# THE EFFECTS OF THE DENSITY OF REINFORCEMENT ON THE APPROPRIATE AND INAPROPRIATE BEHAVIORS OF A CHILD WITH AUTISM

Kristina M. Motiejunas, A.A.S., B.A.

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APPROVED:

Jesús Rosales-Ruiz, Major Professor
Joel Greenspoon, Committee Member
Shahla A'lai Rosales, Committee Member
Sigrid Glenn, Chair of the Department of Behavior Analysis
David Hartman, Dean of the School of Community Service
C. Neal Tate, Dean of the Robert B. Toulouse School of Graduate Studies

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The present study consists of two experiments that analyze the effects of high and low densities of reinforcemnt on the maladaptive behaviors of a 9 year old girl with autism. The first experiment investigates the isolated effects of density of reinforcement on the frequency of maladaptive behaviors during a motor imitation teaching task. High densities of reinforcement produced fewer occurrences of maladaptive behavior than low densities of reinforcement. Experiment 2 analyzes the effects of density of reinforcement during the same teaching tasks as in experiment 1 on maladaptive behavior, task accuracy, prompt resistance, and language. Maladaptive behavior did not recur during experiment 2. High density of reinforcement conditions during the second experiment showed a positive effect on the accuracy of responding and compliance with prompts.

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# CHAPTER 1

## INTRODUCTION

The teaching needs of children with autism are different than those of typically developing children. Empirical evidence shows that their learning requires a greater number of teaching trials/opportunities, in tightly controlled teaching settings, with salient and quick feedback (Lovaas, 1987). The approach has shown significant improvement and in some cases "normalization" of children with autism. These results suggest that an early and intensive behavioral program is the best treatment alternative available (Fenske, Zalenski, Krantz, & McClannahan, 1985; Lovaas, 1987). Treatments that are less intensive in nature do not produce effects as large as more intensive treatment, (Anderson, Avery, DiPietro, Edwards, & Christian, 1987; Lovaas, 1987) or produce long-term outcomes comparable to the intensive approach (see Green 1999).

The recommended early childhood program is intensive in two ways. First, the therapy involves 30-40 hours per week. Second, typically during a teaching session, the same target is presented multiple times, and targets in multiple areas are presented. Interestingly, empirical evidence shows a correlation between the frequency of maladaptive behaviors and the levels of task demands (Edelson, Taubman, & Lovaas, 1983; Weeks & Gaylord-Ross, 1981). Carr, Taylor, and Robinson (1991) found that children are more likely to engage in self-injurious and otherwise aberrant behavior during teaching situations when demands are postponed or removed. Because early intervention procedures incorporate such a large number of task demands they may set up environments in which behaviors that lead to the postponement of demands or removal of

demands are highly likely to be reinforced, and consequently, increase in frequency. Carr et al. (1991) also found that children with problem behavior had lower rates of misbehavior during time periods when teachers were not placing demands on them and higher rates when the teachers were placing demands on them. Therefore, even though intensity of treatment is a key component for the effectiveness of treatment, the high density of demands may increase the probability of the development, maintenance, and intensification of maladaptive behaviors.

In addition to the obvious detrimental effects of self-injurious behavior to the individual, the individual's behavior may systematically affect the behavior of others in several ways. Carr (1991) warns us that the child's curriculum may change because of the punishing effects of the child's behavior on the trainer's teaching behaviors, and that fewer teaching trials in general may be presented. Also, there is a potential for the increase in the severity and rate of the aberrant behavior due to staff behavior and increase likelihood of staff turnover.

Investigators have approached the problem of escape-maintained problem behavior in several ways. One approach involves the direct manipulation of the consequence. For example, Iwata, Pace, Kalsher, Cowdery, and Cataldo (1990) manipulated the escape consequences by continuing the application of demands in spite of misbehavior on the part of the child. This procedure is sometimes referred to as escape extinction. Because the procedure typically involves a temporary increase in the target maladaptive behavior, several researchers designed alternative treatments to minimize this undesirable effect.

A set of procedures categorized under the term "noncontingent reinforcement" have been used in an attempt to reduce the severity of self-injurious behavior rates during escape extinction. For example, Volmer, Marcus and Ringdahl (1995) effectively reduced rates of self-injurious behavior with the use of noncontingent escape. They delivered opportunities for noncontingent escape from task that resulted in reductions of self-injury. The frequency of self-injurious behavior decreased from baseline immediately following the application of noncontingent escape. It is important to mention, however, that the opportunities to escape were initially occurring every 10 seconds and that the time length of instructional activities was gradually increased. One subject worked up to 2 and 1/2 minutes of time spaced between escape intervals. And, the other subject worked up to 10 minutes of time between escape intervals while maintaining low rates of SIB. Similarly, Fisher, Iwata and Mazaleski (1997) applied both noncontingent delivery of consequences identified as maintaining consequences for the target behavior or noncontingent delivery of arbitrarily selected consequences. Noncontingent applications of both types of consequences effectively reduced rates of self-injurious behavior. There seems, however, to be some disagreement over the use of the term "noncontingent reinforcement". Poling and Normand (1999) question the use of the term "noncontingent reinforcement" because it does not describe reinforcement functionally. Volmer (1999) agrees with Poling and Normand's (1999) argument and suggests the terms "fixed-time attention" and "fixed-time escape" instead of noncontingent reinforcement and escape. (Volmer 1999)

In addition to the use of extinction and noncontingent reinforcement procedures, several researchers have deliberately manipulated the temporal position of demand

sequences depending on their historical levels of probability of responding. During instances in which demands associated with a low probability of compliance are immediately preceded by demands that have been associated with a high probability of commands, the probability of the low compliance commands may increase and problem behaviors may be reduced (Mace & Belfiore 1990; Mace et al., 1988; Singer, Singer, & Horner, 1987). McGill (1999) pointed out that several studies have found that presenting demands that have had a history of a high probability of compliance prior to demands that had a low probability of compliance, increased the subjects likelihood to comply with low probability demands. (Mace & Belfiore, 1990; Mace et al., 1988; Singer, Singer, & Horner, 1987). Several studies, however, found the opposite effect. A reduction in the probability of demands that previously had a high probability of compliance occurred when these demands were interspersed or paired with demands that historically had a low probability of compliance associated with (Davis & Reichle, 1996; Zarcone, Iwata, Hughes, & Vollmer, 1993; Zarcone, Iwata, Mazaleski, & Smith, 1994).

