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SYNDROME**

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Linguistic Abilities of Children
with
Fetal Alcohol Syndrome

by
Marilyn Ann Hamilton

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of the requirements for the degree of

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Doctoral Dissertation

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I. INTRODUCTION

In 1973 a group of children born to chronically alcoholic mothers was identified and subsequently diagnosed as having "fetal alcohol syndrome" (Jones, Smith, Ulleland, & Streissguth, 1973). While a majority of these children have developmental difficulties, little has been reported regarding language development. Streissguth (1976) reported that a significant feature of fetal alcohol syndrome was intellectual deficits. Since intellectual deficits increase the probability of language delays, children with fetal alcohol syndrome are high-risk for failing to develop language appropriately. Consequently, the focus of this research is threefold: (1) to determine if children with fetal alcohol syndrome exhibit significant language delays as compared to normal children; (2) to describe the nature of the possible language delay, if present; and (3) to determine if there is a pattern of language development that is common to children with this syndrome. Such information could lead to improved early identification of language problems in this population and subsequent implementation of appropriate remediation.

II. REVIEW OF THE LITERATURE

Fetal Alcohol Syndrome

Problems relating to the adverse effects of alcohol in adults have been the subject of substantial research; however, until recently the effects of in utero exposure to alcohol have been unrecognized. In 1973 Jones, Smith, Ulleland, and Streissguth of the United States described a distinct pattern of abnormalities that was characteristic of eight children born to chronically alcoholic mothers. As a result of their findings the term "fetal alcohol syndrome" (FAS) originated.

Subsequent to the publication of the American findings (Jones et al., 1973) the research community in the United States became aware of an earlier study conducted in Europe by Lemoine, Harousseau, Borteyru, and Menuet (1968) that described similar abnormalities in offspring of French mothers who were considered chronic alcoholics. Additional studies by other investigators revealed that fetal alcohol syndrome was indeed a true clinical phenomenon (Clarren, 1977; Hall & Orenstein, 1974; Palmer, Ouellette, & Warner, 1974).

The use of alcohol during pregnancy poses a potential threat to the unborn. Pawlak-Frazier and Frazier (1978) reported that alcohol crosses the placental barrier in approximately the same concentration as that in the mother. These authors contend that if a woman drinks heavily during the first trimester of pregnancy when the cells are rapidly dividing, the danger of delivering a fetal alcohol syndrome baby is enhanced. During the first trimester the fetus is not capable of metabolizing alcohol because the vital organs are not yet fully operational. Consequently, alcohol ingested in utero results in a destruction of brain cells. This loss of brain cells is particularly harmful since not only is the original brain cell damaged or destroyed but all future cellular growth will be seriously affected (Pawlak-Frazier & Frazier, 1978). A common neuropathologic

finding of FAS is the presence of malformations within the central nervous system of the newborn that result in a disorganization of brain cells ("Fetal Alcohol Syndrome," 1978).

An operational definition of FAS has resulted from research conducted by Jones et. al. (1973) at the University of Washington School of Medicine. Fetal alcohol syndrome is characterized by (1) growth deficiency, (2) characteristic facial appearance, (3) central nervous system damage, and (4) occasionally other malformations such as heart and/or kidney defects, and mild joint anomalies (Hanson, Jones, & Smith, 1976; Jones et al., 1973). These characteristics were noted in approximately 50% of infants born of chronically alcoholic mothers.

Growth deficiency. Infants with FAS are smaller at birth than other babies of the same gestational age. They are shorter, lighter in weight and have smaller head circumferences. As FAS children grow older they usually continue to demonstrate a lag in physical development and thus remain shorter and thinner than their chronological-age peers (Streissguth, 1979).

Characteristic facial appearance. Children with FAS often have short palpebral fissures (the length of the eye slits) which makes them appear to have small eyes. They have a flattened nasal bridge, epicanthal folds, and a short upturned nose. Fetal alcohol syndrome children will usually have an absent or indistinct philtrum and a thin upper lip with a narrow vermilion border. Occasionally, they will have a flattening of the midface and a receding chin. Taken together, this cluster of facial characteristics in conjunction with the size of these children is the major clue to their identification (Clarren & Smith, 1978).

Central nervous system. The consequence of central nervous system damage sustained in utero is frequently manifested by borderline to retarded mental ability (Streissguth, 1979). In general, the more severe the physical anomalies, the more intellectually handicapped the child appears to be (Streissguth, Herman, & Smith,

1978a). The average intelligence quotient (IQ) of FAS children has been reported to be approximately 68 (Streissguth, Herman, & Smith, 1978b). Because there is a wide range of intellectual development in this population, Streissguth et al. (1978b) contend that each FAS child should be individually evaluated.

Language Development in FAS Children

Knowledge about language development in children with fetal alcohol syndrome is limited to clinical observation. Herman (1979) and Streissguth (1980) stated that children with FAS appear to have receptive language deficits; however, their "social speech" appears to be within normal limits. In a similar perspective, Jones (1980) reported an observation whereby a significant number of children exposed to alcohol in utero via the "alcohol drip" procedure subsequently received remedial speech and language therapy. The alcohol drip technique is a procedure in which high levels of alcohol are intravenously administered to pregnant women to prevent premature delivery. In reviewing the medical records of 22 non-FAS youngsters who were enrolled in a classroom for the speech and language impaired, Jones (1980) reported that four of the children were born to women where the alcohol drip technique had been used. Although definitive studies examining the effects of intrauterine exposure to alcohol and subsequent language problems have not been reported, it appears that indeed a relationship may exist.

In addition, since alcohol is known to cause short-term memory deficits in adults (Cermack & Butters, 1973; Goodwin, 1972; Goodwin, Othmer, Halikas, & Freemon, 1970) and short-term memory is believed to be related to the learning of language (Fudala, 1973; Miller & Chomsky, 1963; Wiig & Semel, 1980), one might speculate that children exposed to alcohol in utero may be high-risk for exhibiting an impairment in short-term memory functioning. Such an impairment might manifest itself in a problem with both processing and producing language (Wiig & Semel, 1980).

In an informal pilot investigation, the present investigator sampled language behaviors and short-term memory ability in four FAS children. Although the results were tentative, they appeared to indicate that FAS children were indeed experiencing deficits in both language development as well as in short-term memory functioning. What remains unknown is whether these tentative deficits are a part of an overall delay because of reduced mental ability or whether they are the result of some unique pattern of development that is characteristic of this syndrome. To address this issue, it becomes necessary to deviate from the traditional chronological age/linguistic age controls that are frequently used in speech and language research. Thus, the performance of FAS children should be compared to the performance of normal children of the same level of linguistic functioning as well as to a group of comparably intellectually impaired children. The rationale behind the use of comparison groups is that while linguistic differences may exist between FAS children and younger normals of the same level of linguistic functioning, any comparison may be as much a reflection of the effects of the task as it is of intellectual impairment. For example, if younger normals perform better on a task than older intellectually impaired children, it may be because of their higher intelligence or their richer experience. On the other hand, if intellectually impaired children perform better than younger normals, perhaps intelligence is not a factor in performance or the greater experience of the older children results in better scores (Warren, 1978). One can attempt to unravel the effects of intelligence by comparing the performances of FAS children to the performances of: (1) a group of normal children of the same chronological age level, (2) a group of normal children of the same linguistic level, and (3) a group of children of comparable age and intellectual ability. Such controls may lead to a more accurate documentation of developmental patterns that may be typical of the FAS population.

Syntax, Semantics, and Pragmatics

A current view of describing the linguistic abilities of children is to include a description of the basic components of language that are believed to be important aspects of normal language acquisition. Bloom and Lahey (1978) identified three major components of language (content, form, and use) and believe that this three dimensional view is basic to both describing the development of language as well as to understanding language disorders.

In the past, many researchers described language abilities in mentally retarded and normal populations by focusing on the syntactic component of language (Dever, 1972; Lackner, 1968; Naremore & Dever, 1975; Ryan, 1975). Although syntactic structures make up an important aspect of language, there are other components that should be considered equally as important. For example, the semantic intentions of children's utterances and the ways in which language is used (pragmatics) in different contexts and for different purposes are equally as important (Bloom & Lahey, 1978). Toward this end, the present investigation explored language abilities in children with fetal alcohol syndrome by taking into account syntactic, semantic, and pragmatic development.

Short-term Memory

Although there are severe short-term memory deficits in adults exposed to alcohol over an extended period of time (Butters, Lewis, Cermack, & Goodglass, 1973; Cermack & Butters, 1973; Ryan & Butters, 1980), there has been little information reported regarding short-term memory functioning in children who were exposed to alcohol in utero. Problems in short-term memory can manifest themselves in a problem with processing the structure of a sentence (Wiig & Semel, 1980). Since language structure is an important aspect of language development it seems reasonable to explore short-term memory functioning in children who by the very nature of their syndrome may be regarded as high-risk for exhibiting a

short-term memory deficit. For this reason, the present investigation examined specific aspects of short-term memory that were believed to be related to the learning of language.

Purpose of the Present Study

As the foregoing discussion indicates, language and language processing abilities in children with fetal alcohol syndrome have not been clearly delineated. The purpose of this study was to determine if children with fetal alcohol syndrome have a linguistic system that is quantitatively or qualitatively different from normal children, or both. That is, is their system different in degree (quantitative), or is their system different in kind (qualitative) (Freedman & Carpenter, 1976). To address this issue, the linguistic performances of FAS children were compared: (1) to normative data for children of the same chronological age level, (2) to the linguistic performances of children of the same level of linguistic functioning, and (3) to the linguistic performances of children of similar ages and intellectual levels. The following research questions were proposed:

- (1) What is the nature of syntactic development in FAS children?
 - (a) Are comprehension and production of syntax similar between FAS children and children of the same chronological age level?
 - (b) Are comprehension and production of syntax similar between FAS children and children matched on level of linguistic performance?
 - (c) Are comprehension and production of syntax similar between FAS children and children matched on chronological age and intellectual ability?
- (2) What is the nature of semantic development in FAS children?
 - (a) Is comprehension of semantics similar between FAS children and children of the same chronological age level?

- (b) Are comprehension and production of semantics similar between FAS children and children matched on level of linguistic performance?
 - (c) Are comprehension and production of semantics similar between FAS children and children matched on chronological age and intellectual ability?
- (3) What is the nature of pragmatic development in FAS children?
- (a) Is pragmatic development similar between FAS children and children matched on level of linguistic functioning?
 - (b) Is pragmatic development similar between FAS children and children matched on chronological age and intellectual ability?
- (4) Is there a linguistic pattern that is common to children with fetal alcohol syndrome when examined by syntax, semantics, and pragmatics?
- (5) What is the nature of short-term memory ability in FAS children?
- (a) Is short-term memory ability similar between FAS children and children of the same chronological age level?
 - (b) Is short-term memory ability similar between FAS children and children matched on level of linguistic performance?
 - (c) Is short-term memory ability similar between FAS children and children matched on chronological age and intellectual ability?

