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CONTRIVED VERSUS NATURAL REINFORCERS IN THE
ACQUISITION OF A VERBAL REPERTOIRE
BY ADULT LEARNERS

by

Lisa Ann LeBlanc

A Dissertation
Submitted to the
Faculty of The Graduate College
in partial fulfillment of the
requirements for the
Degree of Doctor of Philosophy
Department of Psychology

Western Michigan University
Kalamazoo, Michigan
June 1991

CONTRIVED VERSUS NATURAL REINFORCERS IN THE ACQUISITION OF A VERBAL REPERTOIRE BY ADULT LEARNERS

Lisa Ann LeBlanc, Ph.D.

Western Michigan University, 1991

Previous research suggests that by making classroom contingencies for verbal responding more like those in the natural environment, i.e., by using motivative variables to evoke verbal responses which are followed by specific actions on the part of listeners, verbal repertoires can be taught more effectively to children and language-impaired individuals. The present study examines the role of specific versus generalized conditioned reinforcement following adult students' question-asking on the acquisition of a verbal repertoire in a classroom setting and on the generalization of this repertoire to a more natural verbal environment.

Subjects were 32 university students in two American Sign Language (ASL) classes. Following teacher demonstration of vocabulary and grammatical structures, students were provided with a set of questions incorporating those items. In Condition 1, students practiced translating the questions with the teacher, who provided praise for correct responding. In Condition 2, pairs of students practiced asking each other the same questions and writing each other's answers. It was hypothesized that practice which involved asking questions and getting answers (natural reinforcement) would be more effective than practice which involved questions followed by praise (contrived reinforcement), which is typical of more traditional methods of language instruction. All students in one class were exposed to Condition 1 for the first session. Each week thereafter, for 9 weeks, two students

were randomly assigned to Condition 2. In the second class, the procedure was reversed. Measures of accuracy (number of errors) and fluency (response times) were obtained via weekly tests and an interview with a fluent ASL-user. Nine students received maintenance tests and interviews two months after training.

Test scores revealed little difference in accuracy--Condition 1 subjects averaged 86%, while Condition 2 subjects averaged 89%. Fluency was more strongly affected--subjects required 15% less time to complete tests in Condition 2 than in Condition 1. Arranging test and interview data in order of increasing amounts of exposure to Condition 2 further indicated that the more training students received utilizing the question-and-answer procedure, the more readily their skills generalized to a naturalistic setting and the more vigor with which they displayed their skills in follow-up measures.

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TABLE OF CONTENTS

LIST OF TABLES	iv
LIST OF FIGURES.....	v
INTRODUCTION.....	1
Programming Transfer of Control to the Natural Environment	2
Skinner's Analysis of Verbal Behavior and Natural Consequences.....	3
Previous Research	6
Antecedents to Verbal Activity or Motivation	14
Verbal Behaviors Targeted	15
Natural Consequences and Question-Asking.....	16
Populations Studied	18
Summary.....	18
METHOD.....	20
Subjects/Setting	20
Design and Procedure	20
Reliability	23
RESULTS.....	25
Weekly Tests	25
Interviews.....	27
Maintenance Tests and Interviews	28
Opinion Survey.....	29
Summary.....	30

Table of Contents--Continued

DISCUSSION	31
Future Directions for Research	35
Conclusion.....	37
APPENDIX	
A. Human Subjects Institutional Review Board Research Protocol Clearance Letters	40
BIBLIOGRAPHY	42

LIST OF TABLES

1. Summary of Procedures Utilizing Natural Contingencies to Train Verbal Repertoires.....	8
2. A Summary of Condition 1, Condition 2, and Maintenance Test Accuracy and Fluency Measures.....	28
3. A Comparison of Final and Maintenance Interview Outcomes.....	29

LIST OF FIGURES

1. Error Frequency and Response Time as a Function of
Exposure to Either Condition in Weekly Sessions 26

INTRODUCTION

Most academic behavior trained in the classroom is verbal in nature. Immediate reinforcement for such activity typically consists of generalized conditioned reinforcers such as praise or other signs of approval from the teacher and attention from peers. Such contrived consequences are utilized because more natural contingencies are difficult to arrange in a classroom setting. However, these contrived consequences are quite unlike those which follow and maintain verbal behavior in the real world, and for that reason, arranging for the transfer of verbal skills to the natural environment is recognized as a major concern (Kohler & Greenwood, 1986; Spradlin & Siegel, 1982; Stokes & Baer, 1977; Vargas & Fraley, 1984).

Resnick (1971) has stated that:

The ultimate goal of most behavior-modification programs is to prepare the individual to function in a "natural" setting, i.e., one in which external reinforcers are not systematically programmed. ... Extensive and systematic study of the relationship between "programmed" and "natural" rewards is badly needed before reinforcement principles can be widely and well used in applied settings. There should be attention given to analyzing the whole range of reinforcers that may operate in an environment. ... In this research, it may be useful to consider reinforcers not as dichotomized into "intrinsic" and "extrinsic" classes, but as running along a continuum from reinforcers closely tied to a given task (i.e., "intrinsic to the task") to highly generalized reinforcers that have no inherent relationship to the task itself. [This] would lead to questions such as the extent to which more generalized reinforcers, which are usually easier to engineer in social settings, can be used to bring individuals into contact with task-specific reinforcers they might otherwise have missed (pp. 328-329).

These questions, raised in 1971, are particularly pertinent to the field of education yet remain to be investigated. The problem of maintaining students'

behavior once they leave the classroom is an issue which an analysis of the discrepancies between classroom and real world contingencies might enlighten.

Programming Transfer of Control to the Natural Environment

Generalization is a fundamental concern of behavioral science. It has been defined by Stokes and Baer (1977) as the occurrence of relevant behavior under different, non-training conditions (i.e., across subjects, settings, people, behaviors, and/or time) without the schedule of the same events in those conditions as had been scheduled in the training conditions. Although it is often discussed and frequently observed in applied behavior analysis, the need to program rather than expect generalization is frequently overlooked. The most frequently used method in the field Stokes and Baer (1977) label "train and hope": After behavior change is effected through manipulation of some response consequences, any generalization is documented but not actively pursued. However, Stokes and Baer found the most dependable method of generalization training to be transfer of behavioral control from experimenter to stable, natural contingencies that can be trusted to operate in the environment to which the subject will return. This is accomplished by choosing behavior to teach that normally will achieve reinforcement after the teaching, or by arranging for responses to occur within natural reinforcement communities that can then refine and maintain those skills without further intervention.

The overt classroom responding which we call academic behavior consists mainly of verbal activity. But the reinforcers used in the classroom are for the most part arbitrarily related to verbal academic behavior and are unlike those which maintain it in the real world. The transfer of control of a verbal repertoire to the natural environment has been addressed repeatedly in the literature and has proven to be a recurring problem, especially for individuals with language deficits (Spradlin &

Siegel, 1982; Warren & Kaiser, 1986). The question of how the transfer of control of academic verbal behavior to the world outside of the classroom is best accomplished has not been answered.

