The Relationship Between Revision Behaviors and Syntax in the Spoken Narratives of Language-Impaired and Normally Developing School-Aged Children

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THE RELATIONSHIP BETWEEN REVISION BEHAVIORS AND SYNTAX IN THE
SPOKEN NARRATIVES OF LANGUAGE-IMPAIRED AND NORMALLY
DEVELOPING SCHOOL-AGED CHILDREN

by

Marilyn Cleckler

A thesis submitted in partial fulfillment
of the requirements for the degree
of
MASTER OF SCIENCE
In
Communicative Disorders
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ABSTRACT

The Relationship Between Revision Behaviors and Syntax in the Spoken Narratives of Language-Impaired and Normally Developing School-Aged Children

by

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Utah State University, 1990

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Department: Communicative Disorders

The relationship between spontaneous revision behaviors and quantitatively measured syntax skills for language-impaired and normally developing school-aged children was investigated. Differences in revision behaviors and syntactic behaviors between the two groups of children and across three age levels were also examined. Narratives were obtained from 39 language-impaired and 39 normal-language children, aged 8 through 10 years. Correlations between spontaneous revision behavior scores and syntax scores were low to moderate. The revision behavior mean scores were not significantly different between the two groups of children. Mean
syntax scores were higher for the NL children and did discriminate between LI and NL children. Among the differing age levels, spontaneous revision behavior mean scores were not found to differ significantly except for 10-year-olds, who produced statistically significantly fewer substitutions and significantly more expansions than 9-year-olds. Finally, with respect to syntax scores, 10-year-olds produced statistically significantly more words per T unit than 8- and 9-year-olds and mean DSS was significantly higher for 10-year-olds as compared to 9-year-olds.
Language is shared among all speakers who participate in the same social system. Knowledge of the rules of language and skill in applying them is part of communicative competence (Hymes, 1971). The structure and meaning of a language must be acquired by all children if they are to communicate within their social systems. They must also learn to become competent interactors in their conversations. To succeed in transmitting information to their listeners, children must utilize their most effective communication strategies. All communication, however, occasionally breaks down because the speaker makes an error or perceives that he or she has made an error in conveying a message or because the listener fails to understand a message. When a breakdown occurs, communication may then be repaired (or "revised") if the speaker so chooses. When a speaker revises a message, the initial breakdown and the revised message provide additional information as to his or her speaking skills.

Revision behaviors are important in understanding a child's communicative competence. Different, conflicting explanations (Kasermann & Foppa, 1981; Liles & Purcell, 1987) have been provided to account for revisions of speech. One explanation is that revision behaviors indicate the child's awareness and monitoring of his or her speech errors (Clark &
Andersen, 1979; Evans, 1985; Laver, 1973; MacLachlan & Chapman, 1988). Revisions, according to DeJoy (1983), "signal points at which the speaker monitors past linguistic output or retrieves elements for upcoming output" (p. 1). The awareness of one's speech errors is one aspect of language awareness and is one of several metalinguistic skills that develop during the preschool and early elementary-school grades. The term "metalinguistic skills" in this context "refers to the language user's ability to evaluate his or her language as an object, altering those utterances that are self-judged to be inaccurate or incomplete in some way" (Liles & Purcell, 1987, p. 186).

A second explanation is that the occurrence of revision behaviors frequently reflects the fact that a speech error has just occurred (Evans, 1985; Laver, 1973; MacLachlan & Chapman, 1988). Certainly there are more opportunities to self-repair when more speech errors are produced. An error, or an "incorrect program" (Laver, 1973), is one "which in some detail distorts the communication of the speaker's idea" (p. 138). Sabin, Clemmer, O'Connell, and Kowal (1979) indicated that self-repairs (or revisions) represent insufficient planning and organization of speech, which led to the repairs for the children in their study.

A third explanation is that the occurrence of revision behaviors indicates the degree of development of necessary primary linguistic
abilities in phonology (sounds), syntax (rules of word structure and order), semantics (meanings), and pragmatics (language use). Kasermann and Foppa (1981) stated that the occurrence of revision behaviors indicates "the child's awareness of correct (in comparison with the adult model) forms" (p. 78).

As previously stated, syntactic skill is one of the linguistic abilities needed to communicate within one's social system. Syntax involves the rules governing the order and combination of morphemes (word units) in the formation of sentences and the relationships among the elements within a sentence or between two or more sentences. (Davis, 1988, p. 298)

Revisions occur in the speech of all children but differ by type in children with linguistic deficits (e.g., deficits in syntax) (Brinton, Fujiki, & Sonnenberg, 1988; Gallagher & Darnton, 1978; Liles & Purcell, 1987) as compared to normal-language children. Since language-delayed and normal-language children differ in the types of revisions they produce, the relationship between the frequency of specific types of revision behaviors and syntactic skills needs to be clarified.

Although understanding the nature of the relationship between syntactic skills and revisions of speech is needed, very few studies exist in which authors have examined revision behaviors in the speech of children.
While authors of a few studies have examined the revision behaviors in the speech of normal-language children (i.e., children who are developing syntactic skills appropriately), even fewer studies exist in which authors have examined the revision behaviors of language-impaired children (i.e., children delayed in their syntactic skill development).

In those studies in which revision behaviors were investigated, the relationship between revision behaviors and syntax was only inferred. This inference was made based on the findings of studies in which three independent variables were investigated: First, revision behaviors have been reported to vary in type and frequency with age (Rogers, 1978; DeJoy, 1983; Evans, 1985; Brinton, Fujiki, Loeb, & Winkler, 1986; Clark & Andersen, 1986; Brinton et al., 1988). Second, revision behaviors have been reported to vary in type and frequency based on the developmental language stages of the children (Gallagher, 1977; Gallagher & Darnton, 1978; Konefal & Fokes, 1984; Tomasello, Farrar, & Dines, 1984). Third, revisions have been reported to vary by language-group membership (i.e., language-impaired or normal-language) (Liles & Purcell, 1987; MacLachlan & Chapman, 1988). The findings from these studies indicate that revision behaviors are developmental in nature and their presence is an indication of linguistic development. No study was located in which the authors have directly
examined the relationship between quantitatively measured syntactic skills and frequency of specific types of revision behaviors in the speech of children, nor have authors examined this relationship in children known to differ in their linguistic skills (i.e., language-impaired as compared to normal-language children).

**Types of Revisions**

Revision behavior (or "repair") is one of four underlying processes that influences utterance productions. These processes include planning, execution, monitoring, and repair (Evans, 1985). Children’s revision behaviors may be elicited or spontaneously produced. Elicited revisions normally occur when a "listener indicates that a speaker’s message has not been understood or cannot be interpreted without clarification" (Brinton et al., 1986, p. 75). The production of elicited revisions, then, is not initiated by the child. Because children do not initiate elicited revisions, only execution and repair processes may be observed by listeners. The planning of speech and monitoring of speech errors may occur, but information about their occurrence cannot be inferred from observations when children’s repairs are elicited.

Spontaneous revisions occur when a child alters utterances "that are
self-judged to be inaccurate or incomplete in some way" (Liles & Purcell, 1987, p. 186). In revisions that occur spontaneously, all four processes can be observed.

