4-1999

Conditional Discrimination and Generalization of Facial Cues as a Function of Training Multiple Exemplars with Autistic Preschoolers

Sebastien Bosch

CONDITIONAL DISCRIMINATION AND GENERALIZATION OF FACIAL CUES AS A FUNCTION OF TRAINING MULTIPLE EXEMPLARS WITH AUTISTIC PRESCHOOLERS

by

Sebastien Bosch

A Thesis
Submitted to the
Faculty of The Graduate College
in partial fulfillment of the
requirements for the
Degree of Master of Arts
Department of Psychology

Western Michigan University
Kalamazoo, Michigan
April 1999

AKNOWLEDGEMENTS

I extend my sincere appreciatioin to Dr. Wayne Fuqua for helping me carry this project to term and to Drs. Galen Alessi and Kristal Ehrhard for theri helpful suggestions. I thank the staff and children from Croyden Avenue School and The Looking Glass Preschool for making this project possible. I dedicate this modest project to my parents, Joël and Marie, who have guided and supported me through the years.

Sebastien Bosch

CONDITIONAL DISCRIMINATION AND GENERALIZATION OF FACIAL CUES AS A FUNCTION OF TRAINING MULTIPLE EXEMPLARS WITH AUTISTIC PRESCHOOLERS

Sebastien Bosch, M.A.

Western Michigan University, 1999

Individuals with diagnosed autism typically show deficiencies in discrimination of facial cues. The ability to respond to facial expressions was assessed and trained with 3 four-year-old subjects diagnosed with autism. Stimulus presentations involved four different stimulus sets (cards with stick figure, cards with cartoon figures, and cards with photographs of a man and a woman displaying the emotional expression).

Training consisted of differential reinforcement of correct responses. The experimental design was a multiple baseline across stimulus sets, with generalization probes conducted after mastery level of performance was reached on each stimulus set. Some evidence of generalization was observed on yet to be trained stimulus sets. A session using videotaped of actors displaying each of the target emotions, revealed levels of discrimination (90% for two of the subjects) for the participants that approximated that of normally developing children exposed to the same video. This study extends prior research in two ways: it demonstrates that preschool aged children can acquire complex discriminations involving facial cues, and it represents the first report of stimulus generalization of facial expressions across novel stimulus sets.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

CHAPTER I

INTRODUCTION

Autism is a pervasive developmental disorder whose etiology is unknown and for which there is no cure. Albeit, with the application of methods derived from the experimental analysis of behavior, many clients achieved significant improvement, and mounting evidence suggests the superiority of the behavior analytic approach compared to other treatments (e.g., Lovaas, 1987).

"The essential features of Autistic Disorder are the presence of markedly abnormal development in social interaction and communication..." (American Psychiatric Association, 1994, p.66). Kanner (1943) wrote that autistic children "have come to the world with innate inability to form the usual, biologically provided affective contact with people" (p. 250) and described how autistic individuals are remarkable for their insensitivity towards the presence and the expressiveness of others. This lead Ferster (1961) to posit that deficiency in social reinforcers is the cause of all the other behavioral idiosyncrasies. The implication of this hypothesis can have a profound impact on affective and social repertoire and language development, which is socially mediated.

As social praise functions as a generalized reinforcer with normally developing children, Lovaas et al. (1966) attempted to remedy two children's lack of responsivity to such social stimuli by establishing the word "good" as a conditioned reinforcer.

Lovaas expected this generalized reinforcer to promote learning outside the original setting, but he did not observe spontaneous nor fundamental behavior changes. This study suggested that establishing reinforcers is relatively difficult to do with this population and that a single "social" stimulus (the word "good") was not sufficient to improve the behavior of the participants. Lovaas's initial disappointment should not deter further research on the autistic population and social stimuli. On the contrary, social stimuli have many advantages over tangible ones. They are immediate and easy to administer, they have a low potential for satiation, and they are relevant to maintaining social interactions. Socially relevant visual stimuli, like facial cues, may be a viable alternative or a complement to vocal verbal stimuli. But one of the questions we have to ask before investing time and effort in establishing reinforcers is whether the multitude of subtle facial cues may remain indiscriminable from each other for children diagnosed with autism.

The face is the central focus of attention during social interactions, and one may argue that it is an important controlling variable for verbal behavior in the sense that it presents opportunities (e.g., eye contact, facial expressions about which a person might inquire) and subtle reinforcers and punishers for verbal and non-verbal behaviors (e.g., facial expression showing pleasure/approval or displeasure/disapproval). An extensive body of literature has emerged focusing on the autistic population's ability to "process" facial expressions. Most of the research, consisting of group comparisons, found that on average the autistic population tends to score lower than normally developing as well as non-autistic mentally retarded control groups on “recognition” of facial emotions (e.g., Davies, Bishop, Manstead, and Tantam, 1994; Feingold, 1987; Hobson, 1986; Hobson, Oustton and Lee, 1989; Macdonald et al. 1989). For example, autistic children (9 to 15 years old) were significantly worse than the mentally retarded control group in finding, as well as labeling, the odd facial expression among otherwise identical cards (Tantam, Monaghan, Nicholson, & Stirling, 1989). This findings suggest that facial expressions remain indiscriminable for children diagnosed with autism. When asked to sort a deck of cards, nine out of twelve autistic children (8 to 22 years old) sorted the cards by type of hat worn or sex of the model rather than sorting by facial expressions (Week & Hobson, 1987). This finding allowed the authors to conclude that, for autistic individuals, facial expressions were not as salient as other characteristics when compared to the matched control group composed of non autistic retarded children. Noticeably, the group designs, used in such investigations, cast little light upon the individual’s performance. This is important because individual diagnosed with autism differ a great deal from each other in their behavioral and cognitive repertoires, while group designs portray the diagnostic category as being homogenous and infer that the findings generalize to the population of individual diagnosed with the syndrome, as a whole. In addition, no assessment included autistic children under the age of eight, when it has been shown that normal 3 year-olds may be able to respond accurately to a complex discrimination task featuring basic facial cues (Izard, 1971).

Even though there is much research in social skill training and assessment of facial cues, and training facial discrimination is a part of published educational programs (Lovaas 1981; Taylor & McDonough, 1996), few studies attempted to remediate deficits pertaining to discrimination of facial cues using individuals diagnosed with autism (Hobson, 1986). He reports that the participants watched videotaped scenarios and chose from schematic drawings of facial expressions (five stimulus cards) the one card that most closely resembled what they saw on the videotape. The experimenters corrected inaccurate matching by presenting a photograph of the videotaped faces and prompting for a new selection. Unfortunately, Hobson gave no details of the procedure as his interest lay in a subsequent assessment, consisting of comparing the normal group with a group of individuals diagnosed with autism and establishing relationships among the result on the experimental task and factors such as mental age, IQ, social impairment. Hobson concluded that children with autism "required significantly more teaching trials than did their matched control group" (p. 327). Thus it is unclear what training technique might improve attention to and discrimination of facial expression for individuals diagnosed with autism.

In a closely related area, two studies taught mentally retarded participants, both adult and adolescent, to emit a correct discriminative response to various facial cues. Like autistic individuals, people with mental retardation are consistently less accurate than normally developing control subjects in "recognizing" facial cues (e.g., McAlpine, Kendal and Singh, 1991). In the first study, McAlpine, Singh, Ellis, Kendall, & Hampton (1992) trained mentally retarded adults to label six basic emotions via instruction about facial characteristics, directed rehearsal, and praise. The four instructional phases consisted of: (1) ensuring that the participants could identify various facial features; (2) describing the facial changes characteristic of each target emotion, and asking the participants to trace the indicated anatomical change with his or her finger; (3) discrimination of photographs, presented in dyads; (4) acceleration of response rate to one response per second. Nonconsecutive probes revealed that, for all seven participants, the responses learned using photographs generalized to video. In the second study, adolescents with mental retardation improved on their ability to match various photographs of faces to the "mood" of a story following the introduction of praise, and correction procedure (Stewart & Singh, 1995). These studies suggest that mentally retarded adolescents and adults, with good verbal skills, may benefit from training addressing discrimination of facial expressions. Yet, this training does not appear appropriate for more severely handicapped populations, such as preschoolers diagnosed with autism, because of the various components drawing on a sophisticated verbal repertoire (e.g., describing facial expressions or listening -- and reacting adequately -- to a story).

