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Generalization of Question-Asking from a Training Situation to a Child's Natural Environment

Joan J. Andress

GENERALIZATION OF QUESTION-ASKING
FROM A TRAINING SITUATION
TO A CHILD'S NATURAL ENVIRONMENT

by

Joan J. Andress

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

Western Michigan University
Kalamazoo, Michigan
April 1977

ACKNOWLEDGEMENTS

I would like to express my deep appreciation to Dr. Daniel E. Hursh for his contributions of time, advice, and knowledge during the initial conception and design of this thesis. I owe an equal debt of gratitude to Dr. Brian A. Iwata for the guidance and encouragement that was instrumental in bringing the original design through to completion. I would also like to thank Drs. Cheryl E. Poshe and Paul T. Mountjoy for their assistance in the final stages of this undertaking. In addition, I wish to acknowledge the cooperation of the staff of Family and Children Services of Kalamazoo in allowing this research to be a part of my foster son's home training program. Finally, I want to thank Donald Andress for his constant intellectual and emotional support and for his help in data collection.

<div align="right">Joan J. Andress</div>

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ANDRESS, Joan Johnson
   GENERALIZATION OF QUESTION-ASKING FROM A
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   Western Michigan University, M.A., 1977
   Psychology, experimental

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INTRODUCTION

In recent years a number of investigators have examined the use of imitation and reinforcement procedures in the production of generative language in both normal and speech-deficient children. The term generative language has been defined by Lutzker and Sherman (1974) as "The appearance of novel language responses within the language repertoire of a child that have not been modelled or directly trained, but that may be related to other language responses." Guess, Sailor, Rutherford, and Baer (1968) suggested that generative language might be viewed as a generalized response class in which all responses in the class are affected by a manipulation applied to only a few responses in the class. Baer, Peterson, and Sherman (1967) have demonstrated that reinforcing some imitative responses served to maintain both reinforced and unreinforced imitative behavior in retarded subjects.

Guess, et al. (1968) chose the productive use of the plural morpheme as a starting point in an experimental analysis of generative language in terms of a generalized response class. They used procedures of imitation and reinforcement to train a retarded subject to respond with singular labels to single objects and with plural labels to pairs of objects. Generative plural production occurred in that the subject correctly labelled new objects which had not been directly trained. In further work on the acquisition of the plural morpheme (Guess, 1969; Guess & Baer, 1973), it was shown that generalization between receptive and productive training

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was not automatic.

Schumaker and Sherman (1970) used imitation and reinforcement procedures to train generative verb usage in three retarded subjects. As each subject was taught verbs within one inflectional class, he not only produced correct forms of trained verbs, but also correct forms of untrained verbs within the inflectional class.

Several investigators have demonstrated generative sentence usage as the result of training procedures utilizing imitation and reinforcement. Wheeler and Sulzer (1970) used imitation and reinforcement procedures to train generative usage of a sentence form which included articles and verbs in a subject who spoke "telegraphic" English in which most articles and auxiliary verbs were omitted. The subject's use of the sentence form was shown to be generative in that he used the trained form to describe novel stimuli. Garcia, Guess, and Byrnes (1973) used imitation, reinforcement, and modelling procedures to train a retarded subject in the usage of singular and plural sentence forms in a labelling task and demonstrated generative usage of these sentence forms in labelling untrained stimulus items. Clark and Sherman (1975) also used modelling and reinforcement to train generative sentence usage in three retarded and four economically disadvantaged subjects. In that study, subjects were trained to respond in complete sentences to three different classes of questions, each of which required a different verb inflection in the response. The subjects were able to produce correct sentence answers to questions within each class for which no direct training had been given. Lutzker and Sherman (1974) used imitation and reinforcement

to train three retarded subjects and two normal toddlers to use two classes of sentences in describing pictures. The subjects produced untrained sentences of the type being trained when generalization probe pictures were presented.

Twardosz and Baer (1973) used imitation, reinforcement, and modelling techniques to train retarded subjects to ask questions and found that the question trained for one subset of letter items generalized to untrained letter, color, and number items.

