

THE UNIVERSITY OF MANITOBA

THE EFFECT OF CO-OPERATION PROCEDURES ON THE ACQUISITION  
AND SUBSEQUENT GENERALIZATION OF A SIGN LANGUAGE COMMUNICATION  
REPERTOIRE IN SEVERELY AND PROFOUNDLY RETARDED GIRLS

by

LARRY WILLIAMS

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A dissertation submitted to the Faculty of Graduate Studies of  
the University of Manitoba in partial fulfillment of the requirements  
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wise reproduced without the author's written permission.

This Thesis is dedicated to my first and most important teacher, my father, for it was his instruction on the notion of "responsibility", and his modeling of patience, perseverance, and honest hard work, which formed my values and maintained my motivation when there was no end in sight.

## Abstract

Three experiments were conducted concerning the acquisition and generalization of a minimal sign language manding repertoire in four non-verbal severely and profoundly retarded adolescent females. In Experiment One, four adolescents were taught to cooperate on a device to earn music and candy reinforcement by responding on three pairs of tasks during separate "mini-sessions". These adolescents, in two dyads, were then taught manual signs relating to the "music machine" behaviors by a variety of procedures which differed in the degree of prompting involved in the teaching, but all of which were of a cooperative nature in that two subjects interacted expressively and receptively under an adult experimenter's "teacher" control. In general, learned signs occurred on the music machine during training sessions and later in probe sessions largely as a result of the presence of or prompting via headphones by the experimenter.

In Experiment Two the same four subjects were taught to sign to mand four mealtime items in individual pre-lunch sessions taught by individual experimenters. Generalization of learned signs was observed to a dining room situation in the presence of the teachers and to adults not present during training. Mealtime signs were acquired quicker and generalized more readily than the signs in Experiment One. Additionally, receptive responses to manded signs were observed in two subjects although never taught.

Experiment Three attempted to teach the same four subjects two signs as mands for obvious reinforcers and two signs as mands for the "behavior of a listener" which was associated with reinforcement for both subjects. This was done in order to ascertain the importance of sign selection for teaching signed mands. Also, for each pair of subjects, one of each pair of signs was taught individually and one was taught with a partner present. Receptive response training was superimposed over all procedures in a staggered fashion. Generalization of peer-peer signs



was monitored in the music machine situation as in Experiment One. The major finding was that subjects manded each other in the music machine situation for both "types" of signs as a function of a contingency which removed the possibility of all other types of responses from gaining reinforcement. Also, most signs were observed as in Experiment One, when the experimenter was present in the game situation. The presence of other adults did not have this control over signing. Generalization was also observed to new partners as a function of the experimenter's presence.

The findings of all three experiments are discussed with a focus on audience control, and the necessity of teaching receptive versus expressive responses, for the development of a manding repertoire. Guidelines for plausible application of the findings are then given.

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## INTRODUCTION

During the past decade, an active area of applied behavior analysis has been in the research and development of procedures for teaching language behavior to the non-verbal retarded population (e.g., Harris, 1975; Sloane & McAully, 1968; Kent, 1974; Garcia & De Haven, 1974; Schiefelbusch & Lloyd, 1974). Within this general framework, there have been flurries of activity concerned with several very specific theoretical and procedural issues, some of which are: the role of imitation in language acquisition (e.g., Lovaas, Berberich, Perloff & Schaeffer, 1966; Lovaas, 1973; Baer & Sherman, 1964; Baer, Peterson & Sherman, 1967); the role of receptive versus expressive components of language (Bricker & Bricker, 1970, 1973); and, the development of "functional" language (Guess, Sailor, Rutherford & Baer, 1968; Guess, 1969; Sailor, 1971; Staats, 1968; Haveland, 1972; Frisch & Schumaker, 1974; Premack, 1970, 1971). Most recently, researchers have investigated other forms of verbal behavior such as sign language and "plastic" language communication (Topper, 1975; Webster, Solomon, Evans & Kuchan, 1973; Fouts, 1972, 1973; Miller & Miller, 1973). The advent of non-vocal communication research has provided both a fresh outlook and a prompt for a new analysis of the language acquisition process and its development to "functional language" (cf. Premack, 1970, 1971).

Within the language training area of applied behavior analysis the investigation of effective procedures which will promote generalization of taught verbal behavior is still very much needed (Harris, 1975). Some research on generalization of learned verbal behavior has focused

on the utilization of established procedures for acquisition (e.g., imitation) and the manipulation of variables such as: number of teaching settings (Hartung, 1970; Griffith & Craighead, 1972; Rubin & Stolz, 1974); number of experimenters (Garcia, 1974); response classes (Frisch & Schumaker, 1974); mode of stimulus presentation (Lovaas, Schriebman, Koegel & Rehm, 1971; Cuttings, 1973); and, the relevance of the current institutional "verbal" environment to the language acquisition process (Veigt, Steven, Allen & Chinsky, 1976; Giles, 1971). Concurrently, many articles in mental retardation journals discussing language deficiencies in this population have appealed for formulations which would involve the child at the child's present communication level and which would relate most to the child's present motivation during the normal daily routine (Leff, 1968).

A review of the relevant literature indicates that the general task of teaching verbal behavior to institutionalized retardates has been attempted at different levels of complexity and from a variety of theoretical analyses of language acquisition (Schiefelbusch & Lloyd, 1974). Operant researchers have been successful at establishing minimal verbal repertoires of varying degrees of topography, under a variety of environmental situations, by a variety of procedures with individuals with no verbal behavior. Concurrently, other researchers of the operant orientation have produced closer approximations to normal language in those who already had some verbal repertoire to begin with. While research of the first variety has uncovered variables and stimulated "theories" of the basic language acquisition process, researchers of the latter variety (cf. Staats, 1976; Lloyd & Schiefelbusch, 1974) have focused their efforts primarily at grammatical structure. These researchers have only recently succeeded in escaping the earlier

' literature war" with the more traditional modern linguistic theorists (Chomsky,1959), whose interests have been more on the structure rather than the function of language.

Research is needed which would provide information on language training which promotes the generalization of learned verbal behavior to the "natural environment" (Harris,1975). More specifically, for the non-verbal institutionalized retarded, there is a need for more research concerning the establishment of verbal behavior in the natural environment where it will be most functional. However, progress has been made in the investigation of a variety of procedures for establishing simple language behaviors (both vocal and non-vocal) in a variety of "classroom " situations. The most popular procedures have involved the establishment of verbal behavior as an imitation repertoire. Also, much of the reported research has described the establishment of receptive behavior (i.e. the appropriate responses to a teacher's verbal behavior) as opposed to expressive verbal behavior (i.e. the production of verbal behavior). The literature also shows that: a) major problems exist in generalizing verbal behavior learned as imitation in the classroom to spontaneous verbal behavior emitted in the daily environment. b) research is needed concerning the specific variables for teaching what is called " functional " verbal behavior in the non-verbal person's daily environment (Harris 1975; Schiefelbusch,1965).

One way to promote verbal behaviors might be to establish useful non-vocal behavior first. Even if no vocal behavior ever occurs, social and self-care behaviors would likely benefit from such a repertoire. The recent literature has supported this notion (Miller and Miller, 1973). However, research on the programming of generalization of non-vocal verbal behavior is still needed. The few anecdotal case studies that do claim to have produced expressive spontaneous signing have indicated the benefits to be gained from teaching in the natural environment ( Topper, 1975). Those more rigorous experiments teaching non-vocal verbal behaviors to chimpanzees (Fouts,1972 Premack,1971) have stressed the functionality of the repertoire.

The present research originally came about from the author's interest in the experimental analysis of social behavior in the severely and profoundly retarded ( Williams, Martin, MacDonald, Hardy, and Lambert, 1975 ). Indeed, a major concern of this paper is to explore the utility for functional verbal behavior of teaching procedures and generalization contingencies which draws upon the experimental analysis of cooperation. A more complete review of the experimental analysis of verbal behavior of the institutionalized non-verbal retarded population is contained in Appendix A. The literature of the development of social behaviors in this population and the literature concerning the experimental analysis of cooperation are contained in Appendices B and C respectively.

From a functional analysis of verbal behavior, it seems probable that the contingencies of a cooperation procedure should produce relevant cues for verbal behavior between cooperating partners. The social interaction increases under cooperation contingencies reported in the literature (Williams et al., 1975) are probably of this nature ( see Appendix C ). Given some cooperative task, where person A's behavior is relevant to providing reinforcement for person B, person A's behavior becomes salient to person B. After appropriate pairing of person A's task behavior and reinforcement, person A may himself become a reinforcer for person B. Many basic verbal behaviors may be acquired by both cooperating people when contingencies are arranged that increase the probability of each providing verbal cues for the other's task behavior.

The present study attempted to provide information about the relevance of cooperation contingencies for the acquisition and generalization of simple sign language by severely retarded, non-verbal institutionalized adolescents. Moreover a variety of teaching procedures and situations, different generalization procedures and situations, and functionally different signs were used.



## Isolation of the Research Question

The present research is concerned with examining the usefulness of operation procedures for the acquisition and generalization of sign language hands in non-verbal severely rearded female adolescents.

Research concerning communication in primates ( Fouts,I972,I973 ) has demonstrated that a chimpanzee can acquire a functional verbal repertoire in the form of sign language. Even more recently( Webster, McPherson, Soloman,Evans,and Muchan,I973; Topper,I975; Van der Hieden, Brown, MacKenzie, Reinman,and Schiebel, I975 ) behaviorally deficient people have benefitted from learning non-vocal communication behaviors, such as American Sign Language, Signed English, and symbolic languageforms such as Bliss Symbols.

It seems reasonable to suggest that more attention be devoted towards evaluating the benefits for the severely retarded, from the acquisition of a basic sign or gestural repertoire. Such a repertoire might function as a first approximation to , if not in lieu of, a vocal repertoire. The application of operant shaping methods to hand movements would seem to appear much easier than shaping vocal responses, especially in cases where the vocal musculature is under poor control or damaged. Also the accessibility of the hands for guidance allows for the possibility of a training procedure that need not involve a verbal response to be acquired as an echoic. This may be an important variable in establishing training procedures that enhance generalization of a verbal repertoire.

A receptive repertoire in a verbal behavior analysis can be thought of as the passive part of the repertoire, and is associated with the role of a listener. We say a person demonstrates a receptive repertoire when he responds appropriately to another's verbal behavior. In more traditional language, it is the behavior that leads us to say that a person " understands". An example would be when a person stands up to the cue "stand up".

An expressive repertoire, from the same analysis, can generally be thought of one that involves the production or emission of verbal behavior, under control of other verbal behavior or environmental cues. Using the same example, the person saying "stand up" is emitting expressive verbal behavior. A person responding to this command with "no" is also emitting expressive verbal behavior and is also demonstrating a receptive repertoire.

To date, there has been few systematic reports concerning the development of teaching procedures for an expressive gestural repertoire with severely retarded people. Indeed, although anecdotal case have indicated that severely retarded or autistic children have acquired small receptive vocabularies, and occasionally have been observed to emit expressive verbal behavior such as signs or Bliss Symbols, there has been a paucity of reported data on, or demonstration of, relevant procedures for the acquisition of sign language, its generalization, or the effects on collateral social development in the severely retarded.

Thus far, procedures for teaching sign language have typically involved modelling of the activity of a gestural sign in the presence of a pictorial display of the activity (Kent, 1974). The operant techniques of prompting a response by modelling it, reinforcing imitation, and gradually fading out the prompts or physical guidance have also been used. Although an expressed target of the training is spontaneous expressive signing in the general environment, such results have not been supported with data (Topper, 1975; Webster et al., 1973). The following diagrammatical display is offered as a general description of traditional procedures.

$S^D$ ( picture of activity and or model )	$R$ ( sign gesture or point to Bliss Symbol)	$S^{R+}$ (food or social )
---	---	-------------------------------

Thus, a verbal response is established under the control of session conditions and generalized occurrences of expressive signing are encouraged if observed in non-session settings.

As an improvement over the existing paradigm, the following display is offered, which provides that a subject's gestural sign be consequted by immediate action on the part of the listener ( the action specified by the sign). Such a cooperative procedure allows the subject to participate as both speaker and listener.

S <sup>D</sup>	( Experimenter emits sign eg. stand)	R (Subject emits behavior eg. subject stands up)	S <sup>R+</sup> Tangible)
S <sup>D</sup>	( Experimenter emits sign for "say" then "stand"	( Subject says stand ie. R (Subject emits sign )	S <sup>R+</sup> Tangible & E stands up)

This procedure produces better approximations to a manding response in the subject in that a sign is emitted that specifies a behavior which is subsequently emitted by the teacher and paired with reinforcement. However, this procedure does not escape the problem of the learned response coming under control of the teacher's behavior of "say". A procedure that did not cue the subject, but rather just shaped expressive signing would escape this problem.

A more optimal procedure might involve the experimenter prompting ( by physical guidance which would be faded out) and reinforcing mands with tangible reinforcers and by engaging in the manded behavior. This would alternate with the subject being reinforced for appropriately responding to the experimenter's mands. Now, a further step might enhance the chances of generalization. If a peer were to replace the experimenter, this would provide an opportunity for the subject and peer to alternate speaker-listener roles, with the appropriate prompting and reinforcement from the experimenter. Thus the paradigm becomes:

Subject one ( emits sign for stand)	Subject two stands	both S <sup>R+</sup>
Subject two ( emits sign for stand )	Subject one stands	both S <sup>R+</sup>

By establishing wider stimulus control over the responses, such a procedure should enhance the chances of generalization to the natural environment.

Independent of the procedures used in training, the generalization of verbal response to another situation, to other people, or to other responses, will be a function of the conditions of these other situations. In keeping with the "relevance of behavior" rule (Ayllon and Azrin, 1966) the signs to be taught should be those that will be maintained in the environment to which generalization is sought.

Theoretically, whether to use mands that specify tangible objects as reinforcers, or those that specify the behavior of the listener which is associated with reinforcement, is only relevant in terms of the function of such behaviors in the generalization environment, and is an empirical question at this point. Mands could be chosen then that specify tangible reinforcers, but these may generalize as expected only to situations where such reinforcement is available. Mands specifying only the behavior of a listener may be used, but these may only be expected to generalize to situations where the behavior of a listener is relevant in gaining some reinforcer for the speaker.

The major goals of the present research were:

1. To examine the effectiveness of a two subject cooperative training procedure for teaching sign-language mands to non-verbal retarded adolescents. These mands specified the behavior of a peer and were consistently associated with reinforcement.
2. To examine the effects of cooperative contingencies for promoting the emission of learned sign-language mands in a cooperative situation where the function of the mands in prompting a peer's task behavior was specific to that task.
3. To examine the acquisition and generalization of sign-language mands under conditions where the mands specify actual reinforcers and are functional in a daily routine.
4. To further examine some of the variables that the above mentioned situations (goal 1, 2, and 3) indicate may be relevant for any observed differences of acquisition rate and/or generalization of learned mands to situations other than the teaching setting.

## EXPERIMENT ONE

### Method

#### Subjects

Four severely retarded female residents of Cedar Cottage, a self-contained unit of the Manitoba School for Retardates in Portage la Prairie, Manitoba, served as subjects in this experiment. Table 1 describes the diagnosis and age of the subjects.

---

Insert Table 1 about here

---

All of the subjects were picked as a result of having acquired a lever press response earlier for contingent music reinforcement. The four subjects participating in this experiment were paired into dyads by approximate ages.

#### Apparatus

The Music Machine: A drawing of the "music machine", as the device was called, can be seen in Figure 1.

---

Insert Figure 1 about here

---

A chair was placed on either end of the device and beside a 0.6 meter square which was taped on the floor at either end of the device. The actual apparatus consisted of a 0.3 by 0.3 by 0.6 meter box which was painted in two distinct colors and which housed a portable 110 volt "M & Ms" candy dispenser (Lafayette Instrument Company). The dispenser was rebuilt such that it would dispense two "M & M's" candies at one time into two white plastic 15 centimeter diameter cups located at either end of the box. The entire apparatus was housed on a small table. Additionally, the box housed sockets for two sets of stereo

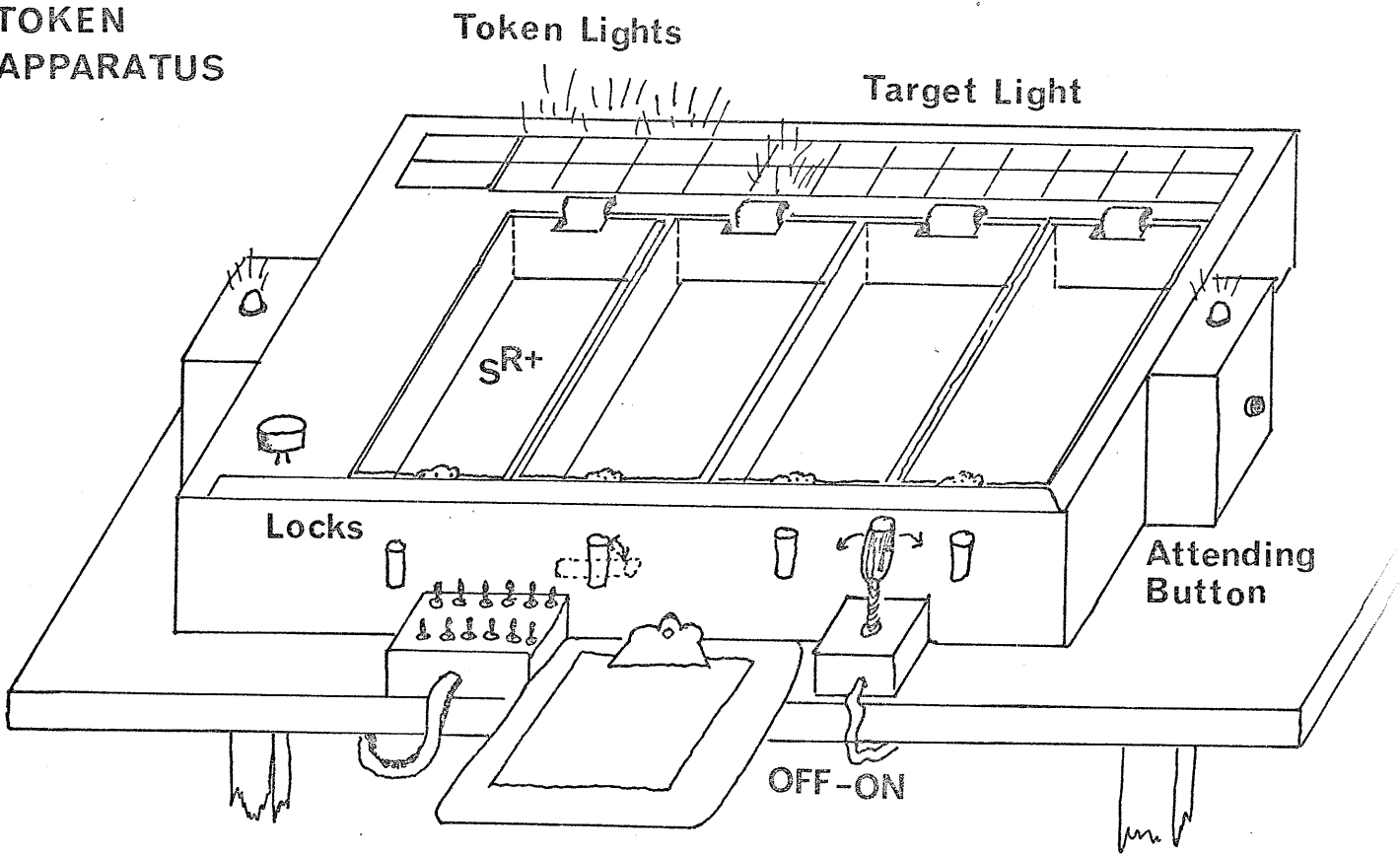
TABLE 1

## List of Subject Characteristics

Dyad I	Age	IQ	
Rita	15	Untestable	Hyperkinetic, Mental Retardation with Epilepsy
Elizabeth	15	Below 30	Down's Syndrome
Dyad II			
Paula	25	Below 20	Scaphecephaly
Shirley	25	Below 20	Congenital Word Deafness

NOTE: All subjects were non-vocal and were chosen from thirty girls at Cedar Cottage after acquiring a lever press response for contingent music reinforcement.

TOKEN APPARATUS



MUSIC MACHINE

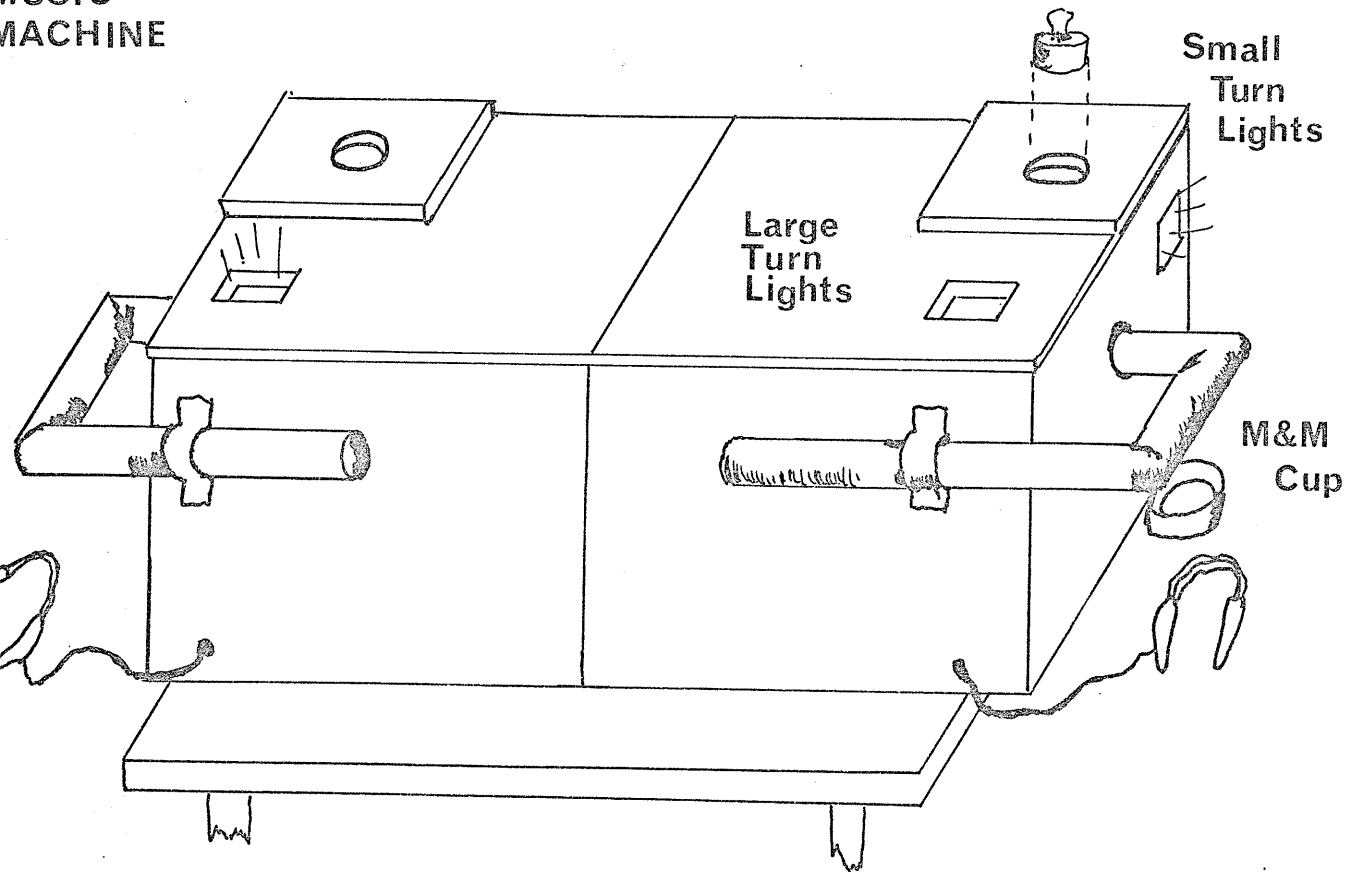


Figure 1. Illustration of the token apparatus and the music machine.

headphones, one at each end, and was outfitted with stimulus lights on its top surface and either end panel.

The stimulus lights on the top surface were 2.54 centimeters in diameter and were the same color (blue or yellow) as that end of the box. Smaller lights on the end panel were 1.3 centimeters in diameter and of opposite color to their respective end of the box, that is, yellow or blue. The lights were wired in such a way that when the large yellow light was illuminated on the top surface the small yellow light on the opposite end panel of the box became illuminated. Similarly, the small and large blue lights operated together. The small lights on the end panels were not visible from the opposite side of the box. A 5 centimeter diameter piece of plastic conduit ran through the center of the box, serving as a guide or channel for two U-shaped conduit "plungers" approximately 4.5 centimeters diameter, which could be fitted to slide in and out of the box. These plungers were prevented from being removed while in operation by large steel pins which sat inside of the internal piece of conduit. These pins slid in cuts made in the large center guide. The top of the lid of the box contained two 5 centimeter diameter wood sockets in which a 5 centimeter wooden block could be placed.

The Token Apparatus: This device shown in Figure 1 was utilized to teach subjects during sign language training sessions and required an attending response and a later consumatory response. The device basically consisted of four bins covered by plexiglass lids which could be opened or locked by the experimenter from the rear, or by a subject's pressing a releasing spring on the lid. Each bin contained a different candy reward. Along the front edge of the bins were



two sets of twelve stimulus lights under opaque glass. One set of lights was red and only one light at a time of this set was illuminated by the experimenter as a "target". The other set of lights was white, and each could be illuminated either individually or all at once in an individual or cumulative fashion. Attached to the device at either side was an attending light and an activating button mounted in a small metal box which sat in front of the subject. As generally used, the experimenter would turn on the red light at some target value, (four, for example). Then, when the subjects illuminated their attending lights, a trial could begin on which subjects earned white token lights cumulatively, or in "flashes" of target numbers of lights. When the white lights equaled or reached the target red light, primary reinforcement was made available from the bins and all lights were turned off to start a new trial.

Recording and Programming Equipment: The testing area which housed the music machine and the training area which housed the token machine were separated by a portable wall as seen in Figure 2.

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Insert Figure 2 about here

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Both of these areas were separated from an observation area which housed a videotape recorder and the mechanical programming relay equipment which activated the music machine. A video camera was installed in the ceiling of the experimental area above the panel divider, such that either side of the divider could be seen via the video equipment in the observation room. Additionally, the observation room was equipped with a one way observation window which allowed visual access to the testing area where the music machine was housed. The programming timing

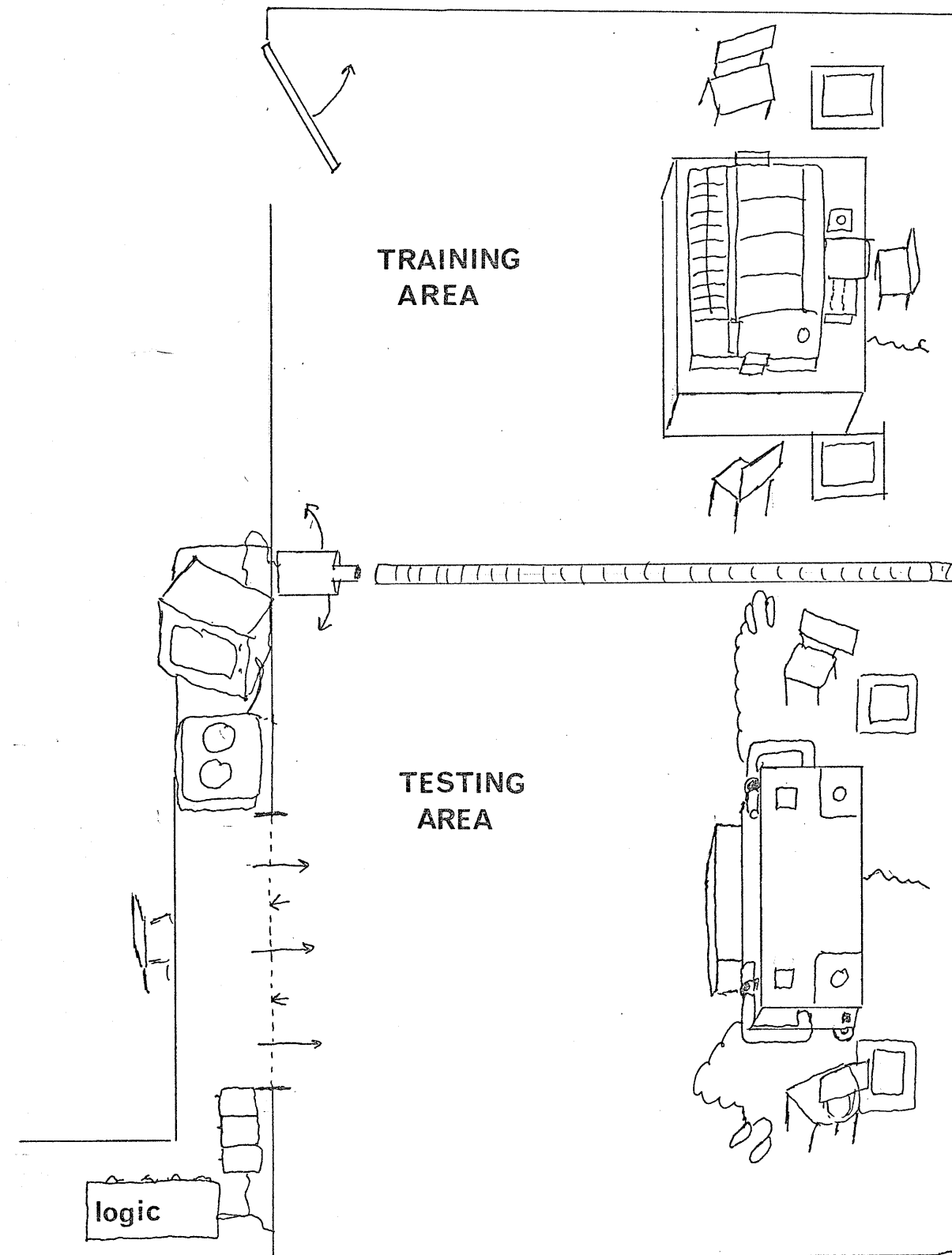


Figure 2. Arrangement of the training and testing areas, with appropriate apparatus.

equipment and two audio cassette tape players were also housed here in front of the window, such that the experimenter could "operate" the music machine candy dispenser, and provide music to the subject's headphones while controlling the stimulus lights on the machine and observing the subjects. Simultaneously, sessions could be video taped for inter-observer reliability and/or records of interesting developments.

The programming equipment which operated the token machine was also of 28 volt electrical mechanical relay type and was housed under the table in the teaching area. Data was recorded in the teaching area on a data sheet by the experimenter and for music machine sessions, on a data sheet by an observer or the experimenter in the observation room. Examples of these data sheets are contained in Appendix D.

In the course of experiment one, the words or signs taught were derived from various sources, but were common American Sign Language variations. Illustrations of the signs used can be seen in Appendix D.

### Procedure

General Procedure: Table 2 summarizes the various phases of Experiment One for each dyad as they were conducted temporally.

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Insert Table 2 about here

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For any particular phase of the experiment the specific procedures are described in the text both in general and, where appropriate, with accompanying flow charts or supplementary tables. The experimental phases may be best followed by using Table 2 as a map of the procedures which may be read individually. In general, each dyad was first taught how to play with the music machine, and then was taught sign language associated with behaviors emitted on the music machine. Then, for each dyad, various manipulations were made to assess the conditions necessary

Table 2. Sequence of teaching procedures and generalization conditions for each dyad in experiment one.

SIGN TRAINING sessions	STAND and SIT PROCEDURE A				3 tests of repertoire							STAND and SIT PROCEDURE B	STAND and SIT PROCEDURE C <sub>1</sub>	GIVE and TAKE PROCEDURE C <sub>2</sub>	
	Individual	Dyad with E	Dyad alone	Remove large lights	No Lights (NL)	Lights (L)	Forced Co-op (L)	Forced Co-op (L)	Forced Co-op (L)	Prompt dom. part.	Forced Co-op (NL)				Prompt both subs.
GENERAL-IZATION ON MUSIC MACHINE 3 MINI-SESSIONS	6	6	6	1	5	2	5	5	5	6	8	6	20	20	12
					5	2	5	5	5	6	8	6	(NL) Prompts	(L) No Prompts	(L) No Prompts
					5	2	5	5	5	6	8	6			
sessions	6	6	6	1	5	2	5	5	5	6	8	6	4	6	3
SIGN TRAINING sessions	GIVE and TAKE PROCEDURE A				3 tests of repertoire							STAND and SIT PROCEDURE B	STAND and SIT PROCEDURE C <sub>1</sub>	STAND and SIT PROCEDURE C <sub>2</sub>	
GENERAL-IZATION ON MUSIC MACHINE 3 MINI-SESSIONS	12	6	6	1	No Lights (NL)	Lights (L)	Forced Co-op (L)	Forced Co-op (L)	Forced Co-op (L)	Prompt dom. part.	Forced Co-op (NL)	Prompt both subs.	Forced Co-op (NL)	No Prompts	(L) No Prompts
					2	5	5	5	5	3	8	3	30	10	12
					2	5	5	5	5	3	8	3	(NL) Prompts	(L) No Prompts	(L) No Prompts
					2	5	5	5	5	3	8	3			
sessions	12	6	6	1	20	GENERALIZATION PROBES (GP)							7	2	2
					20	GENERALIZATION PROBES (GP)							(TDT) and (GP)	(TDT) and (GP)	(TDT)
					20	GENERALIZATION PROBES (GP)							(TDT) and (GP)	(TDT) and (GP)	(TDT)
					20	GENERALIZATION PROBES (GP)							(TDT) and (GP)	(TDT) and (GP)	(TDT)
					20	GENERALIZATION PROBES (GP)							(TDT) and (GP)	(TDT) and (GP)	(TDT)

for generalization of learned signs to the generalization situations both during and after acquisition of signs in training.

Pre-experimental Training Procedures: All subjects were taught to operate the music machine device by individually shaping each subject to engage in each of six behaviors (stand, sit, push, pull, give and take). This was done by the experimenter at first acting as each subject's partner and then placing two taught subjects together. After performance as a dyad was established under the prompts of the experimenter to the machine's "turn" lights, the experimenter was removed and the dyads performed alone under control of the turn lights of the music machine and additional occasional verbal prompts via their headphones. After six sessions of performing as a dyad the large stimulus "turn" lights were removed to assess any communication that this might promote between partners, before training on signs. The details of the pre-experimental shaping are contained in Appendix D.