III. METHODOLOGY

The linguistic performances of FAS children were compared to normative data as well as to the linguistic performances of two groups of controls: (1) a group of linguistically matched younger normals, and (2) a group of intellectually matched same-age counterparts. These control groups were employed in an attempt to more accurately document developmental patterns that were characteristic of FAS children.

FAS Subjects

Ten FAS subjects with intelligence quotients (IQs) between 66 and 85 on either the Wechsler Preschool and Primary Scale of Intelligence (WPPSI) (Wechsler, 1967), or the Stanford-Binet Intelligence Scale (Terman & Merrill, 1973) were selected to participate in the study. This IQ range was selected because it included the average intelligence quotient (65) of FAS children (Streissguth, Herman, & Smith, 1978b). Each FAS subject exhibited a mean length of utterance (MLU) between 3.0 and 4.49 morphemes. The MLU levels were calculated by using Brown's (1973) rules. Each FAS child was matched with a normally developing child on the basis of (1) MLU level, (2) socioeconomic status (SES), and (3) sex. In addition, a second control group was utilized whereby the FAS subjects were individually matched to an intellectually impaired subject on the basis of (1) chronological age (CA), (2) IQ, (3) SES, and (4) sex. The two control groups and the matching variables are described in the subsequent section of this paper. There were 10 pairs of subjects in the FAS/normal control group and 8 pairs of subjects in the FAS/intellectually impaired group. All subjects were required to pass a hearing screening test that consisted of a 20 dB pure tone presented at each of three frequencies: 1000, 2000, and 4000 Hz.

Normal Control Group

Ten children who were reported to be developing normally by the parent(s)

and were functioning within normal limits on the Boyd Developmental Progress Scale (Boyd, 1974) were selected to participate in the study. Functioning within normal limits on the Boyd Developmental Progress Scale was defined as fewer than three failures on the items suggested for a child's particular CA level. The mean age of these subjects was 3;5 (years, months). As shown in Table 1, MLU, SES and sex were used to match the normal and FAS subjects.

Mean length of utterance (MLU) was used as the index for determining whether FAS children and normal children were functioning at the same level of linguistic development. Each child's MLU level was computed from a language sample of 100 consecutive, nonimitated utterances that were calculated by using Brown's (1973) rules. Imitated utterances were defined and subsequently excluded if they satisfied any one of the following criteria (Bloom, Hood, & Lightbown, 1974): (1) the child spontaneously repeats or is asked or prompted to repeat all or part of the adult's previous utterance, (2) the child does not add or change the adult's model other than to reduce it by leaving something out, and (3) if no more than two utterances intervened after the model. All other utterances were considered nonimitated and thus were used in calculating the MLU levels. The language samples were collected in a play situation where both the linguistic and nonlinguistic environments were controlled across children. The linguistic environment was controlled by controlling the investigator's linguistic input to each child. The nonlinguistic environment was controlled by using the same stimulus materials to obtain each language sample. For a more detailed discussion of the linguistic and nonlinguistic environments refer to the language sample section of this paper. The FAS subjects and normal subjects were closely matched on MLU levels; all subject pairs were within .16 of each other.

Table I

Subject Characteristics

Chronological age (CA), mean length of utterance (MLU) in morphemes, socioeconomic status (SES), and sex of the fetal alcohol syndrome subjects and their younger normal counterparts.

	Fetal Alcohol Syndrome Children				Younger Normal Language Children			
	CA (years;months)	MLU	SES	Sex	CA (years;months)	MLU	SES	Sex
1	6;10	3.02	III	M	3;0	3.05	III	M
2	4;7	3.16	III	M	3;7	3.00	III	M
3	5;0	3.56	II	M	3;10	3.52	II	M
4	5;0	4.01	II	M	3;4	4.14	II	M
5	4;9	4.45	II	M	3;6	4.40	II	M
6	5;0	3.66	II	F	3;4	3.70	II	F
7	4;10	3.92	II	F	3;7	3.90	II	F
8	5;5	3.93	III	F	3;9	3.94	III	F
9	4;10	3.93	III	F	3;5	3.99	III	F
10	4;5	4.03	II	F	3;0	4.13	II	F
\bar{X}	5;1	3.80			3;5	3.78		
SD		.43				.46		

KEY \bar{X} = Mean

SD = Standard Deviation

Socioeconomic status was determined by applying an adaptation of Hollingshead's Two Factor Index of Social Position (education and occupation) (Myers & Bean, 1968). The five class index was combined into a three class index (Hedrick, Prather, & Tobin, 1975). Thus, classes I and II were combined into a single class (I, high). Classes IV and V were combined into a single class (III, low), and class III corresponds to Myers and Bean's class III, middle. In the present study, three social classes were recognized (see Table I).

The FAS subjects and the normal subjects were matched on the basis of sex. There were five male and five female subjects comprising each group (Table I).

Intellectually Impaired Control Group

The intellectually impaired population used in this research was a group of children with Prader-Willi syndrome. Prader-Willi syndrome was first described by Prader, Labhart, and Willi in 1956. As a result, this syndrome is sometimes referred to as Prader-Labhart-Willi syndrome. The exact cause of this syndrome is unknown and it appears that Prader-Willi syndrome occurs sporadically. That is, parents who have a Prader-Willi child are not likely to have another child with the same syndrome. A striking feature of this syndrome is obesity; however, there are several other significant characteristics. For example, children with this syndrome will often exhibit hypotonia, hypogonadism, as well as central nervous system dysfunction. Usually, the central nervous system dysfunction will manifest itself in some degree of mental retardation (Schultze, 1980). It has been hypothesized that a single localized developmental defect of the hypothalamic region can account for many of these characteristics (Hall & Smith, 1972).

Three primary considerations governed the selection of Prader-Willi children as a control for FAS: (1) like FAS, children with Prader-Willi syndrome can be identified early in life by physicians familiar with the condition, (2) children with Prader-Willi syndrome have intellectual deficits that are comparable to the range

selected for study in the FAS population, and (3) there is little peripheral impairment of sensory organs (Warren, 1978) that might potentially interfere with the assessment measures in this study. The FAS and Prader-Willi subjects were matched on CA, IQ, SES and sex. Listed below are descriptions of the variables used to match the FAS and Prader-Willi subjects.

Eight FAS subjects were individually matched to a Prader-Willi subject on the basis of CA levels within three months of each other. As Table 2 indicates, the mean age of the FAS children was 5;1, and the mean age of the Prader-Willi children was 5;0 (years and months).

Children in the FAS group were individually matched to a child in the Prader-Willi group on the basis of IQ scores (\pm one standard deviation) from either the Wechsler Preschool and Primary Scale of Intelligence or the Stanford-Binet. The children in these groups had IQ levels between 66 and 85 with an average IQ of 78 in the FAS group and 75 in the Prader-Willi group (see Table 2).

As discussed earlier, three socioeconomic classes were identified by applying an adaptation of the Two Factor Index of Social Position (Myers & Bean, 1968). Thus, the FAS subjects and the Prader-Willi subjects were matched on the basis of social class (class I, high; class II, middle; and class III, low). Refer to Table 2.

The FAS subjects and the Prader-Willi subjects were each matched on the basis of sex. Both groups consisted of three male and five female subjects.

Procedure

Each subject in the study participated in a tape recorded play situation with this investigator. The purpose of this interaction was to elicit a representative language sample (100 utterances) from each child. Following the play situation, each child was administered a battery of tests that included: (1) the Detroit Test of Learning Aptitude (Subtest 6 - Auditory Attention Span for Unrelated Words; and Subtest 13 - Auditory Attention Span for Related Syllables) (Baker & Leland,

Table 2

Subject Characteristics

Chronological age (CA), intelligence quotient (IQ), socioeconomic status (SES), and sex of the fetal alcohol syndrome subjects and Prader-Willi subjects.

	Fetal Alcohol Syndrome Children				Prader-Willi Syndrome Children			
	CA (years;months)	IQ	SES	Sex	CA (years;months)	IQ	SES	Sex
1	6;10	68	III	M	6;9	66	III	M
2	4;7	84	II	M	4;4	79	II	M
3	4;5	84	III	M	4;2	78	III	M
4	5;5	83	II	F	5;6	74	II	F
5	5;0	85	III	F	5;3	84	III	F
6	5;0	78	II	F	5;2	77	II	F
7	4;10	66	II	F	4;11	72	II	F
8	4;10	73	III	F	4;8	69	III	F
\bar{X}	5;1	78			5;0	75		
SD		7.6				5.8		

KEY \bar{X} = Mean

SD = Standard Deviation

1967), (2) the Northwestern Syntax Screening Test (receptive measure) (Lee, 1971), (3) the Peabody Picture Vocabulary Test (Dunn, 1959), and (4) a hearing screening test at 20 dB for frequencies 1000, 2000, and 4000 Hz. In addition, each normal control subject was administered the Boyd Developmental Progress Scale (Boyd, 1974). This test served as a criterion measure for assessing normal development.

Language sample. Since several of the syntactic, semantic and pragmatic assessments were determined from a nonimitated language sample of the children's utterances, it was necessary to control the linguistic and nonlinguistic environments across subjects. Thus, each language sampling situation was structured so that the investigator's linguistic input provided all children the same opportunity to demonstrate their knowledge of the linguistic categories that were used in the data analysis. For example, since the children's responses to questions were analyzed, it was necessary for the investigator to (1) ask questions, and (2) control the number of opportunities across children to respond to questions. These controls were necessary in order to maintain consistency both within and across the three groups of subjects. With the above points in mind, the investigator controlled the linguistic environment by entering each language sampling situation with a master sheet that specified the types of comments and questions that were to be used in obtaining each language sample. The investigator's linguistic input to the children consisted of comments as well as the following types of questions: yes-no, what, where, who, why, and when (Appendix A). All questions and comments spoken by the investigator explored the semantic categories used in this research. Refer to Appendix B for a definition and example of each semantic category. Except for when, the other wh-questions were selected because according to Ervin-Tripp (1970) they are the earliest learned. When-questions were included because they allowed the children to code the semantic category time. Once questions and comments about the different semantic categories were exhausted,

the investigator continued sampling the children's language via the use of neutral prompts such as look here, uh huh, oh oh, yeah, etc. until 100 nonimitated utterances were obtained. To ensure that a minimum of 100 utterances were collected the investigator unobtrusively kept a tally of the children's number of utterances by using a hand counter.