Although most of the above studies assessed generalization from trained to untrained items, none assessed the extent to which the production of generative language abilities generalized to a more natural setting. The unreinforced probe items were generally presented along with trained items in a situation similar to that in which all the training had occurred. Hart and Risley (1968) found that color naming in a group situation in which the teacher prompted and reinforced correct use of color adjective-noun combinations failed to increase the rate of this behavior during a free play situation, but making access to preschool materials contingent upon the use of these adjective-noun combinations to describe materials was effective. The latter procedure served to make the use of descriptive adjectives functional.

It would be interesting to examine whether the generative language abilities produced using modelling and reinforcement during training sessions can be of use to the child in his natural environment. If generalization does not readily occur from training to the natural environment, it would be useful to examine what intervening

steps might facilitate this transition. The present study is an attempt to train generative question-asking during training sessions utilizing modelling and reinforcement procedures and to assess the extent to which question-asking established during training general-ized to the child's natural environment.

METHOD

Child and Setting

The child was the seven-year-old multiply handicapped foster
son of the experimenter. The child's handicapping condition had
been diagnosed as arthrogryposis multiplex congenita, a rare birth
defect characterized by multiple joint contractures and a severe
lack of muscle fibers. The aspect of his handicap most relevant to
the present study was ankylosis of the jaw which was at least par-
tially responsible for his quite severe articulation disorders. The
child was selected for this study because he exhibited a very low
rate of question-asking and his relationship to the experimenter
provided an excellent opportunity for an analysis of generalization
of language training to the natural environment. The child had
lived with the experimenter for two years prior to the beginning of
this study and had participated in an extensive home training pro-
gram involving self-care, locomotion, physical therapy, speech and
language training. Prior to entering the foster home, he exhibited
no expressive language. By the time of the present study, he had
acquired a large expressive language repertoire, but one which was
more unconventional grammatically than that of a normal seven-year-
old.

The study was conducted in the foster home. Training and
observation sessions were conducted daily during the late afternoon
or evening and on weekends. The child attended an orthopedic kinder-

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garten during the day. Training sessions were conducted in one of the bedrooms with the child seated across a table from the experimenter.

Stimulus Items

During the training sessions, the experimenter presented a series of stimulus items to the child and to a puppet operated by the experimenter. These items were designated as known and unknown items. Known items were those to which the child could respond correctly without asking a question. Unknown items were those to which the child could not respond correctly without asking a question to obtain needed information.

For the where-object training component of the procedure, known items consisted of pieces of furniture in a toy house whose locations in the house during training were known to the child. The child was told prior to training sessions in which rooms of the house these known items were placed or, he was allowed to watch as the experimenter put the known objects into the rooms of the house. The location of these objects remained constant throughout the study. For example, the child was told that the big bed would always be placed in the green bedroom of the toy house and may have watched as the experimenter put the big bed into the green bedroom immediately prior to the beginning of the session. Therefore, when presented with the instruction, "Tell me the room the big bed is in," the child could respond correctly, "The big bed is in the green bedroom." Unknown items for where-object training consisted of miniature household

items and pieces of furniture which were randomly placed in the house prior to each session. The child was not allowed to watch as these items were placed. For example, during one session the telephone would be located in the living room but during the next session it might be placed in the kitchen. When instructed, "Tell me the room the telephone is in," the child could not respond correctly based upon the information he already had but could obtain the necessary information by asking the experimenter a question.

For what-object training, known items consisted of pictures of animals and objects, cut from magazines and mounted on thin cardboard, which the child had correctly identified during a pretest conducted over several sessions prior to the beginning of any training. If the child correctly labelled a picture of a cat during the pretest, this item would be designated as known. When presented during training and instructed, "Tell me the name of this," the child could respond, "That is a cat." Unknown items consisted of those pictures which the child could not identify correctly during the pretest. When presented with one of these items during training, the child could not supply the correct label. If the child did label one of these unknown items correctly during training as a result of information obtained in the natural environment during the course of the study or as a result of information obtained through asking appropriate questions during earlier training sessions, this item was redesignated as a known and replaced with an unknown item from the original pool formed during the pretest. As a result of this replacement process, new unknown items were constantly being added

throughout the study, providing a test for generative language responses.

The selection of known and unknown items for what-action training was identical for that used for what-object training except that the pictures used were of people or animals performing some action. An example of a known item would be a boy eating an ice cream cone, while an unknown item would be a man using a computer. The way in which unknowns were transformed into knowns and replaced by new unknowns was also identical to that described for what-object items.