Skinner's Analysis of Verbal Behavior and Natural Consequences

Babies babble innately, it seems clear, but what maintains the rest of our verbal behavior in the real world? What are the natural and intrinsic rewards for the verbal repertoires that are so painstakingly established with contrived reinforcers in the classroom?

Skinner's (1957) analysis of verbal behavior allows for a functional approach to such questions. He defines verbal behavior as behavior reinforced through the mediation of other persons who have been specifically trained to do so. The fact that reinforcement comes about through the actions of other people differentiates verbal from other operant behavior and makes listener/audience variables of paramount importance. Therefore, the goal of all verbal behavior, as Skinner sees it, is to differentially affect a listener. He distinguishes between six types of verbal behavior, based on the relationship between antecedent controlling variable, verbal response, and mediated consequence. These six functional relations he calls mand, tact, echoic, textual, intraverbal, and audience relations.

Linguists and behaviorists would probably agree that to be able to change other people's behavior in ways that are meaningful or important to us as individuals is the ultimate goal of behaving verbally. Thus, a functional verbal repertoire is one that is of direct benefit to the speaker. In the natural environment of a linguistic community, Skinner maintains that generalized conditioned reinforcers (in the form of verbal praise, social approval, etc.) follow all of the elementary verbal operants--except for the mand. A mand is "a verbal operant in which the response is reinforced

by a characteristic consequence and is therefore under the functional control of relevant conditions of deprivation or aversive stimulation ... and in contrast with other types of verbal operants ... the response has no specified relation to a prior stimulus" (Skinner, 1957, pp. 35-36). In other words, the form of this type of verbal response is not determined by a prior discriminative stimulus, as is the case with the other verbal operants--the mand is controlled by the motivative variable currently in effect. Reinforcement for the mand is specific (although mediated): The listener behaves in ways that are specifically reinforcing to the speaker. Said another way, people do what we "want" them to do when we mand appropriately. They provide us with both conditioned and unconditioned reinforcers of various kinds when we ask for or demand them. The specificity of this relationship is a powerful feature, more directly beneficial to us than any of the other ways of behaving verbally. We thus manipulate the environment, through the actions of others, in a very dependable, specific, and powerful way.

Michael (1988) says that "about half of the adult's ordinary daily verbal interaction consists of mands. In addition to the mands for objects and actions there are the mands for SD's and CEO's--that is, for information--that constitute such a large share of what we say to others" (p. 7). He also maintains that "underestimation of the mand's importance in our speculative analysis of everyday language is of little practical significance. Normal children and adults do not need much professional support for their mands, since the mand is the type of verbal behavior that directly benefits the speaker" (p. 7).

Students don't get to mand very much, however. In the classroom, most skills taught are verbal in nature, but the reinforcers provided are arbitrarily related to the verbal behavior they follow. They are not the specific ones which follow mand behavior in the real world.

The difficulty of setting up conditions for mand training in the classroom may be part of the reason why this feature of behaving verbally is neglected. Typically, classroom training involves setting up either intraverbal, tact, echoic, textual, transcriptive, or mand compliance (behaving as a listener) repertoires. Few teachers or instructional designers emphasize three-term functional relations, or effects on listeners, or provide other than social or academic reinforcement (generalized conditioned reinforcers) for behaving verbally (although see Johnson & Chase, 1981, regarding a typology of verbal tasks).

If the goal is to provide students with functional verbal repertoires that will be maintained once they leave school, then the goal is to optimize students' ability to affect others verbally in ways that are specifically reinforcing to them as speakers. This requires controlling not just antecedent stimuli but the students' motivation as well, and the specific mediated reinforcement related to particular motivational states.

Of particular relevance to controlling motivative variables in the classroom is the notion of establishing operations or EOs. "The reinforcing effectiveness of many objects/events is conditional upon the status of other stimulus conditions [EOs]. When these other conditions assume the proper value, the object/event becomes an effective form of reinforcement, and behavior which has been followed by that object/event becomes more frequent" (Michael, 1988, p. 5). Johnson and Chase (1981) say that

"a mand is a verbal performance initiated by establishing operations. EO's heighten the reinforcing effectiveness of some stimulus or event. Some EOs, such as changing conditions of food, liquid, or heat deprivation, or aversive stimulation of sensory receptors, may affect the speaker due to her phylogenic history. Requesting water or a meal, and asking someone to close the window in the dead of winter or turn down an excruciatingly loud stereo are all examples of mands controlled by establishing operations of a phylogenic nature. Some EO's affect the individual due to his reinforcement history as a member of a particular culture. A request to hand you a hammer when you are on top of a ladder, or a request for information you need to

solve a problem, are examples of mands controlled by EOs of an ontogenic nature" (p. 114).

Michael (1988) notes that

"the EO and specific consequences can be used in combination with other variables (non-verbal stimuli, verbal prompts, etc.) to help evoke a verbal response, and then faded out once the response is strong. A student who can successfully mand for, and receive, specific reinforcement is often much more willing to participate in training sessions [and] language training becomes much more like typical verbal interactions" (p. 8).

Previous Research

Attempts have been made to approximate natural conditions in the classroom or training setting in order to more effectively teach verbal responses that generalize well. Procedures variously identified as Incidental Teaching (Hart & Risley, 1968), Time Delay (Halle, Marshall & Spradlin, 1979), Pragmatics (Haring, Roger, Lee, Breen & Gaylord-Ross, 1986), Embedded Instruction (Neef, Walters & Egel, 1984), Natural Language Paradigm (Koegel, O'Dell & Koegel, 1987), Total Physical Response (Asher, 1965), Mand-Model (Rogers-Warren & Warren, 1980), Information Gap (Doughty & Pica, 1986), Loose Training (Campbell & Stremel-Campbell, 1982), Generalization Training (Doyle, Goldstein, Bourgeois, & Nakles, 1989), and Mand Training (Carroll & Hesse, 1987) have sought to effect changes in verbal responding by invoking those contingencies provided naturally by the verbal community. That is, appropriate verbal activity (usually in the form of requests or demands) is followed by the listener's providing the specific item or event indicated. These may be food items, toys, preferred activities, or materials necessary to engage in some activity (e.g., crayons or a paint brush)--they are things the individual wants or needs at the moment. On a more sophisticated level, correct verbal responding may be followed by information or verbal stimulation, provided by the listener, which enables the speaker to then or later obtain other reinforcers. These studies are

summarized in Table 1, and important features of several of them are described in more detail below.

Examinations of incidental teaching and time delay procedures constitute the majority of such research. Incidental teaching procedures involve providing verbal prompts for mands whenever the learner needs help in obtaining some kind of reinforcement during training or other activities. Valdez-Menchaca and Whitehurst (1988) call incidental teaching a "naturalistic" procedure: "the child is exposed to a natural, unstructured, rich environment containing diverse objects and activities that can be accessed through the use of language" (p. 1451). The procedure, originally developed by Hart and Risley in 1968, involves timing occasions of instruction to follow students' spontaneous expressions of interest. A teaching trial is begun when a child verbally or nonverbally indicates interest in a particular object or activity. The teacher requires the child to elaborate the request to fit a target verbal response. After the correct response is produced, the child receives the requested item or activity. The child initiates the interaction and specifies the reinforcer. The child's spontaneous expression of interest insures that the request is not evoked by readily observable stimuli in the environment but presumably by what the child wants, i.e., by whatever establishing operation is currently in effect. Valdez-Menchaca and Whitehurst (1988) have recently demonstrated that verbal models presented following children's spontaneous expressions of interest in a particular item were more efficient than verbal models presented arbitrarily, and they conclude that "extensive applications of incidental teaching with disadvantaged and developmentally disabled children have repeatedly demonstrated its effectiveness in training both receptive language ... and expressive language ... and in facilitating their generalization" (p. 1451).

