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AUTHOR Guenther, Audrey A.; Mills, Patrick R.
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ABSTRACT

The inductivist model of language acquisition was tested by comparing the linguistic development of impulsive kindergarten children with that of reflective children, who, in general, make fewer errors on inductive reasoning tasks. The 81 children sampled were tested with the Matching Familiar Figures Test and with measures of syntactic and semantic development from the Illinois Test of Psycholinguistic Abilities. Measures of rate of speech, number of long pauses, shoulder orientation, and physical distance between the child and the experimenter were also obtained. Results failed to establish any relationship between cognitive style and the linguistic measures, or between cognitive style and the measures of nonverbal behavior. The results were interpreted as discrediting the inductivist model of language acquisition without necessarily confirming the cognitivist model. (AA)

THE RELATIONSHIP OF COGNITIVE STYLE TO LANGUAGE ACQUISITION AND SELECTED ASPECTS OF NONVERBAL COMMUNICATION

by

Audrey A. Guenther

and

Patrick R. Mills

Speech Communication Department

San Diego State University

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This research dealt with the psychological reality of various models depicting the ontogenetic internalization of grammar. Specifically, the question investigated here concerned the nature of the logical paradigm employed to explain the acquisition of syntactic and semantic rules.

Transformational-generative grammarians such as McNeill (1971) characterize the internalization of grammar as a deductive process. Principles underlying this theoretical grammar are derived from the cognitivist linguistics of Chomsky (1965). McNeill (1971) proposed an innate Language Acquisition Device (LAD). This device comprises the child's cognitive intuitions of grammaticality. The incoming corpus of utterances from the child's environment is compared with these intuitions, according to this account. If this incoming corpus and the intuitions of grammaticality coincide, the child deductively hypothesizes that the incoming utterances are well-formed. This model purports to explain the regular acquisition of certain inflections and other psycholinguistic phenomena such as syntactic over-generalization.

Associative-chain grammarians such as Braine (1971) characterize the internalization of grammar as an inductive process. Principles underlying this theoretical grammar are derived from the behavioral psychology of Skinner

(1957). Braine (1971) argues that the child is not equipped with intuitions of grammaticality. Rather, according to this account, the child induces and formalizes syntactic and semantic rules derived from continuous exposure to well-formed utterances from the environment. This theory emphasizes the role of memory in language acquisition.

The fundamental question involved is whether communication experience favors mature constructions. Inductivist psychologists (Braine, 1971) claim that the linguistic environment encourages more mature constructions. Deductivist psycholinguists (McNeill, 1970) deny this. The objective of this experiment is to test the language development of children in order to ascertain which model most reliably explains language acquisition.

The concept of cognitive style (Kagan, 1965; Kagan, Pearson & Welch, 1966) provides a basis for testing these models. Kagan et al. (1966) demonstrated the "temporal stability and inter-task generality of a tendency toward fast or slow decision times to problems with high response-uncertainty." On the basis of this research, Kagan concluded that some children impulsively report the first problem-solving hypothesis that occurs to them. Other children reflectively consider alternative hypotheses. Kagan identified the former population of children as Impulsive, the latter population as Reflective. These

two distinct cognitive styles may also be conceived as conceptual tempos.

Kagan (1965) and Kagan et al. (1966) found that Impulsive children made significantly more errors than Reflective children on inductive reasoning tasks. The positive correlation of impulsivity with errors generalized across a wide spectrum of other inductive reasoning tasks. This spectrum included tests of Haptic-visual matching, Picture-completion reasoning, and Extrapolation reasoning. Experimentation on six-year-olds (Kagan et al., 1966) also revealed that this correlation obtained even when verbal ability was controlled. In this case, verbal ability, defined as a function of lexicon, was measured by the child's performance on the verbal component of W.I.Sc.

In addition to the Impulsives and Reflectives, this research also identified a population of children who exhibited fast response times but made few errors. This population is called Fast-accurate. Another population which exhibits slow response times but made many errors was identified and called Slow-inaccurate. Thus, four conceptually distinct cognitive styles were defined: pure Impulsive (fast and inaccurate), Reflective (slow and accurate), Slow-inaccurate and Fast-accurate.

The potential usefulness of cognitive styles as a basis for testing models of grammar internalization may be briefly explained in the following manner. Inductivist

psychologists (Braine, 1971) regard language acquisition as an inductive reasoning process. Kagan (1965) and Kagan et al. (1966) have demonstrated that Reflective children make fewer errors on various inductive reasoning tasks. Consequently, it might realistically be supposed that Reflective children would make fewer errors on tests measuring syntactic and semantic development, if the inductivist account was accepted.