Items designated as known and unknown for the puppet were the same as for the child. Separate series of items selected for any given session were determined randomly for the child and the puppet.

Response Definitions and Measurement

Training. The behavior of interest, appropriate question-asking, was defined as a vocal response including an interrogative word, a verb, and an object appropriate for the particular type of question being trained and the specific stimulus item used on each trial. The three types of questions trained were labelled where-object, what-object, and what-action questions.

An appropriate where-object question consisted of the word where, followed by the verb is, an article if appropriate, and the name of the unknown stimulus item being considered. An example of an appropriate where-object question would be "Where is the sewing machine?" An inappropriate where-object question would be a where-object question asked in response to the presentation of a known item.

An appropriate what-object question consisted of the word <u>what</u>, followed by the verb <u>is</u>, and the pronoun <u>that</u> referring to an unknown stimulus item. A noun referring to the general class of things of which a specific unknown item was a member would also be considered an appropriate but not essential part of the question. An inappropriate what-object question would be one given in response to a known stimulus item.

An appropriate what-action question consisted of the word <u>what</u>, followed by the verb <u>is</u>, an article if appropriate, the name of the performer of the action, and the verb <u>doing</u>. An inappropriate what-action question would be one directed toward a known stimulus item rather than toward an unknown item.

The experimenter recorded the behavior by copying the child's vocal response to each stimulus presentation on a data sheet on which the randomized sequence of stimulus items had been listed prior to the beginning of the session. The percent of appropriate and inappropriate questions asked during each session constituted the dependent variable.

A second observer independently recorded the child's vocal responses to stimulus presentations once each week. Interobserver agreement was calculated on a word-by-word basis. Reliability was computed by dividing agreements on number of words which matched both lexically and sequentially, by agreements plus disagreements.

<u>Natural environment</u>. Data assessing the generalization of question-asking to free-speech situations were collected during a thirty minute observation session on most training days. The time

and setting of these sessions varied depending upon the schedule of activities in the home and the presence or absence of either an observer or the child on any given day. An attempt was made to include most of the routine activities of the child as well as some more novel situations. The experimenter recorded the occurrence and exact wording of vocal responses beginning with an interrogative word. The number of where-object, what-object, what-action, and other wh-word questions were then graphed separately. No attempt was made to classify questions asked in the natural environment as appropriate or inappropriate since it would be difficult to determine whether the stimulus items toward which questions were directed in the natural environment were known or unknown to the child. Whenever the child asked a question in the natural environment, the foster parents answered the question.

Once a week, a second observer independently recorded the child's question-asking behavior in the natural environment. Interobserver agreement was calculated as described previously. The foster father was used as the second observer because the severity of the child's articulation disorder would have made it very difficult for someone not extremely familiar with his speech to record his vocal responses.

Experimental Procedure

Table I presents a summary of the conditions in effect during training sessions.

Baseline. During each training session a randomized series of fifteen stimulus items (10 unknown and 5 known) was presented by the

Table I: Summary of conditions in effect during training sessions.

Table I

Summary of Conditions in Effect During Training Sessions

Phase	Stimuli Presented	Puppet Responses	Child Responses	Consequences Provided by Experimenter
Baseline Probe	3 Unknowns	Puppet not present	Appropriate question	Answer to question
			Incorrect label No response	Neutral response
			Correct label	Praise and substitution of new unknown item
Baseline	5 Knowns	Correct label	Correct label	Praise
			Incorrect label Inappropriate question	Child required to provide correct label
	10 Unknowns	No response	No response Incorrect label	Neutral response
			Appropriate question	Answer to question
			Correct label	Praise and substitution of new unknown item

Table I continued

Modelling	5 Knowns	Correct label	Correct label	Praise
			Incorrect label Inappropriate question	Child required to provide correct label
	10 Unknowns	Appropriate question	Appropriate question	Praise and answer to question
			No response Incorrect label	Neutral response
			Correct label	Praise and substitution of new unknown item
Maintenance Probe	3 Unknowns	Puppet not present	Appropriate question	Answer to question
			Incorrect label No response	Neutral response
			Correct label	Praise and substitution of new unknown item