The nonlinguistic environment was controlled by standardizing the stimulus materials to elicit the language samples from all of the children. The materials consisted of a Fisher-Price farm, a horse, a boat, and five story books. The Fisher-Price farm contained 22 play parts which included the following: a barn, silo, farm family, animals, and farm equipment. These stimulus materials were selected because they allowed the investigator to structure the language sampling procedure whereby a variety of vocabulary items as well as linguistic categories could be elicited. The five books used were:

- (1) The Sesame Street 1,2,3 Storybook (Kingsley, Moss, Stiles, & Wilcox, 1973),
- (2) That Kitten (Sullivan, 1966),
- (3) Paddington Bear (Bond & Banberry, 1972),
- (4) Cloudy with a Chance of Meatballs (Barrett & Barrett, 1979), and
- (5) Lion Is Down in the Dumps (Hefter, 1977).

The selection of books was based on the criteria developed by Kemp (1972): (1) the books contained pictures that were likely to stimulate conversational speech, (2) the picture referents utilized simple vocabulary, (3) the pictures depicted persons, objects, actions, and events that could be commented upon or questioned, and (4) the pictures, for the most part, were uncluttered with only one or two major referents in the foreground.

Following the assessment session, a 100-utterance language sample for each child was orthographically transcribed from the audio tape following Bloom and

Lahey's (1978) conventions (Appendix C). Both adult and child language and nonlinguistic situational context were transcribed.

The following assessments were made from each language sample: (1) Developmental Sentence Scoring (DSS) procedure, (2) lexical type-token ratios (LTTR), (3) a semantic assessment, and (4) a pragmatic assessment. Each of these measures are described in the following section of this paper.

Measures

Syntactic assessment. Syntax has been defined as a set of rules for relating words, phrases, and clauses to each other for the purpose of forming sentences (Wiig & Semel, 1980). Two measures were used to analyze the syntactic component of language: (1) the Northwestern Syntax Screening Test (NSST) receptive component (Lee, 1971), and (2) the Developmental Sentence Scoring (DSS) procedure (Lee, 1974).

The receptive component of the NSST was selected because: (1) this test screens a child's comprehension ability for differentiating and interpreting sentences of increasing syntactic complexity, and (2) the test is applicable across the age range selected for study in this research. The NSST was used in conjunction with DSS analysis in an attempt to understand and interpret syntactic development in those populations.

The DSS procedure was utilized because: (1) it provides a quantitative measure of the use of syntactic structures in a child's spontaneous conversational speech, and (2) it is standardized on children that included the age range selected for study in this research. The DSS analysis was made from the first 50 utterances in the language sample that consisted of a subject and a verb.

Semantic assessment. Semantics has been defined as the study of the relationship between words and grammatical forms and their underlying meaning (Wiig & Semel, 1980). The following measures were used to assess semantic

development: (1) the Peabody Picture Vocabulary Test (PPVT) (Dunn, 1959), (2) lexical type-token ratios (LTTR), and (3) the mean number of semantic categories per utterance.

The PPVT is a single word receptive test and was selected because: (1) it evaluates a child's knowledge of the meaning of words, (2) it is applicable over a wide age range, and (3) the picture selection format is clear for the vocabulary items tested. The predominate vocabulary items on the PPVT consist of nouns, followed by verbs as the second largest group, and adjectives representing the smallest group of lexical items. The vocabulary items are presented in an increasing order of difficulty.

Lexical type-token ratios provide an assessment of the variety of words (vocabulary) a child uses in his/her spontaneous speech. This measure was used as an expressive complement to the single word receptive assessment made from the PPVT. Lexical type-token ratios were calculated by dividing the number of different words (types) by the number of words in the sample (tokens). In this calculation, free morphemes that carried bound morphemes were counted as separate types and also as separate tokens. For example, the word cat and cats were considered separate morphemes (Dale, 1976) and thus were counted as separate types and tokens. In the FAS/younger normal-language group, lexical type-token ratios were calculated on the first 300 tokens (different morphemes) of the language sample. This number (300 tokens) was selected because it maximally utilized the total number of tokens in these subjects' 100-utterance language samples. In the FAS/Prader-Willi group, lexical type-token ratios were determined by using the first 100 tokens in the language sample. The discrepancy between groups existed because of the reduced number of tokens in the language samples of Prader-Willi children. Several of the Prader-Willi subjects' language samples contained significantly fewer than 300 tokens.

As evident from the foregoing discussion, the semantic measures discussed thus far were in reference to single words (vocabulary items). It is equally as important to assess semantic development from the standpoint of multi-word utterances. In assessing semantic development along this dimension, the index used in this research was semantic complexity as examined by the mean number of semantic categories per utterance. Semantic complexity takes into account words and concepts that are related in meaning to one another. Complexities in meaning are often expressed by increasing the number of semantic categories coded within an utterance (Bloom & Lahey, 1978; Van Kleeck & Carpenter, 1980). In this research, Bloom and Lahey's (1978) semantic content categories were used as the basis for determining the mean number of semantic categories per utterance (Appendix B). Thus, each child's utterances from the language sample were coded for the number of semantic categories that were expressed and a mean statistic was calculated. A noncodeable category which contained all stereotyped utterances that were part of a social interaction was included (Appendix B). Utterances that were placed in the noncodeable category were not averaged into the mean statistic expressed above; rather, this category was analyzed separately.

Pragmatic assessment. Bates (1974, p. 277) defined pragmatics as "the study of the use of language in context, by real speakers and hearers in real situations." Although there are several possible taxonomies of language use, utterances in this study were grouped according to how they functioned in dialogue; whether they were initiations or responses. Initiations were coded as requests or comments (Appendix D). Responses were coded according to the type of response and, subsequently, each type of response was coded for its appropriateness (Appendix D). The pragmatic measures were made based on the frequency with which they occurred in the 100-utterance language sample.

Short-term memory assessment. Short-term memory has been defined as a momentary store of an incoming stimulus which enables a person to hold the stimulus in abeyance until some decision regarding it can be made (Smythies, 1970). An examination of short-term memory was assessed via subtests from the Detroit Test of Learning Aptitude (DTLA) (Baker & Leland, 1967). The specific subtests were: (1) Auditory Attention Span for Unrelated Words - subtest 6, and (2) Auditory Attention Span for Related Syllables - subtest 13. These subtests were selected because they assess auditory memory span as well as auditory sequencing ability. These aspects of short-term memory have been reported to be related to the learning of language (Fudala, 1973; Johnson & Myklebust, 1967; Wiig & Semel, 1980).

Reliability

Interjudge reliability was established for transcribing the language samples from the audio tapes and for calculating the scores for each of the syntactic, semantic and pragmatic measures. Two independent judges each transcribed three 100-utterance language samples from the audio tapes. One language sample was randomly selected from the FAS group of subjects and one from each of the control groups (normal controls and Prader-Willi controls). The judges were both speech pathologists who were trained for several hours on transcribing language samples and scoring the measures before reliability was obtained.

Reliability for transcribing a language sample was computed as percent agreement based on the following dimensions: (1) grouping the child's language into separate utterances, (2) exact transcription of the child's utterances from the audio tape, and (3) description of the nonlinguistic environment. The percent agreement for grouping the child's language into utterances ranged from 89 to 93%; exact transcription of the child's utterances ranged from 88 to 95%; and description of the nonlinguistic environment ranged from 90 to 96% in the three groups of subjects.

Reliability was divided into reliability for measures computed from the language samples and reliability for measures computed via the administration of tests. Reliability was determined as percent agreement for each of the measures. The following measures were computed from the language samples: (1) Developmental Sentence Scoring (percent agreement ranged from 89 to 95%), (2) lexical type-token ratios (percent agreement ranged from 94 to 98%), (3) semantic assessment (mean number of semantic categories per utterance) (percent agreement ranged from 87 to 92%), and (4) pragmatic assessment (percent agreement ranged from 85 to 90%). The following tests were administered and reliability for scoring was established as follows: (1) the Northwestern Syntax Screening Test (receptive measure) (percent agreement ranged from 99 to 100%); the Peabody Picture Vocabulary Test (percent agreement was 100%); and the Detroit Test of Learning Aptitude (combined percent agreement for both subtests (6 and 13) ranged from 96 to 99%).

Data Analysis

In analyzing these data, two types of comparisons were made: (1) the performance of FAS subjects was compared to the performance of younger normal-language subjects, and (2) the performance of FAS subjects was compared to the performance of Prader-Willi subjects. The significance of the differences between the group means on each of the measures was calculated by using a two-tailed t -test for paired samples. The null hypothesis was rejected for a given statistic when the probability value obtained was less than or equal to .05.

IV. RESULTS

Syntactic Comparisons

The first question addressed in this research study was whether FAS children were comprehending and producing syntax similarly to normal children of the same age; similarly to normal children of the same level of linguistic performance; or similarly to children of the same age and level of intellectual ability (Prader-Willi syndrome). The area of syntax was examined through the use of scores from the receptive portion of the Northwestern Syntax Screening Test (NSST) and scores from the Developmental Sentence Scoring Procedure (DSS).

A syntactic comparison of FAS and normal children of comparable chronological age levels. Normative data provided by the standardization of the NSST (comprehension) and DSS procedure were used in the comparisons. In reference to the comprehension of syntactic structures, the mean receptive NSST score for the FAS subjects was 21 (scores ranged from 14-28), indicating that as a group these subjects' performances were below the 10th percentile as compared to normal children of the same age level. Similarly, with regard to the production of grammatical structures, the mean DSS score for the FAS subjects was 5.3 (range of scores was 3.82-6.38), again indicating that these subjects' performances were below the 10th percentile for their chronological age levels. It appears from these data that the FAS subjects in the present study were not comprehending or producing as complex grammatical forms as might be expected of normal children of comparable ages.

A syntactic comparison of FAS children and linguistically matched younger normals. In reference to the comprehension of syntactic structures, scores from the NSST (receptive) indicated that there were no significant differences between the performances of FAS children and a selected group of younger normal children

Table 3

Syntactic measures. Means and standard deviations (in parentheses) for scores on the Northwestern Syntax Screening Test (NSST) and the Development Sentence Scoring (DSS) procedure. Means and standard deviations (in parentheses) for the proportion of utterances from the DSS analysis that were complete grammatical sentences (n = 10 in the FAS/younger normal-language group; n = 8 in the FAS/Prader-Willi group on the NSST measure and n = 7 on the DSS measure; two-tailed probability).