Facial stimuli and the emotion displayed thereon involve complex stimulus displays. Correct discrimination of emotions may involve attending to facial features such as the mouth configuration (e.g., smile, frown), the position of the eyebrows (e.g., raised, lowered), eye characteristics (e.g., presence of tears, degrees to which eyes are opened). It may also involve attending to contextual stimuli (e.g., seeing a person fall), body cues beyond facial stimuli (e.g., wringing hands), and verbal cues (e.g., content and quality of verbalizations). Such discriminations require attention to multiple stimulus elements in a complex stimulus display. A related line of research has investigated how autistic children respond to complex stimuli. Investigators have assessed autistic children's limitations in responding to complex non social stimuli (Allen & Fuqua, 1985) as well as complex social stimuli (Shreibman & Lovaas, 1973). These studies reveal that when the children are exposed to complex stimuli they typically respond to a limited number of components contained within the stimulus complex. These findings may explain the relatively lower score of autistic participants reported in the "facial recognition" literature. Some studies indicate that complex stimuli containing a relatively higher number of components elicited more errors in comparison to other stimuli containing fewer components (Lovaas, Shreibman, Koegel, & Rehm, 1971; Lovaas & Shreibman 1971).

The paucity of research to identify interventions to teach discrimination of facial cues, along with the severity of social impairment in autistic children, justify the need for further investigation. The absence of data on preschoolers diagnosed with autism is also a concern when considering the potential benefits of early intervention. Because attending to a person's face may be a prerequisite skill to many social behaviors, younger trainees may increase their chances of developing a functional repertoire of social behaviors. In fact, attending to a person's face is a prerequisite to many social interactions and autistic children are often said to "lack" eye contact (American Psychiatric Association, 1994, p. 68).

Any attempt to train children diagnosed with autism using a discrimination task should carefully promote and assess the emergence of stimulus classes, because stimulus generalization is limited in individuals whose performances show overselective stimulus control (Allen and Fuqua, 1985; Lovaas, Shreibman, Koegel, & Rehm, 1971). The current study incorporates of generalization probes as stimulus generalization may be essential to a broad network of adaptive behaviors.

The purpose of this study was to investigate autistic preschoolers' responses to the presentation of three facial cues (happiness, sadness and fear). The first issue was to document the extent to which children diagnosed with autism can discriminate these three common facial expressions using a *manded stimulus selection task* (Michael, 1997). The next goal was to test whether a common training procedure (consisting of the visual stimuli from pictures and experimenter's mand for one of the pictures followed by the reinforcement of correct responses and the correction of incorrect responses), produced increments in the selection of the indicated facial emotion. Another purpose of the intervention was to evaluate whether the trained stimuli shared enough common properties with the probe stimuli to sustain the specified acquisition level of responding. Thus, generalization was observed using various stimulus sets (i.e., playing cards displaying a schematic figure, a cartoon character, and photographs of a male and a female, the "Face it" deck, and a video presentation). Ultimately, the present study investigated the potential benefits of training multiple stimulus sets across training phases. This was apparent when observing the generalization gradient from the graphic display of the successive probe scores.

CHAPTER II

METHODS

Subjects

The 3 students who participated in the study attended a center based program for autistically impaired students, Croyden Avenue School. All 3 participants were diagnosed with autism, one student had a secondary diagnosis as indicated below. The teacher from the Preprimatry Impaired classroom identified students who mastered more simple discrimination tasks and that displayed some social skills (e.g., greeting familiars or attempting to play with other of children). After selecting potential subjects according to their current IEPC goals, the teacher sent the informed consent forms to the parents. The forms briefly described the current study and its rationale, as well as the potential benefits and liabilities of participation. All three parents contacted by the teacher signed the informed consent form. Subjects who scored below 70 percent correct responses on pretraining trials qualified for the study. All 3 subjects scored below 70 percent.

Alex was a 3.5-year-old boy diagnosed with autism and a speech and language impairment. He frequently used metaphorical language (only understood by parents and teacher) and composed short sentences. He often echoed verbalizations and often initiated social interactions. Alex did not display any self-stimulatory behaviors.

He participated in discrete trial training .5 hr per day and joined a small group classroom for the remainder of the day. At the time of the intervention, his curriculum consisted of verbal and non-verbal imitation training (duplic repertoire), receptive and expressive color discrimination, and action or object naming (tact repertoire). Alex also had a history of sinus infection but no identified hearing problems.

Ann was a 4-year-old "high functioning" girl diagnosed with autism. She exhibited noncompliant behaviors in response to repeated demands (e.g., during correction procedures). Her noncompliance consisted of turning away from the teacher or investigators and/or engaging in stereotyped and repetitive speech (e.g., singing TV jingles). Although Ann played imaginary games (e.g., feeding a baby doll) she typically played by herself and actively avoided social interactions. She would rarely initiate and never maintain a conversation with other peers or adults. She also showed some impairment in the use of nonverbal behavior (eye-to-eye gaze, and body posture). Ann attended school for half of the day and had had some brief exposure to discrete trial procedures. At her parent's request, she was exclusively involved in small group learning sessions.

Ben was a 4-year-old boy diagnosed with autism, with a short attention span, idiosyncratic language, and abnormal moods (i.e., giggling, howling). He was enrolled in discrete trial sessions for 2.5 hr per day. His curriculum included various expressive and receptive exercises such as naming or pointing to body parts, objects, and labeling actions (tact repertoire and receptive repertoire), along with some verbal and non-verbal imitation training (duplic repertoire). He was described by his instructional aide as being "a highly energetic, talkative and ferociously outgoing young man. [...] who often seeks attention from adults, and to a lesser degree, his peers."

Setting

Daily sessions took place in 3 m X 3 m semi-enclosed booths that contained a table and two chairs. The booths were generally free from visual distractions but were not sound attenuated so that loud sounds from the classroom and adjacent booths could be heard. In all of the sessions, the subject sat at a small table across from the experimenter. The probe sessions assessing generalization across setting and across medium (from static images to dynamic television display) took place in a large conference room, outside the classroom.

Materials

The stimulus materials used in the study consisted of the following:

1. One set (a set consists of cards displaying the same model) of thirty-six 8 x 12.5 cm laminated cards displaying a stick figure drawing, adapted from Hobson's (1986) schematic faces hereafter labeled as "Stick Figure".

2. One set of thirty-six 8 x 12.5 cm laminated cards displaying the face of a cartoon-like character extracted from the "How Are You Feeling Today" poster (Creative Therapy Associates, Inc., 1992), hereafter labeled as "Cartoon Face" .

3. One set of thirty-six 8 x 12.5 cm laminated cards featuring "mug shots" of a female model, hereafter labeled as "Mug shots, female".

4. A similar set with a male model, developed by Ekman and Freisen (1975), hereafter labeled as "Mug shots, male". The facial expressions depicted in stick figure drawings included *happy*, *mad*, *neutral*, *sad*, *scared*, and *surprised*. The cartoon-face stimulus cards and the male and female mug shots included all of the above six facial expression plus one additional facial expression labeled *disgusted* (it was too difficult to draw this facial cue with the schematic-face). Within each set, facial cues included two variations per category (the smallest number for the makings of a potential stimulus class). This means that each of the emotional expressions for each set of cards (excluding the Face It deck) consisted of two exemplars. For example, two examples of the *happy* facial expression were presented in the stick figure set (as well as in the three other sets), one of which displayed a smiling face and the other that depicted a laughing face. These variations within stimulus classes were intended to prevent the emergence of overselectivity for a single and invariant feature, which is detrimental to stimulus generalization.

5. One deck (a deck consists of cards displaying different models) of 6.5 x 9 cm cards featuring 36 models from the "Face It" card game (manufactured by The Center for Applied Psychology,Inc.). The Face It deck featured models of different ages, gender, ethnicity, and head orientations, all displaying socially relevant facial cues. Thus, for each trial, the cards differed from each other on two dimensions: the emotion depicted and the model.

6. One 8 min videotape featuring 2 female actors displaying facial cues. The videotape presented 48 vignettes, each lasting 5 to 7 s out of which time the actors

were “cueless” for 2 s, and produced the cues for 3 to 5 s. Western Michigan University Media Center produced the video.

Selection of Reinforcers and Schedules of Reinforcement

The investigator administered reinforcers commonly used in the classroom, such as edibles (M&M’s©), tangibles (various toys) and praise. Before the experiment began the primary classroom teacher of each participant was asked to nominate a minimum of five stimuli that might function as reinforcers for each participant. Before each session, the experimenter presented 2 or 3 of the nominated items and asked the student: “What do you want to work for?” The subject selected the reinforcer from the options with a verbal statement of preference (e.g., “want candy”) or by an approach response (e.g., touching, reaching) toward one of the available items. The item selected by the student was used as a reinforcer for that particular session. The above selection procedure was used in all experimental sessions.