Elicited Revisions

Gallagher (1977) studied normal-language children between Brown's (1973) Stages I-III. Each stage is associated with distinct language development achievements and can be said to be qualitatively different from all other stages (Morehead & Ingram, 1973; Morehead & Morehead, 1974). Gallagher (1977) questioned whether the frequencies of three types of revisions (i.e., repetition, revision, and no response) in a child's speech varies across Stages I-III. (Note that when adults attempt to elicit revisions from children, "no response" is a plausible category because children may provide no speech to these attempts.) Gallagher (1977) reported that revision categories for revisions elicited by the experimenter (i.e., by asking "What?") vary significantly with a child's language stage. She concluded that "revision behaviors are systematic and change [by type] as the child's knowledge of language structure changes" (p. 316).

Gallagher and Darnton (1978) then studied language-impaired children at Brown's (1973) Stages I-III using the same revision categories. Unlike
the normal-language children in the previous study, these language-impaired children's revisions were unsystematic and undifferentiated by type among
the three language levels. These authors concluded that the
language-impaired child "meets conversational demands in a qualitatively
different manner from the normal child" (p. 134).

Brinton et al. (1988) compared the elicited revision behaviors of
language-impaired children, chronologically age-matched children, and
language age-matched children. The language-impaired children differed
from the other two groups of children in the frequency of types of revisions
(i.e., repetition, revision, addition, cue, and inappropriate) that they
provided and in the quality of their responses.

Results of these three studies indicate that populations of children
believed to differ in skills for language based on group membership (i.e.,
language-impaired versus normal-language) or language stages (Brown,
1973) differ in the way that they use revisions in their speech.

Spontaneous Revisions

Authors of three studies assessed spontaneous revision behaviors in
children's speech. Liles and Purcell (1987) compared the revisions in the
narrative retellings of language-impaired and normal-language children.
The normal-language children were reported to be "more successful" at revising their inaccurate statements than were the language-impaired children. The two groups of children did not differ, however, in their tendency to repair their grammatical errors. Frequency of different types of revisions was not reported in this study, nor was the relationship between types of revision behaviors and syntax skills investigated.

MacLachlan and Chapman (1988) investigated the communication breakdowns and spontaneous revision behaviors of language-impaired children, age-matched children, and children matched for linguistic level under two speech-sampling conditions: conversation and narration. These authors coded communication breakdowns under the categories of stalls, repairs (syntactic, semantic, or phonological), abandoned utterances, and other. The authors reported that while the language-impaired and normal-language children were similar in their relative frequencies of types of repairs, the language-impaired children produced significantly more breakdowns in speaking that needed to be repaired in their narrations than did the normal-language children.

Kirchner and Prutting (1987) investigated the spontaneous repetitions, including expanded repetitions and partial replacements (i.e., two specific types of revision behaviors), of four language-impaired
children and four children matched for linguistic level. For both groups, the children's language was observed in a playroom setting to examine the two potential functions of repetition:

repetition as compensation for linguistic deficits and repetition as a context for practice, which contributes both to the acquisition of language structure and to the development of verbal skill. (Kirchner & Prutting, 1987, p. 147)

Based on the findings that both groups of children "demonstrated high proportions of spontaneous repetition in their speech" (p. 147) and that there were "no differences in patterns of self-repetition" (p. 163), the authors concluded that there was "little evidence that the profiles of repetition were related to language stage" (p. 158). While revision behaviors were examined across language stages for both normal and for language-impaired children, again the association between frequency of specific types of revision behaviors and quantitatively measured syntax skills was not investigated.

**Frequency of Types of Revisions**

Authors of these six studies all concluded that the frequencies of revisions vary by type. The types of revisions were categorized, however, using different definitions for revision behaviors in each of the studies.
Also, common categories were given different names by these authors. For example, the category of substitution, as defined by DeJoy (1983), has also been called revision (Gallagher, 1977; Gallagher & Darnton, 1978; Tomasello et al., 1984, Brinton et al., 1986, Brinton et al. 1988) and syntactic correction (Evans, 1985). Since different categories were used to describe children's revisions, different conclusions were reached for each of the five studies reviewed. Additionally, some categories were "too infrequent to warrant analysis" (MacLachlan & Chapman, 1988, p. 6).

Of the categories used, variations of three major types were frequently used: substitutions, expansions, and incomplete words. Also, these three categories were most often found to describe revisions that occur with a high frequency in children's speech. For example, 86% of the total revisions produced by children aged 3 1/2 and 5 years were accounted for by these three categories collectively (DeJoy, 1983). Consequently, the categories of expansions, substitutions, and incomplete words will be used in the present study. Brinton and Fujiki (1989) indicated that adjustment-of-content self-repairs (i.e., expansions) require more self-monitoring and greater adjustment to the listener than correction self-repairs (i.e., substitutions). And both of these types of self-repairs require more self-monitoring and greater adjustment to the listener than
covert self-repairs (i.e., incomplete words).

Quantitative Syntax Measures

In none of the studies described previously were the syntactic skills of the subjects quantitatively measured. Such a measure is important for determining the relationship between revision behaviors and syntax. Four quantitative measures of syntax will be used in the present study: the Developmental Sentence Score (DSS), the number of words per clause, number of words per T unit, and number of clauses per T unit.

Developmental Sentence Score

Currently, the Developmental Sentence Analysis procedure (Lee, 1974) is the only "language analysis system that quantifies grammatical structures according to developmental difficulty" (Hansen, 1980, p. 20). When analyzing the syntax skills within each sentence using the DSS, eight categories of grammatical forms (i.e., indefinite pronouns, personal pronouns, main verbs, secondary verbs, negatives, conjunctions, interrogative reversals, and wh-questions) are scored using a weighted scoring system (Lee, 1974; Lively, 1984) (See Appendix A for a sample analysis.) The weighted scoring system involves assigning scores to
grammatical forms across a range of points (from 1 point to 8 points for most grammatical categories) based on sophistication and relative difficulty of the grammatical form. For example, an early developing verb such as “is” receives a score of 1 within the main verb category. A passive verb construction such as “was eaten,” however, receives a score of 7 within the main verb category. These weighted scores, then, reflect a progressive sequence of grammatical growth for each category. An additional point, a sentence point, is also given for each sentence that meets adult English standards as judged within a society’s local norms and as reflected in the language of a child’s adult caretakers.

After scoring individual sentences, the Developmental Sentence Score (DSS) is obtained by summing the individual sentence scores and then dividing by the total number of sentences for a mean DSS score. Although the DSS was designed to score individual sentences, the present study will assign DSS scores by T units instead of by sentences. Utterances were segmented into T units by Strong (1989) for the present study due to the “arbitrariness” (Hunt, 1965, p. 8) of using the sentence as an oral segmentation unit.
Words Per Clause, Words Per T-Unit, and Clauses Per T unit

Evidence for the validity of using words per clause (i.e., total number of words divided by total number of clauses, words per T unit, and clauses per T unit) as indices of syntactic behavior is provided by data from Hunt (1965) and Loban (1976). Hunt’s definition of a clause will be used for the present study: “a structure with a subject and a finite verb (a verb with a tense marker)” (p. 15). Hunt (1965) and Loban (1976) investigated these three measures in children’s speech across age levels. Both authors indicated that the children’s average number of words per clause, words per T unit, and clauses per T unit increases with increases in age level.