Measures	Younger Normal- Language Children		Prader-Willi Children	
	FAS Children	FAS Children	FAS Children	Prader-Willi Children
<u>NSST</u> (receptive)	21.10 (4.58)	24.70 (4.98)	19.75 (3.99)	19.37 (3.50)
<u>DSS</u>	5.30 (.87)	6.87 (.80)*	5.40 (.83)	4.21 (.57)*
Proportion of complete grammatical sentences	.64 (.07)	.82 (.08)*	.63 (.08)	.51 (.25)

*Results significant at $p < .05$.

as shown in Table 3. With regard to the production of grammatical forms, the DSS total score was used as a general measure of syntactic complexity. As is evident from Table 3, the younger normal subjects' mean DSS score (6.87) was significantly higher than the mean DSS score (5.30) for the FAS subjects. A further assessment of the production of grammatical forms was determined by examining the proportion of utterances (in the 50-utterance DSS sample) that were complete and correct grammatical sentences (met all rules of Standard English). This measure provides an opportunity to determine what proportion of the children's utterances were grammatically correct, versus the proportion of utterances with grammatical errors. Table 3 also displays the statistical data on this dimension. The younger normals exhibited a significantly higher proportion (.82) of grammatically complete sentences as compared to the proportion (.64) exhibited by the FAS subjects. This finding suggests that there were many grammatical forms that had not yet emerged in the language of FAS children as compared to younger normals. A more specific assessment of the FAS and younger normals' production of grammatical forms was determined by examining the children's performances within each of the following DSS categories: (1) indefinite pronouns or noun modifiers, (2) personal pronouns, (3) main verbs, (4) secondary verbs, (5) negatives, (6) conjunctions, (7) interrogative reversals, and (8) wh-questions. It was observed that both groups of subjects exhibited entries (produced grammatical forms) in all of the DSS categories. It was further noted that the FAS subjects exhibited an average of 21 entries in the wh-question category as compared to six in the younger normal-language group.

Overall, it appears that (1) FAS children comprehend grammatical forms much like younger normals, (2) FAS subjects produce less complex grammatical forms as compared to younger normals, (3) FAS subjects produce significantly fewer grammatically complete sentences as compared to younger normals, (4) FAS

subjects (like younger normals) exhibited entries in all of the DSS categories, and (5) FAS subjects exhibited a larger proportion of entries in the wh-question category than did their younger normal counterparts.

A syntactic comparison of FAS children and children with Prader-Willi syndrome. The FAS subjects were compared to a cognitively matched group of children with Prader-Willi syndrome in an attempt to identify the influence of intelligence on linguistic performance. The FAS and Prader-Willi groups were assessed along the same dimensions as were FAS and younger normals, i.e., comprehension (NSST) and production (DSS) of grammatical structures. In reference to comprehension of syntactic structures, as is shown in Table 3, there were no significant differences in overall performances between the FAS and Prader-Willi subjects on scores obtained from the NSST. With regard to the production of syntactic structures, the FAS subjects exhibited significantly better scores on the DSS measure than did Prader-Willi subjects as shown in Table 3. When comparing the proportion of grammatically complete sentences in the two groups of subjects (Table 3), there were no significant differences between the FAS subjects' performances (.63) and the Prader-Willi subjects (.51). Entries within the different DSS categories were examined and it was observed that children with Prader-Willi syndrome did not exhibit entries in all of the eight possible DSS categories as did children with FAS. Also, children with Prader-Willi syndrome on an average exhibited a smaller number of entries in the wh-question category (9) as compared to 20 in the FAS group of subjects.

One can conclude from these data that (1) that cognitively matched subjects comprehend grammatical forms at approximately the same linguistic level, (2) FAS subjects produce more complex grammatical forms than do children with Prader-Willi syndrome, (3) both groups of subjects produce approximately the same proportion of grammatically complete sentences in their spontaneous speech, (4)

FAS subjects exhibit entries in all of the DSS categories whereas children with Prader-Willi syndrome do not, and (5) FAS subjects on an average exhibited a larger proportion of entries in the wh-question category than did children with Prader-Willi syndrome.

Semantic Comparisons

A second question posited in this study was whether FAS children were comprehending and producing semantic information similarly to normal children of the same age level; similarly to normal children of the same linguistic level; or similarly to children of the same age and intellectual level (Prader-Willi syndrome). The area of semantics was examined by using scores from the Peabody Picture Vocabulary Test (PPVT), lexical type-token ratio scores (LTTR), and semantic complexity scores.

A semantic comparison of FAS and normal children of comparable chronological age levels. Of the semantic measures employed in this study, normative data was available for only the PPVT measure. On this test, IQ equivalent scores and mental age scores were determined and used in the comparisons. The FAS subjects exhibited a mean IQ level of 85 and a mean mental age level of 4;3 (years and months). This finding revealed that in comprehending the meaning of single words, the FAS subjects were functioning at the 15th percentile as compared to normal children of their own age level.

A semantic comparison of FAS and linguistically matched younger normals. In assessing semantic knowledge for single words, both the PPVT and LTTR scores were used in the comparisons. As is shown in Table 4, the IQ equivalent scores computed from the PPVT was significantly higher in the normal-language group (IQ, 102) than in the FAS group (IQ, 85). There was no significant difference between the groups on mental age scores as derived from the PPVT, nor was there a significant difference between the groups on LTTR scores. These findings

Table 4

Semantic measures. Means and standard deviations (in parentheses) for intelligence quotients (IQ) and mental ages (MA) obtained from the Peabody Picture Vocabulary Test (PPVT). Means and standard deviations (in parentheses) for lexical type-token ratio (LTTR) scores (n = 10 in the FAS/younger normal-language group; n = 8 in the FAS/Prader-Willi group; two-tailed probability).

Measures	Fetal Alcohol Syndrome Children	Younger Normal-Language Children	Fetal Alcohol Syndrome Children	Prader-Willi Syndrome Children
PPVT IQ	85.70(18.75)	102.50(10.16)*	79.87(13.28)	78(12.29)
MA (years; months)	4;3(15 mos.)	3;7(11 mos.)	3;9(.68)	3;8(.73)
LTTR	.54(.05)	.57(.03)	.54(.06)	.46(.07)*

*Results significant at $p \leq .05$.

suggest that (1) the five-year-old FAS subjects were comprehending the meaning of single words at a linguistic level expected of normal three-year-olds, and (2) the variety of lexical (vocabulary) items used in the spontaneous speech of FAS children was equivalent to that of the younger normals.

When examining multi-word utterances, semantic complexity was determined by the mean number of semantic categories per utterance. The data provided in Table 5 indicate that the younger normals coded 1.74 semantic categories within each utterance as compared to 1.55 in the FAS group. The difference between these group means is statistically significant. This finding can be interpreted as meaning that within an utterance the FAS subjects were coding (producing) fewer semantic categories, thus exhibiting less complex speech on a semantic level than were younger normals. Both the FAS and younger normal subjects coded the earlier semantic categories (i.e., existence, location, action, etc.), however, neither group exhibited entries in all of the possible semantic content categories (Appendix B). This finding is consistent with the MLU levels of these children.

Additionally, a measure was made of the percentage of utterances that were semantically noncodeable in the 100-utterance language sample (utterances that did not express a semantic intent, i.e., greetings, conversational fillers, etc.). (Refer to Appendix B for a more detailed description of this category.) As shown in Table 5, the younger normal subjects and the FAS subjects performed similarly, indicating that the FAS subjects were functioning like normal three-year-olds with regard to producing utterances that do not make direct reference to ideas about the world.

A semantic comparison of FAS and Prader-Willi children. In reference to the comprehension of the meaning of single words, IQ equivalent scores and mental age scores were computed from the PPVT and thus were used in the statistical comparisons. As indicated in Table 4, there were no appreciable differences

Table 5

Semantic measure. Means and standard deviations (in parentheses) for the mean number of semantic categories per utterance. Means and standard deviations (in parentheses) for the percent of utterances that were considered semantically noncodeable in the 100-utterance language sample. In the FAS/younger normal-language group $n = 10$; in the FAS/Prader-Willi group $n = 8$; two-tailed probability.

Measures	Younger Normal- Language Children		Prader-Willi Children	
	FAS Children		FAS Children	
Mean number of semantic categories/ utterances	1.55(.17)	1.74(.10)*	1.51(.16)	1.24(.20)*
Percent of noncodeable	11.90(7.06)	18.40(8.19)	12.25(6.54)	19.50(6.39)

*Results significant at $p \leq .05$.

between the FAS and Prader-Willi groups on either IQ equivalents nor mental age scores. This finding suggests that the FAS and Prader-Willi children were comprehending the meaning of single words at about the same linguistic level. However, with regard to the variety of words used in spontaneous speech, Table 4 reveals that the FAS subjects exhibited significantly higher LTTR scores (.54) than did the Prader-Willi subjects (.46). This finding suggests that the FAS subjects were using a richer variety of lexical items in their spontaneous speech than were the Prader-Willi children.

Multi-word utterances were assessed for semantic complexity by calculating the mean number of semantic categories per utterance. As shown in Table 5, on an average the FAS subjects coded 1.51 semantic categories within each utterance as compared to 1.24 in the Prader-Willi group. This difference was statistically significant, meaning that the FAS subjects exhibited greater skill in talking about the relationship between words and their underlying meanings than did children with Prader-Willi syndrome. Although both groups of subjects appeared to code the earlier semantic categories (existence, action, etc.), the Prader-Willi subjects exhibited fewer entries in all of the possible semantic content categories than did the FAS subjects. This finding would be expected given the reduced MLU levels of the Prader-Willi children.

The FAS and Prader-Willi subjects' language samples also were analyzed to determine the percentage of semantically noncodeable utterances. As reflected in Table 5, there was no statistically significant difference in performance between these groups, suggesting that these cognitively matched subjects were roughly equivalent in producing utterances that lacked direct reference to ideas about the world.

Pragmatic Comparisons

The third component of the language system addressed in this research study

was the nature of pragmatic development in FAS children. Since there are no standardized test norms on this aspect of language, the FAS subjects' performances were only compared to younger normals and children matched on age and intellectual levels (Prader-Willi syndrome). The comparisons were based on the frequency of occurrence of the pragmatic categories listed in Appendix D.

A pragmatic comparison of FAS and linguistically matched younger normals.

A general pragmatic assessment of the frequency of occurrence of initiations and responses in the 100-utterance language sample was made. This initial comparison involved calculating the number of initiated and responsive utterances by these groups of children. As indicated in Table 6, the average number of initiations in the FAS population was 36 as compared to 37 in the younger normal group; this difference is not statistically significant. Likewise, the average number of responses in the FAS group was 59 as compared to 56 in the younger normal group, again not a significant difference in performance. To further assess the pragmatic component of language for the FAS and normal children, initiations and responses were examined in more detail.

Initiated utterances were coded according to whether they functioned as (1) requests or (2) comments. As reported in Table 7, 12% of the utterances by FAS subjects were classified as initiated requests whereas in younger normal children only 11% were so classified. This difference was not statistically significant. With regard to comment initiations, 25% of the utterances by FAS subjects were classified in this manner whereas in younger normal children 27% were so classified. Again, there was no statistically significant difference between the groups. It was observed that neither the FAS subjects nor the younger normals exhibited entries in all of the possible initiation categories. With regard to coding the request categories, both groups of subjects had more entries in the "request information" category than in any of the other categories (Appendix D). In

Table 6

Pragmatic measures. Means and standard deviations (in parentheses) for the frequency of occurrence of initiations and responses per 100 utterances (n = 10 in the FAS/younger normal-language group; n = 8 in the FAS/Prader-Willi group; two tailed probability).