The schedule of reinforcement was tailored to each subject. Factors that influenced the making of individual schedules included, the schedule of reinforcement used in the classroom at the start of the study, and the compliance issues that emerged during the prebaseline observation sessions (this was a significant issue with Ben). Alex and Ann received one of the identified reinforcers on a VI 2.5 min schedule while Ben received a reinforcer for every correct response (CRF).

Response Definition and Dependent Variables

In all conditions a correct response consisted of pointing to, or picking up the experimenter specified stimulus (the correct stimulus or S+) within 20 s of the experimenter's first prompt. The prompt could be repeated four or five times during the 20 s interval. Scanning with the hand over the cards was not scored until any part of the hand touched a card or the index finger touched the table 1-2 cm in front of a card. In addition, if the subject's hand hovered above a card without touching it, *no response* was recorded. The first instance of *no responding*, within a session, counted as an incorrect response. *Incorrect responses* included pointing to the incorrect stimulus (S-) or simultaneously touching two cards. In all conditions the experimental measure consisted of the percentage of correct responses. The percentage of correct responses is the ratio between the number of correct responses and the number of stimulus presentations: $P = CR / S^D x\ 100$. The percentage was computed for each session.

On the score sheet, the experimenter kept a record of (1) correct responses, incorrect responses, and no responses for each trial. At the end of a session the experimenter also noted, (2) "noticeable" collateral behavior (i.e., relevant verbal behaviors and aggressive or off task behaviors), (3) the specific reinforcers and the schedule of reinforcement in effect, (4) and other potential extraneous factors (sickness, noise level and other distractions, and prior activity).

During all sessions, the experimenter recorded the subject's responses to the instruction "point to the S+ face." On the score sheet, a "+" sign indicated a correct response, a "-" sign indicated a response made to a S-, and "0" indicated no responding. When the subject responded to a S-, the experimenter also recorded the number of correction procedures necessary to obtain a correct response (up to three correction trials). The experimenter also recorded some "spontaneous" vocalizations that appeared to be controlled by the stimulus displays. For example, during baseline, Ann pointed toward a particular S+ while saying "funny-sad", and in the course of training, Alex said "he cries" while pointing to the S+ for *Sad*.

Interobserver Agreement

A graduate student in experimental psychology was trained to score the subjects' responses during the preliminary sessions for subject selection. The experimenter and observer both recorded student responding using the definitions and scoring system described above.

The observer sat inside the booth, avoided eye contact with the subject and refrained from communicating with the experimenter, who was the primary data collector for the experiment. After both the experimenter and the secondary observer had independently collected data, their records were compared for agreements and disagreements on a trial by trial basis. For the percentage of correct responding, the primary dependent variable, an agreement was scored if the experimenter and the observer recorded the same code ("+", "-", or "0") for a particular trial. A disagreement was scored if the experimenter and the secondary observer recorded a different code on a given trial. Interobserver agreement percentages for each session were calculated by dividing the number of trials with an agreement by the sum of agreements plus disagreements and multiplying that ratio by 100 (Kazdin, 1982, p.54).

Design and Procedure

The investigation comprised six conditions: (1) non-contingent reinforcement baseline, (2) four training phases, each featuring one set of cards, with differential reinforcement of correct responses, and (3) non contingent reinforcement probes assessing generalization of responses across stimulus sets (e.g., from a drawing to a photograph or from the photograph of a female to that of a male) followed the completion of each training phase (also referred to as training-probe sessions). Four weeks after the completion of the fourth training phase, the experimenter administered (4) a maintenance session with non contingent reinforcement followed by (5) a session probing for generalization across settings, and (6) at least two probe sessions assessing generalization across medium (using a dynamic television display). If necessary, the experimenter administered booster sessions before assessing generalization across settings and across medium.

A multiple baseline across stimulus sets design, replicated across subjects, was used to verify that the training improved the facial discrimination performance. In addition, intermittent probe sessions were used to evaluate the effect of the training on generalization of the behavior. Additional probes evaluated whether the behavior acquired during training, maintained across time, setting and medium.

General Procedure

In all conditions, the sessions lasted approximately 10 min and occurred five days a week. Twelve trials constituted a training session, while twenty-four trials comprised a baseline and any probe session. All sessions were conducted after lunch, which may have lessened the value of food reinforcers. In all experimental conditions, a trial consisted of three cards, placed 2-3 inches apart, in front of the subject. With each new trial, the experimenter instructed the subject to point the S+ (e.g., "Alex, point to the happy face"), repeated the instruction if it was necessary, waited up to 20 s for a response, and delivered consequences that differed for training and non training conditions (described below). In each trial, the experimenter delivered the action frame, "Point to the S+ face" or "Which one feels S+ [facial cue]." In each trial, the S+ could be a *happy*, *sad*, or a *scared* picture. I selected the facial cues associated with *happy* and *sad* because they are more distinct and universally identified, and the facial cues related to *scared* because it is a more ambiguous expression and it is less readily identified by normal adults (Ekman & Freisen, 1975). The remaining two cards (the S-) could be *disgusted*, *mad*, *neutral*, *surprised*, as well as *happy*, *sad* or *scared* as long as they did not serve as S+ during the trial. In addition, the two S- differed within each triad, so that the S+ could not be singled out because of the rule "pick the different card."

Baseline and Generalization Probes

During baseline and all the probe conditions, the experimenter used two decks of stimulus cards: The Full Probe deck and the Face It deck. The Full Probe deck consisted of triads (sets of three cards) selected from all four sets of cards, totaling 72 cards. With the Full Probe deck a trial consisted of the simultaneous presentation of three cards from a same set. For example, a trial could consist of presenting a happy face, a scared face and a angry face from the stick figure set. The following trial could display a triad made of a *scared* face, a *sad* face, and a *disgusted* face from the male mug shots set, etc. With the Full Probe deck as well as the Face It deck a session consisted of presenting 8 *Happy* S+, 8 *Sad* S+, and 8 *Scared* S+ (totaling 24 trials) in random order. I included the Face It deck, featuring different models and different facial expressions, as an additional probe to insure that the subjects' responding would maintain when I varied the non-emotional characteristics of the models within the triadic presentation. The other four sets of card differed on only one dimension, the facial cues. That is, they included the same model for each stimulus display, holding constant clothing, hair style, lighting and all other cues other than the facial expression.

During baseline and probe sessions the experimenter presented the stimulus material as described above and delivered the previously identified "reinforcer" in a non-contingent manner, more specifically, the reinforcer was delivered shortly after the student's response regardless of the accuracy of that response according to a VT 2.5 schedule. The subjects received no feedback on the accuracy of their responses. In addition, the experimenter praised the subject for attending to the instruction and to the stimulus cards, for responding promptly, and for remaining in his/her seat. The experimenter also complimented the subject for pointing with the index finger, although "slapping" and picking up the card was considered an acceptable response. Training started when the dependent measure showed no trend in at least three consecutive baseline sessions using the Full probe deck and three consecutive sessions using the Face It deck. In turn, when the student met the training criterion (described below), generalization probes were administered. The first two sessions using the Full Probe deck and the third session using the Face It deck.

Within the Full Probe deck, the set producing the highest percentage of correct responses, after averaging the scores obtained on the two probe sessions, served in the subsequent training phase. The training ended before the completion of all the phases if the subject achieved 90% correct responding in the three probe sessions that followed the completion of each training phase (see Figure 1).

