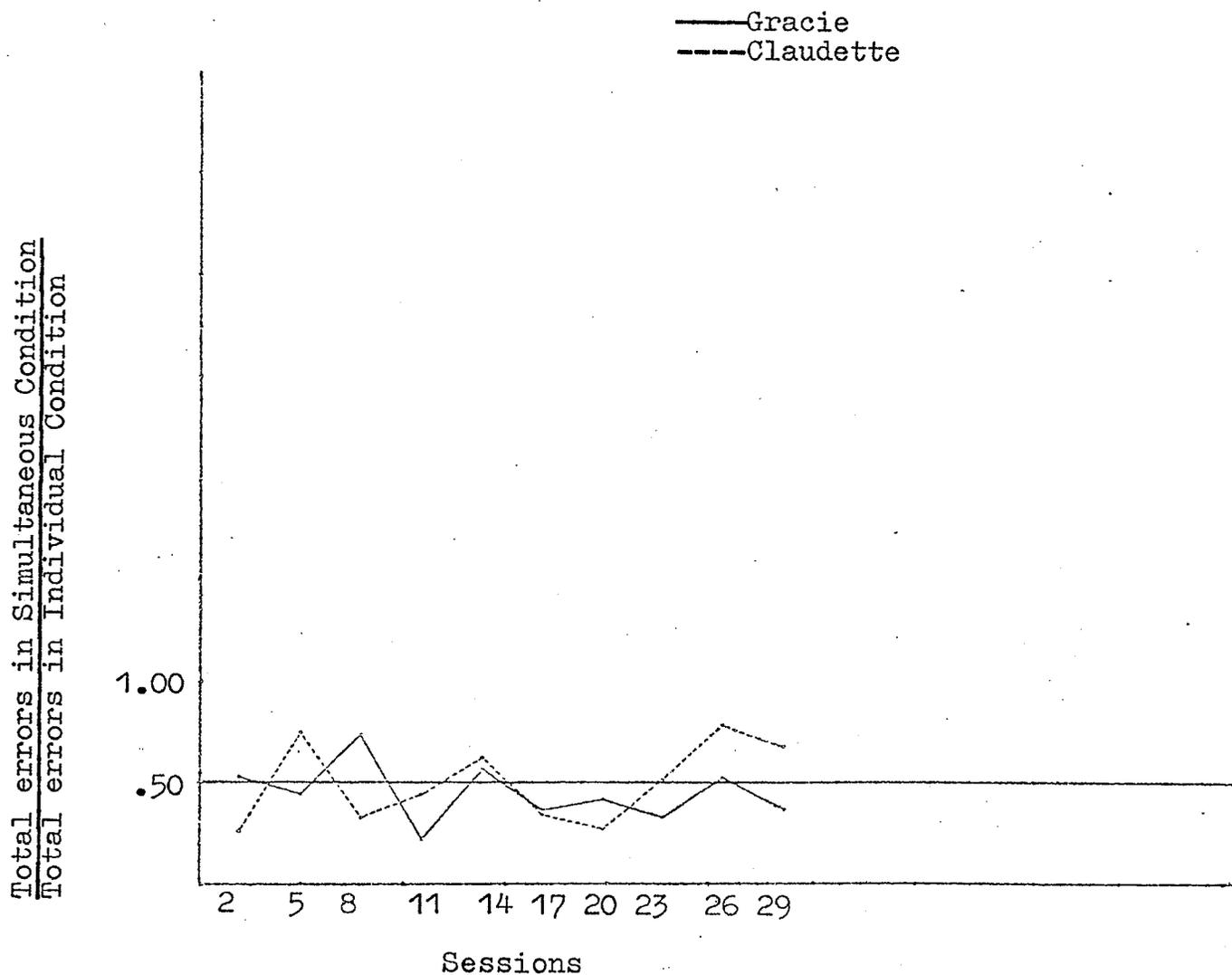


Fig. 18. The ratio of the total number of errors Gracie and Claudette emitted in blocks of three sessions in the Simultaneous Condition over the total number of errors they emitted in the corresponding blocks of three sessions in the Individual Condition. The .50 level indicates the average ratio that would have been expected if there had been no difference between the conditions.

error rate. It can be seen from Figure 14 that Rodney consistently emitted more errors in the Simultaneous Condition than in the Individual Condition. Figures 15, 16, 17 and 18 show that the results of the members of the other pairs showed little difference in the effects of the two conditions.

Thus, for the majority of the subjects, switching to another subject following errors appeared to have no clear-cut effect on the number of errors emitted. For six out of the seven subjects, Figures 14 through 18 show a ratio of errors fluctuating around the .50 level indicating an equal proportion of errors in the Simultaneous Condition to that in the Individual Condition.

Percent correct in the Simultaneous Condition/Percent correct in the Individual Condition. Figure 19 shows the ratio of percent correct for Alex and Rodney. As suggested by the previous figures, Alex's data indicate that a greater percentage of correct responses occurred in the Simultaneous Condition than in the Individual Condition. On the other hand, Rodney's data would appear to indicate an equality of the two conditions regarding percent correct. Figure 20, showing the data

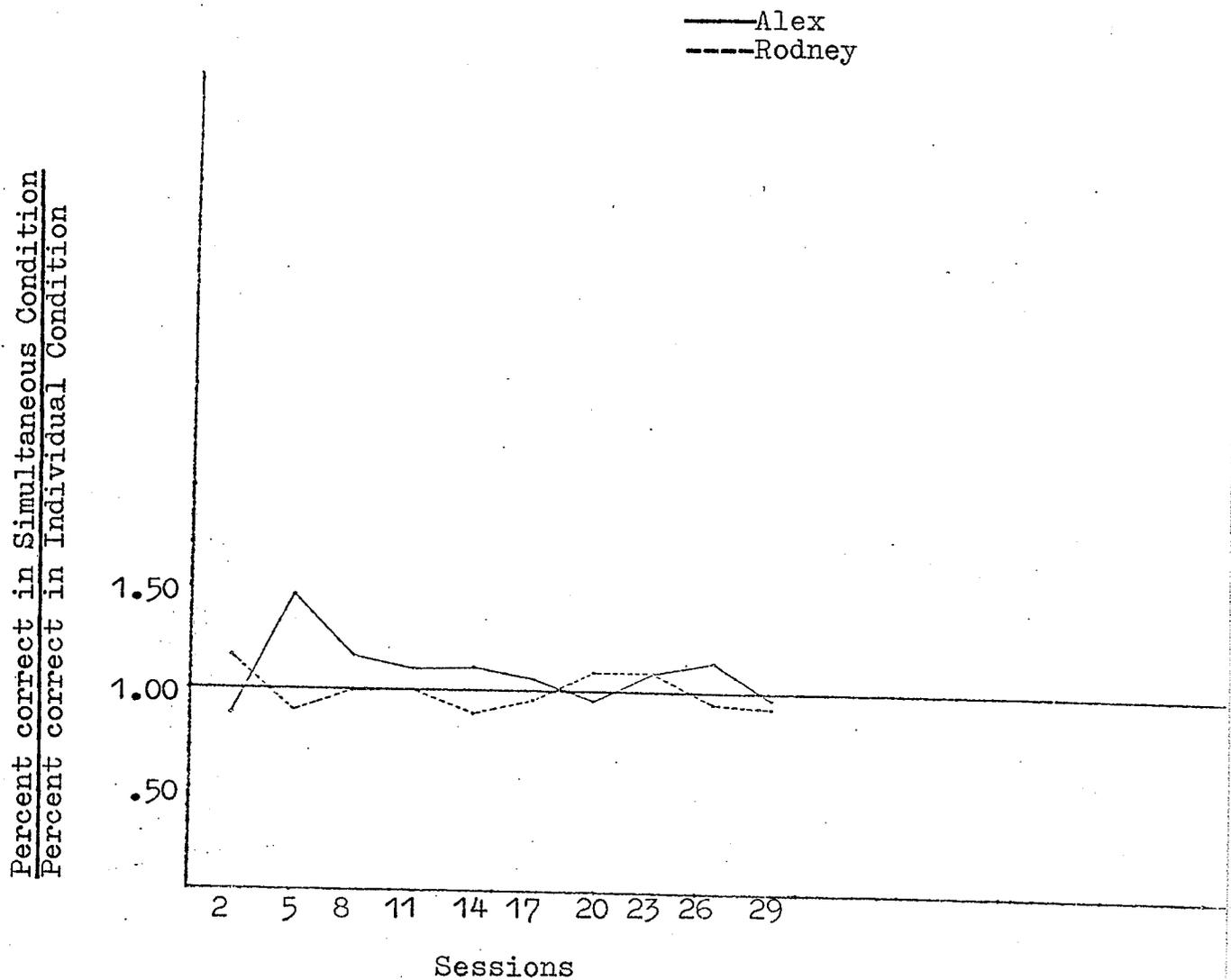


Fig. 19. The percentage of correct responses Alex and Rodney obtained in the Simultaneous Condition over blocks of three sessions divided by the percentage of correct responses they obtained in the Individual Condition over corresponding blocks of three sessions. The solid line at the 1.00 level indicates the ratio expected if the two conditions generated the same percentage of correct responses.

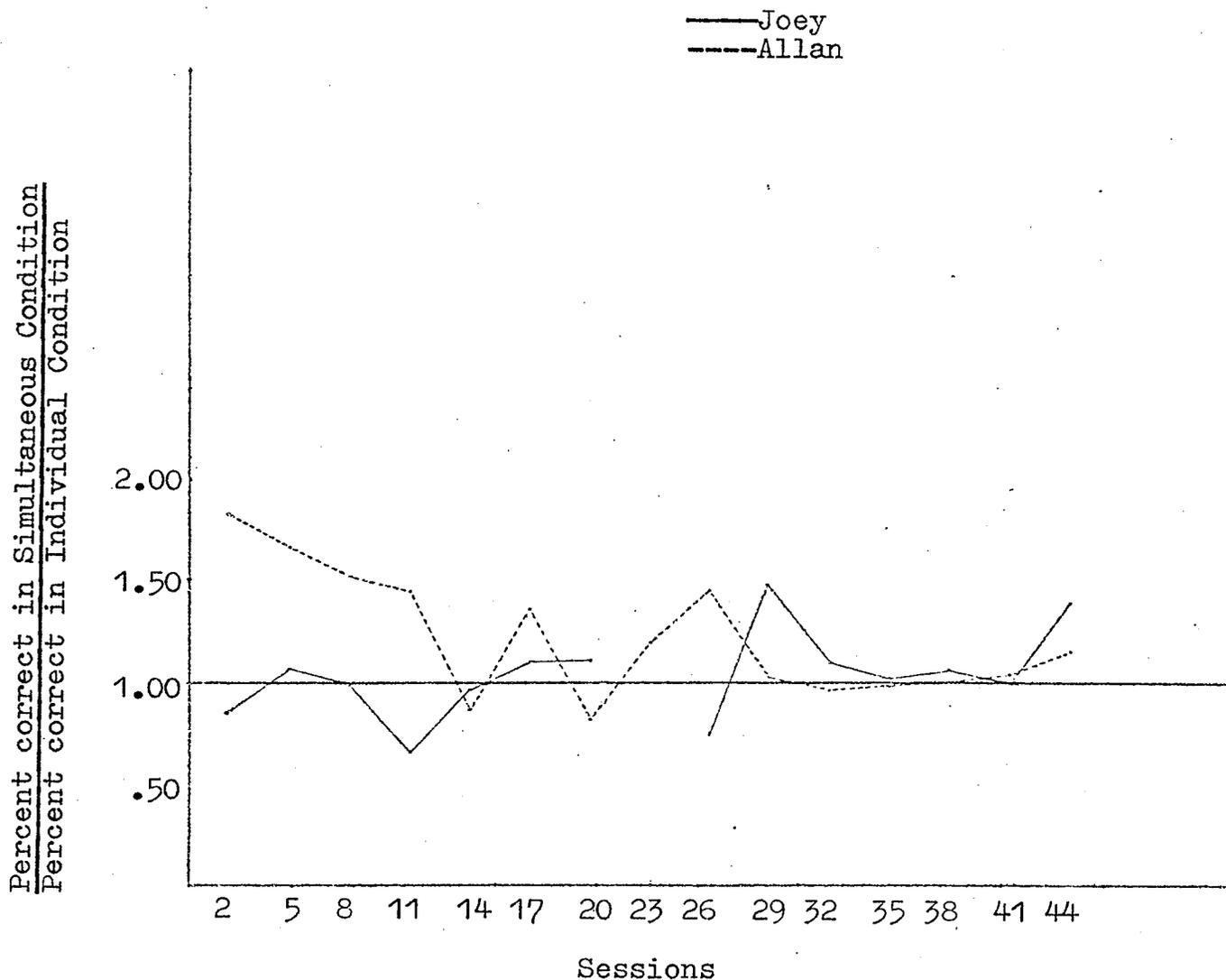


Fig. 20. The percentage of correct responses Joey and Allan obtained in the Simultaneous Condition over blocks of three sessions divided by the percentage of correct responses they obtained in the Individual Condition over corresponding blocks of three sessions. The solid line at the 1.00 level indicates the ratio expected if the two conditions generated the same percentage of correct responses. Between sessions 20 and 25, Joey stopped responding in the Individual Condition which resulted in an undefined ratio.

for Allan and Joey, is quite similar to Figure 19. It shows quite clearly that, for a majority of Allan's sessions, the Simultaneous Condition was superior to the Individual Condition regarding percent correct. Joey's data, on the other hand, would appear to indicate that there were an equal number of sessions in which the Individual Condition had a greater percentage of correct responses than did the Simultaneous Condition. Figures 21, 22 and 23 are all quite clear in their demonstration that for a large majority of the sessions for these six subjects, the Simultaneous Condition had a greater percentage of correct responses than did the Individual Condition.

In all, then, eight out of the ten subjects in the pairs responded correctly a greater percentage of the time in the Simultaneous Condition than in the Individual Condition. For the remaining two subjects, there was an equal number of sessions in which the Individual Condition was superior.

Inattention per trial in the Simultaneous Condition/
Inattention per trial in the Individual Condition. Figures 24, 25, 26, 27 and 28 show the amount of time each subject spent in inattention per trial in the Simultane-

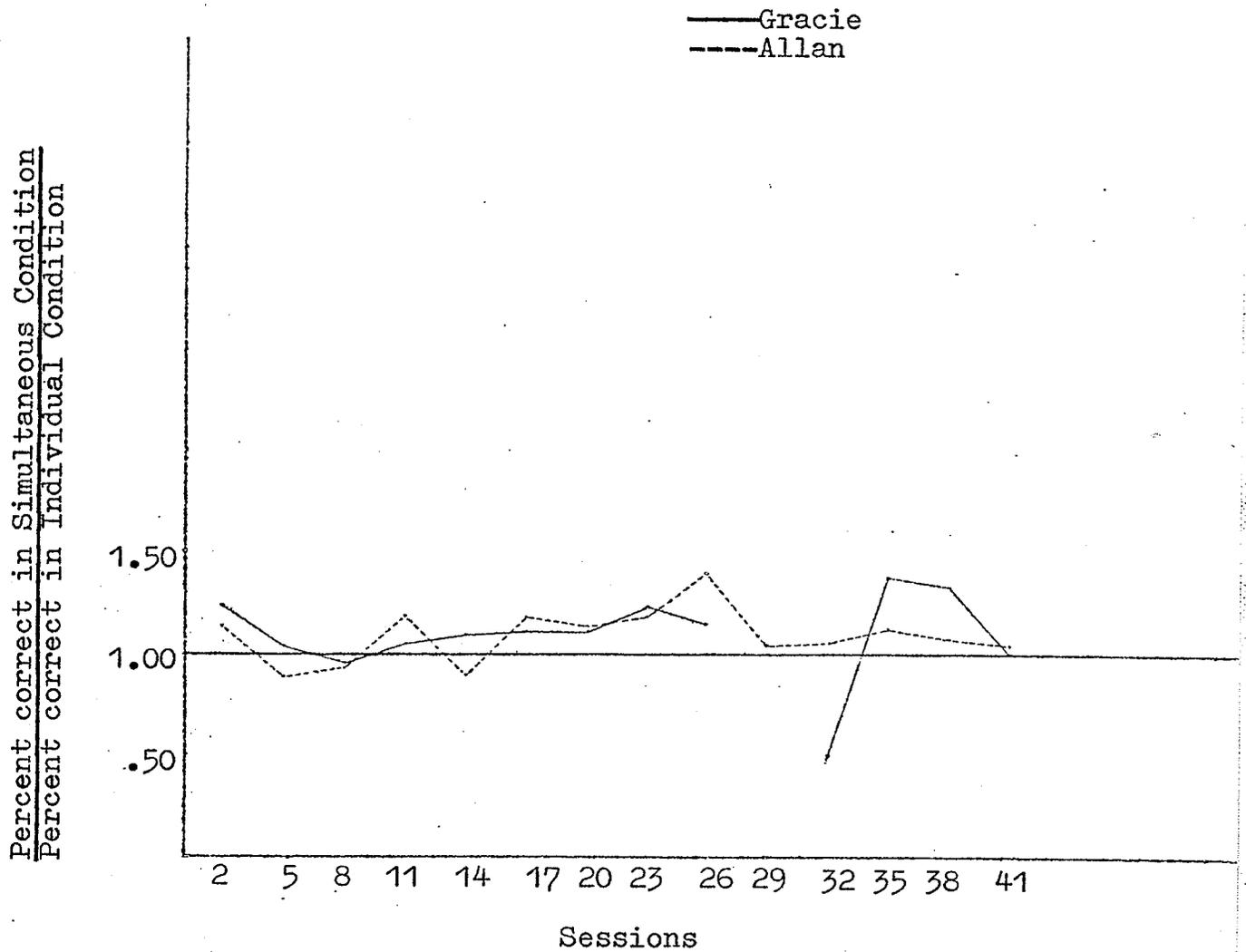


Fig. 21. The percentage of correct responses Gracie and Allan obtained in the Simultaneous Condition over blocks of three sessions divided by the percentage of correct responses they obtained in the Individual Condition over corresponding blocks of three sessions. The solid line at the 1.00 level indicates the ratio expected if the two conditions generated the same percentage of correct responses. Between sessions 26 and 31, Gracie stopped responding in the Individual Condition which resulted in an undefined ratio.

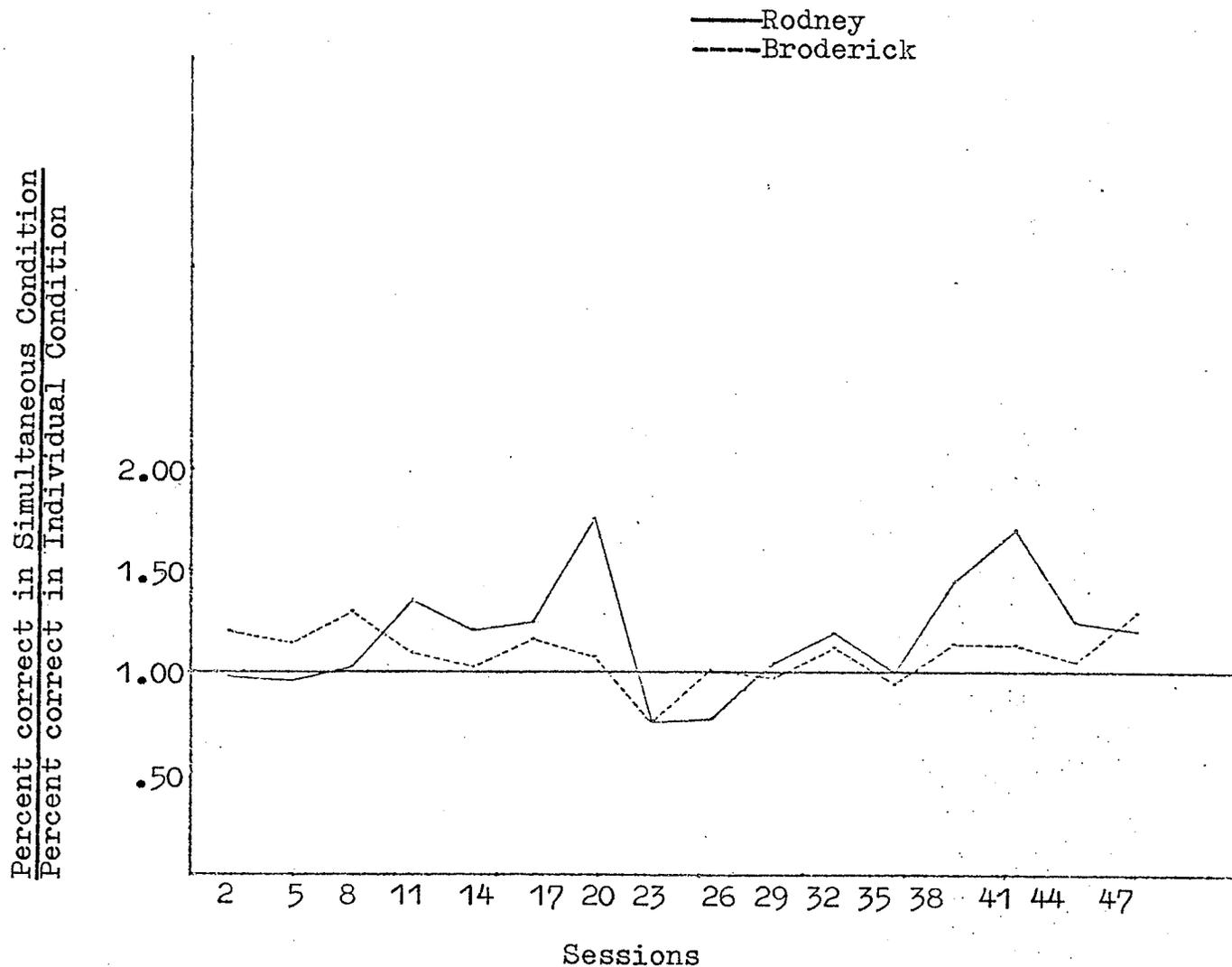


Fig. 22. The percentage of correct responses Rodney and Broderick obtained in the Simultaneous Condition over blocks of three sessions divided by the percentage of correct responses they obtained in the Individual Condition over corresponding blocks of three sessions. The solid line at the 1.00 level indicates the ratio expected if the two conditions generated the same percentage of correct responses.