These studies suggest that an increase in the density of reinforcement can effectively reduce or emeliorate the occurrence of SIB.

Several researchers have reported increases in response accuracy following task interspersal (Dunlap, 1984; R. H. Horner, H. M. Day, J. R. Sprague, M. O'Brien, & L. T. Heathfield; L. K. Koegel & R. L. Koegel, 1986). It is possible that an increase in the density of reinforcement was partially responsible for these increases.

Koegel, R. L., O'Dell, M. and Dunlap, G. (1988) obtained greater vocalization accuracy in a training condition that incorporated a higher density of reinforcement relative to a different training condition that incorporated a lower density of

reinforcement. Every one of the four children who participated in this study improved more in vocalization accuracy during the higher density of reinforcement condition than in the lower density of reinforcement condition. In addition, they observed that all of the participants were scored as having more positive affect ratings on the average ratings of four scales (enthusiasm, happiness, interest, and general behavior) during the higher density of reinforcement condition (Koegel, R. L., O'Dell, M. and Dunlap, G., 1988). Researchers have also implemented procedures that involve a high density of reinforcement and have found that increases in accuracy of vocalizations produced by children in this condition occurred at a higher rate than improvements in accuracy during conditions with a lower density of reinforcement. (Koegel & Koegel 1987). This study suggests that the density of reinforcement can have an affect on both appropriate and inappropriate behaviors.

Both the research literature on noncontingent reinforcement and task interspersal suggest that an increase in the density of reinforcement can effectively reduce or ameliorate the occurrence of SIB and increase socially desirable behaviors such as language. Unfortunately, investigation of effects on a broader range of behaviors has been limited. The present study includes measures of 6 different behaviors, both appropriate and inappropriate. It analyzes the effects of high and low densities of reinforcement on handbiting and screaming (Experiment 1, and 2); and on prompt resistance, accuracy, acquisition of behavior and frequency of vocalizations (Experiment 2).

# CHAPTER 2

# EXPERIMENT 1

# METHODS

## PARTICIPANT

The participant of this study was a ten-year-old-girl with autism. Her skill level in academic and social areas was below that of her typically developing peer group. Her language skills were limited to requests for desired items or activities, and naming familiar objects upon request. She made minimal social initiations to her peers at school and her leisure activities were not age appropriate. She had difficulty with fine and gross motor skills and required assistance with simple tasks such as tying her shoes. At the time of this study she was attending public elementary school. Approximately two hours of her day were spent in the regular education classroom and one-and-a-half to two hours were spent in a resource room where she received one-to-one instruction. In addition, she was receiving two hours of in-home behavior therapy targeting self-care and social skills every day after school. The participant of this study was chosen because she engaged in handbiting, screaming, occasionally pulling others' hair, and eye poking (self and others). Many of these behaviors occurred during one-to-one teaching sessions, and interfered with the child's learning of new skills. The participant's parent and teachers expressed their concern and were interested in a teaching procedure that would possibly help reduce the frequency of these behaviors.

## SETTING

This study took place in the participant's home. Sessions were held in her bedroom on the carpet next to her toy chest.

## DEPENDENT VARIABLES

The dependent variables in this study were occurrences of handbiting and screaming. Handbiting consisted of any instances in which the participant's hand made contact with her open mouth. Screaming consisted of any instances of the child raising her voice above her typical speaking volume while not producing an intelligible utterance. The teacher used pencil and paper to take data during the sessions. During each trial the teacher recorded whether or not screaming or handbiting occurred.

During the first and second sessions only the teacher and child were present in the room. A second observer (the participant's mother) was present during the third session. The mother sat behind and to the left of the child, approximately 7 feet away from the child. The child did not appear to be distracted by the presence of the mother. The child did not look at the mother during any of the conditions once the first trial was presented. The mother was instructed not to talk to the experimenter during teaching sets. Reliability was calculated by dividing the total number of trials the observers agreed handbiting or screaming had occurred by the total number of trials. The reliability was as follows: screaming 95% and handbiting 100%.

## EXPERIMENTAL PROCEDURES

The experimental task of this study was motor imitation. The participant had to imitate the trainer's hand movements. There were four target responses: wave bye, clap hands on knees, raise arms and touch shoulders. All of these responses were novel to the

participant in the motor imitation training context. During each teaching trial, the teacher stated, "Do this!" and then modeled the appropriate response. The participant was given several seconds to respond before the teacher provided feedback.

A session consisted of 3-5 trial sets. Trial sets consisted of 4-20 trials and were separated by a short 3-5 minute break. Only one experimental condition was run during each trial set. Sessions lasted approximately 15-20 minutes and there were three sessions in total for Experiment 1. During the first two sessions of this experimental condition, only the motor model clap hands on knees was given. During session 3, the teacher presented four different motor models (one per trial) in a fixed position rotating sequence: Clap hands on knees, raise arms, wave bye, and touch shoulders.

EXPERIMENTAL CONDITIONS

Three conditions were used in this experiment: (1) Reinforce Corrects Only (RCO); (2) Reinforce All (RA); and (3) Reinforce All with Praise (RAP).

Reinforce Corrects Only (RCO). During this condition, only correct responses were followed by praise and candy. All incorrect responses, approximations, and no responses were corrected as follows: the teacher said a neutral, "No" and then physically prompted the child through the correct response while saying, "This is doing this."

Reinforce All (RA). During this condition, regardless of the accuracy of the child's response to the motor model, the teacher said, "Very good, this is doing this." and prompted the child through the motion of the correct response. The teacher then gave the child a small piece of soft candy. The same procedure was applied if the child displayed no detectable movement after 3-5 seconds.

Reinforce All With Praise (RAP). To test for the reinforcing function of social praise and candy, the candy was removed during trials 17-19 and 28-39 of the first session. The procedures used were identical to those used during the Reinforce All (RA) with the exception of candy delivery.

EXPERIMENTAL DESIGN

An alternating treatment design was used. Condition A (Reinforce Corrects Only), Condition B (Reinforce All), and Condition C (Reinforce All with Praise) were employed during session 1. During sessions 2 and 3, only conditions A and B were employed. The sequences of the conditions for sessions 1,2, and 3 respectively were as follows: BABCAC, BABAB, and BAB.