Problem Statement

In summary, very few studies exist in which revision behaviors in the speech of language-impaired and normal-language children have been examined. In the studies that do exist, the association between revision behaviors and language skills is inferred based on ages of the children, developmental language stages of children, and language-group membership (i.e., impaired language or normal language) and is not directly investigated. The present study will provide information regarding the association between the frequency of specific types of revision behaviors and
quantitative measures of syntactic skills in the narrations of both language-impaired and normal-language children.

Research Hypotheses

The differences in revision behaviors and syntactic behaviors between the two groups of children and across three age levels will be investigated as well. The present study will use existing data (narrations), which were collected, by Strong (1989).

The specific hypotheses formulated to guide this study were:

1. There will be a moderate-to-high correlation (.60 or greater) between the spontaneous revision behavior scores and syntax scores for both groups of children combined and for each group separately.

2. The mean spontaneous revision behavior scores of language-impaired children will be lower than the mean scores for normal-language school-aged children.

3. Mean syntax scores of language-impaired children will be lower than those for normally developing school-aged children.

4. The mean spontaneous revision behavior scores will differ among the age levels.

5. The mean syntax scores will be higher for the higher age levels for
the two groups of children combined and for each group separately.

6. Means will not differ according to group membership and age level.
METHOD

Subjects

The target populations were language-impaired (LI) children and normal-language (NL) children, 8 through 10 years of age, enrolled in a school district in northern Utah.

LI Children

The criteria for selection of the children with language impairment were those used by the Utah State Office of Education (1981). That is, children considered to be language impaired had performed at least one standard deviation below the mean on two or more measures of oral expression or listening comprehension in one or more of the following areas: morphology, syntax, and semantics. The children had been identified by a communicative-disorders specialist as LI and were enrolled in a language-remediation program.

In addition, the LI children had IQ scores of 85 or better on a standardized intelligence test (see Strong, 1989). They also were not classified as intellectually handicapped, emotionally disturbed, or behaviorally disordered, yet they may have been receiving support services from a learning-disabilities or resource-room specialist. They had no
history or evidence of organic disorders and had normal vision and speech intelligibility. The language-impairment diagnosis was not attributable to cultural differences. Subjects were English speakers from monolingual homes. Each child had passed a hearing screening no more than 6 months prior to the time of the study.

Forty-four children met the above qualifications and were thus identified with mild, moderate, or severe language impairment: fourteen 8-year-olds, fifteen 9-year-olds, and fifteen 10-year-olds. All were able to generate enough sentences to produce a usable oral language sample.

**NL Children**

The NL-accessible population was 8- to 10-year-old children in the same school district who had normal language, vision, hearing, and intelligence and average achievement scores.

**Samples**

The selection of samples was contingent on obtaining parental permission. All 39 children receiving parental permission (of the 44 accessible LI children), 13 at each age level, were included in the study. Although technically an accessible population, the group is referred to hereinafter as the LI sample.
Thirty-nine NL children were then randomly selected, one from each classroom in which an LI child was enrolled except in four cases where LI children had been retained. Since age, not grade, was the relevant variable, in those four cases the NL subjects were randomly selected from classrooms containing children of the same age as the LI children. Each NL child was also selected to be the same gender and within 6 months of the age of the LI counterpart.

**Procedures**

Strong (1989) met with each of the 78 children four times. The first session was used to administer a standardized test of oral language, the *Peabody Picture Vocabulary Test, Form L, Revised (PPVT-R)* (Dunn & Dunn, 1981), to estimate oral language abilities and to familiarize each child with the data-collection procedures. The three data-collection sessions were all conducted at 2-week intervals following the first session and required approximately 15 minutes each. A total of 312 samples of discourse were collected, 4 (including the practice sample) from each of the 78 children.
Data and Instrumentation

Narrative Language Sample

The samples of oral language collected were generated by having the children retell stories rather than create their own stories for two reasons. First, narrative retelling allows for the analysis of "multileveled processes [produced within the retellings] while controlling for content [since the same stories are told] across subjects" (Liles & Purcell, 1987, p. 188). Secondly, the retelling task is an easier one for the child who is shy, unsure of the testing situation, or having difficulty using the language (Mates & Omark, 1984). Because it was important to the researcher that each child produce enough language to be analyzed, giving all children the same stimulus ideas ensured that each child had something to talk about.

Stimulus materials. The narrative-language samples were elicited using a slide-tape presentation based on four stories written by Strong (1989) from four picture (wordless) story books: A Boy, A Dog and a Frog (Mayer, 1967), Frog, Where Are You? (Mayer, 1969), Frog Goes to Dinner (Mayer, 1974), and One Frog Too Many (Mayer & Mayer, 1975). These stories were written to be as equal as possible on several variables, including number of slides, sentences, episodes, main characters, and percentages of five types of cohesive ties (see Strong, 1989).
The practice story, *Frog Goes to Dinner* (Mayer, 1974), was used to familiarize the children with the task. The remaining three stories were presented to the children in counterbalanced order, to control for a possible order effect. For the present study, only the children's narrations for *One Frog Too Many* (Mayer & Mayer, 1975) were analyzed, since it was observed that the children produced more revisions in this story than they produced in the other three stories (See Appendix C for narrative presented to the children). In this story, the main character had two frogs, a baby frog and a big frog. On the retelling, the children often revised their stories to clearly specify which frog they were referring to or to correct themselves if they initially referred to the wrong one. Because the stories were retold in counterbalanced order, one-third of the children retold this story at testing Time 1, one third at Time 2, and one third at Time 3. Analyses conducted by Strong (1989) indicated that there was no statistically significant testing-order main effect.

The stories were narrated by a professional narrator (male). They were presented using a rear-projection slide-tape system to control light level, and the slides and tape were synchronized so the stories were automatically presented to each child. To control for auditory distractions and to enhance treatment fidelity, headphones were used by all children as
they listened to the stories.

**Task presentation.** Each child was left alone to view and hear the story. To reduce examiner expectancy effects, standard instructions were given to each child prior to story viewing and story retelling. To enhance treatment fidelity, the listening behavior of 80% of the subjects was observed (all were observed to be attending to the stories). The children’s stories were audiotaped with a directional microphone placed no more than 12 inches from the child on a table.

**Transcription and segmentation.** Once all samples were collected, each child’s audiotape was given an identifying (ID) number to control for possible coder expectancy effects and to insure confidentiality. The tapes were then transcribed in random order by Strong (1989) using standard English spelling, and transcription accuracy was checked following the transcription. All repetitions, substitutions, pauses, and interjections were transcribed as well. A trained transcriber then listened to the tapes for transcription accuracy. When differences occurred, tapes were replayed until agreement was reached. When agreement was not reached on a portion of the sample, that portion was considered to be unintelligible and was not included in the analysis. The children’s revision behaviors were then marked with parentheses by the researcher for the present study so that they could
be coded for revision type.