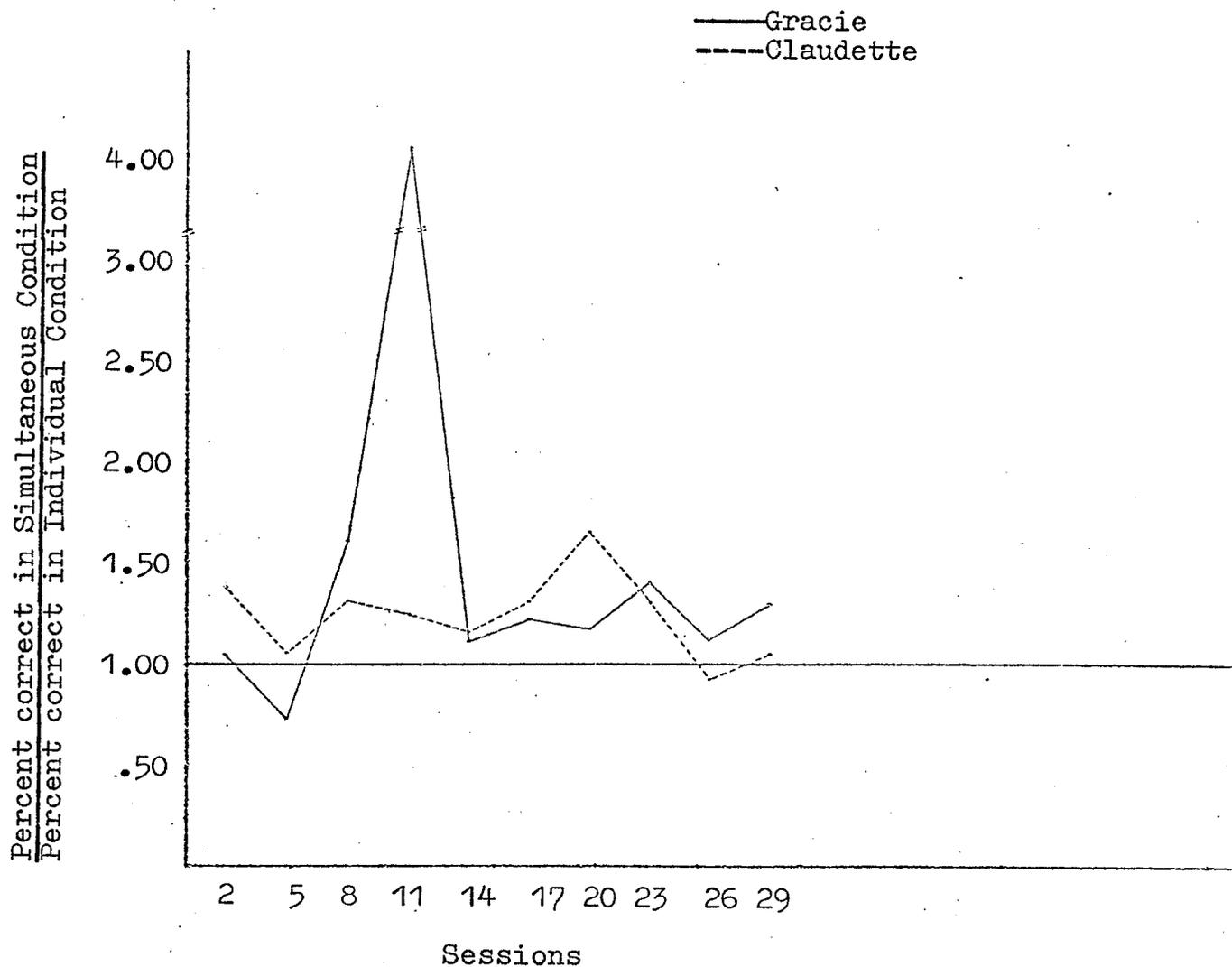


Fig. 23. The percentage of correct responses Gracie and Claudette obtained in the Simultaneous Condition over blocks of three sessions divided by the percentage of correct responses they obtained in the Individual Condition over corresponding blocks of three sessions. The solid line at the 1.00 level indicates the ratio expected if the two conditions generated the same percentage of correct responses.

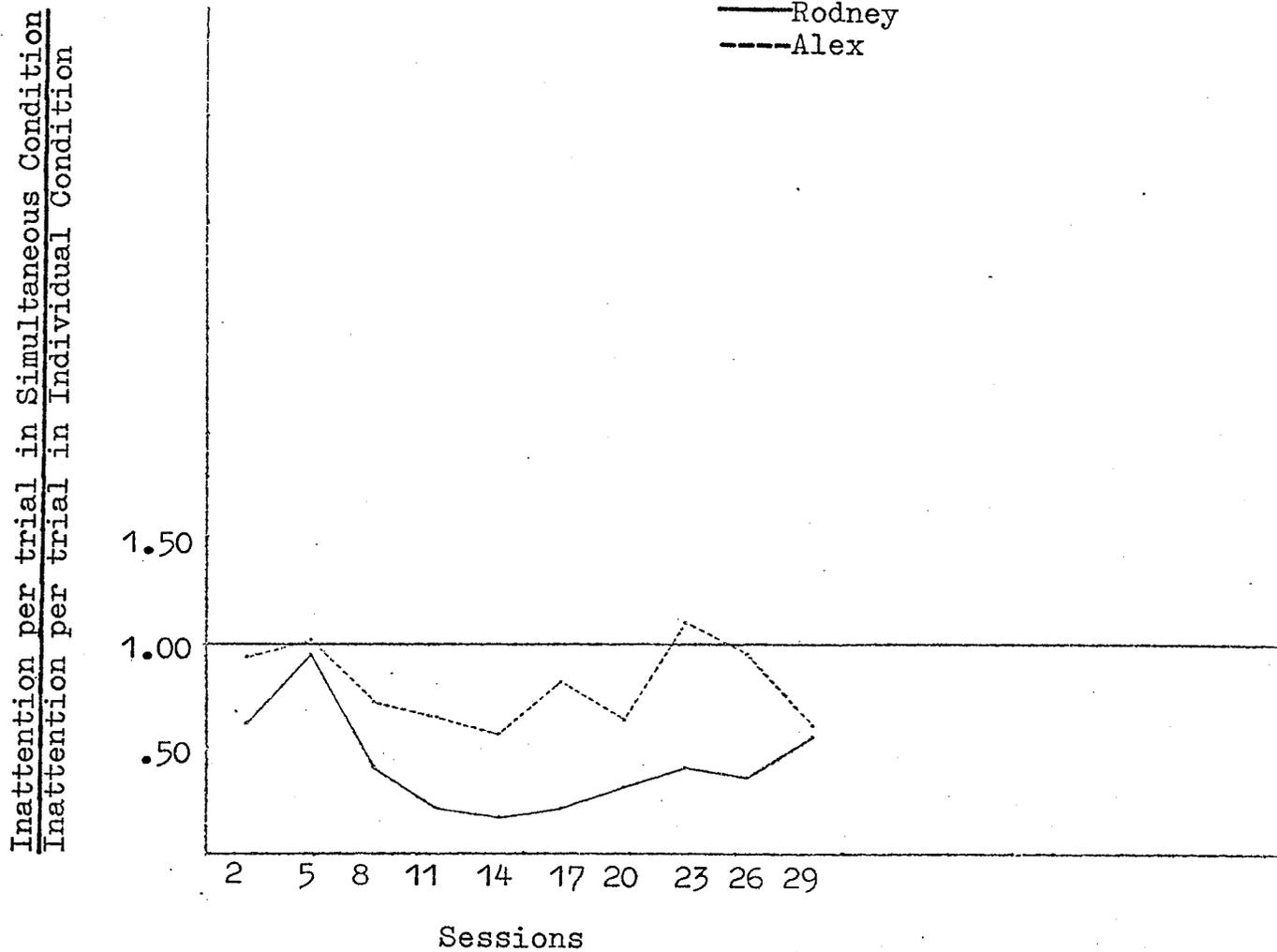


Fig. 24. The ratio of the total number of seconds Alex and Rodney spent in inattention per trial during each block of three sessions of the Simultaneous Condition over the total number of seconds they spent in inattention per trial during the corresponding blocks of three sessions in the Individual Condition. The solid line at the 1.00 level indicates the ratio that would be expected if the two conditions generated an equal amount of inattention per trial.

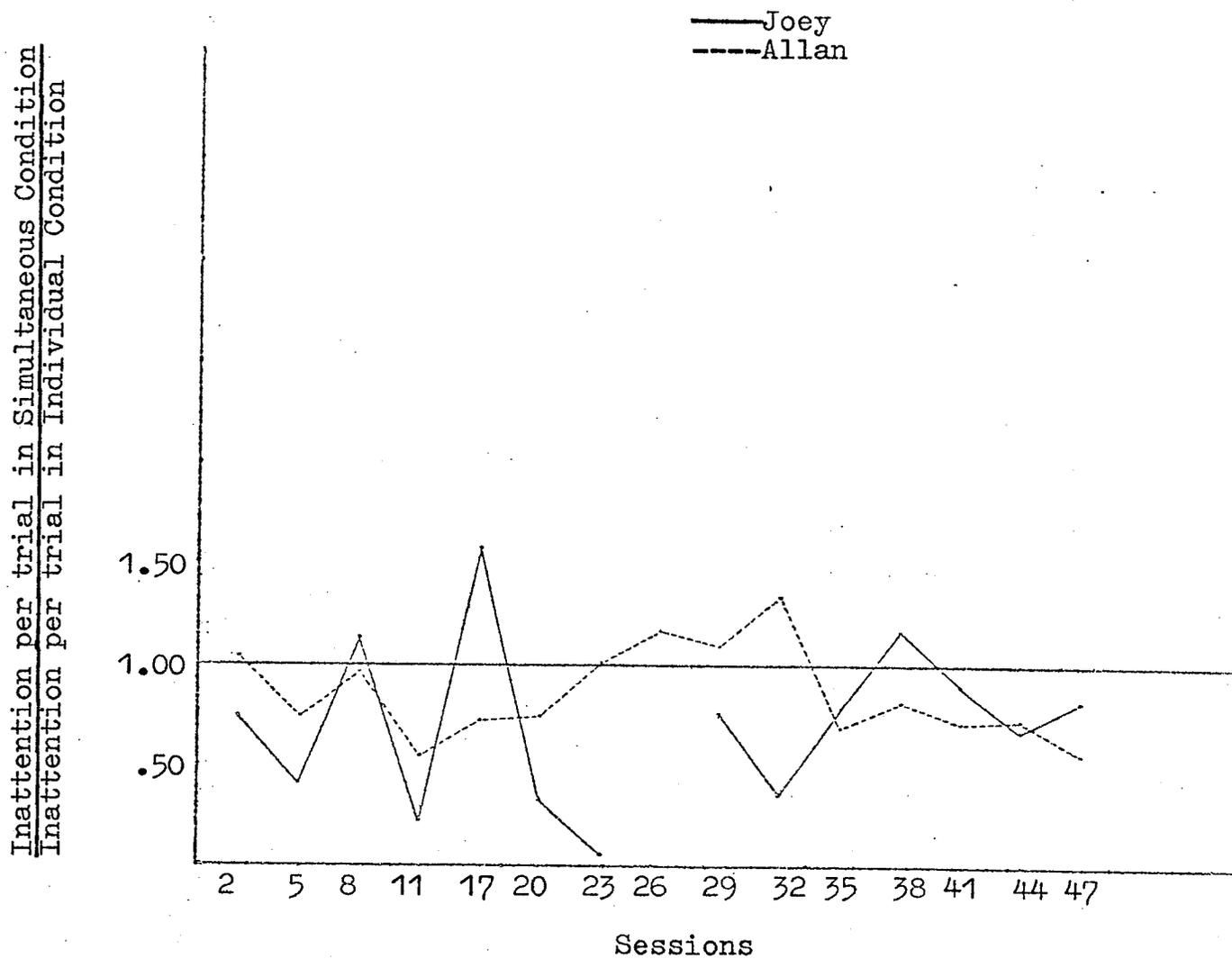


Fig. 25. The ratio of the total number of seconds Joey and Allan spent in inattention per trial during each block of three sessions of the Simultaneous Condition over the total number of seconds they spent in inattention per trial during the corresponding blocks of three sessions in the Individual Condition. The solid line at the 1.00 level indicates the ratio that would be expected if the two conditions generated an equal amount of inattention per trial. Between sessions 20 and 25, Joey stopped responding in the Individual Condition which resulted in an undefined ratio.

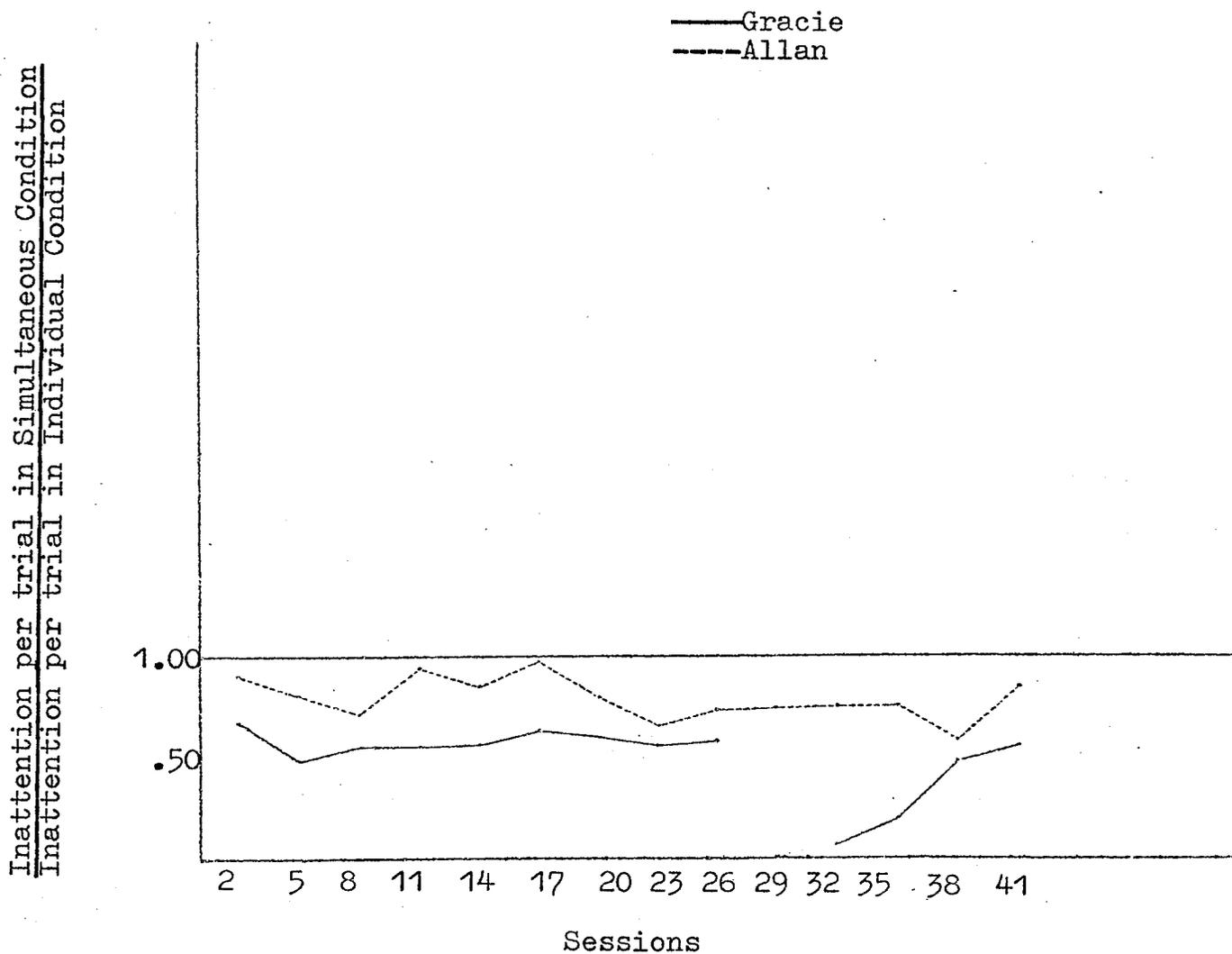


Fig. 26. The ratio of the total number of seconds Gracie and Allan spent in inattention per trial during each block of three sessions of the Simultaneous Condition over the total number of seconds they spent in inattention per trial during the corresponding blocks of three sessions of the Individual Condition. The solid line at the 1.00 level indicates the ratio that would be expected if the two conditions generated an equal amount of inattention per trial. Between sessions 26 and 31, Gracie stopped responding in the Individual Condition which resulted in an undefined ratio.

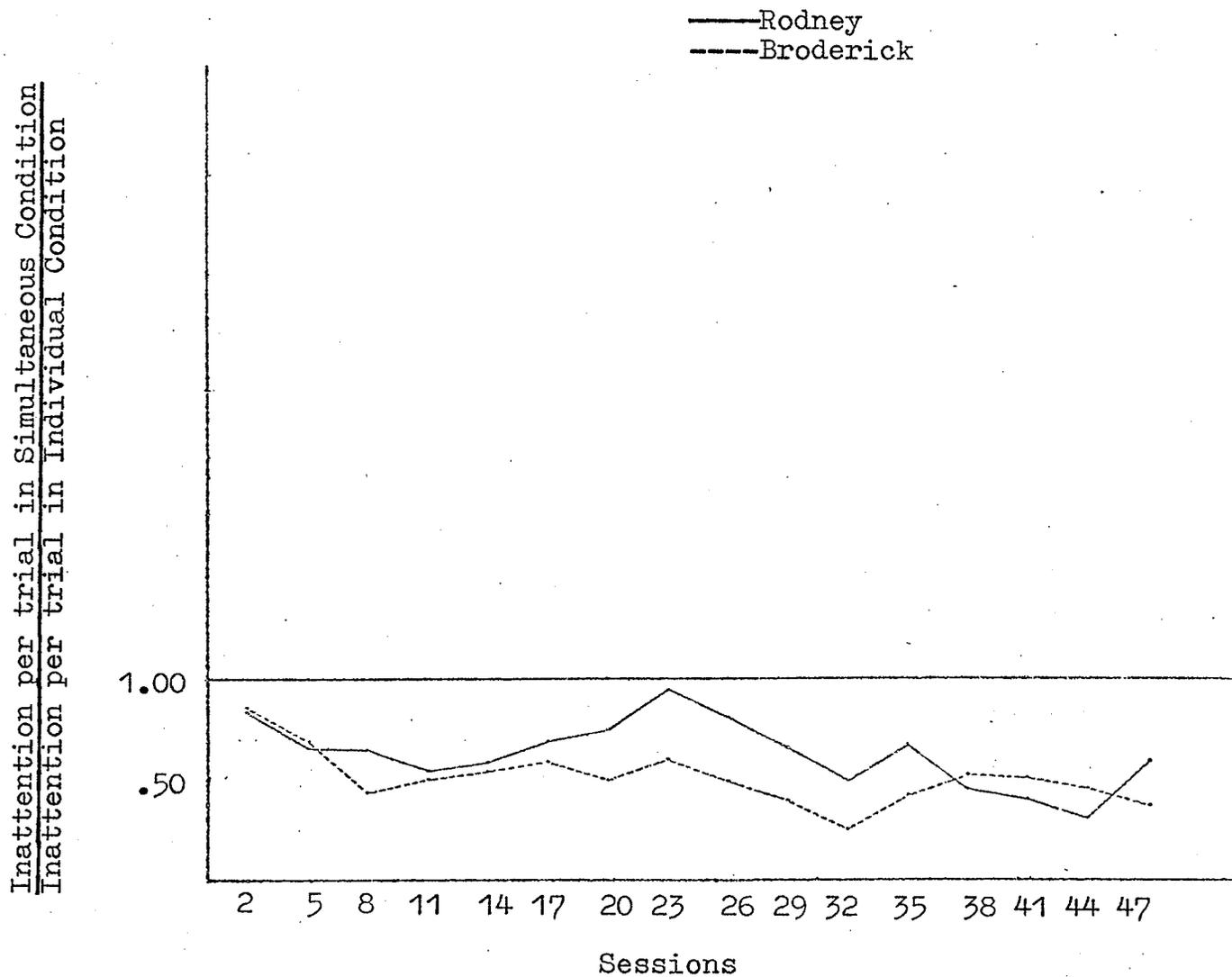


Fig. 27. The ratio of the total number of seconds Rodney and Broderick spent in inattention per trial during each block of three sessions of the Simultaneous Condition over the total number of seconds they spent in inattention per trial during the corresponding blocks of three sessions of the Individual Condition. The solid line at the 1.00 level indicates the ratio that would be expected if the two conditions generated an equal amount of inattention per trial.

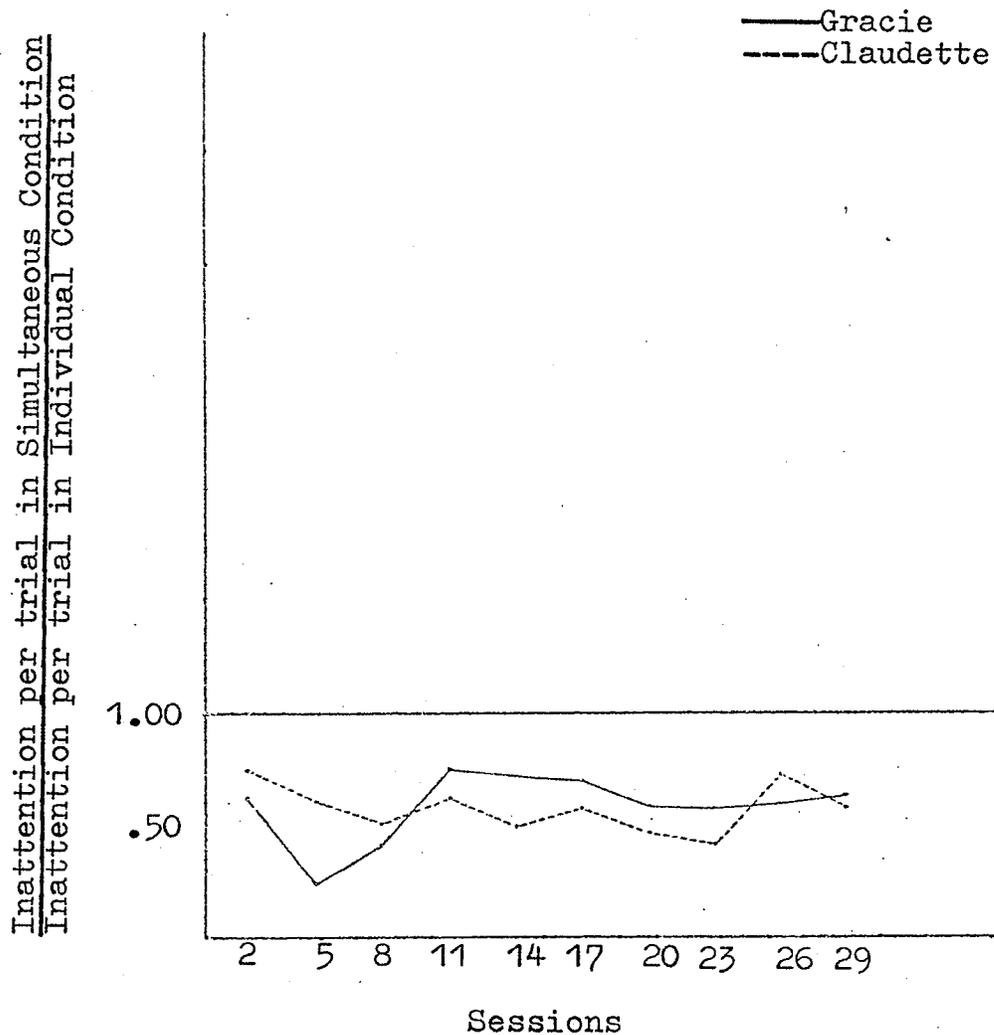


Fig. 28. The ratio of the total number of seconds Gracie and Claudette spent in inattention per trial during each block of three sessions of the Simultaneous Condition over the total number of seconds they spent in inattention per trial during the corresponding blocks of three sessions in the Individual Condition. The solid line at the 1.00 level indicates the ratio that would be expected if the two conditions generated an equal amount of inattention per trial.

ous Condition over the amount of inattention per trial they spent in the Individual Condition. Figure 24 shows clearly that for both Alex and Rodney there was proportionally more time spent in inattention per trial during the Individual Condition than in the Simultaneous Condition. This was also the case with Allan and Joey as indicated by Figure 25. Figure 26 shows that both Gracie and Allan also spent less time in inattention during the Simultaneous Condition relative to the Individual Condition. Finally, Figures 27 and 28 show that for both Broderick and Rodney and for Claudette and Gracie there was less time spent in inattention during the Simultaneous Condition. Thus, for all of the subjects, it appears that the Simultaneous Condition generated more attending than did the Individual Condition.