Sign Training Procedures: In Experiment One, both dyads were taught four signs. The same basic procedure was used for all sessions. Training sessions were always 24 trials in length and were usually 30 to 45 minutes long. A trial was defined as the emission or opportunity for emission of an "expressive" response (a sign) by one subject of a dyad, and the emission or opportunity for emission of a "receptive" response to that sign by the other subject. For the first teaching procedure only (procedure A) the "turn" (the opportunity to emit a sign) alternated every six trials for the first two sessions, every four trials for the next two sessions, and every two trials thereafter. In this way one subject would sign both signs of a pair (e.g., stand and sit), and then respond to both signs. The following

general procedure was used:

Both subjects of a dyad were led to the training room and seated in chairs on either side of the token machine, in the same relative positions as they sat with respect to each other on the music machine (right or left). The experimenter sat behind the token machine, from where he could turn on the apparatus and operate it, while recording data on a clipboard. When the subjects were reasonably quiet, the experimenter would turn on the "target" light which was shaped as a cue for the subjects to illuminate their attending lights (by pressing buttons on the small apparatus in front of them). Once they had done so, the experimenter would wait until they were both attending him with his arm raised, and award one of them a "turn". This was done (for Procedure A, for example) by pointing at a subject<sup>t</sup> and saying, "(Subject one), you tell (subject two) to go there", (while pointing to subject two and the appropriate location for stand and sit, for example). If no response was made after ten seconds, or a wrong response, the experimenter would prompt the subject by repeating the instructions and adding, "Do this," while signing with the correct sign. For the first five or six sessions the prompting was replaced by the experimenter actually physically guiding the subject's hands and gradually fading this out. Similarly, the other subject was prompted (guided at first) to respond with the correct receptive behavior (actually standing up or sitting down). For give and take sessions with the other dyad, the same general procedure was used, except that the receptive response involved manipulating the block. Also, for this dyad, the awarding of the turn only involved pointing at the subject and if no response or a wrong response occurred, the

the correct sign was emitted by the experimenter as a prompt for that subject to sign.

Tokens (white lights) were awarded for correct responses, and correct prompted responses contingent upon the behavior of both subjects. As the target lights were set at four, back-up reinforcement was awarded on a four-to-one ratio, that is, one back-up for every four correct trials. However, in early sessions for procedure A, the token light presentation was altered. For some session (earlier session) token lights were awarded two at a time for a correct trial (one for each subject), but when accumulated to four (two trials) they were left illuminated for a brief time and removed. The back-up was then delivered after the next accumulated four lights were earned. Later sessions (after session 6) followed a procedure where all four lights flashed for one second and on the fourth flash the lights were left illuminated while back-ups were received. Regardless of the token display, the correct trial to back-up ratio for the first four sessions was two-to-one and thereafter four-to-one (that is, four flashes of the lights for one back-up reinforcer).

Although few reinforcers were missed by wrong responding (two errors in a row) when they occurred the experimenter said and signed no and turned off all the lights for ten seconds. Subjects were required to make attending responses before every "turn" (two trials) and after any time-out for errors. By procedure A, Dyad 1 reached a learning criterion of four out of six possible correct expressive and receptive responses, for the stand and sit signs, for three consecutive sessions, in forty sessions. Dyad 2 reached this criterion in forty-three sessions for give and take signs.

Specific Training Procedures: Throughout the experiment, four separate teaching procedures were utilized. These were procedures A, B, C1 and C2 and their specific contingency descriptions are contained in Tables 3 and 4.

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Insert Tables 3 and 4 about here

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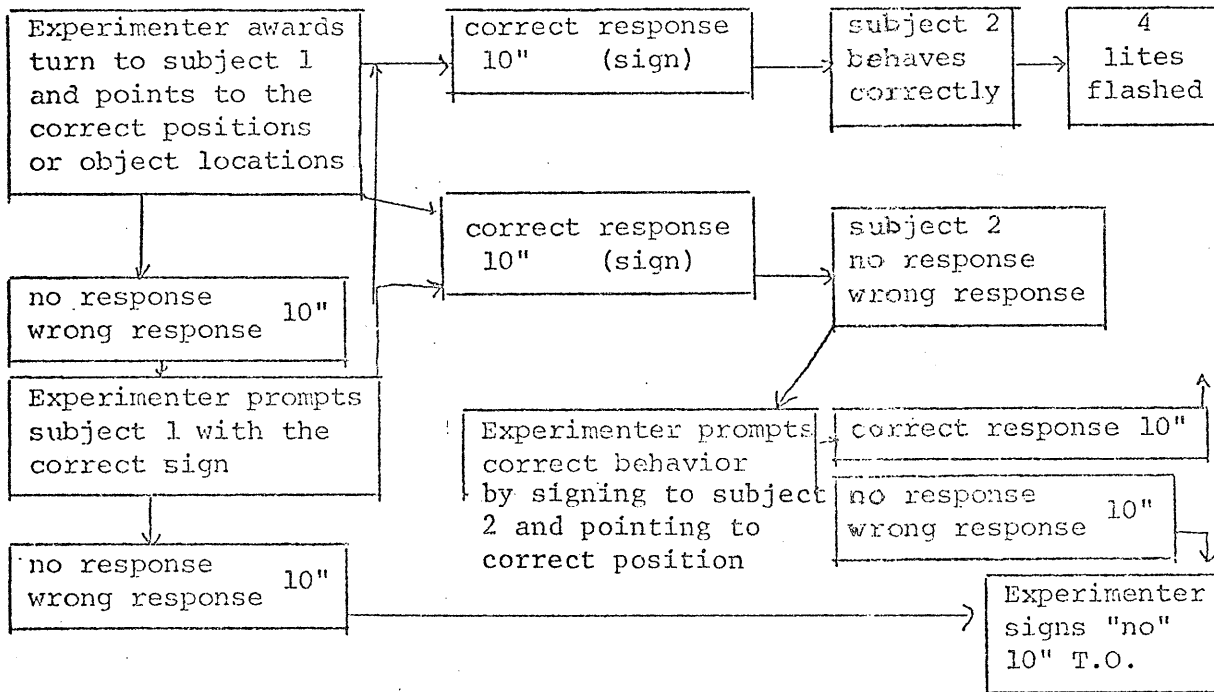
Procedure A has already been described. Procedure B was different from procedure A in that there was a removal of the many discriminative stimuli (prompts) presented in Procedure A ( the experimenter would point to a subject<sup>1</sup> to indicate turn and do nothing else until behavior occurred). By this procedure it was hoped that subjects would respond more to their own and to each others behavior than to the experimenter's behaviors and thus the experimenter would not be such a powerful controlling audience over the signs learned. This, of course, would increase the generalization possible. Thus by Procedure B subjects earned lights as in Procedure A, but no prompts were provided for expressive behaviors when wrong responses or no responding occurred. Additionally, both subjects could lose reinforcement if the partner did not respond receptively to the signing subject without a prompt from the experimenter. Procedure B was used to teach twenty remedial sessions of stand and sit to Dyad 1 and thirty sessions of stand and sit, after ten sessions of Procedure A, to Dyad 2. Additionally, during the remedial training of Dyad 1 a variety of additional reinforcers including some liquid reinforcers were used.

Procedure C1 involved the use of primary and conditioned reinforcement together. Instead of using only lights on one end of the machine, this procedure utilized four lights on either end of the machine. A subject was cued to gain primary reinforcement for an expressive sign by four lights typically awarded for correct receptive behavior on the preceding



Table 3 Flow-chart diagrams of teaching procedures A and B.

## PROCEDURE "A".



## PROCEDURE "B".

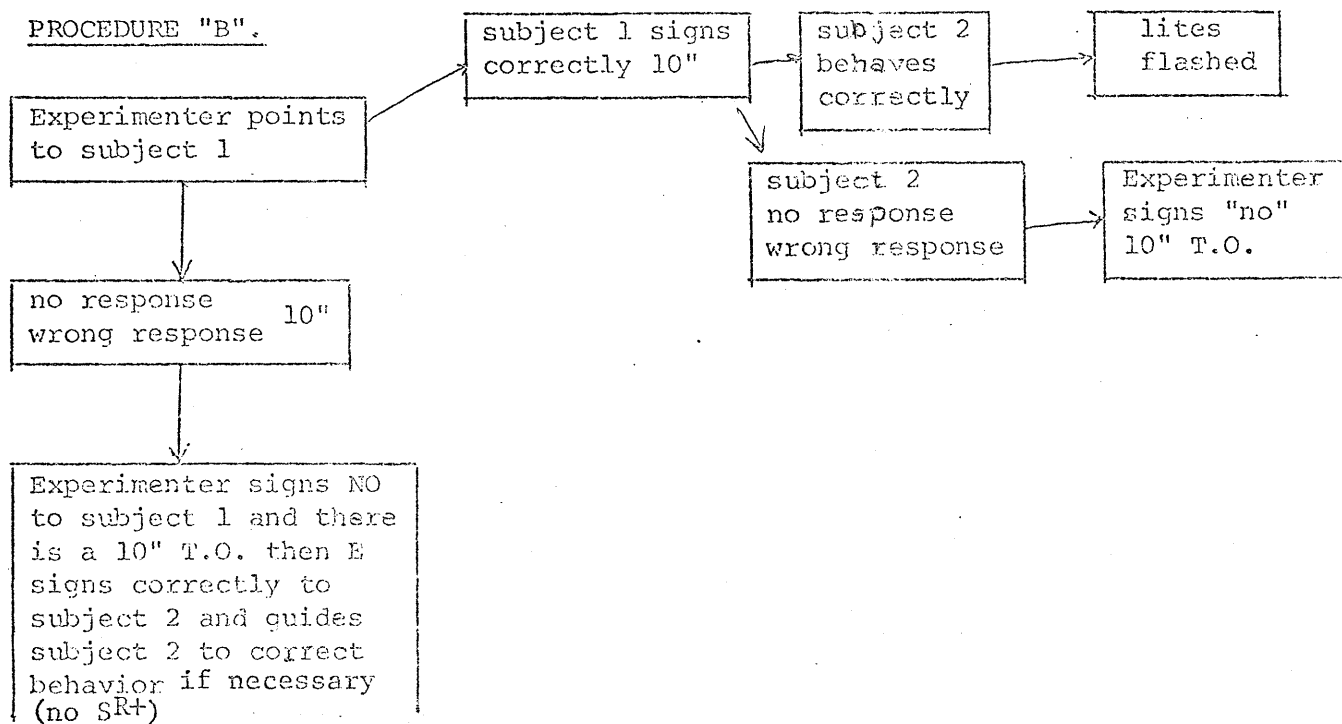
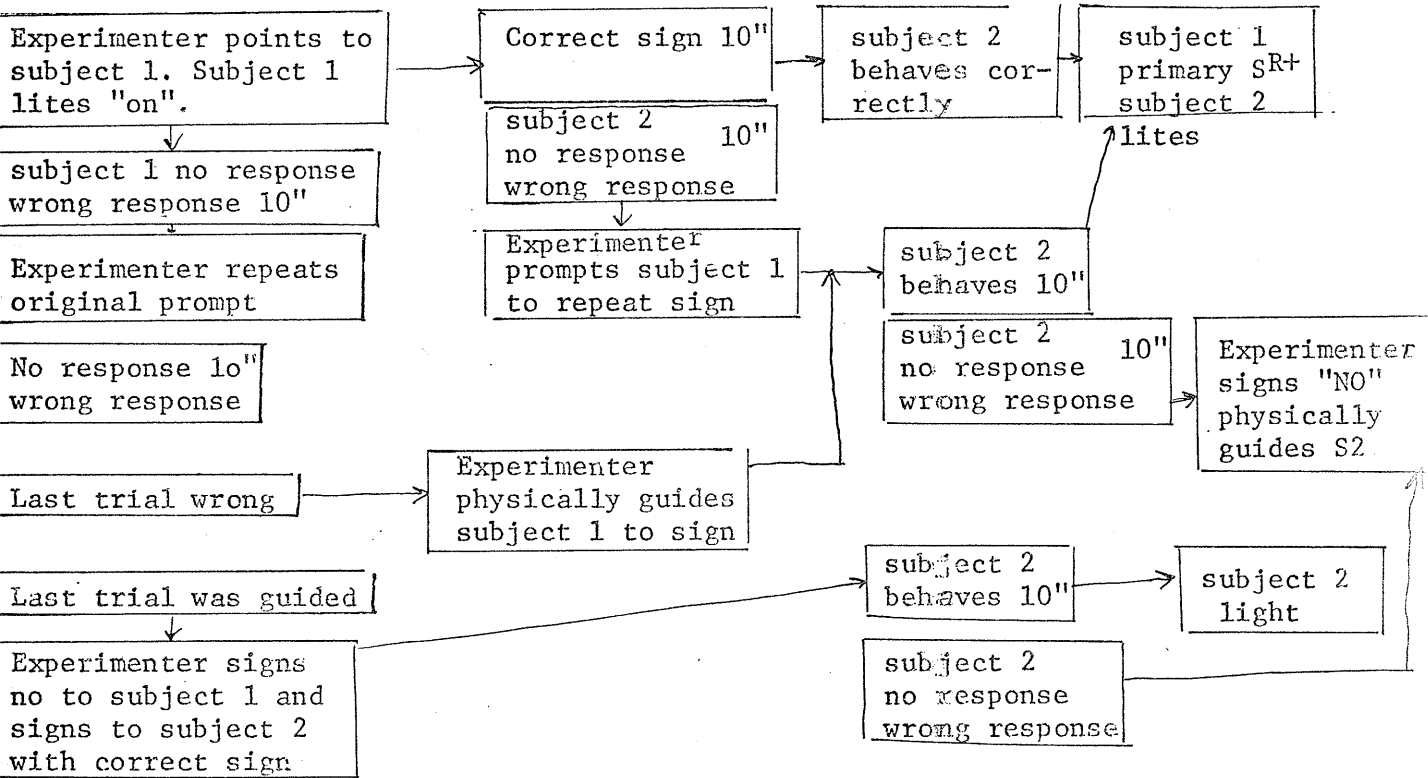
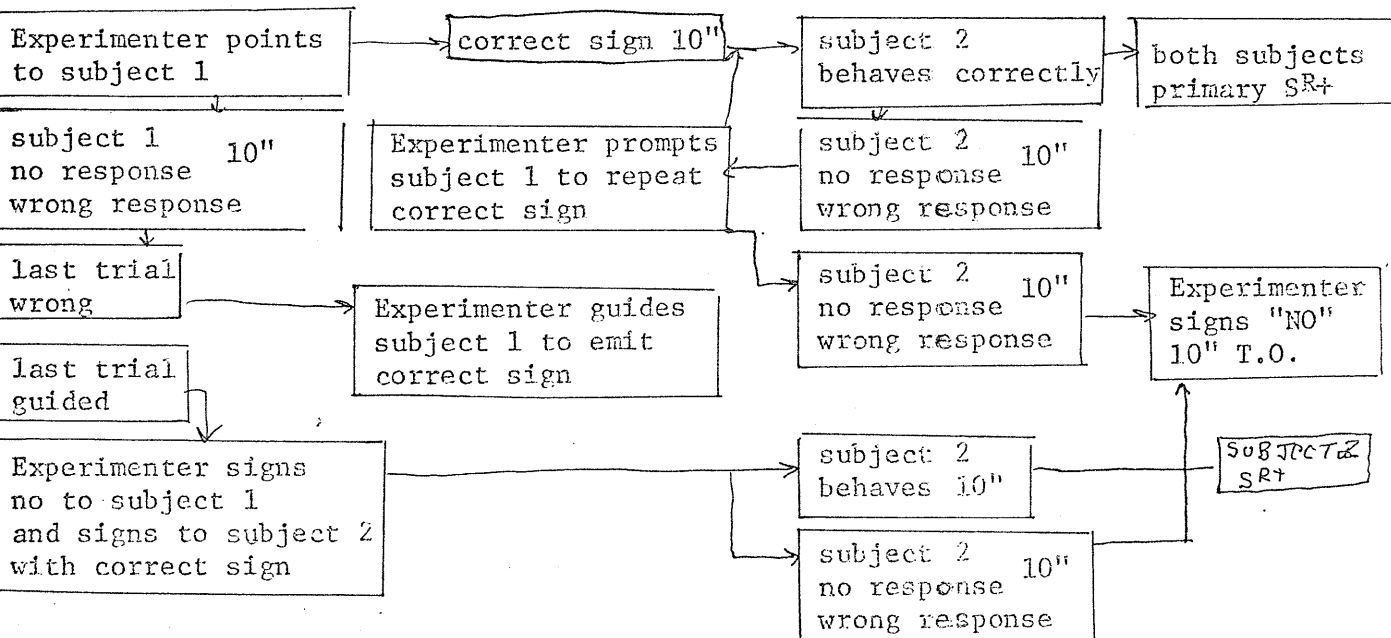


Table 4 Flow-chart diagrams of teaching procedures C<sub>1</sub> and C<sub>2</sub>.

PROCEDURE C<sub>1</sub> (TOKEN MACHINE)



PROCEDURE C<sub>2</sub> (NO TOKEN MACHINE)



trial. However, on opening trials the lights were also presented. Also after ten seconds of time-out or when receptive errors were made on a previous trial, lights would just be illuminated. By this procedure Dyad 1 experienced a further remedial twenty sessions of standing and sitting and Dyad 2 ten remedial sessions of standing and sitting.

Procedure C2 was most different from other procedures in that no machine was used at all. It was hypothesized that any signs being learned may have been under the stimulus control of the token machine. Procedure C2 sessions were, therefore, made up of seating both subjects facing each other, at various locations about the session room, with the experimenter appearing almost anywhere at any time after signaling the signer that it was her turn. In this way it was hoped to remove any stimulus control that may have been established over signing from the experimenter always being between the subjects and by the use of the token machine. By Procedure C2 Dyad 1 was taught give and take for twelve sessions and the last twelve remedial stand and sit sessions for Dyad 2 were taught by this method also.

The essential aspects of the teaching procedures were: under Procedure A, prompted expressive signs were reinforced only if a partner behaved, unprompted by the experimenter. Procedure B dictated that no prompts were given for expressive signs and reinforcement for correct signs was contingent upon a partner's appropriate response. When no sign was emitted however, receptive responses to the experimenter's sign were recorded as correct but not reinforced. During Procedure C1, up to two cues for the turn were presented but no sign prompts. Reinforcement was given individually for expressive signs. Receptive responses to an expressor's guided sign were counted correct and reinforced. Receptive responses to an experimenter's sign were counted correct but not reinforced. Under condition C2 these contingencies remained in effect except that no machine was present and

only primary reinforcement was used. Additionally, only one cue for the "turn" was given.

Thus, Dyad 1 reached a learning criterion for the words stand and sit three times after receiving forty sessions on Procedure A, twenty remedial sessions by Procedure B and twenty more remedial session by Procedure C1. Then give and take was taught for twelve sessions by Procedure C2. Using the same criterion, Dyad 2 was taught give and take for forty-three sessions by Procedure A, stand and sit by Procedure A for ten sessions, then by Procedure B for a total of thirty sessions and twenty-two remedial sessions of stand and sit, ten by Procedure C1 and twelve by Procedure C2.

#### Testing for Generalization of Acquired Signs to the Music Machine

General Procedure: The generalization sessions consisted of the experimenter monitoring subjects of a particular dyad from the observation room, and through video-tape recording, while they behaved in the music machine sessions previously described.

Each session involved three different "mini-session", each composed of sixteen trials, making one complete session of 48 trials. Each mini-session dealt with a different pair of responses on the music machine, but all responses gained the same reinforcers of approximately 12 to 15 seconds of music which was occasionally accompanied by an "M & M" candy. The three pairs of responses were "push" and "pull", "stand" and "sit", and "give" and "take". "Stand" and "sit" sessions required a subject to stand in the square taped on the floor on her side of the music machine, or to sit in her chair if she was standing when her turn was indicated. "Push" and "pull" sessions required either pushing or pulling the plunger in or out of the end of the machine where it was attached. "Give" and "take" sessions required the passing of a small wooden block from the indented sockets on either side of the box top in front of the subjects. The block was only

present for the give and take mini-sessions and the chairs for all three sessions, but moved to one side of the squares on the floor for the stand and sit mini-sessions.

After a dyad had been taught to work the device, and their sign training had begun, they were placed in a music machine session (consisting of all three mini-sessions) after every two sign training sessions. Once the sign training was complete for one set of signs, a dyad would only receive music machine sessions until generalization was achieved, with periodic training reassessment of their repertoire.

Testing During Sign Acquisition: During music-machine sessions after training on signs had begun, the experimenter no longer entered the room to prompt subjects and the following procedure was used. Each subject was given three opportunities to respond to the stimulus light with the correct music-machine behavior. These consisted of three ten-second light illuminations. If no behavior occurred, the partner's light was illuminated for three ten-second periods. A trial was defined then as three ten-second illuminations of a particular subject's light or a correct response, whichever came first. For Dyad 1 this procedure lasted for nineteen sessions and for Dyad 2, twenty sessions.

Removing Large Stimulus Lights: Once training on signs for the first set of signs for Dyads 1 and 2 were completed, the large stimulus lights on the music-machine were removed. This was to provide a need to mand whose turn it was. For Dyad 1, this lasted five sessions, but for Dyad 2 the lights were replaced for "irrelevant" mini-sessions (those not involving stand and sit). This manipulation was made after two sessions as the experimenter feared a total loss of the interest in the machine by the subjects due to a low level of responding. After five sessions, the lights were replaced for

both dyads for two sessions.

Forced Cooperation: The data at this stage of study showed that no generalization of taught signs had occurred and unequal responding on the music machine between partners of both dyads indicated that one subject in each dyad was taking a "free ride" by simply waiting out the ten-second lights and letting her partner do all the responding. Of several options available, the experimenter chose to simply force the turns. A contingency was instituted, therefore, such that when one subject of a dyad responded, both subjects were reinforced but then only a response from the partner could gain future reinforcement as a correct response. This procedure, with the large stimulus lights still present, was used for five sessions for both dyads and continued in effect with other manipulations thereafter. From this time forward in the study, all mini-sessions involving behavior related to the signs taught (for example, "stand" and "sit") lasted for 30 minutes, or 16 trials, whichever came first. The other two mini-sessions would last for 15 minutes or 16 trials, whichever came first.

Prompting the Dominant Partner: As forced cooperation did not produce generalization of the signs, it was decided to actually prompt the subject. One way of realizing that goal without losing the chance of seeing whether manding increased machine performance, was to only prompt one subject in each dyad. This was done by prompting the dominant partner (the subject with the highest response rate) from the observation room, with half of the one way window covered to prevent the partner from seeing the experimenter. Also, the partner's headphones were shut off so that verbal prompts could be used, but both partners could hear music reinforcement as headphones

could be switched back on after prompts were made. The prompts consisted of the experimenter illuminating the observation room (making the one way glass transparent) and saying to the prompted subject, "(Subject one), tell (partner's name) to (behavior)", while signing the correct sign and saying "do this". This condition lasted five sessions with each dyad.

Prompting Both Partners: No unprompted signs had been observed for Dyad 1, Elizabeth and Rita, when one subject, Elizabeth, had been prompted. It was therefore decided to prompt both subjects from the observation room. Also the large stimulus lights were removed to make the signs more "functional". The prompting procedure was the same as in the previous phase. For Dyad 1, both subjects' receptive responses also had to be prompted in this fashion. The same procedure was followed for Dyad 2 as with Dyad 1, with some success. The experimenter never had to leave the observation room, and no receptive responses had to be prompted. After six sessions Dyad 2 had reached a criterion of 50% of unprompted mands (signs) for both signs. Instruction of a new set of signs was begun with Dyad 2 at this point, but testing on the first <sup>w</sup>~~two~~ signs continued for several generalization sessions with prompting when necessary from the observation room.

Experimenter Present in Room and Prompting: With the experimenter prompting both subjects from the observation room no correct unprompted signs had been observed for Dyad 1. Therefore, the experimenter began to enter the room to prompt. This condition lasted for seven sessions.

#### Generalization Procedures During Remedial Training

Dyad 1: Four generalization sessions were conducted during the remedial training for Dyad 1 on Procedure B of stand and sit, (after sessions 14, 16, 18 and 20). In the first of these sessions no large

stimulus lights were used and for the remaining tests lights were present. The experimenter was not present in the room but prompted subjects through their headphones from the observation room using lights to illuminate the observation room. Six generalization tests were conducted during the next twenty remedial sessions of stand and sit taught using Procedure C1. These occurred after sessions 2, 4, 6, 8, 10 and after session 20. Responding on the machine was very low and stimulus lights were present indicating turn. There was no prompting of subjects during this phase. Three generalization tests were conducted for Dyad 1 during the twelve give and take sessions (after sessions 4, 8, and 12). The lights were present and there was no prompting.

Dyad 2: Dyad 2 received eighteen tests for generalization during the thirty stand and sit training sessions taught by Procedure C1. Eleven of these eighteen sessions were conducted during the generalization tests for give and take for this dyad. Four tests were conducted during the last ten sessions of C1 and during Procedure C2. These four were conducted after sessions 4, 8, 12 and 16. During these sessions the large lights were present and the experimenter remained in the observation room and no prompts were given.

### Reliability

Throughout the experiment numerous reliability measures were made for the various teaching procedures and for the different words taught to each dyad. These were collected by having a second observer who was instructed in the teaching procedure view a session via video tape and score the session just as the teacher would. Three different people acted as reliability observers. For Experiment One there were 13 such checks for Dyad 1 and 13 such checks for Dyad 2. These are



indicated in Figures 4 and 5 by the asterisks for the session which they were conducted. Scores were obtained by comparing whether there was agreement or not on each individual trial for each individual expressive and receptive behavior for each subject (refer to the data sheet in Appendix C), in terms of whether the behavior was marked correct or not. For any session there were a total of 48 possible agreements. The number of agreements were placed over disagreements plus agreements and multiplied by one hundred to get a percentage of agreement. These measures had a range of 50 to 100% with a mean reliability for procedures of 88% (Dyad 1) and 87% (Dyad 2). Generalization reliability was assessed in early phases of the study by a second observer viewing actual sessions on the video tape or video tapes of sessions, and recording whether or not machine behaviors and/or verbal behaviors occurred. These measures (four) were all 100%. Thereafter, any behaviors that did occur were kept on tape and viewed by an observer as to whether the signs had occurred. In this fashion, there was always 100% agreement as to whether sign language occurred or did not occur in generalization sessions.

### Results

An examination of Figures 3, 4, 5 and 6 accompanied by the outline of procedures (Table 2) gives the clearest picture of the results of this experiment. To begin with, Figures 3 and 4 demonstrate the acquisition of correct signs by the respective subjects and the receptive responses of partners to these signs in training sessions. The highest possible score for any behavior, expressive or receptive was six.

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Insert Figures 3 and 4 about here

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Figures 5 and 6 show the music machine responses of subjects from Dyad 1 and Dyad 2 respectively across phases, and the mean percentage of possible trials per phase on which taught signs were observed in the music machine situation.

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Insert Figures 5 and 6 about here

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These data represent the mean percentage of possible trials on which subjects engaged in the three sets of music-machine behaviors across phases. Behaviors are presented for each subject and superimposed over each of the music-machine bar graphs, is a dot indicating the percentage of generalization trials per phase on which the signs taught for those behaviors were observed in the generalization sessions. For example, because "push" and "pull" signs were never taught in Experiment One, no occurrence of "push" and "pull" signs were observed nor are they indicated (as a dot) in the graph under push and pull behaviors in Figures 5 and 6. However, because push and pull behaviors were required and emitted in the music machine sessions, the mean percentage of possible behaviors of pushing and pulling for each phase are represented for all subjects by their respective bar graphs.

Examination of the data for Experiment One reveals several interesting effects of teaching expressive and receptive signs concurrently. Additionally, these data indicate that the signing repertoires established under the various "prompting" conditions as provided by the four teaching procedures is very similar to an imitation repertoire under control of the teacher's prompts and the

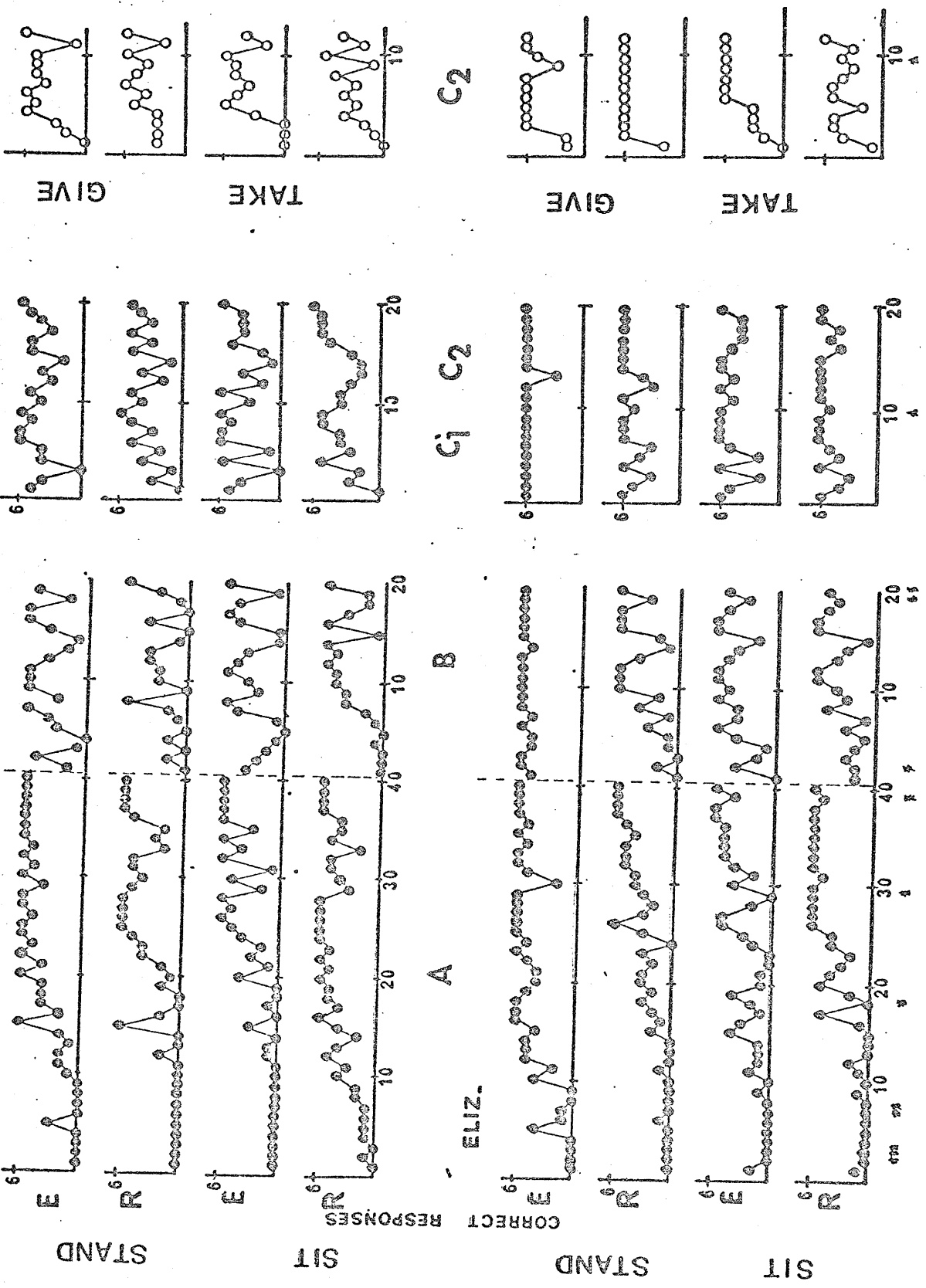


Figure 3 Frequency graph of correct expressive and receptive responses per session during acquisition of stand, sit, give and take for Dyad 1 across teaching procedures A, B, G1 and C2. Asterisks indicate sessions on which reliability measures were taken.

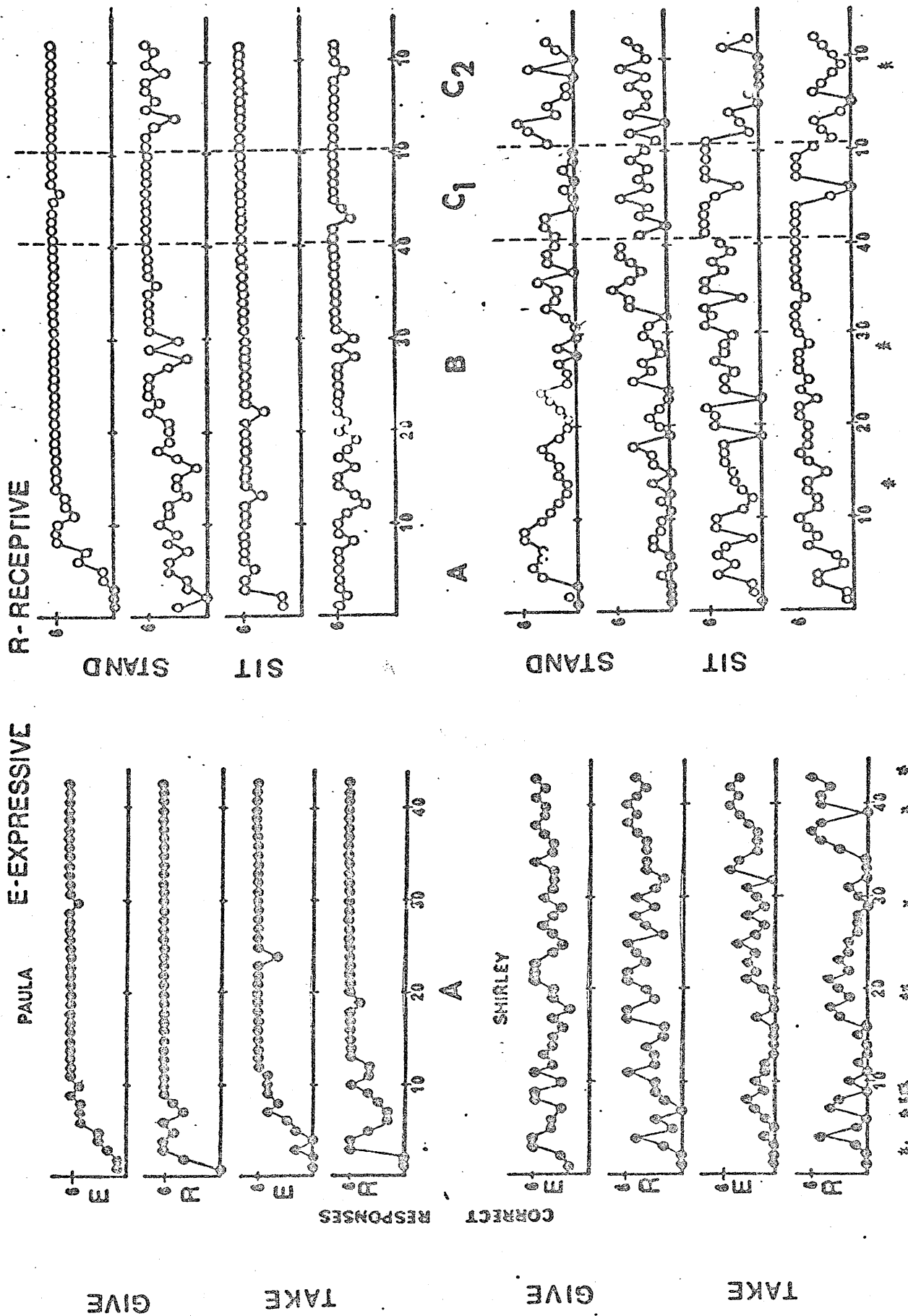


Figure 4. Frequency graph of correct expressive and receptive signs per session during acquisition of give, take, stand and sit for Dyad II across teaching procedures A, C1 and C2. A stepwise indicate sessions on which reliability was measured.