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experimenter for the child to locate (where-object training), label the object pictured (what-object training), or label the action pictured (what-action training). Each of the fifteen training trials was followed by a similar stimulus presentation to the puppet who was subject to the same contingencies as the child. Immediately prior to the presentation of the fifteen training items, six probe items were presented. Probe items were randomly drawn from unknown items related to the two types of questions not then being trained, three items from each of the two types. Probe items were considered baseline probes if the question type to which they were related had not yet been trained. They were considered maintenance probes if the type of question to which they were related had already been trained. The puppet did not participate in the probe portion of the session. Correct labelling responses to the probe items resulted in praise, the reclassification to the item as known for future sessions, and the addition of a new unknown item of the same question type at the end of the six regularly scheduled probe trials. When the child asked a question after the presentation of a probe item, the experimenter immediately answered the question. Incorrect labelling responses and failure to respond vocally to probe items resulted in the experimenter making a neutral response such as writing on the data sheet and then proceeding to present the next stimulus item.

During the training portion of each session during the baseline phases, the puppet was made to correctly label or tell the location of known items after the presentation of the stimulus item and verbal

instruction appropriate to the type of question to be trained in the next phase. Both the child and the puppet received praise for correct labelling of known items. Incorrect labelling and inappropriate questions directed toward known items by the child were corrected by the experimenter, i.e., the child was required to provide the correct label. The puppet made no response to unknown items during baseline. After presenting an unknown item to the puppet, the experimenter waited approximately ten seconds, made a neutral response such as looking for the next stimulus item to be presented, and then presented the next stimulus item to the child. If the child asked a question when presented with an unknown item during baseline or if he correctly labelled an unknown item, the procedure described for these occurrences to probe items was followed. If the child made an incorrect labelling response or failed to respond to an unknown item, the experimenter responded in a neutral manner as described earlier.

Modelling. During the modelling phase, the puppet was made to respond to known items by giving the correct labelling response and to unknown items by asking the question appropriate to the type being trained. Contingencies for correct and incorrect labelling of known items were identical to those in effect during baseline. Question-asking responses to unknown items were reinforced with praise and an immediate answer to the question. A modification was made after the first treatment session was completed such that the experimenter whispered the answers to questions asked by the puppet into the puppet's ear to prevent the child from learning the correct responses to unknown items without asking the questions himself.

Correct labelling responses, incorrect labelling, and failure to respond to unknown items during the modelling phase were treated as they had been under baseline conditions.

Experimental Design

The experimental design was a multiple baseline (Baer, Wolf, & Risley, 1968) across three classes of question-asking behaviors; where-object, what-object, and what-action questions. The sequence of conditions for the first component of the multiple baseline, where-object training, was baseline, modelling, and maintenance probes. The sequence of conditions for the second component, what-object training, was baseline probes, baseline, modelling, and maintenance probes. The sequence for the third component, what-action training, was baseline probes followed by baseline. Throughout the time period in which training was taking place, data was collected concerning the generalization of question-asking to the natural environment. The effect of each training condition upon question-asking in the natural environment could thus be assessed in a multiple baseline fashion.

RESULTS

Reliability

Training. Reliability was computed for sessions six, eleven, nineteen, twenty-four, twenty-nine, thirty-five, thirty-seven, forty-six, and fifty-three. These computations yielded a range from 88.4% to 99.0% interobserver agreement with a mean of 94%.