# CHAPTER 3

## RESULTS

Figure 1 shows the cumulative occurrences of screaming and handbiting during sessions 1-3. During session 1 (top graph) there were no occurrences of either screaming or handbiting when all responses were reinforced with praise and candy (RA). However, screaming and handbiting occurred in almost every trial in the RCO condition. Handbiting tended to occur during the first trials of condition RCO and screaming tended to occur during the last trials of condition RCO. Overall, the rate of handbiting decreased from the first set of trials to the second set of trials in the RCO condition. Generally, handbiting occurred during the first trials of condition RCO and screaming occurred during the last trials of condition RCO. Handbiting also occurred during both trial sets of the reinforce all with praise condition (RAP) and also decreased in frequency from the first trial set to the second trial set. Screaming did not occur during RAP.

During the second session (middle graph), there were no occurrences of either screaming or handbiting during condition RA. However, the cumulative number of handbiting occurrences increased across the three trial sets in condition RCO. During the first trial set, handbiting occurred once. It occurred twice during the second trial set and eight times during the last trial set. Screaming did not occur at all during this session.

During the third session (bottom graph), there were no occurrences of either handbiting or screaming during the RA and RCO conditions. No handbiting occurred during this entire session.

# CHAPTER 4

## DISCUSSION

The results of Experiment 1 show a clear relationship between condition RA (Reinforce All) and minimal occurrences of screaming and handbiting. In contrast, when the trainer delivered verbal praise for all responses and omitted the candy (RAP), the participant engaged in handbiting. The RCO condition initially produced relatively high frequencies of screaming and handbiting. These high frequencies, however, decreased over time. By session three these behaviors were virtually absent. This study supports previous findings suggesting that density of reinforcement is an important variable involved in the occurrence of SIB (Volmer, Marcus & Ringdahl; 1995 Iwata et al., 1990; Fisher, Iwata & Mazaleski,1997).

The decreasing frequency of screaming and handbiting across sessions during the RCO condition suggests that these behaviors were maintained by negative reinforcement, that is, by escaping the task. This would be consistent with observations made in the school setting. Even though a formal functional analysis at school was not conducted, weekly school observations were conducted for several months. This provided opportunities to identify patterns of interactions between the participant and her teachers in the school setting. At school, when the child engaged in screaming or handbiting, the teacher postponed or failed to deliver a teaching demand. Since in this experiment, teaching instructions were delivered consistently despite any instances of handbiting or screaming, these behaviors underwent extinction.

Alternatively, the decrease in hanbiting and screaming and handbiting might have been due to the fact that high density of reinforcement training was interspersed with low density of reinforcement training. This may have set the conditions for decreasing the aversive properties of the training set with low density of reinforcement. Similarly, results have been found by previous researchers who increased the density of reinforcement during demand conditions by applying the use of noncontingent reinforcement (Hanley, Piazza & Fisher 1997; Vollmer, Marcus & Ringdall 1995; Derby, Fisher & Piazza 1996 & Fisher, Iwata & Mazaleski 1997).

During this study, interestingly enough, when verbal praise was delivered as a consequence without candy, handbiting did occur. This suggests that the candy was a key element in reducing the frequency of handbiting in the RA condition.

There were other significant changes that occurred in the child's behavior when switching from condition RA to condition RCO. Unfortunately, there is no record of these changes. These behaviors were subtler than screaming and handbiting but were nevertheless important in the teaching context. Besides the decrease in handbiting and screaming during the RA conditions, the child seemed more accurate, more talkative, and complied better with the task than during the RCO condition. Experiment 2 takes a closer look at these changes in responding in behavior as a function of the RA and RCO conditions. Also, the question remained as to how the accuracy of the participant's responses would be affected by each of the two experimental conditions.

# CHAPTER 5

## Experiment 2

## METHODS

### SUBJECT AND SETTING

The subject, setting, and materials were the same as in Experiment 1.

### DEPENDENT VARIABLES

The dependent variables were screaming, handbiting, response accuracy, number of words spoken per trial, and prompt resistance. The criteria for identifying screaming and handbiting were the same as they were in Experiment 1. The accuracy criteria used for clasping hands, clapping knees, raising arms, waving bye, and touching shoulders was as follows:

Clasping hands. A correct response was scored if the participant placed both hands together and crossed her fingers; an approximation was scored of both hands were placed together but did not meet the criteria for a correct response; any other movement following the instruction was scored as incorrect; if no movement was detected then the trial was scored as no detectable movement.

Clap knees. A response was scored as correct if the participant tapped her knees twice with both hands while her palms were facing down; an approximation was scored if the participant tapped her knees with both hands at least one time; any other responses were scored as incorrect; if no movement was detected then the trial was scored as no detectable movement.

Raise arms. A response was scored as correct if the participant raised both hands simultaneously above the height of her shoulders; an approximation was scored if she raised both of her arms from between waist level up to her shoulders; an incorrect was scored for all other types of movement; if no movement was detected then the trial was scored as no detectable movement.

Wave bye. A correct response was scored if the participant raised her right arm above her shoulder height and moved her hand to either side at least one time; an approximation was scored if the participant raised her arm to at least waist level; all other movement was scored as incorrect; if no movement was detected then the trial was scored as no detectable movement.

Touch shoulders. A correct response was scored if the participant touched both of her shoulders with both of her hands; an approximation was scored if she touched any other part of her arms other than her shoulders; all other movement was scored as incorrect; if no movement was detected then the trial was scored as no detectable movement.

Prompt resistance. This included pulling hands away from the trainer after the trainer initiated the prompt.

Number of spoken words per trial. This included all intelligible words spoken from the time that the trainer gave one instruction (trial) to the time the trainer gave the next trial.

All of the sessions during experiment 2 were videotaped. During the first session, the video recorder was set up on a tripod and the teacher was the only person present. During sessions 5 and 6, a second teacher was present and videotaped the sessions. While viewing the videotaped sessions, the teacher recorded whether or not the

participant engaged in screaming or handbiting. The teacher also recorded the accuracy of each of the child's responses by categorizing them as correct, approximation, incorrect, or no detectable movement and she recorded the number of words spoken per trial. Reliability was assessed by having a second observer score the videotape. Reliability was calculated by dividing the number of trials in agreement by the total number of trials. The reliability was as follows: screaming 100%; handbiting 100%; resisting prompts 96% and response accuracy 90%. Reliability for vocalizations was calculated as follows: the smaller number of vocalizations was divided by the larger number of vocalizations and then multiplied by 100. The total agreement obtained was 97%.