RITA

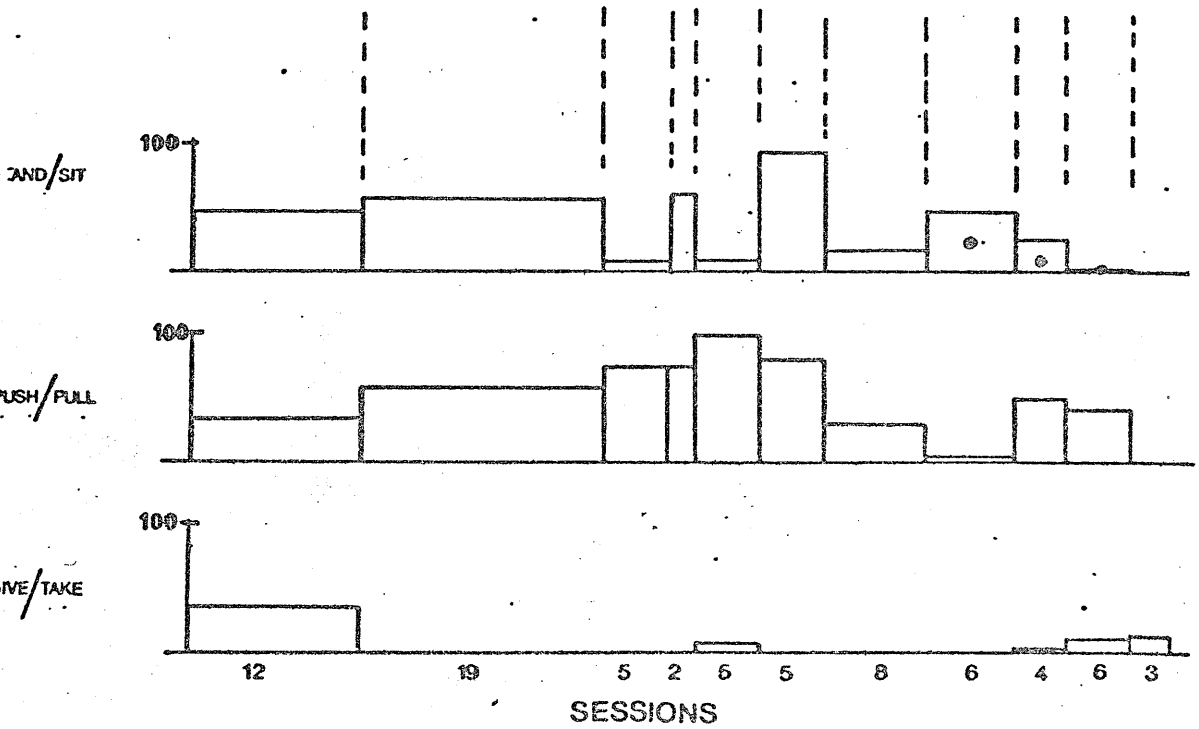
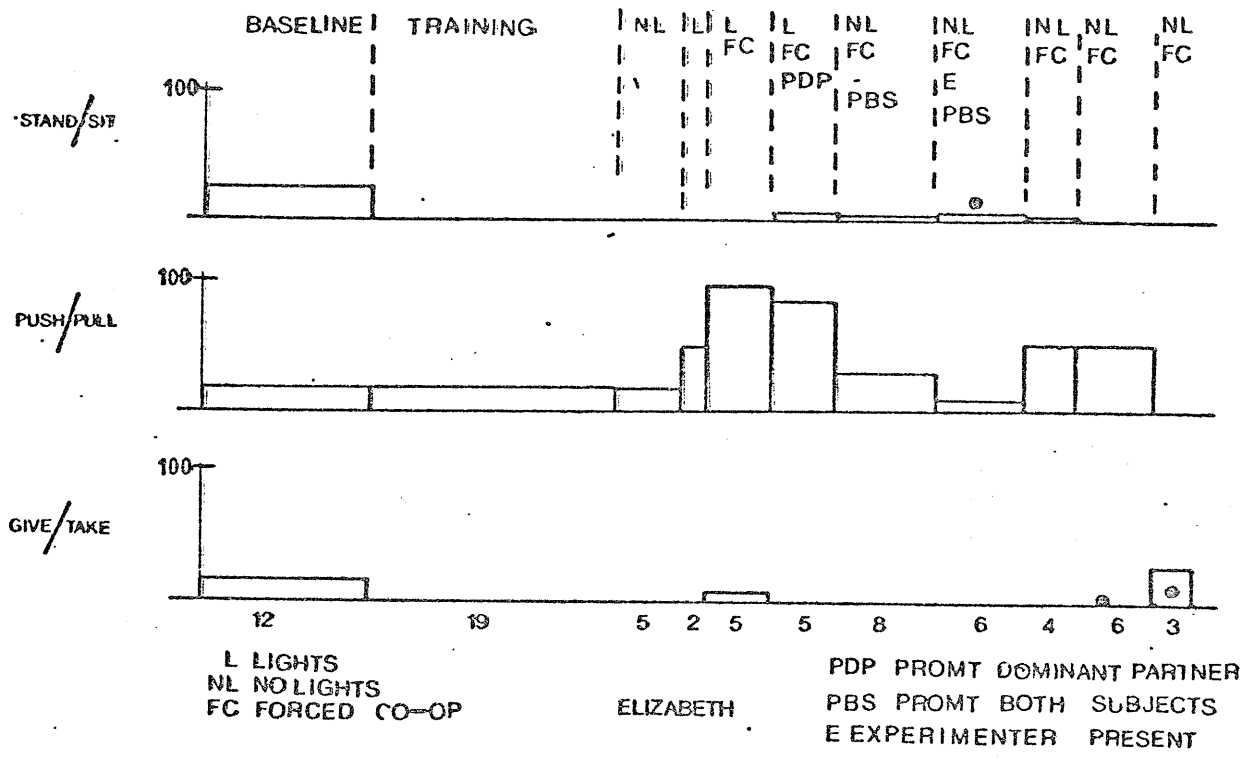


Figure 5. Mean percentage of possible correct music machine behaviors and observed signs across generalization phases for Dyad I. The dots indicate mean percentage of possible observed signs per session during generalization sessions for that phase.

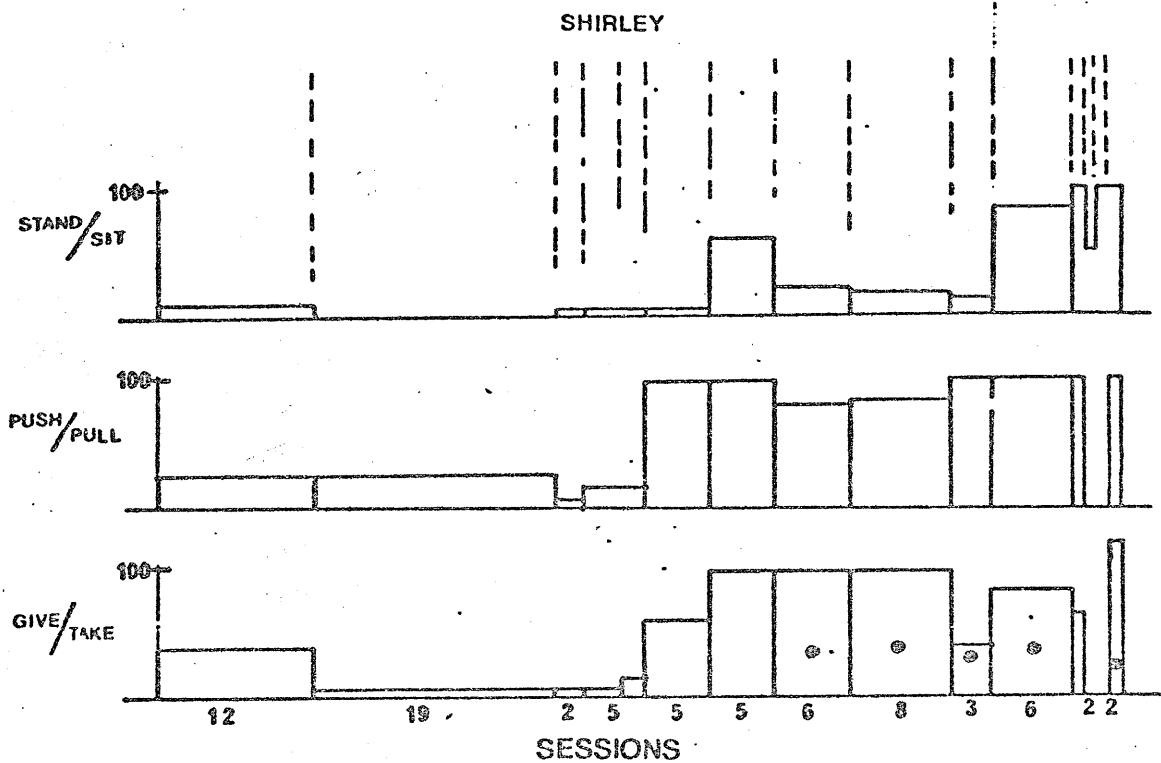
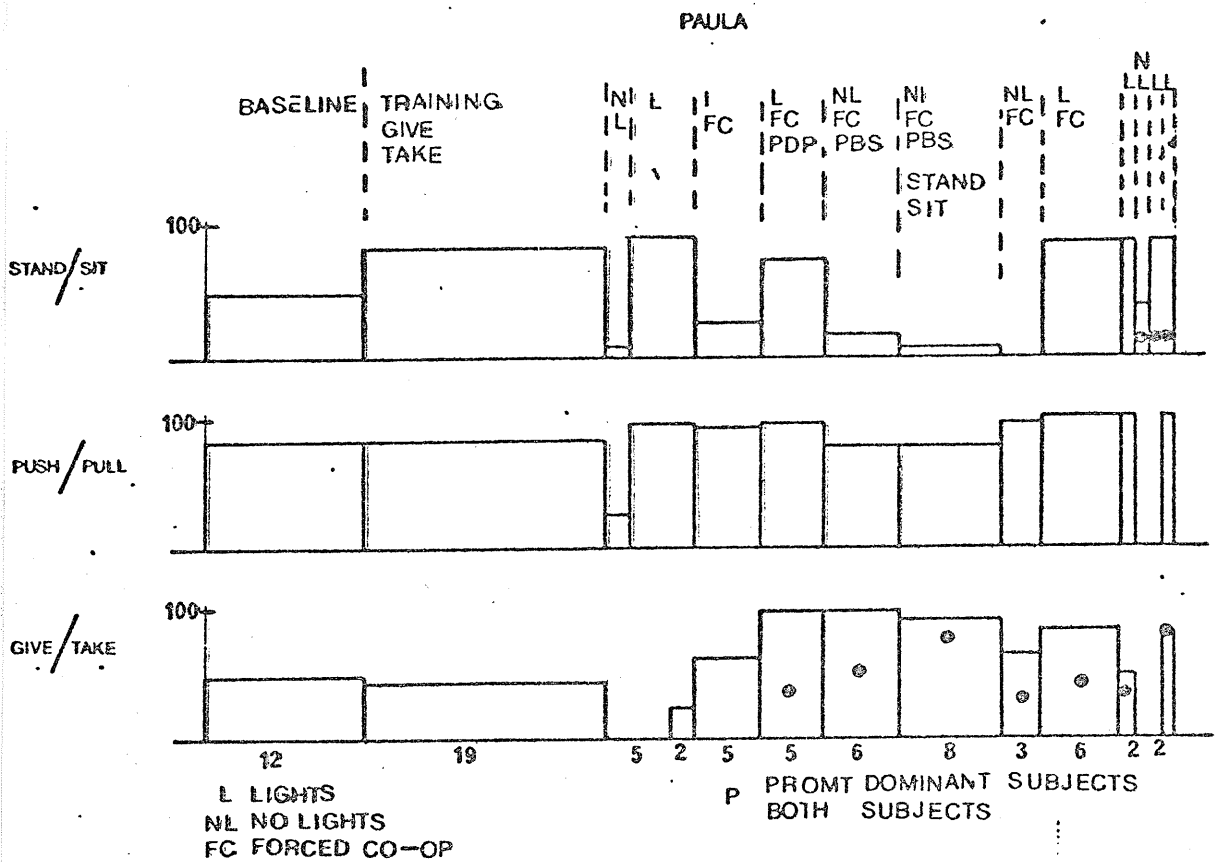


Figure 6. Mean percentage of possible correct music machine behaviors and observed signs across generalization phases for Dyad II. The dots indicate mean percentage of possible observed signs per session during generalization sessions for that phase.

experimental teaching conditions. This is supported by the lack of generalization of learned responses to the music-machine situation, when the experimenter is not present but the sign language behavior is "functional" for gaining reinforcement.

Acquisition: Figures 3 and 4 show that under teaching procedure A (where prompts for expressive signs from the experimenter are the signs themselves) all subjects eventually acquired these signs. When procedure B was introduced, and no prompts (signs) are emitted by the experimenter, the graphs in general show that correct responses are lowered at first and then increase again for some signs for all subjects, while other signs remain unstable. These changes indicate the control of the experimenter's prompts over these behaviors. Control of the token machine over correct responding can be seen on these graphs when Procedure C2 is implemented after Procedure C1, for most expressive and receptive responses of Rita and Shirley, and to a lesser extent for Elizabeth. Paul's behavior seems relatively unaffected other than for receptive standing.

Under Procedure A receptive responses could only be to an expressive partner's sign (prompted or not); under Procedures B, C1 and C2 receptive responses could also be to an experimenter's sign, although these were not reinforced. Under Procedure C1 there was no contingency for the receptive partner to respond to the expressor's sign in order for the expressor to receive reinforcement; in procedure C2 there was such a contingency. These data show that in general, under condition C2, receptive responses stabilize and increase, in comparison to the previous condition. These effects

are confounded by the removal of the token machine in condition C2. Teaching procedure C1 is the only condition where expressive signing could be reinforced regardless of the partner's behavior. Examination of the graphs shows that in general (except for Shirley's standing sign) there is an improvement in expressive signing during this condition.

### Generalization

The generalization data demonstrate several important features. Firstly, although sign language was acquired in the teaching situation, it was not observed in the music-machine situation until the experimenter was present (Dyad 1, Figure 5) or until there was a contingency (forced cooperation and no turn lights) and verbal prompting by the experimenter (Dyad 2, Figure 6). After subjects were prompted to emit signs in the music machine situation, unprompted signs were observed.

The effects of the cooperation contingency in the music machine situation is demonstrated by the control over responding on the music machine by the various manipulations of removing turn lights and forcing turns to alternate (note increases in Rita's and Shirley's music machine behaviors in Figures 5 and 6 respectively). However, whether signs would have been observed had the experimenter been present in the generalization situation without such manipulations having been made, is not known. Additionally, the importance of differences in reinforcers in the two situations is not clear.

A major feature of the generalization data is that the signs give and take generalized (Dyad 2) without the presence of the experimenter. Although stand and sit signs were observed to be emitted by Paula, this was not until much more teaching and by



different procedures (C1 and C2) than those for give and take (Procedure A), which she learned and which generalized. Also Dyad 1 learned give and take signs much more rapidly than they did stand and sit signs and Rita emitted give in the music machine situation. However, give and take signs were taught by Procedure C2 for this dyad. Therefore, although no conclusive statement could be made as to the relative importance of some feature of the signs "give" and "take", or the differences in Procedures A and C2, certainly some insight into various possibilities is gained from this data.

## DISCUSSION

A major goal of Experiment One was to explore the possible utility of cooperative contingencies for the acquisition of sign language mands which did not specify a reinforcer directly, but which were functional because they provided cues for a partner's behavior in a cooperative speaker-listener relationship. The observation of dyadic subjects' interactions as a function of the manipulation of several variables in a separate situation (the music machine), provided some interesting information. In particular information was gained as to the possible utility of cooperation paradigms for promoting the generalized occurrence of learned mands in a situation where such behaviors are functional. Although some peer-peer sign language was acquired by subjects, and was observed to occur in a separate environment from teaching, performance deficiencies in both the acquisition and generalization situations, indicate that procedures such as those used can be quite cumbersome. However, the results also indicate that this general approach, with some refinements, could be very useful.

In general, the results of the present study exposed the problems inherent in teaching expressive and receptive sign language concurrently. "Audience control" of the experimenter over expressive and receptive mands may have been the result of the experimenter prompting subjects to respond in training. The prompting, by emitting signs or otherwise cuing behaviors was considered necessary for preventing extinction of subject's responding as A) a receptive repertoire was not present in subjects to maintain a partner's expressive signs, and B) the expressive signs required prompting or guidance (in early trials at least), and some "cue" in later trials. The resultant repertoire established functioned in a similar fashion to an imitation repertoire in that some subjects

would imitate signs from the experimenter or a partner instead of responding receptively by emitting the appropriate behavior (such as standing for example). Additionally, appropriate signing was observed to be very much under the control of the presence of the experimenter (or his prompts), the reinforcers available in the training situation, and/or the token machine teaching apparatus (see, for example, Figures 5 and 6, Procedures C1 and C2).

The results of the generalization manipulations, demonstrated the difficulty involved in providing an environment in which the behaviors of cooperating subjects for acquiring reinforcement, under the stimulus control of that cooperative situation, can be arranged to function as the previously taught receptive verbal behavior, under control of an expressive partner's mand. Information other than of a general nature was not obtained. This was due to the lack of clarity in the focus of control of the verbal repertoires acquired in training and the relationship of that control to other variables in the generalization situation (such as forcing cooperation, removal of turn lights, or the presence of the teacher). The other variables in the generalization situation were operating in such a way as to effect behaviors which topographically were the receptive verbal responses of the training situation.

The effects of removing "turn" lights from the music machine and forcing cooperation, demonstrated by the variations in the non-taught behaviors of push and pull along with the behaviors associated with taught signs, indicates that there was no contingency for subjects to partake equitably in music machine responding prior to such changes. Thus, there would have effectively been little or no motivation to communicate with a partner in order to prompt her behavior.

Although it is not known if taught mands would have been observed from subjects prior to this manipulation, if the experimenter had been

present, it is interesting to note that those subjects who did partake in the cooperation game the most (the dominant subjects) were those whose manding generalized the most.

Unfortunately, the stimulus control of the small turn lights over music machine responses was in doubt, as the removal of the larger stimulus lights reduced and disrupted appropriate responding. Often, when the small lights alone were illuminated, subjects would respond by emitting music-machine responses instead of waiting for the partner to behave (whose turn it was, as indicated by the light). Thus, the cues controlling music-machine behaviors were not established well enough to fully determine the function and therefore the utility of the cooperation contingencies for promoting the occurrence of the learned mands. However, some manding by some subjects was observed to occur such that it was functional in getting a partner to "take her turn".

The fact that verbal behavior, learned elsewhere, was established at all in the music-machine situation indicates that cooperation contingencies may have some potential for promoting generalized mands. One obvious extension of the present effort would be to teach mands in the actual cooperation game (or ward situation) and investigate generalization of mands to similar situations and other peers. The present results also indicate that cooperative behaviors in such a situation should be well established before expressive verbal behaviors are faded in to control their occurrence as receptive verbal behavior. Thus, by establishing such behaviors first, they would not have to be taught separately in training. Also, by establishing receptive responses before expressive responses, the observed problems of the present study could be avoided.

EXPERIMENT TWO

In the first experiment, one dyad (Dyad 2) acquired the signs "give" and "take" with minimal prompting, and were observed to spontaneously emit these signs in a functional situation (the music machine). One subject of this same dyad (Shirley) did not acquire the signs "stand" and "sit" within a comparable period of time as she did the first signs. Although this subject did not emit the signs on the music machine, her partner Paula did emit the signs spontaneously once or twice. The other dyad (Rita and Elizabeth), although learning the signs stand and sit, by a variety of procedures, never emitted these signs on the music machine unless the experimenter was present and prompting them. This dyad learned the signs give and take much quicker than the first signs, but only one subject emitted one sign once on the music machine spontaneously. Whether the experimenter's presence and/or prompting would have produced the signs is not known. The cost of gaining more information seemed too great when weighed against the benefits of another experiment. Thus a second experiment was undertaken to examine the acquisition and generalization of mands that specify an actual reinforcer as opposed to mands that specify another's behavior which is associated with reinforcement. It was speculated that the relatively better performance for both dyads on give and take may have been due to the presence of the block of wood (manipulable object). It may be that mands specifying tangible objects may be acquired and generalized quicker than mands such as "stand" and "sit" which only specify a behavior of a partner and in that sense are more "abstract", in the sense that the behavior of the listener is not directly associated with reinforcement

as when a tangible object is present to manipulate.

The second experiment was designed to monitor the acquisition and generalization of mands that specified specific reinforcers as opposed to a listener's behavior which was somehow related to a reinforcer. These mands were denoted as "primary mands", as they typically described an actual reinforcer. The generalization of the mands taught was monitored in the daily noon mealtime situation in which the mands would be functional.

#### METHOD

##### Subjects

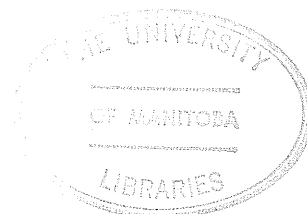
The same two dyads as participated in experiment one, participated in experiment two. Although they remained in their respective dyads for analysis, they were taught individually for this experiment.

##### Apparatus

The signs chosen for experiment two were "food", "fork", "drink" and "spoon"; these signs can be seen in Table 1. Two of these signs specify reinforcers and two of these signs specify objects needed to consume reinforcers. New data sheets were devised to record daily sessions and generalization data to the daily lunch situation. Kitchen utensils and small portions of the daily lunch meal were utilized in training the four signs. The sessions were conducted in separate classrooms from those in the first experiment. Video equipment was utilized to make a demonstration film of the teaching procedure and generalization of behavior.

##### Procedure

General Procedure: In this study two new experimenters were used, thus a total of three experimenters participated, each of the two new



experimenters teaching all four signs to one subject each, and the original experimenter teaching all four signs to two of the subjects. The general procedure was to run one session per day with each subject and to test that subject each day at lunchtime for the generalization of acquired signs to the new situation and the new experimenters. Sessions were run about ten to fifteen minutes before lunchtime using the food of the day to teach one of the four signs. The signs taught each subject and the order of teaching can be seen in table one.

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Insert Table 1 about here

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The general procedure was to gather together the objects and data sheets necessary for running the sessions and then to secure the subject. The subject was taken to a classroom and placed in a chair across a table from the experimenter such that the experimenter was easy to attend.

Specific Training Procedure: Each day every subject received ten training trials for a specific sign taught by a specific procedure. The individualized procedures follow below. Regardless of the word being taught, each trial was conducted according to a "master procedure" which each experimenter was given in flow chart form and learned. This flow chart can be seen in table two.

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Insert Table 2 about here

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Food: The reinforcer used to teach this word was the food of the day. The child was always made to use the proper utensil (for example, a spoon or fork) for specific foods. If necessary, food such as meat

TEACHING ORDER OF SIGNS

Subjects				
Rita	DRINK	SPOON	FOOD	FORK
Elizabeth	FORK	FOOD	SPOON	DRINK
Paula	SPOON	DRINK	FORK	FOOD
Shirley	FOOD (eat)	FORK	DRINK	SPOON

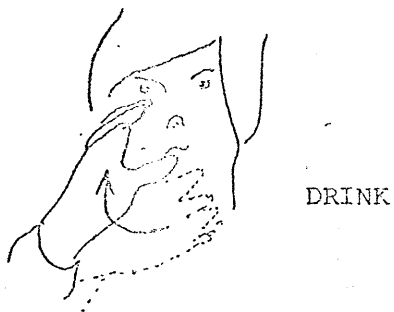
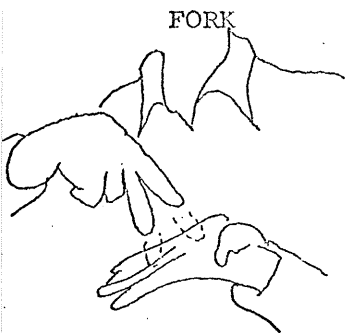
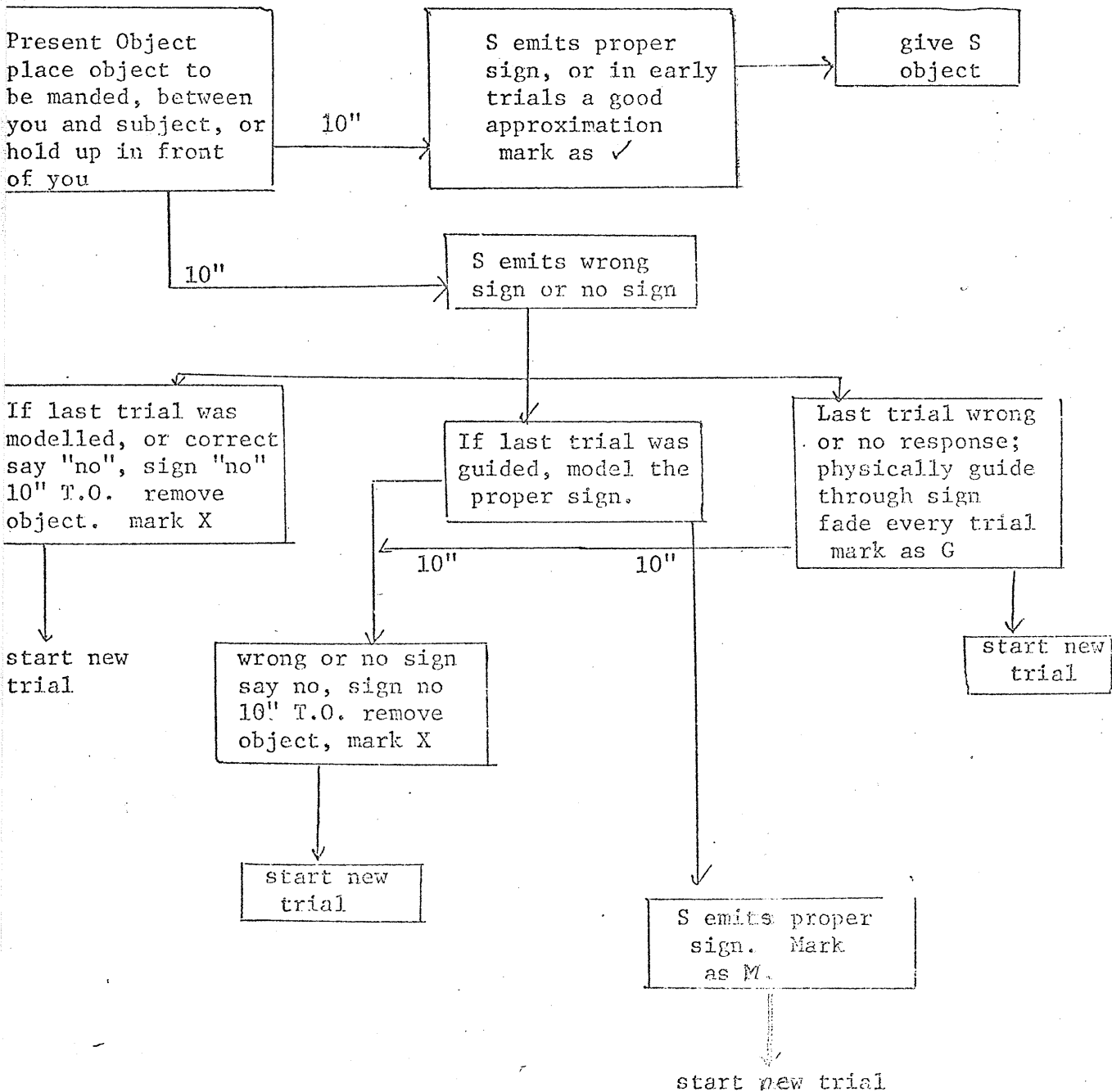




Table 2

## Teaching procedures for teaching the mealtime signs



was cut prior to a session commencing. Having determined the proper utensil for that subject for that food for that day, the utensil was placed in front of the subject and one bite of the food or one mouthful was placed on a small plate and held up in front of the subject, to begin the first trial. Attempts to take the food with the fingers were not allowed.

Drink: The reinforcers used to teach drink were milk or any kind of fruit juice. Using a regular kitchen glass, a small amount was poured into a separate glass to be used on each trial (one mouthful). This small mouthful was then used to start a trial.

Fork: A small supply (one bite) of the daily food was placed on a plate and placed in front of the subject, keeping the main supply of food out of reach of the subject. A verbal prompt and gesture were given in early trials for the subject not to touch the food with her fingers, although this was rarely a problem. A training trial would then be commenced by holding up the fork between the subject and the experimenter with the subject attending to the experimenter. The flow chart procedure would then be followed.

Spoon: The same procedure as was used for fork was used for spoon except that the food used was the daily luncheon soup. All trials for all words were marked as correct, guided, modeled or wrong, as indicated in the flow chart.

#### Generalization Procedures:

Generalization sessions were conducted at the noon meal immediately after training sessions each day in the dining room of Cedar Cottage, where the subjects lived. All subjects and most of their peers had previously

been taught to pick up their eating utensils and a food tray and then pick up their lunch (food, soup, beverage) from a display table in the dining room (much like any self-serve cafeteria). Once they had secured their meal items on their tray they would proceed to any free table in the dining room and eat their lunch. There had never been any contingency for any of the girls at Cedar to ask for any of these items, as they were always merely available for the girls to take. Typically, an aide of the cottage would stand near the food counter and correct girls who took more than one eating utensil or prompt girls to take items they may have missed. At no time were any girls required to ask for any item.

After every training session each subject went to lunch with the peers she normally ate with, where a generalization procedure was followed until generalization was seen to occur in three situations.

- 1) When the child would enter the dining room she picked up her utensils and food and sat down and ate. The first test was merely presenting the child, who previously had been handed everything, with the object in question being held by the experimenter who taught the sign for that object. If no response occurred within ten seconds, the object was given to the subject and the next item was tested.
- 2) Once a child had sat down and was eating her lunch the same experimenter would approach the subject at her table and, removing all items, would hold up each item taught for a ten-second period awaiting a response. If no response was made the item was placed on the table and the experimenter would leave.
- 3) Once every meal the experimenter would test another child on any signs that they had been taught at their table during lunch. In this way each of the experimenters were used to test learned items taught by the other experimenter with the original teacher as a reliability check.

Thus, each day each subject was given the opportunity to ask for

some mealtime object by emitting the signs she had learned or was currently learning in the sessions from her signing teacher. Each child was also tested at her table by her signing teacher while all items were present in front of her. Finally, each child was tested at her table by a different experimenter to see if she would emit the signs for the objects she was learning or had learned. For this third and last test the first experimenter tested the subjects taught by the other two experimenters and each of the other two experimenters tested each of the subjects taught by the first experimenter.

Specific Procedures: The specific procedure for testing each sign were a) in the line up for the first situation the experimenter would allow the subject to take all items as usual except the items to be tested (example, fork). Then, before proceeding "down the line", the experimenter would hold up the item in question. If the subject signed correctly or with a good approximation, the item was given to the subject. If no sign was observed within ten seconds, the item was placed on the subject's tray and the experimenter walked away or moved down the line to test another item (example, food).

In the second situation when a subject was seated at a table, the experimenter would approach her and sliding her tray away would present an item to be tested just like in a session. If no sign was observed within ten seconds, the experimenter would place the item on the tray and test another item. When testing was finished, the tray was given back to the subject. Any items signed by the subject were immediately given to the subject. An attempt was always made to test items in such an order as to enhance their functionality (example, food would be tested first, and then fork). In the third test, the new experimenter

would follow the same procedures used in the second test by the regular sign teacher. By these procedures each child was tested prior to training to observe that no vocalizations or gesturing were being emitted prior to the experiment.

Learning Criterion: A sign was considered learned if it was emitted for ten correct trials in a row or three days in a row. That is, after thirty consecutive responses.

Generalization Criterion: A sign was considered to have spontaneously generalized when it occurred without prompting by experimenters in each of the three testing situations on the same day. Thereafter, if a learned item that had been seen to have generalized did not occur in the dining room after ten seconds, the experimenter would hold up the item for an additional thirty seconds. If a subject still did not sign appropriately to gain the item, the experimenter would prompt by modelling the sign for the subject.

Reliability: The reliability of the teaching procedures were assessed by one experimenter observing the others doing one session via a one way mirror. Each experimenter was observed once for their subjects and all reliabilities were 100%. Once a behavior had generalized, no formal reliability was measured as the signs were very obviously occurring or not, even though some were approximations. It was felt the video tape demonstration would provide enough reliability for these signs as to whether they were occurring or not occurring in the generalization situation.

Probe Procedure: During acquisition of the second sign, all subjects showed a tendency to emit the signs that they had learned earlier. Thus, for Shirley, it was decided to teach the item "fork" contingent upon her emitting the new sign, "food". Thus while learning "fork", Shirley also

emitted the sign food for every trial. This was only conducted for "food" and "fork". Also for Shirley, who later proved to learn at a very slow rate, any hand movement to the mouth quickly turned into a sign for food. For this reason, the sign for drink was changed for Shirley to a flat hand held under the chin as shown in Appendix D. During later trials for spoon, Shirley demonstrated a great deal of confusion and could never differentiate between pointing at her palm (fork) and brushing it upwards towards her lips (spoon). Shirley never did emit spoon with the appropriate topography from fork and food. The topographical similarities were apparently too close for her to discriminate.

Test for Receptive Repertoire: Late in the training of all words for all subjects a test was conducted by the first experimenter to test the receptive components of the vocabularies that had been established. The experimenter would approach the subject at her table after testing in the routine way and emit the sign for give and then the sign for each of the four words. The experimenter would then observe the subject's behavior. After waiting for ten seconds, if no response was emitted, the procedure was repeated. This test was conducted with all four children twice.

### Results

The results of Experiment II are illustrated in Figure 1, which shows the cumulative acquisition rate for all four signs for each subject.

