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ABSTRACT

This study examined children's development of the concept of the reciprocal relationship of question and answer by asking subjects to form questions to fit given answers and to form answers for given questions. A total of 72 children (18 per grades 1, 4, 7, and 10) participated in the study. Each child was tested individually on two tasks (the formation of questions and the formation of answers) and with two presentation modes (verbal context alone and verbal context in combination with pictures). The results showed significant effects for grade, task, mode of presentation, and interaction of grade and task. Children in all grades formed more correct answers than questions. While question means increased over grade level, answer means did not. It was concluded that (1) the task of question formation is a more demanding measure of the concept of question-answer reciprocity than is answer formation; (2) expression of the concept of question-answer reciprocity increases over the age period encompassed in this study; and (3) the levels of question formation and answer formation eventually converge for most subjects, indicating a fully abstract understanding of the reciprocal relationship. (Author/JMB)

KNOWING THE QUESTION TO AN ANSWER:

THE LATER DEVELOPMENT OF QUESTION-ANSWER RELATIONSHIPS

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Knowing the question to an answer is fully as much a part of an abstract concept of question-answer relationships as is knowing the answer to a question; the ability to go either from a question to an appropriate answer or from an answer to an appropriate question must be present before we can say that one fully understands the reciprocal relationship of the question form and the active form. The operations involved may well be termed cognitive, but they are not external to the linguistic concept of question-answer relationships. If the concept is fully abstract, it should also be possible to apply it in unfamiliar situations and under minimal contextual support.

Widely varied criteria may be used for knowledge of the same linguistic construction, each suggesting a different age of acquisition. Rather than deciding that some of these are inaccurate, it may be most productive to conceptualize each criterion as tapping one aspect or level of knowledge. As the concept gradually develops from a minimal concept toward its fullest expression, use of more than one criterion may serve to mark progress.

If these assumptions about the nature of language learning are accurate, certain linguistic constructions which show very early growth may, when examined rigorously, be found to continue to mature over a long period. McGrath and Kunze (1973), for example, found that while tag questions (He ate it, didn't he? We're going home, aren't we?) were used as early as age two and one-half, certain of the more complex rules for coordinating the tag with the sentence stem were not fully mastered by all children at age eleven. In the case of question-answer

relationship for Wh- questions, the ability to form appropriate answers for questions may indicate that the concept is well begun, while the ability to form a question to fit a given answer may indicate a relatively late-developing abstract level of this same concept.

Noting the form of children's responses to questions about a picture book, Ervin-Tripp (1970) reported that initial discrimination of questions from other forms was present even in her youngest subject, at age one year, nine months. By age two years, the children could all respond appropriately to "What" questions and "Where" questions. The order of development of appropriate responses to various question types was: What, Where, What-do, Whose, Who, Why, Where-from, How, and When. By age three and one-half, Ervin-Tripp's subjects had mastered all except certain variants of "When." Although there was often a delay of several months between the time of answering appropriately and the time of spontaneous production, the children had clearly mastered many elements of question-answer relations well before school-age.

On the other hand, certain other elements may be acquired more slowly. Torrance (1970) noted that six-year olds, when asked to form questions, had a strong tendency to answer questions, unless pretraining on formation of questions was given. Chomsky (1969) found that many children in the age range five to ten had difficulty with certain aspects of question production. They could more easily act out "Tell Bobo what time it is" than "Ask Bobo what time it is." Even though they could presumably formulate such questions spontaneously, children responding to the "ask" sentences must formulate a question in which the topic and the form are appropriately coordinated. Mastering this task may require not only secure mastery of the syntactic concept, but some skill in logical coordination.

These and other studies suggest that even when a child has begun to

develop a given concept, there are several factors that are likely to affect the degree to which he can express his knowledge. One of these factors is the spontaneity of the question. In spontaneous production, the child has an optimal situation—he has full command of the situation, he has the intention to express a message, and he may avoid using those constructions with which he is least comfortable. An imposed task, however, may require more of the child; McGrath and Kunze (1973), for example, noted that younger subjects had a strong tendency to abstract from the experimental task less complex rules than those which they apparently applied in their spontaneously generated questions. Yamamoto (1962), however, noted that "the child's questions emitted when he is 'asked to ask' under the testing situation show a similar developmental tendency to that of the spontaneous questions" (p. 89).

Certain aspects of the type of response required may also be important. Verbal responses are likely to be more difficult than non-verbal responses, and those verbal responses which require application of one's rules or concepts to an unfamiliar situation are likely to allow a more rigorous test of an abstract concept than those responses which could be formed on the basis of verbal habits (c.f. Berko, 1958; Piaget, 1926). Another consideration is the type of stimulus used or the method of presentation. Torrance (1970), for example, found that for six-year olds the opportunity to manipulate objects affected the number and quality of questions asked.