Natural environment. Reliability was checked for sessions five, twelve, twenty, twenty-nine, thirty-eight, forty, fifty-one, and fifty-six. Both observers agreed that no questions were asked during sessions five, twelve, and forty. For the remaining sessions, reliability was computed as for training sessions and yielded a range of 87.5% to 100% with a mean of 97.5%.
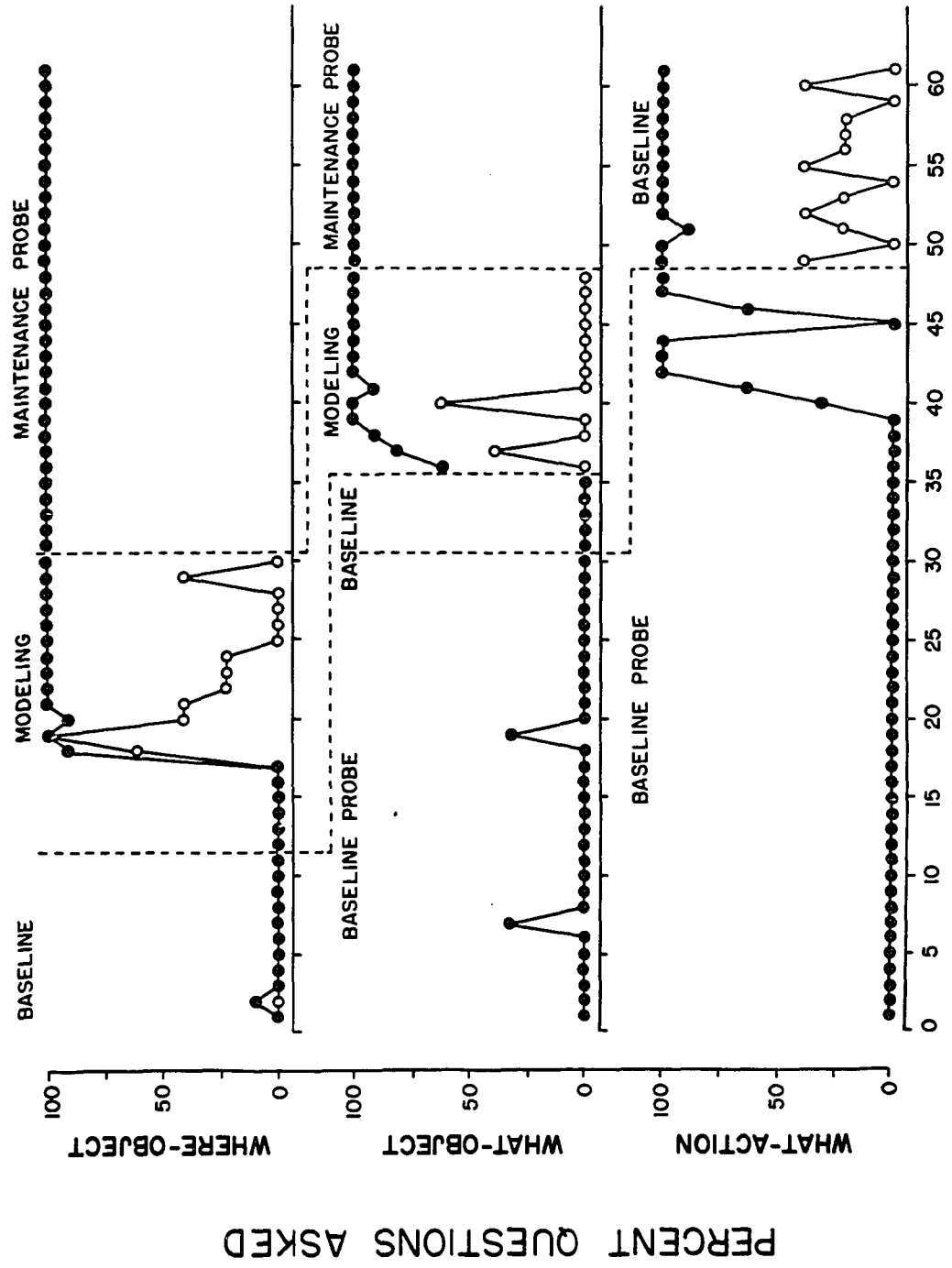
Training

Figure 1 shows the percent of appropriate and inappropriate questions asked by the child during each session of each phase of the three components of the multiple baseline.

Where-object training. The child asked no inappropriate questions durine baseline, i.e., he asked no questions in response to known items. One appropriate where-object question was asked during session two of baseline. The child asked no questions during the first six sessions of modelling, but the percent of both appropriate and inappropriate questions asked then sharply increased such that both reached 100% by the eighth session of modelling. Appropriate question-asking remained high throughout the remainder of the phase,

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Figure 1: Percent of appropriate and inappropriate questions asked
during training sessions.

APPROPRIATE QUESTIONS
INAPPROPRIATE QUESTIONS

BASELINE

MODELING

MAINTENANCE PROBE

WHERE-OBJECT

BASELINE PROBE

BASELINE

MODELING

MAINTENANCE PROBE

WHAT-OBJECT

BASELINE PROBE

BASELINE

WHAT-ACTION

100

50

0

100

50

0

100

50

0

0   5   10   15   20   25   30   35   40   45   50   55   60

TRAINING SESSIONS

PERCENT QUESTIONS ASKED

figure I

while the percent of inappropriate questions asked gradually de-
creased. Maintenance probes conducted throughout the remainder of
the study indicated that the child asked appropriate questions to
all probe items presented. No probes were presented to further as-
sess inappropriate question-asking. All probe items were unknowns
making all questions directed toward them appropriate.