Words learned. Figures 29 through 38 present the cumulative number of words each subject of the pair learned to criterion in each condition over sessions. As can be seen from Figure 29, Alex learned three words in the Individual Condition, and two words in the Simultaneous Condition. Rodney, Alex's partner, learned more words in the Simultaneous Condition. Figure 30

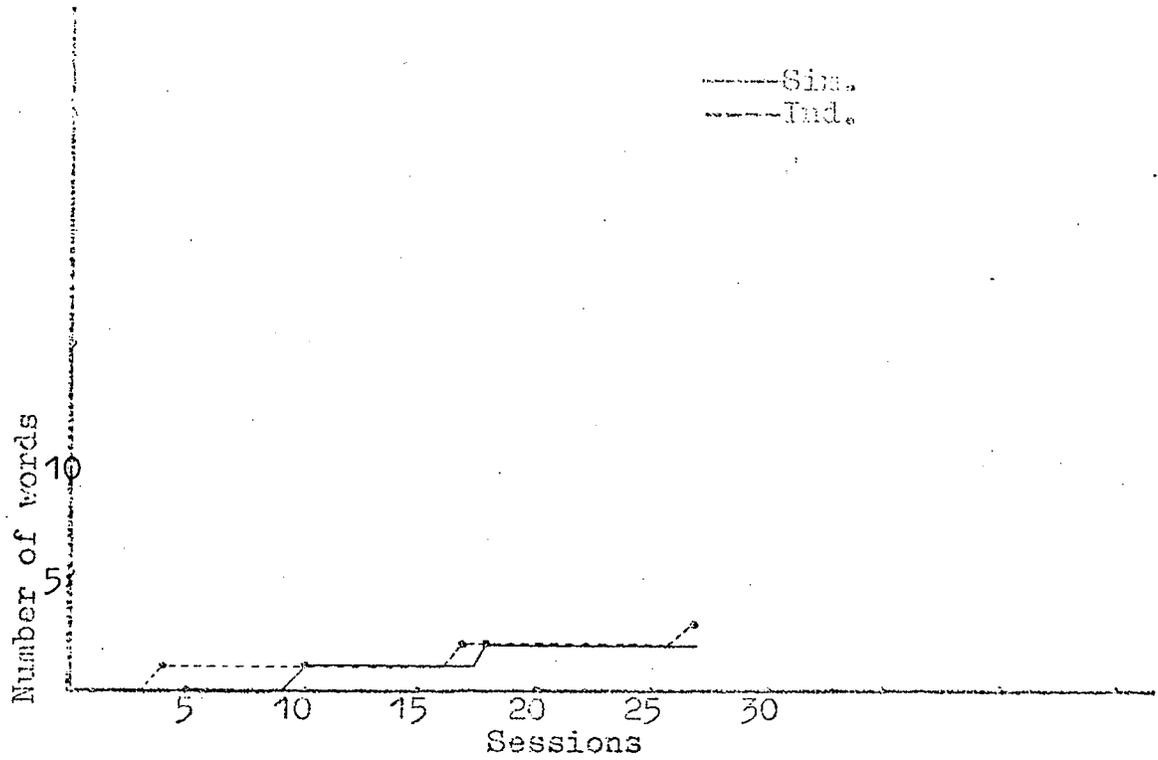


Fig. 29. The cumulative number of words learned to criterion in each condition by Alex.

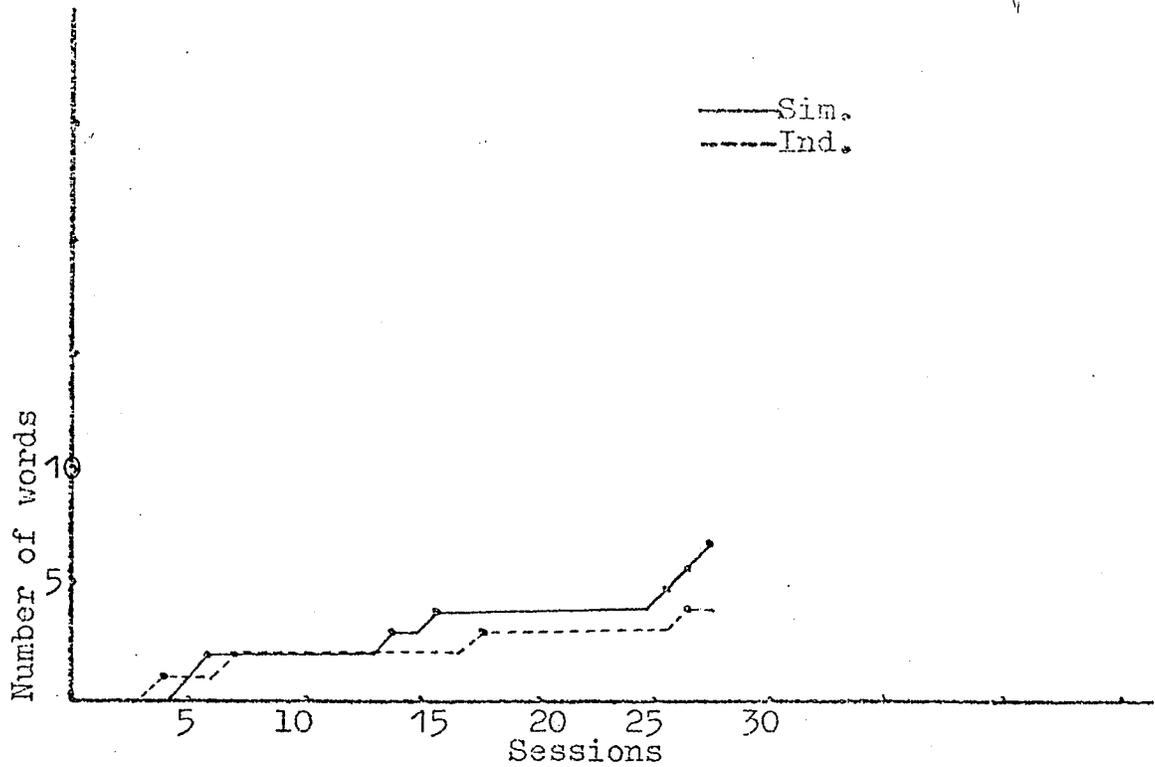


Fig. 30. The cumulative number of words learned to criterion in each condition by Rodney.

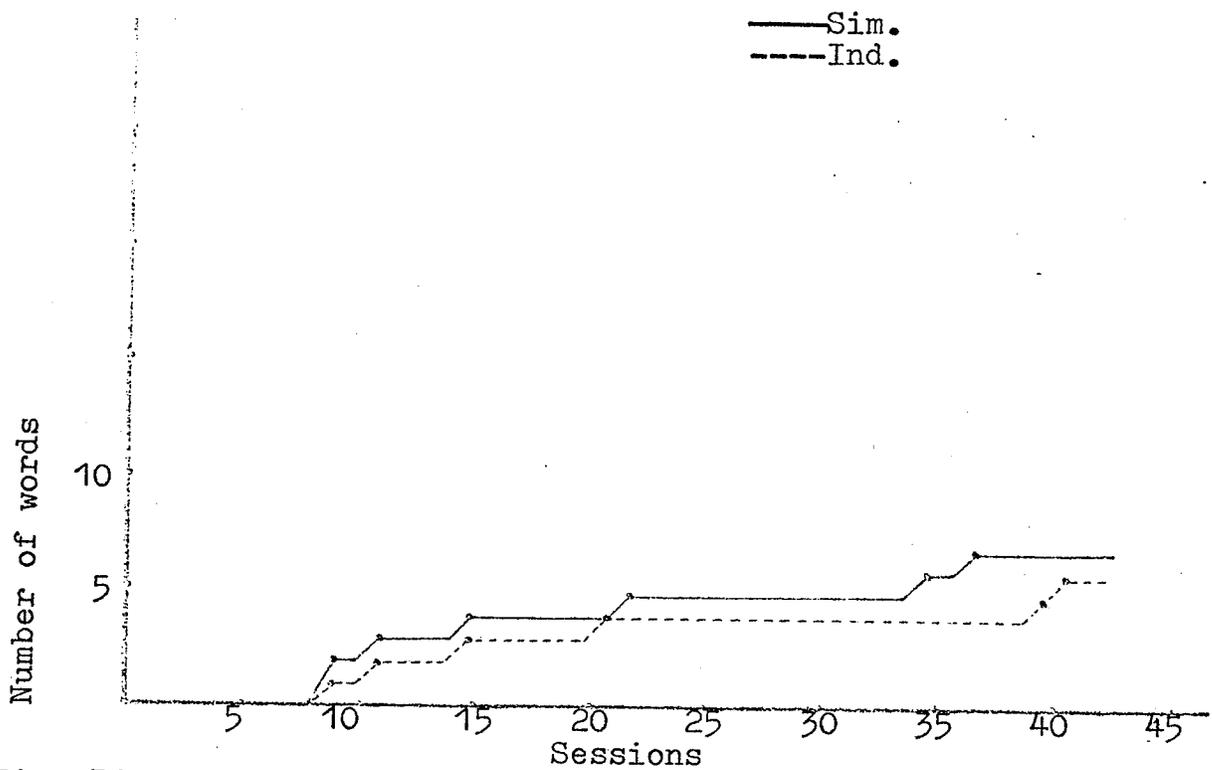


Fig. 31. The cumulative number of words learned to criterion in each condition by Joey.

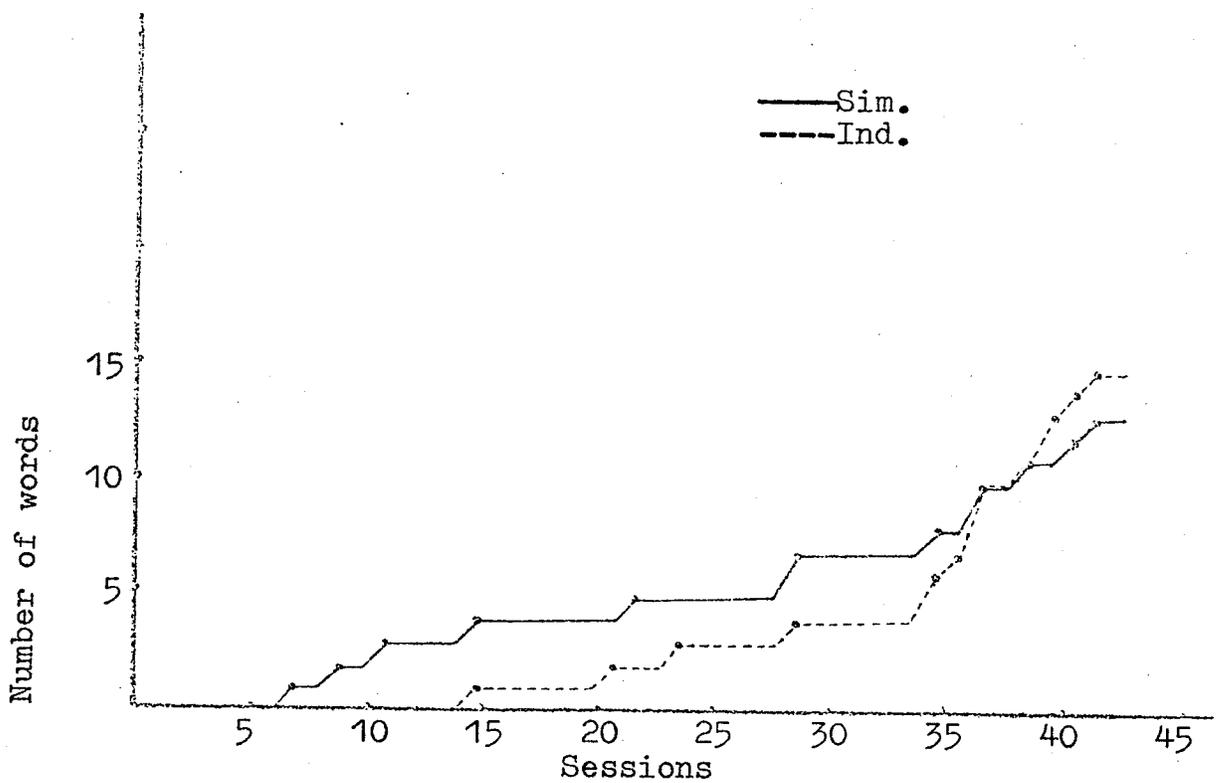


Fig. 32. The cumulative number of words learned to criterion in each condition by Allan.

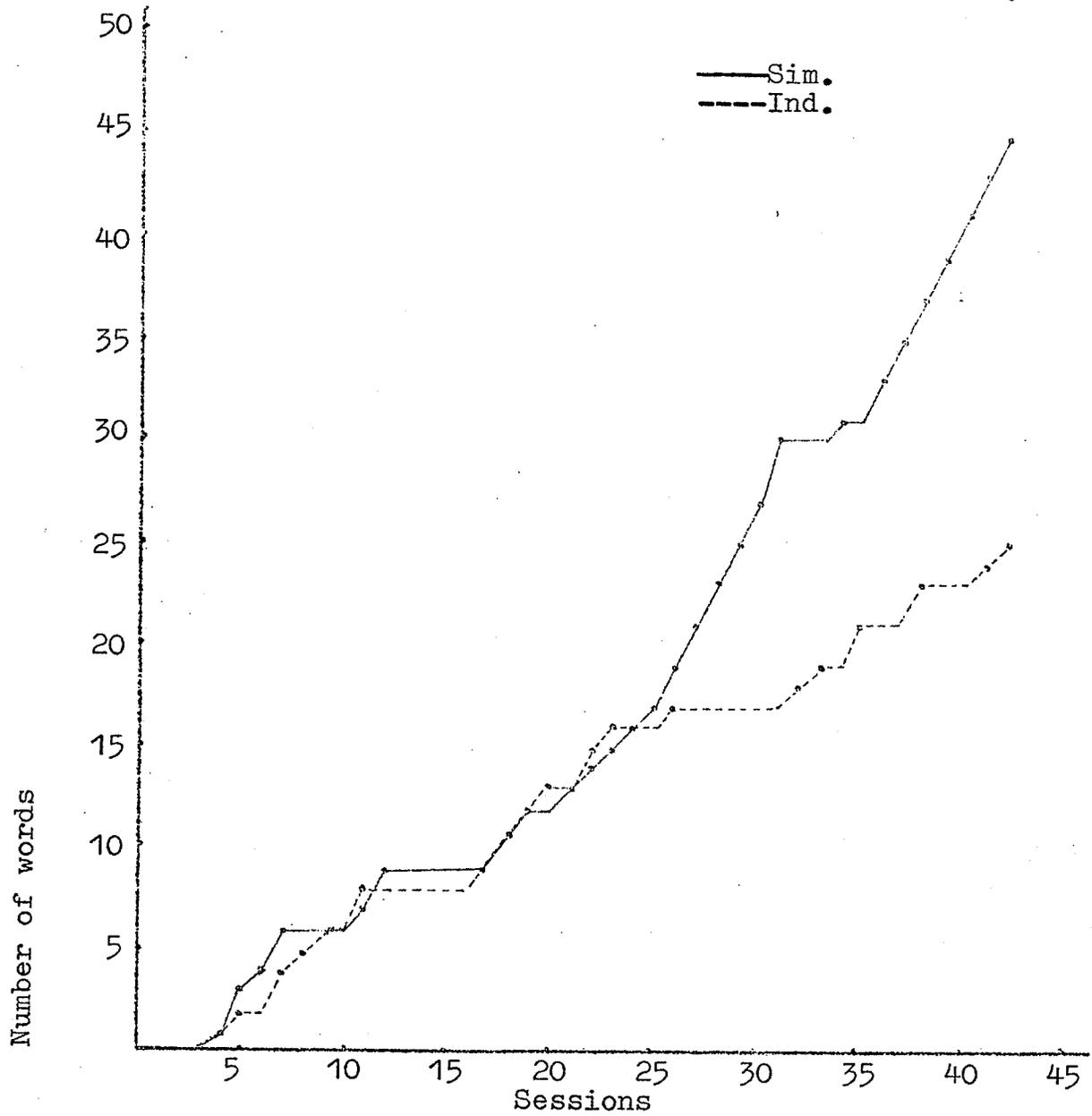


Fig. 33. The cumulative number of words learned to criterion in each condition by Allan.

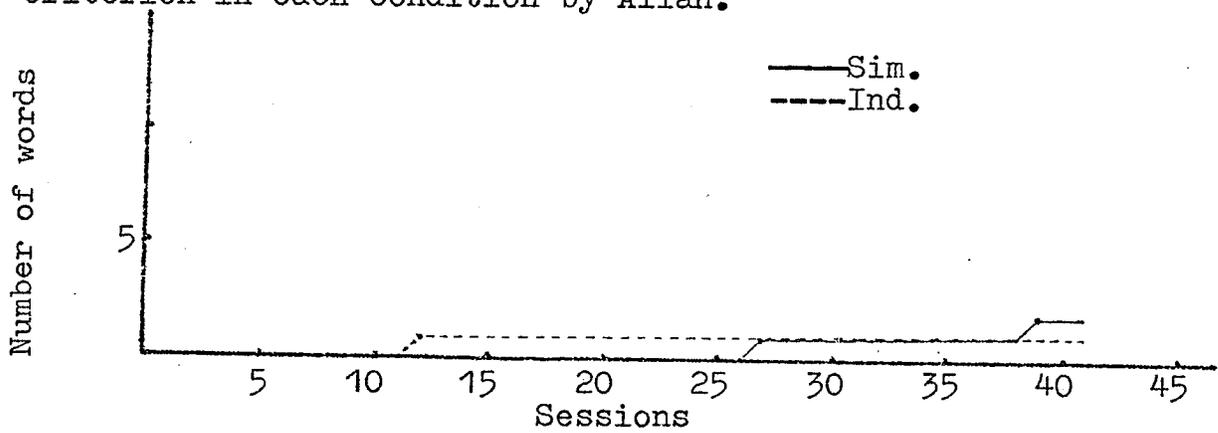


Fig. 34. The cumulative number of words learned to criterion in each condition by Gracie.

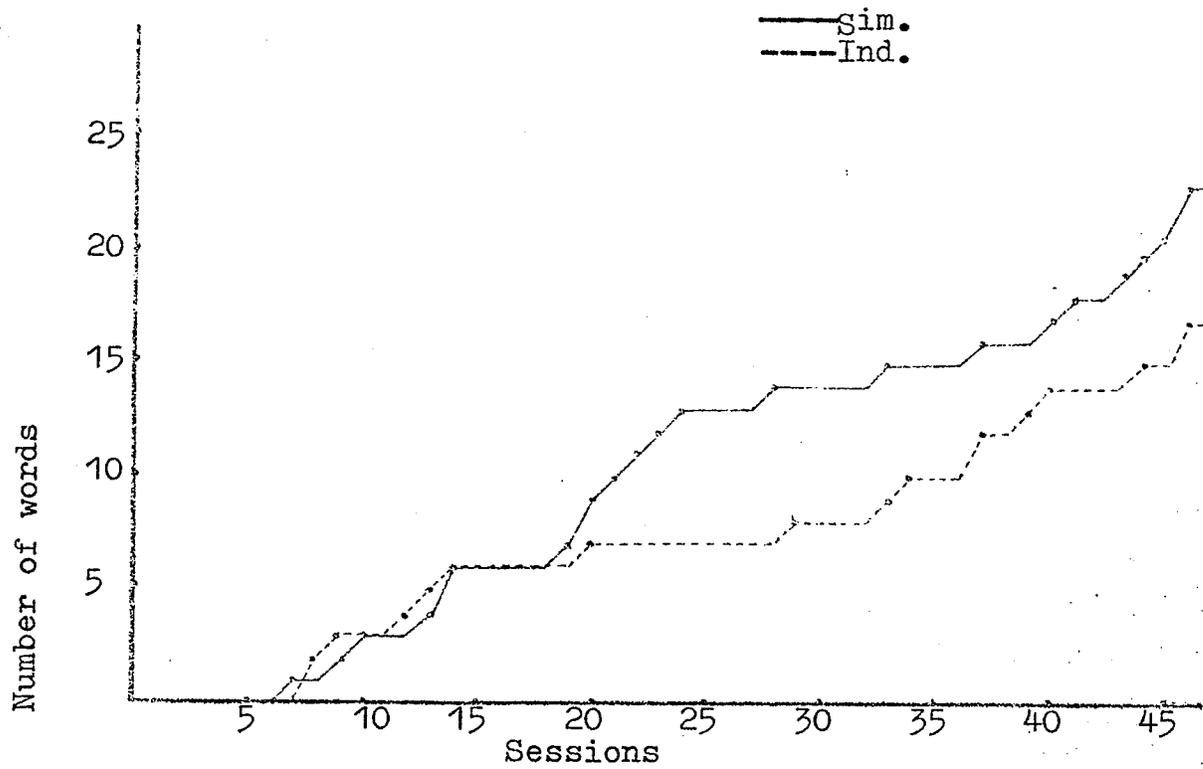


Fig. 35. The cumulative number of words learned to criterion in each condition by Broderick.