Time delay procedures (Angelo & Goldstein, 1990; Charlop, Schreibman & Thibodeau, 1985; Halle, Baer & Spradlin, 1981; Halle et al., 1979) proceed from a

Table 1
Summary of Procedures Utilizing Natural Contingencies to Train Verbal Repertoires

Authors	Year	Procedure	Subjects	Target Behavior	Consequences Provided By Listener
Hart & Risley	1968	Incidental Teaching	Disadvantaged preschool children	Spontaneous use of adj-noun combinations	Item requested
Reynolds & Risley	1968	Incidental Teaching	Disadvantaged preschool girl	Spontaneous requests for materials	Item requested
Hart & Risley	1974	Incidental Teaching	Disadvantaged preschool children	Spontaneous use of compound sentences	Item requested
Knapczyk & Livingston	1974	Verbal prompts	EMR children	Question-asking	Information requested
Asher, Kusudo & De La Torre	1974	Total Physical Response	Normal adults	Commands in a 2nd language	Item/activity requested
Hart & Risley	1975	Incidental Teaching	Preschool children	Spontaneous use of compound sentences	Item requested
Halle, Marshall & Spradlin	1979	Time Delay	Severely/moderately retarded children	Spontaneous requests for food items	Item requested
Hung	1980	Modeling	Autistic children	Yes/no as mands	Item identified
Rogers-Warren & Warren	1980	Mand-Model	Language deficient preschool children	Spontaneous verbalization; novel words/combinations	Item or event requested

Table 1--Continued

Authors	Year	Procedure	Subjects	Target Behavior	Consequences Provided By Listener
Halle, Baer & Spradlin	1981	Time Delay	Severely/moderately retarded children	Spontaneous requests for materials or help	Item or event requested
Campbell & Stremel-Campbell	1982	Loose Training	Moderately retarded children	Spontaneous use of is/are in 3 syntactic structures	Information requested
Schepis et al.	1982	Incidental Teaching	Retarded & autistic youths	Prompted & unprompted manual signing	Item or event requested
Carr & Kologinsky	1983	Incidental Teaching	Autistic children	Spontaneous requests in sign	Item or event requested
Neef, Walters & Egel	1984	Embedded Instruction	Autistic children	Response to yes/no questions	Item identified
Charlop, Schreibman & Thibodeau	1985	Time Delay	Autistic children	Spontaneous request for item	Item requested
McGee, Krantz & McClannahan	1985	Incidental Teaching	Autistic children	Spontaneous use of prepositions	Item identified
Doughty & Pica	1986	Information Gap	Normal children and adults	"Modified interaction;" requests, questions, etc.	Information requested
Haring et al.	1986	Time Delay	Moderately handicapped children	Initiation & expansion of conversation	Conversation, verbal stimuli

Table 1--Continued

Authors	Year	Procedure	Subjects	Target Behavior	Consequences Provided By Listener
Carroll & Hesse	1987	Mand Training	Normal preschool children	Mands (requests) for items	Item requested
Hall & Sundberg	1987	Mand Training	Severely MI youths	Mands (requests) for items, in sign	Item requested
Koegel, O'Dell & Koegel	1987	Natural Lang. Paradigm	Autistic children	Imitative & spontaneous utterances	Item or event identified
Laski, Charlop & Schreibman	1988	Natural Lang. Paradigm	Autistic children	Speech, verbalization about a particular item	Unclear
Valdez-Menchaca & Whitehurst	1988	Incidental Teaching	Normal preschool children	Spontaneous use of nouns in a 2nd language	Item requested
Whitehurst & Valdez-Menchaca	1988	Incidental Teaching	Normal preschool children	Spontaneous use of nouns in a 2nd language	Item requested
Yamamoto	1988	Mand Training	Autistic children	Mands (requests) for items	Item requested
Charlop & Milstein	1989	Videotape Modeling	Autistic children	Novel statements & questions/requests	Item/information identified
Doyle et al.	1989	Generalization Training	Broca's aphasic adults	Requests for information (question-asking)	Information requested

Table 1--Continued

Authors	Year	Procedure	Subjects	Target Behavior	Consequences Provided By Listener
Knapczyk	1989	Videotape Modeling	Learning disabled children	Question-asking	Information requested
Angelo & Goldstein	1990	Time Delay	Developmentally delayed children	Requests for information	Information requested

similar conceptual basis. The time delay procedure consists of initially presenting a target stimulus (a cookie, for example) and prompting an appropriate response ("I want cookie"). Once the child can model, the prompt is increasingly delayed. Responding before the prompt indicates that control has been transferred from verbal prompt to target stimulus (and presumably to motivative variables or EO's associated with target stimuli, such as food deprivation). The results indicate that this procedure facilitates generalization across settings, objects, and people. Charlop et al. (1985) note that the success of their procedure may be due in part to the type of target stimuli used: "the target stimulus and the reinforcer were one and the same" (subjects' mands specified what would function as reinforcement), and "this stimulus specific reinforcement may have facilitated response to the target stimuli" (p. 164).

Haring et al. (1986) base their approach to training conversation skills on Pragmatics, which stresses the functional effects of language on other people. In this analysis, utterances are examined within a social context--the effectiveness of a given verbal response is determined by its effects on others in the situation, i.e., the listeners. Moderately handicapped elementary school children were taught to initiate and expand on conversational topics through the use of praise, modeling, and natural conversational consequences. The skills they acquired generalized to the regular school environment and were maintained by peer social interaction--a natural verbal community. These findings (of generalization) are not consistent with those of many other social skills studies, and it is not unreasonable to suggest that their success might be attributed to the use of conditions that simulated natural conversation and contexts.

Practitioners of the Total Physical Response (TPR) method of language instruction have made inadvertent but apparently effective use of the natural consequences of mands to teach second language skills to children and adults.

Originally introduced by Asher in 1965, TPR classroom activity consists initially of obeying commands given by the instructor that involve an overt physical response on the part of the student. The TPR approach is exceptional in that input (the teacher's behavior) is all in the form of mands, and when students are ready to begin talking in the second language, they are encouraged to give commands and instructions themselves, to their classmates and to the teacher. Students' receptive skills are demonstrated by their ability to carry out commands, and their expressive performances are reinforced by their listeners' obeying their commands. Krashen's (1982) review of the most widely used (foreign) language teaching methods in regular classroom settings found Total Physical Response and similar approaches to be clearly superior to all others.