In the present study, the task was experimenter-generated, and all responses were verbal. While answering questions could be aided by verbal habits, forming questions to fit answers was a less familiar task, designed to require application of abstract rules rather than dependence upon prior learning. The amount of extrasentential context was manipulated in order to gauge the effect of such context. Development of the concept of the reciprocal relationship of question and answer was assessed by

asking subjects in grades one, four, seven, and ten to form questions to fit answers (designed to elicit Wh- questions) and to form answers for given Wh- questions.

It was expected that (a) the mean for forming questions in response to specified answers would be less than the mean for forming answers to questions; (b) the means for correct responses would increase over grades; (c) there would be an interaction of grade and task, with a large initial discrepancy decreasing over the grades tested; and (d) the mean for correct responses would be greater in a presentation mode which included both picture and verbal context than in a condition which provided only verbal context.

METHOD

Subjects:

At each of four grade levels (first, fourth, seventh and tenth), 18 subjects were tested individually in late spring. Subjects were drawn from public schools serving largely middle-class families in a Northeastern city, and were predominantly Caucasian.

Procedures:

Subjects were tested individually, with the examiner recording subjects' responses. All subjects were tested first on formation of questions and then on formation of answers. Subjects were randomly assigned to one of two answer-stem lists for the first task and were presented the list of questions which did not correspond to those answer-stems.

In the verbal presentation, subjects were presented with 12 answer-stems (e.g., "under the chair"). After all verbal items on this task were presented, those items for which responses were incorrect or not immediately classifiable were presented again with a picture. The same procedure was followed when questions were presented.

Materials:

Two 12-item lists of questions and two related 12-item lists of answer-stems were formed. Six question types were used—Who, What, When, Where, Why, and How, with two items for each type of each list. For each question, an answer-stem which could reasonably answer or elicit such a question was developed. It was not expected that answers would necessarily elicit the exact question listed, but that competent speakers would usually respond with questions appropriately related to the answers. Phrases and pictures were designed to be within the range of experience of even the youngest subjects tested.

Item types were randomly assigned to position on the first half of the list, with the same order used in the second half, and individual items were randomly assigned to the first or second half of list 1 or list 2. The same order of items was used for all subjects, though subjects were randomly assigned to one of the two lists.

Directions:

Forming questions. "Sometimes people ask questions and you tell them the answers, but this time I'm going to tell you some answers and I want you to make up some questions that fit those answers. For example, if I said, 'a hat', you could ask me, 'What is on your head?' though there are other questions that would fit that answer too." Unless responses were consistently correct, the examiner would precede each item by saying, "Remember, I'll give you the answer, and you make up a question that fits that answer, so that my answer could be the answer to your question."

Forming answers. "This time, I'll ask you some questions, and I want you to make up some answers to fit them."

Scoring:

Scoring was based on appropriateness of the question-answer re-

lationship. Factual accuracy was not considered; a response was considered correct if the answer to a question was of a form class syntactically appropriate to the question. For example, given the question, "Who eats the pie?", a response such as "Because I like it" would be scored as incorrect, while answers such as "Father and Mother" or "The monkey" would be scored as correct. These were the general criteria applied:

Who — animate object, human or animal
What — any object, including animate
When — temporal reference
Where — locative reference
Why — implied causal reference
How — means or manner of action

Similar criteria were applied to responses in the question formation task. For example, in response to the answer, "under the chair," a question such as "Where is the ball?" would be considered correct because it refers to a place.

Design:

The main analysis was based on the total number of syntactically appropriate responses to each task in each context condition.

Responses were analyzed in a 4 (Grade) x 2 (Task) x 2 (Mode of Presentation) repeated measures design. Subjects received both tasks under both context conditions. Relative difficulty of the sentence types within tasks was also examined.

RESULTS

There were significant effects ($p < .001$) for grade, task, mode of presentation and for the interaction of grade and task (see Table 1). The overall means increased over grades. Evaluating these differences

/Insert Table 1 about here/

by Tukey's *a* procedure (Winer, 1971, p. 198), with $q(4, 68) = 3.39$, the mean for first grade was significantly different from the means for

seventh and for tenth grades, but the difference of first and fourth grade overall means was not quite significant. No other differences in grade means were significant.

The overall mean for forming answers to fit questions was nearly twice the mean for forming questions to fit answers. The effect of presentation mode (picture or verbal) although statistically significant, was of minimal practical significance in this age range. The mean for responses in the verbal presentation mode was 9.13, and the mean for presentations in which picture context was added to the verbal context was 9.54, despite the fact that all responses correct in the verbal condition were credited as correct in the picture condition score.