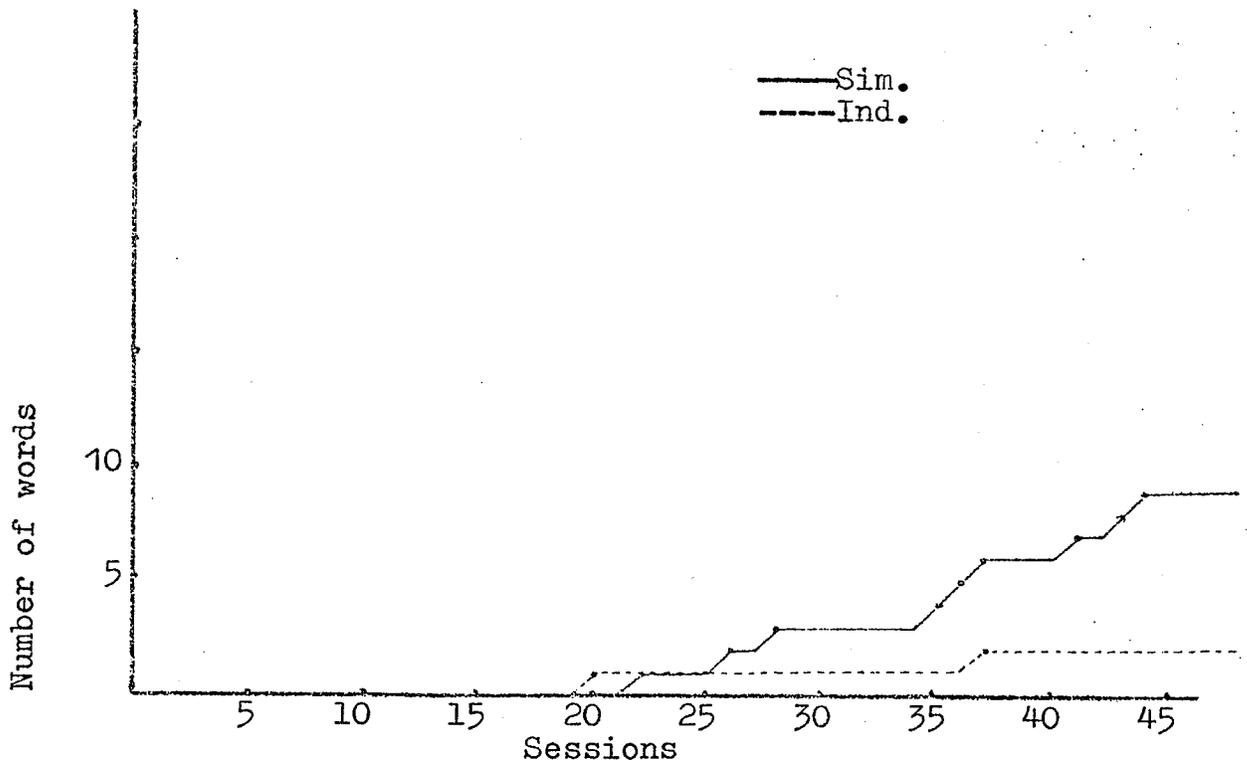


Fig. 36. The cumulative number of words learned to criterion in each condition by Rodney.

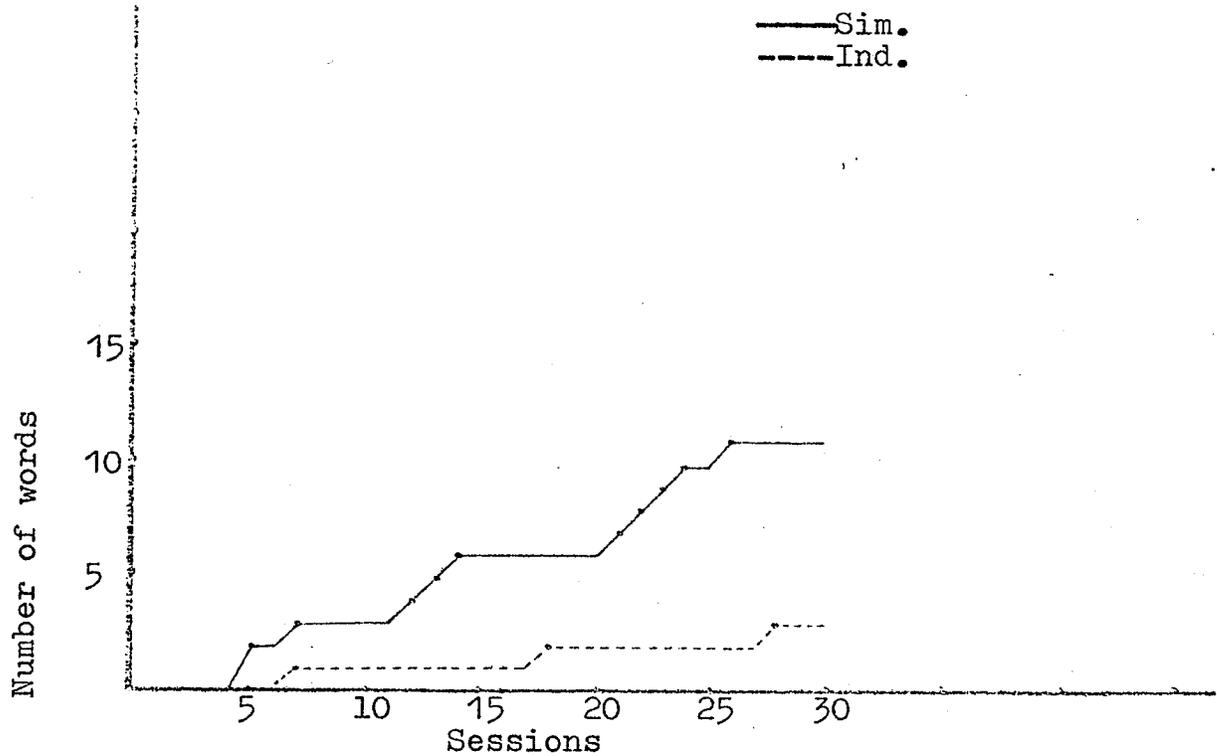


Fig. 37. The cumulative number of words learned to criterion in each condition by Claudette.

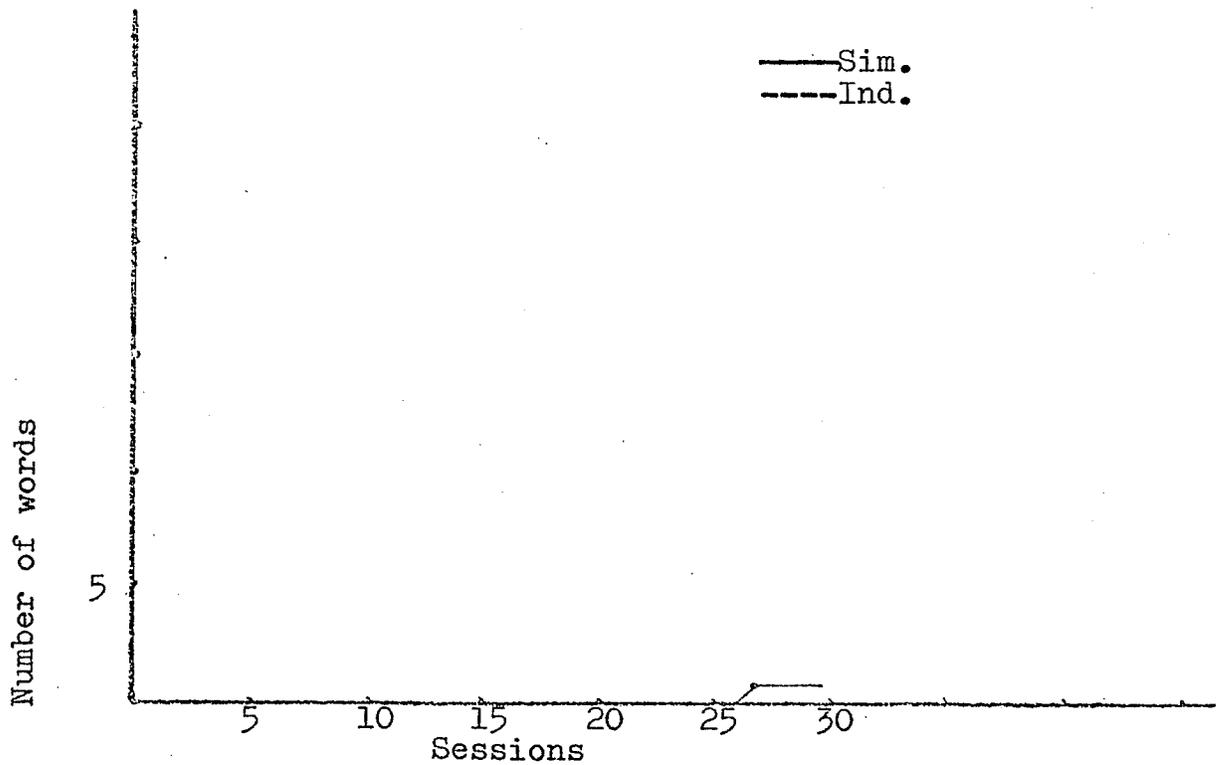


Fig. 38. The cumulative number of words learned to criterion in each condition by Gracie.

shows that he learned seven words in the Simultaneous Condition as opposed to four words in the Individual Condition.

Figure 31 shows that while learning seven words in the Simultaneous Condition, Joey learned only six words in the Individual Condition. Figure 32 shows that his partner Allan, on the other hand, learned fifteen words in the Individual Condition and thirteen words in the Simultaneous Condition.

Figure 33 shows that this same subject, Allan, learned forty-five words in the Simultaneous Condition and only twenty-five words in the Individual Condition when Gracie was his partner. Figure 34 shows that Gracie, on the other hand, learned two words in the Simultaneous Condition and only one word in the Individual Condition.

Figure 35 once again illustrates the superiority of the Simultaneous Condition. This figure shows that while learning only seventeen words in the Individual Condition, Broderick learned twenty-three words in the Simultaneous Condition. His partner, Rodney (Figure 36), also did better in the Simultaneous Condition by learning

nine words in this condition as opposed to only two words in the Individual Condition.

Claudette also learned more words in the Simultaneous Condition sessions. As can be seen from Figure 37, she learned eleven words in the Simultaneous Condition while learning only three words in the Individual Condition. Her partner, Gracie, also did better, learning one word in the Simultaneous Condition and no words in the Individual Condition as can be seen in Figure 38.

For the majority of the subjects, then, it appears that the Simultaneous Condition was superior in regard to generating more learned words. In eight out of the ten partners, more words were learned to criterion in the Simultaneous Condition even though this condition required that the experimenter spend less time with any one partner than in the Individual Condition.

Test for incidental learning. Four subjects, Broderick, Rodney, Gracie and Claudette were tested to see if they had learned any of their partner's words in the Simultaneous Condition. This involved asking them to identify a list of pictures containing the words taught

to their partner, an equal number of comparable words that neither subject was taught, and words they themselves were taught. Table 1 presents the results of this test.

These tests would appear to indicate that while learning their own words during the Simultaneous Condition, the subjects were also learning some of their partner's pictures as well. For most of the subjects, this incidental learning was quite large when compared to an equal number of pictures that were not involved in the sessions.

Summary of results. Figures 39 to 42 present the major results of Experiment I in summary form. They combine the data from both subjects of a pair and present a comparison between the two conditions. Figure 39 shows the total number of trials each pair of subjects initiated over the length of the experiment. As can be seen from this figure, Alex and Rodney initiated a total of 4,668 trials in the Individual Condition. In the Simultaneous Condition they initiated 3,354 trials. Since there were only one-half the number of sessions in the Simultaneous Condition as there were in the Individual Condition

Table 1. Test for incidental learning. The number of words each subject could identify correctly in each list of pictures presented. The numbers in parentheses are the total number of pictures presented.

Subject	Own Pictures	Partner's Pictures	Comparable Pictures
Broderick	42 (45)	13 (16)	3 (16)
Rodney	18 (19)	15 (43)	5 (43)
Gracie	17 (20)	12 (20)	4 (20)
Claudette	23 (24)	5 (19)	2 (19)

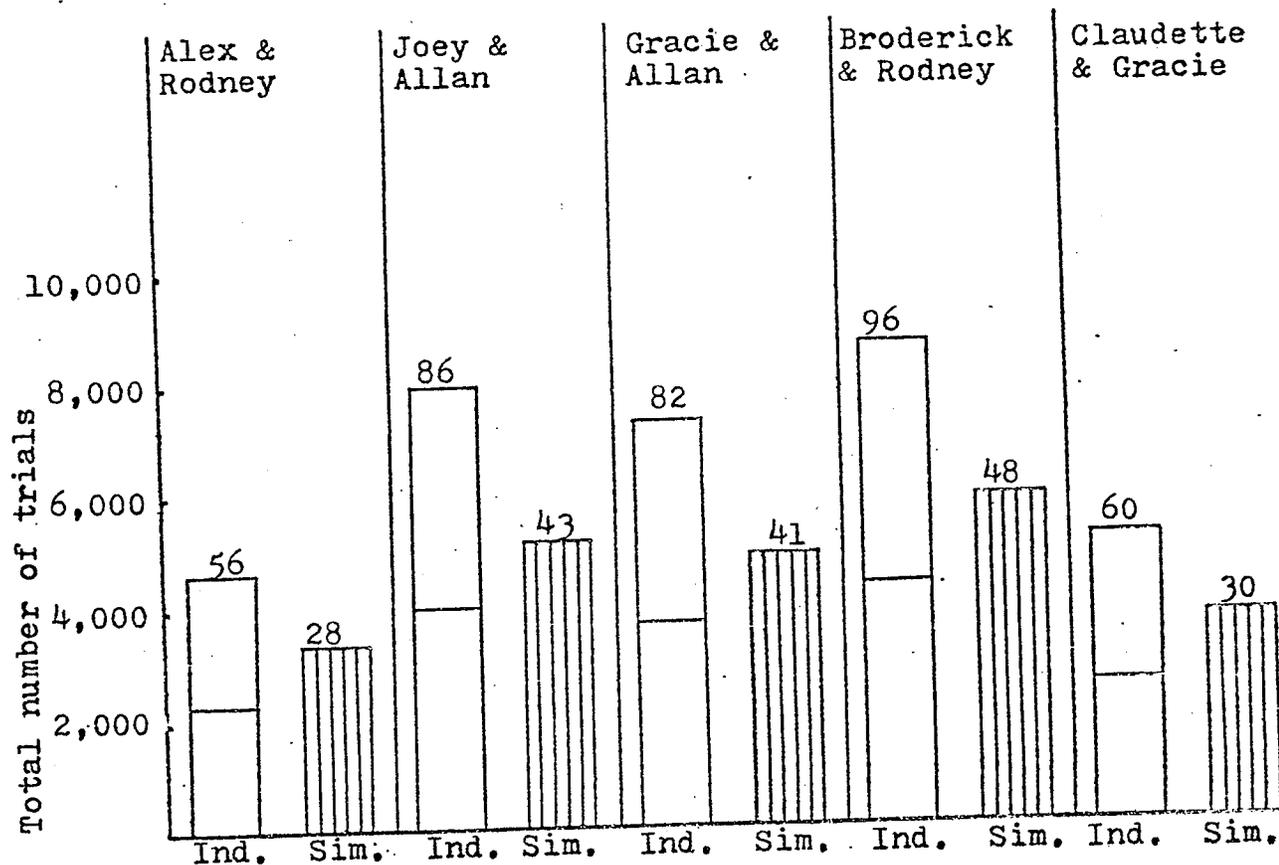


Fig. 39. The total number of trials for each pair of subjects in the two conditions. The lines half-way through the bars for the Individual Condition represent the adjustment that would be necessary to equate the two conditions with respect to the number of sessions (since for each pair of subjects there were twice as many Individual Condition sessions as there were Simultaneous Condition sessions). The number above each bar indicates the number of sessions given to both members of a pair in the conditions indicated.

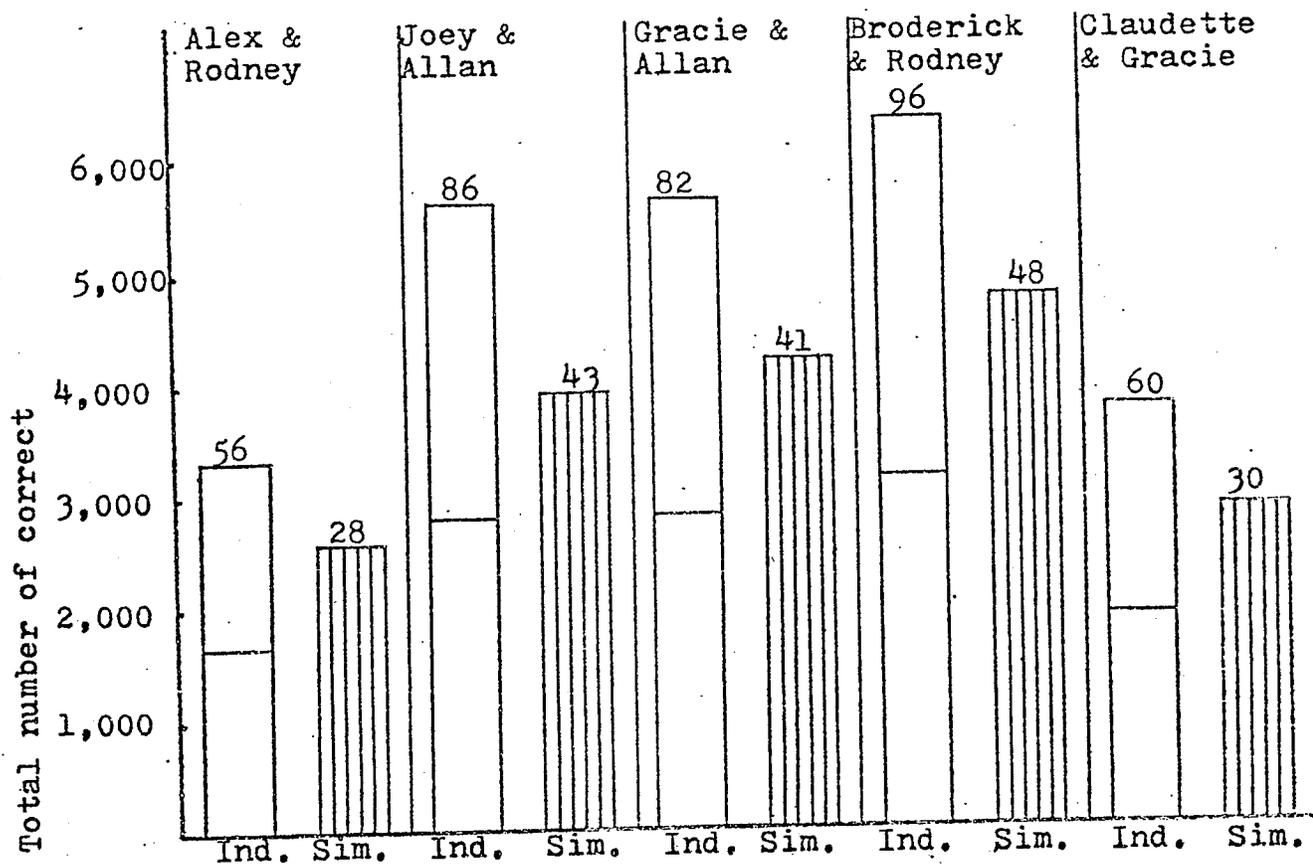


Fig. 40. The total number of correct responses for each pair of subjects in the two conditions. The lines half-way through the bars for the Individual Condition represent the adjustment that would be necessary to equate the two conditions with respect to the number of sessions (since for each pair of subjects there were twice as many Individual Condition sessions as there were Simultaneous Condition sessions). The number above each bar indicates the number of sessions given to both members of a pair in the conditions indicated.

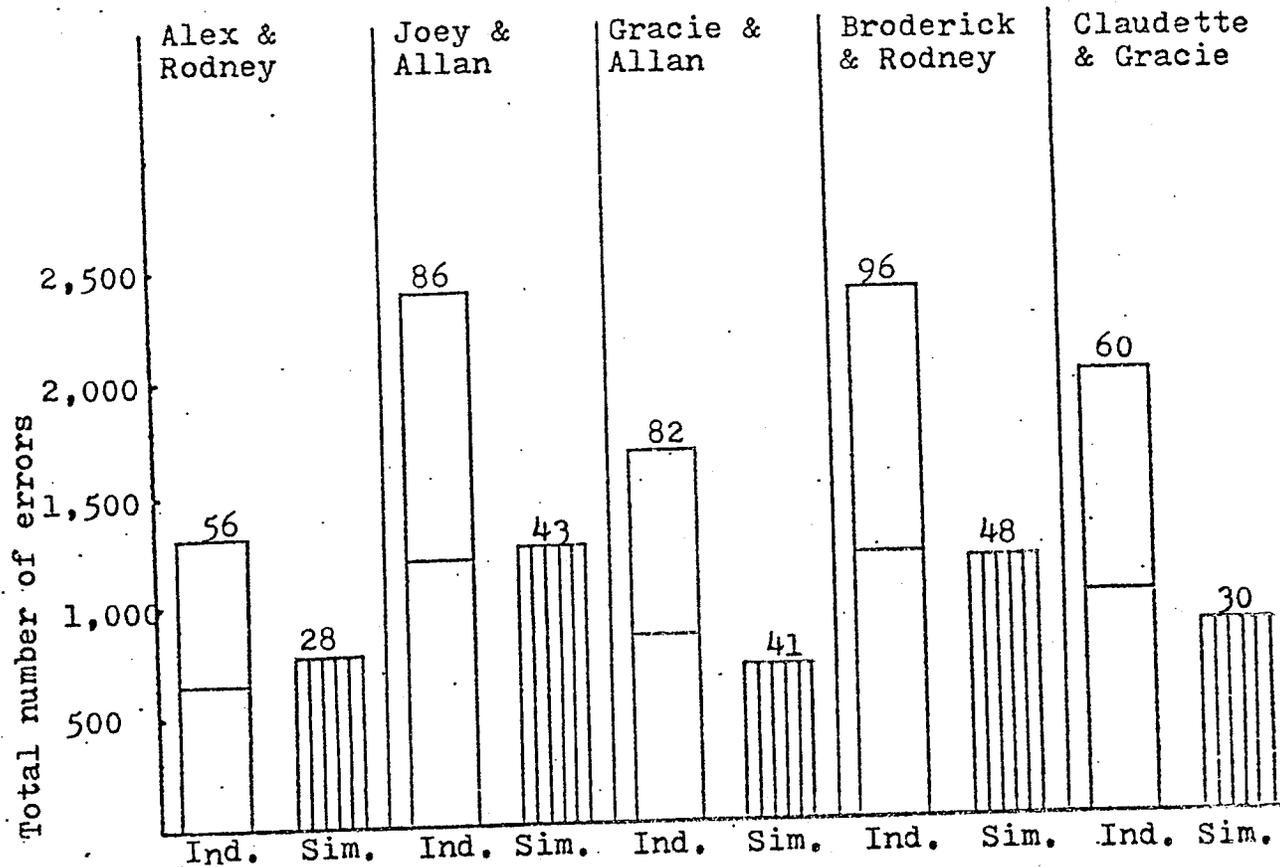


Fig. 41. The total number of errors for each pair of subjects in the two conditions. The lines half-way through the bars for the Individual Condition represent the adjustment that would be necessary to equate the two conditions with respect to the number of sessions (since for each pair of subjects there were twice as many Individual Condition sessions as there were Simultaneous Condition sessions). The number above each bar indicates the number of sessions given to both members of a pair in the conditions indicated.