Two hypotheses follow from the above reasoning.

Hypothesis 1: Reflective children will score significantly higher than Impulsive children on a test measuring syntactic development.

Hypothesis 2: Reflective children will score significantly higher than Impulsive children on a test measuring semantic development.

These are, of course, inductivist hypotheses. It is necessary to construct these hypotheses in inductivist terms since the inductivists attribute verbal development to concrete cognitive operations. Cognitivists attribute verbal development to abstract intuitions of grammaticality. By definition, these intuitions are difficult to operationalize.

Since the study of speech communication includes both verbal and nonverbal behavior, this experiment includes components which measure both the internalization of grammar and the emergence of various nonverbal affects.

Only recently has nonverbal communication been described as a set of rules for the communication of information and attitudes. An established system of coding and classifying nonverbal communication has not been fully developed. Another fundamental problem is the lack of knowledge concerning the basis of nonverbal language. As a result of the absence of a firm empirical foundation in the study of nonverbal communication, and, specifically, due to the lack of research linking cognition with nonverbal affects, this experiment will formulate research questions about the nonverbal domain rather than hypotheses.

This experiment dealt with four nonverbal variables: proxemic space, shoulder orientation (axis), rate of speech and long pauses. The following question was posed: Is there a significant correlation between cognitive style and any of the above nonverbal variables?

Method

Subjects

The subjects for this experiment were 81 Kindergarten pupils enrolled at a municipal elementary school. Subjects were predominantly middle-class, white, Standard-English speakers. The experimental population included 43 females and 38 males.

The data were collected during a four week period during April, 1976. At this point in the school year the mean age of the pupils was 5 years 8 months.

The final number of subjects per cognitive style was: Reflective 17, Slow-inaccurate 13, Impulsive 14 and Fast-accurate 12.

Procedure

Subjects were segregated into cognitive style categories on the basis of their performance on the Matching Familiar Figures test, or MFF (Kagan et al., 1966). In this test the child is presented with a picture of a familiar object. This picture functions as a stimulus-standard. The child is then presented with six additional stimulus pictures. One of these is identical to the stimulus-standard; the remaining five are quite similar, but not identical. The task confronting the child is to correctly identify which of the six stimulus pictures is identical to the stimulus-standard. Final classification into cognitive categories was accomplished by taking both response time and number of errors into consideration.

After the cognitive style populations were segregated each subject was individually administered two tests. One test was designed to measure syntactic development and the other was designed to measure semantic development. Both tests employed were sub-components of the Illinois Test of Psycholinguistic Abilities (revised edition, 1968).

The test employed to measure syntactic development was the grammatic closure sub-component. This test measures the development of tense and pluralization inflections, prepositional clauses, sex-marked pronouns and various other syntactic features. The test employed to measure semantic development was the verbal expression sub-component. In this test, oral responses describing four familiar objects are elicited from the subject. The responses must be accurate, discrete, and relevant.

Nonverbal behavior was elicited from the subject by exposing the S to a component of the Ginn Reading Readiness program (1965). The S was required to tell the E a story based on four picture cards.

Experimental sessions were conducted in rooms that the subjects knew were employed for out-of-class activities. Every session was tape recorded. Verbal and nonverbal tasks were alternated randomly. Two E's were present for every session.

Measurement

Scoring standards for the tests of syntax and semantics were derived from the chronological-age norms compiled by the authors of the Illinois Test for Psycholinguistic Abilities.

The scales used to record proxemic behavior were adapted from those described by Hall (1963). In order to eliminate height as a potential confounding variable, the

E was seated and the S stood during the sessions. The physical distance separating the E from the S was measured.

Scoring of shoulder orientation was derived from the studies on children by Aiello and Jones (1971) and Jones (1971). These studies modified Hall's (1963) schemata. The axis may be conceived as hours on a clock. For example, a noon relationship is a face-to-face orientation. A one o'clock position represents a shoulder orientation with a slight angle. A side-to-side position is a six o'clock orientation.

Two judges were trained in the use of the scales before the experiment began. Both judges rated the S's proxemic space and axis. Previous studies (Aiello & Jones, 1971; Jones, 1971) have demonstrated that this method results in high inter-judge reliability, both in laboratory and field conditions.