Neef et al. (1984) say that "the essential problems of generalization and relevance have been identified as formidable challenges to behavioral analyses of language" (p. 453). They reason that this is so because the focus has been on "the acquisition of grammatical structures rather than on [teaching] functional responses to novel situations" (p. 453). They also identify the use of appropriate natural consequences as a factor which may have contributed to the success of their research--their students learned more readily when their responses were followed by characteristic consequences (characteristic of those in the natural environment). They note that many others (Saunders & Sailor, 1979; Spradlin & Siegel, 1982; Williams, Koegel & Egel, 1981) have made similar observations.

Neef et al. (1984) indicate that the teaching procedures which have proven most effective in promoting language in everyday settings share these characteristics: (a) the environment is arranged to set the occasion for language (i.e., verbal action can have immediate and reinforcing consequences); (b) a specific language form or

function is prompted or modeled; and, (c) natural consequences for correct responding are provided by delivering the item or event requested.

"In this way, the trainer uses naturally occurring opportunities to teach verbal operants," Neef et al. (1984, p. 454) state. Such procedures may be carried out in a naturalistic setting, if not in the home itself, with natural caretakers, including parents. Furthermore, reinforcers are specifically rather than arbitrarily related to verbal responses, i.e., they are typical of consequences in the natural linguistic community. Thus, students are allowed opportunities to affect their environments verbally and spontaneously--without cues from others but rather controlled by their own states of deprivation or aversive stimulation.

This type of training is in contrast with typical classroom procedures for developing verbal repertoires: verbal activity takes place in an artificial setting; antecedent controlling stimuli consist of teachers' spoken or written prompts; consequences consist of generalized conditioned reinforcers such as praise or points/grades, which may or may not be immediately contingent on appropriate responding, and students' verbal behavior does not in any real way affect the environment or listeners.

Antecedents to Verbal Activity or Motivation

In the real world, appropriate language behavior gets results. When we command, demand, request, or suggest, we get what we want frequently enough to maintain such behavior at a fairly high rate. These are the essential features of the mand, a verbal operant in which the response is reinforced by a characteristic consequence and is therefore under the functional control of relevant conditions of deprivation or aversive stimulation. But in a training setting it is difficult to control what people want. How to motivate students to want something specific which can

be tied in with instruction is typically circumvented in regular educational settings by using generalized conditioned reinforcers--which we want or will work for nearly all the time. Many of the procedures named above solve the problem of motivating young children by using a natural setting with lots of different reinforcers available, at least one of which it is presumed a child will want at any particular time, and which can then be used to train related vocabulary use or other responding. Angelo and Goldstein (1990), Carroll and Hesse (1987), Hall and Sundberg (1987), and Yamamoto and Mochizuki (1988) have more directly addressed motivational variables in the acquisition of a verbal repertoire by manipulating establishing operations to increase subjects' opportunities to mand. For example, in Yamamoto and Mochizuki's (1988) study, the reinforcing value of specific objects was established by instructing autistic students to request and bring some object from one adult to another. In other words, students were induced to "want" that object and ask for it, and in the process learned the names of those objects more readily. Managing the motivation of adults in a similar manner has not, to this writer's knowledge, been investigated empirically, although descriptive research on one-way and two-way communicative tasks and problem solving activities in second language acquisition (Long & Porter, 1985; Pica & Doughty, 1985) suggest that it is feasible to arrange conditions such that adult students need or want some information that is available only from another student in order to solve a problem or complete a task.

Verbal Behaviors Targeted

The responses targeted for intervention in the research utilizing natural consequences have been broadly classified as speech or conversation, but they have also been identified as nouns, adjective-noun combinations, compound sentences, and prepositions. Novel responses of varying lengths, responses that include the words

is/are or yes/no, and responses in the form of requests or questions have also been the focus of some of these procedures. In addition to vocal, first-language repertoires, the role of natural contingencies in the acquisition of second language repertoires (Valdez-Menchaca & Whitehurst, 1988), of signed repertoires (Carr & Kologinsky, 1983; Hall & Sundberg, 1987; Schepis, Reid, Fitzgerald, Faw, Van Den Pol & Welty, 1982), and of communication board use (Angelo & Goldstein, 1990) has also been examined (see Table 1). However, since no agreed-upon definition of language emerges, and Skinner's (1957) analysis is rarely made use of, comparisons among the different studies regarding changes in language behavior are hampered.

Natural Consequences and Question-Asking

Mands on the listener in the form of questions are a common occurrence in daily life. It is interesting to note that question-asking as a means of affecting the behavior of listeners is also common in classrooms--by the teacher, that is. The behavior of students asking questions rather than answering them has not been of much academic concern. Dillon's (1988) recent manual of practice for the use of questioning in teaching only briefly mentions student question-asking, and a review of current research on question-asking as a classroom activity in Wilen (1987) neither presents nor discusses any empirical evidence regarding student question-asking but only reiterates the point that research has focused on the teacher as key questioner in the classroom. A survey of the behavioral literature likewise reveals only a limited number of researchers who have directly addressed student question-asking and its natural consequences. Hung (1980), Twardosz and Baer (1973), and Warren, Baxter, Anderson, Marshall and Baer (1981) have focused on the formal rather than functional or contextual elements of question-asking. On the other hand, Angelo and Goldstein (1990), Doyle et al. (1989), Knapczyk (1989), and Knapczyk and

Livingston (1974) have taken some account of the motivational antecedents and natural consequences which follow question-asking in their investigations, and their work serves to suggest that information can function as a reasonable substitute for tangible items or events supplied by the listener following speakers' requests in training a verbal repertoire. In fact, procedures in which subjects have been induced to mand for information or verbal stimulation from a listener appear to be equally as successful as those which involve mands for objects or events. For example, Knapczyk (1989) demonstrates that the use of prompting and videotape modeling increased student question-asking (for information regarding class activities or assignments), which also positively affected their reading performance, on-task behavior, and math scores. Doughty and Pica (1986) discuss studies of a variety of "information gap" or information exchange activities and their effect on language classroom interaction. ("Information gap refers to the existence of a lack of information among participants working on a common problem," p. 307). They conclude that because such activities generally result in increased verbal exchanges (questioning, confirming, clarifying, etc.), language acquisition is facilitated. Current theory and practice in second language instruction reflects this conclusion (Long & Porter, 1985), although satisfactory empirical data are lacking.

Although verbal community standards require native or near native competency of listeners to provide consequences for accurate responding on the part of speakers, there is evidence to suggest that students at or near the same level of proficiency can reinforce each other for accurate mands for information. Long and Porter (1985) report that current linguistic research supports the notion that group work and "interlanguage talk"--interactive exchanges among non-native speakers--is facilitative of second language acquisition. Doughty and Pica (1986) too claim that their research shows that group work and pair work "is eminently capable of

providing students with opportunities to produce the target language and to modify interaction" and that "to be effective, group interaction must ... include a requirement for a two-way or multi-way exchange of information" (p. 322).