Measures	Younger Normal- Language Children		Prader-Willi Children	
	FAS Children		FAS Children	
Initiations	36.50(16.70)	37.50(11.48)	35.37(18.46)	22.37(10.23)
Responses	59.90(19.36)	56.20(12.84)	61.12(21.70)	70.62(11.08)

*Results significant at $p < .05$.

Table 7

Pragmatic measures. Means and standard deviations (in parentheses) for the percent of initiations that were considered requests or comments (n = 10 in the FAS/younger normal-language group; n = 8 in the FAS/Prader-Willi group; two-tailed probability).

Measures	Younger Normal- Language Children		Prader-Willi Children	
	FAS Children		FAS Children	
Initiations				
Percent of requests	12.30(6.79)	10.60(5.50)	12.62(7.65)	6.00(5.00)
Percent of comments	24.50(14.87)	26.90(9.68)	23.12(16.11)	16.37(9.10)

*Results significant at $p \leq .05$.

reference to comment initiations, both the FAS and the younger normals exhibited more entries in the "comment on activity or state" category than in any of the other comment categories (Appendix D).

When examining responses, the subjects' utterances were coded for appropriateness (see Appendix D for a definition and example of the appropriateness categories). To examine this dimension of pragmatics, responses were coded as (1) adequate, (2) inadequate, (3) ambiguous/noncodeable, and (4) no response. The above categories were examined in reference to the child's contingent responses to adult-initiated requests. Although the appropriateness category serves a pragmatic function, this category makes a judgment about appropriateness with regard to content as well. The percent of responses in the 100-utterance language sample in each of the above categories was determined. The data are presented in Table 8. The younger normal children exhibited a significantly larger percentage of adequate responses (85%) than did FAS subjects (67%). There was no significant difference between the groups in the percentage of time their utterances were coded in either the ambiguous/noncodeable or the no response categories. Both the FAS and younger normal subjects exhibited entries in all of the possible response categories.

Overall, it appears from these pragmatic data that the younger normals and the FAS subjects were functioning similarly with regard to the production of initiations and responses in conversation. The one significant difference in their performance was noted in the smaller percentage of adequate responses in the FAS group as compared to younger normals. Refer to Appendix E for typical examples of dialogue between FAS children and the investigator.

A pragmatic comparison of FAS and Prader-Willi children. The frequencies of occurrence of initiations and responses in the 100-utterance language sample are reported in Table 6. The average number of initiations in the FAS

Table 8

Pragmatic measures. Means and standard deviations (in parentheses) for the percent of responses that were considered adequate or inadequate in the 100-utterance language sample. Means and standard deviations (in parentheses) for the percent of utterances that were considered ambiguous/noncodeable or were considered no response in the 100-utterance language sample ($n = 10$ in the FAS/younger normal-language group; $n = 8$ in the FAS/Prader-Willi group; two-tailed probability).

Measures	Younger Normal- Language Children		Prader-Willi Children	
	FAS Children	FAS Children	FAS Children	Prader-Willi Children
Percent of adequate responses	67.70(5.79)	85.50(7.60)*	65.75(4.33)	68.87(14.37)
Percent of inadequate responses	30.00(6.96)	9.60(5.56)*	32.62(4.13)	31.62(12.81)
Percent of ambiguous/ noncodeable	2.30(2.98)	4.90(8.13)	1.75(1.98)	2.50(2.13)
Percent of no responses	1.40(.96)	2.60(2.59)	1.37(1.06)	1.00(1.06)

*Results significant at $p \leq .05$.

population was (35) as compared to (22) in the Prader-Willi group; this was not a significantly different performance. Likewise, the average number of responses in the FAS group was (61) as compared to (70) in the Prader-Willi group of subjects. Again, this difference was not statistically significant. Initiations and responses were analyzed in more detail and the results are reported below.

In reference to initiations, as shown in Table 7, the average percentage of initiated requests was (13%) in the FAS population as compared to (6%) in the Prader-Willi group. Likewise, the average percentage of comment initiations in the FAS population was (23%) and (16%) in the Prader-Willi population. There was no significant difference between groups on either of these dimensions. Further, it was noted that neither group exhibited entries in all of the possible initiation categories. Both the FAS and Prader-Willi subjects coded initiated requests most often by making entries in the request information category. Similarly, with regard to comment initiations, both groups coded the comment on activity or state category most frequently (Appendix D).

As was done in comparing the pragmatic aspects of conversational speech of normals and FAS children, four pragmatic measures were used to examine the appropriateness of responses by FAS and Prader-Willi children during conversational speech (see Table 8). The performance of the FAS and Prader-Willi subjects were similar; there were no statistical differences between the groups on the percentage of responses coded as (1) adequate, (2) inadequate, (3) ambiguous/noncodeable, and (4) no response measure. It was further observed that although the FAS subjects had entries in all of the pragmatic response categories, the Prader-Willi children did not.

Overall, it appears from these pragmatic data that the FAS children were functionally similarly to Prader-Willi children in their uses of language with one exception. The FAS subjects were more versatile in entering all possible pragmatic

response categories than were the Prader-Willi children.

Linguistic Pattern of FAS Subjects

An additional question addressed in this research study was whether there was a linguistic pattern of performance that was common to children with fetal alcohol syndrome. This issue was addressed by examining the linguistic performances between the FAS and younger normal subjects as well as examining the variability of performance within the FAS group.

When comparing the FAS children to younger normals, it appears that indeed there may be a pattern of linguistic development that is characteristic of children with this syndrome. For example, although the FAS subjects were delayed in both the comprehension and production aspects of syntax, it was evident from these data that the FAS subjects were unable to consistently produce some of the grammatical forms that one might expect with regard to their comprehension ability. This notion was reflected in two ways: (1) although the FAS subjects performed like younger normals on the comprehension of syntactic structures, their performances were not comparable to younger normals with reference to production, and (2) the FAS subjects exhibited significantly fewer grammatically complete sentences in their spontaneous speech than did the linguistically matched younger normal subjects.

With regard to semantic development, it appears that the same linguistic pattern discussed in reference to syntax again emerges. For example, although the FAS subjects comprehended and produced single words much like younger normals, they were unlike normals with regard to the semantic complexity of their utterances. Because of the inter-relationship between semantic and syntactic complexity, it was not surprising that this pattern emerged. For example, coding more semantic categories within an utterance will generally increase the syntactic complexity of that utterance as well. The fact that the DSS scores were lower in

the FAS group compared to younger normals corresponds with the finding that semantic complexity scores for the FAS subjects were lower as well.

In reference to pragmatics, the use of pragmatic functions in FAS children was similar to that observed in normal three-year-olds, with one exception. The FAS subjects exhibited significantly fewer adequate responses as compared to younger normals. This finding, coupled with the fact that the FAS children "responded" with approximately the same frequency as did younger normals, suggests that the FAS children attempted to fulfill their conversational obligation to take a turn in dialogue with little regard for whether these turns were complementing the investigator's antecedent utterances. This notion will be expanded upon in the discussion section of this paper.

In summary, although the present investigator included more production measures than comprehension measures, the linguistic pattern that appeared to emerge was that the FAS subjects exhibited even poorer performances in the production aspects of language than they did on comprehension tasks. These delays spanned across all of the major linguistic components addressed in this study (i.e., syntax, semantics, and pragmatics).

Although the FAS and younger normals were matched on MLUs, on many of the dependent measures, the younger normals' performances were significantly better than the FAS subjects. Such findings imply that for many of the measures used in this investigation, the performances of the FAS subjects were poorer than would have been predicted on the basis of MLUs.

When examining within group performances, the following findings were observed for the FAS children. First, with regard to syntax, the range of scores on the NSST was (14-28). Although this range shows variable performance, the highest score obtained on the NSST by an FAS child was below the 50th percentile for normal children of the same chronological age level. Likewise, the range of

performances by FAS children on the DSS measure was (3.82-6.38), again the highest score was below the 50th percentile for normal children of similar age levels. Second, on the semantic measures the range of mental age scores by the FAS children on the PPVT was (2;11-7;5), although this range reflects considerable variability in performance, the score of (7;5) was an isolated incident. The remaining FAS subjects had mental age scores substantially below their chronological age levels. Lexical type-token ratio scores indicated a range of performance between (.43-.60) while the range for semantic complexity was (1.27-1.73). Taken together it appears that although there was variable performance within the FAS population, as might be expected, semantically these subjects' performances were lower than would be expected from their MLU levels. Third, with regard to pragmatics, a more pronounced pattern of performance was noted for the FAS children (range of initiations was 13-68; range of responses was 28-85). However, when observing how younger normals performed within these same categories it was noted that the spread of scores was similar to that in the FAS group.

Even in light of the within-group variability, within the FAS group of subjects the linguistic performances were similar enough to conclude that these subjects have linguistic systems that appear to be different from younger normals. The linguistic performances of younger normal children were better than the linguistic performances of FAS children, and the FAS children's linguistic performances were better than those of children with Prader-Willi syndrome. Table 9 presents a visual display of these findings.

Short-term Memory Comparisons

The final question addressed in this research study was whether FAS children demonstrated short-term memory skills similar to normal children of the

Table 9

Visual display of syntactic, semantic, and pragmatic performances of FAS children, younger normal children, and Prader-Willi syndrome children; (=) means equal performance; (+) means significantly higher scores.

Measures	Fetal Alcohol Syndrome Children	Younger Normal-Language Children	Fetal Alcohol Syndrome Children	Prader-Willi Syndrome Children
<u>Syntax</u>				
NSST (receptive)	=	=	=	=
DSS		+	+	
Proportion of complete grammatical sentences		+	=	=
<u>Semantics</u>				
PPVT (IQ)		+	=	=
PPVT (MA)	=	=	=	=
LTTR	=	=	+	
Mean number of semantic categories per utterance		+	+	
Percent of noncodeable	=	=	=	=

Table 9 (continued)

Measures	Fetal Alcohol Syndrome Children	Younger Normal-Language Children	Fetal Alcohol Syndrome Children	Prader-Willi Syndrome Children
<u>Pragmatics</u>				
Percent of initiation	=	=	=	=
Percent of response	=	=	=	=
Percent of requests	=	=	=	=
Percent of comments	=	=	=	=
Percent of adequate responses		+	=	=
Percent of inadequate responses	+		=	=
Percent of ambiguous/noncedeable	=	=	=	=
Percent of no responses	=	=	=	=

same chronological age; similar to normal children of the same linguistic level; or similar to children of the same chronological age and intellectual level. Scores from two subtests of the Detroit Test of Learning Aptitude were used in the comparison. Specifically, scores from subtest 6, Auditory Attention Span for Unrelated Words and scores from subtest 13, Auditory Attention Span for Related Syllables comprised the statistical data.