What-object training. The child asked two appropriate what-
object questions during the thirty sessions of baseline probes.
Only unknown items were presented during this phase. During the
baseline phase, in which both known and unknown items were presen-
ted, the child asked no what-object questions in response to either
type of stimulus item. The child began asking appropriate what-
object questions during the first modelling session, and the percent
of appropriate questions asked reached 100 on the fourth session of
the phase and remained high throughout the phase. The child asked
inappropriate questions on the second and fifth sessions of the
phase. The child asked what-object questions to all maintenance
probes presented.

What-action training. The child asked no what-action questions
during the first thirty-nine sessions in which the baseline probe
condition was in effect. The child began asking what-action ques-
tions in response to probes on session forty and continued to do so
throughout the remainder of the phase, asking questions to 100% of
the probes on five of the last seven sessions. During baseline,
when both known and unknown stimulus items were presented, the child
asked appropriate questions at a level of 100% on twelve of the

thirteen sessions in that phase. He also asked inappropriate questions in response to known items throughout the phase with the percent of inappropriate questions never exceeding 40%. Modelling for what-action questions was not instituted in view of the child's performance during baseline.

Table II presents a summary picture of the child's question-asking behavior during training. The percent of questions asked to known and unknown stimulus items during each phase of each component of the multiple baseline has been listed. During where-object training the percent of appropriate questions asked increased from 0.9% during baseline to 67.4% during modelling and 100% during maintenance probe. During what-object training, the child asked appropriate questions to only 2.2% of baseline probes and 0% of unknown items presented during baseline in comparison to percentages of 93.8 and 100 during modelling and maintenance probe phases, respectively. During what-action training the child asked questions to 13.9% of baseline probe items and to 99.2% of unknown items during baseline.

Inappropriate question-asking was 31% during the modelling phase of where-object training, 6.6% during the modelling phase of what-object training, and 17.3% during the baseline phase of what-action training.

Natural Environment

Where-object questions. The child asked two where-object questions in the natural environment during the time covered by the

Table II: Percent appropriate and inappropriate questions asked
during training sessions.

Table II

Percent Appropriate and (Inappropriate) Questions
Asked During Training Sessions

Phase	Question Type		
	Where-object	What-object	What-action
Baseline Probe	* (*)	2.2 (*)	13.9 (*)
Baseline	0.9 (0)	0 (0)	99.2 (17.3)
Modelling	67.4 (31.0)	93.8 (6.6)	* (*)
Maintenance Probe	100 (*)	100 (*)	* (*)

* Condition not run

baseline phase for where-object training, nineteen during the time period in which where-object modelling was in effect during training sessions, and twenty-three during the time in which training was being conducted on other types of questions with maintenance probes for where-object questions.

What-object questions. The child asked a total of fifteen what-object questions during the thirty-five observation sessions which took place prior to the beginning of what-object modelling compared to a total of fifty what-object questions which occurred in the twenty-six sessions after the beginning of what object modelling in training sessions.

What-action questions. The child asked a total of nine what-action questions during the forty-eight observation sessions prior to the beginning of the what-action baseline training condition in which the child asked high percentages of appropriate questions. Subsequent to the beginning of that training condition, the child asked sixteen what-action questions in the remaining thirteen observation sessions.

Other questions. Three other questions were asked during where-object baseline, four during the time period in which modelling was taking place for where-object questions, five during the time covered by what-object baseline, six during what-object modelling, and eight during the time in which what-action baseline was being conducted.

Table III presents the mean number of questions asked during observation sessions in the natural environment during the time periods

Table III: Mean number of questions asked in natural environment.