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Insert Figure 1 about here

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The generalization of these signs to the mealtime situation is also shown

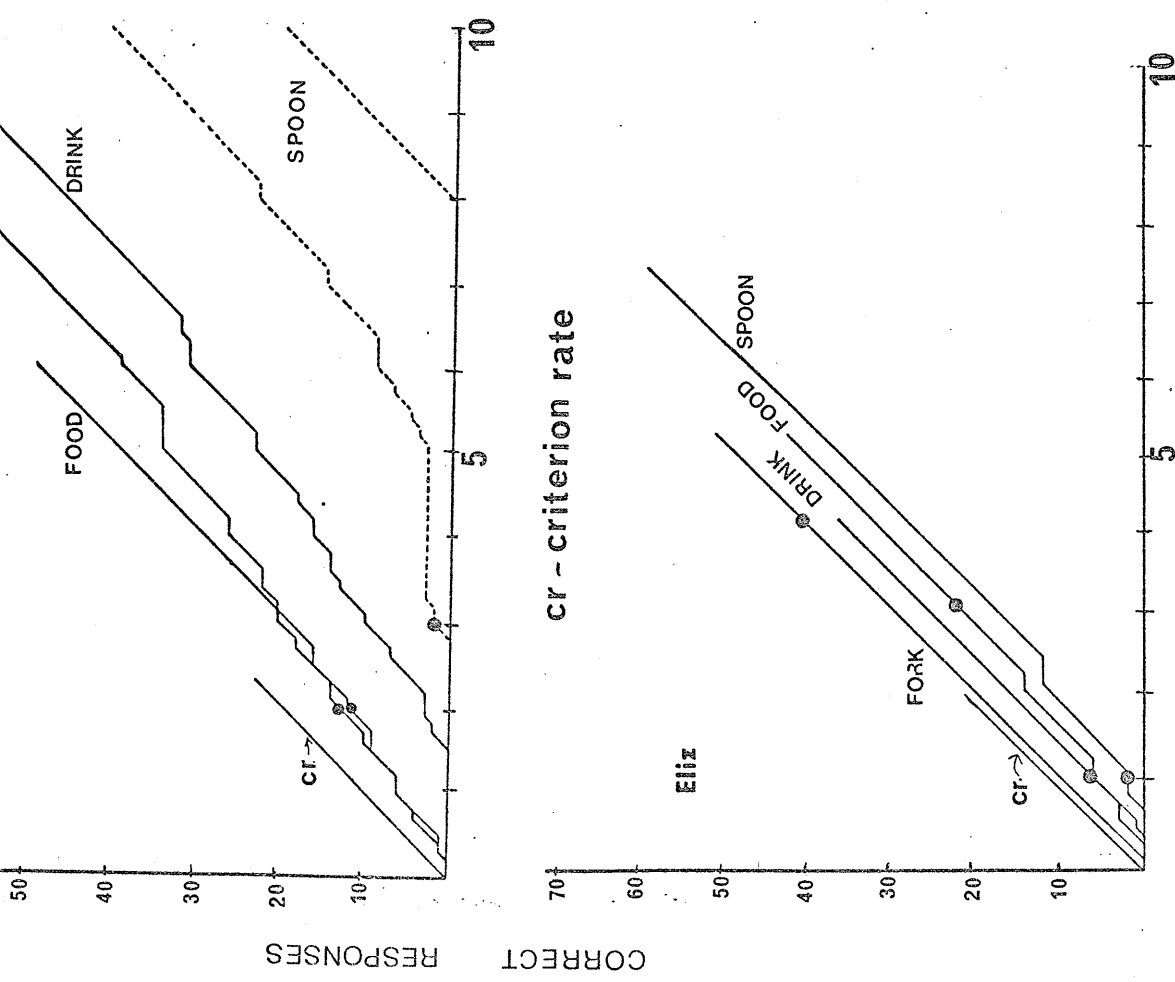
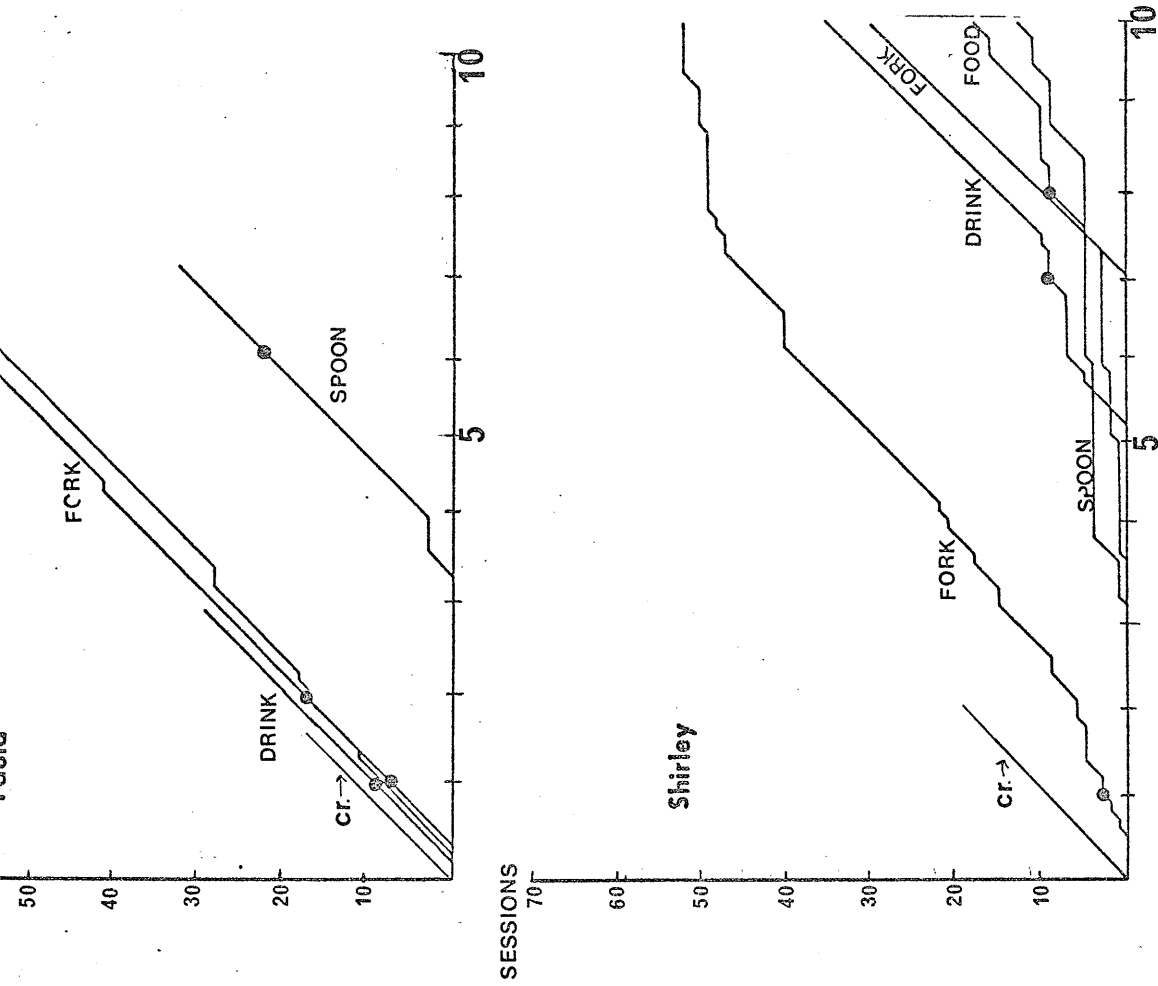


Figure 1. Cumulative correct responses across teaching sessions for all four subjects for mealtime words. Dots indicate the point in training when generalization to the dining room was observed.

on these graphs by a dot, when it occurred.

Dyad One: Figure 1 shows the cumulative correct responses of Rita and Elizabeth for all four mealtime words. The final rate in all cases being approximately a 45° slope due to the imposed ten trial per session restriction. From such a graph one can see the speed of acquisition quite clearly. Spoon was acquired slower than drink in terms of cumulative trials to terminal rate. Food was learned slightly quicker than fork with both of these reaching terminal rate sooner than the first two signs. The point in acquisition where generalization to all three tests occurred were shown. Drink did not generalize spontaneously until the ninth session day. However, subsequent signs generalized almost immediately in terms of the opportunity for them to occur only coming after ten trials. Note that later learned signs generalized quicker than earlier signs. For Elizabeth, all signs were acquired very rapidly with terminal rates being evidenced very early. For Elizabeth, "fork" was learned first and was also the quickest to reach criterion. This sign generalized after four sessions. Food was taught next and generalized after three sessions, spoon was third, although criterion was not met until later than any of the other words (seven sessions). These signs generalized on the very first opportunity in the lunchroom. Similarly, drink generalized on the first test and acquired terminal rates sooner than food or spoon, but slightly lower than fork. Thus, dyad one acquired the signs in much the same order with spoon being learned slowest and Elizabeth achieving the terminal rate in acquisition and generalization quicker than Rita. However, both children demonstrated the same phenomenon of generalizing signs sooner as they were learned regardless



of the kind of sign (food versus object).

Dyad Two: Figure 1 also shows the cumulative correct responses for the mealtime signs and their generalization for dyad two. As seen in figure 1, Paula achieved terminal rate almost immediately for the last three signs once she had learned the first sign (spoon), which was the slowest to be learned. Generalization of spoon occurred at the sixth test and her first opportunity for drink and food on the second test and the second test for fork. Shirley did not achieve terminal rate for food for thirteen sessions (off the graph) and similarly, for fork (thirteen sessions) and drink (eleven). Spoon was not learned by Shirley after thirteen sessions. Shirley did show the same pattern of generalization as the other subjects in that later signs generalized at earlier opportunities than did later signs. Having emitted the signs correctly in sessions at all seemed to be the only prerequisite for the sign to generalize spontaneously to the lunch time test. Thus, Dyad 2 followed the same general pattern as did dyad one, in terms of acquisition rate increasing as signs were acquired and generalization of these signs coming sooner with each learned sign. As signs generalized in most cases the generalization occurred as soon as the opportunity to generalize was presented.

Receptive Repertoire Results: Of all four children, Paula, from Dyad 2 would correctly hold out the correct object to the experimenter when the experimenter signed give and the object in question for all four items. Elizabeth on one occasion held up her spoon and her glass, the other subjects only repeated the signs to the experimenter on both of the testing occasions.

Additional Results: Throughout this experiment many other side effects were observed by the experimenter and the ward staff. The most striking occurrence was on prompting Elizabeth for fork (only after she had learned spontaneously to generalize this sign), Elizabeth would emit error responses in the lunch situation later on in training as more responses were learned; thus, when the experimenter would hold up an item Elizabeth would emit all the signs she knew. A few remedial sessions outside the lunch situation once the signs were trained established good stimulus control over the responses by the objects. Prior to this training, however, the author was prompting Elizabeth on one occasion to sign "fork". Elizabeth persisted in signing "spoon". The experimenter in exasperation, finally said, "No Elizabeth. Say 'fork'", while holding up the fork. At this point Elizabeth, who had previously never been known to verbalize any words clearly said "fork" verbally and signed "fork". The other two experimenters and several ward staff were present and observed the same phenomenon.

Paula would often hold up objects to any of the experimenters and sign the objects (tact) them spontaneously while laughing. She seemed very pleased to be able to identify things. On one occasion, in another room where the experimenters kept data, Paula, on entering the room signed drink and pointed to the corner of the room. The two experimenters present in the room noticed a tin of Coca Cola in the corner, which Paula was immediately given. In addition to the mealtime signs Paula acquired a goodbye wave and a goodbye kiss (throwing a kiss) taught to her by one of the experimenters. During the course of the mealtime experiment Paula also began to clearly verbalize "yeah" and "no".

Although she had been known to make noises and to nod her head yes, there was a clear increase in the frequency with which she would verbalize these words. Unfortunately, no hard data measures were taken on these before the experiment, and the actual increase is not known. After Paula had learned "spoon", her first sign, and the behavior was seen at mealtime, Paula also was observed by ward staff to emit "spoon" while given a cup of coffee in the T.V. room at her cottage when sugar needed to be added to it. Unfortunately, the staff thought she was saying thank-you, and stirred her coffee for her rather than just giving her the spoon. In either case Paula got her coffee sweetened by her verbal behavior.

#### Discussion

A comparison of the rate of acquisition and generalization of signs taught to the same subjects in Experiment Two as those taught in Experiment One show glaring differences. Such a comparison for each dyad can be seen by referring to Figure 2 .

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Insert Figure 2 about here

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In these figures the bar graphs provide a measure of three phenomena. The height of the bar (the solid line) is the number of sessions until a learning criterion of thirty correct consecutive responses (the mealtime criterion) was achieved. The dashed line indicates at which point six consecutive responses were observed in training (the Experiment One criterion). The combined dashed and dotted line indicates at what point generalization occurred spontaneously to another setting where the behavior was functional. Clearly, the mealtime situation was better suited for generalization of the words taught in experiment one. For all subjects except Shirley, the second music machine signs learned reached

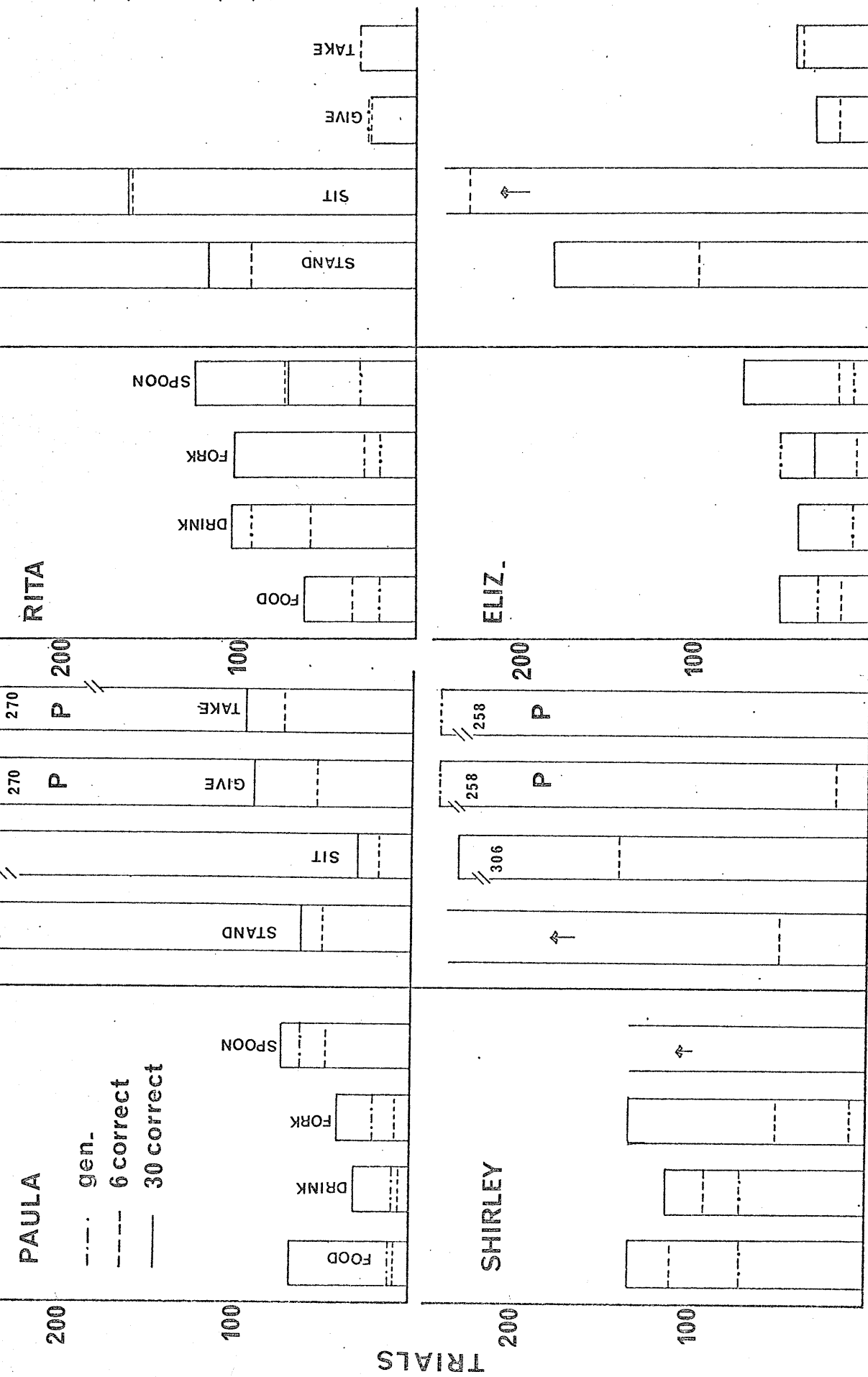


Figure 2. A comparison of the number of trials until the criteria of 6 and 30 consecutive responses and generalization to another area was observed for all words taught in Experiments 1 and 2 for both dyads.

criterion earlier than the first, however, for Elizabeth sit never never hit a criterion of thirty correct as was the case for Shirley for all other music machine signs except sit.

All subjects reached the six consecutive correct criterion for experiment one signs however, for Dyad One this took much longer for stand and sit than the mealtime signs did, but for give and take these signs were learned at a lower or comparable rate to the mealtime signs. For Dyad 2, the six correct criterion was also reached in a comparable time to the mealtime signs except for the sign take for Shirley, which never did hit this criterion. The major difference in the two sets of signs for both subjects is the obvious lack of generalization on the music machine of signs learned in experiment one until prompting occurred or until the experimenter was present and prompting as opposed to the mealtime signs where in general, generalization occurred very soon in the training and quite spontaneously. There are, however, some major differences in what these two sets of data represent, which may account for these differences in generalization.

The mealtime signs to begin with, all referred to objects and specifically two of them referred to primary reinforcers, whereas with the music-machine signs, no reinforcers were specified by the signs taught and only the signs give and take were associated with an object (the block of wood). It is interesting to see that the comparable rates of acquisition are the same in general for the mealtime signs and give and take signs. Additionally and probably most importantly, the signs in each experiment were taught by two different methods and procedures.

hereas the music-machine signs were taught to both Dyads ( that is stand, it, give, and take ), using the token machine and a two-subject-one experimenter procedure, the mealtime signs were taught without the token machine. In the mealtime experiment the object ( the reinforcer ) was used right in training and the procedure was one subject to one experimenter. Using the subject itself in training improved all subject's rates of learning. Another glaring difference in the two experiments was the presence of the teacher in the generalization setting in experiment two and the absence in experiment one. A third experiment could clarify the relevance of some of these variables.

EXPERIMENT THREE

The first two experiments gave rise to a delineation of at least two kinds of mands that may be taught to non-verbal, severely retarded children. These have been referred to as primary and secondary mands. A primary mand had been defined as a mand which specifies a reinforcer which is a manipulable object. A secondary mand was defined as a mand which specifies the behavior of a listener which is in turn related to or associated with some reinforcer. In Experiment One (the teaching of the secondary mand to children in a game situation), non-verbal retardates learned a secondary manding repertoire in terms of responding to each other when taught as a pair, but they showed little generalization of manding repertoire to the game situation until prompting from an experimenter in that situation was introduced for one dyad, and the presence of the experimenter for the other dyad. When prompting and the experimenter were removed, the signing behavior observed also decreased. It is possible that the repertoires established in Experiment One may not have been functional manding repertoires, but merely imitation repertoires.

During Experiment One a variety of procedures were used to teach manding to subjects. Each of the procedures differed in the degree to which they removed experimenter's prompts and/or teaching apparatus from the teaching procedure. It is possible that there was too much stimulus control of the teaching situation over the manding repertoire in terms of the presence of the experimenter, a token machine, the reinforcers, or the teaching procedures. It is also possible that the actual music

machine game behaviors were not established well enough to assess other variables. Experiment One carefully charted the progress of subjects as they learned receptive and expressive components of the various mands taught to them. A major feature of Experiment One was that the expressive and receptive components of any sign were taught simultaneously to a subject by having two subjects cooperate by alternating the expressive and receptive "turns" in the teaching procedure. From Experiment One it was clear that secondary mands are not easy to teach as a first mand, as the attention of both subjects to both subjects' behaviors is required at all times. This conclusion stems from the observation that during the teaching in Experiment One, a major cause for the poor learning seemed to be the lack of attention that subjects paid to each other as opposed to the attention they paid to the experimenter. Thus the procedures were difficult to carry out as when one subject would attend the partner would not and a sign would be emitted to a listener who wasn't attending. Subsequent prompts from the experimenter to attend, resulted in subjects attending only to the experimenter and not each other. Behaviors taught in this fashion often came under the control of the experimenter's prompts and not the partner's initial mand. All of these items need to be clarified in further research. Experiment Two of this study demonstrated that what had been delineated as a primary mand was learned much faster and generalized more readily to another situation and to other people than did the secondary mand. However, in Experiment Two there were two main differences in procedures from Experiment One over and above the primary-secondary mand differences. All the mands in Experiment Two were taught in a one to one fashion and generalization was to other experimenters who were adults and not to children. Moreover, no receptive component was systematically taught during Experiment Two for any of the four mealtime signs



at were taught. Experiment Three was designed to clarify the importance of these variables.

In particular, Experiment Three was designed to clarify some of the points regarding 1) the kind of mand ( primary versus secondary) that is optimal for teaching non-verbal severely and profoundly retarded children as a first repertoire, in terms of speed of acquisition and subsequent generalization; 2) The best teaching procedure by which to teach this kind of verbal behavior( a one-to-one procedure or more than one subject at a time) ; 3) The necessity of including a receptive component in the training procedure regardless of the type of procedure or the type of mand being taught. the latter point was included because a) the receptive component was a major stumbling block in the two-person teaching procedure and should be avoided if possible, and b) it may not be necessary to teach a receptive repertoire specifically in order to establish a receptive repertoire. Some subjects demonstrated a receptive repertoire in Experiment Two without ever being taught the receptive components in sessions.)

### Method

#### Apparatus

Reinforcers: No token apparatus was used to train signs in Experiment Three. Instead, subjects in all conditions received immediate candy and

music reinforcement as they did on the music-machine game. Candies were placed in white plastic cups identical to those used on the music-machine game, and music was dispensed from a cassette tape player out of sight under the table but which fed two sets of headphones as in the music game situation. The switch that turned on the music was a hand-held multiple direction type which the subjects handled from each other or from the experimenter. There were no lights present in the training of any signs taught in experiment three.

Push and Pull: To train the signs "push" and "pull" an apparatus was made similar to that used for the original "give" and "take" teaching sessions in Experiment One. The plungers from the music box were used to slide in and out in this apparatus.

Generalization - Music Machine: In order to enhance the reinforcing qualities of the music machine a color organ was attached to the music source. This simply gave an added light display to music that was received by headphones. It was hoped that this inclusion would make the music responses more probable for those two subjects who were known to be at least partially deaf (Rita and Shirley).

### Procedures

In order to gain information relevant to the findings of the first two experiments, it was necessary that the signs taught in this third experiment be comparable to both the first and second experiments. For this reason two primary mands were taught and two secondary mands were taught to each dyad. The primary mands had to satisfy the condition that they specified a manipulable object reinforcer that was received, or manipulated and also they must be applicable in the music machine game situation for comparison to the secondary mands associated with that situation. For these reasons the signs "candy" and "music" were chosen. The secondary mands taught were the signs "push" and "pull", originally

to be taught on the music machine in Experiment One. Since neither dyad had been taught these words yet, and since for both dyads the pushing and pulling behaviors on the music-machine game were the strongest, (i.e., of the highest frequency), these seemed to be the ideal signs to use for comparison. Thus, for a situation that was well established for both dyads, a comparison was being made of the acquisition and generalization of mands that specified immediate reinforcers versus mands that specified the behavior of a partner to gain the same reinforcers.

In order to assess the relevant importance of the teaching procedure by which mands might be taught, two different procedures were used. To begin with each dyad was taught a different kind of mand by an individual procedure in which subjects were taught in a one-to-one fashion. Next, each dyad was taught the other set of signs by a dyadic procedure. In the dyadic procedure subjects were taught two at a time; i.e., both subjects were present and the experimenter taught them to emit the signs to each other. In both cases, by both procedures, no receptive component was taught for either dyad at first. However, the receptive component was included for each dyad at the same time for signs taught during the individual one-to-one procedures, and in a staggered multiple baseline fashion for signs taught during the dyadic condition. In this way, acquisition and generalization of manding could be examined as a function of the kind of sign, the type of teaching procedure, and whether or not the receptive component involved in the teaching procedure was a salient feature for either of these processes. The schedule of conditions for Experiment Three is shown in Table 1.

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Insert Table 1 about here

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Each dyad experienced twenty training sessions in each of the two training conditions for two different sets of signs. In the individual condition, the experimenter was the partner for each subjects as they were taught individually; for the dyadic condition, the experimenter was present, having each subject of the dyads responding to each other.

General Procedure: In general, the format for all training sessions was as similar as possible in each condition. All sessions, whether individual or dyadic, were conducted in the same area at the same table with any particular subject seated in the same place as in Experiment One. For any session subjects always wore headphones, whether the music reinforcement was forthcoming or not, and the plunger, housing apparatus was always present although the actual plunger may not have been. The switch for turning off and on the music was present only during music sessions. The reinforcers were always some combination of "M & M's" and music, but never were both given as a reinforcer for any one behavior at the same time.

Sessions always contained ten expressive trials for any particular subject (that is, ten trials in which the subject was given the opportunity to emit a sign). However, in receptive conditions each subject also experienced ten receptive trials (on these trials the subject was given the opportunity to respond to a partner's sign or an experimenter's sign). Receptive trials were always alternated with expressive trials during the receptive componenets of the study. In dyadic sessions where there was no receptive requirements, the experimenter performed the

Table 1 . Schedule of Procedures and Conditions for Phase 3

<u>INDIVIDUAL TEACHING PROCEDURE</u>			<u>DYADIC TEACHING PROCEDURE</u>		
Rita			Rita		
Music (Primary)	Expr.	Rec.	M & M's (P)	Expr.	Rec.
Push (Secondary)	Expr.	Rec.	Pull (S)	Expr.	Rec.
Elizabeth			Elizabeth		
Music (P)	Expr.	Rec.	M & M's (P)	Expr.	Rec.
Push (S)	Expr.	Rec.	Pull (S)	Expr.	Rec.
Paula			Paula		
M & M's (P)	Expr.	Rec.	Music (P)	Expr.	Rec.
Pull (S)	Expr.	Rec.	Push (S)	Expr.	Rec.
Shirley			Shirley		
M & M's (P)	Expr.	Rec.	Music (P)	Expr.	Rec.
Pull (S)	Expr.	Rec.	Push (S)	Expr.	Rec.

receptive role for the subject in question, but both subjects received any reinforcement forthcoming. Because each subject was taught two signs in any one session the order of teaching these signs was always alternated to balance any order effects.

The specific contingencies of each condition are best described by the flow charts to be discussed later, but the same general rules held for all conditions. When no receptive component was required physical guidance was always used and faded out. Similarly with expressive behavior, guidance was used and faded out to prompting and eventually nothing. After any unprompted trial occurred the flow chart contingencies were utilized and guidance was only used after a wrong trial. For dyadic conditions where reception was included, wrong responses removed the chance for a partner to perform receptively, and guided expressive responses were always followed by guided receptive responses of a partner. Wrong receptive responses in dyadic conditions always resulted in a loss of reinforcement for both partners.

Specific Training Procedures: The specific training procedures are available in the flow chart seen in Tables 2 to 5.

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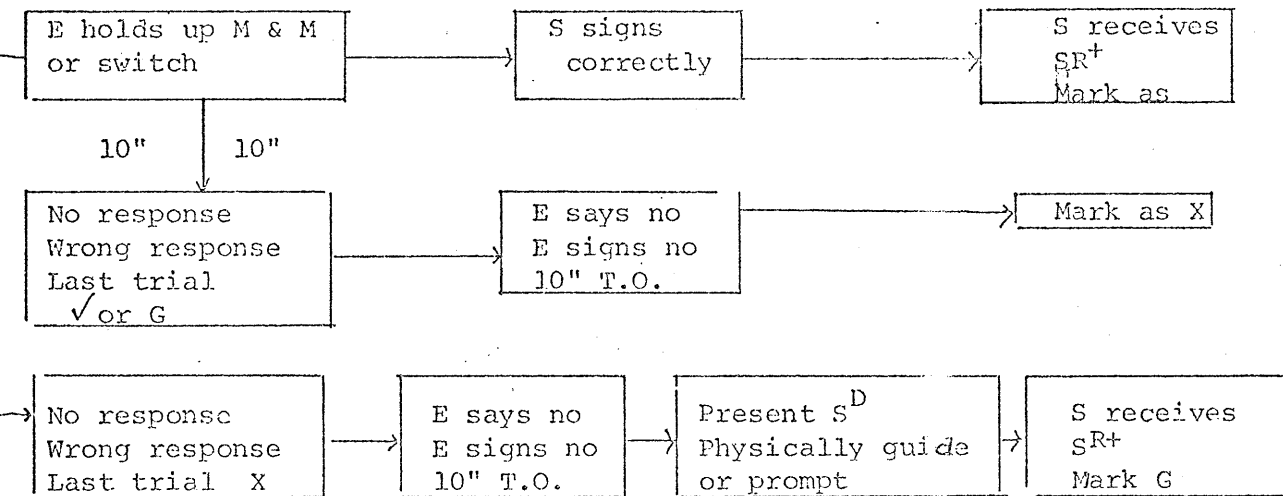
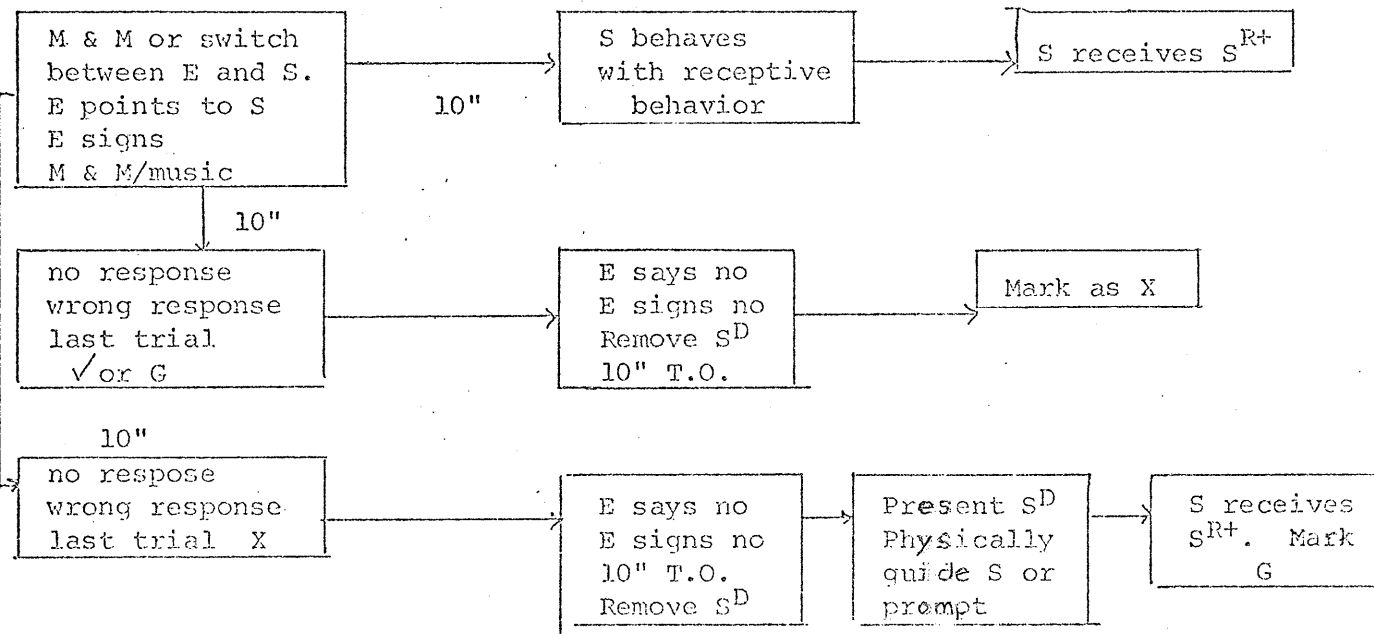
Insert Tables 2, 3, 4 & 5 about here

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In all cases the contingencies indicated in these flow charts were applied only after a preliminary physical guidance fading procedure which took place during the first session for all conditions for all subjects except for Shirley for learning the sign push in the dyadic condition for which this did not occur until session three.