Rate of speech is the ratio of the number of words divided by the number of seconds speaking. A long pause is defined as an unfilled pause that is at least one second in duration.

The first review of tapes was undertaken for the purpose of timing the pauses. This was done by stop watch at least twice for every pause. The total time for each story was scored in seconds from the tape and the number of words was recorded. Two judges were used in this procedure.

Results

Statistical tests employed the .05 level of significance.

Hypothesis 1: Reflective children will score significantly higher than Impulsive children on a test measuring syntactic development.

A t-test was undertaken to measure the significance of the difference in raw score means achieved by the Reflective and Impulsive populations. The raw scores tabulated for each S were obtained by comparing the normed syntactic age of the S against the S's real age in years and months. The means for these two groups are presented in Table 1. The t value obtained was .044, substantially short of 1.174, needed for significance at the .05 level.

Table 1

Table of Means: Reflective and Impulsive Syntactic Raw Scores

Condition	n	$\bar{X}$
Reflective	14	6.78
Impulsive	11	7.70*

*The raw scores are the number of months above or below normed age-levels.

Hypothesis 2: Reflective children will score significantly higher than Impulsive children on a test measuring semantic development.

A t-test was undertaken to test the difference in raw score means achieved by the Reflective and Impulsive populations on the semantic test. Raw scores were obtained in the same manner as those obtained for the syntactic test. The means for the two groups are presented in Table 2. The obtained t value was 1.785 (21 df) which exceeded the value necessary for statistical significance.

Table 2

Table of Means for Reflective and Impulsive Semantic Raw Scores

Condition	n	$\bar{X}$
Reflective	13	1.69
Impulsive	10	-.82*

*The raw scores are the number of months above or below normed age-levels.

Though possibly of only artifactitious significance, the value obtained was technically significant. Because of this, an analysis of variance was performed. Data for this analysis included semantic raw scores obtained from the Fast-accurate and Slow-inaccurate

populations, as well as the scores obtained from the Reflectives and Impulsives. These data were included in an attempt to ascertain whether the response-time dimension or the accuracy dimension was the major contributor to significance.

Results, as indicated in the ANOVA summary in Table 3, were nonsignificant at the .05 level.

Table 3

Analysis of Variance: Semantic Raw Scores

N = 40

Source	SS	df	MS	F
Accuracy dimension	139.95	1	139.95	.476 ns
Response time dimension	-11.25	1	-11.25	.038 ns
Interaction	979.15	1	979.15	3.33 ns
Error		36	293.86	
Total		39		

Research questions: Is there a significant correlation between cognitive style and any of the nonverbal variables tested?

A χ^2 analysis was employed on the data yielded by the measurements of proxemic space. Proxemic scores from all four cognitive style populations were included in this analysis. A nonsignificant χ^2 value of 2.13 was obtained.

Because the axis raw scores for all cognitive style populations were almost uniformly distributed, non-significance was obvious.

A t-test was undertaken in order to determine whether the mean number of long pauses for the Reflective and Impulsive populations was significantly different. The mean number of pauses for the two groups is presented in Table 4. The t value obtained was .67, substantially short of 1.734 required at the .05 level of significance.

Table 4

Table of Means for Reflective and Impulsive Long Pauses

Condition	n	$\bar{X}$
Reflective	11	4.82
Impulsive	19	3.67*

*Raw scores are the number of long pauses.

A t-test was undertaken in order to determine whether the mean rate of speech for the Reflective and Impulsive populations was significantly different. The mean rates of speech for the impulsive and reflective subjects are presented in Table 5. The obtained value (1.63, 18 df) failed to reach significance.

Table 5

Table of Means for Reflective and Impulsive Rates of Speech

Condition	n	$\bar{X}$
Reflective	11	2.05
Impulsive	9	1.61*

*Raw scores are the rate of speech.

Discussion

This experiment attempted to test two models depicting the internalization of grammar. Specifically, the inductivist position epitomized by the Discovery Model of Braine (1971), was investigated. This view characterizes language acquisition as an inductive reasoning process. The concept of cognitive style introduced by Kagan (1965) and Kagan et al. (1966) provided a basis for testing the adequacy of the inductivist position. Research has demonstrated that Impulsive cognitive style is positively correlated with errors on inductive reasoning tasks, it was reasoned that if language acquisition was an inductive reasoning task, those children who were more successful on tests of induction should employ more mature linguistic constructions. This reasoning generated both hypotheses tested. Predictions were made that Reflective subjects would score significantly higher on tests

measuring syntactic and semantic development. In addition to these predictions, a research question was posed: Is there a relationship between cognitive style and various nonverbal affects?