A short-term memory comparison of FAS children and normal children of comparable chronological age levels. Scores from subtest 6, Auditory Attention Span for Unrelated Words revealed that the FAS subjects were functioning at least two standard deviations below the mean for normal children of the same age level. Likewise, on subtest 13, Auditory Attention Span for Related Syllables, the FAS subjects were functioning one standard deviation below the mean for normal children of the same age level. These findings suggest that FAS children were functioning below age level in short-term memory ability. However, the FAS children had better recall for sentences than for word series, implying that FAS children used meaning and sentence structure to facilitate immediate recall.

A short-term memory comparison of FAS children and normal children of the same linguistic level. Table 10 presents a display of the statistical data for the short-term memory measures. Scores from subtest 6, Auditory Attention Span for Unrelated Words revealed that the mean performance of the FAS subjects was not significantly different from the mean performance of younger normals. Scores from subtest 13, Auditory Attention Span for Related Syllables indicated that the younger normals' performance was significantly better than the FAS subjects. These findings indicate that younger normals have better immediate recall ability for sentences than do children with fetal alcohol syndrome.

A short-term memory comparison of FAS children and children with Prader-Willi syndrome. Scores from subtest 6, Auditory Attention Span for

Table 10

Short-term memory measures. Means and standard deviations (in parentheses) for scores obtained on the Detroit Test of Learning Aptitude (DTLA) subtest 6 - Auditory Attention Span for Unrelated Words and subtest 13 - Auditory Attention Span for Related Syllables. In the FAS/younger normal-language group n = 10; in the FAS/Prader-Willi group n = 8; two-tailed probability.

Measures	Younger Normal-		Prader-Willi	
	FAS Children	Language Children	FAS Children	Children
<u>DTLA</u>				
Subtest 6 (simple score)	23.60(6.85)	30.60(12.07)	23.00(5.45)	22.62(6.69)
Subtest 6 (weighted score)	103.80(41.82)	158.30(63.70)	100.75(30.83)	99.00(39.41)
Subtest 13	18.80(7.43)	36.20(10.00)*	16.25(4.86)	6.37(5.97)*

*Results significant at $p \leq .05$.

Unrelated Words indicated that there was no significant difference in performance between the FAS and Prader-Willi groups. However, on subtest 13, Auditory Attention Span for Related Syllables, the FAS subjects had significantly better scores than the Prader-Willi subjects (Table 10). This finding suggests that the FAS subjects were making better use of meaning and sentence structure to facilitate sentence recall than were the children with Prader-Willi syndrome. One might reason that this finding is expected given FAS children have better linguistic skills.

V. DISCUSSION

This study was designed to investigate the level of linguistic functioning in children with fetal alcohol syndrome. One can infer from the data reported in the results section that the FAS subjects were indeed exhibiting significant language delays.

When comparing and contrasting the FAS subjects' linguistic abilities to those of linguistically matched younger normals, the following linguistic profile emerged:

Similarities.

- (1) The five-year-old FAS subjects comprehend syntactic structures similarly to normal three-year-old children.
- (2) FAS subjects comprehend the meaning of single words similarly to younger normals.
- (3) The ratio of different words in the spontaneous language samples of FAS children was similar to the ratio used in the younger normal group.
- (4) The percentage of utterances that were regarded as semantically noncodeable was similar between the two groups.
- (5) There was no significant difference between the groups in the percentage of time they initiated conversational speech.
- (6) There was no significant difference between the groups in the frequency of responses during conversational speech.
- (7) FAS subjects requested information in conversation as frequently as younger normals.
- (8) FAS subjects commented in dialogue as frequently as younger normals.
- (9) FAS subjects produced responses that were regarded as ambiguous/noncodeable in about the same frequency as younger normals.
- (10) FAS subjects did not respond (when a response was warranted) with about the same frequency as younger normals.

Differences.

- (1) FAS subjects did not produce as syntactically complex utterances as younger normals.
- (2) FAS subjects produced fewer grammatically complete sentences than did younger normals.
- (3) FAS subjects did not produce as semantically complex utterances as did younger normals.
- (4) FAS subjects produced a significantly smaller percentage of adequate responses as compared to younger normals (thus, a significantly larger percentage of inadequate responses).

When reviewing the syntactic and semantic measures obtained in this research study, it should be pointed out that the only production measure where both the FAS and younger normal subjects exhibited similar performances was on lexical type-token ratio scores. Because this measure assessed the variety of vocabulary items a child produced in spontaneous speech it is believed that perhaps this finding was an artifact of the language sampling procedure. For example, the materials used to elicit each language sample were standardized across groups thus placing some restraints on the variety of vocabulary items that could occur in the speech of these subjects.

If a linguistically impaired child is developing the same kind of linguistic system as a normal child, but at a slower rate, the child's linguistic system may be regarded as quantitatively different. It appears from these findings that perhaps FAS subjects have a quantitatively different linguistic system from normal children. Quantitative differences in linguistic performances are usually interpreted as meaning that these differences are with respect to degree. In reference to the present research study, the FAS subjects appeared to be exhibiting at least a quantitative difference with regard to language acquisition. This

conclusion was supported in two ways: (1) on normative data, the FAS subjects' linguistic performances were significantly below the mean performances of children of similar age levels, and (2) the FAS subjects' linguistic performances did not exceed the linguistic performances of younger normal children matched on utterance length. These findings suggest that the FAS subjects were indeed developing language at a slower rate (quantitative).

On the other hand, qualitative differences in linguistic performances refer to differences in kind. If a linguistically impaired child is developing language differently from normal children (uneven linguistic performances as compared to linguistically matched normals), this difference is regarded as qualitative (Naremore & Dever, 1975). One might argue that the FAS subjects had a qualitatively different linguistic system as well. This hypothesis is supported by the dissimilar performances between the FAS subjects and the younger normals as evident from syntactic, semantic, and pragmatic measures. For example, although the FAS and younger normal subjects functioned similarly with regard to comprehending syntactic structures, the FAS subjects did not function similarly on the production of grammatical structures as did children matched on utterance length. This finding was reflected in poorer performances on the DSS measures. Similarly, this pattern of performance was observed in the production of semantically complex utterances as well. As reported earlier, the FAS subjects' utterances were not as semantically complex as those from younger children matched on utterance length. This finding may have been expected given that the DSS scores and the proportion of grammatically complete sentences (from the DSS sample) were lower in the FAS group than in the younger normal group. That is, producing more complex grammatical forms within an utterance usually increases the semantic complexity of that utterance as well.

When examining the pragmatic component of the language system, again the

FAS subjects demonstrated a linguistic difference as compared to younger normals. This finding was noted in significantly fewer appropriate responses produced in the language of FAS children. Taken together, these findings can be interpreted as meaning that on several of the production measures (i.e., DSS, semantic complexity, appropriateness of response) the FAS subjects' linguistic system may be regarded as qualitatively different (different in kind) from that used by three-year-old normal children.

In an attempt to assess the impact of intelligence on linguistic performance, the present research compared the linguistic performances of FAS children to those of intellectually matched and age-matched Prader-Willi subjects. These comparisons did not clarify whether the FAS subjects' linguistic delays were part of an overall delay because of reduced mental ability or whether these delays were characteristic of their syndrome. When examining these data it was clear that younger normals performed better than FAS children and FAS children performed better than Prader-Willi children. The FAS subjects exhibited better linguistic skill than Prader-Willi children on DSS procedures, LTTR scores, and semantic complexity. It should be pointed out that the above measures were all production measures, suggesting that Prader-Willi children were even more delayed in the production of language than were the FAS children. Had the FAS and Prader-Willi subjects performed similarly it would have appeared more likely that their linguistic delays were the result of reduced mental ability. Since that did not happen, clear interpretations of the role of reduced intelligence in FAS children with regard to linguistic development are not possible. However, since both the FAS and Prader-Willi subjects performed similarly with regard to comprehension tasks, it appears from this study that the variability in linguistic performances between syndrome groups is manifested more on language production rather than on language comprehension tasks.

In addition to the specific questions addressed above, an additional linguistic pattern emerged that is worth pursuing. During the course of this investigation the FAS children appeared to be especially adept at maintaining dialogue. This finding was evident by examining the response pattern of FAS children to adult-initiated requests. The fact that a significantly larger number of the FAS subjects' responses were inadequate (did not meet the demands imposed by the adult's requests) suggest that perhaps the FAS subjects were attempting to fulfill their conversational obligation to take a turn in dialogue even though their responses were inadequate. As reported in the literature (Bruner, 1976; Scherer & Coggins, in press) children learn very early in dialogue to differentiate the pragmatic intent of the adult's utterances and thus are able to provide a response. The fact that a significant number of these children's responses were not adequate suggests that the FAS subjects had successfully mastered the turn-taking stage of linguistic development but were unable to combine such knowledge with an appropriate response pattern. Perhaps this phenomenon is what Herman (1979) and Streissguth (1980) observed when they stated that FAS children appear to have good "social speech", yet it appears that these same children have difficulty in comprehending the message.

Although the FAS subjects were adept at maintaining dialogue, these children exhibited linguistic problems that were manifested in both language comprehension and production deficits. The linguistic production deficits exhibited by the FAS children were of the nature that would not have been predicted on the basis of their MLU levels. One might have expected better production performances from children with MLUs above 3.0 morphemes (as were the MLU levels in the FAS population). Finally, the linguistic deficits exhibited by FAS children spanned across the syntactic, semantic, and pragmatic components of language.

With regard to short-term memory ability, children with FAS were not

performing similarly to children of their own chronological age level as evident from normative data. These same children, however, were functioning similarly to younger normals in short-term memory for unrelated words but had poorer performances than younger normals in short-term memory for related words. Likewise, FAS and children with Prader-Willi syndrome performed similarly in short-term memory for unrelated words, however, when examining short-term memory for related words the FAS subjects' performances were significantly better than children with Prader-Willi syndrome. These findings suggest the following: (1) FAS children are delayed in short-term memory ability, (2) the delay is more pronounced in short-term memory for related syllables when compared to younger normals, and (3) although FAS children apparently use meaning and sentence structure to facilitate immediate sentence recall, these subjects may not use these linguistic cues to the extent that the younger normals use them. On the other hand, the FAS subjects made better use of linguistic information contained within sentences to facilitate immediate recall than children with Prader-Willi syndrome. This latter finding may have been expected given that children with Prader-Willi syndrome have auditory processing deficits, specifically in short-term memory functioning (Schultze, 1980; Warren, 1978). Because of the relationship between short-term memory and alcohol misuse (Cermack & Butters, 1973), clinicians should be alerted to evaluate this processing skill in FAS children. Since short-term memory is needed to process the structure of a sentence (Wiig & Semel, 1980), perhaps a part of the linguistic delay that FAS children are experiencing may be attributed to a deficit in short-term memory. Of course, further investigation needs to be conducted before final conclusions can be drawn.