Populations Studied

Carroll and Hesse (1987), Hall and Sundberg (1987), and Sundberg (1980) have shown that the essential features of spontaneous language use are those of mand behavior and have demonstrated that direct training of mands leads to the acquisition of functional language for certain language-disabled individuals. The procedures listed in Table 1 have also demonstrated that utilizing natural or mand contingencies facilitates the acquisition of verbal responses which generalize readily to the natural environment, and that these have proven effective with autistic, learning disabled, mildly to severely retarded, and normal children and youths. It has not been shown, however, whether what has been learned from these populations is applicable to normal adult learners. There is some indirect evidence for the efficacy of such training with adults in the literature on second language acquisition (Asher, Kusudo & De La Torre, 1974; Doughty & Pica, 1986; Krashen, 1982; Long & Porter, 1985; Pica & Doughty, 1985), but no published empirical studies have been found which directly assess the effects of mand training on the verbal skills of adults in a classroom setting.

Summary

The studies identified above suggest that by making classroom contingencies for verbal responding more like those obtaining in the natural environment, i.e., by using motivative variables to evoke verbal responses which are followed by specific actions on the part of listeners, we can teach verbal repertoires more effectively to

children and language-impaired individuals. The research described herein seeks to extend these findings to adult populations and expand upon the results of Asher's (1965), Pica and Doughty's (1985), and Valdez-Menchaca and Whitehurst's (1988) work with natural contingencies in second language acquisition. It also extends the work of Knapczyk (1989) and Knapczyk and Livingston (1974) on question-asking as a vehicle for language training by determining whether question-asking (as a form of mand) on the part of normal adult students facilitates the acquisition of grammar and vocabulary skills in a second language. Thus, the present study examines the role of specific versus generalized conditioned reinforcement following adult students' question-asking on the acquisition of a verbal repertoire in a classroom setting and on the generalization of this repertoire to a more natural verbal environment.

In the present study, conditions were arranged such that a student was required to obtain some information from another student. Having this information thus became important to the student (mainly to avoid the teacher's or peers' disapproval) and thus provided motivation for question-asking. The content and accuracy of the students' question-asking determined how well they were able to obtain the information required by the teacher. It is hypothesized that such practice, which involves asking questions and getting answers (questions as mands) will be more effective than practice which involves questions followed by signs of teacher approval or other generalized conditioned reinforcers (questions as tacts, intraverbals, or other verbal operants).

METHOD

Subjects/Setting

Thirty-two adult students in two introductory American Sign Language classes at Western Michigan University served as subjects. The settings were two regular classrooms on the university campus. An evening class of 18 students (designated Group A) and an afternoon class of 14 students (Group B) met for three hours, once a week, for twelve weeks. Both classes were taught by the same teacher (E) using the same materials and format. If students missed a meeting of one class they could attend the other, but all were encouraged to attend the class for which they registered.

Design and Procedure

Treatment and data collection were implemented within a multiple baseline design across subjects. Baseline or Condition 1 involved the use of generalized conditioned reinforcers following accurate verbal responding, the traditional method of second language instruction. All students in Group A were exposed to Condition 1 for the first training session. Each week thereafter, two students were randomly assigned to Condition 2, the question-and-answer treatment condition, such that by the end of the semester all students were in Condition 2 and receiving the experimental treatment. Conversely, all students in Group B were exposed to Condition 2 for the first training session, and two students were randomly assigned to Condition 1 each week thereafter. One training session occurred during each class, for a total of 9 sessions.

Each class began with the introduction of new vocabulary and grammatical structures in ASL through demonstration and teacher-directed group practice. A new unit of material was covered each week. The presentation of new material, a discussion period, and a short break required approximately one and one-half to two hours of class time. These were followed by the experimental training condition, which lasted an average of 30 minutes. Any remaining class time was spent in games, movies, or other activities.

Students in the Condition 1 group were engaged in small group practice with the teacher, translating a list of English questions, prepared by the teacher, into ASL. These sentences incorporated the new vocabulary and grammar points that had just been presented and were in the form of questions regarding personal history, current circumstances or habits, future plans, etc. Each student had the opportunity to emit all of the question at least once. The teacher provided reinforcement in the form of vocal praise, smiles, etc., following accurate translation of each question.

In Condition 2, randomly paired students were provided with the same set of questions as the Condition 1 students, half of the questions going to each member of the pair. They were told to get the answers to the questions from their partners, using only ASL. Since the information to be obtained consisted of personal facts unique to each individual, they presumably were unknown to the other student. Partners took turns asking and answering each other's questions and writing the answers. When they finished, students were directed to trade papers and check the accuracy of the answers recorded by their partners, still using only ASL. Inaccurate answers were circled and the papers turned in upon completion. Immediate reinforcement for accurate question-asking thus consisted of the information provided by the partner, which the student then wrote down and turned in to the instructor. Thus, students in both conditions had the opportunity to ask the same set of questions (and practice the

same vocabulary and grammatical structures), but those in Condition 1 received praise for their efforts, while those in Condition 2 received answers.

Expressive and receptive skills were assessed weekly at the beginning of each class session, and scores were obtained in the form of number of incorrect responses. For receptive evaluation, students wrote English translations of four ASL sentences similar to the training sentences as they were signed to the class by the teacher. For expressive evaluation, which was videotaped, students translated four English sentences (written on the blackboard) similar to the training sentences into ASL. Measures of ASL fluency were also obtained. The amount of time required to complete the expressive portion of the test (response time) was recorded via automatic timer on the videotape camera, which recorded the elapsed time on the tape. Counting began when subjects oriented their eyes toward the blackboard and ended when subjects completed the last sign of the last test sentence and lowered their hands. No immediate feedback as to accuracy was provided for either receptive or expressive portions of the test, but graded tests were returned and discussed the following week.

At the end of the semester (week 12), students were also tested on generalization of skills to a more natural context, i.e., in a non-structured verbal exchange with a fluent ASL-user. Students were invited to interview another individual (a skilled signer who visited the class for this purpose) for two minutes. They were told to find out as much information about the person as they could, using only ASL. These sessions were videotaped and evaluated for accuracy (number of errors) and fluency (number of questions asked and number of signs used during the two-minute period). In English and in ASL, yes/no questions require a short yes-or-no answer, whereas WH-questions (those beginning with who, what, when, etc.) typically are followed by longer, more informative replies. Since lengthy answers by the interviewee could potentially reduce the amount of time available to subjects for

asking more questions, the types of question asked (WH or yes/no) were also noted to establish whether one or the other predominated during the interview.

Nine sets of grammar and vocabulary items were presented during the course of the semester. No new material was presented during the first class or the last two classes, and the material taught did not vary in degree of difficulty by week. In addition to the test and interview measures, written products (completed lists of questions and answers) were obtained from each of the Condition 2 subjects at each session.

Follow-up measures were also obtained two months after the end of the semester from 9 students who did not continue their academic study of ASL or their interactions with other ASL-users. A test with receptive and expressive components similar to the unit tests and containing material from all 9 units was administered, as was a two-minute interview with a fluent signer. The same recording and evaluation procedures were followed as described above for the unit tests and interviews.

Reliability

Permanent products were obtained on all test measures in the form of written and/or videotaped responses (answers). All written unit tests were returned to students the following week, scores were discussed in class and publicly posted, and videotaped portions of the tests were reviewed when necessary. Thus, any recording discrepancies were readily noted and corrected, and further measures of reliability for unit tests were considered unnecessary. All interviews were also videotaped. An individual fluent in ASL independently observed 40% of these interviews and scored them for number of errors, number and type of questions asked, and total number of signs used. These scores were then compared with those obtained by (E).