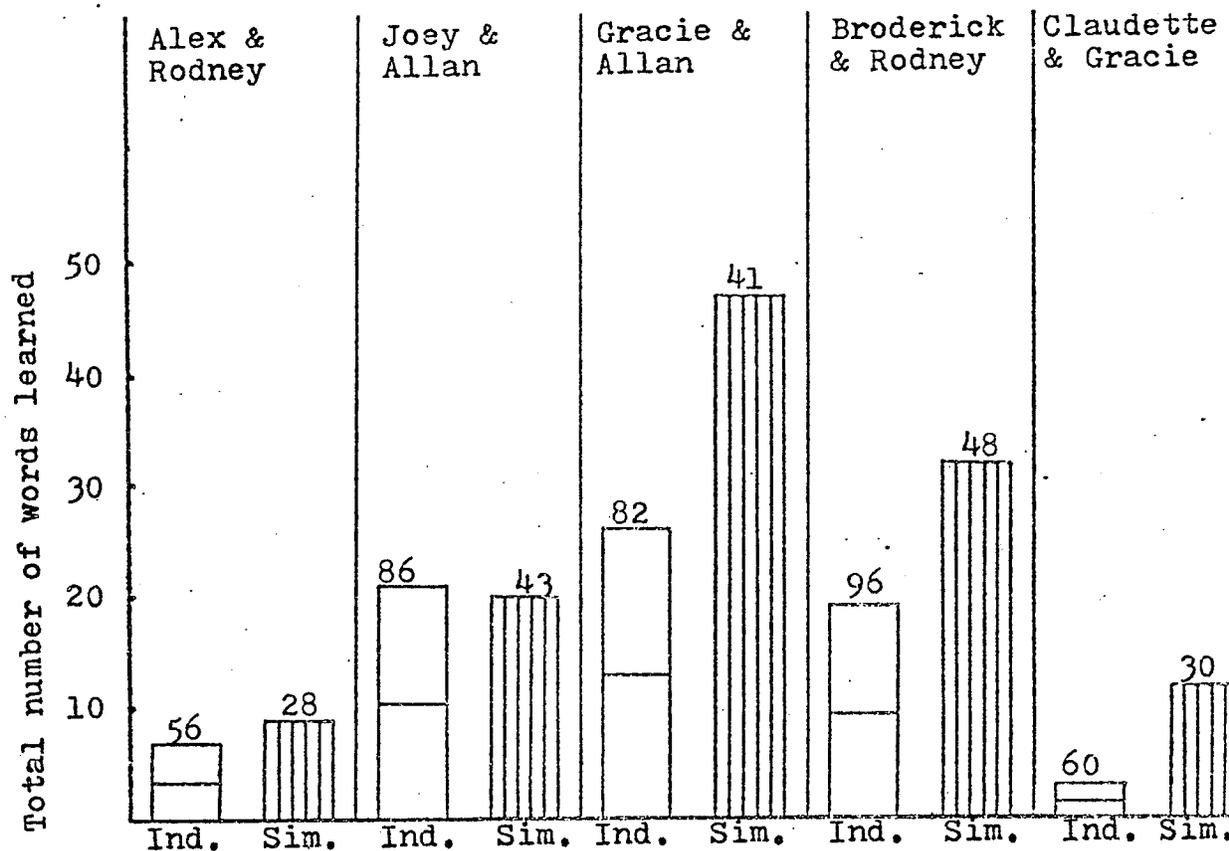


Fig. 42. The total number of words learned by each pair of subjects in the two conditions. The lines half-way through the bars for the Individual Condition represent the adjustment that would be necessary to equate the two conditions with respect to the number of sessions (since for each pair of subjects there were twice as many Individual Condition sessions as there were Simultaneous Condition sessions). The number above each bar indicates the number of sessions given to both members of a pair in the conditions indicated.

(28 and 56 respectively) it appears that there is a distinct superiority of the Simultaneous Condition. The mean number of trial initiations per session for this condition was 119.79 as opposed to only 83.36 for the Individual Condition. Similar results were obtained by combining the data of the other pairs of subjects.

Joey and Allan, for example, initiated a total of 8,029 trials in their 86 Individual Condition sessions for a mean of 93.36 trial initiations per session. In the 43 Simultaneous Condition sessions they initiated a total of 5,186 trials for a mean of 120.60. Gracie and Allan initiated 7,337 trials in the 82 sessions of the Individual Condition and 4,928 in the 41 sessions of the Simultaneous Condition with means of 89.48 and 120.20 respectively. Broderick and Rodney had 8,724 trial initiations in their 96 sessions of the Individual Condition for a mean of 90.88. In the 48 Simultaneous Condition sessions they initiated 5,937 trials for a mean of 123.69 trials per session. Finally, Gracie and Claudette had 5,179 trials in the 60 sessions of the Individual Condition averaging out to 86.32 trials per session. In the 30 Simultaneous Condition sessions they had 3,732 trials for a mean

of 124.40.

Figure 40 presents the total number of correct responses each pair of subjects emitted in the experiment. The first section shows the combined results of Alex and Rodney. In the 56 Individual Condition sessions these subjects emitted a total of 3,356 correct responses or an average of 59.93 correct responses per session. In the Simultaneous Condition, they emitted 2,590 correct responses in 28 sessions for a mean session rate of 92.50. The other sections of Figure 40 are similar to the above results with the total number of correct responses in the Individual Condition being 5,628, 5,665, 6,341, and 3,780, respectively, compared to 3,943, 4,218 and 2,871 correct responses generated by the Simultaneous Condition.

Figure 41 sums the errors each pair of subjects made throughout Experiment I. Unlike the variables presented in the preceding figures, there is no clear distinction between the two conditions regarding errors. It appears that the number of errors per session emitted by each pair of subjects was approximately the same in both conditions when equated for session length.

By far the largest and most important distinction between the two conditions of Experiment I is shown in Figure 42. This figure compares the total number of words that were learned to criterion in the two conditions. In four out of five pairs of subjects, the data show that the subjects (in combination) learned more words in the Simultaneous Condition than in the Individual Condition. This is in spite of the fact that they accomplished this in one-half the time. The fifth pair of subjects, while not surpassing the Individual Condition in words learned, did learn more than one-half of the number learned in the Individual Condition.

Discussion of Experiment I

The results of Experiment I demonstrate quite clearly that training two children simultaneously on a picture-naming task has distinct advantages over training the same children individually. One advantage is the savings in the experimenter time. In the typical applied setting of institutions for the retarded it is quite often economically impossible for a picture-identification task to be taught to very many retardates. This being the case, there are often a number of subjects that could be taught

if there were enough time, money and/or trained personnel. With the Simultaneous Condition procedure this problem is reduced by half.

The above advantage would, of course, be negligible if the Simultaneous Condition procedure did not produce at least one-half the responses or one-half the words learned of the comparable Individual Conditions. Also, the Simultaneous Condition procedure would not be as advantageous if it produced more than one-half the errors, or one-half the inattention. As can be seen from the preceding Figures, such was not the case. In the majority of the subjects tested, there was more than one-half the responding in the Simultaneous Condition than in the comparable Individual Condition. There was also more than one-half the words learned and less than one-half the inattention.

For a few of the subjects in some of the dependent variables measured, their responding was slightly better in the Individual Condition. If, however, one combines their data with that of their partner's, it becomes obvious that combined, the pair did better in the Simultaneous Condition. In most cases, per-

formance in the Simultaneous Condition was well above the 50% level and at times exceeded the 100% level. This means that, at times, the subjects performed better in the Simultaneous Condition than in the Individual Condition and in half the time.

The present results therefore tend to confirm the inference by Borus et al. (1973) that children worked with in a group "appeared to progress at a rate approximately equal to that of children receiving similar therapy individually (p.544)".

Another advantage of the Simultaneous Condition results from the incidental learning taking place. The tests administered to some of the subjects indicated that in the Simultaneous Condition they learned not only the pictures taught to them, but also some of the pictures taught to their partner. The degree to which this incidental learning took place differed from subject to subject, but in all cases the result was large enough to qualify as a significant addition to the number of words in a subject's repertoire.

While the results of Experiment I revealed that a real difference existed between the effects of the

Simultaneous Condition and the Individual Condition, Experiment I was not designed to delineate the major variable or variables that made such a difference. Also, while the test for incidental learning suggested that each subject was learning his or her partner's words, the criticism could be advanced that perhaps they already knew their partner's words prior to the test. Experiment II was initiated to look at both of these questions.

Chapter IV

Experiment II

Rationale of Experiment II

While it is not necessary to understand the "why" of applied procedures in order to use them effectively, it is necessary to understand underlying causes in order to develop a science of behavior. Since it was impossible to delineate which variable(s) was causing the differential effects of Experiment I, Experiment II analyzed one of the major potential variables affecting the differences of Experiment I. An analysis of the Simultaneous Condition would suggest that there were perhaps four main variables operating to effect a difference in Experiment I. These were:

1. The "punishment" contingency of switching to the other subject following errors, omissions and inattention; (i.e., the time-out period)
2. The shorter period of time spent with each individual subject during the Simultaneous Condition;
3. The stimulus change provided by the switching over

to the other subject;

4. The presence of another subject performing the same task.

Experiment II involved an examination of the effects of this last variable - that of the presence of another subject performing the same task. This involved a comparison of the Simultaneous Condition of Experiment I with the Individual Condition which closely approximated the Simultaneous Condition except for the presence of another subject performing the same task. In effect, the Individual Condition training sessions included the three other variables mentioned above; viz., there was still a "punishment" contingency, a shorter time spent working with each subject, and the stimulus change of "switching over" - but there was no other subject present. Experiment II also attempted to provide a better procedure for the test of incidental learning. Two pairs of subjects from Experiment I were used: Claudette and Gracie, and Broderick and Rodney.

Specific Procedures

The Individual Condition. The Individual Condition

proceeded according to the following steps:

1. The subject was seated behind a subject's response panel while the other panel was placed to one side but within clear view of the subject.

2. While sitting opposite the subject, the experimenter activated the equipment by depressing a switch on the master control panel which illuminated a blue light and a red light on the subject's response panel and started the two timers in the adjoining room. One timer recorded the total time the experimenter spent with that subject during the session while the other timer recorded the subject's inattention.

3. When the subject pressed his or her lever, the red attending light turned off and the inattention timer stopped for a period of seven seconds. Immediately after the lever press, the experimenter presented a picture from the Individual Condition word pool for that subject and proceeded with the picture-naming procedure outlined in Experiment I.

4. A correct response to either the prompt or ques-

tion trials was reinforced with a "Good boy" or "Good girl" and recorded on the daily data sheet. Seven seconds following a lever press the subject's red attending light and inattention timer turned on.

5. After the subject made an incorrect response or an omission, was inattentive for ten seconds, or was reinforced with the back-up reinforcer after five correct responses, his response panel was made inoperative. By pressing a button on the master control panel, the experimenter turned off the red and blue stimulus lights and the two timers recording total working time and inattention.

Concurrently, the other response panel was activated which illuminated the red and blue stimulus lights of that panel and turned on a timer in the adjoining room. This other panel remained activated for a random time interval which approximated that which occurred in the Simultaneous Condition. This time interval was determined by dividing the number of switch-overs the subject had in the previous Simultaneous Condition into the total amount of time the experimenter spent with the other subject. The average time interval was then

programmed into the digital logic's random generator in order to approximate the average amount of time spent with the other subject in the Simultaneous Condition. Following completion of each random time interval, the other panel turned off and the subject's response panel was activated as in step 2.

The Simultaneous Condition. The Simultaneous Condition was exactly the same as in Experiment I .

Test for incidental learning. Prior to conducting Experiment II, each subject was tested to determine whether he knew the pictures that were going to be taught to his partner. Also, a list of comparable words that neither subject of the pair was taught was tested with each subject. This pre-testing was done to insure that each subject did not know any of his partner's new words or any of the pictures from the comparable list that neither subject was to be taught.

At the end of Experiment II, each subject was tested on a random selection of words containing all the words that had been presented to him, all the words that had been presented to his partners, and the comparable list

of words which neither subject had been taught. Such a test would clearly indicate whether incidental learning was taking place in the Simultaneous Condition.

Sessions. In all other respects, sessions were carried out exactly as in Experiment I. Twenty-six Simultaneous Condition sessions were conducted with Broderick and Rodney, and twenty-seven with Claudette and Gracie. Each subject received the same number of sessions in the Individual Condition as he did in the Simultaneous Condition.

Results of Experiment II

The same method of analysis which was used in Experiment I was chosen for Experiment II - the ratios of dependent variables in the Simultaneous Condition over those in the Individual Condition. However, unlike Experiment I, these ratios were compared to the 1.00 level since both conditions were now equated with respect to the time spent with the subject (in the sense that the Individual Condition sessions were conducted "as though" another subject was present).

Total trials in the Simultaneous Condition/ Total

trials in the Individual Condition. Figure 43 shows the ratio of total trials in the Simultaneous Condition to total trials in the Individual Condition for Broderick and Rodney. As can be seen from this figure, both subjects continued to initiate more trials in the Simultaneous Condition than in the Individual Condition. Figure 44 shows similar results for the second pair of subjects, Gracie and Claudette. Here, too, the large majority of sessions for both subjects showed a greater number of trials initiated in the Simultaneous Condition. It would appear, then, that the Simultaneous Condition was superior to the Individual Condition in generating more responding even when these two conditions were equated except for the presence of another subject.

Correct responses in the Simultaneous Condition/Correct responses in the Individual Condition. Figure 45 shows the ratio of correct responses in the two conditions for Broderick and Rodney and once again illustrates a superiority of the Simultaneous Condition. Both subjects emitted a greater number of correct responses in the Simultaneous Condition than in the Individual Condition. The same is also true for Gracie

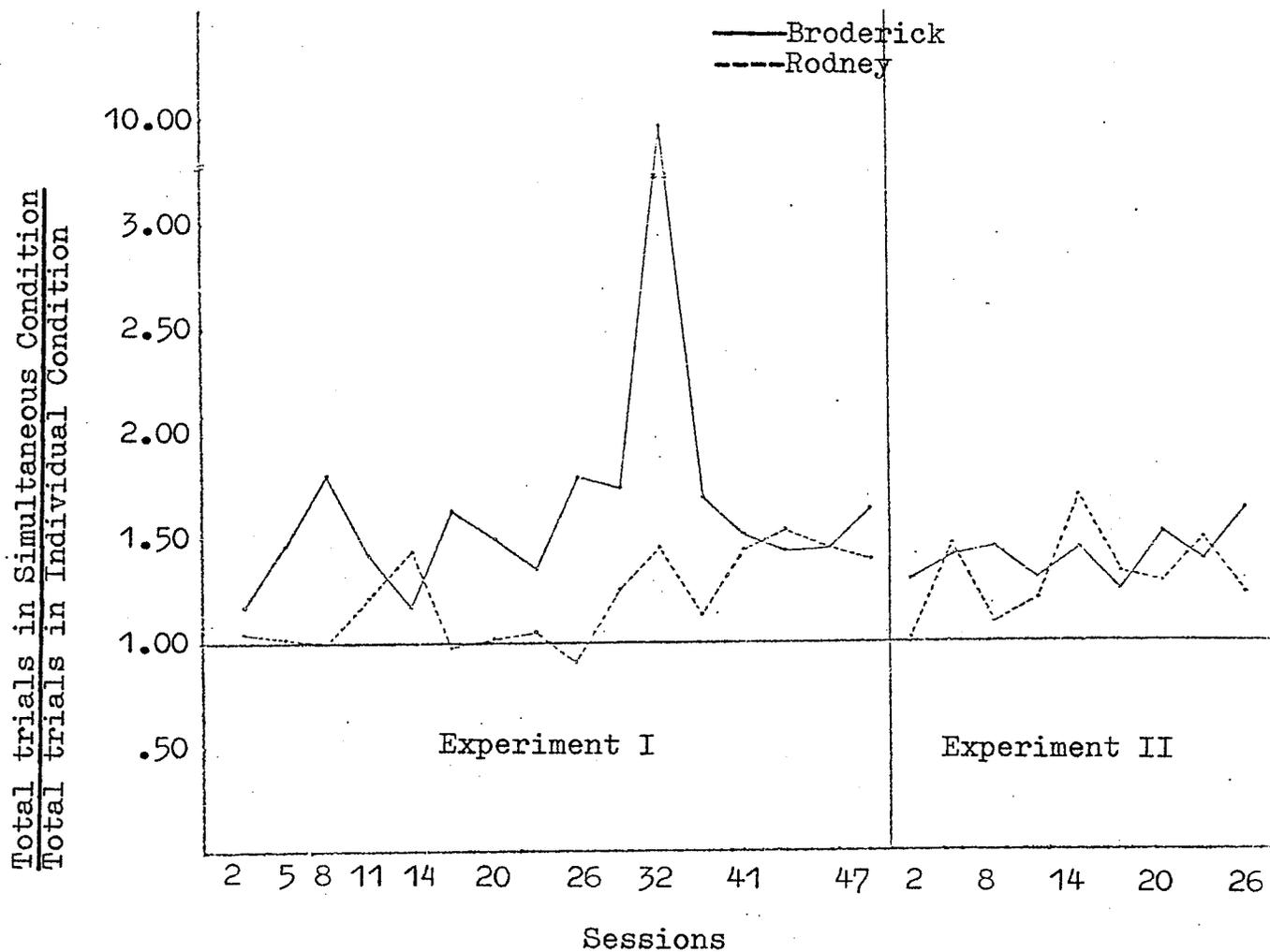


Fig. 43. The total number of trials Broderick and Rodney initiated in the Simultaneous Condition in blocks of three sessions divided by the total number of trials they initiated in the Individual Condition during the corresponding blocks of three sessions. The line at 1.00 indicates what the ratio would be if there were no differences between the two conditions. Included in the figure are the ratios from Experiment I which are presented as baseline information. To make these ratios comparable to those of Experiment II, data from the Simultaneous Condition of Experiment I were multiplied by two before dividing them by the corresponding data from the Individual Condition.

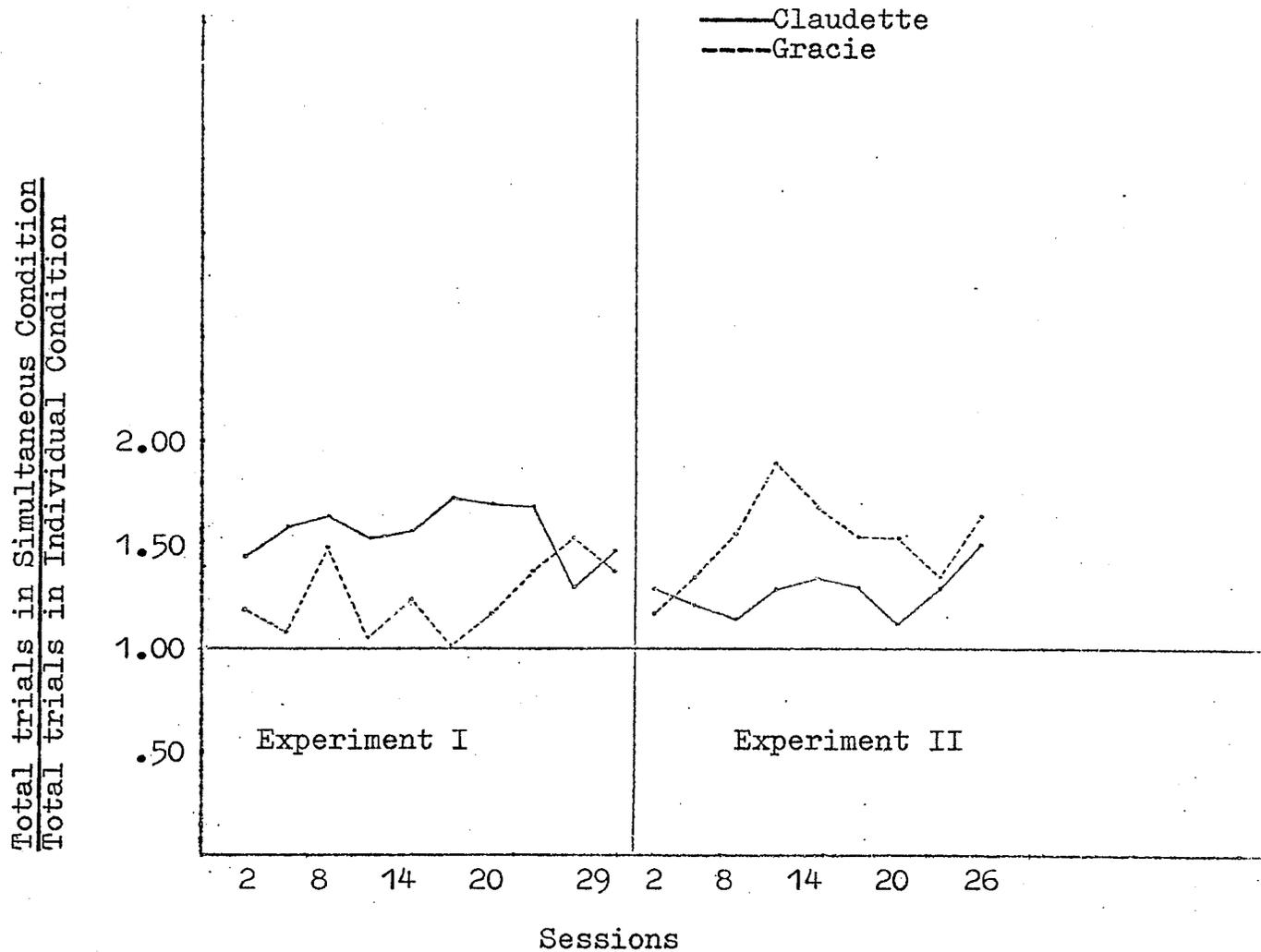


Fig. 44. The total number of trials Claudette and Gracie initiated in the Simultaneous Condition in blocks of three sessions divided by the total number of trials they initiated in the Individual Condition during the corresponding blocks of three sessions. The line at 1.00 indicates what the ratio would be if there were no differences between the two conditions. Included in the figure are the ratios from Experiment I which are presented as baseline information. To make these ratios comparable to those of Experiment II, data from the Simultaneous Condition of Experiment I were multiplied by two before dividing them by the corresponding data from the Individual Condition.