Experimental results generally disconfirmed the hypotheses. The results of this experiment imply that no intimate cognitive relationship between inductive acuity and maturity of linguistic constructions exists. Though this fact would seem to discredit the claims to psychological reality of inductivist models of grammar internalization, it does not, of course, imply that the opposite is necessarily true. In no way do the results of this experiment confirm the existence of what the cognitivists call intuition of grammaticality. Hopefully, this study indicates the need for subsequent testing of the cognitivist models.

Though the results of the t test on syntactic development were nonsignificant, results on the semantic test were significant. This finding may be of only minimal importance. However, it may suggest that the cognitive mechanism operating during the acquisition of syntax is independent of the mechanism operating during the development of semantic competence. This is a possibility proposed by various semantic theorists (Palermo & Molfese, 1972).

Possible alternative explanations for the non-significance of the experimental results exist. These alternative explanations are both technical and conceptual. The most conspicuous technical objection to the inferential power of the experiment is the relatively small n in each cognitive style category. Though the original N was comparatively large for a linguistic experiment, the need to derive four sub-populations within the N reduced the cell numbers to the lower limits of inferential adequacy. A second technical objection relates to the relevance of the Illinois Test of Psycholinguistic Abilities as a test instrument. This is a structural rather than a transformational test. None of the sub-components of this test are explicitly designed to measure the development of transformational competence. Despite this fact, the test has proved highly reliable. The authors of the test report median reliabilities of the differences among all subset pairs ranging from .57 to .88, with median .74; the corrected-for-range reliabilities range from .67 to .91, with median .81. Score profiles are stable. Further research on the reliability of the test demonstrates its superior status as a predictor of chronological age. Hirshoren (1969) found that the test correlation with chronological age was .72, while the Stanford-Binet correlation was .60. Mueller (1969) determined that the test was superior to the Stanford-Binet

in the prediction of achievement among the educable mentally retarded.

Potential conceptual objections to this experiment center around the question of the psychological reality of the cognitive style concept. A frequently expressed objection to the cognitive style concept is that it simply serves as another name for intelligence. Research, however, indicates that intelligence and cognitive style are independent. For example, Esha and Black (1971) demonstrated the independence of inductive reasoning tasks to I.Q. and Eagle (1965) found only a "low level" relationship between cognitive style and I.Q.

Experimental results failed to demonstrate any significant relationship between cognitive style and the nonverbal variables tested. Though the results failed to demonstrate any significant correlation between cognitive style and proxemic space, an observation was made that subjects communicated almost exclusively in the intimate and personal zones. This observation confirms previous research (Aiello & Jones, 1971; Aiello & Jones, 1973; Schiff, 1973). This observation also corroborates the suggestion made by Wood (1976) that children do not acquire a schemata for social and public zones until some time beyond seven years of age. Other research (Miesels & Guardo, 1969) supports Hall's (1963) conceptualization of the adult space zones as applicable to children's spatial schemata.

Axis was not found to be positively correlated with cognitive style. Results also yielded the observation that sex was not positively correlated with axis. Previous research (Aiello & Jones, 1971; Aiello & Jones, 1973) has yielded contradictory findings on the relationship of sex to axis. Our results do not clarify this relationship, but they do suggest that the role relationships of sex to axis observed among adults probably emerge at some time beyond six years of age.

The results linking cognitive style to the paralinguistic variables of long pauses and rate of speech were nonsignificant. The question of whether the presence of unfilled pauses (Goldman-Eisler, 1958; Levin & Silverman, 1967) are indicative of some cognitive organization, is not answered by this study.

In summary, no definitive statistical results were obtained which would suggest a relationship between cognitive style and the emergence of various nonverbal affects.

Summary

This experiment undertook a test of the inductivist model of language acquisition. The concept of cognitive style was employed. Predictions were made that Reflective subjects would employ more mature linguistic constructions than Impulsive subjects. In addition to these predictions, research questions relating to the

possible relationship of cognitive style to several nonverbal variables were posed. Results generally disconfirmed the hypotheses and failed to establish any relationship between cognitive style and nonverbal affects. These results are thought to discredit the inductivist model of language acquisition, but are not interpreted to mean that the cognitivist model is necessarily reliable. The probably artifactitious significance of the t test on verbal expression leaves open the question of whether the cognitive mechanisms functioning during the acquisition of syntax and semantics are independent.

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