Following the transcription and agreement checks, utterances were then segmented into Hunt's (1965) minimal terminable units (T units) or "one main clause with all the subordinate clauses attached to it" (p. 20) by Strong (1989) and were checked for agreement by a trained coder. Once 97% agreement was reached on independent transcript segmentations, Strong (1989) proceeded with segmentation. During segmentation, intercoder agreement was calculated on one randomly selected transcript from among every 10 using point-to-point rater agreement checks (McReynolds & Kearns, 1983), and disagreements were resolved. Thirty-two intercoder agreement checks were conducted; the average agreement was 98.7%. For two of the coder checks, agreement fell below 90%, the stipulated criterion for minimum agreement. For these two instances, segmentation rules were reviewed, and another randomly selected transcript from among the 10 was checked with 100% coder agreement.

In addition, after every 30th transcript, Strong (1989) resegmented one of the 30, randomly selected, to ensure that application for the criteria had not shifted. Average intracoder agreement for these checks was 99%.
Coding of Revision Behaviors and Syntax

Revision behaviors. The three categories used in the present study were (a) substitution (e.g., "I like ice cream - peanut butter"), (b) expansion (e.g., it's in my pocket - right pocket), and (c) incomplete words (e.g., "Then the fro- boy fell down"), which is actually another type of substitution because whole words are replacing incompletely produced words. (See Appendix B for additional examples of revision behaviors and DeJoy's, 1983, definitions for scoring revisions.) These three categories were used because they are the most frequently occurring types of revision behaviors in the speech of children (DeJoy, 1983). The three categories were scored as defined by DeJoy (1983).

The absolute frequencies of each of the three revision types and the total number of revisions per narration were calculated and then entered on a Data Entry Instrument for each subject. Because the narratives produced by both groups of children varied in length and in the number of revision behaviors, scores were converted to percentages--e.g., number of expansions divided by total number of revisions used \( \times 100 \) = percentage of revisions that were expansions.

The reliability of the revision scores was checked in the following manner. The T units for each narration were first counted and then marked.
at the midpoint to separate the story into two halves. Whenever there was an odd number of T units, the extra T unit was included in the second half. Revision scores were entered on the Data Entry Instrument for each half and for the total.

**Developmental sentence scores.** In addition to the analysis of revision behaviors, each sample was scored for syntactic maturity according to the Developmental Sentence Scoring (DSS) procedure (Lee, 1974). Although the children for this study were older than those described by the normative data, a ceiling effect was not anticipated because maximum DSS values are theoretically unlimited. Additionally, a leveling off of development for syntactic skills was not found for the standardization group (Lee, 1974, p. 134-135). Furthermore, it was expected that the DSS scores of the language-impaired and normal-language children in this study would provide a quantitative measure of any differences in syntactic skills between the two groups of children.

A DSS score was calculated from each child's story. If the child did not produce 50 analyzable T units, the available T units were analyzed and total points were divided by the number of T units produced to determine the mean DSS value. Again, scores were entered on the Data Entry Instrument for each half and for the total.
Words per clause, words per T unit, and clauses per T unit. The number of words and the number of clauses were counted by Strong (1989) using the procedures specified in Hunt (1965), and the number of words per clause, words per T unit, and clauses per T unit were computed. Scores were again entered on the Data Entry Instrument for each half and for the total.

Inter- and Intracoder Agreement

Each of the 78 narratives was marked by the researcher for the presence of revisions. A second coder then independently marked one randomly selected narration from among every 10 to check for agreement. The percentage of agreement between coders was calculated by dividing the total number of agreements for words or segments of words in which revisions occurred by the total number of agreements and disagreements for words or segments of words in which revisions occurred times 100. Intercoder agreement for presence of revisions was 100% based on a check of 8 randomly selected narrations.

After the presence of revisions was marked, scoring for type of revisions began, using DeJoy’s (1983) definitions for substitutions, expansions, and incomplete words. Before coding began, the two coders
trained together on the first 10 narratives, resolving all disagreements, to
establish how DeJoy's (1983) definitions were to be applied to these
particular children's narratives. Intercoder agreement checks were then
conducted on the next 40 narrations. The average percentage of agreement
for these 40 narrations was 92%, based on the same formula used for
marking the presence of revisions. Note that this formula includes the
revisions that did not fall into any of the three scored revision types (i.e.,
substitutions, expansions, and incomplete words). Revisions that were not
scored included the repetitions found in the children's stories and also
included words for which agreement for scoring could not be reached. For
example, it was unclear whether "frog", produced in the T unit "and (the frog
didn't like). -the bigger frog. want (frog). -ride frog with him", was a
substitution of "bigger frog" or merely a repetition of part of what had
already been said. Following intercoder agreement checks on the 40
narrations, three random checks (1/10) were conducted on the last 28
narratives (i.e., narratives 50 through 78). Average percentage of agreement
for these 3 narratives was 95%.

Intracoder agreement was also checked. After scoring every 30th
narration, the researcher rescored one randomly selected narration of the
30 without benefit of the first coding sheet to assure that application of
the rules for scoring revisions had not shifted. Average intracoder percentage of agreement for the three narrations was 100%.

In addition to the analysis of revision behaviors, each narration was scored for syntactic maturity using the Developmental Sentence Scoring (DSS) procedure (Lee, 1974; Lively, 1984) and by counting numbers of words and numbers of clauses. The researcher calculated a DSS score for each narration and for the two halves of each narration. The second coder, an instructor skilled in scoring the DSS, then independently scored 1 of every 10 narratives, randomly selected, to check for agreement. The same formula described previously was used to calculate the percentage of intercoder agreement, that is, the total number of agreements for words that received a DSS score divided by the total number of words receiving a DSS score (the sum of agreements and disagreements) times 100. Eight of the narrations were checked for agreement. The average percentage of agreement for these narrations was 97%. Intracoder agreement checks were also conducted for DSS scores for every 30th narration. Average intracoder percentage of agreement was 100% for the 3 narrations that were checked.

Inter- and intracoder agreement checks for number of words and number of clauses per narration were calculated. For number of words, average intercoder agreement was 99%, and intracoder agreement was 100%.
For number of clauses, average intercoder agreement was 98%, and intracoder agreement was 100%.

Reliability of Scores

Estimation of the reliability of the revision behavior scores and syntax scores was necessary for meaningful interpretation of the study results -- that is, if scores are not reliable, true differences between means tend to be obscured, and correlation coefficients may be attenuated. A split-half coefficient was obtained (i.e., reliability was estimated from analysis of the internal consistency of scores) and was corrected with the Spearman-Brown prophecy formula (Cangelosi, 1982).

For clinical assessment purposes, a reliability coefficient of $r = 0.80$ is considered minimally adequate. For research purposes, somewhat less rigorous standards are usually applied (Nunnally, 1978). Although the low reliability of scores can obscure true relationships, coefficients of .70 are, nevertheless, typically taken to be of sufficient magnitude for correlational studies (Nunnally, 1978).

The reliability coefficients were computed with LI and NL subjects separately and pooled. Only the coefficients for DSS for the subjects pooled and for the NL subjects were of acceptable magnitude for research purposes.
Very few of the reliability coefficients for the remaining seven dependent measures (i.e., percentage of substitutions, expansions and incomplete words, total revisions, words per T unit, words per clause, and clauses per T unit) were at or near the .70 research criterion, most were so low that results based on them are questionable.