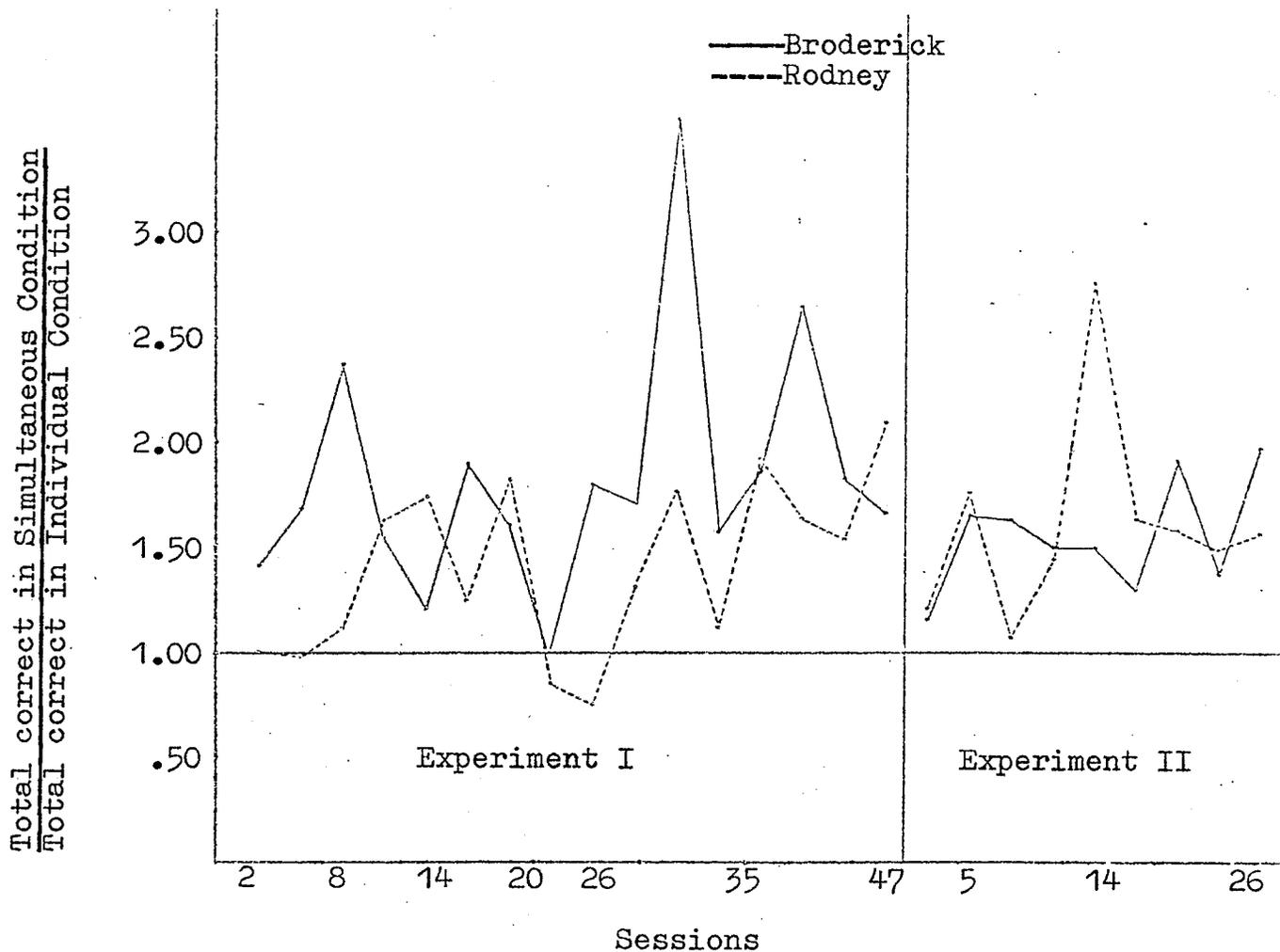


Fig.45. The total number of correct responses Broderick and Rodney made in the Simultaneous Condition in blocks of three sessions divided by the total number of correct responses they made in the Individual Condition during the corresponding blocks of three sessions. The line at 1.00 indicates what the ratio would be if there were no differences between the two conditions. Included in the figure are the ratios from Experiment I which are presented as baseline information. To make these ratios comparable to those of Experiment II, data from the Simultaneous Condition of Experiment I were multiplied by two before dividing them by the corresponding data from the Individual Condition.

and Claudette (Figure 46). Both girls made more correct responses in the Simultaneous Condition than in the Individual Condition. Both pairs of subjects thus seem to show that more correct responses are obtained in the Simultaneous Condition even when this condition is compared to an equivalent condition except for the presence of another subject.

Total errors in the Simultaneous Condition/Total errors in the Individual Condition. Figures 47 and 48 present the ratio of errors in the Simultaneous Condition to errors in the Individual Condition for both pairs of subjects. As in the previous experiment, there is no clear distinction between the two conditions. All four subjects emitted approximately as many errors in the Simultaneous Condition as in the Individual Condition when averaged out over sessions.

Percent correct in the Simultaneous Condition/Percent correct in the Individual Condition. Figure 49 shows the ratio of percent correct for Broderick and Rodney. It is clear from this figure that for a large majority of the sessions the Simultaneous Condition had a greater percentage of correct responses than did the Individual

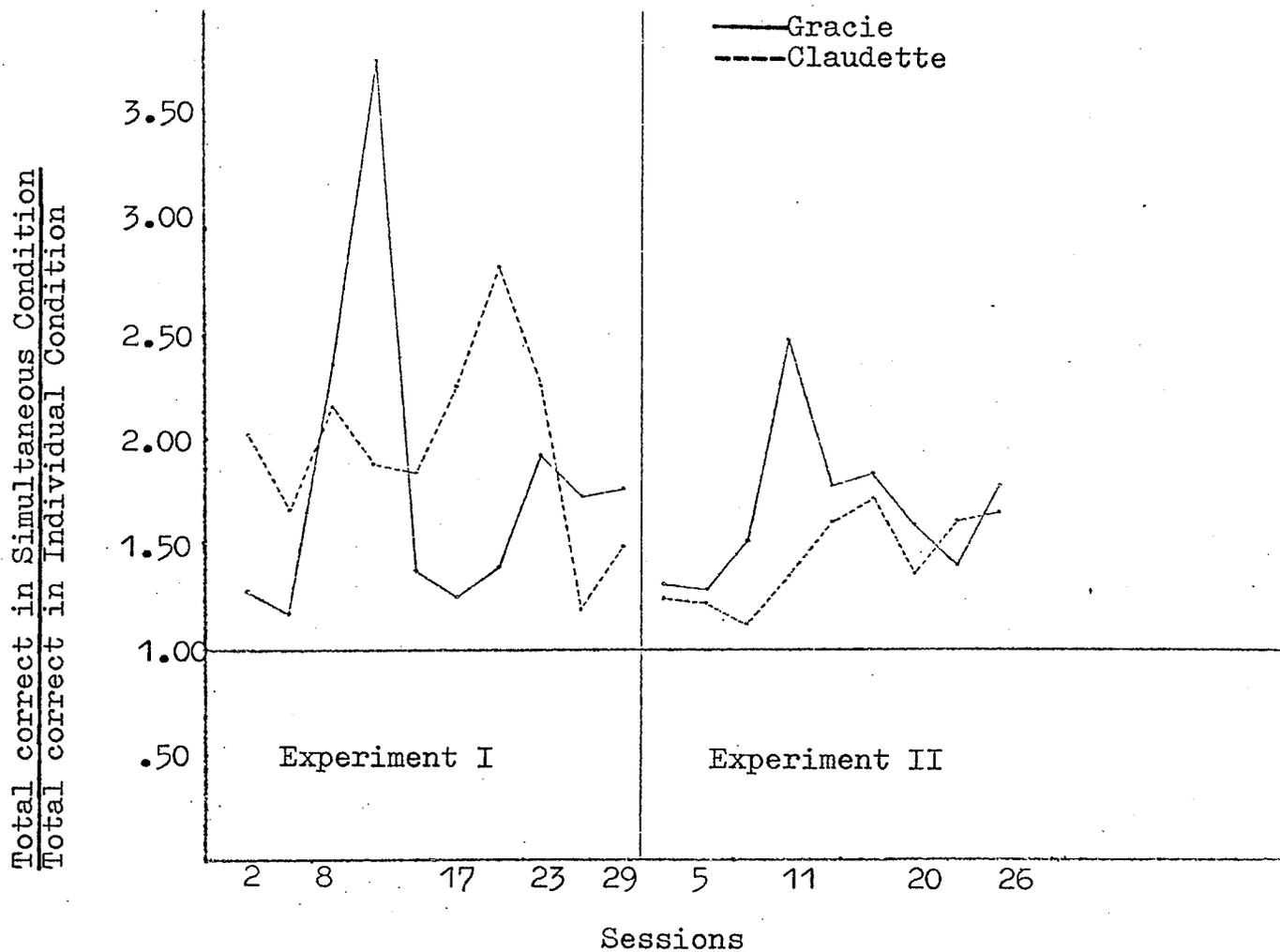


Fig. 46. The total number of correct responses Gracie and Claudette made in the Simultaneous Condition in blocks of three sessions divided by the total number of correct responses they made in the Individual Condition during the corresponding blocks of three sessions. The line at 1.00 indicates what the ratio would be if there were no differences between the two conditions. Included in the figure are the ratios from Experiment I which are presented as baseline information. To make these ratios comparable to those of Experiment II, data from the Simultaneous Condition of Experiment I were multiplied by two before dividing them by the corresponding data from the Individual Condition.

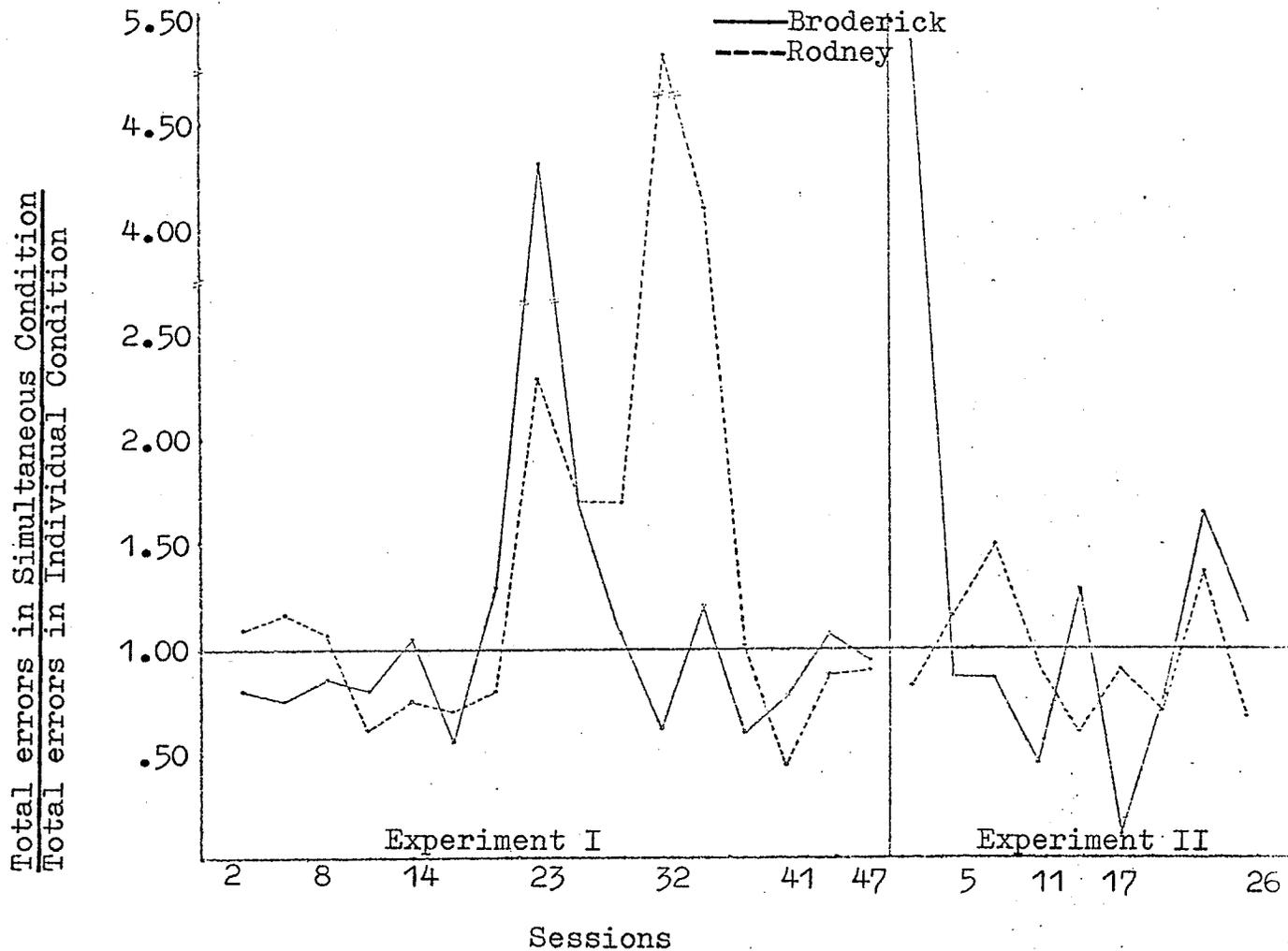


Fig. 47. The total number of errors Broderick and Rodney emitted in the Simultaneous Condition in blocks of three sessions divided by the total number of errors they emitted in the Individual Condition during the corresponding blocks of three sessions. The line at 1.00 indicates what the ratio would be if there were no differences between the two conditions. Included in the figure are the ratios from Experiment I which are presented as baseline information. To make these ratios comparable to those of Experiment II, data from the Simultaneous Condition of Experiment I were multiplied by two before dividing them by the corresponding data from the Individual Condition.

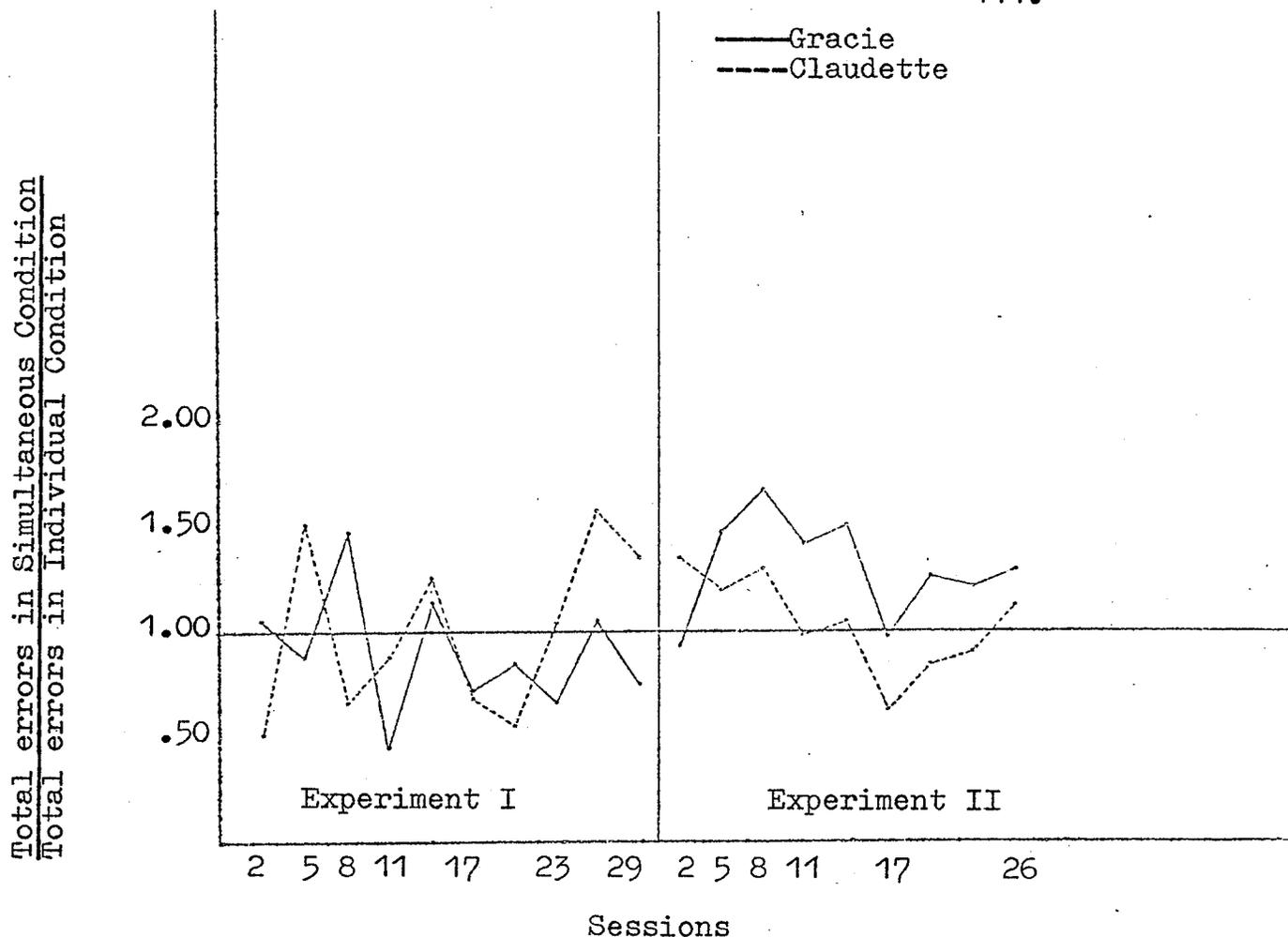


Fig. 48. The total number of errors Gracie and Claudette emitted in the Simultaneous Condition in blocks of three sessions divided by the total number of errors they emitted in the Individual Condition during the corresponding blocks of three sessions. The line at 1.00 indicates what the ratio would be if there were no differences between the two conditions. Included in the figure are the ratios from Experiment I which are presented as baseline information. To make these ratios comparable to those of Experiment II, data from the Simultaneous Condition of Experiment I were multiplied by two before dividing them by the corresponding data from the Individual Condition.

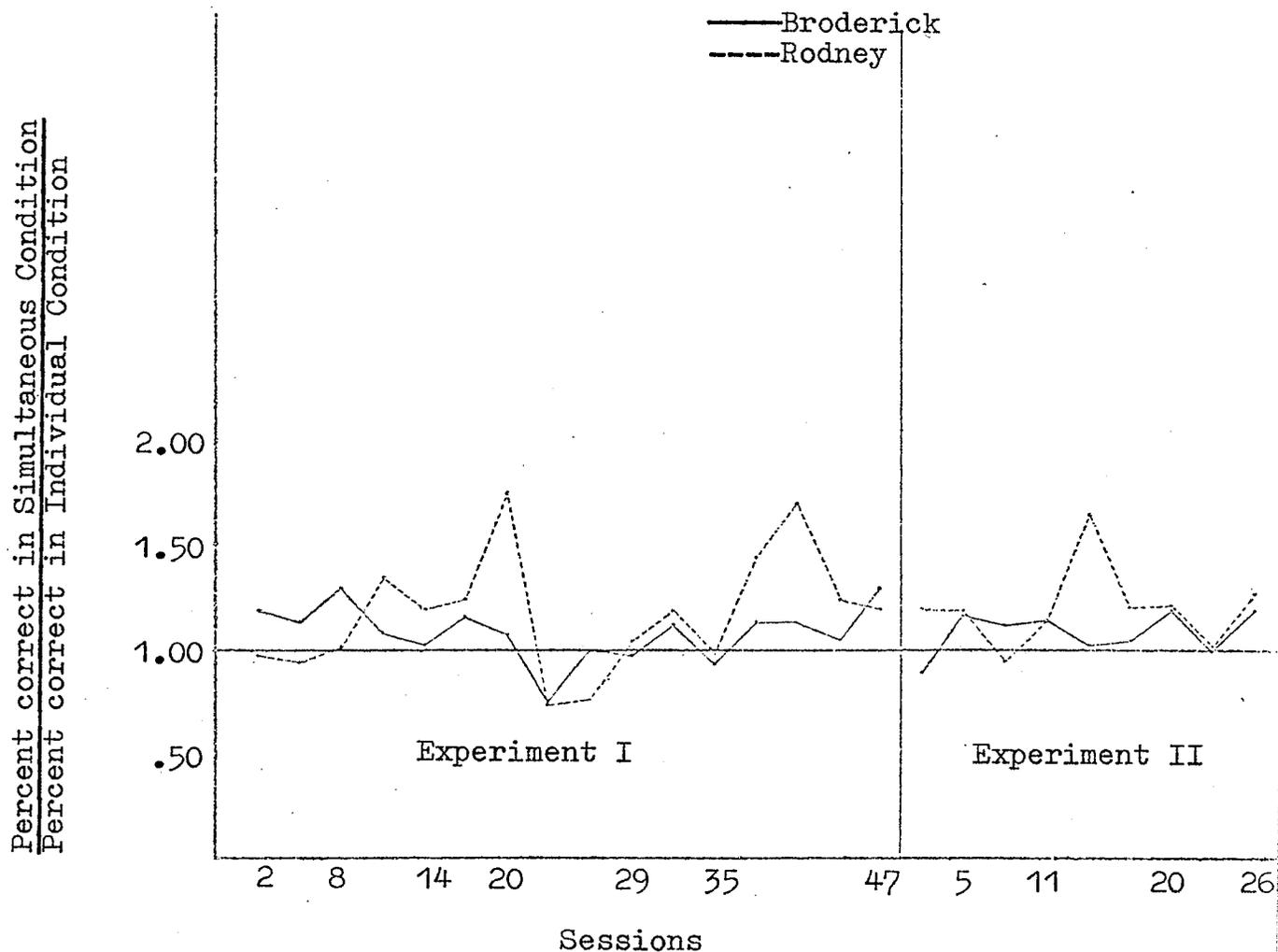


Fig.49. The percentage of correct responses made by Broderick and Rodney in the Simultaneous Condition in blocks of three sessions divided by the percentage of correct responses they made in the Individual Condition during the corresponding blocks of three sessions. The line at 1.00 indicates what the ratio would be if there were no differences between the two conditions. Included in the figure are the ratios from Experiment I which are presented as baseline information.

Condition for both of these subjects. This superiority of the Simultaneous Condition is again shown in Figure 50 which shows the ratio of percent correct for Gracie and Claudette. These figures would thus appear to indicate that for both pairs of subjects, the equating of the two conditions, except for the presence of the other subject, did not affect the ratio of percent correct to any great extent.

Inattention in the Simultaneous Condition/ Inattention in the Individual Condition. Figures 51 and 52 present the data on inattention for both pairs of subjects. In both, while there appears to be a decrease from the effect found in Experiment I, over sessions there remained a distinct superiority of the Simultaneous Condition in generating more attending.

Words learned. Figures 53, 54 and 55 present the total number of words each subject of the pair learned to criterion in each condition. For Broderick, Rodney, and Claudette, there was again a dramatic difference in the number of words learned in the two conditions. All of these subjects learned over twice as many words in the Simultaneous Condition than in the Individual Condition.