Table III

Mean Number of Questions Asked in Natural Environment

Conditions in Effect During Training Sessions	Question Type			
	Where-object	What-object	What-action	Other
Where-object Baseline What-object Baseline Probe What-action Baseline Probe	.18	.36	.09	.27
Where-object Modelling What-object Baseline Probe What-action Baseline Probe	1.00	.47	.26	.21
Where-object Maintenance Probe What-object Baseline What-action Baseline Probe	1.50	.50	.25	1.25
Where-object Maintenance Probe What-object Modelling What-action Baseline Probe	.83	1.80	.16	.50
Where-object Maintenance Probe What-object Maintenance Probe What-action Baseline	.70	2.80	1.60	.80

covered by the various training conditions. The condition actually
in effect in the natural environment remained constant throughout
the study. When the child asked a question in the natural environ-
ment, the foster parents answered the question. The mean number of
where-object questions asked increased from .18 during where-object
baseline to 1.00 during where-object modelling and remained at com-
parable levels during the time that where-object maintenance probes
were being made. The mean number of what-object questions asked in
the natural environment increased from .50 during what-object base-
line to 1.80 during what-object modelling and continued to increase
during the time period covered by what-object maintenance probes.
The mean number of what-action questions asked in the natural environ-
ment increased from levels of .09, .26, .25, and .16 during time
periods covered by what-action baseline probes to 1.60 during the
what-action baseline phase. The number of other questions asked in
the natural environment also tended to increase as training progress-
ed.

Figure 2 represents the mean number of questions asked in the
natural environment during the time periods corresponding to the vari-
ous training phases when all four types of questions are pooled. A
clear upward trend in mean number of questions asked during observa-
tion sessions in the natural environment, where conditions remained
constant, can be seen as training progresses.

Figure 2: Mean number of questions asked in natural environment during each training phase.
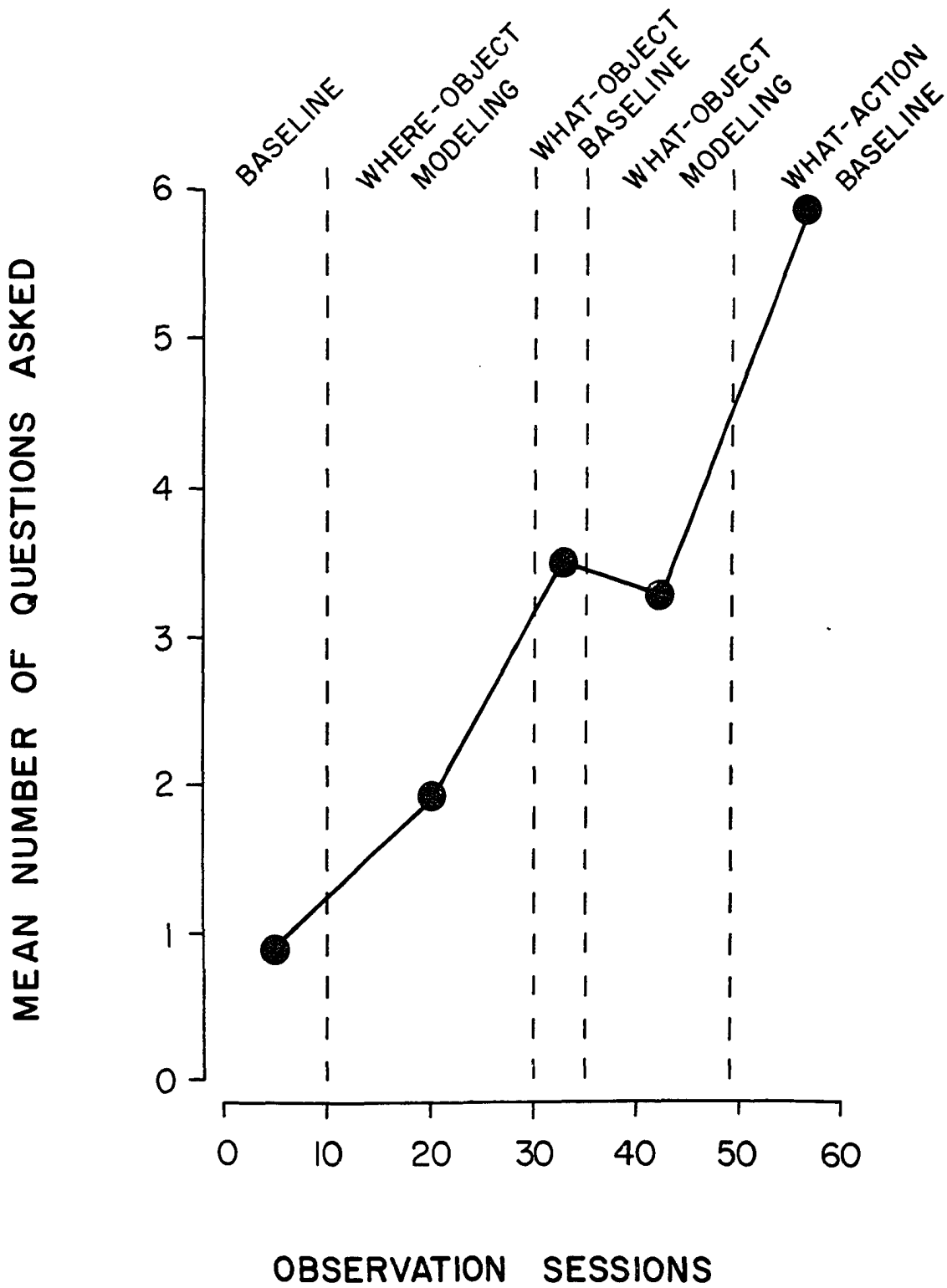
figure 2