EXPERIMENTAL PROCEDURES

The experimental task of this study was motor imitation. The participant had to imitate the trainer's hand movements. There were four target responses: wave bye, clap hands on knees, raise arms, and touch shoulders. During each teaching trial, the teacher stated "Do this!" and then modeled the appropriate response. The participant was given several seconds to respond before the teacher provided feedback.

EXPERIMENTAL CONDITIONS

Three conditions were used in this experiment. The first two conditions, RA (Reinforce All) and RCO (Reinforce Corrects Only) were the same conditions used in the first experiment. A new condition, RN (Reinforce None) was introduced as well.

Reinforce None (RN): In each trial during this condition, the teacher gave the instruction, "Do this!" and modeled the correct motor imitation response. The teacher then allowed several seconds to pass so that the child had the opportunity to respond. In

contrast with the RA condition, during the RN condition, the teacher did not reward any responses. The teacher said "No" as a consequence for all responses and then physically prompted the child through the correct motor response while saying, "This is doing this."

EXPERIMENTAL DESIGN

Experiment 2 took place across 3 sessions. An alternating treatment design was used. The sequences of the conditions for days 1, 2, and 3 respectively were as follows: AB, BABAC, and AAA. During the first session, the target responses in each trial varied in a rotating fixed sequence pattern. The same pattern was used during both conditions, and was presented in the following order: clap knees, wave bye, touch shoulders, and clasp hands. During session 2, clap knees was the only target response for condition RCO, and, clasp hands was the only target motor response for RA. During session 3, the target response for the first RA condition was clap knees. The target response for the second RA condition employed was clasp hands. Lastly, the target response for the third application of condition RA during session 3 was raise arms.

# CHAPTER 6

## RESULTS

Figure 2 shows the cumulative occurrences of screaming and handbiting during sessions 4, 5, and 6 of experiment 2. There were no instances of screaming or handbiting in either the RA or RCO condition.

Figure 3 shows the cumulative verbalizations during sessions 4, 5, and 6 of experiment 2. Overall, there was a cumulative number of one hundred eighty vocalizations during the RA condition. During the RCO condition, however, no vocalizations occurred. During the fifth session (middle graph), in the NONE condition there were approximately 30 cumulative vocalizations emitted between trials thirty-four and forty.

Figure 4 shows the accuracy of responding during session 4, 5, and 6. During session 4 (top graph), none of the responses emitted met the accuracy criteria during the RA condition. In fourteen opportunities to imitate, 5 responses were approximations to the target response, and, 9 responses were incorrect responses. During the next fifteen trials of the RCO condition, none of the responses emitted were accurate, two responses were approximations to the target response, and thirteen responses were incorrect. During the fifth session (middle graphs), all imitative responses during the RA condition with task 4 were correct. However, none of the imitative responses during the RCO condition were correct. Of the 27 trials of the RCO condition, 17 were no responses, 4 were incorrect, and 6 were approximations. During the NONE condition with imitation task 5 there were 8 correct responses, 26 approximations, 5 incorrect responses, and 18

no responses. During the sixth, and final session (bottom graph), when the RA condition was applied to task 1 there was a steady increase in the accuracy of responding, going from not responding to incorrect responding, to approximate responding, to accurate responding. When the RA condition was applied to task 4, the subject continued responding with 100% accuracy as previously done. When the RA condition was applied to task 5, the subject responded accurately during each trial.

Figure 5 shows the cumulative number of occurrences of resistance to prompts during sessions 4, 5, and 6. During session 4 (top graph), there was only one occurrence of prompt resistance during the first condition where all responses were reinforced with candy and praise (RCO). During the fifth session (middle graph), the cumulative number of prompt resistance during the RA condition with task number 1 was zero. However, prompt resistance occurred in 40/80 trials during the RCO condition with imitation task number 4. Prompt resistance occurred at a higher frequency during the condition where none of the responses were reinforced with imitation task 1. During the sixth session (bottom graph), one instance of prompt resistance occurred during the first trial set of RA with imitation task number 1. During the two subsequent applications of RA, with imitation tasks 4 and 5, prompt resistance did not occur.

# CHAPTER 7

## DISCUSSION

This study showed that delivering rewards during every teaching trial reduced the rates of behaviors which interfered with the shaping and maintenance of new skills with a child with autism. During the RCO (Reinforce Corrects Only) Condition, response accuracy decreased, prompt resistance occurred, and the rates of spontaneous vocalizations decreased markedly. During the RA (Reinforce All) Condition, the accuracy of the participant's responses improved, overall compliance with prompts was maintained, and the spontaneous language of the participant increased. Handbiting and screaming did not occur at all during Experiment 2. The decrease in these behaviors seen during Experiment 1 maintained during Experiment 2. The decrease of screaming and handbiting across decreased across sessions in Experiment 1 suggested that these behaviors may have been maintained by negative reinforcement and underwent extinction. Due to a two-month break, however, between Experiment 1 and Experiment 2, no clear conclusions about the maintained reduction in screaming and handbiting can be made. However, the other changes in the participant's behaviors shows that the effect is more complex.

The reduced spontaneous vocalizations, prompt resistance, and low accuracy resemble the general decrease in activity produced by punishment. Because only correct responses were reinforced in the RCO Condition, it is possible that elements of this condition became aversive to the participant because of the reduced density of reinforcement. Components of these stimulus events may then subsequently punish and

suppress any of the child's behaviors emitted during the teaching session. If this is the case, many of the behaviors that can facilitate effective student/teacher teaching interactions (e.g. compliance and attending) may be at risk of being inadvertently reduced. As a result, the child may not have the opportunity to respond accurately with respect to the targeted stimulus dimensions. The trainer cannot necessarily dictate which behaviors will be reduced and which ones will not be reduced. This poses a problem. Any teaching conditions with properties aversive enough to bring about behavior change may have an overall suppressive effect on a great deal of the child's behavior. By employing escape extinction procedures, it may appear that the child's overall condition has improved because of the reduction of rates of screaming and handbiting, when in fact, highly desirable behaviors may have diminished as well.

Similarly, prompt compliance on the part of the student is highly desirable in the training of children with autism. The tactile hand-over-hand prompt used in this experiment is a fairly common type of prompt used to teach motor imitation. New teaching targets typically have to be physically prompted until the child has acquired a generalized imitative repertoire. The results of Experiment 2 show a clear relationship between the density of reinforcement and the participant's compliance with prompts. A high density of reinforcement maintained compliance with prompts and a low density of reinforcement created a situation in which the participant actually actively resisted or tried to avoid the trainer's prompts. It is hard to pinpoint what maintained prompt resistance. Given that prompts are used with the purpose of improving task accuracy, the degree to which a student complies with prompts is an important factor during teaching.