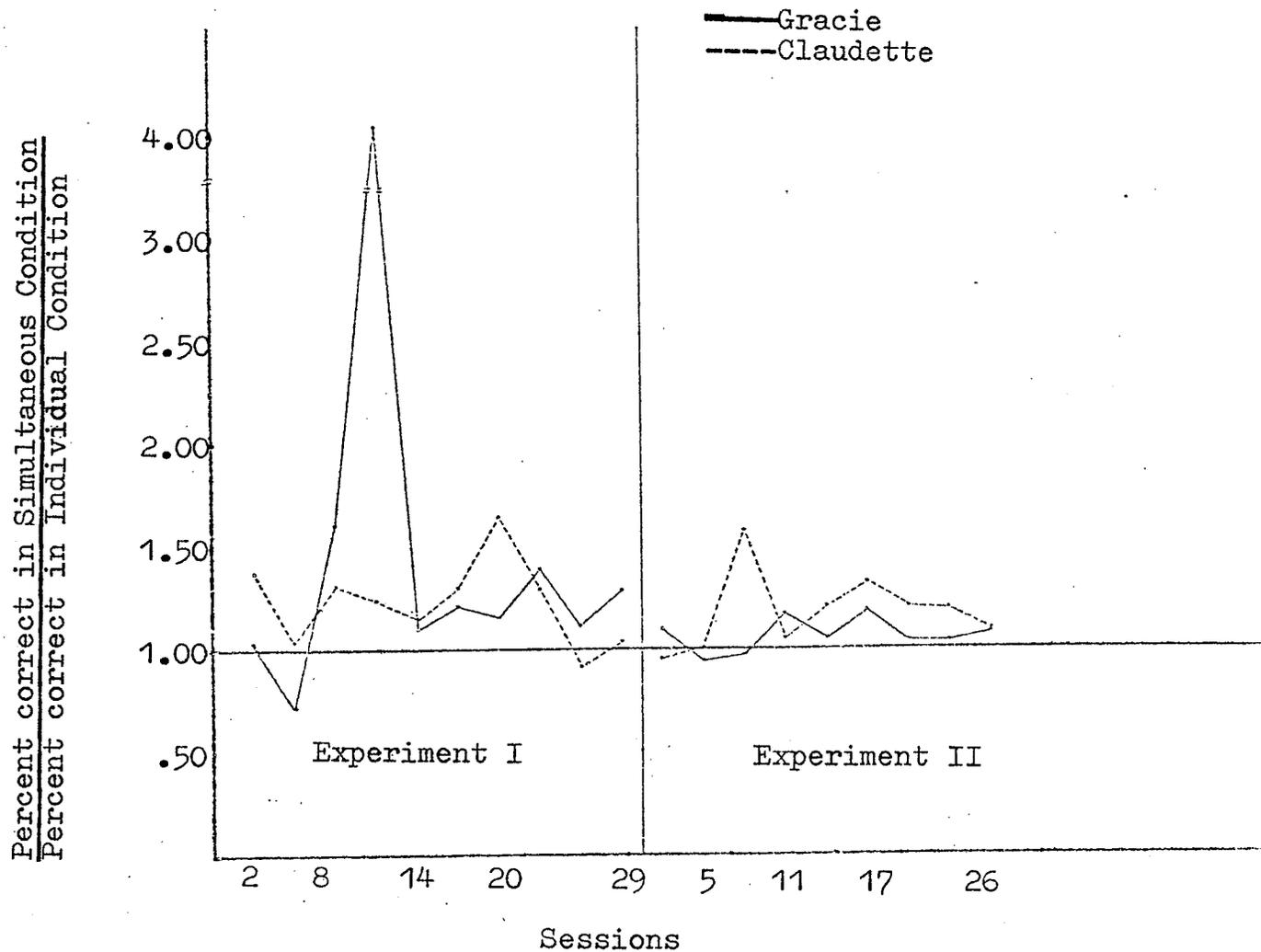


Fig. 50. The percentage of correct responses made by Gracie and Claudette in the Simultaneous Condition in blocks of three sessions divided by the percentage of correct responses they made in the Individual Condition during the corresponding blocks of three sessions. The line at 1.00 indicates what the ratio would be if there were no differences between the two conditions. Included in the figure are the ratios from Experiment I which are presented as baseline information.

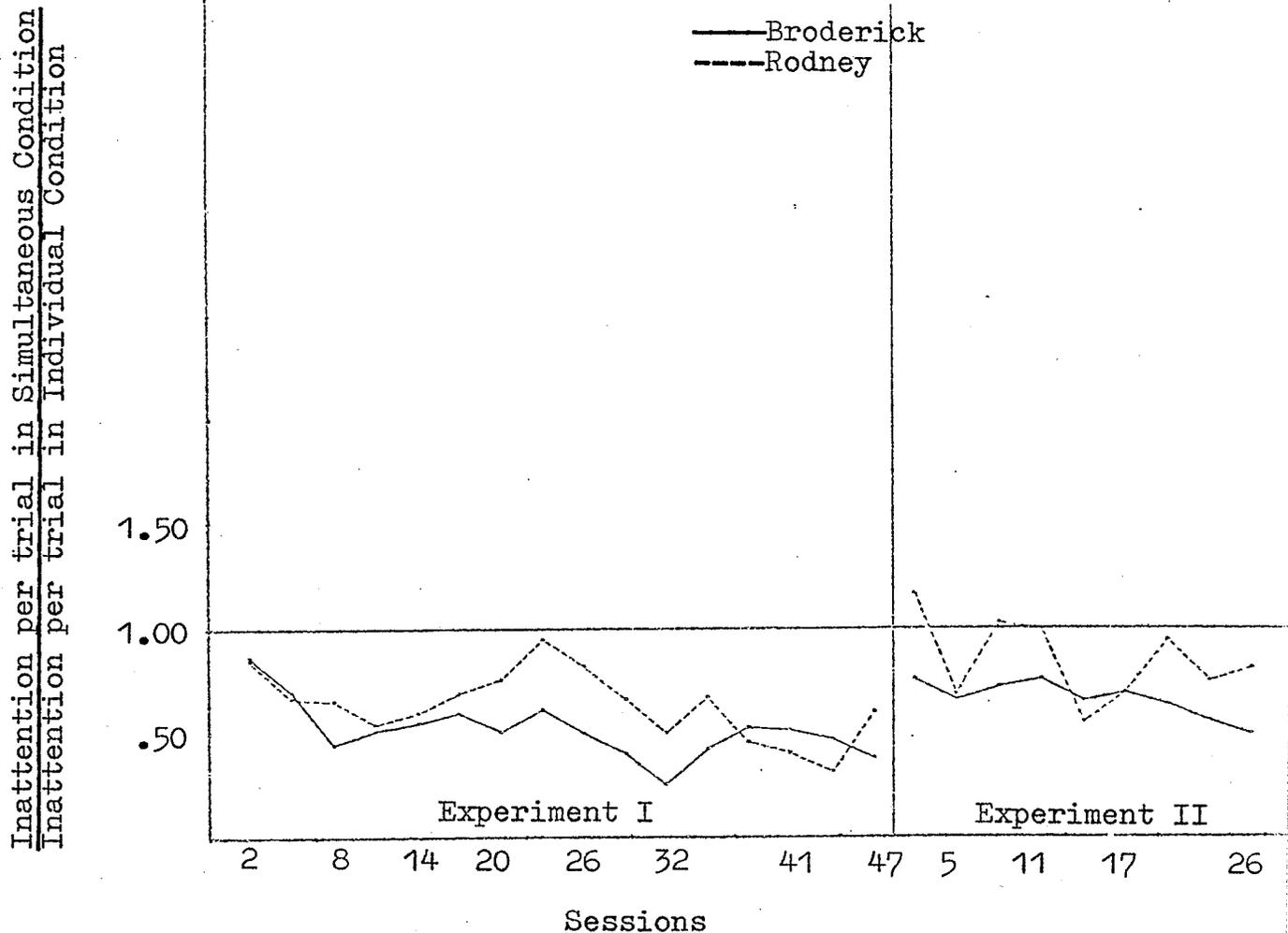


Fig. 51. The total number of seconds Broderick and Rodney spent in inattention per trial in the Simultaneous Condition in blocks of three sessions divided by the total number of seconds they spent in inattention per trial in the Individual Condition during the corresponding blocks of three sessions. The line at 1.00 indicates what the ratio would be if there were no differences between the two conditions. Included in the figure are the ratios from Experiment I which are presented as baseline information.

$\frac{\text{Inattention per trial in Simultaneous Condition}}{\text{Inattention per trial in Individual Condition}}$

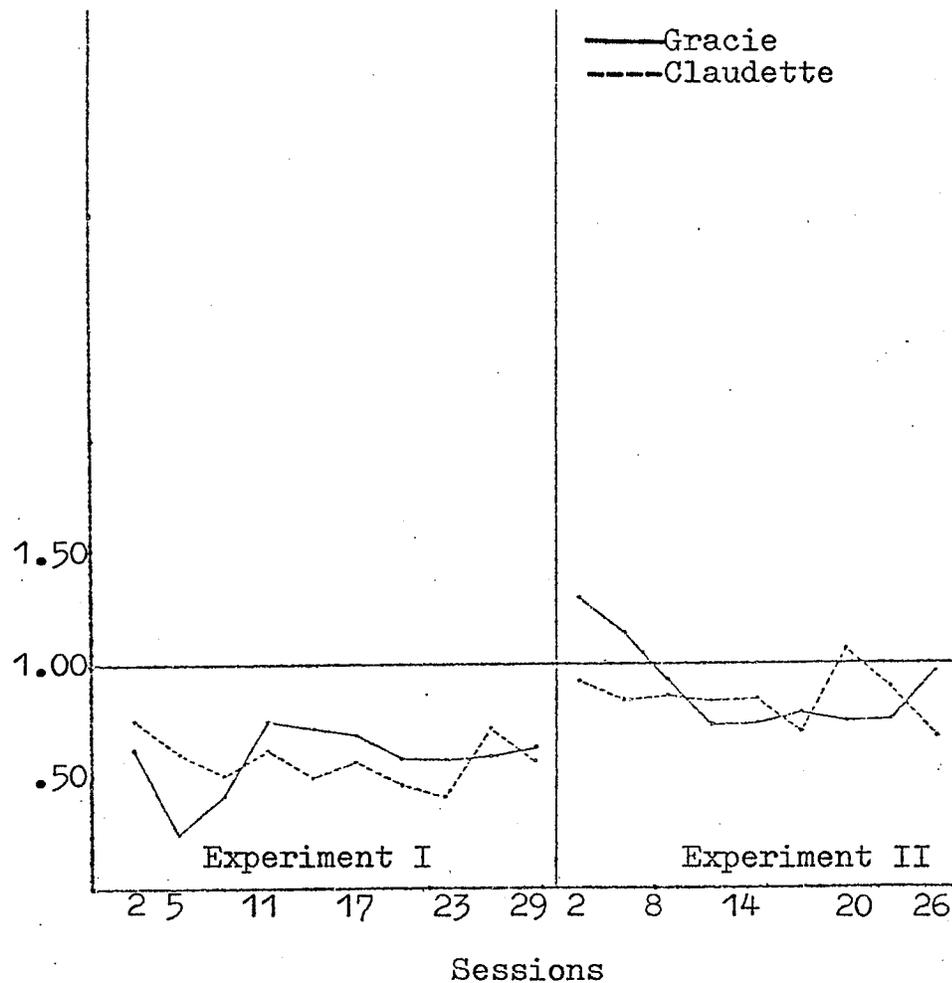


Fig. 52. The total number of seconds Gracie and Claudette spent in inattention per trial in the Simultaneous Condition in blocks of three sessions divided by the total number of seconds they spent in inattention per trial in the Individual Condition during the corresponding blocks of three sessions. The line at 1.00 indicates what the ratio would be if there were no differences between the two conditions. Included in the figure are the ratios from Experiment I which are presented as baseline information.

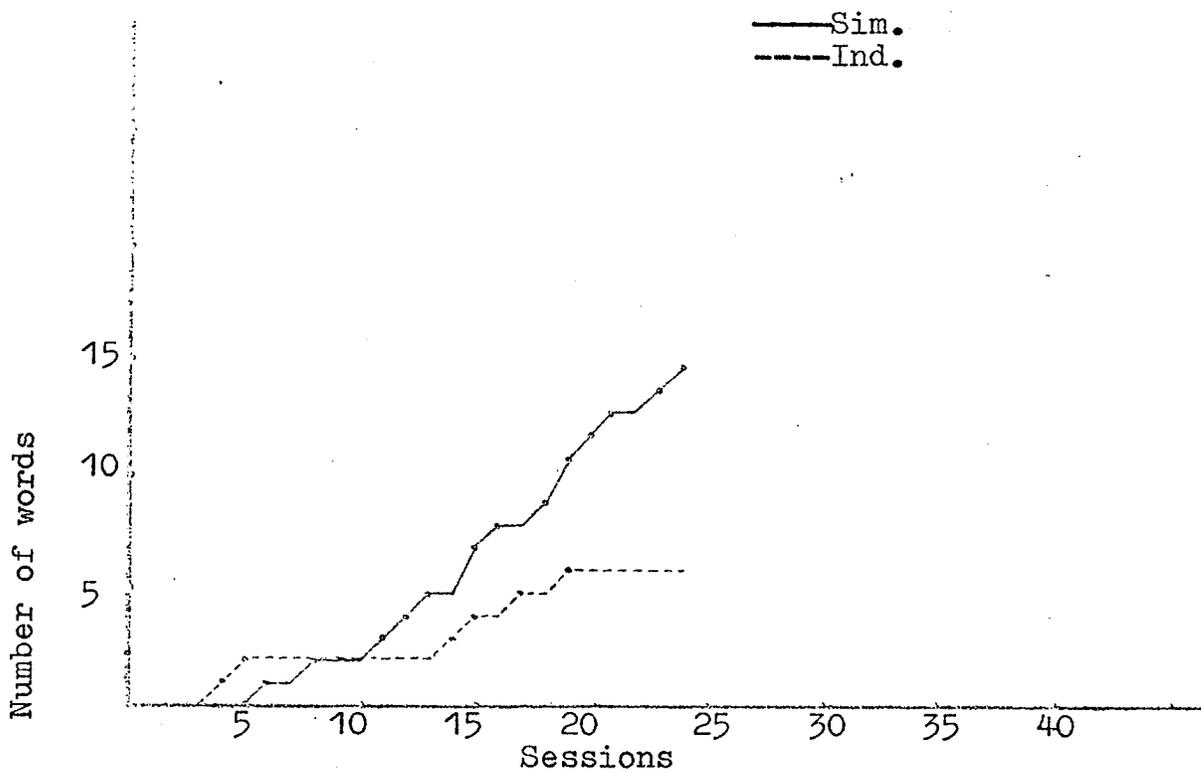


Fig. 53. The cumulative number of words learned by Broderick during the two conditions of Experiment II.

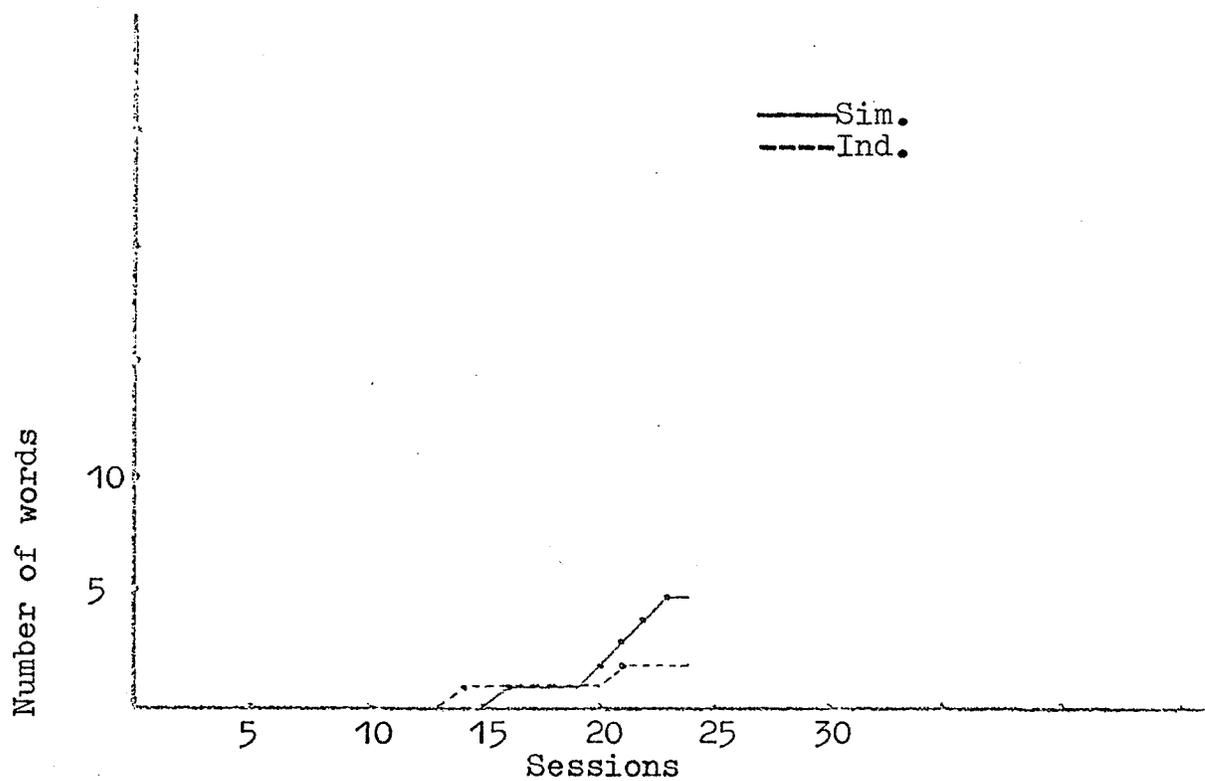


Fig. 54. The cumulative number of words learned by Rodney during the two conditions of Experiment II.

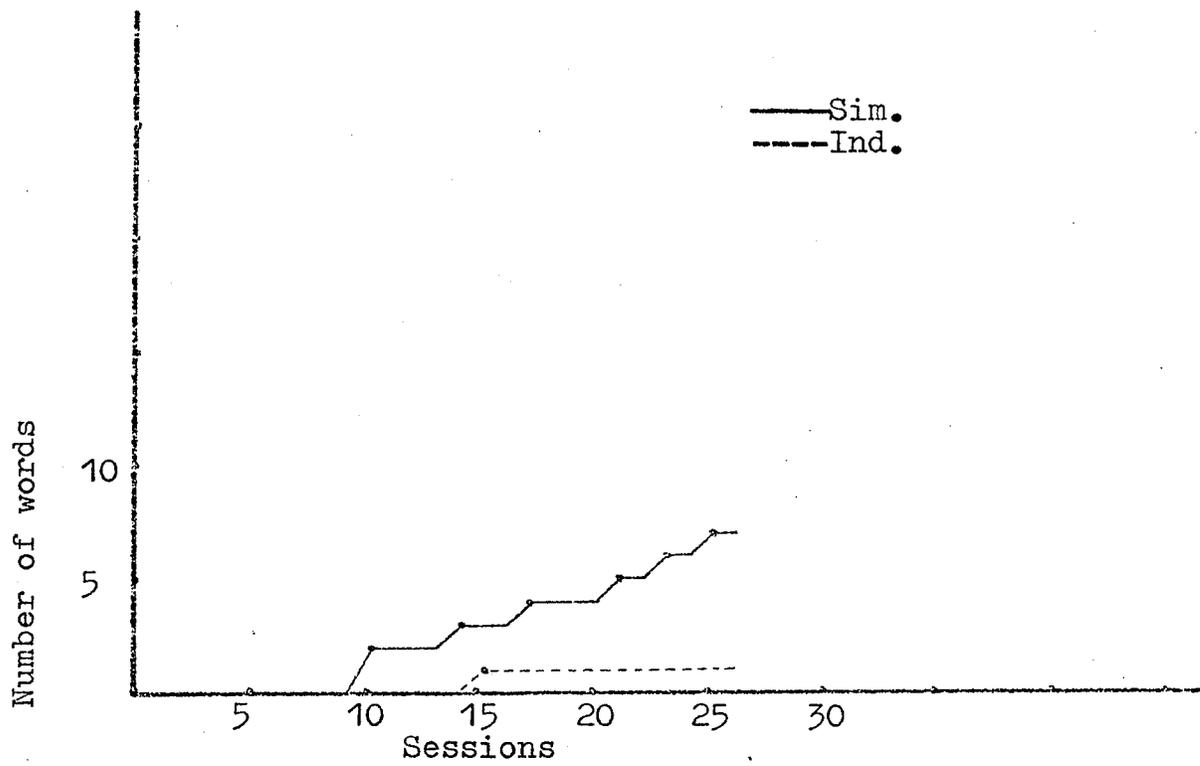


Fig. 55. The cumulative number of words learned by Claudette during the two conditions of Experiment II.

For Gracie, no words were learned in either condition. In general, then it would appear that the equating of the two conditions did not change the results from those of Experiment I regarding words learned.

Test for incidental learning. Broderick, Rodney, Gracie, and Claudette, were tested for incidental learning at the completion of Experiment II. This time, however, the words they were tested on were determined to be unknown to them prior to the beginning of Experiment II. Once again, they were tested on a random selection of words containing all the words that had been presented to them, all the words that had been presented to their partner, and a comparable list of words which neither subject had been taught.

The results of the test are presented in Table 2. They would appear to indicate that the pictures the subjects could name from their partner's list had been acquired during the session and not any where else.

Summary of results. Figures 56 and 57 present the major results of Experiment II in summary form. As with the preceding summary graphs, they combine the

Table 2. Test for incidental learning during Experiment II. The number of words each subject could identify correctly in each list of pictures presented. The numbers in parentheses are the total number of pictures presented.

Subject	Own Pictures	Partner's Pictures	Comparable Pictures
Broderick	48 (51)	6 (30)	0 (30)
Rodney	20 (23)	5 (31)	0 (31)
Gracie	1 (26)	12 (56)	0 (56)
Claudette	28 (28)	4 (26)	0 (26)

data from both subjects of a pair and present a comparison of the two conditions. Figure 56 shows the total number of trials initiated and the total number of correct responses emitted by each pair in each condition. For both pairs, the Simultaneous Condition generated a greater number of trials than did the Individual Condition. Whereas Broderick and Rodney initiated 2,728 trials over 26 sessions for an average of 104.92 per session in the Individual Condition, they initiated 3,599 trials for an average of 138.42 per session in the Simultaneous Condition.

Similarly, Gracie and Claudette initiated 2,753 trials over 27 sessions in the Individual Condition and 3,651 trials in the Simultaneous Condition. The means were 101.96 and 135.22 respectively.