The interaction of grade and task, a central concern in this study, is indicated by Figure 1 and Table II. Although none of the means was significantly different on the Task of forming answers for questions, the

/Insert Figure 1 and Table II about here/

means for forming questions in response to answers showed clear differences by grade level, and the difference in means for the two tasks decreased over grades. The mean for first grade on forming questions was significantly different from all other grade means for questions; the other means for forming questions did not differ among themselves.

The differences between means for forming questions and for forming answers were particularly revealing. The mean for first grade on forming questions (1.56 of a possible 12) was significantly different from all means for forming answers. The mean for fourth grade on forming questions was significantly different from any of the grade means for forming answers. The means for seventh and tenth grades on forming questions were not significantly different from any of the grade means for forming answers, indicating that at this age level the difficulty of these two tasks was comparable.

In Table 3, the percentages of correct question formation responses to various answer-stems are displayed. The differences between grades were more obvious than the differences in formation of appropriately related questions of various types. At three out of four grades tested, however, there were fewer "Why" questions formed than any other question types. There was greater variability among question types at first grade (range, 6% to 17%) and tenth grade (range, 72% to 89%) than at fourth and seventh grades. While the major differences over time were between first and fourth grades, the differences between seventh and tenth grades ranged from 0% for "Why," apparently the most difficult, to a 17% increase for "Who," which appeared to be among the easiest responses.

DISCUSSION

When means for question formation and answer formation were collapsed, there was a significant difference only between first and seventh and first and tenth grades. When the means for question were analyzed separately, the first grade differed from the fourth grade as well as from the seventh and tenth, and fourth grade was not significantly different from seventh and tenth grades. While the greatest growth in this skill was apparently between first and fourth grades, the fact that not all fourth graders had mastered the concept of question-answer reciprocity was apparent in examination of the distributions in Table 5.

/Insert Table 5 about here/

In order to explore more fully this development, subjects were categorized on a post hoc basis in terms of total score. Using the categories Concept Present (score of 9-12), Emergent (5-8), or Lacking (0-4), no first graders were credited with full possession of the concept, 15 were scored as lacking the concept and 3 as emergent. While 11 fourth graders were credited with mastery of the concept, 7 did not demonstrate

the concept. While 15 of the 18 tenth graders clearly possessed the concept, 2 did not demonstrate mastery of the concept of question-answer reciprocity, and 1 was categorized as having the concept emergent.

A key finding was the grade by task interaction. While in the early grades forming questions and forming answers showed very different patterns, by seventh grade there was no significant statistical difference in means for question formation and answer formation. The fact that most subjects of this age could move either from question to answer or from answer to question indicates that the tasks were for these subjects equally difficult and may reasonably be interpreted as indicating mastery of the higher levels of complexity of this concept.

While the rationale of this study presented these skills as different levels of a continuous stream of development of understanding question-answer relationships, the strongest test of this assumption would be longitudinal analysis of a more continuous age sampling, preferably in third through fifth grades. The finding that a few subjects at tenth grade had apparently not mastered this skill was surprising, and suggests that, as happens with some other concepts, differences that are primarily developmental during earlier periods may later stabilize as individual differences. It would be of interest to examine correlates of such performance.

More basic, however, is examination of the degree to which the present procedures, designed to examine spontaneous tendencies, may yield underestimates of competence. Addition of picture context did yield higher levels of response, though the magnitude of difference was small, and even that may be in part artifactual in that any correct performances in the verbal presentation were credited as correct on the picture presentation. It is likely that performance would be increased somewhat if procedures included pretraining on the response, or feedback such as an opportunity to hear one's question repeated with the answer following it.

The likelihood that such procedures would not erase all differences, however, is illustrated vividly by the case of one tenth grade boy not included in the research sample. This boy produced no correct responses on the question formation task, despite frequent repetition of the directions. He was able to answer all questions. After using the standardized procedure, employed for all other subjects, the examiner probed and used trial teaching techniques but the boy waa still unable to produce a correct question. He was even unable to identify whether a sentence the examiner used was a statement or a question. In brief, he left the examiner with the impression that he had no abstract understanding of what a question is, even though he was able to respond to them correctly. A check of the boy's class placement indicated that he was in an average 10th grade English class, though no information as to his achievement was available.

Although detailed analysis of the form of questions and answers is not included in this report, some aspects are of particular interest. While most question types elicited answers relatively homogeneous in form, responses to "How" and "Why" questions were more diverse in form.