The RA condition may be a particularly efficient teaching method because it was effective not only in reducing the occurrences of maladaptive behaviors and in increasing prompt compliance, but it also was efficient in improving the participant's accuracy of responding. Accuracy improved by simply reinforcing the participant's attempts irrespective of the accuracy of those attempts. The accuracy of the child's responses improved without corrective feedback following errors or omission of praise and tangibles for incorrect responses. Both of these procedures can have a strengthening effect on a child's maladaptive escape maintained behaviors depending on their instruction history.

Several researchers employed a task interspersal procedure obtained improvements in task accuracy (Dunlap, 1984; R. H. Horner, H. M. Day, J. R. Sprague, M. O'Brien, & L. T. Heathfield; L. K. Koegel & R. L. Koegel, 1986). However, it is not clear if increases in density of reinforcement during task interspersal may be responsible for changes in responding during tasks. The present study isolated the relationship between the density of reinforcement and accuracy of responding. In contrast with previous research, no trial by trial task interspersal was implemented. The trial sets of condition RA and condition RCO trained only one target response at a time. The RA condition clearly showed improvement and maintenance of task accuracy while the RCO condition clearly showed a degenerative effect on response accuracy and on response attempts in general. When training switched to the RA (high density reinforcement) condition, their accuracy improved immediately. Since prompting procedures in both the RA and RCO conditions were identical, and that the same targets were tested under both

conditions, it seems that the density of reinforcement allowed the prompting procedures to function effectively.

The effects of an increased density of reinforcement on accuracy may have been due to the relationship between prompts and target responses. The topography of the target task was closely related to both the prompt provided and the instruction. Target skills are often trained with the use of prompts that are extra-stimulus prompts. Under these conditions it is possible that the increase in density of reinforcement may not enhance accuracy to the same extent. Further research is needed to clarify the condition under which an overall increase in the density of reinforcement benefits accuracy of responding.

In addition to the reliable and accurate responding obtained in the RA condition, there was also an increase in language even though this behavior was not targeted. This is quite significant given that an increase in rates and variability of utterances can help promote the development of language through the use of shaping procedures. Since this study was conducted in the child's home setting and several of her teachers were able to observe the effects of the procedures employed in this study. The benefits of practicing language skills may have been stronger in this situation than in situations where the training is conducted in a prosthetic environment.

Because, this study employed a measure of the effects of the independent variable on a number of behaviors, relationships between the density of reinforcement and behaviors other than screaming and handbiting were identified. High densities of reinforcement may not only increase responding to target tasks but may additionally increase the frequency and variation of series of behaviors relevant to the shaping of

language and social behaviors. One example of this in the present study is the disparity of the rate of vocalizations obtained during the high and low density of reinforcement conditions. Identifying the clear relationship between the density of reinforcement and vocalization rate was possible only because multiple measures were taken. Children with autism typically share the common characteristic of delayed language development in comparison with their peers. Because of this, one of the main areas emphasized in early intensive behavioral training is language. The findings of this study suggest that treatments involving low densities of reinforcement may possibly inhibit language in children with autism.

Overall, this study showed that increasing the density of reinforcement may be a simple straightforward procedure that can not only reduce maladaptive behaviors but that can enhance development in several areas concurrently. By addressing the effects of a single treatment procedure on multiple behaviors, it was possible to gain a more comprehensive and broad view of the effects of the training procedures. Future research is needed in order to address the generality of these finding with different subjects and during different teaching tasks.