In conclusion, FAS children do indeed exhibit significant short-term memory delays as well as linguistic delays. As mentioned earlier, the delay in short-term memory is more pronounced in short-term memory for sentences rather than word

series. With regard to language, the linguistic deficits that FAS children exhibit are manifested in syntactic, semantic and pragmatic delays, with the production of language more severely affected. This latter finding must be tempered because there were more production measures than comprehension measures. Further investigation along this dimension should be conducted. Because FAS children tend to exhibit adequate social skills with reference to language, their linguistic deficits may sometimes be "camouflaged". That is, an adult may perceive that FAS children have better linguistic skills than these children actually exhibit because of their skill at maintaining conversation. This is particularly true when considering the small physical stature (size) of these children. Given fetal alcohol syndrome can be diagnosed early in life by physicians familiar with the condition, an early intervention program should be initiated.

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APPENDIX A

MASTER SHEET FOR OBTAINING THE LANGUAGE SAMPLE

<u>Semantic Categories</u>	<u>Adult Probes for Semantic Categories</u>	<u>Examples</u>
(1) Existence	what + existence	What is this?
	comment + existence	That's a farmer.
	yes-no question + existence	Did he get hurt?
(2) Nonexistence	where + nonexistence	Where is bear's food?
	comment + nonexistence	The chickens are all gone.
	what + nonexistence	Why didn't it open?
(3) Recurrence	comment + recurrence	I'll give you another animal.
	yes-no question + recurrence	Do you want another horse.
	where + recurrence	Where are more animals?
(4) Rejection	yes-no question + rejection	Do you want to have a broken tail like the horse.
	comment + rejection	Don't open the door.
	why + rejection	Why can't you have one?
(5) Denial	yes-no question + denial	Is that a dog (when object was obviously a cow)?
	comment + denial	That's not a dog.
	why + denial	Why isn't that a sheep?

<u>Semantic Categories</u>	<u>Adult Probes</u>	<u>Examples</u>
(6) Attribution	comment + attribution	The horse has a broken tail.
	what + attribution	What happened to the big boat?
	where + attribution	Where is the red boat?
(7) Possession	who + possession	Who does the book belong to?
	comment + possession	That's my coat.
	when + possession	When will you get your farm house?
(8) Action	why + action	Why is he hitting the table?
	comment + action	The farmer is eating dinner.
	who + action	Who cooked the dinner?
(9) Locative	comment + locative	Bear's going outside.
	where + locative	Where is duck going?
	what + locative	What's in the can?
(10) State	why + state	Why is daddy sad?
	comment + state	The boy is happy.
	who + state	Who is that funny man?
(11) Quantity	Comment + quantity	I have two books.
	why + quantity	Why do you have two books?
	when + quantity	When will you get some animals for your farm?

<u>Semantic Categories</u>	<u>Adult Probes</u>	<u>Examples</u>
(12) Notice	comment + notice	I see you.
	yes-no question + notice	Can you see him down there?
	why + notice	Why aren't you looking at the pictures?
(13) Time	when + time	When will you finish?
	comment + time	Let's put the toys up now.
	yes-no question + time	Will you go to school tomorrow?
(14) Coordinate	comment + coordinate	The farmer and his son are going for a ride.
	who + coordinate	Who's running and who's jumping?
	where + coordinate	Where is the mama and little girl going?
(15) Causality	comment + causality	Move the horse so it won't fall.
	what + causality	What will happen if you won't open the gate?
	who + causality	Who opened the gate so the cow could get out?
(16) Dative	comment + dative	Give the pig some water.
	who + dative	Who's going to feed the animals?
	what + dative	What will you give daddy to drink?

<u>Semantic Categories</u>	<u>Adult Probes</u>	<u>Examples</u>
(17) Specifier	comment + specifier	This is the little farmer.
	what + specifier	What's the big farmer going to do?
	where + specifier	Where is that one going to sleep?
(18) Epistemic	comment + epistemic	I think maybe he's hurt.
	when + epistemic	When do you think he might come home?
	why + epistemic	Why might they not have lunch?
(19) Mood	comment + mood	You can go now.
	who + mood	Who should drive the tractor?
	why + mood	Why must you drink from the can?
(20) Antithesis	comment + antithesis	She's sick but she won't go to the doctor.
	why + antithesis	Why won't horsey eat if he's hungry?
	when + antithesis	When you're tired you shouldn't play.

APPENDIX B

DEFINITIONS OF SEMANTIC CATEGORIES

- (1) Existence. Labeling was coded as existence in single word utterances (Bloom & Lahey, 1978). In multi-word utterances, naming statements in which the identity was specifically stated as in His name is Paddington was coded as existence (Van Kleeck & Carpenter, 1980).
- (2) Nonexistence. Placed in this category were utterances that made reference to the disappearance of an object or the nonexistence of an object or action in a context in which its existence might somehow be expected, as in The milk is all gone (Bloom & Lahey, p. 610). Also placed in this category were utterances where the action did not occur, as in It didn't break (Van Kleeck & Carpenter, 1980).
- (3) Recurrence. Utterances that made reference to the reappearance of an object, or another instance of an object or event with or without the original instance of the object still present. Example, Here are more bears (Bloom & Lahey, 1978).
- (4) Rejection. Utterances where the child opposed an action or refused an object and used forms of negation were coded in this category. Example, No, I don't want to (Bloom & Lahey, p. 610). Also placed in this category were utterances which coded prohibition, as in Don't open that (Van Kleeck & Carpenter, 1980).
- (5) Denial. Utterances that negated the identity, state, or event expressed in another's utterance or in his/her own previous utterance were coded as denial. Example, That's a stick. Oh no, it's not (Bloom & Lahey, p. 610).
- (6) Attribution. Utterances that made reference to properties of objects with respect to (1) an inherent state of the object (e.g., broke or sharp), or

- (2) specification of an object that distinguishes it from others in its class (e.g., big or red) were categorized as attribution. Another form of coding attribution was to refer to an attribute as a condition of the object with a copula sentence such as The car is big. This form of coding attribution was placed under state (Measure 10) (Bloom & Lahey, p. 610).
- (7) Possession. Utterances placed in this category made reference to objects within the domain of different persons. Example, His hat is big. As with attribution, there is an alternative form for coding possession; one can specify the possessive state of the object with the copula sentence, as in That car is mine. This form of coding possession was placed under state (Measure 10) (Bloom & Lahey, p. 610).
- (8) Action. Placed in this category were utterances that referred to movement where the goal of the movement was not a change in the location of an object or person, as in The dog is eating the food (Bloom & Lahey, p. 611). Also coded as action were utterances which did not code movement but which contained verbs where the act occurred merely by uttering the word, as in Shall we invite the children to dinner? (Van Kleeck & Carpenter, 1980).
- (9) Locative. Coded in this category were utterances that referred to movement where the goal of the movement was the change in location of a person or object, as in She went outside. Also coded in this category were utterances that referred to the relationship between a person or object and its location, as in The doll is in the bed (Bloom & Lahey, p. 611; modified by Van Kleeck & Carpenter, 1980).
- (10) State. Utterances in this category referred to states of affairs involving persons or other animate beings including: (a) internal states, as in I like your dress, (b) external states, as in It's dark outside, (c) states of ownership or

possession, as in The car is mine, or (d) attributive states, as in He's funny (Bloom & Lahey, p. 611).

- (11) Quantity. Utterances were placed in this category if they designated the number of objects or persons either by use of a number word, plural -s inflection, or adjectives such as some or many. Example, I have two cars (Bloom & Lahey, p. 611).
- (12) Notice. Utterances coded in this category referred to attention being directed to a person, object, or event by using a verb of notice such as see or hear, since such events as seeing or hearing could not be identified by aspects of context and behavior. Utterances in this category often involved two clauses, one of which contained a notice verb that focused on the object of attention, which was the complement of the second clause. Example, Look at what I am doing (Bloom & Lahey, p. 611).
- (13) Time. Placed in this category were utterances which made reference to time. These included just, now, then, before, at night, yesterday, or next year. Example, I want to do it now (Bloom & Lahey, p. 611).
- (14) Coordinate. This category included utterances that referred to two events and/or states that were independent of each other (i.e., the joining of the two does not create a new meaning) but were somehow bound together in space and/or time. The two clauses could include the same or different verbs and could relate to sequential, simultaneous or static events and/or state. This category was also used to refer to two objects conjoined intraclausally that are independent of each other but are bound together in space and/or time. Examples are: Daddy and bear want to go for a walk; The farmer's gonna eat a hot dog and his wife's gonna eat one, too; and He's fishing and she's watching (Bloom & Lahey, p. 612).

- (15) Causality. Utterances that had an implicit or explicit cause and effect relationship between two verb relations, that is, one expressed event or state and was dependent upon the other for its occurrence. Example, Move your foot so I won't step on it (Bloom & Lahey, p. 612).
- (16) Dative. Utterances were coded in this category if they designated the recipient of an object or action with or without a preposition. Example, Give the cow some hay (Bloom & Lahey, p. 612).
- (17) Specifier. Utterances were included in this category if they specified a particular person, object, or event by contrastive use of the demonstrative pronouns this versus that or by contrastive use of the articles the versus a. Also, specification sometimes involved the joining of two clauses, one of which specified or described an object or person by function, place, or activity, as in The baby sitting at the table is hungry (Bloom & Lahey, p. 612).
- (18) Epistemic. Utterances were coded as epistemic when the relationship between two states or an event and a state referred to certainty or uncertainty about the event or state. Example, I think maybe she's hurt (Bloom & Lahey, p. 612).
- (19) Mood. Utterances in this category expressed the attitude of the speaker about an event by the use of modal verbs such as can, should, or must. Example, We should put the toys up now (Bloom & Lahey, p. 612).
- (20) Antithesis. Utterances were placed in this category when a dependency between two events or states existed and the dependency was a contrast between them. The relationship between the clauses could be one of opposition, where one clause negates or opposes the other, or exception, where one clause qualifies or limits the other. Example, She's sick but she won't go to the doctor (Bloom & Lahey, p. 612).

- (21) Noncodeable. Placed in this category were utterances or parts of utterances which were part of a social function, and which lacked reference to ideas about the world. The following types of utterances were placed in this category: (1) counting or reciting the alphabet with no referent present; (2) sounds accompanying toys or animals; (3) verses, songs, poems, and lines from stories; greetings as in Hello, how are you? Also included were conversational devices such as affirmative comments yeah or okay; requests right?; interjections oh or ah; polite forms please or thank you; attention getters (calling a child's name); and sentence starters well, gee, boy, or oh (Van Kleeck & Carpenter, 1980).