Training

The training consisted in the sequential training of multiple exemplars (suggested by Stokes and Baer, 1977). Each training phase (featuring one stimulus set), and each session within the phase, comprised 12 stimulus presentations of three cards from one of the following stimulus set: Stick figure set; Cartoon face set; Female mug shots, and Male mug shots set (see Appendix A) . Because the same model appeared in a given set, only facial cues varied across cards from the same set. Viz.,

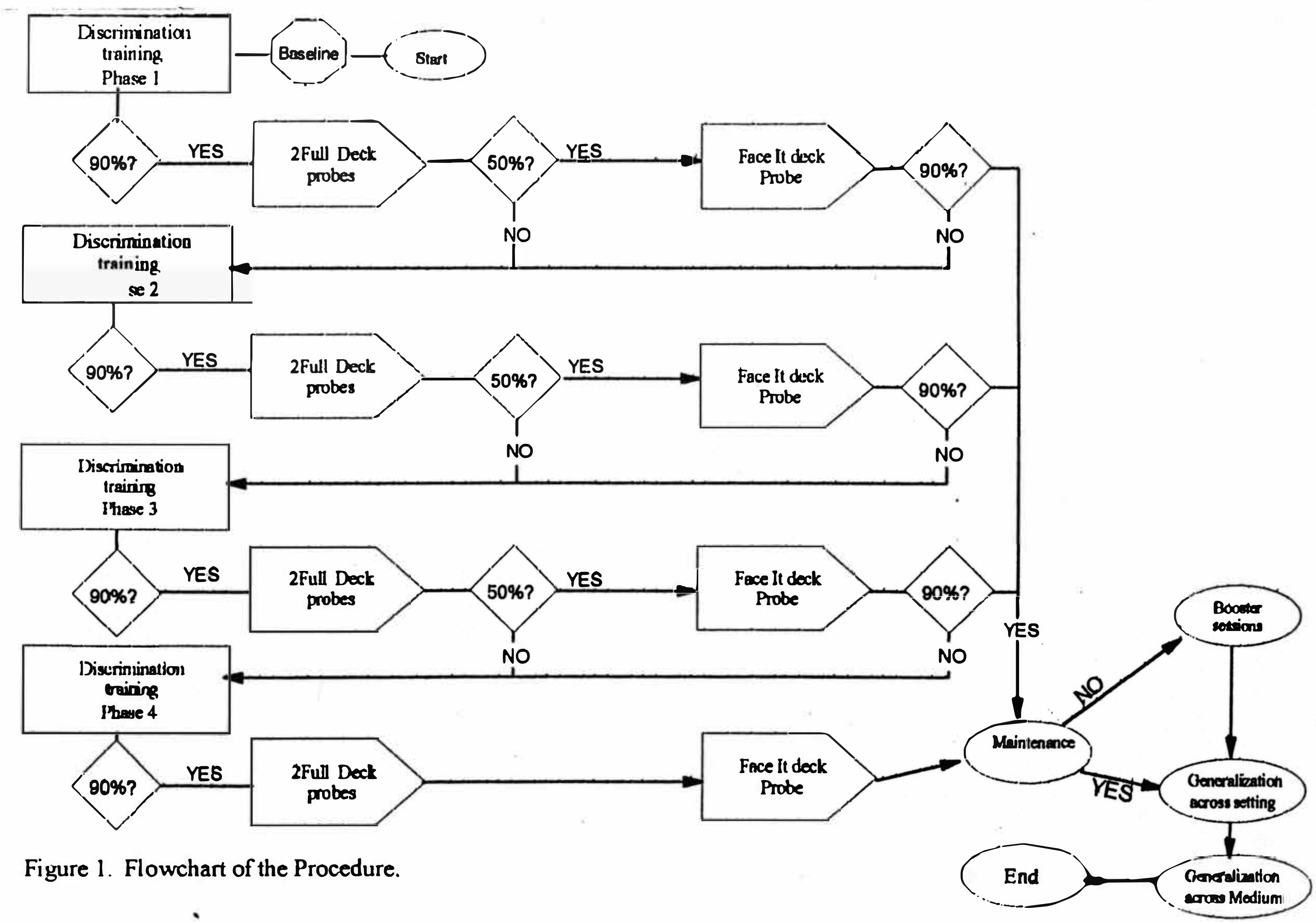


Figure 1. Flowchart of the Procedure.

the three cards placed on the table displayed the same model, thus forcing a discrimination based on critical differences, such as the facial cues. To insure that the relevant stimulus controlled the response and to rule out a response controlled by topography (i.e., the location of the card on the table and the movement of the subject's arm) the experimenter controlled for the location of the S+ on the table by preselecting the location and insuring that the S+ was evenly distributed among the three possible locations. The presentation of the stimulus cards and the experimenter's instructions were identical to those of the baseline and the probe sessions. In the training condition, each correct response received an enthusiastic and descriptive praise, e.g., "Alright! Great pointing to the scared face!" The experimenter delivered edible or tangible reinforcers according to each student's schedule of reinforcement. *Incorrect* responses, and *absence* of response, were followed by the experimenter stating "No, this is happy" or "Look, he/she feels happy," pointing to the S+, and physically prompting the subject's pointing to the S+. Then, the experimenter represented the same triad in a different order to assure that the response was controlled by the visual and the verbal stimuli (i.e., the S+ and the instruction) rather than by the topography of the last response (i.e., the last location of the card on the table and the proprioceptive and kinesthetic stimuli associated with reaching to the specific location). If necessary, this correction procedure was repeated twice. This meant that following the third incorrect response, the experimenter pointed to the S+ while saying "This one is happy," removed cards and presented the next card triad according to the order displayed on the score sheet (see Figure 2). During the correction procedure, praise, escape from physical guidance and regaining the opportunity to earn tangibles/edibles were the consequences for a correct response.

The students achieved the criterion level performance if they reached 9 out of 10 correct responses at any time during a training session. (In retrospect I used a low criterion, but it made for a dynamic procedure that emphasized the "imperfect" training of multiple exemplars, and the assessment of the transfer of training to new stimulus conditions.)

Maintenance

One month after the completion of the training the experimenter assessed maintenance of the target behaviors, using the Face It deck for at least two sessions. The procedures and the setting were identical to those used during baseline. On the day following the termination of this condition we assessed stimulus generalization across setting.

Booster Sessions

The experimenter initiated booster sessions if the average score from the maintenance sessions was 10% under that of the average percentage obtained during the last probe session using the Face It deck. The setting and contingencies were identical to those used during training. Booster session used the Full Probe deck (the combined four sets of cards used separately during training) and ended when the