Figure 56 also shows the total number of correct responses each pair emitted during Experiment II. Once again, there is a clearly superior performance in the Simultaneous Condition. Broderick and Rodney emitted 2,004 correct responses in the Individual Condition (mean of 77.08 correct responses per session) and 2,934 correct responses in the Simultaneous Condition

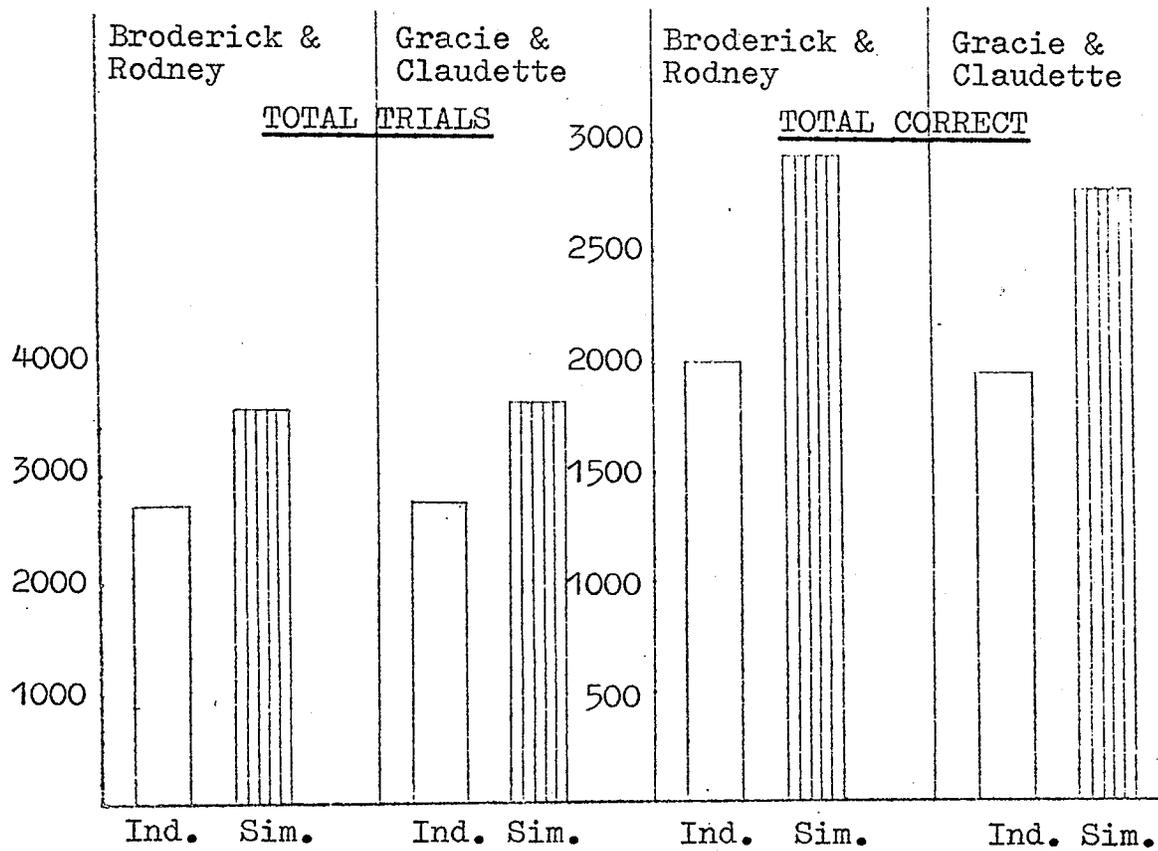


Fig. 56. The total trials and total correct of both pairs of subjects in the two conditions of Experiment II.

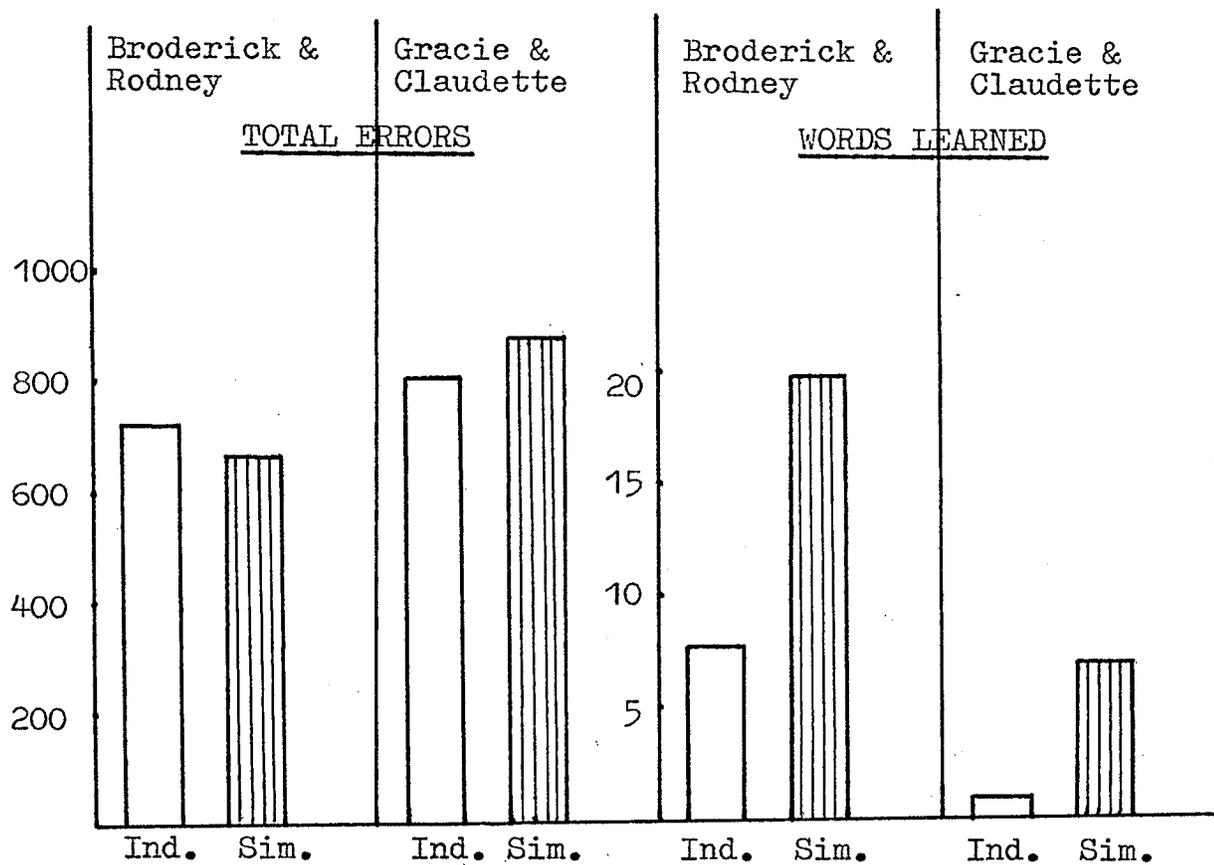


Fig. 57. The total errors and words learned of both pairs of subjects in the two conditions of Experiment II.

(mean of 112.84 per session). Gracie and Claudette emitted 1,939 correct responses in the Individual Condition and 2,776 correct responses in the Simultaneous Condition. The mean number of correct responses per session for two condition was 71.82 and 102.82 respectively.

Figure 57 presents the total number of errors each pair of subjects emitted during Experiment II. For Broderick and Rodney and for Gracie and Claudette, there was approximately the same number of errors in both conditions, 803 and 875 for the boys and 724 and 665 for the girls.

Figure 57 also shows the number of words each pair of subjects learned to criterion in both conditions. Broderick and Rodney learned twenty words in the Simultaneous Condition as opposed to only eight words in the Individual Condition. Gracie and Claudette learned seven words in the Simultaneous Condition and only one word in the Individual Condition.

Discussion of Experiment II

The results of Experiment II suggest that the pre-

sence of another subject was indeed the major variable affecting the differences found in Experiment I. This suggestion is borne out by comparing the ratios of all the dependent variables with the baseline data of Experiment I. On all but one variable, inattention per trial, there was no dramatic change in the ratio values from Experiment I to Experiment II. With the equating of the two conditions, except for the presence of another subject, there was a slight drop in the superiority of the Simultaneous Condition regarding the inattention of the subject. It would therefore appear that some variable other than the presence of another subject was also affecting the differences in inattention found in Experiment I between the two conditions.

The results of Experiment II also suggest that incidental learning indeed took place in the Simultaneous Condition. Since each subject could not identify his or her partner's pictures prior to the commencement of Experiment II, they must have learned them sometime during Experiment II. However, since they could not identify a set of comparable picture cards, the learning probably did not take place outside the experimental setting. The learning must, therefore, have taken place during the Simultaneous Condition sessions.

Chapter V

General Discussion

The results of Experiment I of this study demonstrated an effective procedure for the verbal training of retarded children. This procedure, involving switching from one subject to another following inattention, errors, and the delivery of primary reinforcers for correct responses, increased responding and reduced inattention. There was also a corresponding increase in the number of correct responses, the percentage of correct responses, and the number of words learned. Finally, this procedure also produced incidental learning of the other subject's words which further increased the number of words learned.

These results were generally the same for all seven subjects who served in the experiment. In a few instances, where the data indicated poorer performance for a subject in the Simultaneous Condition procedure, a combining of his or her data with those of his/her partner consistently showed a superiority of the Simultaneous Condition over the Individual Condition ses-

sions for the two subjects. That is, while on several occasions a single subject's data indicated poorer performance in the Simultaneous Condition, this was compensated by an increase in his or her partner's performance. This resulted in an overall superiority of the Simultaneous Condition.

The generality of this superiority may be seen not only in its presence in all seven subjects, but also in its presence when subjects with different rates of learning the words were paired. Rodney, for example, was superior in performance when compared to his partner Alex. On the other hand, he did not perform as well as his partner Broderick in a later portion of the experiment. In both instances, however, Rodney's Simultaneous Condition performance was superior to his Individual Condition performance. This would appear to indicate that similar results would be obtained regardless of the "type" of subjects paired together; both slow learners and fast learners within the range of the learning speeds of the present subjects perform better in the Simultaneous Condition.

The results of Experiment I also showed that the switching over to another subject following incorrect

responses did not reduce their frequency. Indeed, in the majority of the sessions, the subjects emitted approximately as many errors in the Simultaneous Condition as they did in the Individual Condition. Such being the case, it would appear that the switching over to another subject was not effective punishment.

The results of Experiment II of this study showed that even when the two conditions were equated except for the presence of another subject, the difference found in Experiment I was replicated completely. It would appear then, that the major variable affecting the differences in the two conditions was the presence of another subject, although the present results do not indicate whether this difference depended on the subjects engaging in the same task.

The present research results would thus appear to be only partially consistent with the social facilitation literature which states that coaction and the presence of others facilitates the emission of well-learned responses but impairs the acquisition of new responses (Zajonc, 1966). According to this literature, there

should also have been some impairment in the performance of the subjects during the Simultaneous Condition since the picture-naming task involved not only the rehearsal of already-known words but the teaching of new words as well. There are several possible interpretations available to explain why this impairment did not occur. One interpretation is that the nonreinforced partner may have simply imitated the behavior of the other subject which led to his or her reinforcement. Thus the non-reinforced subject responded more quickly and more often by imitating the behavior of his or her partner who had just received reinforcement for similar behavior.

Another interpretation to explain the effects found in this experiment relates to the cue properties of reinforcement. Reinforcement delivered to one subject may have functioned as a discriminative stimulus for the other subject because it often preceded contingent reinforcement for the other subject. Thus, for example, when the experimenter reinforced one of the partners, it made it more likely that the performance of the other subject would soon be reinforced. Hence, reinforcement delivered to one subject may have served as a cue to the other subject that his or her performance may be rein-

forced. Interestingly, with this interpretation, the behavior of the other subject is not important. The partner is affected by the cue value of reinforcement to the other subject rather than responding to the contingent application of reinforcement to the other subject for a specific behavior.

Although the Simultaneous Condition involved a picture-identification task with retarded children, it may be a useful technique in other applied settings with other populations. For example, it should be possible to use this procedure to teach a subject such things as prepositional usage and other such discriminations necessary for productive language skills. This could involve, for example, teaching one subject the correct use of the preposition "in" while teaching the other subject the correct use of the preposition "on". Also, the procedure may not be restricted to the teaching of language skills. Such manual tasks as shoe tying, recreational skills, and domestic skills may possibly be taught with the same procedure as well.

Finally, it is interesting to speculate upon the number of subjects that could feasibly be involved in

such a procedure. Would similar results be obtained with three subjects or even four? The only restrictions might be those of space and appropriate recording equipment. On the other hand, one might reach a point of diminishing returns. It would be interesting to know what the limits are. It would also be interesting to know the different effects of specific rules for alternating between subjects.

Chapter VI

Summary

In Experiment I, a procedure involving teaching two children a picture-naming task simultaneously was compared to a procedure which taught them individually. The former involved switching from one subject to the other subject following errors, omissions, inattention, and correct responses followed by primary reinforcement. The results indicated that the subjects initiated more trials, made more correct responses, learned more words, and were more attentive during this Simultaneous Condition procedure than during the comparable Individual Condition procedure. The results of Experiment I also suggested that the subjects were learning some of their partner's words as well.

Experiment II demonstrated that when the two conditions, the Simultaneous Condition and the Individual Condition, were equated except for the presence of another subject, the differences found in Experiment I were maintained. This would appear to indicate that the major variable causing the differentiation between

the two conditions in Experiment I was the presence of another subject. In addition, Experiment II demonstrated more conclusively than Experiment I that the subjects learned to identify their partner's pictures in the Simultaneous Condition.

The present study thus provided a viable alternative procedure for the verbal training of retarded children. Rather than using a costly one-to-one subject-experimenter ratio, a two-to-one procedure can be used with better overall results. Further research extending the limits of improved responding with larger groups is indicated, as is also research on the effects of various rules for alternating between subjects.

References

- Ader, R. and Tatum, R. Free-operant avoidance conditioning in individual and paired human subjects. Journal of the Experimental Analysis of Behavior, 1963, 6, 357-359.
- Allport, F. H. The influence of the group upon association and thought. Journal of Experimental Psychology, 1920, 3, 159-182.
- Ayllon, T. and Michael, J. The psychiatric nurse as a behavioral engineer. Journal of the Experimental Analysis of Behavior, 1959, 2, 323-334.
- Baer, D. M. and Guess, D. Receptive training of adjectival inflections in mental retardates. Journal of Applied Behavior Analysis, 1971, 4, 129-139.
- Bandura, A. Vicarious and self-reinforcement processes. In R. Glaser (Ed.), The Nature of Reinforcement. New York: Academic Press, 1971, Pp. 228-278.
- Barton, E. S. Inappropriate speech in a severely retarded child: a case study in language conditioning and

generalization. Journal of Applied Behavior Analysis, 1970, 3, 299-307.

Bensberg, G. J., Colwell, C. N., and Cassel, R. H. Teaching the profoundly retarded self-help activities by shaping behavior techniques. American Journal of Mental Deficiency, 1965, 69, 674-679.

Bergum, B. O., and Lehr, D. J. Effects of authoritarianism on vigilance performance. Journal of Applied Psychology, 1963, 47, 75-77.

Birnbrauer, J. S. Preparing "uncontrollable" retarded children for group instruction. Paper read at American Educational Research Association Convention, 1967.

Birnbrauer, J. S., Bijou, S. W., Wolf, M. M., and Kidder, J. Programmed instruction in the classroom. In L. P. Ullmann and L. Krasner (Eds.) Case Studies in Behavior Modification. New York: Holt, 1965, Pp. 358-363.

Birnbrauer, J. S., Wolf, M. M., Kidder, J. D., and Tague, C.

Classroom behavior of retarded pupils with token reinforcement. Journal of Experimental Child Psychology, 1965, 2, 219-235.

Borus, J. F., Greenfield, S., Spiegel, B., and Daniels, G. Establishing imitative speech employing operant techniques in a group setting. Journal of Speech and Hearing Disorders, 1973, 38, 533-541.

Dashiell, J. F. An experimental analysis of some group effects. Journal of Abnormal and Social Psychology, 1930, 25, 190-199.

Doubros, S. G. Behavior therapy with high level, institutionalized retarded adolescents. Exceptional Children, 1966, 33, 229-233.

Edgerton, R. B. The Cloak of Competence. Los Angeles: University of California Press, 1967.

Evans, G. W. and Spradlin, J. D. Incentive and instructions as controlling variables of productivity. American Journal of Mental Deficiency, 1966, 71, 129-132.

- Garcia, E. The training and generalization of a conversational speech form in non-verbal retardates. Journal of Applied Behavior Analysis, 1974, 7, 137-149.
- Garcia, E., Guess, D., and Byrnes, J. Development of syntax in a retarded girl using procedures of imitation, reinforcement, and modelling. Journal of Applied Behavior Analysis, 1973, 6, 311-329.
- Gardner, W. I. Use of punishment procedures with the severely retarded: a review. American Journal of Mental Deficiency, 1969, 74, 81-103.
- Gardner, W. I. Behavior Modification in Mental Retardation. Chicago: Aldine Atherton, Inc., 1971.
- Girardeau, F. L., and Spradlin, J. E. Token rewards on a cottage program. Mental Retardation, 1964, 2, 345-351.
- Gorton, C. E. and Hollis, J. H. Redesigning a cottage unit for better programming and research for the severely retarded. Mental Retardation, 1965, 3, 16-21.

- Grossman, H. J. Manual on Terminology and Classification in Mental Retardation, 1973 revision. Garamond/Pridemark Press, Baltimore.
- Guess, D. A functional analysis of receptive language and productive speech: acquisition of the plural morpheme. Journal of Applied Behavior Analysis, 1969, 2, 55-64.
- Guess, D., Sailor, W., Rutherford, G., and Baer, D. M. An experimental analysis of linguistic development: the productive use of the plural morpheme. Journal of Applied Behavior Analysis, 1968, 1, 297-306.
- Hall, R. V., Fox, R., Willard, D., Goldsmith, L., Emerson, M., Owen, M., Davis, R., and Porcia, E. The teacher as observer and experimenter in the modification of disputing and talking out behaviors. Journal of Applied Behavior Analysis, 1971, 4, 141-149.
- Hamilton, J., Stephens, L., and Allen, R. Controlling aggressive and destructive behavior in severely retarded institutionalized residents. American Journal of Mental Deficiency, 1967, 71, 852-856.

- Hill, W. F. Learning theory and the acquisition of values. Psychological Review, 1960, 67, 317-331.
- Husband, R. W. Analysis of methods in human maze learning. Journal of Genetic Psychology, 1931, 39, 258-277.
- Kanfer, F. H. Vicarious human reinforcements: a glimpse into the black box. In L. Krasner and L. P. Ullmann (Eds.) Research in Behavior Modification. New York: Holt, Rinehart and Winston, 1965, Pp. 244-267.
- Karen, R. L. and Maxwell, S. J. Strengthening self-help behavior in the retardate. American Journal of Mental Deficiency, 1967, 71, 546-550.
- Keilitz, I. Tucker, D. J., and Horner, R. D. Increasing mentally retarded adolescents' verbalizations about current events. Journal of Applied Behavior Analysis, 1973, 6, 621-630.
- Kerr, N., Meyerson, L., and Michael, J. A procedure for shaping vocalizations in a mute child. In L. P. Ullmann and L. Krasner (Eds.), Case Studies in Behavior Modification. New York: Holt, 1965, Pp. 366-370.

Kircher, A. S., Pear, J. J., and Martin, G. L. Shock as a punishment in a picture-naming task with retarded children. Journal of Applied Behavior Analysis, 1971, 4, 227-233.

Kliebhan, J. M. The effects of goal-setting and modeling on the performance of retarded adolescents in an occupational workshop. In L. P. Ullmann and L. Krasner (Eds.) A Psychological Approach to Abnormal Behavior. New Jersey: Prentice-Hall, Inc., 1969, P . 568.

Martin, G. L., England, G., Kaprowy, E., Kilgour, K., and Pilek, V. Operant conditioning of kindergarten-class behavior in autistic children. Behavior Research and Therapy, 1968, 6, 281-294.

McReynolds, L. V. Application of time out from positive reinforcement for increasing the efficiency of speech training. Journal of Applied Behavior Analysis, 1969, 2, 199-205.

Minge, M. R. and Ball, T. S. Teaching self-help skills to profoundly retarded patients. American Journal of Mental Deficiency, 1967, 71, 864-868.

- Pessin, J. The comparative effects of social and mechanical stimulation on memorizing. American Journal of Psychology, 1933, 45, 263-270.
- Peterson, L. W. Operant approach to observation and recording. Nursing Outlook, 1967, 15, 27-32.
- Risley, T. and Wolf, M. Establishing functional speech in echolalic children. Behavior Research and Therapy, 1967, 5, 73-88.
- Roos, P. Development of an intensive habit-training unit at Austin State School. Mental Retardation, 1965, 3, 12-15.
- Sailor, W. Reinforcement and generalization of productive plural allomorphs in two retarded children. Journal of Applied Behavior Analysis, 1971, 4, 305-310.
- Sailor, W. S., Guess, D., Rutherford, G., and Baer, D. M. Control of tantrum behavior by operant techniques during experimental verbal training. Journal of Applied Behavior Analysis, 1968, 1, 237-243.

Sailor, W. and Taman, T. Stimulus factors in the training of prepositional usage in three autistic children. Journal of Applied Behavior Analysis, 1972, 5, 183-190.

Santostefano, S. and Stayton, S. Training the preschool retarded in focusing attention: a program for parents. American Journal of Orthopsychiatry, 1967, 37, 732-743.

Schumaker, J. and Sherman, J. A. Training generative verb usage by imitation and reinforcement procedures. Journal of Applied Behavior Analysis, 1970, 3, 273-287.

Steeves, J. M., Martin, G. L. and Pear, J. J. Self-imposed timeout by autistic children during an operant training program. Behavior Therapy, 1970, 1, 371-381.

Tate, B. G., and Baroff, G. S. Aversive control of self-injurious behaviors in a psychotic boy. Behavior Research and Therapy, 1966, 4, 281-287.

- Thompson, T. and Grabrowski, J. Behavior Modification of the Mentally Retarded. Don Mills: Oxford University Press, 1972.
- Travis, L. E. The effects of a small audience upon eye-hand co-ordination. Journal of Abnormal and Social Psychology, 1925, 20, 142-146.
- Twardosz, S. and Baer, D. M. Training two severely retarded adolescents to ask questions. Journal of Applied Behavior Analysis, 1973, 6, 655-661.
- Watson, L. S., Jr. Application of operant conditioning techniques to institutionalized severely and profoundly retarded children. Mental Retardation Abstracts, 1967, 4 (1), 1-18.
- Wheeler, A. J. and Sulzer, B. Operant training and generalization of a verbal response form in a speech-deficient child. Journal of Applied Behavior Analysis, 1970, 3, 139-147.
- Wiesen, A. E. and Watson, E. Elimination of attention seeking behavior in a retarded child. American

Journal of Mental Deficiency, 1967, 72, 50-52.

Wolf, M. M., Birnbrauer, J. S., Williams, T., and Lawler, J.

A note on apparent extinction of the vomiting behavior of a retarded child. In L. P. Ullmann and L. Krasner (Eds.), Case Studies in Behavior Modification. New York: Holt, 1965, Pp. 364-366.

Zajonc, R. B. Social Psychology: An Experimental Approach.

Belmont, Calif: Wadsworth Publishing Co., Inc., 1966.

Zimmerman, J., Stuckey, T. E., Garlick, B. J., and Miller, M.

Effects of token reinforcement on productivity in multiple handicapped clients in a sheltered workshop. Rehabilitation Literature, 1969, 30, 34-41.