APPENDIX C

CONVENTIONS FOR TRANSCRIPTION OF LANGUAGE SAMPLE

- (1) All speech by the child and all speech to the child or within the child's hearing is fully transcribed on paper divided by a vertical line. Utterances by the adult appears on the left and child utterances appear on the right. Each person is identified by his or her initial. Information about the situational context appears on the left and is enclosed in parentheses (Bloom & Lahey, 1978, p. 600).

(M takes dog out of barn)

M: What is this?/

dog/

- (2) An action or event that occurs simultaneously with the child's utterance appears on the same line with that utterance (Bloom & Lahey, p. 600).

(C walking pig to barn)

walk/

- (3) When an utterance precedes or follows an action or event, the utterance appears on the preceding or succeeding line (Bloom & Lahey, p. 600).

(C pushes toys off table)

no more toys/

(C picks up another toy)

more/

- (4) Note the differential use of verb tenses in describing the situations: progressive for simultaneous action, simple present for actions or events that precede or follow an utterance (Bloom & Lahey, p. 600).
- (5) For situational information accompanying utterances by the adult, use the same verb tense conventions; however, utterances and descriptions can succeed one another on different lines since there is rarely enough space to

put both on the same line (Bloom & Lahey, p. 600).

(M reaching in barn)

M: What do you think I have?/

(M pulls out sheep)

M: I think that's a sheep/

- (6) Utterances that immediately succeed each other with no change in situation should follow each other on the same line (Bloom & Lahey, p. 601).

(C reaching for chicken) more/ more/more chicken/

- (7) For adult and child utterances, a (/) is used to mark the utterance boundary (Bloom & Lahey, p. 601).

- (8) Adult questions are indicated by question marks. Wh-questions by the child are indicated by question marks; however, other types of questions that appear to have a rising intonation are marked by a rising arrow (↗) instead of a question mark. A slash should also be used to mark the boundary (Bloom & Lahey, p. 601).

(C looking in boat) where is the farmer?/

(C turns boat upside down)

farmer all gone /

- (9) A pause within an utterance is indicated by a (.) (Bloom & Lahey, p. 602).

(C trying to put the

animals in the barn)

put . farmer here/

- (10) A curving arrow is used when there is some kind of utterance boundary, yet the utterance sounds unfinished, such as when the child is counting or listing (Bloom & Lahey, p. 602).

one ↗ /

two ↗ /

three ↗ /

(11) Names are capitalized. Initial letter of child utterance is not. Initial letter of adult utterance may be (Bloom & Lahey, p. 602).

(12) When a child or adult interrupts his/her own utterance, this abrupt interruption is indicated by using a (____) line (Bloom & Lahey, p. 603).

M: Do you want to ____/

(Child drops horse)

(13) When a child or adult interrupts his/her own utterance to correct it, a self correct symbol (s/c) is used (Bloom & Lahey, p. 603).

M: Those are your s/c my toys/

(14) An unintelligible utterance or portion of an utterance is indicated by three dashes (---). If possible, a phonetic transcription is used instead (Bloom & Lahey, p. 603).

(toys falling off table)

give me the /---/ farmer/

(15) When a child or adult repeats his/her own utterance completely and exactly, an (X) is used to show the repetition (Bloom & Lahey, p. 603).

(C falling out of chair)

M: Be careful/X/

(16) When an adult repeats a child's utterance, an equal sign (=) is used to show the repetition. When a child repeats an adult's utterance, however, the child's utterance is written in full, even if the repetition is exact (Bloom & lahey, p. 603).

two cows/

M: =/ Where is the other one?/

APPENDIX D
DEFINITION OF PRAGMATIC CATEGORIES

Initiations.

Placed in the initiation category were child utterances that did not complement the adult's previous utterance by affirming/negating, providing information, agreeing/denying, complying, qualifying, or commenting. Thus, initiations were utterances that originated with the child's own intention and for purposes of this research took the form of requests and comments. Below is a definition and example of each of the initiation categories.

Requests. Utterances that solicited information, action, permission, objects/people, acknowledgments, or affirmation/negation were coded as requests. A description and example of each request category is provided below.

- (1) Request information. Wh-questions that solicited information about the identity, location, state, time, activity, or property of an object, event, or situation were coded as request information. For example, the child's utterance Where's bear? was coded in this category (Dore, 1977).
- (2) Request action. Utterances that solicited a listener to perform, not to perform, or cease to perform an action were coded in this category. For example, the child's utterance Give me the boat was coded as request action (Dore, 1977).
- (3) Request permission. Placed in this category were utterances that solicited a listener to grant permission for the speaker to perform an action. For example, the child's utterance Can I go? was coded in this category (Dore, 1977).
- (4) Request object/people. Utterances that directly or indirectly solicited the

listener to give the speaker an object or to produce a person was coded as request object/people. For example, the child's utterances Give me the tractor or I want mama were coded in this category.

- (5) Request acknowledgment. Utterances that solicited the listener's acknowledgment to allow the speaker to continue speaking were coded in this category. For example, the child's utterance You know what I did yesterday was coded as request acknowledgement (Dore, 1977).
- (6) Request affirmation/negation. Yes-no questions that solicited affirmation or negation of the propositional content of the speaker's utterance were coded in this category. For example, the child's utterance Is that a farmer? was coded as request affirmation/negation (Dore, 1977).

Comment initiations. Coded in this category were utterances that originated with the child's own intention and took the form of (1) comment on activity or state, (2) comment on labels, and (3) comment on general information.

- (7) Comment on activity or state. Comments describing the child's or adult's ongoing activity or state, or activity or state of an object that the child or adult was manipulating and/or attending to were coded in this category. The child's utterance He's walking in the barn produced as the child was walking the animal to the barn was coded as comment on activity or state (Van Kleeck & Carpenter, 1980).
- (8) Comment on labels. Coded in this category were comments which served to name or label an object, person, event, or situation that the child or adult was manipulating and/or attending to. The child's utterance His name is Paddington was coded as comment on labels.
- (9) Comment on general information. Placed in this category were utterances which gave information but did not directly comment on ongoing activities, states, objects, persons, events or situations that the child or adult was

manipulating and/or attending to. The child's utterance My brother had a birthday yesterday was coded as comment on general information (Van Kleeck & Carpenter, 1980).

- (10) Noncodeable. Coded in this category were utterances that were incomprehensible from the standpoint of expressing a full proposition that could be captured by this analytic scheme. Included in this category were conversational devices such as greetings, farewells, polite forms, conversational fillers such as oh or what, and attention getters such as hey or look (Dore, 1977).

Responses

The response category consisted of child utterances that did not originate as a result of the child's own intention, but rather, originated as a result of some previous utterance spoken by the adult. Responses took the following form:

- (11) Yes-no responses. Utterances coded in this category complemented yes-no questions by affirming, negating, or otherwise answering them. In a sequence where the adult said Is the boat broken? and the child responded No, it's not, the child's utterance was coded as yes-no response (Dore, 1977).
- (12) Wh- responses. Placed in this category were utterances that complemented wh-questions by providing the requested information about the identity, state, location, activity, etc. In a sequence where the adult said Where's John? and the child responded He's under the table, the child's utterance was coded as wh-response (Dore, 1977).
- (13) Agreements. Coded in this category were utterances that complemented previous utterances by agreeing with or denying the content. In a sequence where the adult said That's a dog and the child responded That's not a dog, the child's utterance was coded as agreement (Dore, 1977).
- (14) Compliances. Placed in this category were utterances that complemented

requests by complying with or refusing to comply with them. In a sequence where the adult said Why don't we put the animals up now and the child responded I don't want to, the child's utterance was coded as compliance (Dore, 1977).

- (15) Qualifications. Coded in this category were responses that complemented the adult's previous utterances by qualifying, clarifying, or otherwise changing the content. In a sequence where the adult said The horse has a broken tail and the child responded But I didn't do it, the child's utterance was coded as qualification (Dore, 1977).

- (16) Comment responses. Placed in this category were utterances that complemented the adult's previous utterances via the use of comments. The child's utterance may take the form of comments on state, identity, activity, location, etc. In a sequence where the adult said Here is a boat and the child responded I like boats the child's utterance was coded as comment response.

Appropriateness of the response. Child responses were judged by the degree to which they met the demands imposed by the adult's previous utterance. The following categories were used to capture this dimension:

- (17) Adequate. Coded in this category were child responses that extended, met the demands of, or elaborated on the adult's previous utterance. In a sequence where the adult said What's on your shoe? and the child responded Dirt, the child's response was coded as adequate (Blank & Franklin, 1980).
- (18) Inadequate. Child responses that were invalid, irrelevant, or insufficient to meet the constraints established by the adult's utterance were coded in this category. In a sequence where the adult said What's on your shoe? and the child responded I have new shoes, the child's response was coded as inadequate (Blank & Franklin, 1980).

- (19) No response. If no answer was offered by the child in response to the adult's previous utterances, this behavior was coded as no response (Blank & Franklin, 1980).
- (20) Ambiguous. Child responses that were unclear or ambiguous and therefore could not be interpreted as either adequate or inadequate was coded in this category. In a sequence where the adult said What's on your shoe? and the child responded I don't wanna tell you, the child's response was coded as ambiguous (Blank & Franklin, 1980).

APPENDIX E

EXAMPLES OF DIALOGUE BETWEEN FAS CHILDREN AND THE INVESTIGATOR

Adult Utterances

Child Utterances

Example 1

What did you have for breakfast today?/

I didn't have some breakfast/

Why didn't you have breakfast?/

I gotta go to grandma's and
think/

Did you have cereal?/

daddy left my breakfast in
the car/

So you didn't have breakfast /

yes/

Well, what did you have for breakfast?/

I didn't have some breakfast/

Example 2

They're working/

yeah/

What are they working on?/

they're working at the
poopsie/

I don't know what you mean/

What's happening here?/

they taking hootie/

APPENDIX E (continued)

Adult UtterancesChild UtterancesExample 2 (continued)

They're talking what /

hootie/

Look at the lady/

she's ooniing/

I don't know that word/

Where is the lady going?/

for a nunnie walk/

Example 3

What does your horse do?/

Know what my horse does/

he does that (child demon-
strated action)/ That's why
he wants to do that/ and I
say/you cut that out/ and my
horse knocked the fence
down/ and I saw that boom/

Oh/

Biographical Note

Name: Marilyn Ann Seibert Hamilton
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Place of Birth: New Roads, Louisiana

Parentage:

Father - Frank Seibert

Mother - Elvira Dejan Seibert

Secondary Education:

<u>Institution</u>	<u>Degree</u>	<u>Date</u>
Rosenwald High School		1962
Southern University	B.A.	1966
University of Washington	M.S.P.A.	1971
University of Washington	Ph.D.	1981