Agreements, divided by agreements plus disagreements, times 100 yielded an average reliability of 98% on these measures.

RESULTS

Weekly Tests

A multiple baseline design was chosen for this research to facilitate the observation of any changes in skill acquisition at the level of single vocabulary items and grammatical structures (which varied by session). The individual records indicate, however, that such changes did not occur on a session-by-session basis. In fact, viewing composite test scores session by session (Figure 1) reveals that those subjects in Condition 2 during any particular session fared only slightly better in terms of number of errors (accuracy) than those in Condition 1. Condition 1 subjects averaged 86% on weekly tests, while Condition 2 subjects averaged 89%. Fluency was more strongly affected, however--while subjects in Condition 1 required approximately 72 seconds to complete their tests, Condition 2 subjects were able to finish theirs in about 61 seconds, a not insubstantial difference of 11 seconds.

Arranging subjects in order of increasing exposure to Condition 2 also revealed a consistent trend in both test scores and response times which corroborates the slight edge conferred by Condition 2 training described above. Trend lines indicate that greater exposure to Condition 2 is associated with lower error rates as well as with lower response times. This is evident in measures taken in both Condition 1 and Condition 2. Decreases in error frequency of up to 48% in Condition 1 and 56% in Condition 2 were found.

No systematic differences were found when comparing the test scores of Group A (for whom Condition 1 was followed by Condition 2) and Group B (Condition 2 followed by Condition 1) in either condition. Group B response times,

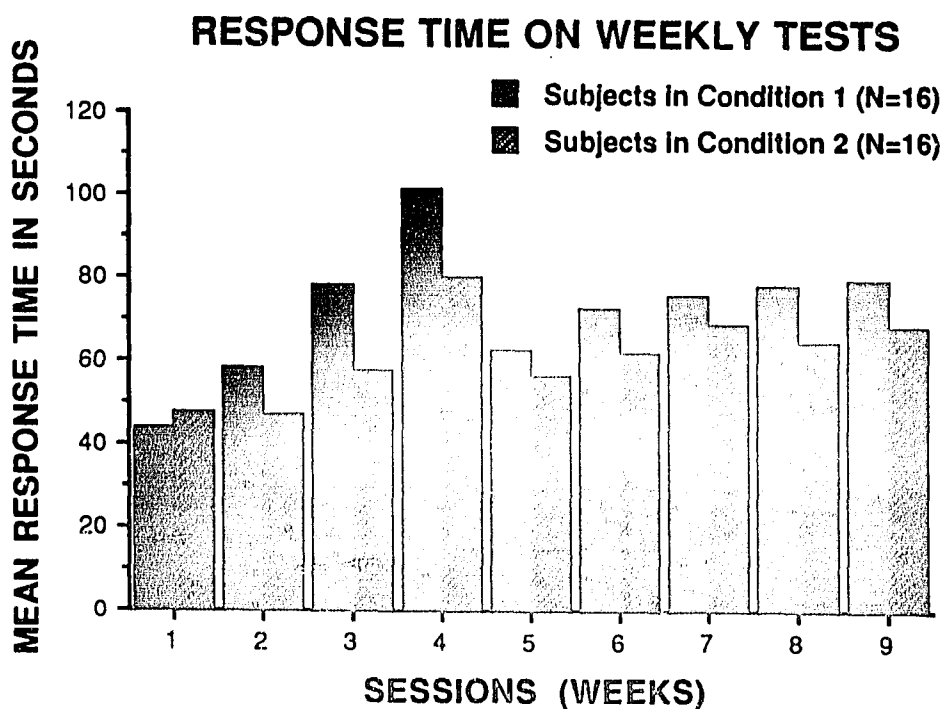
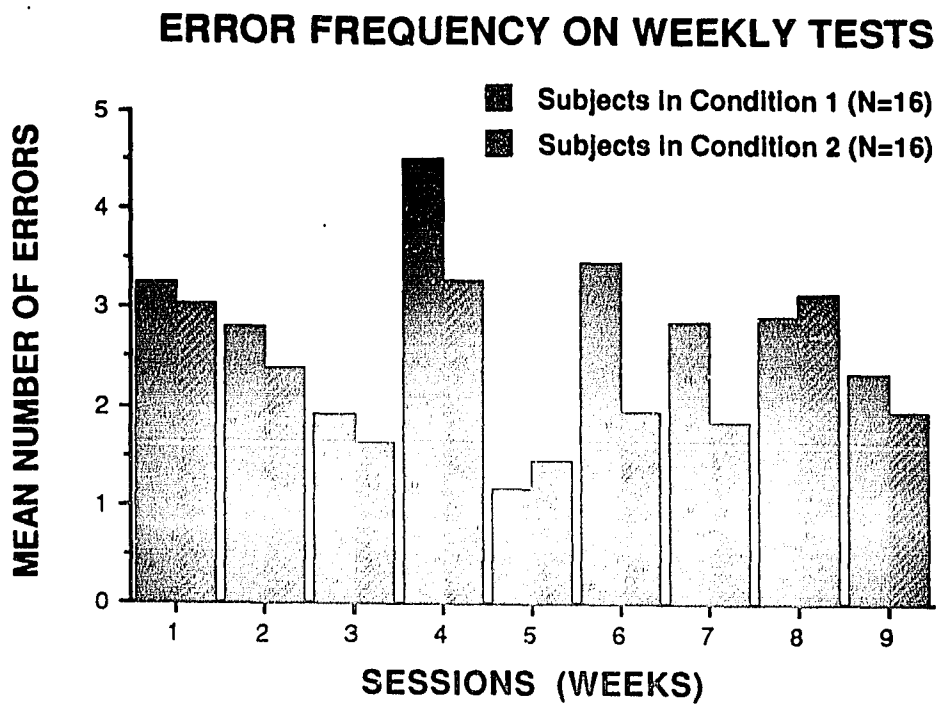


Figure 1. Error Frequency and Response Time as a Function of Exposure to Either Condition in Weekly Sessions.

however, were consistently lower in Condition 2 than in Condition 1, while the same does not hold true for Group A. It is to be expected that response times would increase over time as a result of the increasing complexity of the vocabulary and grammatical material being acquired. The lower response times for Group B may be related to the fact that more subjects in that group were exposed to Condition 2 early on, when response rates in general would tend to be lower, while more subjects in Group A were exposed to Condition 2 later in the semester, when response rates would be higher. However, combined data from both groups still reflect a downward trend in response times to be associated with increasing amounts of exposure to Condition 2.

Because Subjects 1, 28, 29, 31, and 32 were not exposed to both treatment conditions, their data were excluded from analyses that compared Condition 1 with Condition 2. Recall that all students started the semester in either Condition 1 or Condition 2, and that each week thereafter, for 9 weeks, two students in each class were randomly assigned to the alternate treatment condition. Larger than anticipated class sizes, drop-outs, and absences resulted in there not being enough time for all students to participate in the alternate condition.