DISCUSSION

This study examined the effects of modelling of appropriate question-asking on a child's question-asking behavior during training sessions and under more naturalistic conditions. Results indicate that modelling during training sessions produced an increase in the number of appropriate questions asked by the child both in the training situation and during his daily activities.

The number of appropriate where-object and what-object questions asked increased during training sessions and in the natural environment after the introduction of modelling for those particular responses, suggesting that the modelling condition was responsible for the increase in appropriate question-asking. The number of what-action questions asked by the child during training sessions increased prior to the introduction of modelling for that type. It appears that the child's ability to produce what-action questions was a result of generalization from training on the other question types. Other experimenters (Lutzker and Sherman, 1974; Guess, 1969; Guess et al., 1968; Schumaker and Sherman, 1970) have shown that as training progresses, new training items are learned more rapidly. In the present study, training progressed more rapidly on the second component of the multiple baseline than on the first, indicating that the child had learned the general strategy of asking questions to unknown items; thus, the second question type was more easily learned than the first. The stimulus items for the second and third components of the multiple baseline were quite similar (pictures cut from magazines), and this

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similarity would have further promoted generalization. The number of what-action questions asked in the natural environment did not increase until after the child's exposure to the what-action baseline condition in which he had the opportunity to ask greater numbers of what-action questions per session than he had during the probe condition.

Several previous studies (Guess, 1969; Schumaker & Sherman, 1970; Lutzker & Sherman, 1974) have shown overgeneralization of the response forms initially trained. In the present study, no overgeneralization was seen from one question type to another (i.e., the child did not ask where-object questions to what-object stimuli), but overgeneralization did occur in that the child asked questions to known stimuli which he had previously labelled correctly. The modelling condition was continued for each question type until such overgeneralization decreased; however, no probe items were presented to test for the possibility that overgeneralization might continue to occur following training.

An important finding of this experiment was that question-asking did generalize from training to the child's natural environment. These results should not, however, be interpreted as an indication that such generalization is always likely to occur. The extent to which responses learned in a training situation would generalize to the natural environment could be effected by many variables such as the mental capabilities of the child, the similarity between the training situation and the child's natural environment, and the extent to which the response trained would be functional in the child's

natural environment. Several factors may have favored generalization in this study. Although delayed in acquiring language, the child was of normal intelligence and had acquired many generative language abilities in the preceding two years without structured training. An attempt had been made to choose stimulus items similar to those encountered in the natural environment. Training was conducted in the child's home by the child's foster mother so that the training situation and natural environment shared a number of important stimulus characteristics. Finally, question-asking as the trained response is also more functional than many types of generative language responses frequently trained such as the use of plurals, tenses, and particular sentence forms. Questions are more likely to be attended to directly that is the use of an appropriate plural form or tense because questions require an answer. The verbal interaction and information gained probably function to reinforce the question-asking behavior.

The present study has shown that question-asking behavior trained using a modelling procedure can generalize to a child's natural environment. Further study is needed to determine what variables influence the extent to which generative language abilities learned in training will generalize to the natural environment. The importance of variables such as the intelligence of the subject, similarities between the training situation and the natural environment, and the consequences typically produced by the newly trained language response in the subject's natural environment warrant further investigation.

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