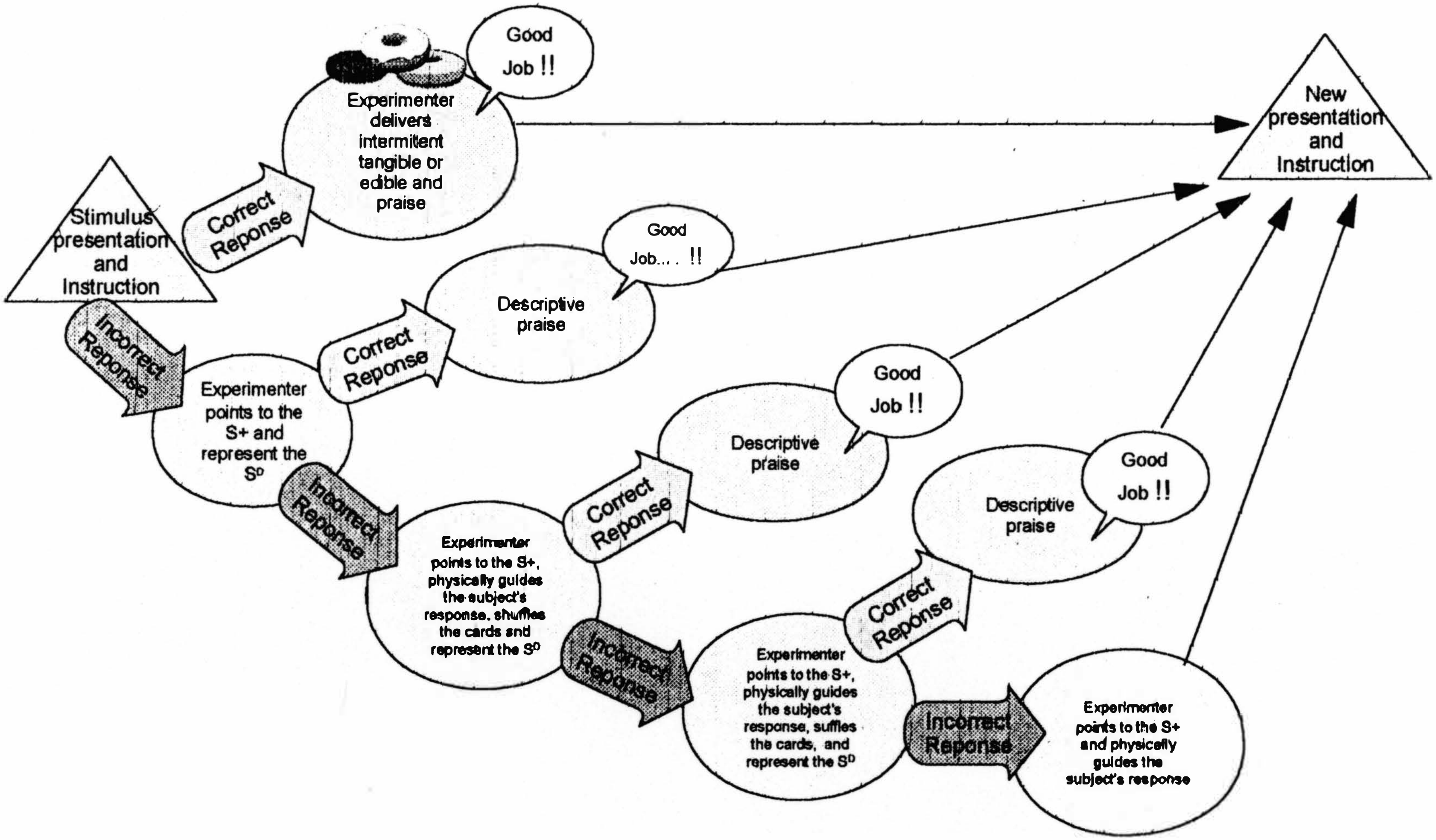


Figure 2. Discrete Trial Flowchart.

subject reached the correct response level of the last generalization probe using the Full Probe deck. No subject required booster sessions.

Generalization Probe Across Settings

The procedure and the stimulus material were identical to those used during maintenance. This extra probe was necessary because the video equipment, to be used in the probe assessing for generalization across medium, could not be brought into the training environment. So, a poor score on the assessment using the video display would have been confounded with the novelty of the setting and the novelty of the stimulus mode (i.e., the dynamic television images). On the day following the termination of this condition the experimenter assessed stimulus generalization across medium.

Generalization Probe Across Medium

The general procedure was similar to that used for baseline and probes but the timing of the instruction was different. First, the experimenter introduced the instruction while the videotape was on *pause* during each "black-out" separating the presentation of a vignette (e.g., "Look at the TV, and point to the sad face when you are ready"). Then, the experimenter paused the image at the apex of the cue, re-stated the instruction ("Now, point to the sad face") and waited a few seconds for a response. The viewing of the 48 vignettes required two 10-min sessions.

CHAPTER III

RESULTS

The percentages of facial expressions accurately selected by Alex, Ann, and Ben during baseline, training and generalization sessions are shown on Figure 3, Figure 4, and Figure 5.

During baseline, Alex's accuracy ranged from 24.6% to 41.7% with a mean of 31.2%. Ben's scores ranged from 16.6% to 37.5% with a mean of 27.6%. In contrast, during baseline, Ann scores averaged above random chance responding (33.3 percent). Ann's accuracy ranged from 33.3% to 63.6% and averaged 49.21%. During the first phase of training, accuracy levels increased for all participants, with all subjects reaching or exceeding the mastery criterion (nine consecutive correct answers). Alex (trained with the Stick face) and Ben (trained with the Female Mug shots) achieved mastery in 11 sessions while Ann (trained with the Stick face) required 10 sessions. Following the completion phase 1 the participants received the generalization probe sessions. During the probe sessions, Alex and Ann's accuracy respectively increased, relative their baseline scores, to 72.2% and 73.3%, suggesting a substantial stimulus generalization to the untrained stimulus items (i.e., the untrained sets from the Full Probe deck and the Face it deck). As shown in Figure 5 Ben's stimulus generalization scores did not reveal a noticeable increase from random responding, as his accuracy averaged 36.9% on the untrained stimulus material.

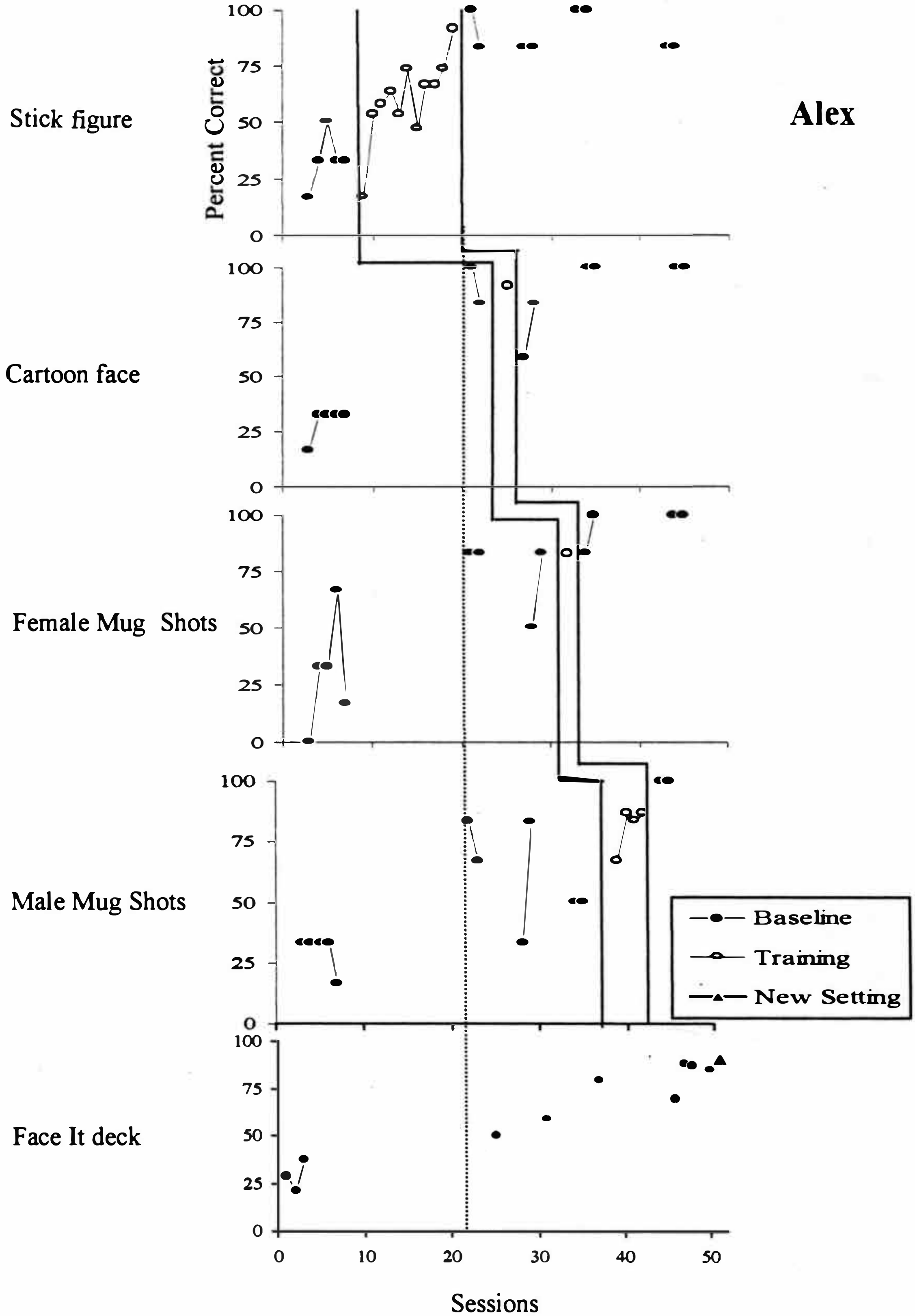


Figure 3. Alex's Percent Responding to S+ on Training and Probe Sessions.