Interviews

The data derived from the interview which followed the last training session were also arranged in order of subjects' increasing exposure to Condition 2. A very slight upward trend in error frequency is counterbalanced by a more pronounced increase in total number of questions asked (up to 28%) and number of signs used (as much as 27%) by subjects during the final interview, indicating that greater exposure to Condition 2 is correlated with greater fluency but not with enhanced accuracy. While the longer answers which typically follow WH-questions (versus yes/no

questions) might conceivably have held down the number of questions a subject had time to ask by using up the time available for responding during the two-minute interviews, the possibility was not controlled for in this study. However, a strong upward trend is evident in the number of WH-questions asked (up to 44%) as exposure to Condition 2 increased, with no corresponding decrease in the total number of questions asked.

Maintenance Tests and Interviews

Approximately two months after the last training sessions were held, nine subjects who did not continue their study of or involvement with ASL were administered a maintenance test and interview. While test performances deteriorated somewhat (see Table 2), those with greater exposure to Condition 2 maintained their advantage. Arranging subjects' data in order of increasing exposure to Condition 2 revealed that the greater their exposure, the fewer their errors (up to 65% fewer) and the lower their response times (as much as 35% faster) on the maintenance test.

Table 2
A Summary of Condition 1, Condition 2, and Maintenance Test
Accuracy and Fluency Measures

	Condition 1	Condition 2	Maintenance
Accuracy			
Mean Test Score	86% (3 errors)	89% (2 errors)	74% (5 errors)
Fluency			
Mean Response Time	72 seconds	61 seconds	104 seconds

Subjects' performances on the maintenance interview likewise resembled those seen at the end of training. Although fewer errors were made during the maintenance interview, subjects asked fewer questions, including WH-questions, and used fewer signs than during the final interview (see Table 3). However, it should be noted that trends generated by arranging subjects in order of increasing exposure to Condition 2 again demonstrate that they asked up to 38% more questions, used up to 45% more signs, and made only 18% more errors as the amount of their exposure to Condition 2 increased.

Table 3
A Comparison of Final and Maintenance Interview Outcomes

	Number of Errors	Number of Questions Asked	Number of WH- Questions Asked	Number of Signs Used
Final Interview (Means)	5.5	13	7	39
Maintenance Interview (Means)	4	10	6	30

Opinion Survey

At the end of training, all subjects were asked to describe which training condition they had liked best and why. While many pointed out that they saw advantages to both methods, and used virtually the same terms to describe why they liked them, they almost unanimously (24 out of 27) preferred the condition they had most recently been exposed to. Thus, of the 27 subjects who had experienced both conditions, 12 preferred the question-and-praise method (Condition 1), while 14

selected the question-and-answer method (Condition 2) as their favorite. One subject had no preference.

Summary

Overall, while in Condition 2, subjects responded more accurately and fluently on tests of ASL skill than did those in Condition 1. The more exposure to Condition 2, the greater the effect on test performance and rate and on similar measures of language behavior in more naturalistic settings. Measures taken two months after training reveal that these effects related to greater exposure were maintained.

DISCUSSION

While the improvements described above are modest by any standard, it is also the case that no deficits accrued following Condition 2 training versus Condition 1 training. Considering the short-term nature of the intervention, the substantial changes in fluency related to Condition 2 training are especially noteworthy. Furthermore, these results indicate that the more training students received utilizing the question-and-answer procedure, the more readily their skills generalized to a naturalistic setting and the more vigor with which they displayed their skills in follow-up measures. In other words, we can conclude that the use of natural contingencies in a question-and-answer format does not impede students' skill acquisition and may in fact enhance learning if sufficient training sessions are provided.

This research adds to the work of Asher et al. (1974) utilizing mand contingencies to train adult second language skills and extends to an adult population the findings of Valdez-Menchaca and Whitehurst (1988) and Whitehurst and Valdez-Menchaca (1988) that natural contingencies for language behavior can be more effective in training a verbal repertoire in a non-native language than can arbitrary or contrived reinforcers.

The present study also lends weight to the notion that the facilitative effects of natural consequences for language behavior are not restricted to spoken languages, as is also evident in the work of Schepis et al. (1982), Carr and Kologinsky (1983), and Hall and Sundberg (1987), wherein signed requests for items or events were successfully trained using those items/events as reinforcers.

Further evidence that natural reinforcement need not be restricted to any

particular mode or medium, nor to the use of primary reinforcers, is provided by Angelo and Goldstein's (1990) communication board training of requests for information (rather than tangible items or events) and is borne out by the present study as well, which used sign language requests for information to train a verbal repertoire. It further extends the work of Doyle et al. (1989), Knapczyk (1989), and Knapczyk and Livingston (1974) in this regard and adds to the credibility of the conclusions drawn by Doughty and Pica (1986) and Long and Porter (1985) that communicative competence is of primary importance in acquiring a verbal repertoire and is best obtained via consequences provided by listeners which are the same as or similar to those obtaining in the natural linguistic environment.

Angelo and Goldstein (1990), Carroll and Hesse (1987), Hall and Sundberg (1987), and Yamamoto and Mochizuki (1988) made it clear that it is possible to alter motivative variables in a classroom setting to obtain desired verbal performances with normal and disabled children. The present study adds to that evidence by demonstrating that the same can be accomplished with normal adults by manipulating establishing operations to evoke mand behavior.

Finally, this study supports Skinner's (1957) theoretical stance and the contentions of Stafford, Sundberg, and Braam (1987) and Carroll and Hesse (1987) that, once acquired, verbal responses in the form of mands constitute a stronger repertoire than those composed of the other verbal operants, probably owing to the specificity of the relationship between response, reinforcer, and establishing operation. It is further supportive of a behavioral interpretation of language behavior in that, by analyzing and manipulating antecedent and consequent controlling variables, the desired effect on verbal action was obtained and potential avenues for further exploration were made clear.

The usual problems to be found in applied settings were encountered in this research, as were some procedural difficulties which are worth noting. Students were absent, dropped out, left early, came late, did not have a partner, etc., as is typical of most classroom situations. Nineteen of 32 subjects missed one or more training sessions, although only one subject missed more than two. Three students dropped the class after the second week, but there were still many more students enrolled than originally anticipated. Thus, although some variation in the amount and timing of exposure to the different conditions was considered unavoidable, subjects in this study were exposed to as many training sessions as could be arranged under normal classroom conditions. It was also not possible to control for outside practice, experiences, or history with deaf individuals for the students in these classes, so variations in these factors must be allowed for in the interpretation of this and other applied studies of classroom techniques.

The minimal effects reported above are certainly related to the limited amount of time available for training. As sessions were approximately 30 minutes in length once a week for 9 weeks, the total amount of training time was only about 4-1/2 hours. As the data demonstrate the positive effects of greater exposure to treatment conditions, this is a variable that clearly needs to be further explored.

Based on the patterns of scores observed across sessions, it may be that there was some variation in the degree of difficulty of the material presented by session/unit. While it was not possible to precisely quantify the degree of difficulty, the approximate number of vocabulary items and the number and complexity of grammatical structures introduced were held constant across sessions, as were the teaching procedures. Even so, it appears that some items proved more difficult to master than others. Although the reasons for this remain unclear, they may be related to the degree of similarity of said items to their English counterparts. For example,

confusion between subject/object and possessive pronouns--a simple topographical distinction in ASL--proved to be a continuing source of error, while a complex set of gender-related vocabulary items (kinship terms not semantically distinct from English ones) was readily mastered. While errors related to interference from native language patterns are typical of early stages of second language acquisition, the relationship of degree to difficulty to acquisition under differing treatment conditions was not the focus of this investigation. Future studies would need to more evenly distribute those grammatical structures which are likely to cause problems solely by virtue of their dissimilarity to English, or to control for their error-enhancing effects in other ways.