APPENDIX

FIGURES 1-5

Figure 1. Occurrences of Screaming and Handbiting During Experiment 1

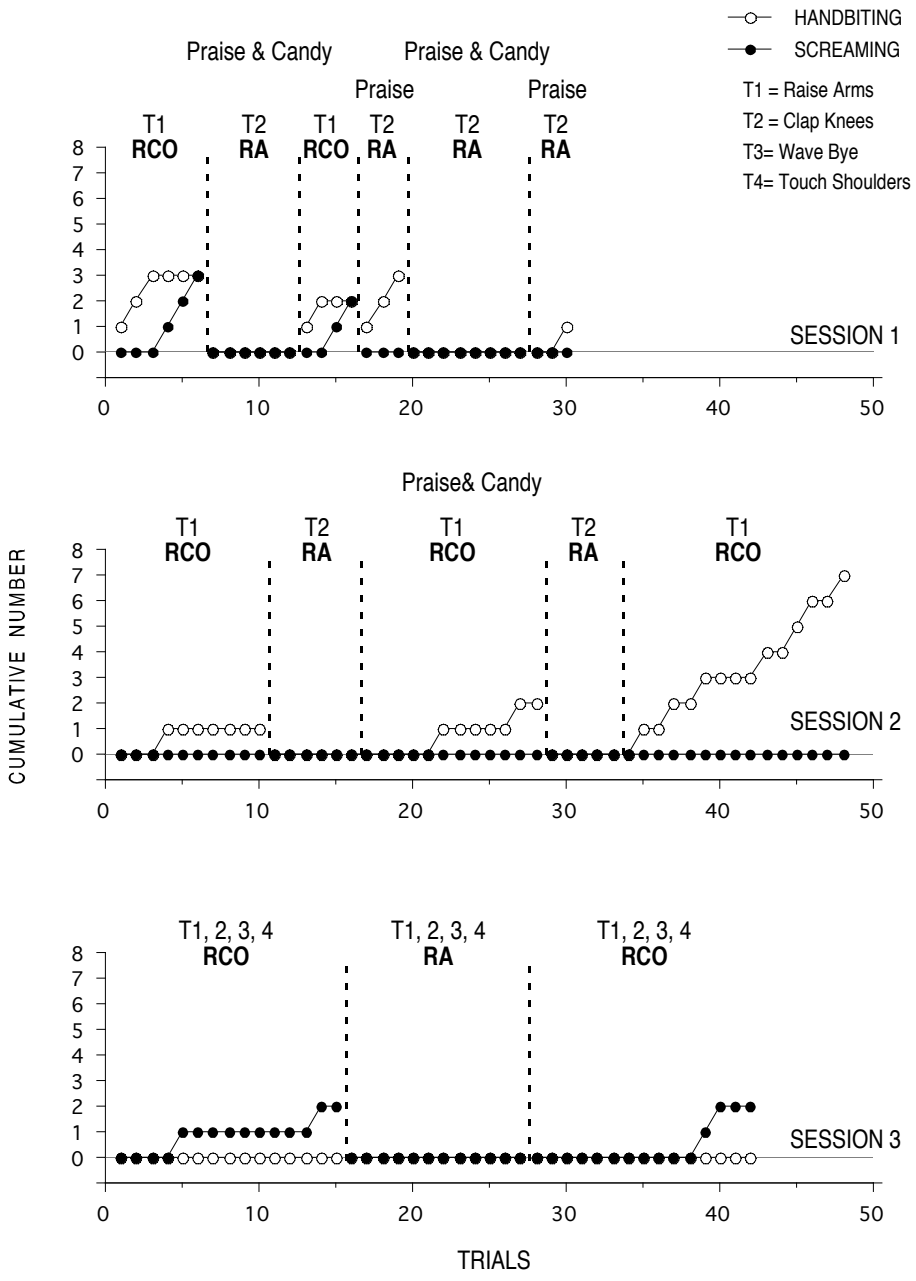

HANDBITING
SCREAMING
T1 = Raise Arms
T2 = Clap Knees
T3= Wave Bye
T4= Touch Shoulders
Praise & Candy
Praise & Candy
Praise
Praise
T1
RCO
T2
RA
T1
RCO
T2
RA
T2
RA
T2
RA
SESSION 1
Praise& Candy
T1
RCO
T2
RA
T1
RCO
T2
RA
T1
RCO
SESSION 2
T1, 2, 3, 4
RCO
T1, 2, 3, 4
RA
T1, 2, 3, 4
RCO
SESSION 3
CUMULATIVE NUMBER
TRIALS

Figure 2. Cumulative Occurrences of Handbiting and Screaming During Experiment 2

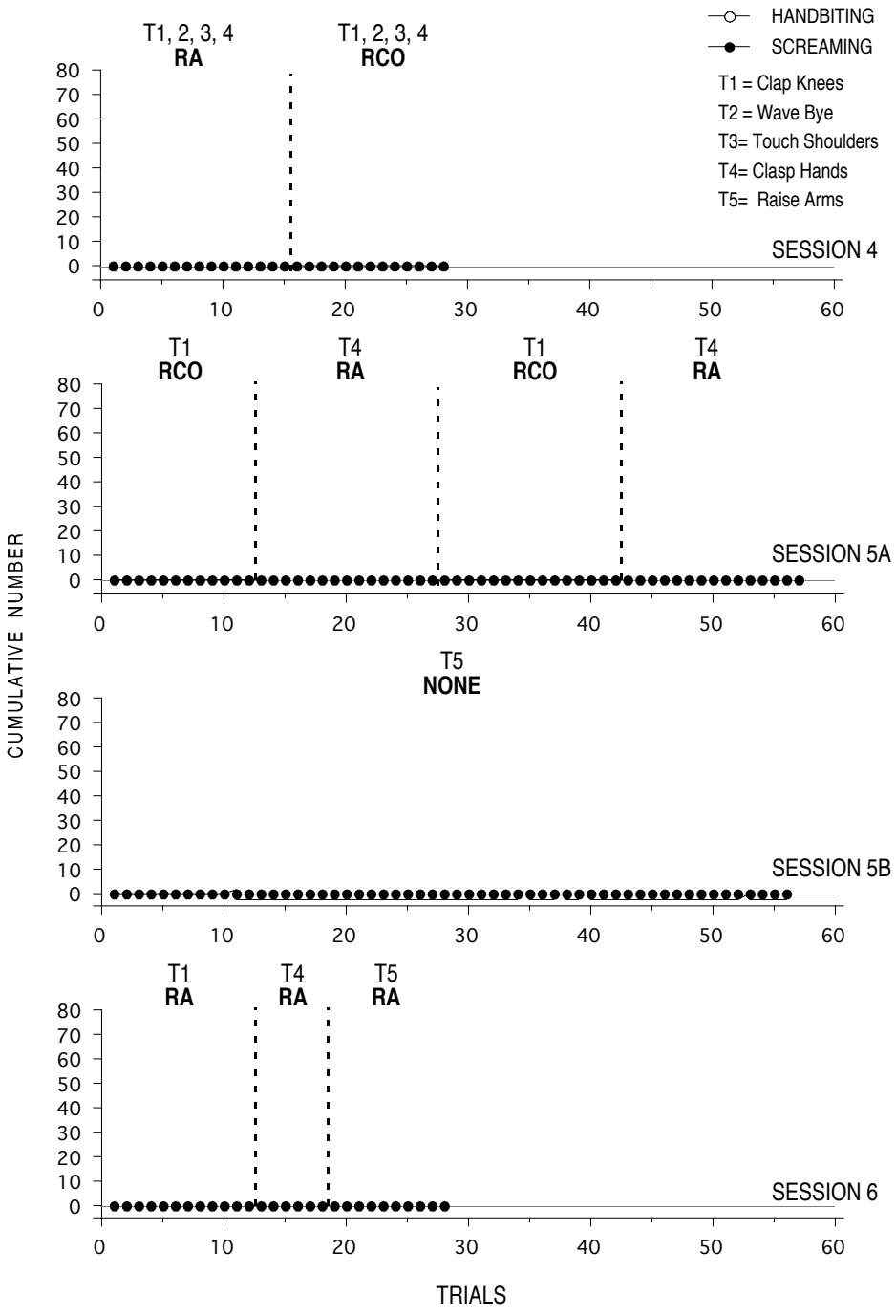

HANDBITING
SCREAMING
T1 = Clap Knees
T2 = Wave Bye
T3= Touch Shoulders
T4= Clasp Hands
T5= Raise Arms
T1, 2, 3, 4
RA
T1, 2, 3, 4
RCO
SESSION 4
T1
RCO
T4
RA
T1
RCO
T4
RA
SESSION 5A
T5
NONE
SESSION 5B
T1
RA
T4
RA
T5
RA
SESSION 6
CUMULATIVE NUMBER
TRIALS