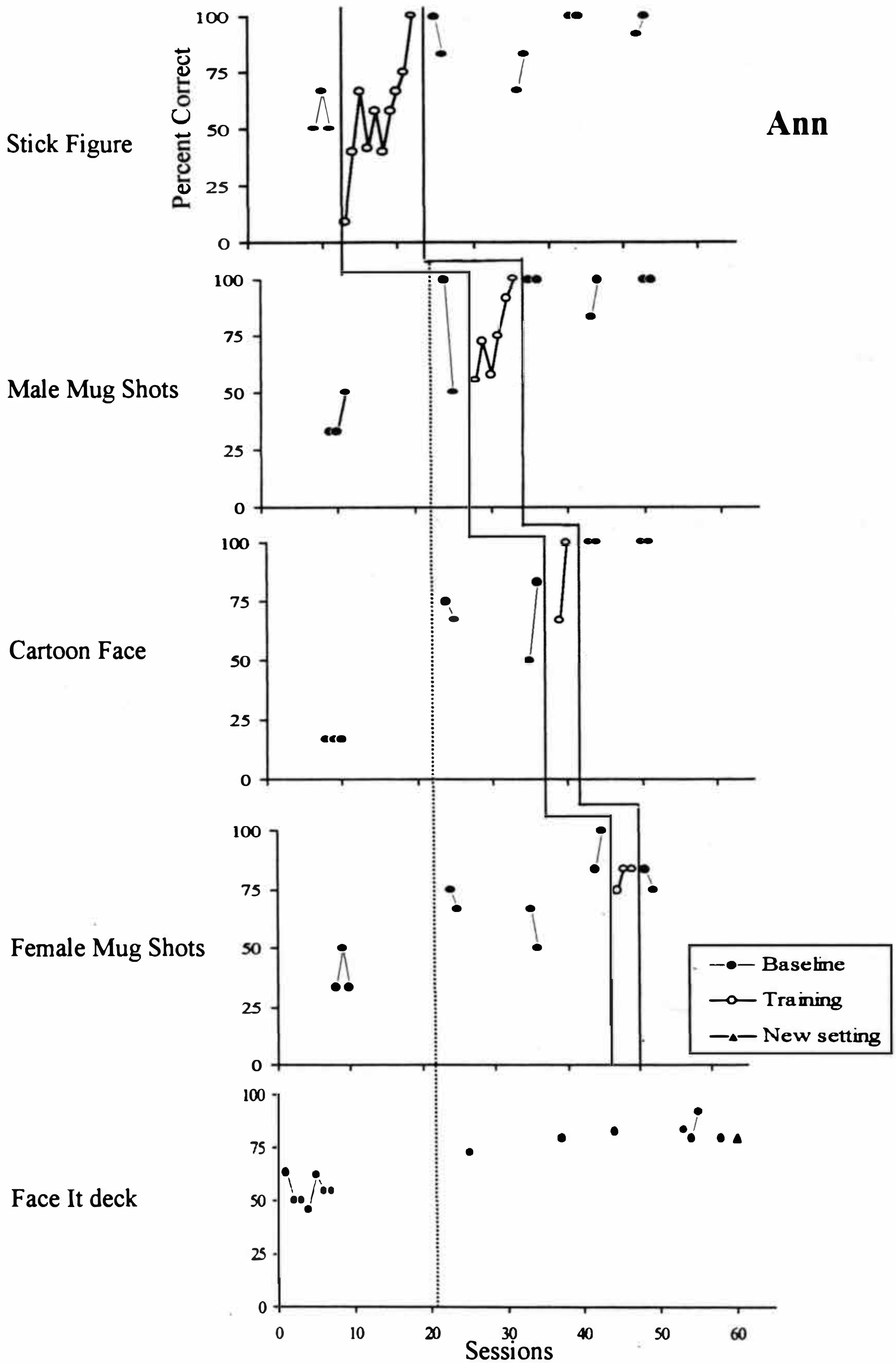


Figure 4. Ann's Percent Responding to S+ on Training and Probe Sessions.

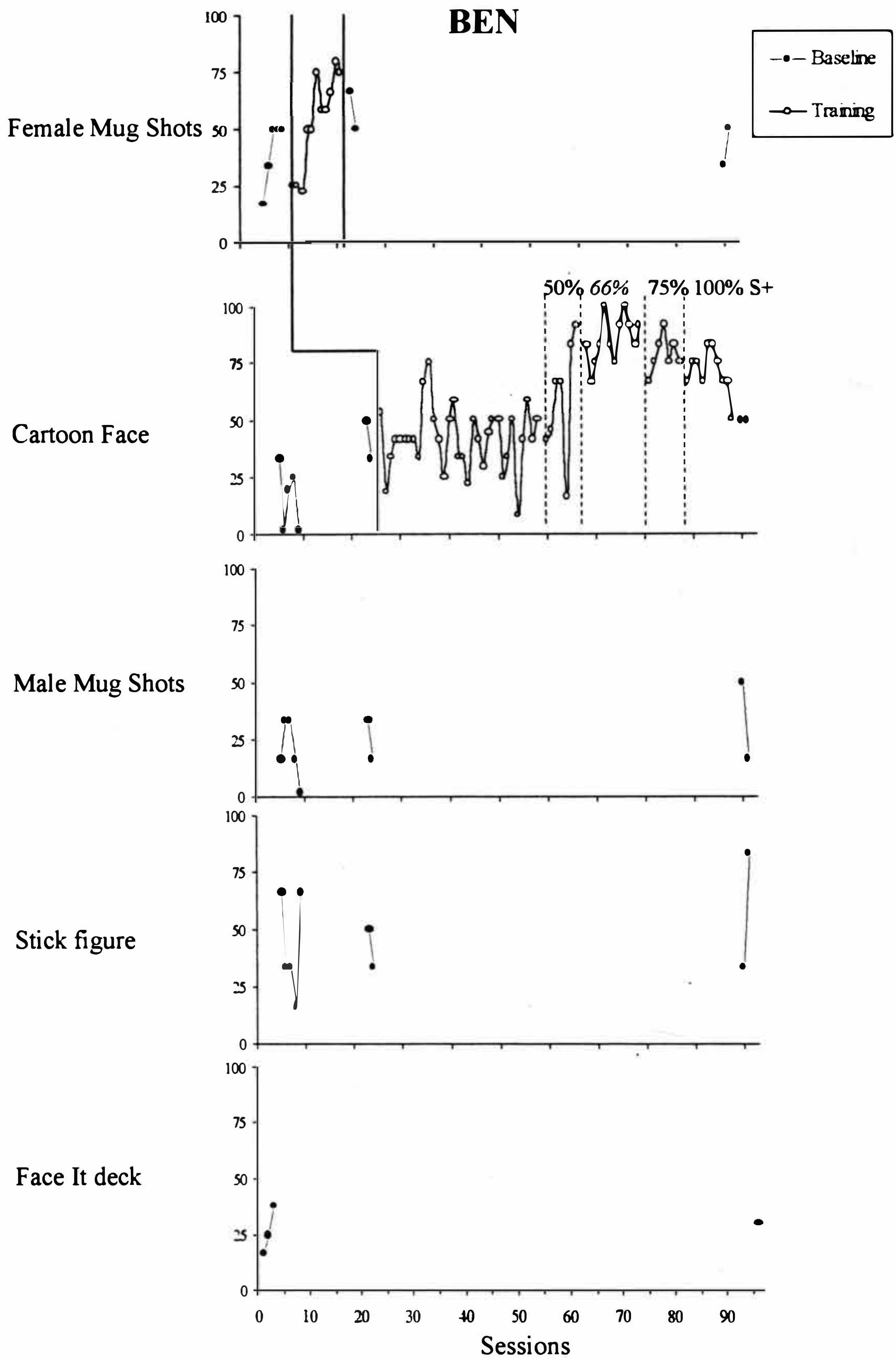


Figure 5. Ben's Percent Responding to S+ on Training and Probe Sessions.

Alex and Ann required one and six sessions respectively to reach the mastery criterion for the second training phase (consisting of training with the male mug shots for Ann and the cartoon face for Alex). Because Ben's scores did not improve after thirty-five sessions, phase 2 was modified for Ben. At first, I withdrew 50 percent of the S+ cards contained in the cartoon face set. As a result, only one of the two variations of the same expression remained in the set. This alteration in the stimulus array resulted in improved performance for Ben. As Ben reached the training criterion, I reintroduced the training cards, one S+ card at a time, until the cartoon face set contained all the original S+ cards. Ben's scores increased and then decreased again as S+ were added to the set (see Figure 5). Ben had not achieved mastery after sixty-nine sessions, at which point we discontinued the intervention.

On the three generalization probes following training phase 2, Alex averaged 61.1% of correct answers and Ann reached 75%. Although Ben had not completed training phase 2 we administered "exit" probes on which, in average, he responded correctly on 39.7% of the trials. For the training phase 3, Alex and Ann only required one and two sessions, respectively, to reach the mastery criterion. On the last generalization probes with the Full Probe deck, Alex responded correctly to 50% of the untrained stimulus cards (Female Mug shots) for both sessions, and reached 79.2% with the Face It deck. During the probes following completion of phase 3 Ann scored 83.3 and 100 percent on the remaining untrained stimulus cards (Female Mug shots). Training phase 4 consisted of four sessions for Alex and three sessions for Ann. Immediately following the completion of phase 4, both subjects received three probe sessions with the Face It deck. Alex averaged 80.8% of correct responses while Ann averaged 84.7%.