Reliability tends to be a function of (a) test length (i.e., measures of behaviors that occur frequently will have higher reliability coefficients than measures of behaviors that occur infrequently) and (b) the standard deviation of the scores (i.e., scores with greater variability will have higher reliability coefficients than scores with lesser variability) (Nunnally, 1978). For this study, all revision behaviors occurred relatively infrequently, and for syntax scores standard deviations were quite small relative to the group means. It is not surprising, then, that the reliability coefficients were low.

**Analysis**

In this analysis, the independent variables were (a) group membership, i.e., language-impaired (LI) or normal-language (NL), and (b) age-level, i.e., 8-, 9-, and 10-year-olds. The eight dependent variables were (a) percentages of substitutions, (b) percentages of expansions, (c)
percentages of incomplete words, (d) total number of revisions, (e) DSS scores, (f) number of words per clause, (g) number of words per T unit, and (h) number of clauses per T unit.

Hypothesis One

Pearson product-moment correlation coefficients among all dependent measures were computed for the subjects pooled (LI and NL) and for each group separately, and correlation matrices were constructed. Coefficients of determination were also computed to determine the proportion of variance that scores on each variable have in common.

Hypotheses Two, Three, Four, Five, and Six

A two-way analysis of variance (ANOVA)--i.e., two levels of group membership and three levels of age--was used to test the statistical significance of differences among the means on the dependent measures for group membership and age level and to test for statistically significant interactions between group membership and age level. The actual probability level was reported.

The magnitude of results was described with effect sizes. Standardized mean differences (SMDs) were calculated for the differences
between pairs of means using the pooled, raw-score standard deviation. Cohen's (1988, pp. 25-27) standards of .2 as a small effect size, .5 as a medium effect size, and .8 as a large effect size were used as arbitrary, though reasonable, criteria to judge the magnitude of SMDs. In some cases, judgments about the importance of results were made from the perspective of a speech-language clinician.

For statistically significant main effects for age level, the Newman-Keuls multiple comparison technique (Hopkins & Anderson, 1973) was used to test the statistical significance of each pair of means.
RESULTS

Correlation Coefficients

Hypothesis 1 was that there would be a moderate-to-high correlation (.60 or greater) between the spontaneous revision behavior scores and syntax scores for both groups of children combined and for each group separately. The results of the correlational analyses follow.

For all subjects pooled and for the LI subjects, all of the coefficients were low (see Table 2). The coefficients for the NL subjects were primarily low, however, two coefficients were moderate for NL subjects: coefficients for the relationship between percentage of incomplete words and clauses per T unit and percentage of incomplete words and DSS (i.e., $r = .62$ and .53, respectively). These two coefficients were statistically significant as well. These findings are not surprising, given the low reliability coefficients that were obtained for all dependent measures for all groups except for clauses per T unit and DSS for the NL subjects (see Table 1). Because the coefficient for the relationship between incomplete words and DSS did not meet the .60 hypothesized criterion, Hypothesis 1 was confirmed only for NL subjects for the relationship between incomplete
words and clauses per T unit.

**Correlations Among Scores for Dependent Measures**

**Revision scores.** Although not a hypothesis, it is of clinical importance to determine which of the revision behaviors were highly associated with one another (see Table 3). For all groups, percentage of substitutions was highly but negatively associated with percentage of expansions ($\rho = - .77, - .79, - .73$, respectively). All remaining coefficients were low.

**Syntax scores.** Coefficients were also calculated for the correlations among the syntax scores (see Table 4). For all groups, words per T unit and words per clause were moderately to highly associated ($\rho$ ranged from .66 to .84). For the subjects pooled and for NL subjects, DSS and clauses per T unit were highly associated ($\rho = .67, \rho = .70$, respectively). All remaining coefficients were low to moderate.

**Group-Membership Differences**

**Revision Behaviors**

The second research hypothesis to be tested was that the mean spontaneous revision behavior scores of LI children would be lower than
those for NL children. For all of the revision behavior measures (i.e., percentage of substitutions, expansions and incomplete words, and total revisions), there were no statistically significant differences between the mean scores for the two groups ($E(1, 74) = .77, 1.35, .05, 1.62$, respectively, $p > .05$). Furthermore, the standardized mean differences were small (see Table 5). Again this is not surprising, given the low reliability coefficients that were obtained for all revision behavior scores. Hypothesis 2 was then not confirmed.

**Syntax Scores**

The third research hypothesis was that mean syntax scores of LI children would be lower than those for NL school-aged children. For all of the syntax measures (i.e., words per T unit, words per clause, clauses per T unit, and DSS), the mean scores of the NL subjects were statistically significantly higher than the mean scores for the LI subjects ($E(1, 72) = 14.82, 4.42, 7.30, 31.10$, respectively, $p < .05$). The standardized mean differences were moderate to large (see Table 6). Hypothesis 3 was then confirmed.

For words per clause, there was a statistically significant difference between the mean scores for the groups; however, there was a statistically
significant interaction between age level and group membership 
\((E(2,72)=4.35, p<.05)\). Inspection of the group membership means for each 
age level indicated that mean number of words per clause did not differ 
among the age levels for language-impaired subjects but did differ among 
the age levels for normal-language subjects. Ten-year-old NL subjects 
produced more words per clause than 8-year-olds, who in turn produced 
more words per clause than 9-year-olds.

**Age-Level Differences**

**Revision Behaviors**

The fourth research hypothesis was that the mean spontaneous 
revision behavior scores would differ among the age levels. There were 
statistically significant differences among the mean scores for the age 
levels for percentages of substitutions \((E(2,69)=4.68)\). To determine which 
means were statistically significantly different from one another, the 
Newman-Keuls multiple comparison technique was used to test for the 
statistical significance of each pair of means. The mean contrast for 9-
versus 10-year-olds was statistically significant (see Table 7). The SMD 
for percentages of substitutions was \(-.82\), a large effect size by Cohen's 
(1988) standards, indicating that 10-year-olds produce fewer substitution
revisions than 9-year-olds.

For percentages of expansions, there was a statistically significant difference among the mean scores for the age levels; however, there was a statistically significant interaction between age level and group membership ($F(2,69)=3.84, p<.05$). Inspection of the mean age-level scores for each group indicated that mean expansion scores did not differ among the age levels for normal-language subjects but did differ among the age levels for language-impaired subjects. Ten-year-old LI subjects produced more expansions than 8-year-olds, who in turn produced more expansions than 9-year-olds.

There were no statistically significant differences among the mean age-level scores for percentages of incomplete words and for total revisions ($F(2,69)=1.05, 1.47$, respectively, $p>.05$). The SMDs were small for all contrasts of means.

Hypothesis 4 was confirmed for percentages of substitutions only for the contrast between 9- and 10-year-olds when all subjects were pooled. Hypothesis 4 was confirmed for percentages of expansions only for LI subjects for the contrast between 9- and 10-year-olds. Given that the reliability coefficients were low for all revision behavior scores, these results are surprising.
**Syntax Scores**

The fifth research hypothesis was that the mean syntax scores would be higher for the higher age levels for the two groups of children combined and for each group separately. There were statistically significant differences among the mean age-level scores for words per T unit and DSS ($t(2,72)=4.23, 3.75$, respectively, $p<.05$). The Newman-Keuls multiple comparison technique was used to test for the statistical significance of each pair of means. For words per T unit, the mean contrasts for 8- versus 10-year-olds and 9- versus 10-year-olds were statistically significant (see Table 7). For DSS, only the mean contrast for 9- versus 10-year-olds was statistically significant. Again, given the generally low reliability coefficients obtained for all syntax measures except DSS, these results are surprising.