Figure 3. Cumulative Vocalizations During Experiment 2

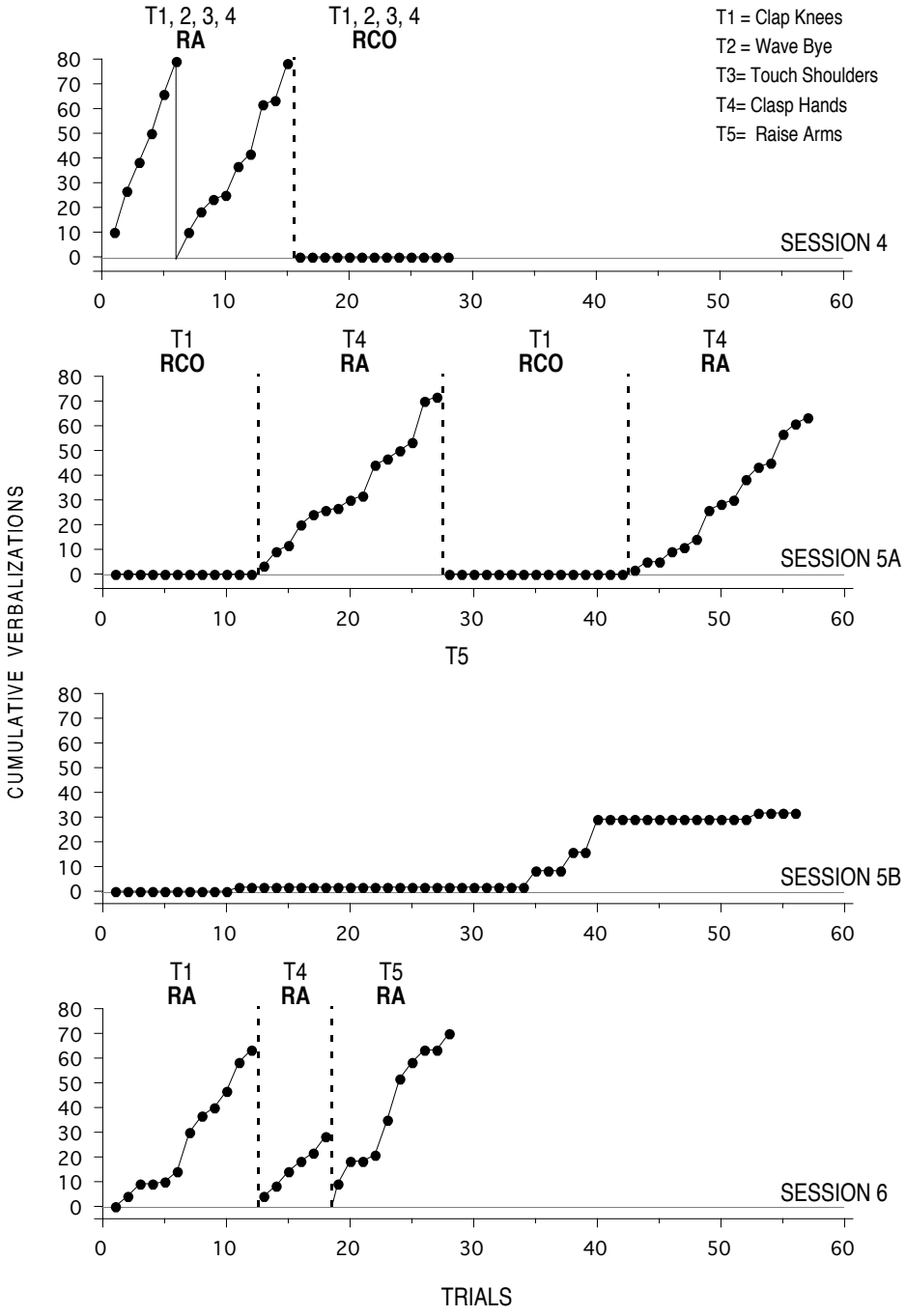

T1, 2, 3, 4
RA
T1, 2, 3, 4
RCO
T1 = Clap Knees
T2 = Wave Bye
T3= Touch Shoulders
T4= Clasp Hands
T5= Raise Arms
SESSION 4
T1
RCO
T4
RA
T1
RCO
T4
RA
SESSION 5A
T5
SESSION 5B
T1
RA
T4
RA
T5
RA
SESSION 6
CUMULATIVE VERBALIZATIONS
TRIALS