The answers to "Why" questions point out the bidirectional nature of causality—depending on the content of the question, the listener may be influenced to search either for a cause of the proposition in the sentence or for a result flowing from the proposition. While 3 out of the 4 "Why" questions were answered either with noun phrases (she hit him) with or without "because" preceding the phrase, the question "Why do people work?" elicited no "because" responses. The predominant response (e.g., "to make money") focused on the anticipated result of working. Although this may be viewed as a cause in that it is an anticipated reward, this type of response seemed sharply different from those given for other "Why" questions, and warrants further investigation.

For "How" and "Where" questions as well, there were differences in

the form and content of answers which seemed to be related to the form and content of the specific question used. These results suggest the usefulness of further investigation of the semantic effects and syntactic aspects of questions.

The central findings in this study were (1) the task of question-formation is a more demanding measure of the concept of question-answer reciprocity than is answer-formation; (2) expression ofthe concept of question-answer reciprocity, as measured by the relatively demanding criterion of forming questions to fit specified answers, increases over the age period encompassed in this study; (3) the levels of question-formation and answer-formation eventually converge for most subjects, indicating a fully abstract understanding of the reciprocal relationship.

These findings encourage further examination, in various syntactic constructions, of the development of logical concepts implicit in the fully-formed syntactic concepts. The wide age range over which certain syntactic concepts develop suggests the feasibility of studying both the developmental trends and the correlates and implications of individual differences in awareness of the subtler aspects of language. Such investigations may help to bridge the chasm which presently limits our ability to link two disparate bodies of knowledge, the rich studies of very young children and the equally rich studies of competent adult speakers. Filling in the center would allow a fully articulated picture of the way in which humans come to know their language.

Table 1

Items Presented in Question Formation Task
and Answer Formation Task

Question Type	To elicit Questions	To elicit Answers
Who	the boy	Who is hitting the ball?
	the girl	Who is carrying the bag?
	the fat man	Who drives the car?
	a lady	Who eats the pie?
What	an elephant	What is always big?
	a rabbit	What runs away?
	a leaf	What falls down?
	a flower	What is very pretty?
When	next week	When will school be over?
	at lunch time	When will you eat?
	in the morning	When do you play?
	at night	When do we sleep?
Where	on the hill	Where is the tree?
	in the glass	Where is the milk?
	under the chair	Where does a puppy go?
	over the house	Where does a plane fly?
Why	because the bottle fell	Why is the baby crying?
	because she's happy	Why is the girl smiling?
	so they can get money	Why do people work?
	because she bothered him	Why did he hit her?
How	by riding his bike	How will the boy get home?
	by hopping along	How do frogs move?
	by getting rain and sun	How will the flowers grow?
	by moving their tails and fins	How do fish swim?

Note: Although the questions and answers listed on the same line are appropriate matches, there was no expectation that this specific response would be made. No subject heard both question and answer from a given pair listed here.

Table 2

Analysis of Variance

Source	df	SS	MS	F
Between	(71)			
Grade	3	788.17	262.72	18.06 *
Error 1	68	989.33	14.55	
Within	(216)			
Mode of Presentation	1	12.50	12.500	40.06 *
Mode x Grade	3	.78	.259	<1
Error 2	68	21.22	.312	
Task	1	1682.00	1682.00	115.87 *
Task x Grade	3	758.39	252.80	17.41 *
Error 3	68	987.11	14.52	
Mode x Task	1	.50	.50	1.95 NS
Mode x Task x Grade	3	.56	.19	<1
Error 4	68	17.44	.26	
Total	(287)			

* $p < .001$ N = 72

Table 3

Means by Task and Grade

Grade:[a]	1	4	7	10	Total
Task:					
Forming Questions $\bar{x}$	1.56	7.06	9.00	10.06	6.92
Forming Answers $\bar{x}$	11.69	11.75	11.81	11.75	11.75
Total	6.63	9.40	10.40	10.90	9.33

Note: Maximum score on each task = 12.

[a] n = 18 per grade

Table 4

Percentage of Correctly Formed Questions by Type and by Grade

Grade[a]	Question Type						
	Who	What	How	When	Why	Where	Total
1	14%	17%	11%	11%	6%	14%	12%
4	56%	58%	56%	61%	53%	56%	57%
7	69%	78%	69%	78%	72%	67%	72%
10	86%	89%	75%	86%	72%	83%	82%
Total	56%	60%	53%	59%	51%	55%	

[a] n = 18 per grade.

Table 5

Mastery of the Abstract Concept of Question-Answer Relationships at Various Grade Levels

	Grade			
	1	4	7	10
Concept Absent score = 0-4	15	7	3	2
Concept Emergent 5 - 8	3	1	4	1
Concept Present (score = 9-12)	0	10	11	15

n for each grade = 18

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