Criterion for Introducing Receptive Component to Training: For each dyad for each condition a receptive component was introduced to the teaching procedure. The receptive component basically involved the

Table 2. Procedure for Individual Teaching of Primary Words

Expressive ProcedureReceptive Procedure

NOTE: Wrong response:

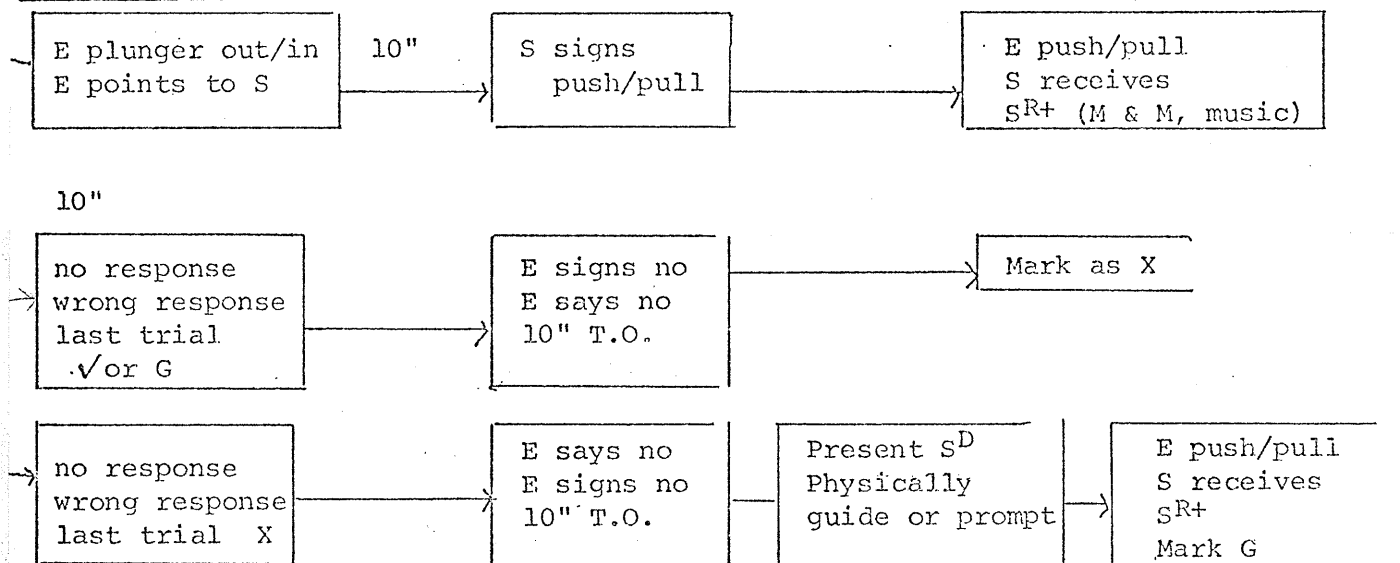
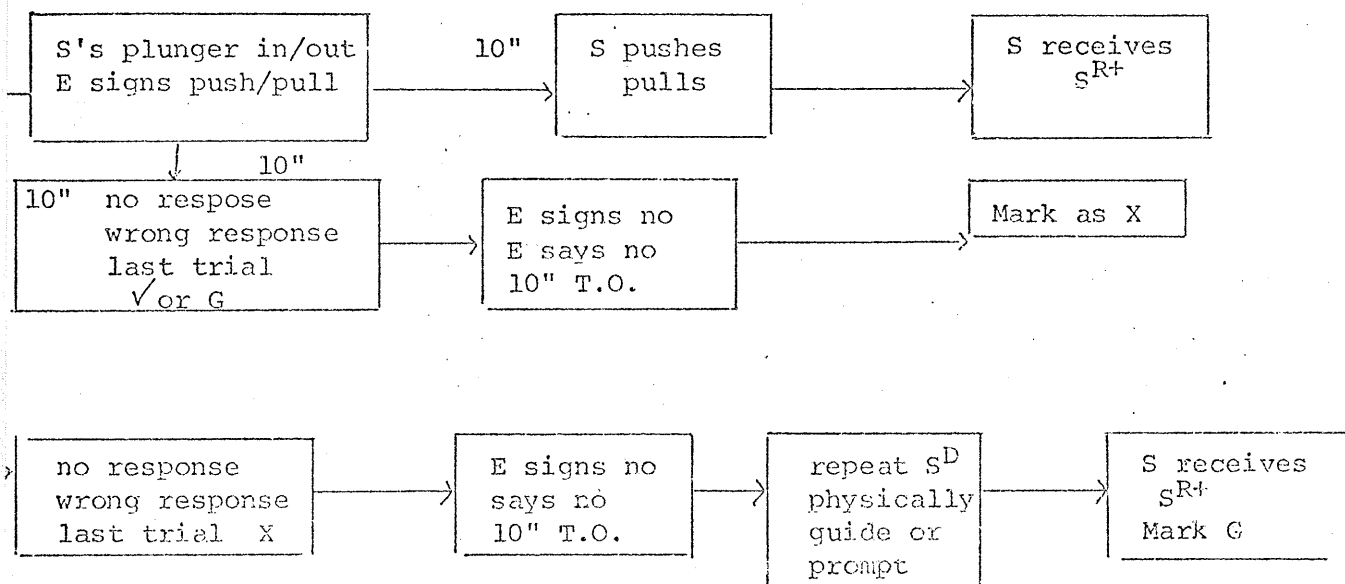
receptive

anything other than delivering M & M or  
closing switch

expressive

approximations accepted for signs,  
but mark as A

Table 3. Procedure for Individual Teaching of Secondary Words

Expressive ProcedureReceptive Procedure

NOTE: Wrong response:

receptive

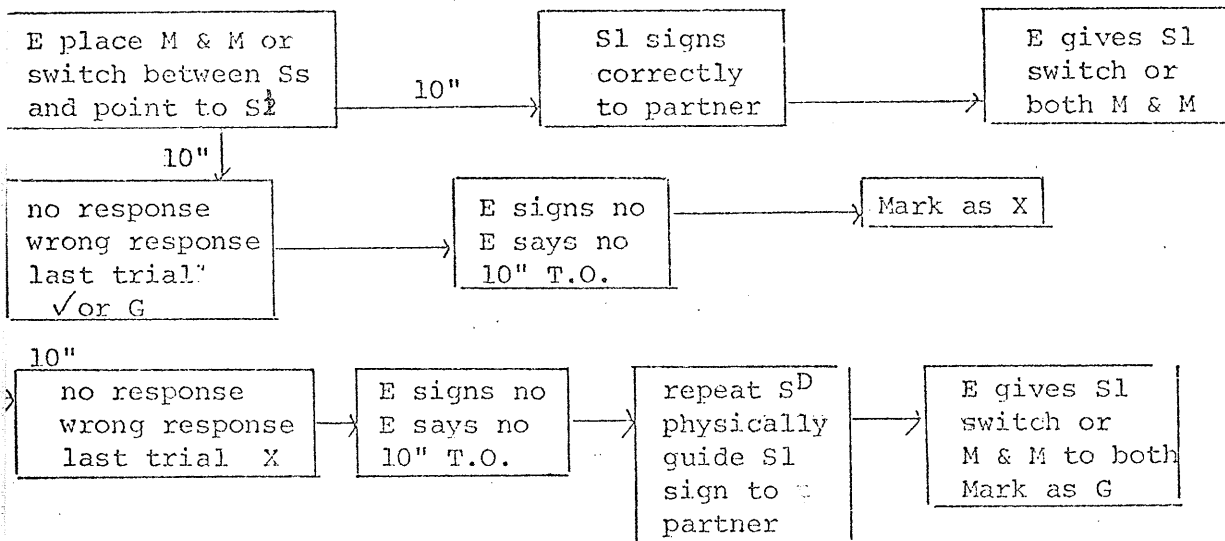
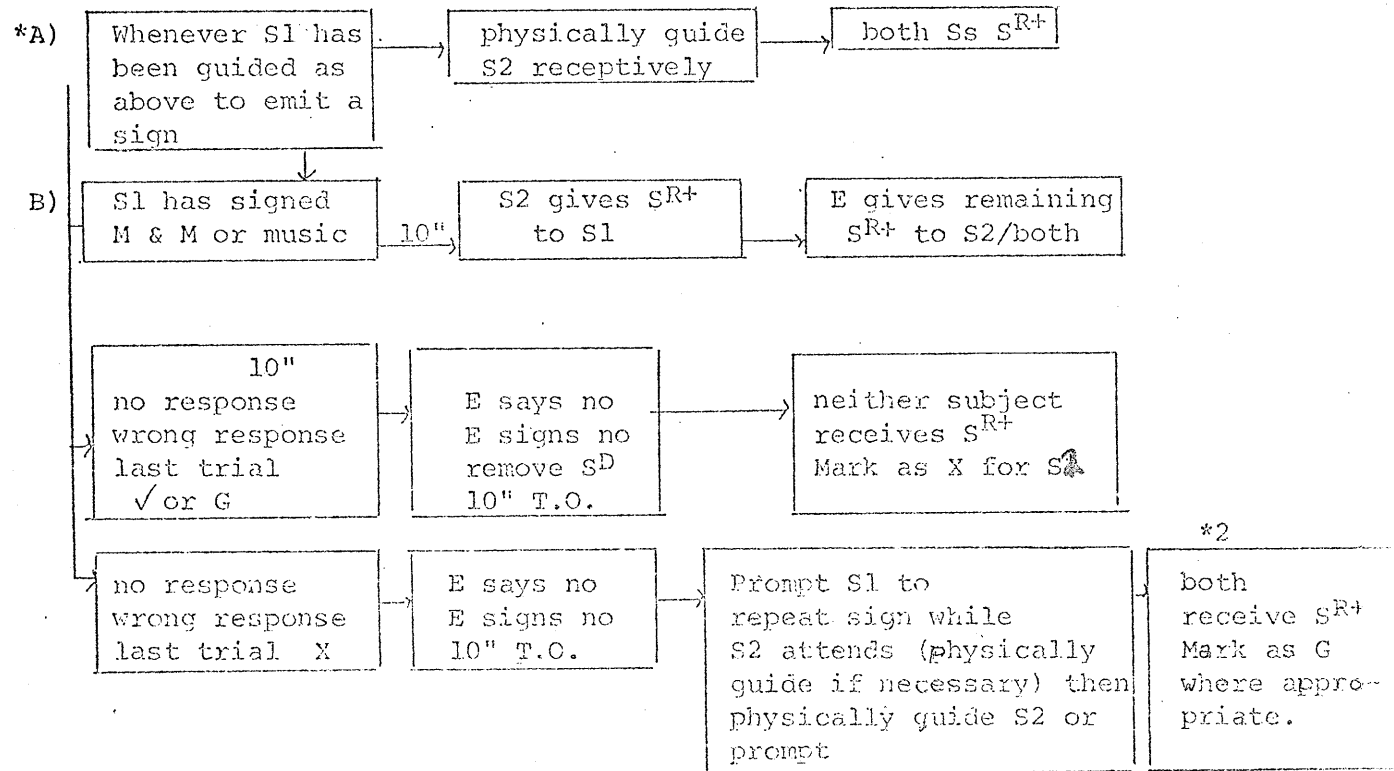
anything but a push or pull alone!

expressive

approximations accepted to signs  
but mark as A



Table 4. Procedure for Dyadic Teaching of Primary Words

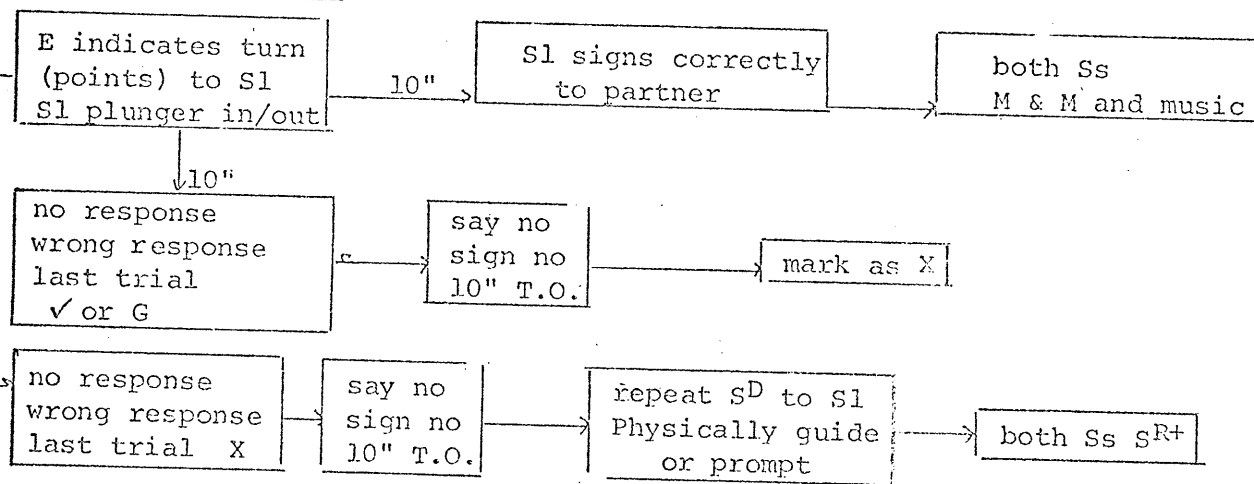
Expressive ProcedureReceptive Procedure

\*NOTE: A in effect only during receptive condition

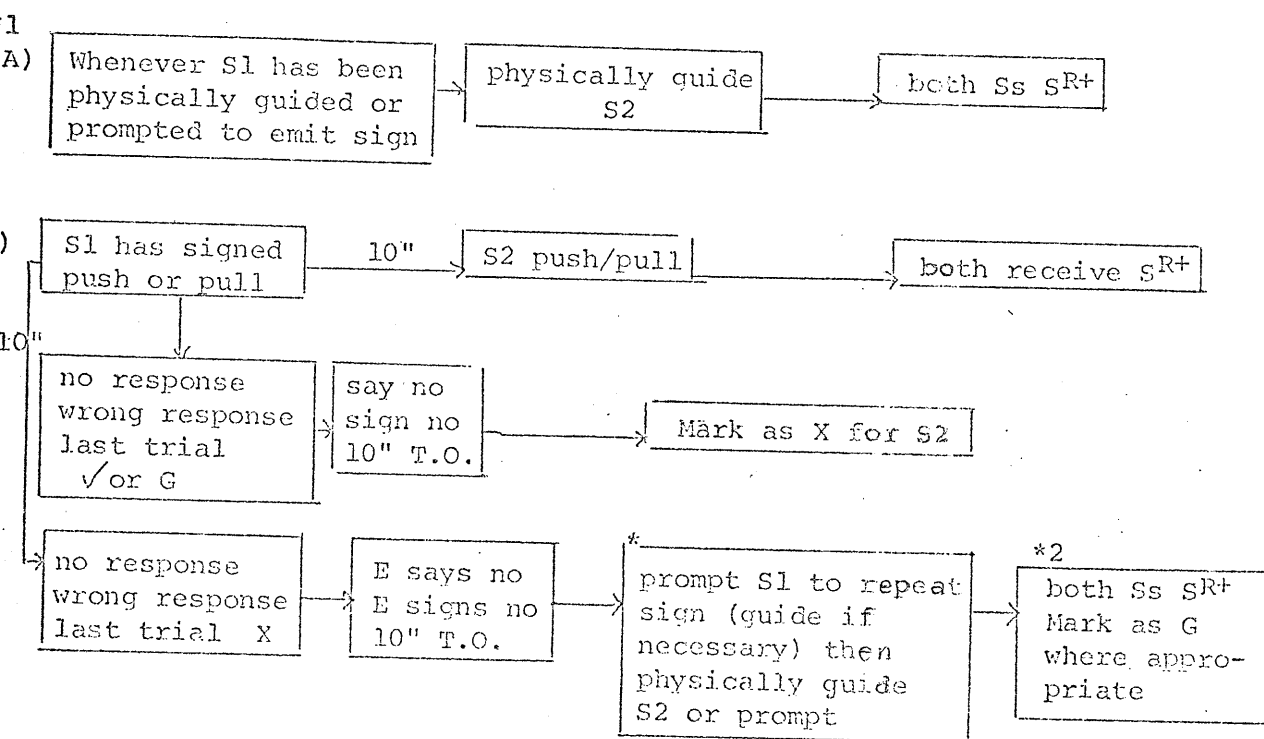
\*2 Mark as ✓ if ✓ first time for S1

Table 5. Procedure for Dyadic Teaching of Secondary Words

## Expressive Procedure



## Receptive Procedure



## NOTE:

1. Applies only during expressive condition
2. Only mark S1 as G if original turn was G, otherwise mark as ✓

contingency that one subject of a dyad was to respond to partner's expressive mand in order that both might receive reinforcement. This contingency was introduced for all words during individual teaching for all subjects at the ten session mark. During dyadic teaching procedures for Dyad 1 (Rita and Elizabeth) the receptive contingency was introduced for the word "M & M" after seven sessions and for the word "pull" after eleven sessions. For dyad two (Paula and Shirley), in the dyadic teaching condition the receptive component was introduced for the sign push after fourteen sessions and for the sign music after eighteen sessions. In general, an attempt was made not to introduce the receptive component until the expressive repertoire had been well established (ten of ten correct responses); however, for one subject, (Shirley), this criterion was not met for one sign, and for another sign ("push") this criterion was met on the same day that the receptive component was introduced.

Testing for Generalization - General Procedure: After every two training sessions, regardless of the condition, each dyad was tested for the generalization on the music machine. In the past, in Experiment One, a generalization test on the music machine situation had consisted of three mini-sessions. One mini-session was for standing and sitting and another for giving and taking and another for pushing and pulling behaviors. Each of these mini-sessions had lasted at least 15 minutes. For experiment three only push and pull mini-sessions were run in order to avoid any possible fatigue variable (that had been noted as possible in Experiment One). Thus, for the individual teaching phase of experiment three there were ten generalization tests and similarly for the dyadic teaching phase of experiment three there were ten generalization tests.

At the completion of experiment three, a series of probe generalization tests were conducted. Each subject experienced a five minute music machine session with the experimenter as partner, each dyad experienced a five minute music machine session with the experimenter present, a five minute generalization session with another adult male present and an additional five minute dyadic procedure with a female ward staff present. Following these probe generalization tests the subjects of each dyad were then placed in a fifteen minute push and pull session with a subject from the other dyad; that is, Rita and Shirley were placed together for fifteen minutes on the music machine game and Paula and Elizabeth were placed together for fifteen minutes on the music game. Following these sessions an additional five minute session with each of these new dyads was conducted with the experimenter present and occasionally prompting subjects, if necessary, to sign.

Specific Generalization Procedures: Mini-sessions on the generalization music machine situation were essentially identical to those for experiment one except that the behaviors in this case were push and pull. That is, two subjects of a dyad were led to the music machine session room, placed in their respective chairs on either side of the machine, headphones were placed on the subjects, and the experimenter then left the room and monitored the session from the observation room. During Experiment Three subjects were never prompted via their headphones by the experimenter from the observation room. A session lasted until sixteen trials were complete or until thirty minutes had elapsed, whichever came first. One mini-session was run prior to experiment three with

each dyad with the large turn light present. These lights stayed on for the first five generalization tests in the individual condition. Thereafter, during any of the generalization tests these large lights on the top of the box indicating turn were never present. Only the lights on the end panels were present at any time to indicate to subjects that it was a partner's turn to respond. For both dyads for the individual teaching procedure the ten generalization tests were conducted as they were in experiment one. That is, each subject's turn alternated back and forth. For both dyads this same condition existed for the first five generalization tests during the dyadic teaching procedure. However, the last five generalization tests for the dyadic teaching procedures were conducted using a different procedure. During the first fifteen minute component one subject would have no lever while the other subject would have a lever. During the second fifteen minute component the reverse situation would be in effect. The responsibility for pushing or pulling the lever was then delegated to the subject who had the lever present. Under these conditions it was hoped that a higher probability of manding could be produced for the subject without the lever. During this procedure, only lever presses from a subject when that subject's turn light was being indicated to the partner were considered correct responses. That is, if subject A of a dyad had the lever and pushed it, but the turn indicating light in front of subject B indicating that it was subject A's turn was not illuminated, the response was ignored by the experimenter. Often the experimenter would randomly turn the light off or on numerous times in any one trial. In this way a real need to mand each other was arranged between partners.

During probe sessions in which the experimenter was present on the music machine with each individual subject these same conditions applied, that is, the experimenter had the lever while the subject had no lever. During dyadic probe conditions both subjects had levers, except for some trials with Dyad 2, when Shirley's lever was removed.

Reliability Measures: There were two methods of assessing the reliability of data collected during Experiment Three. Procedural reliability was evaluated for each dyad for each condition for each sign once. This was done by an observer viewing a video tape of a teaching session after having studied the flow chart teaching procedure for that session. The observer then scored a data sheet identical to the one used by the experimenter during sessions. In this was procedural reliability for teaching was gained for each subject for each sign for each teaching condition throughout Experiment Three. Generalization data reliability was gained by having an observer view video tapes of generalization sessions on which signs were seen to occur by the experimenter. Although no data sheet was used for these purposes, the experimenter would instruct an observer to view the video tape and to report any signs that they had observed. Observers always agreed 100% with the experimenter with the occurrence or nonoccurrence of signs during such sessions. The usual co-efficient of reliability calculated by placing the number of agreements over the number of disagreements plus agreements was calculated for the procedural reliabilities. Agreements were calculated by comparing the trial by trial indications of both the observer and the experimenter in each case.

By this method the reliability for a total of 22 checks ranged from a low of 80% to 100% with a mean reliability of 96% for Dyad 1 and 95.8% for Dyad 2.

### Results

Sign Acquisition: The correct responses during acquisition for each subject for the four signs taught during the two conditions are presented in Figures 1, 2 and 3. In Figure 3 the terminal rate indicates approximately ten out of ten correct.

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Insert Figures 1, 2 & 3 about here

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Although the cumulative receptive responses are not shown in Figures 1 and 2, the point at which receptive training was included with expressive training is indicated in each figure.

In general, except for Rita, all subjects learned individually taught signs at a faster rate than they did dyadically taught signs. Within Dyad 1, the inclusion of the receptive component is not seen to disturb the expressive components for Rita's behavior nor so much for Elizabeth's behavior, except for "pull" for two sessions. Within Dyad 2 the inclusion of the receptive teaching component disrupted Shirley's expressive signing for both signs but did not affect Paula's signing to any great extent. For Dyad 1 during dyadic teaching, the inclusion of the receptive component is seen to disrupt Rita's expressive signing but not Elizabeth's expressive signing to any great extent. For Dyad 2 the inclusion of the receptive component has no effect on Paula's expressive signing and also does not seem to have a great distinguishable effect on Shirley's expressive signs.

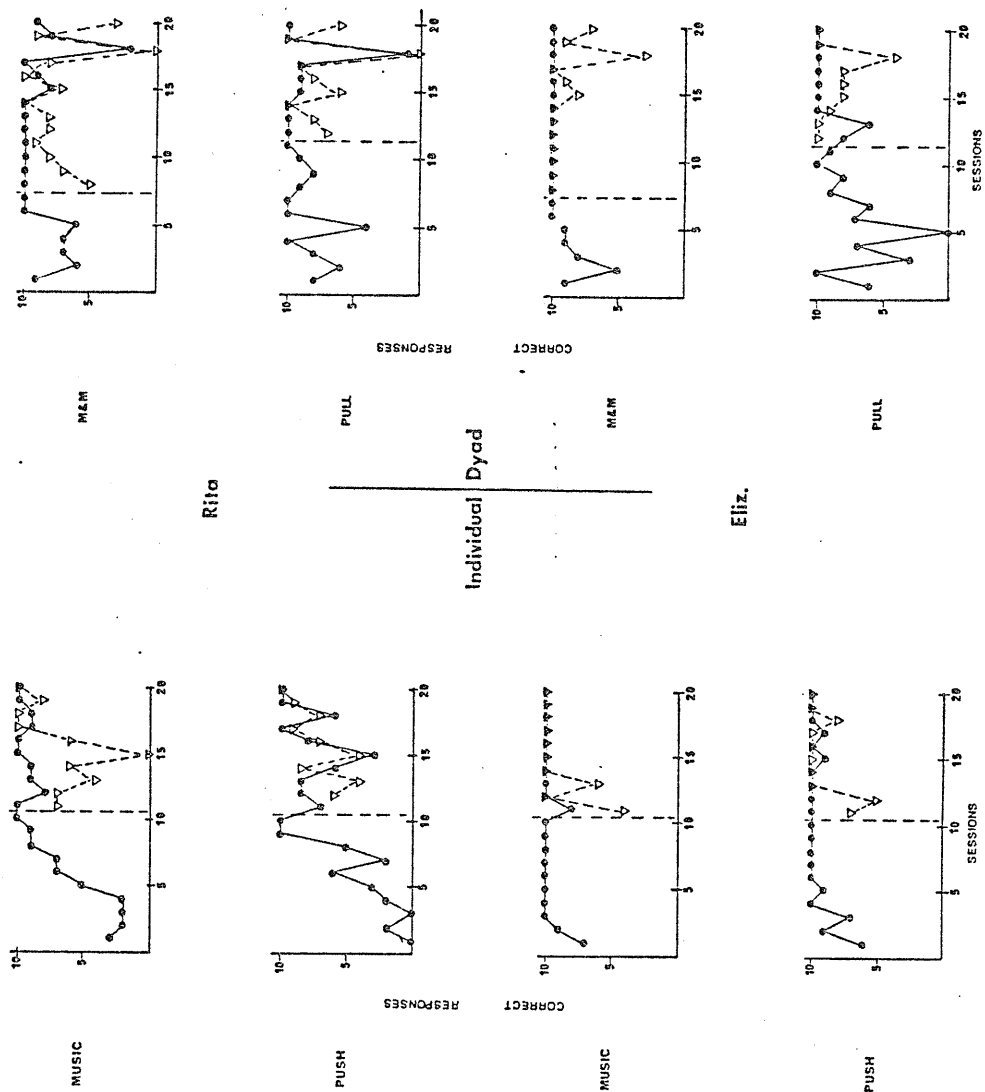


Figure 1. Frequency graph of the number of correct expressive and receptive responses per session in individual and dyadic training for Dyad 1. Triangles indicate receptive training and arrows indicate sessions on which reliability was measured.



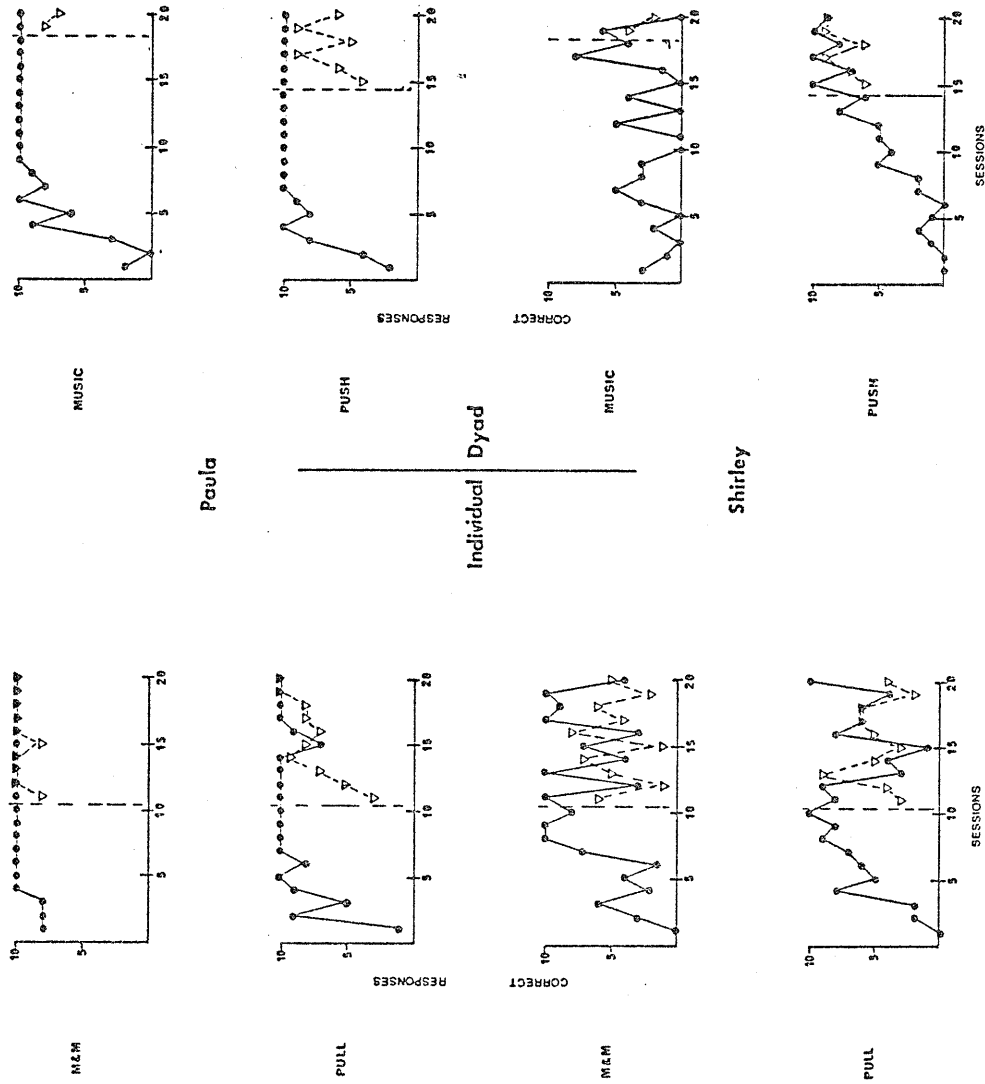


Figure 2. Frequency graph of the number of correct expressive and receptive responses per session in individual and dyadic training for Dyad 2. Triangles indicate receptive training and arrows indicate sessions on which reliability was measured.

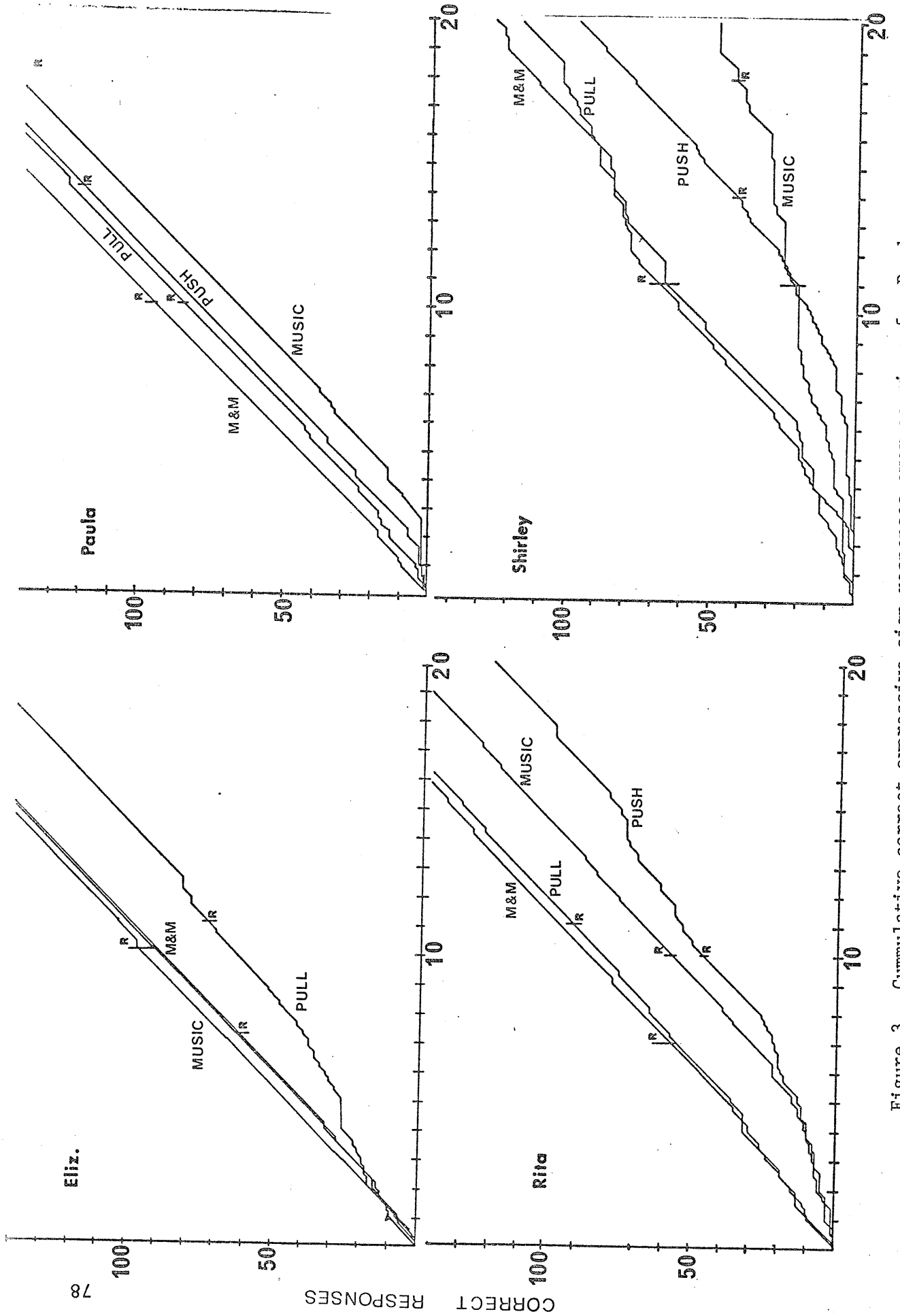


Figure 3. Cumulative correct expressive sign responses over sessions for Dyads I and II. R indicates the point at which receptive training commenced.

Generalization Results: Figure 4 shows the frequency of occurrence of the taught signs as they were observed in generalization sessions on the music machine during the conduct of the individual and dyadic teaching conditions for experiment three.

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Insert Figure 4 about here

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From an examination of Figure 4 one can see that there was not much generalization at all for either dyad, but there was more generalization <sup>for</sup> dyad two than dyad one, and most of this generalization was due to Paula. Virtually all occurrences of signs for Dyad 2 that were observed on the music machine were observed after the procedure was instituted, which removed the lever from one subject for a fifteen minute period.

For Dyad 1, the only occurrences of signs in the music-machine situation were observed from Elizabeth and in both cases the signs were emitted before the inclusion of a receptive component in the training of those signs. For Elizabeth, of the two signs observed in the generalization situation, one was a primary mand and the other was a secondary mand. For Dyad 2 the signs that generalized were both primary and secondary mands. The highest observed occurrence of generalization was for Paula for the secondary mand push. Most of the occurrences for this sign were before the inclusion of a receptive component in training (five occurrences as opposed to two). For dyad two there was a total of nine signs observed before receptive training, as opposed to five that occurred after receptive training had commenced. For Shirley, the sign music was seen to occur only after the inclusion of receptive training in the teaching procedure.

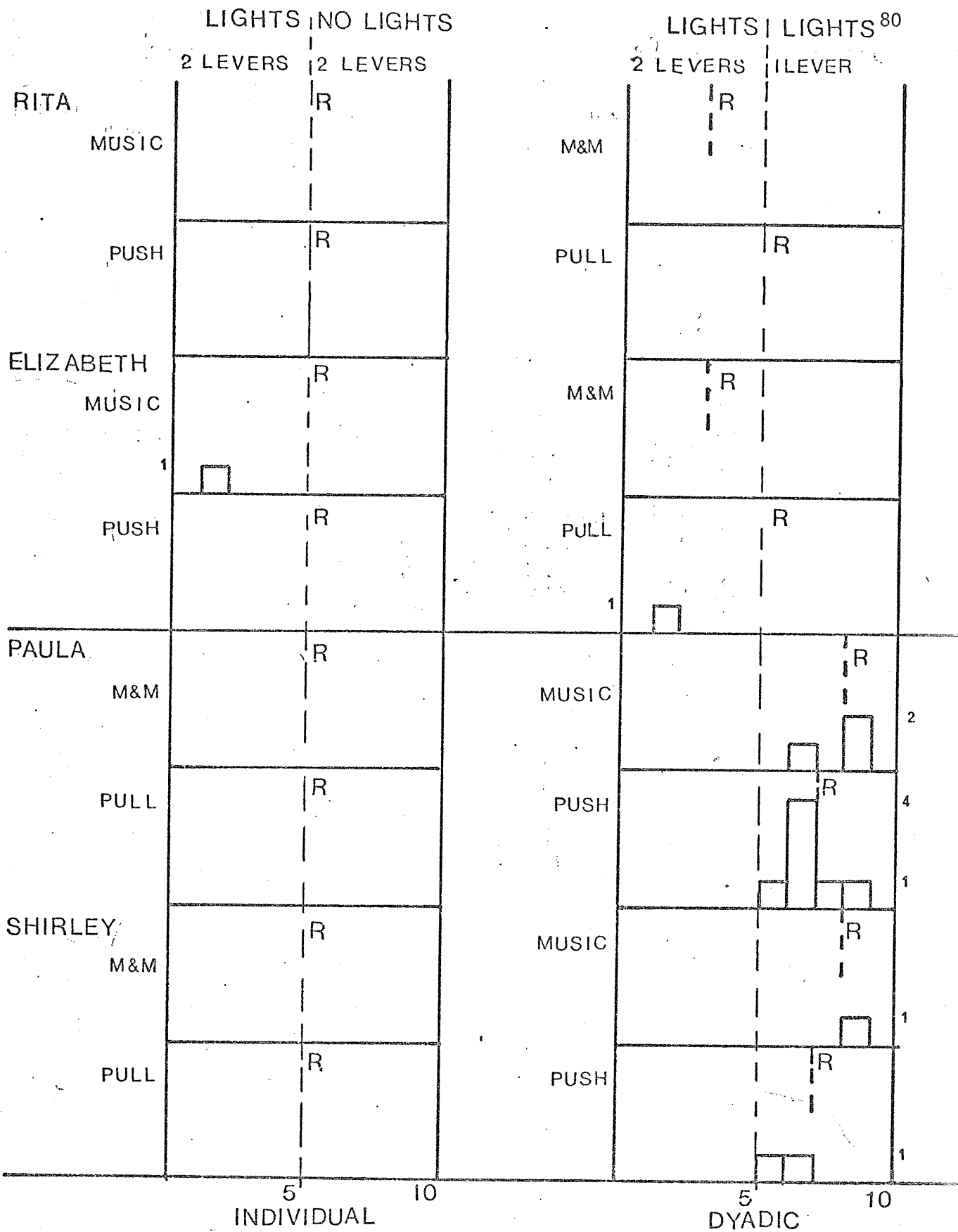


Figure 4. Frequency of occurrence of taught signs in music machine situation over 20 tests and various conditions for both dyads. R indicates receptive training commencement.

All observed occurrences of signs in the music machine situation were emitted during the dyadic teaching condition, except for Elizabeth emitting the sign for music (as a tact). Except for one occurrence of Elizabeth emitting the sign for pull, all of the observed generalization occurred after the generalization procedure was switched to one in which each subject was without a lever for fifteen minutes, that is, for the last five generalization tests. Additionally, on the first generalization test after this manipulation, Shirley was observed on one occasion to emit the sign "M & M" which she had been taught individually and which had never been observed to occur at any other time.