Figure 4. Task Accuracy During Experiment 2

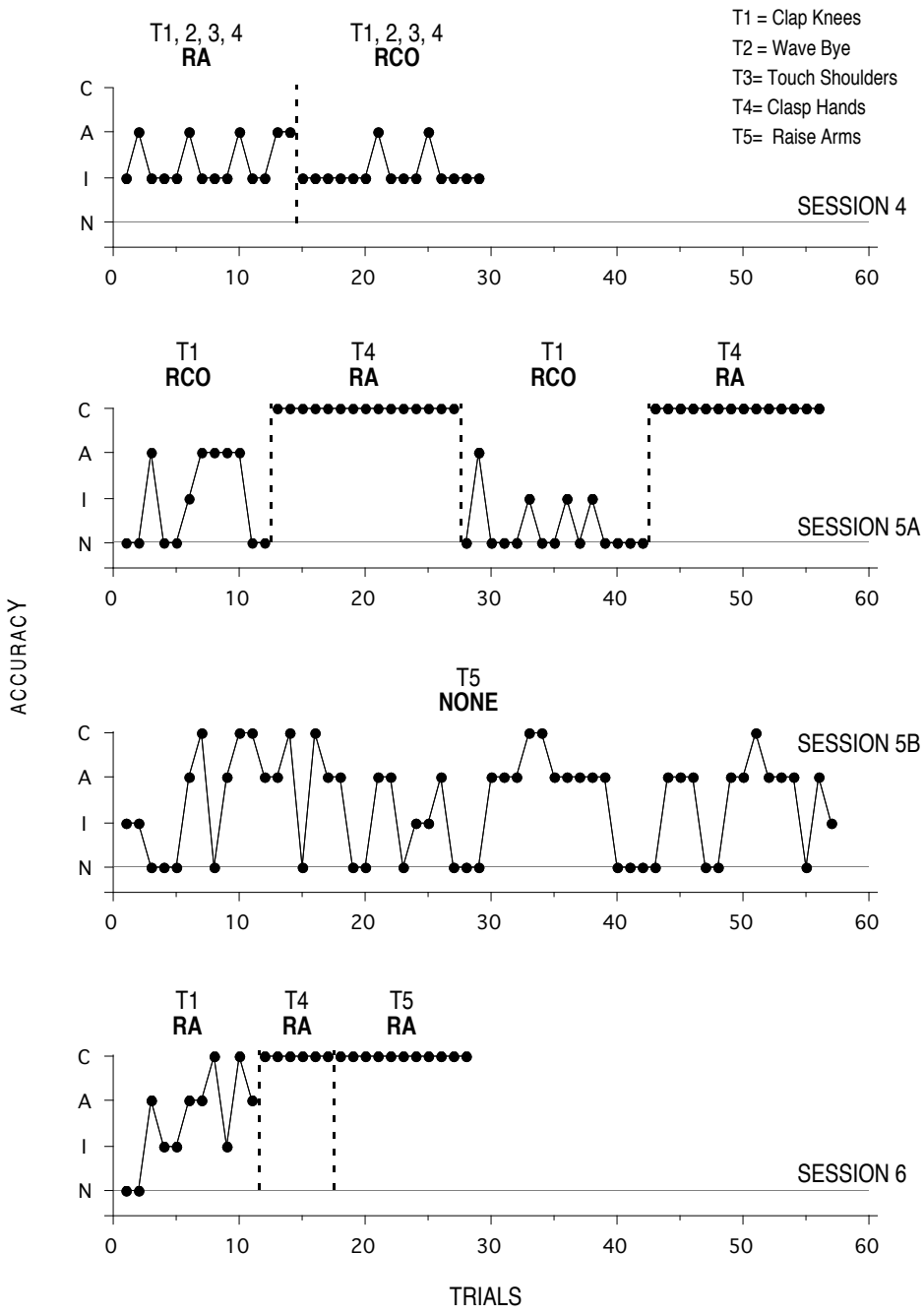
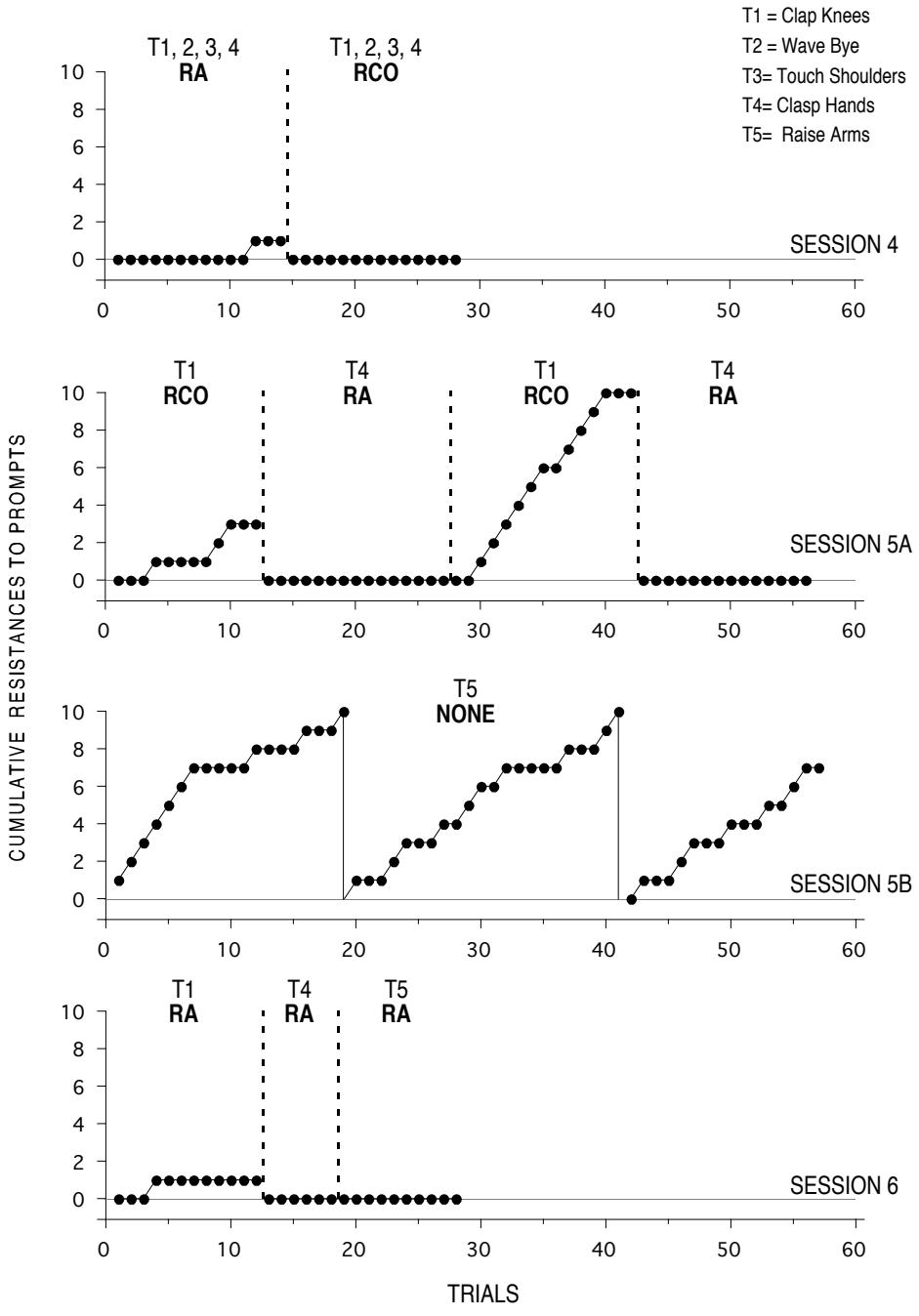

T1 = Clap Knees
T2 = Wave Bye
T3= Touch Shoulders
T4= Clasp Hands
T5= Raise Arms
T1, 2, 3, 4
RA
T1, 2, 3, 4
RCO
SESSION 4
T1
RCO
T4
RA
T1
RCO
T4
RA
SESSION 5A
T5
NONE
SESSION 5B
T1
RA
T4
RA
T5
RA
SESSION 6
C
A
I
N
0
10
20
30
40
50
60
ACCURACY
TRIALS

Figure 5. Cumulative Prompt Resistance During Experiment 2


T1 = Clap Knees
T2 = Wave Bye
T3= Touch Shoulders
T4= Clasp Hands
T5= Raise Arms
T1, 2, 3, 4
RA
T1, 2, 3, 4
RCO
SESSION 4
T1
RCO
T4
RA
T1
RCO
T4
RA
SESSION 5A
T5
NONE
SESSION 5B
T1
RA
T4
RA
T5
RA
SESSION 6
CUMULATIVE RESISTANCES TO PROMPTS
TRIALS

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