The SMDs for words per T unit for these contrasts were both .63, a medium effect size by Cohen's (1988) standards, indicating that 10-year-olds obtained a higher mean for words per T unit than 8- and 9-year-olds. The SMD for DSS was .62, again a medium effect size, indicating that 10-year-olds obtained a higher mean DSS than 9-year-olds.

There were no statistically significant differences among the mean
age-level scores for clauses per T unit ($E(2,72) = 2.43$). The SMDs were small for all contrasts of means. For words per clause, there also was no statistically significant difference among the mean scores, however there was a statistically significant interaction between group membership and age level which was discussed previously. The medium effect size for the contrast between 8-, 9- and 10-year-olds (i.e., SMD = .54) for clauses per T unit reflects this interaction (i.e., 10-year-old NL subjects produced more words per clause than 8-year-old NL subjects, who in turn produced more words per clause than 9-year-olds).

Hypothesis 5 was confirmed for words per T unit for the contrasts between 8- and 10-year-olds and 9- and 10-year-olds and for DSS for the contrast between 9- and 10-year-olds only.

**Interactions**

The sixth hypothesis was that the means would not differ according to group membership and age level. As previously discussed, there were statistically significant interactions between age level and group membership for percentages of expansions and for words per clause, indicating that mean age-level scores varied significantly by group membership. Consequently, Hypothesis 6 was only confirmed for
percentages of substitutions, percentages of incomplete words, total revisions, words per T unit, clauses per T unit, and DSS.
DISCUSSION AND CONCLUSIONS

This study was conducted in order to clarify the relationship between revision behaviors and quantitatively measured syntax skills. The behaviors of normal-language and language-impaired children aged 8-, 9-, and 10-years of age were compared. The scores of these two groups, which differed in language ability, were compared to help discern the relationship between revision behaviors and syntax.

The findings from this study indicate that there was a moderate, positive correlation between the spontaneous revision behavior scores and syntax scores only for NL subjects. That moderate coefficient was obtained for the relationship between percentages of incomplete words and clauses per T unit. For all subjects pooled and for LI subjects, coefficients between the revision behavior scores and syntax scores were low.

This study provided no support for the hypothesis that the mean spontaneous revision behavior scores would be lower for LI children than for NL children. In other words, the frequency of occurrence of all of the revision behavior measures (i.e., percentages of substitutions, expansions and incomplete words, and total revisions) was not significantly different between the two groups of children. It should be noted that although the differences between the means were not statistically significant, NL
children had a higher mean score than LI children for percentage of expansions. Further, LI children had a higher mean score than NL children for percentage of substitutions. These findings are consistent with Brinton and Fujiki's (1989) contention that expansions require a greater level of self-monitoring and adjustment to the listener than substitutions. One would expect the NL children to be able to adjust a message to be more informative for the listener more often than would the LI children.

Lower mean scores were also hypothesized for LI children, as compared to NL children, for syntax. Findings from this study do support this hypothesis as all of the syntax mean scores did discriminate between LI and NL children.

For all subjects pooled, 10-year-old children were found to have a significantly lower mean score for percentage of substitutions than 9-year-old children. Ten-year-old LI subjects were found to have a significantly higher mean score for percentage of expansions than 9-year-old LI children. Again, these findings are consistent with Brinton and Fujiki's (1989) contention that expansions require more self-monitoring and adjustment to the listener than substitutions. All other mean spontaneous revision behavior scores were found to not differ significantly among the age levels.
Age-level comparisons for syntax scores revealed a significantly higher mean score for words per T unit for 10-year-olds as compared to 8- and to 9-year-olds. The DSS mean score was significantly higher also for 10-year-olds as compared to 9-year-olds.

**Comparison With Prior Studies**

While no studies were discovered in which the relationship between revision behavior scores and quantitatively measured syntax scores were examined, comparisons can be made between this study and others in which children's revision behaviors were investigated. Significant differences were not found to occur in the mean spontaneous revision behavior scores between LI and NL children for the present study.

Liles and Purcell (1987) found that while LI and NL children, aged between 7.6 and 10.6, did not differ in spontaneously revising their grammatical errors in narratives, the LI children differed from NL children for the NL children were "more successful" at repairing their inaccurate statements. Communicative success of repairs was not evaluated in the present study. Liles and Purcell (1987) did not, however, compare syntax scores between the LI and NL children, so the relationship between revision behaviors and syntax skills was not determined.
MacLachlan and Chapman (1988) reported that the relative frequency of types of different spontaneous revision behaviors in the conversations and narrations of LI children aged 9.10 to 11.11 was similar to that of age-matched NL children and to language-matched younger children. The present study also found no significant differences between NL and LI children in the relative frequency of the different types of spontaneous revision behaviors. Unlike the present study where there was no statistically significant difference between mean total revision scores for LI and NL groups, MacLachlan and Chapman (1988) reported a higher number of conversational breakdowns that needed to be repaired by the LI children as compared to age-matched and to language-matched children.

Kirchner and Prutting (1987) studied the spontaneous revision behaviors of younger children, aged 3.2 to 4.4 years, in their spontaneous language samples. Similar to the findings of the present study, they found "no differences in patterns" (p. 163) between LI and NL children. However, unlike the present study, which revealed a low frequency for all revision behaviors being observed, Kirchner and Prutting reported a high frequency of all revision behaviors being observed. This may be due to the fact, however, that the children in this study had memory for a script (i.e., they retold the presented narratives) and therefore produced fewer speech errors, while the
children’s revisions in the Kirchner and Prutting study occurred during spontaneous language samples. All of the revision behaviors examined for the present study occurred so infrequently that reliability concerns were raised, as will be discussed below.

One possible explanation for the differences between this study’s findings and those of the other studies in which revision behaviors were examined may be that LI and NL children’s use of revision behaviors may differ according to the age being studied. It may be that the children in the present study, both LI and NL children, produced speech in their narratives that they rarely believed needed to be repaired. Evans (1985) stated:

self-repair may initially increase in frequency with increasing monitoring skill and then begin to decrease as language skill becomes relatively sophisticated and the ability to plan and organize one’s thoughts in advance becomes well developed. (p. 369)

If age and behaviors are related in an “inverted U-function” (p. 369), as Evans claims, older, more sophisticated language users would be expected to produce relatively fewer revisions in their narratives. Compared to younger children from other studies, the 8-, 9-, and 10-year-old children in this study did indeed produce fewer revisions.