Probe Generalization Results: Figure 5 represents the observed generalization of signs to the testing situation during the probe generalization tests for each subject in each dyad.

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Insert Figure 5 about here

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In Figure 5 the signs underlined for each subject are the signs taught by the dyadic procedure. There are a number of interesting results to be seen in this figure. Firstly, there is relatively little observed occurrence of generalized signs in the situation in which the experimenter was not present; namely, when another male was substituted for the experimenter, when a female staff member was substituted for the experimenter, and when subjects were placed with a partner from the opposite dyad for fifteen minutes. The second interesting feature of the data is that, except for Rita, subjects in general emitted more individually taught signs in the individual situation and dyadically taught signs in the dyadic situations. Another interesting feature is that most of the generalized occurrences of signs occurred for the secondary mands "push" and "pull", and, indeed, what may be considered the most primary

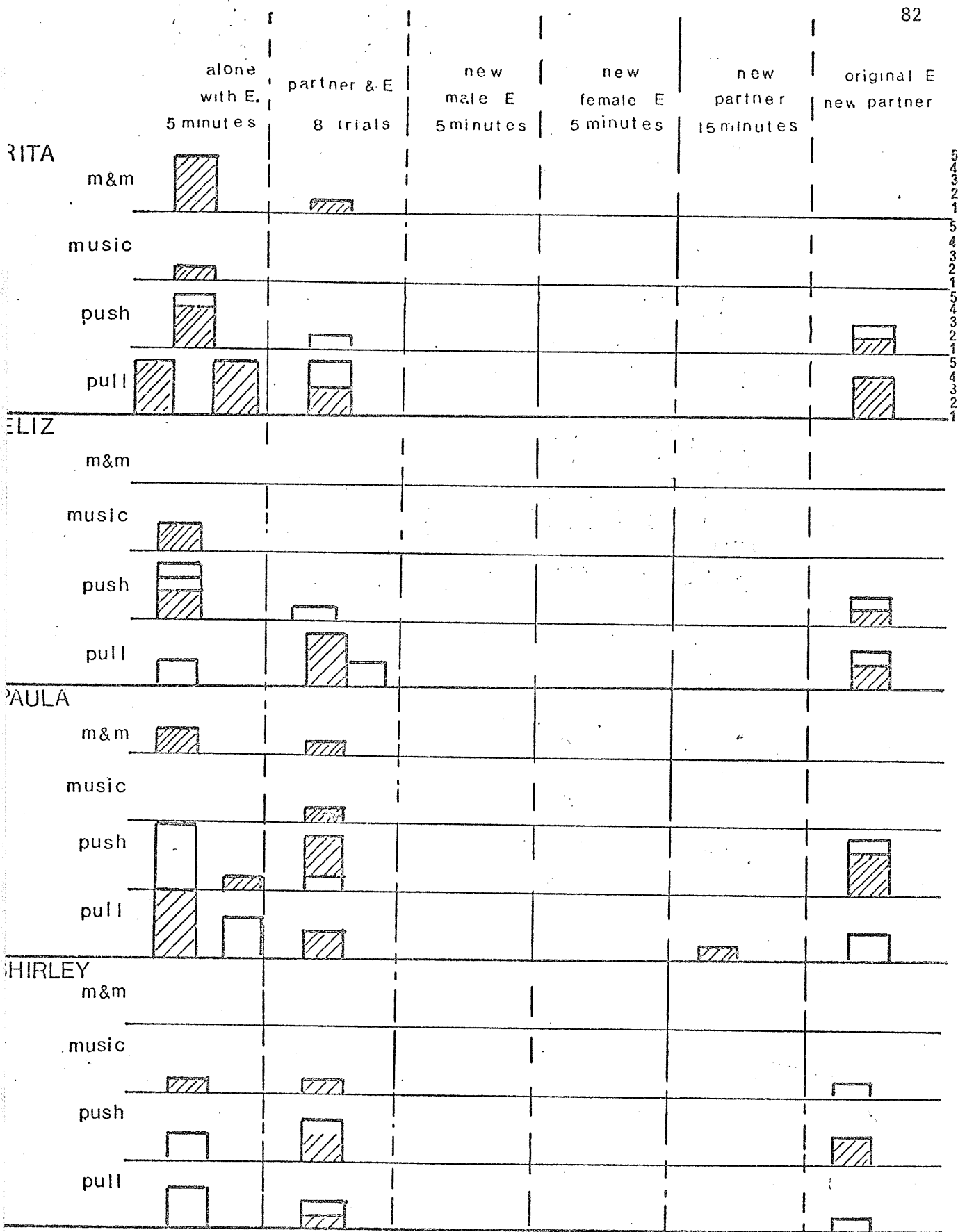


Figure 5. Frequency of occurrence of taught signs in the music machine situation across probe conditions for both dyads. Shaded blocks indicated unprompted, correct signs.

sign, "M & M", was emitted primarily in the individual probe condition by Rita and Paula and not at all by Shirley and Elizabeth. Similarly in the dyadic probe conditions, Rita and Paula emitted "M & M" once, Shirley and Elizabeth never emitted this sign. Of all the subjects only Paula spontaneously generalized two signs, music and pull, once each, to another partner when the experimenter was not present. Still another interesting feature of Figure 5 is the relative equality of the generalized occurrences of signs in the dyadic condition with the experimenter present (in the second column) and the dyadic condition with a new partner and the experimenter present.

#### Discussion

Experiment Three originally was designed with three questions in mind. The first question was whether one should teach a primary or a secondary mand. The findings from Experiment Two indicated that a primary mand (a mand specifying an actual primary reinforcer) was learned faster and generalized to a greater extent than a secondary mand (one specifying some behavior that is only associated with a reinforcer). However, Experiment Three shows that the signs "push" and "pull" generalized even more than did "M & M" and "music". Thus the mere presence of a manipulable object in training may make the sign associated with the manipulable object as easy to learn as a sign specifying an obvious primary reinforcer. This can be seen in a comparison of all three experiment's data in Figures 6 and 7.

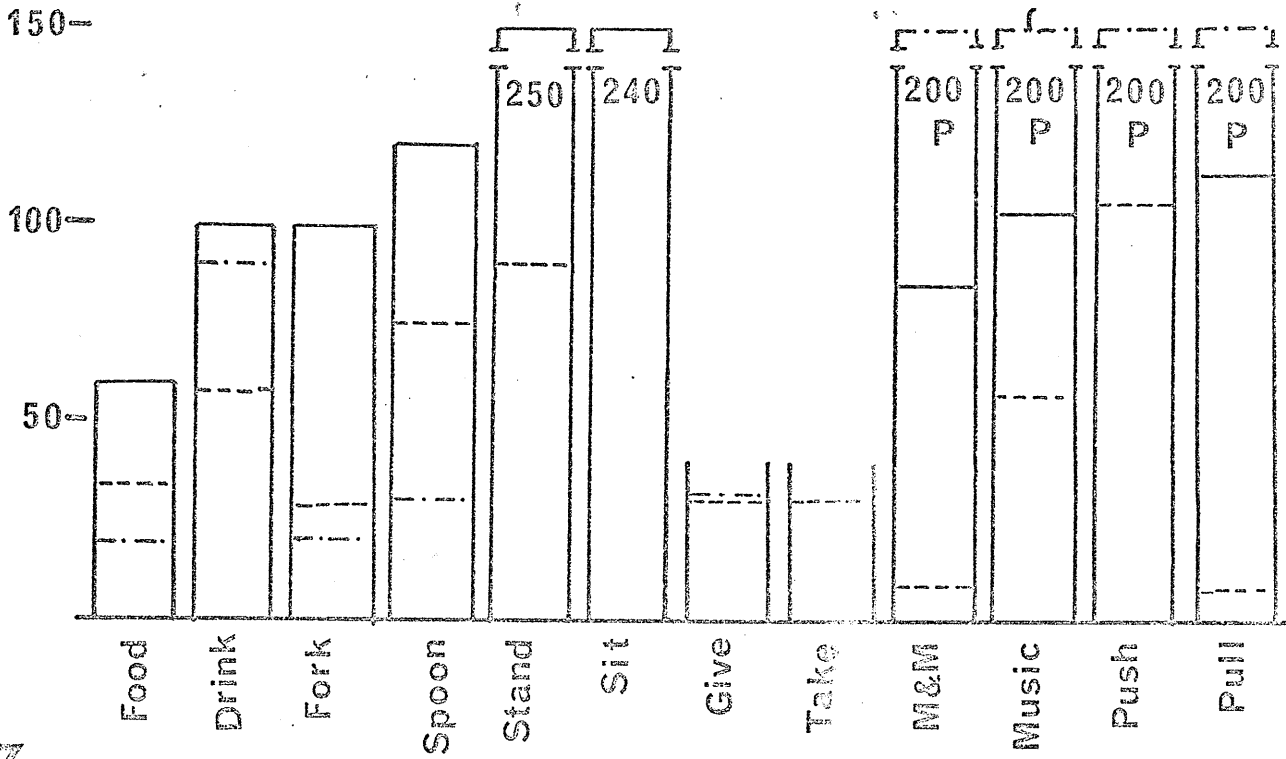
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Insert Figures 6 & 7 about here

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Experiment Three additionally sought an answer to the question of whether one should teach mands individually or in dyadic partnerships. An examination of the generalization data in Experiment Three do not

Rita



Eliz.

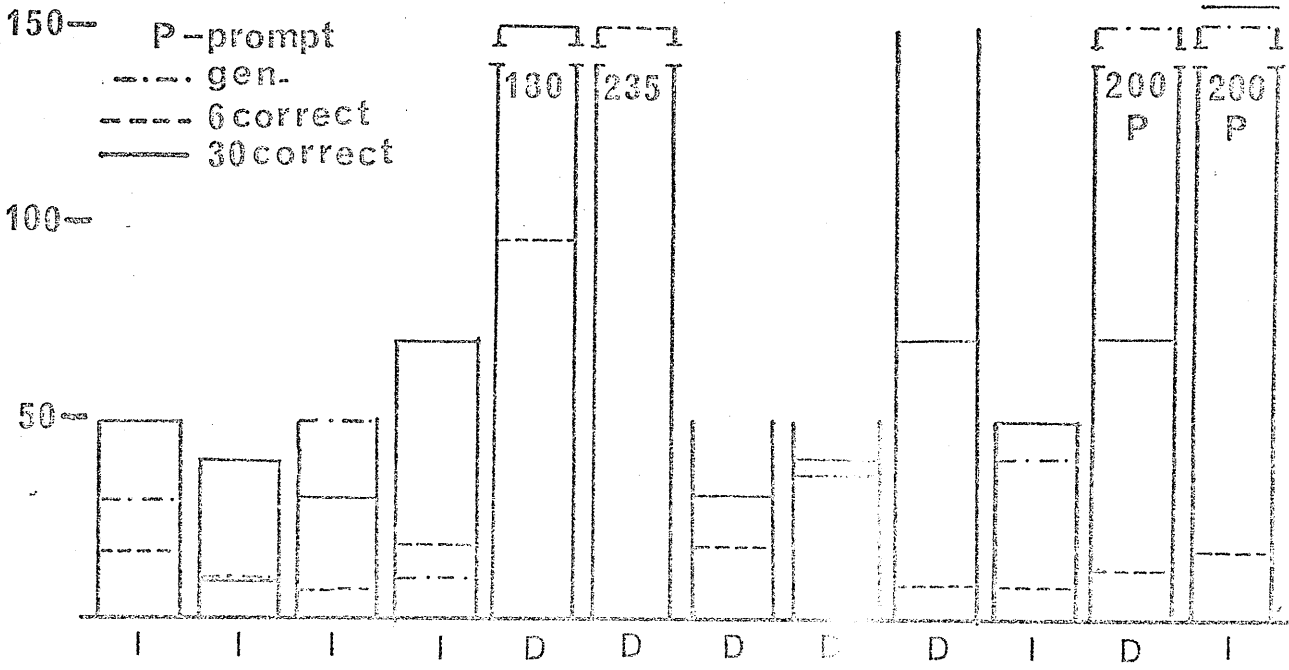
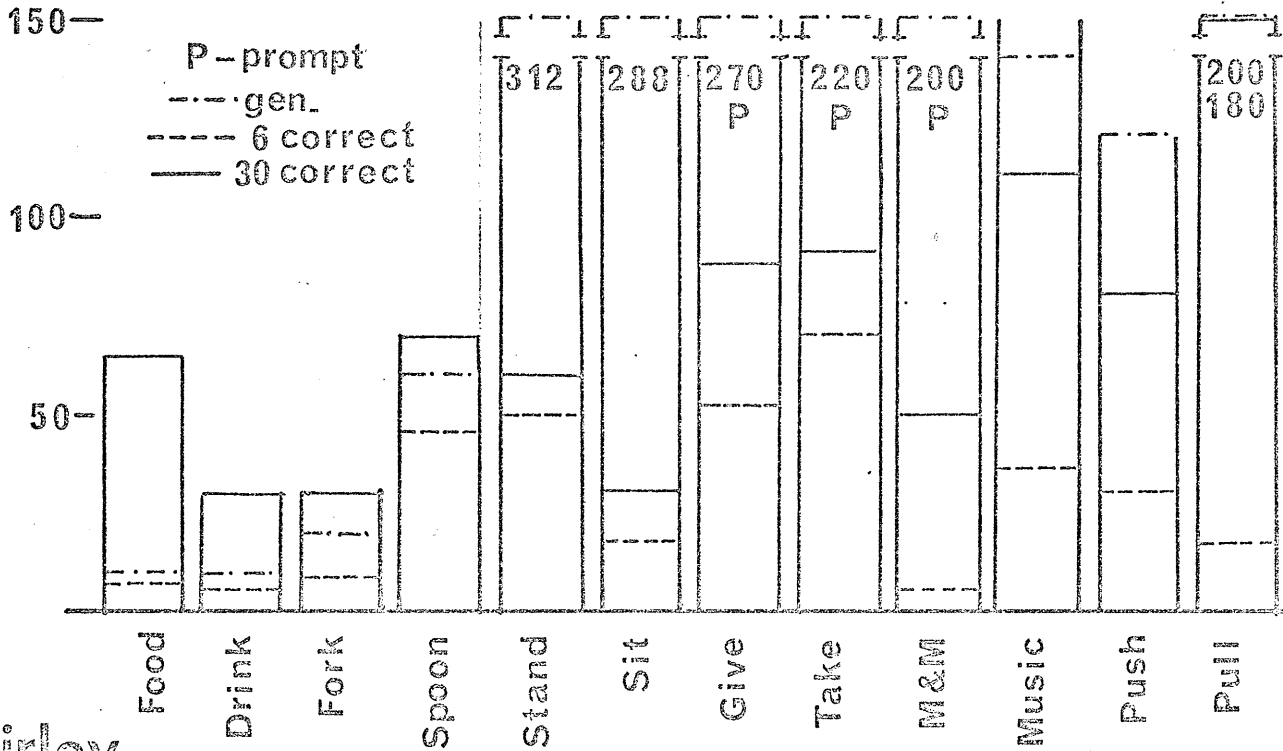


Figure 6. A comparison of the number of teaching trials until two learning criteria and generalization to another area than the teaching situation were observed, for Izad I. across all three experiments.



Paul



Shirley

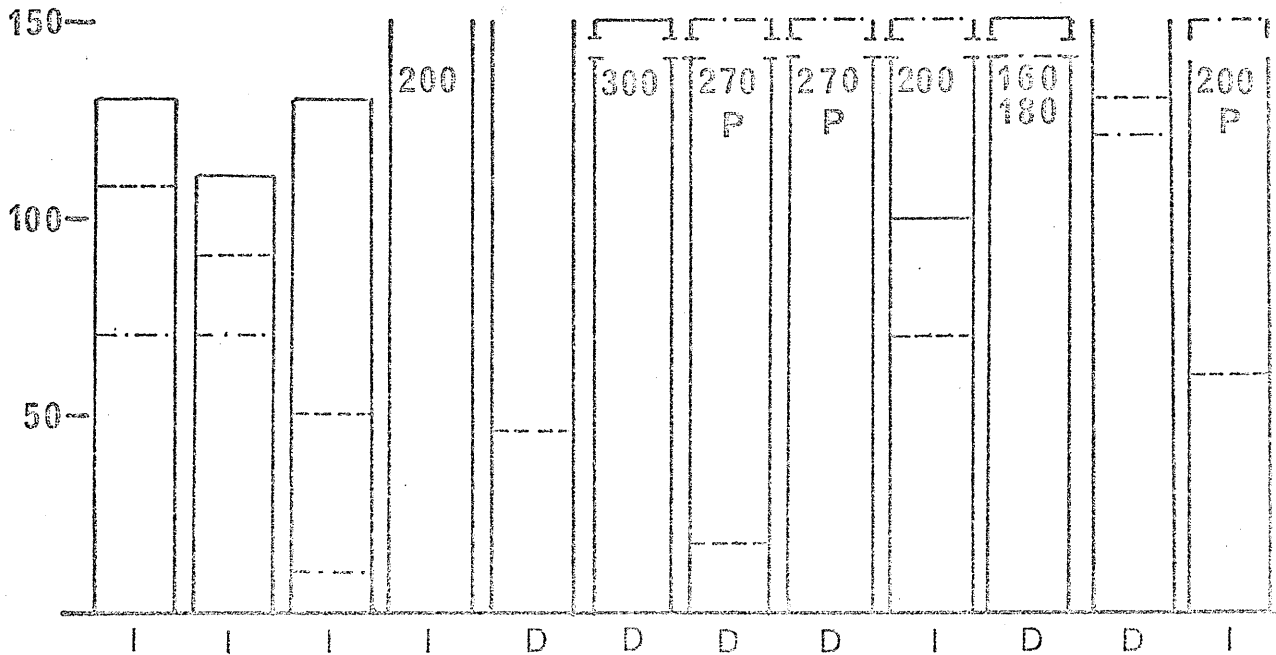


Figure 7. A comparison of the number of teaching trials until two learning criteria and generalization to another area than the teaching situation were observed, for Dyad 2 across all three experiments.

indicate a clear answer. However, the probe generalization data seems to indicate that individually taught signs generalize to a situation in which the teacher was present alone, whereas dyadically taught signs generalized to those situations where dyads were present. Although this was not the case in all instances it seemed to be the general trend in the limited data provided by Experiment Three.

A third question Experiment Three was attempting to answer concerned the relative merit of including a receptive component in the teaching procedure. Findings of Experiment Three would seem to indicate at best that there is no relationship between the inclusion of a receptive teaching component and whether expressive verbal behavior would generalize to another situation. The best example of this was the generalization observed during teaching of signs in which most of the generalization occurred before the inclusion of a receptive component in teaching. However, one must also note that those subjects for which the inclusion of the receptive teaching component did not disturb their already existing expressive repertoires were the two subjects who acquired behavior quickest and who seemed to generalize the most; that is, Elizabeth from Dyad 1, and Paula from Dyad 2. Therefore, the importance of a receptive component in teaching manding behavior still remains an important question and the relationship between expressive and receptive mands still needs further experimentation. There is no doubt, however, that by teaching expressive verbal behavior alone (at least with sign language) in a manner that resembles a functional mand, a receptive repertoire may be acquired by the subjects without being taught.

DISCUSSIONAudience Control

The literature has indicated that expressive verbal behavior is usually preceded by receptive verbal behavior in teaching procedures. This study taught expressive manding first, or at least simultaneously with receptive manding. Other variables being constant, the probability of a mand securing reinforcement, is directly proportional to the consistency with which a listener behaves to the mand. The type and strength of reinforcement will also determine the effectiveness of early cues in the paradigm for promoting the expressive mand. Thus if a specific reinforcer is available or presented consistently following certain cues for a sign, then these cues will come to control the occurrence of that sign. (ie. cue-sign-listener behaves-specific  $S^{R+}$  ). If a specific listener is involved in the paradigm, he may come to exert "audience control" over certain mands which he has consistently reinforced, and/or for rewards only he has supplied.

In Experiment Three the experimenter's cues to subjects were always followed by music and M&Ms ( when subjects behaved correctly). Also, the experimenter was a more consistent listener than any partner. Thus, the experimenter gained audience control over expressive manding. In a similar way, receptive responses were often prompted by the experimenter (when the receptive subject failed to respond to a partner's mand under some procedures). It appeared that those subjects who eventually learned the receptive responses and displayed generalized expressive responses, were those subjects for whom receptive training did not disrupt already learned expressive training. ( some subjects emitted more expressive errors at the commencement of receptive training due possibly to the similarity in the cues presented for both types of training.) In all cases there were more generalized occurrences of signs on

the music machine, when the experimenter was present, than when subjects were alone (as in Experiment One). Additionally, a closer analysis of all responses observed in the music machine situation both during normal testing during the training sessions and in later "probe" sessions, reveals that 1) signs taught only in the presence of the experimenter were observed on the music machine only in the presence of the experimenter, 2) signs taught in the presence of the partner were observed only in the presence of the partner on the music machine, and on some occasions just in the presence of the experimenter (who of course was present during the training of these signs). Thus, there was little observation of individually taught signs in a situation where the experimenter was not present (except for "music" being emitted once as a tact and M&M being emitted in the presence of an M&M). Further examples of the extent of the audience control was seen when no signs of any form were observed in the presence of other adult experimenters on the music machine during some of the probe sessions, and the occurrences of signing to "new" partners on the music machine only in conditions where the experimenter was present.

Experiment One showed tremendous control of the experimenter's presence over expressive manding. Only where a) some control was exerted by the presence of a manipulable object, and b) a teaching procedure that ensured a receptive response concerning the manipulation of that object, was there any manding observed when the experimenter was not present. Even for "give" and "take", acquired by other procedures (A or B), the experimenter's presence was approximated by his prompting the behavior from the observation room.

The generalization observed in Experiment Two was to other adults, and what is referred to as spontaneous generalization to the dining room is actually the occurrence of the response to the same object as in training, in the presence of the same audience, for the same reinforcer in a different setting from training but a setting associated with that reinforcement. However, generalization was observed to similar teachers (for Paula and Elizabeth, for whom the author was a teacher in Experiment One) and may have encouraged generalization in these subjects. Rita did generalize but in a much longer time period. Shirley however, never successfully made the discriminations to acquire all the signs. However, the signs that did learn did generalize to other adults in the dining room situation with maintenance under an imposed contingency to mand (removal of tray for 30 seconds once she "spontaneously" manded one day). However, the 25 year history of never having to mand even for powerful reinforcement, may account for the low level of observed generalization.

Thus, this study appears to have contributed some knowledge to the solution of the problem: how would one teach mands to most benefit the severely and profoundly retarded non-verbal population? The exposure of powerful and accountable audience control in this study provides a strong prompt for the task of assessing which audience is going to be a target for a first repertoire. It may be that manding may come under more audience control than a tacting repertoire, given that mands are more likely to produce more powerful types of reinforcers than are tacts (in the typical institution). Unfortunately this audience control is going to be primarily by adult, institutional

staff, as opposed to peers. However, any interaction is better than none and manding to adults may generalize if contingencies are arranged.

Given the analysis by Veigt et al. (1975), it seems that most interactions between institutional staff and residents are mands from staff to residents and are concerned with care of resident tasks (washing, dressing, etc.). These interactions were judged by Veigt et al. to be only sometimes pleasant or neutral. In their study, of all resident-initiated interaction (less than 10% of all interactions), 90% were tacts to adults in a social play situation (where interactions have a high probability of being positive and therefore good stimulus control over resident initiated verbal behavior was observed). Non-verbal institutional residents could initiate more resident-staff interactions of a positive nature, if these interactions were mands, involving "natural" reinforcers provided in (resident care) situations and over which these situations would eventually come to acquire stimulus control.

This target, is part of what has been referred to in the verbal behavior literature as a functional verbal repertoire. It would seem, therefore, that a manding repertoire which provided "relevant" reinforcers would benefit non-verbal residents and can easily be established (experiment two).

Residents may acquire a manding repertoire with peers only if peers are associated with reinforcement, specified by that manding repertoire. From experiments one and three, the power of cooperative contingencies for such arrangements can be seen. Even against a lack of appropriate peer audience control, new reinforcers, new

tasks and a new situation, some subjects emitted mands when cooperation contingencies were strengthened and alternative responses for cuing a partner's behavior were removed. This was best demonstrated by the fact that the bulk of observed generalization in Experiment Three occurred when levers were removed (and there was no opportunity for one subject to prompt a partner to behave by, on purpose or not, manipulating her lever and demonstrating it was not her turn, as no reinforcement was forthcoming). Previous to this lever removal, there was possibly no real "need to mand", as other cues could successfully predict when manipulating the lever would result in reinforcement.

Similarly, experiment one demonstrated the relevance for communication of contingencies of cooperation and cues for cooperative behavior. The "free ride" phenomenon was seen in both dyads and reduced any requirement for these subjects to behave or mand. For their partners, it was more beneficial in terms of reinforcement density, to simply do all the work, rather than emit verbal behavior that may have been reinforced on a much leaner schedule. If it is the case that Experiment One taught a great deal of "imitation" as opposed to receptive responses to mands, it is possible that subjects who did mand (Elizabeth and Paula) effectively had their manding attempts extinguished by non-responding partners in training and/or the music-machine situation.

#### Imitation and Receptive and Expressive Verbal Behavior

Many verbal training methods have involved imitation training and skillful fading out of prior cues (by the experimenter), for the establishment of expressive verbal behavior (Lovaas et al. (1966, 1973). For expressive verbal behavior to occur spontaneously it must come under controls other than when teachers provide models or prompts for verbal behavior. Ideally this behavior should become under control of strong

environmental cues or "internal states of deprivation", as the mand does.

Although in topography a tact and a mand may be taught by a very similar procedure, the function of a response as a mand will differ in that the reinforcer that is specified is supplied. If what is specified is generalized social reinforcement, then indeed one could analyze a tacting repertoire as a manding repertoire when the speaker is in a "relevant state of deprivation" for attention. However, the manding repertoire is more realistic to gain most other "natural" reinforcers (even in the sense of solutions to problems being reinforcers). Therefore, as Skinner (1957) postulated, mands become reinforcer specific,

It seems that manding is more related to expressive verbal behavior than receptive verbal behavior for development in as much as the expressive repertoire usually will involve less energy than the equivalent non-verbal behavior. That is, to gain reinforcement, it is easier to ask for something and receive it, than to get it by other behavior (for many situations this is not true, of course, but what is at issue here is the obvious utility of expressive verbal behavior). However, regardless of how a mand may come to function, its topography must be established first. In this sense a response must be emitted and have a particular relationship to environmental stimuli. To become a mand the response must be constantly associated with a particular reinforcer, and therefore typically with some prior cue or stimulus. The particular response established is some behavior from a



special class of responses - verbal responses. Within the response class of verbal responses are a class of responses that are the same as all other behavior except their controlling stimuli are verbal behaviors (these verbal responses are delineated as receptive verbal behavior). Unfortunately it appears that topographically, any behavior can be receptive verbal behavior, but not all receptive behavior will come to function as expressive verbal behavior.

A mand, as expressive verbal behavior, is generally what one refers to when describing a functional manding repertoire. Therefore, an analysis of the function of the various stimuli and responses of the expressive and receptive mand seems necessary to establish the utility of, or the nature of the receptive mand as it is related to the expressive mand. From the present study, it appears that the receptive mand may not be very useful as a device for the general encouragement of expressive manding which is more clearly a repertoire that is reinforcer specific, and has many obvious benefits and therefore, would encourage its own generalization and acquisition to novel situations.

The receptive mand might be viewed as the middle term in this example paradigm:

verbal cue (pass the salt)	some behavior (passing salt)	some reinforcer (thank-you)
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This behavior might also be the expressive mand in the second term

below:

any cue (salt)	verbal behavior (pass the salt)	a listener's behavior (passes salt)	some reinforcer (get salt)
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If learned separately, as must occur, it can be seen that where some

receptive verbal responses may be acquired as the middle term of the first paradigm, this behavior is generally some operation on the environment and is far from the behavior of providing a discriminative stimulus that control it. This provision of a discriminating stimulus function is the expressive verbal behavior that is the second term of the lower paradigm. This behavior affects the environment in a very different way than the behavior of a listener who provides the receptive response. Learning to be a listener is very different from being a speaker.

Concerning the utility of teaching a manding repertoire, the question of relevance is: If we want someone to acquire an expressive verbal repertoire, should we teach a receptive repertoire; and if so, before, after, or concurrently with the expressive repertoire? The answer to this question has relevance for whether the first mands learned will be to perfect listeners (adults) or poor listeners (peers). When the expressive paradigm is used, the verbal response (a sign or vocal response) is a particular response of a particular topography under some environmental (internal included) control. To then begin training in which this topography is now presented as a discriminative stimulus for some other behavior (the receptive response) seems a formidable task! One might expect there to be some deterioration of the expressive repertoire, as previously reinforced responses are extinguished when they are emitted as imitation (when first responded to as discriminative stimuli they can only act as prompts to emit the only behavior learned thus far - the expressive mand). Thus, to teach the receptive component last would seem to cause confusion. This is

seen in Experiment Three for subjects whose expressive repertoire was disrupted by receptive training. If a receptive repertoire is learned first, we have a situation in which some behavior (not expressive verbal behavior) is under control of some verbal cue. When expressive training is commenced, a new cue is presented in the presence of which the subject is encouraged to emit a topographically new behavior (the production of the old stimulus) for engaging in some other behavior (receptive) already known to the subject. Although complex, if physical guidance is used as opposed to modelling signs, then the subject may learn to provide the response as easy or easier than if the expressive response was learned first. Some problems might be encountered, however, if there is modelling, as the subject will probably merely engage in the receptive behavior already learned.

Thus, to teach the expressive component last would seem to be the most beneficial. This is supported in the literature (Bricker & Bricker, 1971, 1972, 1974) and relates to the notions of Guess, Sailor and Baer's (1974) proposal for a language training program. Teaching both expressive and receptive components concurrently would seem to require a great differentiation in the experimental cues that preceded the behaviors in question. This is necessary to ensure that the receptive response comes to occur reliably to a speaker's expressive sign as opposed to a subject merely imitating a sign or always operating as a receiver and never as a sender. Such are the problems involved in teaching both expressive and receptive behaviors to equally naive subjects. With the inclusion of additional problems such as lack of attention, a past history of responding only to adults, and inconsistent

provision of reinforcement, it should not be surprising to find unstable or at worst non-existent acquisition ( see Experiment One).

Thus, receptive manding, it seems, is not necessary for the acquisition of expressive behavior. If taught first, however, it would seem to enhance expressive manding. The reverse is not true.

There is another sense in which we speak of verbal behavior as being receptive. It is in the sense of association, or reference, or "understanding". I separate the two classes only in that this type of function or receptive behavior is probably always learned when receptive behavior is "learned". However, because of the reduced response cost, it may be learned but the other behaviors associated with receptive verbal behavior in the broader sense, may not be observed.

An example would be when a subject who had acquired an expressive response for some object (tact or mand) could identify the object if the expressive verbal behavior is given them as a discriminative stimulus, along with a further mand such as "give". The receptive component of give is inferred by the action but the receptive component of the object is inferred by which object is chosen. If there is no choice to be made, no receptive component can be assumed.

The receptive component in the present study reported for mealtime objects is probably more an indication of the receptive repertoires of subjects for give than for the objects in question. When signed to for objects, some subjects only signed back; i.e., the sign was not a stimulus for anything but to repeat the sign. For others (the best learners) it was responded to by holding up the correct item.

Guidelines

This research concerning the utility of cooperation procedures for the acquisition and generalization of sign language mands, suggests some conclusions and guidelines:

1. For the teaching of expressive mands, it does not seem necessary to teach a receptive component ( see results of Experiment Two). If a receptive component is taught, it should probably be taught first (see results of Experiment One where problems were encountered involving attention of the listener in a two subject teaching procedure which lead to subjects relying on experimenter cues for responding receptively as opposed to the partner's expressive mand. Also see experiment three where receptive training disrupts previously acquired expressive responses possibly due to the similarity of the cues provided in the two types of training.)

2. It is advisable to teach signs that are topographically different ( see Experiment Two results for Shirley who could not discriminate between signs that involved touching the face at any point. )

3. It is advisable to teach signs that specify an actual reinforcer as opposed to those that specify only the behavior of a listener which has been associated with reinforcement. The presence of a manipulable object will enhance learning as opposed to trying to teach signs which have no such referent in the environment. ( see Experiment One results for stand and sit and compare to give and take. Additionally compare Experiment One results and Experiment Two results ( Experiment Two Figure 2) ).

4. During actual training, if using a cooperative procedure involving two subject, do not situate yourself as the teacher in any one location, and especially not between subjects. Ideally the teacher should not be there at all. The subjects must attend to each other and not the teacher. (see Experiment One

where subjects acquire expressive responses that are under the audience control of the teacher. Additionally see Experiment Three results of probe sessions, where observed generalization is under control of the presence of the teacher ( Experiment Three Figure 4 and 5. )

5. It is advisable to teach a cooperation task first before using that situation to teach verbal behavior. That is , a cooperation task seems to be possibly useful for actually teaching manding between cooperating subjects as opposed to its use in the present experiments as a testing situation for generalization of mands learned elsewhere. See results of Experiment One where it is not clear whether a lack of observed generalization to the music machine is the result of the behaviors of signing not being established appropriately, or the poor cooperative responding of subjects which would itself remove any "need" to mand each other.) ( see also Experiment Three Figure 4 where expressive mands are observed in the music machine situation as a function of removing other response forms from gaining and thus forcing subjects to emit verbal behavior in order to cooperate on the task behaviors to gain reinforcement.)

#### Generalization

1. Teach mands in the location where they will be emitted in the natural environment, at those time and if possible when the items to be manded will be available. ( see Experiment Two Figure I and note the short time of acquisition for mealtime words and the increased rate of generalization of learned signs over signs for all subjects. It is speculated that if teaching was conducted during meals these phenomena would be observed to an even greater extent.

2. Teach mands between more than two peers. ( It is only speculative but, if signs in the present experiment had been taught to more than one partner more generalization may have been observed due to less audience control.

Additionally, one should employ more than one teacher. ( the superior results of Experiment Two may also have been due to continual testing of generalization by adults other than the teacher and in this respect subjects eventually were responding to more than one person. )

3. Ensure that there is a contingency in the natural environment that will encourage manding. ( This is straight forward; if a person does not have to ask for something in order to get it, they will not ask for it. The results of Experiment Two ( figure I ) show that at first no subject asked for their food items and if a contingency more harsh than a delay of ten seconds was used, generalization may have been observed sooner than it was.) In short when verbal behavior is first being acquired , contingencies ensure its occurrence. Once the natural reinforcement of obtaining reinforcers at the reduced response cost of verbal behavior( as opposed to other behavior) take over, a generalized verbal repertoire may develop at a rapid rate.

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APPENDIX ACommunication and the Retarded

The present review will discuss research in the area of communication and deviant populations with a major focus on the retarded. Although the term verbal behavior does not refer to vocal behavior only, it is widely used in this context. This paper will also use the term, but in its broader definition of behavior shaped and maintained by consequences mediated by another organism's behavior (Skinner, 1957).