Despite the absence of strong effects, other features recommend the use of this procedure over more traditional approaches. Question-and-answer as a training technique is both economical and feasible in a regular classroom setting. Its implementation requires no special materials, equipment, or personnel. As it consists solely of peer-generated reinforcement, it also requires no supervision on the part of the instructor, which makes it unique among classroom training methods. The teacher is free to observe students interacting naturally in the target language and to make corrections (or not) on an individual, as-needed basis. Enhanced question-asking skills also foster continued improvement because students are more likely to solicit verbal feedback from listeners and thus involve themselves in more complex interactions and diverse verbal communities. Seliger's (1983) correlational studies support the notion that learners who maintain higher levels of interaction in and outside of the classroom make greater progress in second language acquisition than those who do not. Furthermore, informal verbal reports following pilot studies undertaken by this experimenter, and the results of the opinion survey described above, indicate that students like the question-and-answer procedure as well as or better than the traditional approach and thus are more inclined to participate

enthusiastically in training activities. Further evidence for this positive effect was gained in informal observation of training sessions. All students engaged in the question-and-answer condition (Condition 2) appeared interested and enthusiastic (i.e., they maintained eye contact with their partners and smiled or laughed frequently), whereas those engaged in the question-and-praise condition (Condition 1) frequently looked bored or disinterested (i.e., they did not visually attend to the teacher, yawned, and fidgeted). While the former are more likely to induce teachers to continue such activities, whether such correlaries are actually related to enhanced skill development remains to be investigated.

The interview technique used here to assess generalization also has potential as a training device. It takes advantage of the naturally occurring audience comprised of class members and/or teacher. As it simulates natural conditions, it requires no script/prepared questions and can be adapted to incorporate a variety of language activities. It is also feasible to arrange for interactions with more advanced students or other fluent individuals. Finally, informal reports indicate that students find this procedure to be "fun" as well, and thus may be more willing to take part in activities which incorporate this method.

Future Directions for Research

Exigencies of the modern classroom frequently preclude conducting research with the rigor of laboratory experimentation. One of the unavoidable pitfalls of research in a regular classroom setting is the built-in delay between teaching and testing of what has been learned. It is not uncommon even today for adult college students to have only one or two exams per semester, with the pattern of weekly or more frequent testing still being somewhat unusual. Assessment immediately following training is a desirable but impractical goal, which means that the effects of

practice (or lack thereof) and other intervening variables must often remain uncontrolled and unmeasured. It must be kept in mind, when considering the results herein, that unit test measures were taken one week after each training session, during which time intervening forces may be presumed to have had their influence. It is therefore recommended that future researchers consider carefully the pros and cons of other testing arrangements.

Differences in language modality may or may not have a bearing on the effectiveness of the question-and-answer procedure described here, and the relevance of such training to the acquisition of spoken (rather than signed) languages needs to be assessed. Educators might also wish to explore whether or not, and how, such a procedure could be used to train other types of verbal repertoires (e.g., medical terminology, mathematics). Incorporating specific elements of grammar and vocabulary in higher-level skill training (i.e., extensions to more complex verbal behavior) is also a direction that merits further investigation.

More precise or detailed measures of the generalization of skills acquired under experimental conditions would be worth pursuing in future studies. That is, while the interviews herein approximated information-gathering activities in the real world, it would be helpful to assess subjects' effectiveness in a truly unengineered setting (e.g., at a social club, on the job, etc.) interacting with deaf individuals or groups. Future investigators may wish to begin by referring to the work of Haring et al. (1986), who assessed generalization of question-asking skills in unplanned conversations in the classroom and cafeteria by "wiring" their subjects with small microphones.

Error analysis of performances on tests and in natural settings might prove informative as well. Random sampling of the data in this study showed no clear pattern to the types of errors committed. That is, "phonological" (or topographical),

semantic, and syntactic errors seemed to be evenly distributed. Future studies with longer training times and thus larger language samples might reveal error distribution differences correlated with the type of training provided.

It is unfortunate that language instruction is often limited to one or a few classes per week, hardly the optimal arrangement for acquiring a novel repertoire of any kind. The effects of more training time and more frequent sessions utilizing a question-and-answer procedure therefore deserve to be a priority in further investigations of this technique.

It appears that empirically based research in the area of second language acquisition is long overdue. The majority of recent studies of second language acquisition via formal instruction are correlational, Long (1983) notes, and Henning (1988) points out that while research on adult second language acquisition is voluminous, little is experimentation in the scientific sense. Studies which explore the variables responsible for measurable changes in functional language behavior are therefore sorely needed.

It might also be informative to experimentally assess the "fun" aspects of the question-and-answer methodology and the interview technique described herein. One might seek to determine whether any relationship exists between the variables responsible for students' preferences and their skill acquisition, and how that might be applied to other training methods and settings.

Conclusion

Verbal behavior is an extremely important part of the lives of most humans, and techniques with the potential for improving language skills deserve to be fully investigated. This research describes a way to incorporate the variables that maintain language behavior in the natural environment into a classroom setting. Further

exploration of these variables and their effects on generalization should prove both interesting and useful.

Appendix A
Human Subjects Institutional Review Board
Research Protocol Clearance Letters

Human Subjects Institutional Review Board



Kalamazoo, Mich.

WESTERN MICHIGAN UNIVERSITY

Date: September 20, 1990

To: Lisa Ann LeBlanc

From: Mary Anne Bunda, Chair

Re: HSIRB Project Number 90-09-08

Mary Anne Bunda

We have received the revisions to your protocol as requested in our September 12 letter. Therefore, this letter will serve as confirmation that your research protocol, "The Role of Contrived versus Natural Reinforcers in the Acquisition of a Verbal Repertoire," has been approved after full review by the HSIRB. The conditions and duration of this approval are specified in the Policies of Western Michigan University. You may now begin to implement the research as described in the approval application.

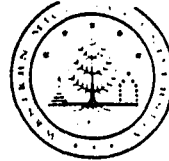
You must seek reapproval for any change in this design. You must also seek reapproval if the project extends beyond the termination date.

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

xc: Howard Farris, Psychology

Approval Termination: September 20, 1991

Human Subjects Institutional Review Board



Kalamazoo

WESTERN MICHIGAN UNIVERSITY

Date: December 6, 1990

To: Lisa LeBlanc

From: Mary Anne Bunda, Chair

Re: HSIRB Project Number 90-09-08

Mary Anne Bunda

This letter will serve as confirmation that the changes in your research protocol, "The Role of Contrived versus Natural Reinforcers in the Acquisition of a Verbal Repertoire," were received by the HSIRB on December 3, 1990.

The changes are acceptable, and your protocol continues to be approved.

xc: Howard Farris, Psychology

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