The spontaneous revisions of children in other studies with comparable ages have not been examined by type or by frequency. Children’s
revision behaviors have been examined for semantic and grammatical "correctness" of repairs (Liles & Purcell, 1987) and have been examined to determine their frequency in narratives versus their frequency in conversation (MacLachlan & Chapman, 1988). Although MacLachlan and Chapman coded the types of revisions (i.e., addition, deletion, or substitution), frequency of the types produced was not reported. Other than the current study, children aged 8 through 10 years have not been examined to determine the types and frequencies of differing revision behaviors. Studies comparable to the current study are needed to examine both frequency and type of spontaneous revisions in children at this particular age level.

Secondly, differences between this study and others reviewed may be related to the low internal-consistency coefficients that were obtained for the scores for all of the measures in this study. As stated previously, reliability tends to be a function of the number of items in a measurement and of the variability of the scores (Nunnally, 1978). It is likely that reliability coefficients were low, because so few revision behaviors were produced by the children and because standard deviations for the syntax measures were small. When scores have low reliability, correlation coefficients may be attenuated. In this study the coefficients describing
the association between revision scores and syntax scores were low.

**Implications for Assessment**

Through this investigation into the relationship between revision behaviors and syntax scores, several implications relevant to clinical practice were discovered. These are listed below.

1. Prior researchers have not reported correlation coefficients between spontaneous revision behavior scores and syntax scores; the correlation coefficients were primarily low in this study. Only those coefficients describing the relationship between percentage of incomplete words and clauses per T unit and between percentage of incomplete words and DSS were moderate. However, given the low reliability of the scores, this finding does not provide support for the absence of a relationship between revision behaviors and syntax.

As stated previously, reliability tends to be a function of length and of the variability of the scores. Since reliability is a prerequisite for validity, researchers and clinicians interested in revision behaviors and syntax scores may improve the reliability of their scores by increasing the length of the sample being assessed (i.e., the children's narrations). It is likely that because so few revision behaviors of any type were produced
within the children's narrations and because the standard deviations for the syntax measures were small relative to their mean, low reliability coefficients were obtained. And because the low reliability of scores can attenuate correlation coefficients, it is not surprising that low coefficients were obtained for the relationships between the revision behaviors and the syntax scores examined in this study.

The narratives that the children listened to in this study were approximately 45 T units long. The effects on the reliability coefficients of using longer stories should be investigated.

2. Unless the frequency of specific types of revisions are found to differ between language groups (i.e., language impaired versus normal language) for the age groups studied (i.e., 8-, 9-, and 10-year-olds), the frequency of specific types of revisions or of total revisions produced for clinical assessment purposes is not recommended as useful.

3. The association among syntax measures was examined during this study as well. Since words per T unit and words per clause were highly associated for all subjects, it is suggested that in clinical practice both measures need not be obtained for assessment purposes. Similarly, for LI subjects, words per T unit and words per clause were highly associated, and for NL subjects, DSS and clauses per T unit were highly associated. These
associations suggest that all four measures do not need to be obtained but that one measure may provide an adequate index of a child’s syntactic proficiency and syntactic growth. Since DSS evaluates the differing syntactic structures and can guide clinicians as to specific forms to remediate, this would likely be the most functional measure of the four used in this study.

4. The association among the scores for revision behaviors was also examined. Percentage of substitutions was found to be negatively correlated with percentage of expansions. In other words, the child who tends to replace one word or idea for another does not also typically adjust the message to be more informative for the listener by expanding the content within his or her narratives. Alternatively, the child who tends to expand the content to be more informative does not also merely substitute one form for another. Again, this finding is consistent with Brinton and Fujiki’s (1989) classification system, in which expansions are differentiated from substitutions.

5. Brinton and Fujiki (1989) note that there are both positive and negative aspects of a child’s use of revision behaviors. Revision behaviors can lead to a revision of an error “before it can interfere with communication or call attention to itself” (p. 195). A high frequency of
revision behaviors, however, "may result in a halting pattern of output that is difficult [for listeners] to understand" (p. 195).

Clinically, for a child whose output sounds difficult, labored, or halting or whose productions seem confused or disorganized due to frequent revisions, continued modeling of structures being learned may help reduce revisions. If frequent revision behaviors appear to indicate word-finding or motor-programming problems, these are the problems therapy should address. Finally, if a child's revisions make no adaptations in order to be more informative for the listener, Brinton and Fujiki (1989) recommend that the should be encouraged to "respond to requests for repair from others" (p. 197).

**Conclusion**

In summary, except for a moderate association between incomplete words and clauses per T unit for NL children, only a small degree of association was observed between the spontaneous revision behavior scores and syntax scores for either LI or NL children between 8, 9, and 10 years of age. Between the two groups of children, LI and NL, no significant differences in mean revision behavior scores were obtained. Across age levels, 10-year-olds produced statistically significantly fewer
substitutions than 9-year-olds, and, for L1 children only, 10-year-olds produced statistically significantly more expansions than the 9-year-olds who in turn produced more expansions than did the 8-year-olds. For syntax measures, the scores did discriminate between the two language groups. Some syntax scores discriminated among differing age levels as well: words per T unit were higher for 10-year-olds as compared to 8- and 9-year-olds, and DSS was higher for 10-year-olds as compared to 9-year-olds.
Table 1

Internal Consistency Pearson Product-Moment Coefficients (Adjusted by Spearman-Brown Prophesy Formula) for All Dependent Measures, All Subjects Pooled and Each Group Separately

<table>
<thead>
<tr>
<th>Dependent Measure</th>
<th>Subjects Pooled</th>
<th>LI</th>
<th>NL</th>
</tr>
</thead>
<tbody>
<tr>
<td>% Substitution</td>
<td>-.31</td>
<td>-.04</td>
<td>-.66</td>
</tr>
<tr>
<td>% Expansion</td>
<td>.04</td>
<td>.30</td>
<td>-.23</td>
</tr>
<tr>
<td>% Incomplete Words</td>
<td>-.32</td>
<td>-.30</td>
<td>-.37</td>
</tr>
<tr>
<td>Total Revisions</td>
<td>.39</td>
<td>.38</td>
<td>.40</td>
</tr>
<tr>
<td>Words/T Unit</td>
<td>.49</td>
<td>.31</td>
<td>.47</td>
</tr>
<tr>
<td>Words/Clause</td>
<td>.28</td>
<td>.37</td>
<td>.13</td>
</tr>
<tr>
<td>Clauses/T Unit</td>
<td>.28</td>
<td>-.84</td>
<td>.63</td>
</tr>
<tr>
<td>DSS Score</td>
<td>.71</td>
<td>.38</td>
<td>.74</td>
</tr>
</tbody>
</table>

Note. With subjects pooled, N = 78; LI subjects, n = 39; NL subjects, n = 39.
Table 2

Pearson Product-Moment Correlation Coefficients for the Relationships Between Syntax Scores and Revision Scores, All Subjects Pooled and Each Group Separately