As noted by Blount (1969) there have been many reviews of verbal conditioning or language training in deviant populations (cf. Clarke & Clarke, 1965; Geortzen, 1957; Hanson, 1958; Karlin, 1952; Smith, 1962; Spradlin, 1963, 1966; O'Connor & Hermelin, 1963; Spreen, 1965a, b; all in Blount). However, Blount (1969) also noted:

With the exception of a few pages in Clarke and Clarke (1965) and O'Connor and Hermelin (1963) there has been no attempt to deal with the literature as it pertains to the more severely mentally retarded. (p. 21)

The paper by Blount deals with comparisons of normals to severely retarded, involving various language scales and statistical analysis.

Blount summarizes his review with:

Thus the more severely retarded subject is only impaired in his ability to use auditory and vocal mechanisms in a sequencing manner as he is equivalent to the LA (Language Ability ITDA) norms for the use of these mechanisms singly. p. 28

Blount further recommends "The way of future programs seems clear.

Whatever the therapy program, it should include all of his environment."  
(1969, p. 28)

Garcia and DeHaven (1974) provided a more recent review of language training from a behavioral standpoint. Their review deals with the literature and procedures for training imitation, functional speech and generative response class (including productive and receptive speech). This excellent review also contains a section of practical considerations and needed research. Among six neglected areas mentioned are two of relevance to this review: (1) the function of training motor imitations prior to vocal imitation, and (2) the practical issues concerning the necessity of a one to one relationship and the area of highly trained receptive speech to those individuals who show severe verbal deficiencies and would otherwise require a long history of training in the area of productive speech. The authors also support Blout's appeal to treat the individual's deficiency at his level.

There have been many articles discussing language training for retardates. Schiefelbusch (1965) criticized the practise of "labelling" of deficiencies in a paper referring specifically to the poor communication abilities of retardates as "speech deficiencies". He was promoting the independence of speech ability and potential to learn in general, by arguing that retardates were receiving low IQ scores and expectancies due to their lack of verbal expressiveness. He began the promotion of a functional language approach. He suggested the use of the term "communication behavior" in response to Spradlin's (1963) definition of "the speech and gestures of a speaker and the response to speech and gestures made by a listener". Schiefelbusch also noted that the slower developing child may have to improve such interpersonal

processes as a feature of his social adaptations. Thus, the functional approach to communication and its relationship to other behaviors began.

Support for the hypothesis that verbal expressivity and measures such as intelligence were independent of each other was provided by Halpern and Equinozzi (1969). These authors noted, however, that expressivity was related to measures of adaptive behavior and was a good predictor of such scores on adaptive behavior scales.

With the realization of the importance of language training and its possibility for severely retarded people, has come the call for systematic procedures for establishing language (cf. Goda, 1969; Bricker & Bricker, 1970). Goda, a well published speech specialist, noted that "the child's expressive level of speech functioning should determine the speech response he is capable of speaking" p. 23). Bricker and Bricker (1970) offered a systematic methodology for language training in the severely retarded. Their paper includes a discussion of operant audiology, receptive vocabulary, imitation, naming and sentence production all following a hierarchy of behaviors diagrammatically presented.

Guess, Smith and Ensminger (1971) offered evidence that specialists are necessary for such training. Four severely retarded children were trained for two years by two psychiatric aides. Those children attending language classes showed significantly greater raw score gains on the Illinois Test of Psycholinguistic Abilities (ITPA) than did a matched control group.



There have been many others who have contributed to the area. Happ and Lyon (1972) reiterated that non-vocal social situations must be considered in establishing verbal skills. Stremmel (1972) used behavioral techniques to teach subject-object responses in three moderate-severe retardates. Longhurst (1972) described the increasing of descriptive skills in retardates in a two person situation. Perozzi (1972) reiterated the relationship of language acquisition to adaptive behavior. He used the AAMD classification manual (Heber, 1961) and noted the sensitivity of learning, maturation, and social development scales to language acquisition. In a speculative theoretical article, Lynch and Bricker (1972) have presented the general notion that "if the cognitive psychologist and the linguist can define it, the behaviorist can shape it."

#### Experimental Analysis of Verbal Behavior

A large part of communication literature, relevant to the retarded, comes from the experimental analysis of verbal behavior both in theory and in applications and demonstrations of the functional role of language or communication behaviors. The following sections are therefore provided as exemplary of the analysis and its application.

Since Skinner's (1957) theoretical analysis, verbal behavior has been studied as an operant and its controlling variables discussed and demonstrated in many situations (Krasner, 1958). A popular example of such demonstrations is the Greenspoon (1951) experiment in which the emission of plural nouns was manipulated by a listener reinforcing occurrences of plural nouns with "mm hm". Since then verbal conditioning has been demonstrated in a variety of settings (e.g., Lindsley, 1959, with psychotic verbal behavior; Goldiamond, 1959, with normals trained to stutter with subsequent removal of stuttering).

Azrin, Holz, Ulrich and Goldiamond (1961) reported a series of experiments originally based on a strict replication of Verplanck (1955) who reported that undergraduate subjects were able to exert strong control over the casual conversation of people by selectively reinforcing certain opinion statements and extinguishing all other opinion statements. Verplanck had found that "all subjects increased their rate of stating opinions regardless of the topic of conversation, its setting or S's particular relationship with the E" (Verplanck, 1955, p. 673). The three experiments reported by Azrin et al, (1961), however, could make the same conclusions. Although their students were successful at conditioning opinion statements, information gained by the authors led them to realize that much of their data was fake! One experiment showed that when defined as "catharsis" -- disagreement caused an increase in opinion statements -- but when defined as operant extinction -- it caused a decrease in the same responses. The authors concluded that new procedures would be needed to demonstrate control over conversation. As is, their data demonstrate the power of experimental bias. A less exciting, but sound demonstration of control was reported by Levin and Shapiro (1962) who controlled the order of speaking in a group conversation by contingent reward.

Operant control of vocalization has been demonstrated in the chicken (Lane 1961) and in dogs (Salzinger & Waller, 1962). Lane has published a series of experiments concerning the control of vocal responses in humans. Lane (1960) demonstrated a technique for measuring some temporal and intensive properties of a human vocal operant and its application to an analysis of responding on a differential reinforcement of low rates (DRL) schedule of reinforcement. He noted that vocal

responding on DRL schedules, followed closely to the specifications of DRL values imposed. Two kinds of performance during early stages of DRL were discussed based on whether responding was being accelerated or (from an interresponse time analysis) to that observed in non-human organisms. In both cases (acceleration and deceleration) the terminal rate on a differential reinforcement of low rates (DRL) schedule is found to fall short of the rate maximizing reinforcement frequency, programmed by the schedule.

Lane and Shinkman (1963) extended this analysis to variable interval schedules. Parameters such as mean and variance of amplitude, pitch and duration were shown to increase for continuous reinforcement to variable interval reinforcement, and from variable interval reinforcement to extinction and in some cases from continuous reinforcement to extinction in humans. In a further study, Lane (1964) demonstrated control of duration of the vocal response /u/, using money reinforcement in a series of five experiments with human subjects.

Bernstein and Wolf (1964) reinforced five, three-man teams on a multiple differential reinforcement of high rates (DRH)-DRL schedule in five three minute sessions. In general, individual team members showed little stimulus control in group situations as compared to individual reinforcement conditions. The authors concluded that collective reinforcement is highly inefficient in comparison to procedures employing individual feedback.

Davison and Kirkwood (1968), using avoidance schedules, conditioned vocal responses in human subjects of various durations and intensities. Similarity to the control of motor operants was demonstrated in this study.

### Non-Verbal Imitation

Ball (1970) has noted that imitation was used as a teaching device as long ago as 1806 by Itard (The Wild Boy of Aveyrone Humphrey, 1932). However, a more frequently cited modern reference on imitation is the work on generalized imitation which was introduced by Baer and Sherman (1964). This was an early example of behavior modification technology which has become a corner stone of many behavioral applications involving language intervention. Early research (Sherman, 1963, 1965) demonstrated that imitation could be used to reinstate verbal behavior. Many researchers have since reported the use of non-verbal imitation as part of a language training progression (Lovaas et al., 1966; Bricker & Bricker, 1970; Buddenhagen, 1971). Typically, procedures describe such behaviors as clapping hands and touching body parts being slowly faded to the mouth area (Sloane, Johnston & Harris, 1968). Stark, Giddan and Miesel (1968), for example, reported the development of vocal imitation of consonants, vowels and combinations of these sounds in a 5 year old autistic child.

A major feature of such studies (as noted by Harris, 1975) is the difficulty in transferring non-vocal imitation to vocal imitation (cf. Garcia, Baer & Firestone, 1971). Previous researchers such as Lovaas, Freitas, Nelson and Whalen (1967) had demonstrated that complex behaviors could be developed through imitation. These results strengthened the notion of an imitation repertoire that was reinforcing in and of itself, but other work (Baer, Peterson & Sherman, 1967) developed arguments for the existence of a generalized imitative response class per se in a demonstration with three retarded children, who after being rein-

forced for imitation, would imitate sooner, both on newer items and with new experimenters.

Butz and Hasazi (1973) developed verbal imitation in a mute profoundly retarded girl. First, non-contingent reinforcement was alternated with contingent reinforcement to bring vocalization under experimenter control. Next, five specific sounds were taught in a multiple baseline design by presenting all five sounds but reinforcing only one. Evidence of a generalization imitative repertoire was seen in responding on non-reinforced trials.

Peterson (1968) and Saunders and Bringham (1970), however, were able to maintain non-reinforced mismatching (non imitation) interspersed with reinforced matching (imitation) and mismatching respectively. This led to the notion that the imitation hypotheses of Baer and Sherman (1964) may have been premature. More recent research (Stewart, 1972; Epstein, 1973) supports this notion in that subjects would imitate or not imitate, depending on what response class was reinforced. At the present time there seems to be a need for research examining the speed of generalization and limits of generalized imitation (Harris, 1975).

#### Verbal Imitation

Although detailed examples of how verbal imitation is established can be found in Sloane et al. (1968), Kent (1974) and other texts, most procedures are similar to those first established by Lovaas et al. (1966). These basically involved a) rewarding all vocalization, b) rewarding vocalization within 6 seconds of the model's vocalization, c) rewarding approximations to the model's sounds within 6 seconds of the model's sound, and d) introduce new sounds randomly with learned sounds. Most

research using operant techniques in language intervention have followed this general strategy (e.g., Blake & Moss, 1967; Hewett, 1965; Guess, Rutherford & Twitchell, 1969, to mention just a few). For a more complete listing see Harris (1975) who notes now a need for more novel applications and controls.

In a separate review Guess, Sailor and Baer (1974) have noted that many researchers conducting remedial speech training have omitted the non-vocal imitative step and simply began teaching vocal imitations (Risley & Wolf, 1967; Sulzbacher & Costello, 1970). The relevance of such issues for generalization is also noted in Garcia, Baer and Firestone (1971) who found generalizations did not occur from motor to vocal imitations. Thus, their reports have dealt with the development of generalized vocal imitative repertoires, and have approached its development by first developing motor imitations and then proceeding to vocal imitations. The usefulness of either a motor imitation prior to vocal imitation, or vocal imitation alone for the establishment of speech is not disputed, but for the clarification of the necessity of either or both for functional language development is certainly warranted.

There are many unanswered questions in the teaching of verbal behavior by the above techniques; questions such as how to control the attentiveness of the subject and what are the most economical methods of prompting and fading cues for responding. Hintgen and Trost (1966), for example, simply shaped successive approximations of vocalizations to high vocalization rate without using any prompting or modelling. McReynolds (1969, 1970) and MacCubrey (1971) used backward chaining to

obtain complex sounds. Unfortunately, there is little information comparing such issues. Related to these studies, Lovaas, Koegel, Simmons and Long (1973) and Lovaas, Schreiberman and Koegel (1974) have questioned the use of prompting at all, due to problems in attaining generalization in autistic children. Their own research has indicated that autistic children are over-selective of stimuli controlling responses.

#### Functional Verbal Behavior

The following presentation is offered as an example of the kinds of problems, methods and situations in which research on verbal behavior has been attempted in establishing functional verbal behavior in applied situations.

Although a verbal deficiency was only one of the problems dealt with by Wolf, Risley and Mees (1964) in dealing with an autistic child, it is an example of early reports. The subject could mimic some phrases and words and was shaped to near normal vocal behavior by use of contingent conditioned reinforcers, first by therapists, and then by his parents in natural settings.

In a classic report, Isaacs, Thomas and Goldiamond (1960) described the reinstatement of verbal behavior in two mute psychotic schizophrenics. Using chewing gum as a reinforcer, an experimenter gradually established verbal responses in the patients by reinforcing successive approximations (such as eye and lip movements) to speech. After a small number of vocal responses was emitted, there was generalization of the behavior to other people in other situations.

Lovaas, Berberich, Perloff and Schaffer (1966) reported the acquisition of imitative speech by autistic children. They utilized the principles of shaping, prompting and reinforcement to build imitative

verbal behavior in non-verbal children. This well known article is an example of the first attempts at applied operant conditioning.

Nathan (1966) explored the patterns of extinction in looking and listening to a communicating partner via programmed audio-visual experiment on which these behaviors were reinforced. He noted that looking and listening extinguished at different rates. His analysis offered (as explanations of the differences) the differential reinforcing values of looking and listening along with differing values of quality of feedback during the study.

Locke and Strayer (1971) programmed reinforcement and punishment contingencies on the basis of vocalization rates for five triads of mildly retarded female adolescents. Reinforcement was contingent upon a target subject's vocalizations and any other subject's vocalizations would remove points from a group score. Control over subjects' vocalizations was demonstrated in all five groups.

Barton (1970) demonstrated control of inappropriate verbalizations in a severely retarded boy to questions about magazine pictures by contingent attention and removal of magazines. Generalization of the verbal behavior was minimal.

McCuberey (1971) used shaping and fading to increase language skills in a group of six severely to moderately retarded children in comparison to a control group. Subsequent IQ measures of the experimental group showed an increase. This points to the relevance of language deficiencies for such children in terms of evaluations made of their retardation levels.

Locke and Gates (1971) exposed nine pairs of moderately retarded children to individual reinforcement for vocalization over six seconds.



When reinforced in dyads the subjects increased lengthy vocalizations but developed repetitions and meaningless responses emitted in unison.

Whitman, Berrish and Collins (1972) used direct reinforcement to increase the interpersonal language of two moderately retarded children. The free play social behavior of these and two other non-experimental subjects was monitored. Although language behaviors increased in all four children during periods of training when compared to baseline conditions, no increase in other social behaviors was observed.

In a series of four experiments Longhurst (1974) demonstrated that his sample of retarded adolescents had poor communicative skills in an analysis of speaker-listener functions. There were significant group differences between various levels of retardation but not between sexes. The speaker functions of subject repertoires speculated to be deficient as all subjects demonstrated adequate listener functions when competent speakers were substituted for poor ones.

Sulzbacker and Costello (1970) reported the teaching of expressive, functional language in a six year old autistic boy. Beginning with the establishment of attention for five months, they then taught Teddy a variety of objects by utilizing pictures and objects and fading the imitative cues for responses. After five months of this training they capitalized on Teddy's reading repertoire to establish functional speech by fading out signs as cues for objects so that responses were emitted to the object alone. An important feature of this report was the attempted generalization to a home situation where a variety of objects were available to him if he emitted the appropriate vocal behavior. Generalization was not observed to any great extent and the

authors speculated that generalization was possibly hampered by the stimulus effects of different schedules of reinforcement operating in the training and generalization environments.

Peine, Gregson and Sloane (1970) described a program to maximize reinforcement to increase a nine year old untestable child's verbalizations. Initially a teacher would model, "I want a candy" and the child would imitate that response and be reinforced. Once the child had emitted the behavior it was no longer prompted. Eventually the child began to emit appropriate descriptions and demands on her environment and have them reinforced. A prominent feature of this study was the detailed fading procedure used to remove the modelled prompts which controlled the occurrence of her verbal behavior in early learning sessions.

Jeffrey (1972) also reported the teaching of "mands" (Skinner, 1957) after initially following a Lovaas (1966) procedure for developing object naming in an eleven year old retarded girl. There are three major features of this study: 1) the selection of functional verbal behaviors, 2) the use of a "language master" so the subject could produce slides on her own and in effect, instruct herself, 3) the use of peer trainers. A high rate of emitting sounds and emitting phonemes was established. The subject's verbalizations in an ongoing classroom situation increased from 15% to 41% during treatment and decreased only slightly when treatment stopped.

Further support for the importance of functional language training for the retarded is seen in a study by Simic (1976) who successfully trained and produced generalization of spontaneous speech ("I wanna" and "out") in five non-verbal children. The relevance of the maintenance

of such learned behavior by reinforcing consequences was well demonstrated in this study.

Most recently there have been a variety of reports concerning both the teaching of various grammatical forms of language and the generalization of language. Some of this research has been concerned with the relationship of receptive language to expressive language and the implications of the relationship for teaching language. Guess, Sailor, Rutherford and Baer (1968) demonstrated that using imitation procedures, expressive use of plural nouns could be taught to a retarded subject who had never used plural forms. Guess (1969) similarly taught receptive plurals to two additional subjects but found that generalization to expressive usage did not occur without specific training.

Sailor (1971) investigated the effects of differential reinforcement for usage of plural endings "/es/" vs "/z/" and established learning variables as being more salient to the acquisition of such behavior as opposed to physiological factors affecting the ability of subjects to make these sounds.

A more detailed investigation by Guess and Baer (1973a) attempted to obtain generalization across response modalities for plural word ending usage. Four severely retarded subjects were taught concurrently two varieties of word ending articulations ("s" and "es"). Two subjects were taught (using tokens and praise) to use the "s" ending receptively and the "es" ending expressively. The other two subjects were taught the opposite endings. Generalization to the other response modality was tested in unreinforced probe sessions. Guess and Baer (1973) found

that teaching responses to novel instances within the same response class was relatively easy but that generalization across response class was more difficult to establish. These results and a discussion of their theoretical implications are discussed by Guess and Baer (1973b).

This type of analysis has been extended to past and present verb tenses (Schumaker and Sherman, 1970) and to adjectives in receptive speech (Baer & Gess, 1971). Accurate use of prepositions (Sailor & Tamon, 1972) and the syntax of complete sentences (Wheeler & Sulzer, 1970) has also been investigated. Concurrently an analysis of the operant approach and other approaches to language acquisition and the benefits to be gained from their amalgamation has been developed (Staats, 1968, 1976).

Operant techniques have also been used to train such behaviors as question asking (Twardoz & Baer, 1973), verbalizations about current events (Keilitz, Tucker & Horner, 1973), and interactive behaviors of mental patients (Bennet & Maley, 1973).

#### Non-Vocal Communication

Communication has also been the focus of attention for researchers working with non-human primates such as the chimpanzee. Recently, Rumbaugh, Gill and Von Glasserfield (1973) and Rumbaugh, Gillis and Brown (1973) demonstrated that a chimp can acquire an extensive vocabulary in a specially designed language via operations on a computer terminal. Others (Gardner & Gardner, 1960, 1970, 1975; Fouts, 1972, 1973) have demonstrated that a chimpanzee can acquire a basic sign language and thus a functional communication repertoire.

Premack (1970, 1971), a pioneer of invention in operant research, discussed the acquisition of a minimal functional language by Sara, a

chimpanzee. An important feature of this work was the functionality of language taught by Premack. By using plastic symbols and natural reinforcers, Premack and his associates trained Sara to properly produce short word combinations in order to receive the items corresponding to the symbols. Eventually Sara learned over 130 separate signs, and could arrange various kinds of declarative and interrogative statements for teachers.

Gardner and Gardner (1969) adapted American Sign Language for use with a young chimpanzee, Washoe. Using physical guidance and modelling, they successfully taught Washoe a variety of simple signs, which then generalized to a number of other situations. An interesting feature of these studies was the fact that Washoe's first words were demands. Also, Washoe demonstrated other major features of language acquisition observed by most other researchers investigating language acquisition, viz., an increasing rate of acquisition for new words once learning commenced, and the stringing together of individual words into combinations of two or more.

Fouts (1972) used three training methods to teach three four-word groups of words to the Gardner's chimpanzee, Washoe. The methods were modelling (imitation), molding (physical guidance) and free style (a combination of the two). The first phase of the research involved teaching the signs in one-hour sessions (one hour per word). He found Washoe learned only one word in one of the four sessions using modelling and four additional sessions produced no change. All of the other words taught by physical guidance and free style were learned. Fouts noted that touch words (signs with physical contact between hands or the hand and the body) were learned faster than other words. In Phase II of this research two groups of nine words were taught by the

the separate procedures of molding followed by modelling and modelling followed by molding. The results were unequivocal: all signs except one were acquired only during conditions with molding. The exception was the sign for "lollipop". These findings will be of relevance later in the discussion of procedures for teaching sign language.

In a later study (Fouts, 1983) these findings were extended to four more chimpanzees. Fouts found that these chimps also could acquire basic signs and also isolated some major features concerning errors in learning signs. In particular, his data indicated that errors occurred mainly in signs involving conceptual similarities (food, fruit, etc.), gestural similarities (topographically similar signs) and errors of "preference" (perhaps related to the pre-experimental strength of various motor movements in the chimp's repertoire).

#### Applications of Non-Vocal Communication

Combinations of vocal and non-vocal communication procedures have been reported with populations of retarded children. Miller and Miller (1973) used a function approach to teaching sign language by which they demonstrated the acquisition of signs that were useful to a retarded child in the learning environment. Signs were taught to children on an elevated parallel board apparatus by a procedure which also utilized vocal instructions from teachers. In order to "cross" the apparatus, the child would have to emit signs to "open" a door and "lower" a drawbridge, among other operations.

Brady (1975) conducted a more detailed evaluation of procedures that combine vocal and manual language acquisition. His study compared sign language, the operant conditioning of vocal behavior, and a combination or "total communication" approach in a six year old autistic child. He found that there was no difference in acquisition of words

taught by signs or vocalization, but that the combination of procedures was significantly (statistically) better. An important feature of this study was the autor's discussion of his findings with respect to Fouts and Fulwiler's (1974) review of the non-vocal communication literature. They had postulated possible neurological dysfunction in autistic children which prevents auditory-visual cross-modular associations as opposed to separate visual or auditory process dysfunctions. In essence, Brady argues that sign language is successful with these patients because of its primarily visual mode and motor feedback features.

Most recently applied research has reported the usefulness of gestural and other non-vocal language systems with retarded and autistic children (Webster, McPherson, Soloman, Evans & Kuchan, 1973; Kent, 1974; Topper, 1975; Vanderhieden, Brown, MacKenzie, Runem & Schiebel, 1975; Bliss, 1974).

#### Generalization

Throughout the literature on language acquisition for the non-verbal retarded, two common features are: 1) the overwhelming agreement by researchers on the need to produce a generalized language repertoire, and 2) the perplexing deficits in the present technology for producing it. Although almost every article dealing with language training at least attempts to establish some form of generalization few are even moderately successful. This section of the literature review will present a few relevant articles which have dealt specifically with this, the most important issue in the language acquisition process.

Harris (1975) has provided an excellent review of the literature pertaining to language training of the non-verbal child. The review

is especially useful because it emphasizes problems with generalization. The review is divided into areas of attention, non-verbal imitation, verbal imitation, and functional language. Although the general view held by Harris is that operant conditioning techniques have been successfully used to train skills necessary for functional language, much more work is needed to provide procedures for establishing the generalization of these behaviors from the situations in which they are taught to the "natural" environment.

Hartung (1970), in a review of procedures for increasing verbal imitation skills and functional speech in autistic children, noted that:

Newly acquired appropriate speech will often spontaneously generalize to situations outside the specific conditioning environment. Self initiated speech seems to generalize primarily because of its functional value for the child...the child soon discovers that by using words he can effectively satisfy his desires. (p. 214)

The general rules Hartung suggests, to ensure the encouragement of behaviors taught elsewhere are: 1) reinforce the behavior in a variety of situations, 2) train with a variety of teachers, 3) teach words that are of relevance to the child, and 4) give a lot of social reinforcement for verbal behavior that occurs. Similar suggestions come from Drew and Espeth (1968) who investigated transfer-of-training of motor perceptual acts in retarded subjects.

Hartung also draws some conclusions from the literature relevant to imitative vocal behavior; viz., that "the child who fails to speak before 5 years won't in general",



and that

Not only is imitative verbal behavior considered a prerequisite to functional speech, but functional speech cannot be developed in a non-speaking child unless that child first imitates the verbal responses of others consistently. (p. 205)

Additionally, he also notes that

The child who does not attend adequately to outside cues is incapable of modifying his behavior accordingly and will hardly establish an imitative repertoire leading to effective usage of language. (p. 207)

Hartung also discusses the guidelines first proposed by Lovaas et al. (1966) for selecting vocal sounds that one might teach a non-vocal child. Sounds should be chosen that: 1) may be prompted manually (e.g., holding the lips), 2) the lip movements of which can also be seen easily (e.g., /m/, /a/), 3) words that the child can already use (those that occur frequently). Lovaas et al. (1966) found children discriminate sounds with visual components more easily than those with only auditory components.

Although there are occasional reports of spontaneous generalization of verbal behavior taught in one situation to another situation or to people other than the trainer (e.g., Isaacs, Thomas & Goldiamond, 1967; Gray & Ygetakis, 1968a), this usually is not the case. In fact, the overwhelming evidence of the literature upholds the early position of Baer, Wolf and Risley (1968) concerning the fact that generalization must be programmed. Griffith and Craighead (1972), for example,

assessed the generalization of the correct articulation of the phoneme /l/ in a retarded subject with poor articulation. In their study they described three different stimulus modes under which a subject was taught ten trials of producing the sound /l/ correctly. These were words, pictures and short phrases following a multiple baseline design across three stimulus types. One experimenter would reinforce correct responses each day in a classroom situation. The other experimenter would test the boy each day for all three classes in the cottage where he resided. Cottage responses were not reinforced. They found that correct articulation came only after reinforcement and only occurred in the cottage when prompted and reinforced in that setting.

Another excellent study that demonstrates the necessity of programming for generalization was reported by Rubin and Stolz (1974). They were concerned with generation of self-referent speech in a 13 year old severely retarded boy. In a controlled experiment they monitored his self-referral speech in a classroom setting while concurrently teaching him correct personal pronoun usage in another setting. After training was complete, it was extended to the classroom situation. They found that correct usage was infrequent in his spontaneous speech after training alone with one of the authors. When a teacher's aide in the classroom situation also began training, his correct self referral speech improved dramatically with decreases in idiosyncratic speech and improvements in normal speech. The latter included proper use of pronouns with other words not used in training. A follow-up verified that these improvements were long lasting. Thus, generalization was demonstrated along four dimensions: a) membership of a stimulus class, b) related behavior, c) membership of the response class, and d) time.

The authors concluded that explicit programming of stimulus generalization is essential for improving spontaneous speech, and speculate that perhaps once a grammatical response is established using programmed reinforcement it will be maintained by natural occurring social reinforcement in the natural environment.

Also relevant here is another paper by Lovaas, Schreibman, Koegel and Rehm (1971) concerning the responses of normal, retarded, and autistic children to multiple stimuli (auditory, visual and tactile). All three stimuli were presented as cues that bar pressing would be reinforced. After responding was established, stimuli were presented individually. Normal children responded to all three types of stimuli, retarded children to two, and autistic to one. The implications for language learning are that perhaps some populations will require repeated training in more than one stimulus situation before any generalized responding is seen. Thus, in all likelihood language training will focus on the natural environment as opposed to the classroom.

The generalization of verbal conditioning also has been demonstrated in training receptive prepositions (such as "in", "on", "under") in retarded children (Frisch & Schumaker, 1974). Three retarded children were trained using prompting and reinforcement to respond to three classes of prepositions. Untrained requests were presented to the children, unprompted and unreinforced. As training was established for a category, untrained responding occurred for that category.

Garcia (1974) successfully trained two non-verbal profoundly retarded subjects to imitate three sequential verbal responses to both pictures and questions about those pictures. Both subjects learned the

trained sentences, but showed little generalization across experimenters. However, after intermixing a probe testing procedure with training, one experimenter observed generalization across materials. Generalization to a third experimenter was obtained for one child only after two previous experimenters used intermixed probe sessions with that subject.

Generalization of verbal conditioning to verbal and non-verbal behavior has been demonstrated with chronic mental patients by Tracey, Bridell and Wilson (1974). Female patients working on a token economy received token reinforcement for positive statements about optional hospital activities and about other people. Increases in these statements as a result of token reinforcement was empirically demonstrated.

Along the lines of environmental planning for the maintenance of behavior, Coleman and Stedman (1974) have shown the effect of modelling on increasing vocal frequency and volume in the acquisition of a labeling repertoire. By means of an imitation procedure, a ten year old autistic child was taught labels and subsequently modelled a peer in the frequency and volume of emission.

Haviland (1972) suggested a three-pronged attack, aimed at creating an institutional environment in which language can be acquired. This would include development of visual, auditory and tactile stimuli, the education of staff in techniques to develop and maintain language, and improving institutional conditions in general. Haviland points out that if there is no need to communicate, the mentally retarded person will not.

The relationship of the "verbal environment" of institutions to the problem of generalization of verbal behavior has been the subject

matter of various articles concerning the importance of promoting communicatory behavior in non-verbal institutionalized populations such as the severely and profoundly retarded.

Perozzi (1972), as mentioned previously, discussed language as adaptive behavior. He discusses various measures of adaptive behavior and suggests that variables affecting such behaviors might be related to those of language development.

In a theoretical paper, Mahoney (1975) concluded that the functional aspects of language have been ignored by theorists who have been interested in the structural features of language. His position is that language is basically communication and, therefore, should be viewed from a psycho-social context. He states:

Language acquisition therefore fundamentally involves the modification and refinement of the more primitive communication systems between children and their environment. (p. 140)

Mahoney essentially argues that if communication is the major goal of language then language training procedures should focus on the communication needs of the individual and not on training procedures based on theoretical structures derived from an examination of the grammatical structures of the "normal" verbal community.

Related to this general notion, other researchers have reported the importance of past experience with language for learning language. Hoemann (1972) found that quality and accuracy of peer-peer interactions in children who were deaf was poorer than normals in a controlled experiment involving description of defined events. Hewes (1973)

reported interference with decoding of sign language (receptive behavior) in deaf persons who had accidentally received lesions in the dominant cerebral hemisphere. His conclusions in this paper were that manual communication is as much related to cognitive structure as spoken language and indeed may be historically a precursor to spoken communication.

Gayton and Bessett (1972) reported data supporting a position that past history with respect to learning verbal behavior is a powerful variable in acquisition of new verbal behavior. He compared three groups representing different conditions of high, low and no reinforcement for verbal responses on continuous and variable reinforcement.

Probably the most relevant work in this area involves the analysis of existing environments in institutions as exemplified by the work of Veigt, Steven, Allen and Chinsky (1976) and Giles (1971).

Veigt et al. conducted an analysis of the daily interactions between institutional retardates and their attendants from 7 a.m. to 8:30 p.m. on a typical "cottage" type of ward common to many institutions today. Observations in continuous time intervals over a seven week period showed that the ward interactions were consistently characterized by care and management activities in an "affectively neutral" atmosphere in which adult caretakers initiated most of the interactions. By categorizing interactions functionally as tacts or mands (Skinner, 1957), attendant or child initiated, and on a scale of negative, neutral or positive, they reliably observed interactions with an elaborate interval recording method. This study showed that of all observed time intervals, only 56% contained interactions. Of all interactions, over 90% were attendant initiated and of these, mands (commands and

instructions) were observed to occur approximately five times more than tacts (declarative statements). For resident-initiated interactions (of which gestures outweighed vocal behaviors 5 to 1), which totalled 8.8% of all interactions, tacts occurred about three times more often than mands. Moreover, 90% of the resident initiated interactions occurred in a small segment of the day labelled "social play time".

If one can say these data represent the typical institutional ward environment for non-verbal severely retarded -- if not the more "progressive" institutions, which is more probable --- a definite pattern of interaction can be surmised:

- non-verbal institutionalized retarded residents do not engage in expressive verbal behavior even with normal adults (let alone with each other) during the course of the day, except for very short (15 minutes or half and hour) play periods;
- when interactions do occur they are not mands, but tacts;
- only a small portion of all interactions are positive;
- most opportunities or situations throughout the day to teach functional expressive verbal behavior about eating, dressing, toileting, etc. are characterized by adult aides doing everything for the resident, and at best requiring some receptive verbal behavior in the form of compliant responses to an aide's commands.

These results verify the indications of a previous study by Giles (1971) who studied the verbal environment of 32 retarded children in two separate institutions. One institution represented a larger, older type of institution and the other, a small newer environment. Of the 16 children chosen for the study in each institution, eight

had high verbal skills and eight had little or no verbal skills. He observed these children for 32 days during all of their waking hours, and conducted a detailed analysis of their interactions.

Giles' findings showed that non-verbal behavior accounted for over 50% of the observed time periods for highly verbal children and over 64% of all observed time periods for low verbal children, regardless of institution. Another finding was that peer-peer interaction constituted less than 4% of all interactions for any group. Additionally, he found that attendants directed more verbal behavior to more verbal children than to less verbal children in each institution. Thus, regardless of verbal skills, and type of institution, the verbal stimulation for the institutionalized retarded is extremely low for adult-resident interactions and functionally non-existent for peer-peer interactions.

It would seem then that although many of those concerned with environmental conditions for the teaching and generalization of verbal behavior have produced what may be effective procedures for such a task, an immense problem in the daily environment prevents promotion of language in institutions. Additionally, if the general consensus among language teachers (as exemplified in the articles reviewed) is to utilize the natural environment as the teaching environment, this has been virtually ignored in practise.



## GENERAL SOCIAL BEHAVIORS

Appendix BIntroduction:

This appendix is to provide exemplary relevant literature concerning the experimental evaluation, or direct manipulation of social behaviors. The studies are broken into these categories primarily because these studies discussing manipulations of social behaviors have typically been more recent and behaviorally oriented. The older literature was concerned primarily with establishing the parameters of social behaviors in a general sense and was not attempting to directly intervene into a particular subject's repertoire in a therapeutic sense. The studies presented then are only briefly discussed in terms of the variables manipulated and the general results and are not always concerned with retardation but often contrast retarded children to non-retarded children.

Evaluations of Social Behaviors:

Researchers have focused on various methods of evaluation of social behaviors. Lovaas, Freitag, Gold and Kassorly (1965) described an apparatus and procedure for observing the behavior of children in free play settings. Hollis (1965a, 1965b) conducted a series of studies concerned with the effects of social stimuli on behaviors of severely retarded children. In his first paper (Hollis, 1965a) he demonstrated that specific forms of physical and social stimulation have definite and differential effects on the behaviors of profoundly retarded children. (In this study he reported a reciprocal relationship between outer directed behavior such

as physical contact, and social stimuli (people). That is, his subjects were more self stimulatory in a social situation than in solitude, and were more physically interactive when alone. The second study (Hollis, 1965b) replicated the first but with males instead of females and in this paper he concluded that "the environmental conditions militate against the development of social behaviors" (Hollis, 1965b, p. 783). This conclusion was based on the observation that the interactions shaped between residents and adult aides had given a negative valence to interactions in general. Also the cessation of peer interactions by aides, combined with major perceptual deficiencies could account for his findings. Hollis, a major contributor to the general area, also conducted research on the behavioral dominance of peer interactions in profoundly retarded children, (Hollis and Gunnell, 1965c).