Finally, we implemented a maintenance session (four weeks after the last probe) and we assessed stimulus generalization across setting and medium (video presentation). Alex reached 83.3% correct responses and Ann reached 79.2%, with the Face It deck, in the setting used during training. In the new setting, still using the Face it deck, Alex reached 91% of correct answers while Ann's score remained 79.2%.

The assessment across medium, consisting of 48 videotaped vignettes, revealed high levels of correct responding for Alex and Ann, 93.3 and 79.5% respectively (Table 1). Ben's scores were consistent with random responding. Same age peers demonstrated near perfect scores on the videotape as their scores ranged from 91.5% to 98% of correct answers (Table 1). Anecdotal observation suggests that normal peers' response latency was noticeably shorter than that of autistic children. In fact, the experimenter rarely pressed the *still* button on the tape player to allow more time for the selection to occur.

Interobserver agreement observations were conducted across 22% of the total sessions. The percent agreement during those sessions ranged from 87.5% to 100% and averaged 96.5%.

Table 1

Percent Responding to the S+ for Autistic Participants and for Normally Developing Peers During the Generalization Across Medium Probe

A/I Students	Percent Correct
Alex	93.3
Ann	79.5
Ben	53
Normal Peers	
Dan 4 yrs-old	97.4
Ema 3.5 yrs-old	91.5
Mag 4.5 yrs-old	95.7
Art 4.5 yrs-old	95.7
Sue 4.5 yrs-old	91.5

*Ramdom responding at 50%

CHAPTER IV

DISCUSSION

Although discrimination of facial expression was low or absent at baseline, for two of the three participants, stimulus discrimination training resulted in markedly improved performances on the initial training stimuli. These discrimination skills showed generalization to additional stimuli that differed in topography (different models of various age, gender, and ethnicity) and in medium (television dynamic display).

The results of this study provide some evidence that the use of multiple exemplars (within and across stimulus sets) is an effective and simple way to train the discrimination of facial cues when compared to the training packages implemented by Stuart and Singh (1995) and McAlpine et al. (1991).

With Ben, the frequency of escape behaviors increased steadily during the four months of the intervention. In an effort to more clearly understand this treatment failure, we simplified the task for Ben. As a result, his accuracy increased, and his off task behavior decreased dramatically. As the task difficulty gradually increased, Ben's scores waxed and finally waned to pre-training levels (fifty percent). The frequency of Ben's escape behaviors decreased at first, but ultimately increased again as the task difficulty increased. These observations are consistent with Robbin and Dunlap (1992) who found that autistic children engaged in a higher frequency of "problem behaviors" when training on a new and difficult task, as compared to a maintenance task. Ben's results indicate that even with intensive one-on-one training, the conditions for optimal performance are precarious. The failure to acquire this receptive repertoire or manded stimulus selection for the three facial expressions suggests that attentional problems may have been at the root of the problem. Most new students are required to sit still, have quiet hands, and maintain eye contact during instructions. Unfortunately, when the student progresses in the curriculum and begins mastering more complex skills, expectations regarding the on task behavior changes. That is, the differential reinforcement of low frequency of off-task behavior is superseded by speculative and mentalistic explanations such as, boredom, hyperactivity, bad mood, problems in the home, stubbornness, or manipulative intent. As a result of these frames, which present the problem as the product of some internal and unchangeable process, functional assessments and effective interventions are seldom attempted. The facial cues training was relatively more difficult than any other procedures in the current curriculum of the participants.

From the results if this study, it is unclear whether the stimulus generalization observed with Alex and Ann was a function of the exposure to the multiple sets or to the multiple exemplars (two variations for each facial expression of emotion) within each set. This problem could have been addressed by training an additional facial cue (e.g., anger) with only one stimulus card (instead of two topographically different but functionally equivalent stimulus cards) within each set.

This study presented a putative social stimulus in a non social context. This format is strongly preferred by educators and is recommended by specialists in developmental disabilities (Lovaas, 1981; Maurice et al. 1996), but it fails to capture the "essence" of facial cues. Viz., facial cues could set the occasion for appropriate responses. For example, in the normal population, a smile may function as a discriminative stimulus for functional and socially relevant responses that have been reinforced in their presence and not in their absence. The facial cue may also function as conditioned establishing operations (CEO). For example, seeing a parent cry may function as a reflexive CEO by evoking behavior, such as hugging or speaking kind words, that have been reinforced by the removal of the emotion. In addition, seeing an acquaintance cry may function as a transitive CEO by making some other stimulus change, such as handing a handkerchief, effective as a form of reinforcement and evoking all the behavior that obtained the handkerchief. Unfortunately, the selection based procedure used for this study lacks social validity and cannot address these dimensions. Thus, because mounting evidence suggests that autistic children's responding (tacting and manded stimulus selection) can be brought under the control of subtle stimulus changes, future studies should address the remediation of social deficits in the context of social interactions.

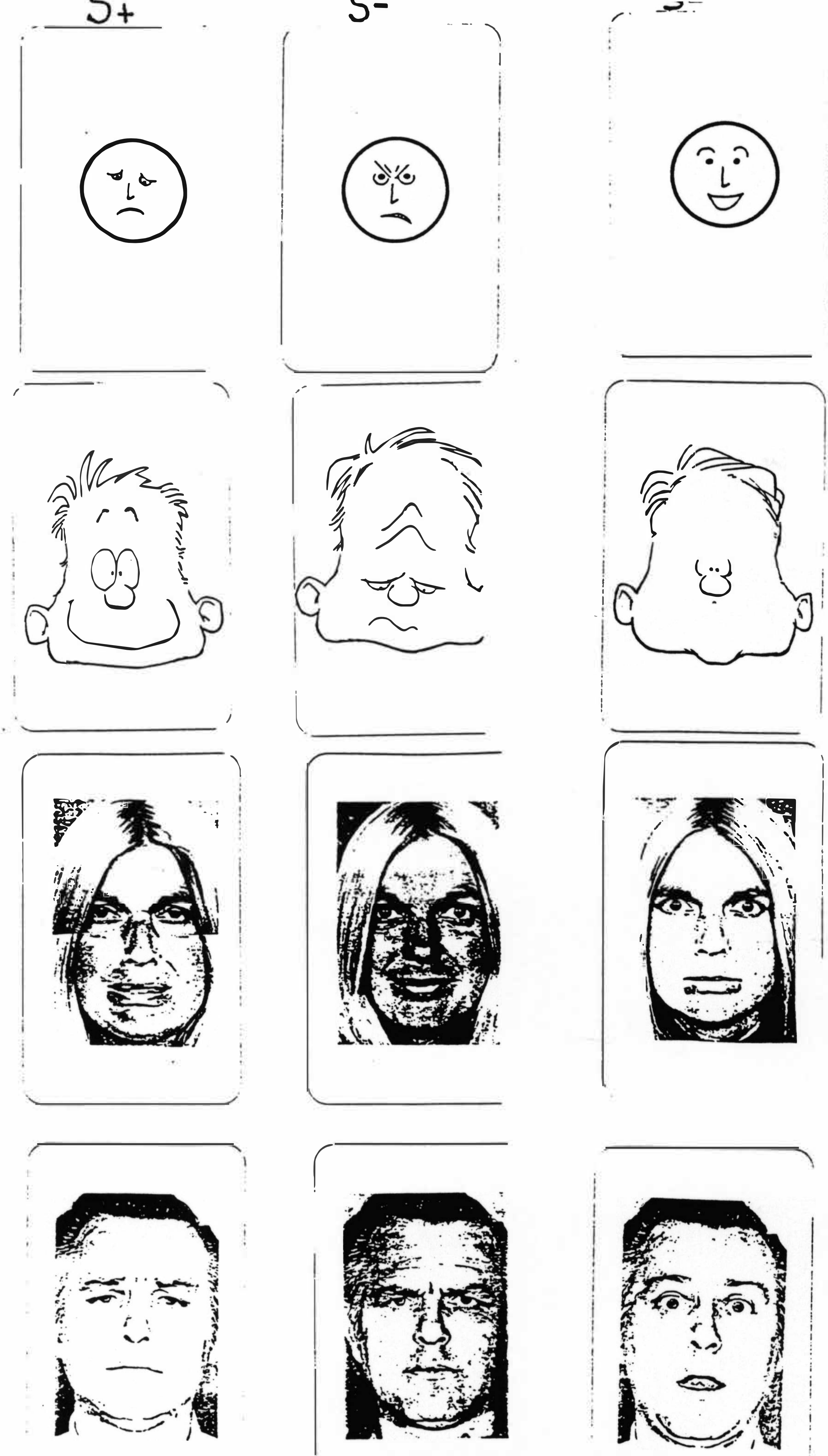
We can identify at least two strategies to bring behavior under operant control of facial cues, (1) reinforcing a range of socially appropriate responses (either verbal or non verbal) in the presence of some facial cues and not reinforcing the same responses in the absence of those cues, or (2) teaching tact and intraverbal relations and assessing response generalization in various social settings. For example, a tact related to a facial expression would evoke intraverbal stimuli specifying verbal and/or non verbal behavior. As a result, the autistic student may behave according to the "rules" thus specified.

For many autistic children, facial cues appear to be at best neutral stimuli. Future studies may attempt to alter their function by pairing specific facial cues with reinforcing or punishing stimuli, or events. Later, the successful function altering effect of the pairing could be tested by shaping or punishing a behavior solely on the presentation of a facial cue. This is a common occurrence in the normal population, where "a look" can convey approval or reprobation, and thus probably altering the future frequency of the behavior it immediately followed.

In conclusion, discriminations between various subtle variations of the face can be effectively trained in classroom, with static displays and multiple exemplars. But manded stimulus-selection procedures require a extensive and systematic scanning repertoire (which can easily be interfered with if the subject display some off task behaviors), which is not required with other training involving conditional discriminations, such as a topography-based training. However, these findings do not diminish the utility of picture cards and photographs in training facials cues because the trained responses generalized beyond the training situations. This study demonstrates that preschoolers diagnosed with autism can acquire discriminations based on facial cues, thus ruling out one explanation for the impoverished social repertoire often displayed by this population.

Appendix A

Training Stimuli


S+
S-

Appendix B

Protocol Clearance From the Human Subjects
Institutional Review Board

Human Subjects Institutional Review Board

Kalamazoo, Michigan 49008-3899

WESTERN MICHIGAN UNIVERSITY

Date: 22 November 1996

To: R. Wayne Fuqua

From: Richard Wright, Chair

Re: HSIRB Project Number 96-10-15

This letter will serve as confirmation that your research project entitled "Training Discrimination of Facial Expressions with Children Diagnosed with Autism" has been **approved** under the **full** category of review by the Human Subjects Institutional Review Board. The conditions and duration of this approval are specified in the Policies of Western Michigan University. You may now begin to implement the research as described in the application.

Please note that you must seek specific approval for any changes in this design. You must also seek reapproval if the project extends beyond the termination date. In addition if there are any unanticipated adverse reactions or unanticipated events associated with the conduct of this research, you should immediately suspend the project and contact the Chair of the HSIRB for consultation.

The Board wishes you success in the pursuit of your research goals.

Approval Termination: 20 November 1997

xc: Sebastien Bosch

BIBLIOGRAPHY

Allen, K. D., & Fuqua, R. W. (1985). Eliminating selective stimulus control: comparison of two procedures for teaching mentally retarded children to respond to compound stimuli. *Journal of Experimental Child Psychology, 39*, 55-71.

American Psychiatric Association. (1994). *Diagnostic and statistical manual of mental disorders* (4th ed.). Washington, DC: Author.

Creative Therapy Associates, Inc. (Producer). (1992). *How are you feeling today?* [Poster]. Cincinnati, OH: C.T.A.

Davis, S., Bishop, D., Manstead, A. S. R., & Tantam, D. (1994). Face perception in children with Autism and Asperger's syndrome. *Journal of Child Psychology and Psychiatry, 35*, 1033-1057.

Ekman, P., & Freisen, W.V. (1975). *Unmasking the face. A guide to recognizing emotions from facial cues.* englewood Cliffs. New Jersey: Prentice Hall.

Face It! [card deck]. King of Prussia, PA: Childs work/Childs play. (Aquisition No. G7475A).

Feingold, B. (1987). Preference for facial expressions among autistic and mentally retarded boys as a function of expressive language development and eye contact. *Dissertation Abstracts International, 47*, 3518B.

Ferster, C.B. (1961). Positive reinforcement and behavioral deficits of autistic children. *Child Development, 32*, 437-456.

Hobson, R. P. (1986). The autistic child's appraisal of expressions of emotions. *Journal of Child Psychology and Psychiatry, 27*, 321-342.

Hobson, R. P., Ouston, J., & Lee, A. (1989). Naming emotions in faces and voices: Abilities and disabilities in autism and mental retardation. *American Journal of Mental Retardation, 1*, 237-250.

Izard, C. E. (1971). *The face of emotion.* New York: Appleton-Century-Crofts.

Kanner, L. (1943). Autistic disturbances of affective contact. *Nervous Child, 2*, 217-250.

Kazdin, A. E. (1982). *Single-case research designs: Methods for clinical and applied settings* (p. 54). New York: Oxford University Press.

Lovaas, O. I. (1981). *Teaching developmentally disabled children: The ME book*. Austin, TX: PRO-ED.

Lovaas, O. I. (1987). Behavioral treatment and normal educational and intellectual functioning in young autistic children. *Journal of Consulting and Clinical Psychology, 55*, 3-9.

Lovaas, O. I., Freitag, G., Kinder, M. I., Rubenstein, B., Schaeffer, B., & Simmons, J. Q. (1966). Establishment of social reinforcers in two schizophrenic children on the basis of food. *Journal of Experimental Child Psychology, 4*, 109-125.

Lovaas, O. I., & Shreibman, L. (1971). Stimulus overselectivity in autistic children in two-stimulus situation. *Behavior Research and Therapy, 9*, 305-310.

Lovaas,O. I., Shreibman, L., Koegel, R. L., & Rehm, R. (1971). Selective responding by autistic children to multiple sensory input. *Journal of Abnormal Psychology, 77*, 211-222.

Macdonald, H., Rutter, M., Howlin, P., Rios, P., Le Conteur, A., Evered C., & Folstein, S. (1989). Recognition and expression of emotional cues by autistic and normal adults. *Journal of Child Psychology and Psychiatry, 30*, 865-877.

Maurice, G. Green, & S. C. Luce (Eds.). (1996), *Behavioral intervention for young children with Autism: A manual for parents and professionals*. Austin, TX: PRO-ED.

McAlpine, C., Kendall, K. A., & Singh, N. N. (1991). Recognition of facial expressions of emotions by persons with mental retardation. *American Journal of Mental Retardation, 91*, 29-36.

McAlpine, C., Singh, N. N., Ellis, C. R., Kendall, K. A., & Hampton, C. (1992). Enhancing the ability of adults with Mental Retardation to recognize facial expressions of emotions. *Behavior Modification, 16*, 559-573.

Michael, J. (1997). *Selection based verbal behavior*. Unpublished manuscript.

Murris, P., Meester, C., Merckelbach, H., & Lomme, M. (1995). Knowledge of basic emotions in adolescent and adult individuals whit Autism. *Psychological Reports, 76*, 52-54.

Robbins, F. R., Dunlap, G. (1992). Effects of task difficulty on parents teaching skills and behavior problems of young children with autism. *American Journal on Mental Retardation, 96,* 631-643.

Shreibman, L., & Lovas, O. I. (1973). Overselective responding to social stimuli by autistic children. *Journal of Abnormal Child Psychology, 1*, 152-168.

Stewart, C. A., & Singh, N. N. (1995). Enhancing the recognition and production of facial expressions of emotion in children with Mental Retardation. *Research in Developmental Disabilities, 5*, 365-382.

Stokes, F. T., & Baer, D. M. (1977). An implicit technology of generalization. *Journal of Applied Behavior Analysis, 10*, 349-367.

Tantam, D., Monaghan, L., Nicholson, H., & Stirling, J. (1989). Autistic children's ability to interpret faces: A research note. *Journal of Child Psychology and Psychiatry, 30*, 623-630.

Taylor, B. A., & McDonough, K. A. (1996). Selecting teaching programs. In C. Maurice, G. Green, & S. C. Luce (Eds.), *Behavioral intervention for young children with Autism: A manual for parents and professionals* (pp. 63-177). Austin, TX: PRO-ED.

Weeks, S. J., & Hobson, R. P. (1987). The salience of facial Expression for autistic children. *Journal of Child Psychology and Psychiatry, 28*, 137-152.