Charlesworth and Hartup (1967), devised an observational method to obtain normative information on the amount and kind of positive social reinforcement dispensed by normal pre-school age children in a nursery school setting. In general, older children reinforced peers who were younger. Reinforcement given was also mostly associated with dramatic play period activities rather than quieter activities such as table games. One-half of the reinforcement given was spontaneous as opposed to responses to a peer's action.

A comparable investigation by Whaler (1967) demonstrated that behaviors such as co-operation, aggressiveness and speech could be manipulated by peer reinforcement. The reinforcing possibilities of peer related behaviors has also been demonstrated by Hardy (1973).

More recently, Strain and Timm (1974) have investigated the social interaction of behaviorally disordered school children under two

procedures. In one condition, verbal praise and physical contact was given to a target subject's peer for appropriate interactions with the target. In another condition the consequence was to the target subject. Both procedures facilitated a rapid increase in peer social interaction but recipients of the reward generally initiated more social contacts than others.

Several studies have compared different populations for peer interactions. For example, Severy and Davis (1971) investigating "helping" behavior, found that of two groups of children, older normals were no more helpful toward their peers than were younger retardates or normals, on a work task. However when unequal opportunities to help were controlled, older retardates were seen to attempt to help more often any other group, and were as successful in their attempts as older normals.

Frietag (1970) found that autistic boys were more "removed" in a marble dropping task, than normal or retarded boys. The study was designed to give support to the notion that autistic children are more sensitive in inter-personal relations and therefore are apprehensive to act.

#### Manipulations of Social Behavior:

A number of studies have been concerned with the direct or indirect manipulation of social behaviors, by some specific procedure or technique in order to assess these in some systematic way. Wieson, Hartley, Richardson and Roske (1967) increased the social interactions of six retarded children with candy rewards and social rewards. Their study was concerned with the changes in a "generosity" response, along with looking, and a proximity measure.

Kale, Kaye, Whelan and Hopkins (1968) used cigarettes to systematically increase a greeting response in chronic withdrawn mental patients. The response was strengthened and generalized to several experimenters after the schedule of reinforcement for cigarettes was weaned and natural reinforcers took over.

Hopkins (1968) used a similar procedure to increase smiling in two severely retarded boys, using candy reinforcers and weaning. In addition a sign was worn by the boys which provided cues to institutional staff as to how to appropriately consequence the behaviors of the boys. By reversing the contingency for smiling, dramatic control of the behavior by social factors, was demonstrated.

Stokes, Baer, and Jackson (1974) used prompting and shaping to develop a hand waving gesture in four severely and profoundly retarded children. A multiple baseline design across subjects showed no generalization to another experimenter, but to other staff after the subjects had been trained by a second experimenter.

Whitman, Mercurio, and Caponigri (1970) developed the social interactions of two severely retarded children by their partaking in a ball rolling task. Social behaviors increased and generalized to a non-training environment. The social behaviors of peers, not included in the study who interacted with subjects also increased.

Clement and Moss (1967) demonstrated the effectiveness of token, verbal, and no reinforcement on social behaviors of eleven third grade withdrawn boys. Approach behaviors were most affected by tokens, followed by verbal praise and no reinforcement. Using a structured booth apparatus, Blake and Moss (1967) taught some imitative responses to a mute autistic boy along with some verbalizations.

Of a similar vein is a study by Milby (1970) in which two adult male schizophrenics increased their interactions with staff and other patients when staff social reinforcement was made contingent upon these behaviors. Although such control by manipulation of staff behaviors has been amply demonstrated (Allyon and Micheal, 1959; Allyon and Haughton, 1962) the present study was specifically concerned with social development while earlier studies have noted such control in efforts to change many behaviors in pioneer investigations. Also of relevance here are numerous articles on social interaction and co-operation. However they will be discussed in appendix C as they seem more relevant to that section.

#### Social Behavior as a Side Effect:

A number of studies have been reported in which social behaviors have been changed as a result of the manipulation of contingencies for other behavior. For example the power of reinforcing other behavior to reduce undesirable behavior was well demonstrated by Sewell, McCoy, and Sewell (1973). Tantrums and other undesirable behaviors were removed and more positive peer relations established in a child.

Buell, Stoddard, Harris and Baer (1968), in their classic article, reported the increase of social interactions of a three year old pre-school child, with social and motor development deficits. The child was reinforced for using outdoor play equipment and was ignored for attention seeking behaviors toward staff members. The results were an increase in the touching and verbalizations toward other children, co-operative play, and the decrease of attention seeking.

Kirby and Toler (1970) observed increases in the proximity

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co-operation, and verbalizations to peers in a five year old pre-school boy, when he was allowed to dispense candy rewards to nursery school classmates, for their appropriate behaviors. Variables such as the pairing of the child with primary reinforcement, were among those discussed by the authors as plausible explanations.

Imitation:

The reader interested in the role of modeling research and social behaviors is referred to Hardy (1975), for a complete review of there produre and the retarded. In general, observational paradigms have been successfully demonstrated to be of great use in promoting social behaviors.

Paloutzain, Hasazi, Streifel, and Edgar (1971) used prompting and reinforcement to develop an imitative repertoire of social behaviors in ten severely retarded children. The subjects showed a significantly higher mean occurrence of social responding after training, than did ten control subjects who were not trained. The major contribution of this study is a demonstration that currently used imitative procedures could be expanded to teach complex social responses.

In an interesting display of modeling effects, O'Conner (1969) observed an increase in social behaviors of a group of isolate nursery school children who had been exposed to a film depicting social interactions between model peers, with a narrative. A control group, who saw a non-social film, made no improvement. In a further study, O'Connor (1972) employed 33 social isolates from four schools. One-half of these were shown a film depicting appropriate social behaviors, while the other half were shown a control film. Then, one-half of each of these two groups were reinforced for appropriate social behaviors. Modeling

was shown to be more rapid than shaping in acquisition of social behaviors and modelling subjects were observed to engage in more stable interactions over time whether shaped or modelled alone. In a follow up, modelled subjects remained at a non-isolate level of interaction, whereas subjects who had received shaping alone, had returned to previous low levels of interaction.

More recently, Keller and Carlson (1974) exposed 19 isolate pre-school children either to four, five minute video tape recordings of social skills, or four, five minute recordings of nature films. Observers rated the frequency with which subjects then dispensed reinforcement and interacted with peers. Only the modelling group increased on all three of the measurements taken.

In an interesting and relatively new approach to social play behaviors, Quilitch and Risley (1973) have examined the effects of play materials on social play behaviors. Their report demonstrates the control of various play materials over behaviors in a group of recreation center children.

Thus, social behavior has been studied from a variety of perspectives. Efforts have been made at evaluating the social behaviors of a variety of populations and at devising methods and procedures for such a task. These have been numerous demonstrations of the ability of reinforcement procedures to increase social behavior under both direct contingencies and under contingencies for other behaviors. Recent literature indicates that social behaviors between people may also be caused to increase when external cooperative contingencies are placed on those persons.



## CO-OPERATION AND SOCIAL BEHAVIOR

Appendix C:

Co-operation is a term usually associated with any situation in which two organisms behave in a manner that summates their efforts to gain some mutual goal. For this reason most co-operation situations have had some relationship to an analysis of social behavior. However, from a behavioral analysis concerning the taxonomical distribution of responses and reinforcers, a general definition of co-operation allows many procedural variations, (cf. Hake and Vukelich, 1972). The essential aspects of any co-operation procedure as posited by Hake and Vukelich (1972; 1973) are that

- (1) the reinforcers of both individuals are at least in part dependent upon the responses of the other individual and (2) that the procedure allows such responses, designated as co-operative responses, to result in an equitable division of responses and reinforcers. An increase in co-operative responses is indicative of a co-operation effect. (Hake and Vukelich, 1972, p. 333)

Thus, such general terms as social behavior and co-operative behavior become too universal to be of use. When the notion of communication is introduced, we are in a real dilemma as to which level of analysis will be most productive. With this qualification of the discussion, this section of the present review will deal with literature relevant to an experimental analysis of co-operation as it relates to the social behaviors of organisms placed in such situations from subhuman examples to complex human examples. In particular the process of co-operation

rather than the outcomes (choice behavior) will be discussed.<sup>1</sup>

Co-operative Behavior Analysis in Subhuman Organisms:

One of the earliest reported attempts at examining co-operation was by Daniel (1942) with rats. Eight rats were shaped individually to avoid an electric shock in a chamber by sitting on a shelf which terminated current flow to the grid floor. These same animals were also allowed access to food reinforcement from a food dish located in the centre of the chamber, under a no shock condition.

Then pairs of rats were placed in the chamber with food in the centre dish and the shock contingency in effect. After approximately forty session days, the rats acquired a form of co-operative responding. While one animal would sit on the shelf to remove the shock, the other would feed. Daniel reported that the shelf animal would typically nudge or bite the feeding animal, or crawl on its back until the feeding animal would assume the shelf sitting position and be replaced by the other rat at the feeder. A second study (Daniel, 1943) arranged for a food dish cover to be lifted by the weight of one animal sitting on the shelf. In this situation, with no shock contingency, co-operation was not observed.

Skinner (1962) presented two similar displays of co-operation in pigeons. In one display, pigeons were reinforced individually for pecking a ping pong ball to make it fall on the opposite side of a table.

<sup>1</sup> The reader interested in choice and outcome research (e.g., Prisoner's Dilemma Game) is referred to Nemeth (1970) as exemplary of such research and Cook and Stingle (1974) for an eclectic general review of the area.

When reinforcement was made intermittent, and two birds placed opposite each other, the result was similar to a table tennis game between pigeons.

A second demonstration was of relevance to a leader-follower relationship. Pigeons were trained to peck two different sets of keys simultaneously to gain mutual reinforcement. Skinner observed that one animal came under control of the keys and the other animal's responses came under the control of the first animal's responses. This analysis was supported in that the follower bird would imitate actions of the leader, that were not relevant to the food contingency (such as dunking).

Boren (1966) trained monkeys individually on a multiple schedule to lever press at high rates and then to not press (mult FR DRO), when placed in a dyadic situation with stimulus lights to indicate the components of the multiple schedule. A response-exchange relationship could be maintained in this situation, where monkey A would respond and monkey B would receive the reinforcer. When stimulus lights were removed, co-operation deteriorated. Monkey A's behavior extinguished and monkey B became satiated. This study will be of importance in a later discussion.

In a later study (Colman, Liebold and Boren, 1969) monkeys in pairs were placed in adjacent cages and each allowed to choose between a response that fed each individually, or both monkeys. Although only one of four monkeys was always altruistic the authors indicated by this report that several types of responding were observed as being possible and this provides incentive for further research.

#### Co-operative Behavior Analysis in Humans:

One of the classic applications of an experimental analysis

of behavior to the study of co-operation was reported by Azrin and Lindsley (1956). Ten 2 person teams of children were taught to place sticks into corresponding holes for mutual reinforcement by responding at the same time. All ten partnerships learned the co-operative response within ten minutes. Experimental control was demonstrated by removal of the reinforcement contingency causing extinction of the co-operative response and reinstatement of the response when the contingency was re-introduced.

Sidowski, Waycoff and Tabourey (1956) conducted a study on the effects of reinforcement and punishment in a minimal social setting using 20 dyads of university students. Two subjects, unaware of each other's presence, had a choice between two buttons to push at any one time. One button shocked the partner, the other scored points for him. The twenty dyads were divided into weak and strong shock groups. Results indicated that strong shock dyads learned to earn each other points and avoid shock whereas weak shock dyads did not. Learning occurred in the first 5 minutes of a 25 minute session. This study supports a view that "social" behavior is a product of the same principles that determine individual behavior, and research should focus on functional variables rather than those such as awareness, attitudes or understanding. A similar study and discussion are reported by Sidowski (1957).

The validity of such co-operation procedures as mentioned here as indications of extra-experimental clinical evaluations of social behaviors was demonstrated by Cohen (1962). Justin, a thirteen year old normal boy was allowed to co-operate with five other people from his daily life on the lever pulling apparatus of Azrin and Lindsley (1956).

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By controlled conditions of leadership and competitive contingencies, the behavior of Justin and his peers was shown to correlate highly with the general patterns of cooperation and competition Justin displayed with these people in his daily routine. When working with a partner with whom he normally assumed a dominant role, and allowed to be leader, cooperative response acquisition was rapid. When the partner was allowed leadership control, acquisition of cooperation was slow or competition began. This research sparked some later work by Lindsley.

Lindsley (1966) further used the free-operant method of analyzing cooperative and competitive behaviors. Lindsley defined a cooperative response for a dyad of children as each subject pulling a plunger within a half second of the other. Subjects were exposed to conditions of social and non-social working, and the order in which they could respond was altered. By such an analysis the social variables per se could be related to leadership parameters. The acquisition of cooperation was not nearly as quick in non-social situations as in social. Leadership was shown to be controlled via contingency arrangements. Thus principles of reinforcement that had been shown to control individual responding were shown to be salient in controlling a social situation.

Hintgen, Saunders and De Myer (1965) used a cooperation procedure in shaping three teams of autistic children. Candy reinforcement was made contingent upon a cooperative lever task and they observed an increase in physical contact and vocalizations although never directly reinforced. A second study (Hintgen & Trost, 1966) attempted to directly reinforce these behaviors and was successful in shaping vocalizations in all but one child:

The establishment and analysis of co-operative behavior have been approached by two major groups of researchers since the first demonstrations by those such as Lindsley.

Mithaug and his associates have published an informative series of articles, investigating the parameters of co-operation in young children working in small groups (Mithaug and Burgess, 1967, 1968; Mithaug, 1973; and Stewart, Zelman and Mithaug, 1971).

These studies have demonstrated the importance of individual reinforcement contingencies (Mithaug and Burgess, 1967) and feedback (Mithaug and Burgess, 1968) in developing a group response. The authors note in these articles how a group response must be "shaped" the same way individual behavior must be shaped. Later studies have demonstrated control over the group response rate by reinforcement of specific outcome rates between groups of children (Stewart et al, 1971) and the usefulness of a subject's "score comparison" behavior as an indicator of competition in a co-operation situation (Mithaug, 1973).

Schmitt and Marwell (1968) conducted a further investigation of co-operation using the Lindsley (1966) apparatus and general procedure. Their findings indicate that the original implications of Lindsley's research on leadership and co-operation may have been premature. Schmitt and Marwell demonstrated that co-operative responses defined by two people responding between three to three and one half seconds of stimulus onset for one of the dyad in a leader-follower fashion were not observed nearly as frequently as in the original Lindsley study. They reasoned that in the original design where time outs were employed (and house lights were turned off) the subjects were both responding to the stimulus associated with the cessation of time

out. This was demonstrated by the fact that responses of both subjects were within .2 seconds of each other (an impossible feat due to human reaction time). Thus one subject was not following the other at all but rather both subjects in Lindsley's studies may have been under control of stimulus features of the procedure. Therefore the leadership responding in Lindsley's experiments may have been due to chance and not an orderly demonstration of contingency control.

Further research by Schmitt and Marwell (1971a; 1971b) has investigated co-operation in partnerships, a function of opportunity to disrupt co-operation in partnerships, a function of opportunity to disrupt co-operative responding by taking reinforcement from the partner and the enhancement of co-operation when taking could be avoided.

In the first paper (Schmitt and Marwell, 1971a) a series of three experiments is presented. An interesting feature of these experiments was that the university student "partners" never met or saw each other. The opportunity to take reinforcement from the partner generally disrupted or eliminated ongoing co-operative behavior regardless of the higher money reinforcement available during co-operation episodes. The second paper investigated additional conditions that generated co-operation despite the "risk" involved. One experiment allowed each subject to be signalled when a "take" response had been made. A loss could be avoided by switching to a lower reward individual task within five seconds. Co-operation was high as long as the avoidance response was available. In a second experiment a response was introduced that prevented taking for a specified period. Co-operation was maintained under this condition but was eliminated when such avoidance responses subtracted from earnings in the experiment.



After their timely review of co-operation procedures, Hake and Vukelich (1972) reported an interesting series of studies on co-operative behavior in children. Hake and Vukelich (1973) studied the effects of the availability of a non co-operative response on co-operative responding in retarded children in a special education class, for a matching to sample work task. Important features of this research were that it allowed deviations from reciprocity, a seemingly important variable in studying co-operation, and it attempted to determine if co-operation was due to the procedure per se.

Subjects had two panels, a fixed working panel and a sample stimulus panel that was moveable. With two subjects facing each other at a distance, their sample producing behavior was monitored as the sample stimulus panel was moved in stages farther away from each subject and closer to the partner. When sample stimulus panels were equidistant from each respective subject, or closer to a partner than a subject, co-operation was observed. In general subjects responded with that response which provided the least effort (distance).

A second experiment then removed the partner for a period of time or punished sample producing responses with a partner present. The first procedure produced individual responding which turned to co-operative responding on re-introduction of the partner. The punishment contingency also generally removed co-operative responding. Thus the co-operation was under control of the procedure for most subjects and instructional or social control for deviant subjects.

Hake, Vukelich and Kaplan (1973) reported two experiments concerning audit responses during co-operation. An audit response was one which was maintained by its production of access to scores. Using

the same matching to sample apparatus as the previous studies by Hake and Vukelich (1973), four pairs of high school students were shown to produce more self audits under social procedures than non social procedures. A social procedure was one in which a partner was allowed to provide a subject's sample stimulus. Although communication was allowed if a conference response was made, it did not occur very frequently. Also when a subject made a self audit, this usually was followed by a coactor audit. A second experiment was designed to determine the aspect of the coactor that was responsible for an increase in self audits by comparing the rates of self audits when a subject worked alone, during parallel work with a coactor present but his score unavailable and during parallel work with a coactor present, working, and his score available. With the later condition, the most audits were made, and in the parallel work with coactor present more audits were made than in non social conditions.

A further experiment (Hake and Vukelich, 1974) used the same procedure and apparatus but controlled the distribution of problems available to subjects so that a subject's score could be behind, equal to or ahead of a partner's. Even conditions produced the most audits and the authors attributed this to the fact that such conditions were the ones in which the possible reinforcement of being ahead or getting ahead, were most readily apparent to a subject.

Hake, Vukelich and Olvera (1975) furthered their analysis of co-operation in terms of what they refer to as "correspondence".

While increases in co-operative responses are indicative of control by the reinforcer resulting from the co-operation procedure, control by the reciprocal nature of the co-operation

procedure also requires equality or at least an increase in the degree of correspondence between the numbers of reinforcers or cooperative responses of the members of a pair. If co-operation is to be considered a social behavior, correspondence should be calculated as the per cent of the number of reinforcers or co-operative responses of one subject relative to the number of the other subject, rather than related to a total number of trials or opportunities for co-operation.

(Hake et al., 1975, p. 63)

Using the same matching to sample task as in their previous studies Hake and Vukelich (1974) and high school volunteers, they examined correspondence in seven dyads. On each trial a subject could (1) give the matching to sample problem to his coactor (give or co-operative response) or (2) take the problem for himself (take responses). The first member of a pair to respond made the choice. Under this procedure correspondence increased compared to a random choice baseline condition. The increase was usually due however to take responses rather than co-operative give responses. The authors called this sharing and noted that subjects alternated turns at problems. Their discussions of the two experiments they conducted deal with the differences in correspondence from the co-operative procedure and from sharing. Eleven of the fourteen subjects gained most of their reinforcement from take responses (sharing). There was also a difference in correspondence when trials were massed or spaced out over days. Sessions over days gained more correspondence but this could have been due to the additional co-operative control exerted by each subject having to show up each day for sessions. A comparison of the present results to

prisoner's dilemma research was included.

Manipulation of Co-operative Behavior in Applied Settings:

The following articles are exemplary of research that has been conducted in the "field", concerned with the parametric involved in co-operation. Some of the studies are group comparisons of various populations, other are highly controlled single subject designs investigating specific parameters. All are relevant exemplary of co-operation research.

Co-operation or co-operative behavior has also been referred to or examined in social settings for some time. O'Leary and Becker (1967) presented a case study to demonstrate the application of a set of procedures to produce co-operative behavior in two siblings of age six and three. According to a psychiatrist they were "seriously disturbed" but with prompting, fading, and general shaping procedures they were soon taught to play co-operatively and not be destructive or aggressive.

Hart, Reynolds, Baer, Brawley and Harris (1968) demonstrated that adult attention could increase co-operative play, in a five year old pre school child if and only if it was made contingent upon such behavior. When attention was given randomly throughout the school day, co-operative behavior was not observed.

Redd (1970) demonstrated the generalization of stimulus control over co-operative play behavior in four severely retarded boys. The children received contingent reinforcement from one adult and non contingent reinforcement from another. Only the control exerted by the contingent adult generalized to another non experimental setting.

Shapira and Madsen (1969) reported an interesting difference in two sets of children. Israeli children from either an urban setting or a Kibbutz participated in two experiments designed to assess degree of co-operation or competition. Under group reward both groups of children co-operated, but when individual reward was introduced, urban children began to compete in a non-adaptive manner, while Kibbutzen children continued to co-operate. In a second study where competition was salient to success, Kibbutz children were much less successful than urban children.

Altman (1971) has demonstrated that reinforcement contingencies per se may not be the whole reason for co-operation in natural settings. In a lab setting, ten dyads of children were taught a co-operative response which affected the frequency and nature of their later interactions in a free play setting for only seven pairs. The other three partners did not improve at all and sparked Altman's discussion of the importance of programming generalization.

In a related study, Diegel, Butler and Rickard (1971) conducted a controlled observation study on children of normal IQ, but who were enrolled at a summer camp for emotionally disturbed children. Four groups of six boys each were arranged. (Two groups of older boys [8 - 12], and two of 13 - 15 years). One group from each category were control groups. The other two groups experienced two conditions. Under individual conditions each boy in a group could match lights to a sample to gain reinforcement. Under co-operative conditions, input as to which light to illuminate was required from the whole group. After five daily thirty minute periods for each group, the conditions were

reversed for the two experimental groups. Judges, recording concurrent undesirable social interactions such as verbal abuse, aggression, withdrawal, and inattention, reported fewer undesirable responses in the older subjects than in younger as a group in co-operative situations and less undesirable responses for experimental subjects over control subjects as a group.

Madsen and Connor (1973) reported a study concerned with differences in retarded and normal children in a competitive situation, from a cognitive developmental concept. Two age groups of each population (6-7 years and 11-12 years) were assessed in a situation where competitive interactions were non-adaptive in attaining reinforcement. They found in general that retarded children were more co-operative than normals and younger children of both groups were more co-operative than older.

Jackson and Jackson (1974) examined the distribution of reinforcement behavior in mild and moderately retarded subjects, in an attempt to determine how a subject would divide a fixed amount of reinforcement in a situation where he is told he has done all the work of a task, or in a situation where he is asked to divide reinforcers for two other subjects where one has done more work. All cases were no-cost to the subjects. The authors claimed from their results that retarded persons are sensitive to the amount of work contributed by each member of a group. Unfortunately the procedures and analysis of this study are lacking in empirical foundation and seem very speculative if not mentalistic.

Co-operation and Communication:

Although relevant to the previous two sub sections of co-operation analysis with humans, some studies seem to warrant special consideration in this review due to their concern with co-operation and communication within dyads. Such an organization of articles also will lead the present review more appropriately into the next and final section on Communication and Social Behavior.

Sparked by earlier research on co-operation in dyads such as Rosenberg (1960), much attention has been focused on an experimental investigation of communication and co-operation. Evans (1965) using a modified Wisconsin General Testing Apparatus (WGTA), examined the opportunity to communicate and co-operation in dyads of moderate and mildly retarded children. The apparatus consisted of four levers which simultaneously moved trays toward the subject (operator) and toward a partner (receiver) when pulled. Thus an operator could deliver reinforcement to himself, or to a partner, or both depending on the choice of lever pulled. Sixteen dyads were placed in a free communication procedure in which both subjects could see each other. Sixteen other dyads were placed in a restricted communication condition in which only an "operator" subject could see the trays of the apparatus but the receiver could not. Of eleven dyads who co-operated in the study nine did so in the free communication condition. However under a reversal condition eight of twelve co-operating dyads did so under the restricted communication procedure. In a summary discussion the authors conclude that free communication increases the probability of co-operation when and only when the opportunity to freely communicate is present from the outset of a dyadic work task.

Spradlin, Giradeau and Corte (1967, 1969) have reported the results of a series of experiments designed to investigate communication and co-operation in dyads of retarded children. In the first report, two experiments are presented with ten dyads of higher level (mean IQ 61) and ten dyads of lower level (mean IQ 40) retarded adolescents (11 - 15 years old) who worked on the modified WGTA discussed above. The first experiment provided an operator of a dyad with two choices: (1) to respond on a lever pull to give a partner reinforcement and himself reinforcement; or (2) to deliver reinforcement to himself only. The carts holding reinforcement in these experiments were in full view of both operator and receiver. Three-quarters of the operators would give reinforcement to both himself and receiver under these conditions (no cost). A second experiment, provided that the trays were visible only by the receiver. Each operator worked six sessions with a higher level receiver and lower level receiver. Operators made more correct responses (delivered reinforcement to both) when assembled with high level receivers than with low. In general, when working with low level receivers, operators improved over sessions, with some operators performing at chance levels. These experiments led the authors to conclude that the receivers were providing discriminative stimuli for operators and that communicative behaviors could possibly be aided by colouring trays to identify them and provide stronger cues for verbal behavior. Preventing gestural communication might increase vocal behaviors in such situations.

In a further experiment (Spradlin et al., 1969) twenty-four pairs of mild and moderately retarded children worked on the same apparatus. In this study, giving was examined as a function of the amount of reinforcement given, and the cost to the operator. The value of reinforcement



was not important, when there was no cost to the operator and five of twenty-four still gave when it cost them their reinforcers. When co-operation involving communication resulted in both subjects being reinforced eighteen of twenty-four co-operated. In this condition only the receiver could see which cart contained reinforcement. The communication in these studies was not measured per se. That is, communication was assumed to have taken place as a result of higher than chance co-operation when only the receiver received the information leading to mutual reinforcement.

An earlier study by Hollis (1966) used the same apparatus and procedures but was designed within the frame of reference of previous communication with monkeys (Manion and Hollis, 1962).

Nine dyads of severely retarded institutionalized retarded children worked on the previously mentioned modified WGTA apparatus. In the first experiment, it was demonstrated that subjects acting as operators would not respond to provide reinforcement to a partner at a greater rate than to an empty chair. In a second experiment, the carts were situated such that each subject could only give rewards to a partner and not to himself. Seven of nine did so. A third experiment shielded the carts from the operator and it was observed that receivers gestured as to the correct cart 60% of the time. As operators responded accordingly 58% of the time it was concluded that the gestures must have been functional. Then child receivers were replaced with adult male or female experimentors. Operator performance increased to 90 and then 97% accuracy in delivering the signalled tray.

A further experiment then trained the subjects to correctly tap the table, point or vocalize to an experimenter as the operator.

With one exception all the subjects ended up at a 99% accuracy level for gestural and vocal responses as receivers in a tent condition.

These studies, using the WGTA have great relevance to the research question to be later presented, and demonstrate some relationships to be later discussed between co-operation and communication.

Powers and Powers (1971) reported an experiment modelled on the design of Boren's (1966) monkey study. Two dyads of retarded children were allowed to respond in pairs on individual fixed ratio schedules to provide each other with reinforcers on what they called a "back scratch" schedule of reinforcement. Under such a contingency, subject A responds and subject B receives the reinforcer and vice versa. After two applications of this procedure to the children, somewhat corresponding rates of responding and reinforcement were gained. A side effect, not measured but noted by the authors, was that the subjects of a dyad would interact during sessions more than previous to the study. There was also some generalization of this to ward situations.

Williams, Martin, McDonald, Hardy and Lambert (1975) responding to Powers' and Powers' suggestion that social interaction per se might be investigated as a function of a back scratch contingency, monitored the social behaviors of two dyads of severely retarded girls. The girls were twice given token reinforcers on a back scratch schedule for a table sewing task after individual token reinforcement for that behavior in a multiple baseline design study. Social interaction defined as looking, touching, pointing, and vocalizing increased during cooperative phases with a corresponding increase in a general ward setting. A second study, Williams, Martin and Abrami (1974) determined that such increases in interactive behaviors in severely retarded children were

mostly due to the contingency per se and not merely the pairing of a subject's name with reinforcement. In this study inconsistent instructions to subjects regarding which subject's responding had provided reinforcement, did not control social behaviors as greatly as the actual contingency applied to a lever pressing task. That is, a co-operative response-exchange contingency increased social interactions regardless of instructions to a subject on each trial that he was providing his own reinforcers due to his own responding.

Thus co-operation is a very large area of research, and as demonstrated, is very relevant to social behavior in the retarded. Theoretical research on the parameters involved in any co-operation procedure, coupled with findings on co-operative behaviors in applied settings have led to procedures for furthering research and increasing social behavior. Co-operation procedures may also have relevance as procedures to teach communicatory behaviors.

Appendix DPre-Experimental Training Procedures

Individual Shaping: Each subject was taken to the music machine area and seated in one of the two chairs on each side of the apparatus. The experimenter would sit in the other chair after placing a pair of headphones on the subject and himself. The machine was operated by a second experimenter from the adjacent observation room. The following general procedure was then followed:

A subject's large stimulus light on the top of the machine was illuminated for ten seconds and the experimenter physically guided the subject to emit one of the two behaviors for that mini-session (for example, stand). Reinforcement was delivered, and the experimenter's large stimulus light was then illuminated and he would emit the appropriate behavior also (stand). This process was repeated for the other behaviors for all three mini-sessions, for the first session. After this session the following procedure was used. A subject would receive a ten second light illumination, and if no behavior occurred a further ten second illumination was presented with a prompt from the experimenter of, "It's your turn", and a point to the correct behavior (the square on the floor, for example, for standing). If no behavior occurred, a third ten second presentation of the large light was made and the experimenter physically guided the subject through the behavior. (Actually helping the child to stand in the square). For each mini-session of sixteen trials, eight trials were devoted to each of the two behaviors. Each subject received six of these individual training sessions with the experimenter as a partner.

Shaping Dyadic Partners: Subjects were assigned to dyads by proximity of age. That is, subjects of a dyad were approximately the same age, and dyads one and two were completely non-verbal, while

dyad three was partially verbal. Subjects of a dyad were taken to the music machine area and always seated in their same chairs (relative to the music box) and the experimenter would sit behind the machine, between the two subjects. The same procedure as was used for individual training was used for dyadic training. That is, subjects were taught to respond to their large stimulus lights with one of the two responses for a particular mini-session, with prompts and guidance when necessary from the experimenter. When one subject responded correctly, both subjects were reinforced. Dyad one received two such sessions, while dyad two received three.

Dyad Performance Alone: The final dyadic performance was achieved by following the same general procedure as before, but the experimenter was not present in the room. When a prompt was necessary, the experimenter would enter the room, but gradually prompts were faded to only verbal prompts via the subject's headphones with the experimenter being located in the observation room. As one area of interest to the experimenter was whether or not later acquired verbal behavior between partners of the dyad would improve music machine cooperative behaviors, a weak criterion of performance was set at 50% correct responses for all behaviors and not necessarily on the same session. Dyad one satisfied this requirement in twelve sessions, dyads two and three in thirteen sessions.

For all sessions, for all dyads, the order of the mini-sessions was altered each session to avoid any ordering effects. Within a particular mini-session, the "turn" typically alternated from one subject to the other but occasionally one subject would be given a few trials in a row in an effort to enhance the stimulus control of the lights over responding.

OBSERVER. \_\_\_\_\_

DATE \_\_\_\_\_  
Session # \_\_\_\_\_

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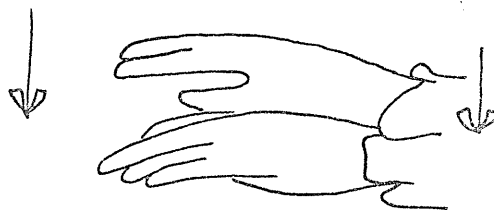
ILLUSTRATIONS OF SIGNS FOR EXPERIMENT I

STAND



Two hands  
Upward Motion

SIT



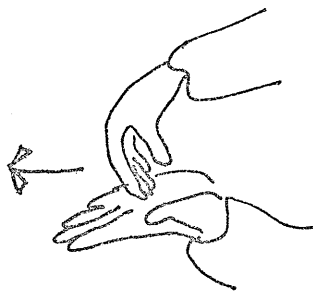
Two hands  
Downward Motion

GIVE



One hand  
Palm up, stationary

TAKE



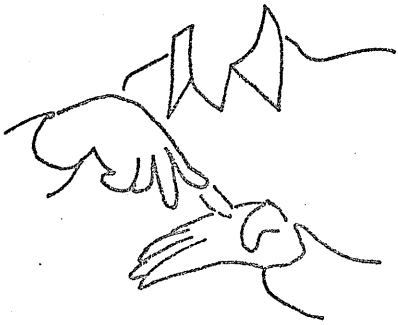
Two hands  
One sweeping the  
stationary "GIVE" palm





ILLUSTRATIONS OF SIGNS FOR EXPERIMENT II

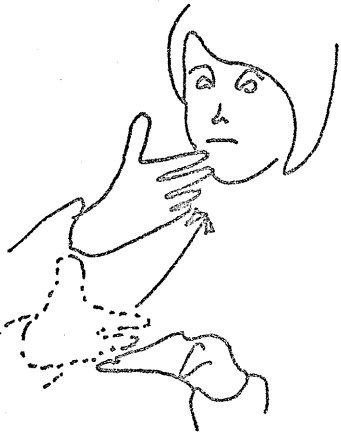
FORK



FOOD



SPOON



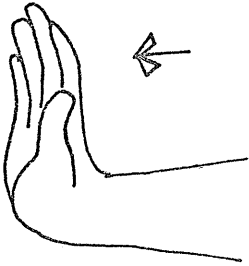
DRINK





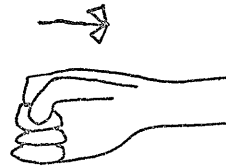
## ILLUSTRATIONS OF SIGNS FOR EXPERIMENT III

PUSH



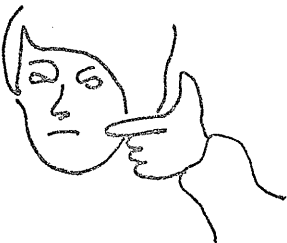
One hand  
Palm moved horizontally  
away from body

PULL



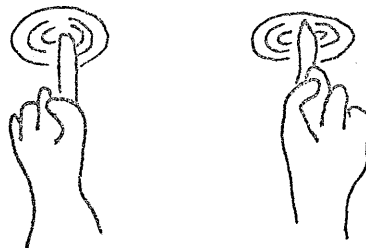
One hand  
Fist moved horizontally  
toward body (shoulder)

M &amp; M



One hand  
Index finger is "twisted"  
in contact with cheek

MUSIC



Two hands  
Index fingers are  
raised and "wiggled"