<table>
<thead>
<tr>
<th></th>
<th>Syntax Scores</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Words/Clause</td>
<td>Words/T unit</td>
<td>Clauses/T unit</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>% Substitution</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Subjects pooled</td>
<td>-.34*</td>
<td>-.35*</td>
<td>-.05</td>
<td>-.19</td>
</tr>
<tr>
<td>LI</td>
<td>-.51*</td>
<td>-.39*</td>
<td>.25</td>
<td>.05</td>
</tr>
<tr>
<td>NL</td>
<td>-.11</td>
<td>-.32</td>
<td>-.25</td>
<td>-.36</td>
</tr>
<tr>
<td>% Expansions</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Subjects pooled</td>
<td>.28*</td>
<td>.20</td>
<td>-.10</td>
<td>.08</td>
</tr>
<tr>
<td>LI</td>
<td>.34</td>
<td>.32</td>
<td>-.08</td>
<td>.07</td>
</tr>
<tr>
<td>NL</td>
<td>.18</td>
<td>.03</td>
<td>-.20</td>
<td>-.02</td>
</tr>
<tr>
<td>% Incomplete Words</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Subjects pooled</td>
<td>.13</td>
<td>.27</td>
<td>.22</td>
<td>.18</td>
</tr>
<tr>
<td>LI</td>
<td>.36</td>
<td>.18</td>
<td>-.28*</td>
<td>-.18</td>
</tr>
<tr>
<td>NL</td>
<td>-.09</td>
<td>.41*</td>
<td>.62*</td>
<td>.53*</td>
</tr>
<tr>
<td>Total Revisions</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Subjects pooled</td>
<td>.12</td>
<td>.30*</td>
<td>.29*</td>
<td>.24</td>
</tr>
<tr>
<td>LI</td>
<td>.22</td>
<td>.43*</td>
<td>.38</td>
<td>.28</td>
</tr>
<tr>
<td>NL</td>
<td>-.07</td>
<td>.10</td>
<td>.21</td>
<td>.12</td>
</tr>
</tbody>
</table>

Note. Coefficients of .28 or larger are statistically significant, \( p \leq .01, N = 78 \). Coefficients of .39 or larger are statistically significant, \( p \leq .01, N = 39 \).
Table 3

Intercorrelation Matrix for Revision Scores. All Subjects Pooled and Each Group Separately

<table>
<thead>
<tr>
<th>%Substitutions</th>
<th>%Expansions</th>
<th>%Incomplete Words</th>
</tr>
</thead>
<tbody>
<tr>
<td>%Expansions</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Subjects Pooled</td>
<td>-.77*</td>
<td></td>
</tr>
<tr>
<td>LI</td>
<td>-.79*</td>
<td></td>
</tr>
<tr>
<td>NL</td>
<td>-.73*</td>
<td></td>
</tr>
<tr>
<td>%Incomplete Words</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Subjects Pooled</td>
<td>-.48*</td>
<td>-.21</td>
</tr>
<tr>
<td>LI</td>
<td>-.18</td>
<td>.36</td>
</tr>
<tr>
<td>NL</td>
<td>-.41*</td>
<td>-.31</td>
</tr>
<tr>
<td>Total Revisions</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Subjects Pooled</td>
<td>-.04</td>
<td>-.06</td>
</tr>
<tr>
<td>LI</td>
<td>.01</td>
<td>-.07</td>
</tr>
<tr>
<td>NL</td>
<td>.10</td>
<td>.09</td>
</tr>
</tbody>
</table>

Note. Coefficients of .28 or larger are statistically significant, p ≤ .01, N = 78. Coefficients of .39 or larger are statistically significant, p ≤ .01, N = 39.
### Table 4

**Intercorrelation Matrix for Syntax Scores. All Subjects Pooled and Each Group Separately**

<table>
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<tr>
<th></th>
<th>DSS</th>
<th>Words/clause</th>
<th>Words/T unit</th>
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<tr>
<td><strong>Words/Clause</strong></td>
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<tr>
<td>Subjects Pooled</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>LI</td>
<td>.14</td>
<td></td>
<td></td>
</tr>
<tr>
<td>NL</td>
<td>.05</td>
<td></td>
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<tr>
<td><strong>Words/T Unit</strong></td>
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<td></td>
<td></td>
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<td>Subjects Pooled</td>
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<td>.75*</td>
<td>.50*</td>
</tr>
<tr>
<td>LI</td>
<td>.41*</td>
<td>.84*</td>
<td>.32</td>
</tr>
<tr>
<td>NL</td>
<td>.59*</td>
<td>.66*</td>
<td>.52*</td>
</tr>
<tr>
<td><strong>Clauses/T unit</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Subjects Pooled</td>
<td>.67*</td>
<td>-.19</td>
<td>.50*</td>
</tr>
<tr>
<td>LI</td>
<td>.51*</td>
<td>-.24</td>
<td>.32</td>
</tr>
<tr>
<td>NL</td>
<td>.70*</td>
<td>-.30</td>
<td>.52*</td>
</tr>
</tbody>
</table>

*Note. Coefficients of .28 or larger are statistically significant, $p \leq .01$, $N = 78$. Coefficients of .39 or larger are statistically significant, $p \leq .01$, $n = 39$. 
Table 5

Means, Standard Deviations, and SMDs for LI and NL Groups for Revision Behaviors

<table>
<thead>
<tr>
<th>Dependent Measure</th>
<th>LI Group (n = 39)</th>
<th>NL Group (n = 39)</th>
<th>SMD</th>
</tr>
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<tbody>
<tr>
<td>% Substitutions</td>
<td>55.28 (25.73)</td>
<td>51.09 (18.74)</td>
<td>-0.19</td>
</tr>
<tr>
<td>% Expansions</td>
<td>30.46 (22.28)</td>
<td>35.34 (17.99)</td>
<td>0.24</td>
</tr>
<tr>
<td>% Incomplete Words</td>
<td>14.27 (16.01)</td>
<td>13.57 (13.44)</td>
<td>-0.05</td>
</tr>
<tr>
<td>Total Revisions</td>
<td>7.54 (5.29)</td>
<td>8.87 (3.89)</td>
<td>0.29</td>
</tr>
</tbody>
</table>

Note. Standard deviations are in parentheses. SMDs were computed using standard deviations for all 78 subjects. Cohen's (1988) standards of .2 as a small effect size, .5 as a medium effect size, and .8 as a large effect size were used to judge the magnitude of SMDs. *Statistically significant differences between group means based on ANOVAs, p < .05.
Table 6

Means, Standard Deviations, and SMDs for LI and NL Groups for Syntax Scores

<table>
<thead>
<tr>
<th>Dependent Measure</th>
<th>LI Group (n = 39)</th>
<th>NL Group (n = 39)</th>
<th>SMD</th>
</tr>
</thead>
<tbody>
<tr>
<td>WTU</td>
<td>7.68 (.84)</td>
<td>8.44 (.97)</td>
<td>.78*</td>
</tr>
<tr>
<td>WCL</td>
<td>6.95 (.75)</td>
<td>7.30 (.77)</td>
<td>.45*</td>
</tr>
<tr>
<td>CLTU</td>
<td>1.11 (.07)</td>
<td>1.16 (.11)</td>
<td>.56*</td>
</tr>
<tr>
<td>DSS</td>
<td>7.70 (1.40)</td>
<td>9.78 (1.98)</td>
<td>1.04*</td>
</tr>
</tbody>
</table>

Note: Standard deviations are in parentheses. SMDs were computed using standard deviations for all 78 subjects. Cohen’s (1988) standards of .2 as a small effect size, .5 as a medium effect size, and .8 as a large effect size were used to judge the magnitude of SMDs. *Statistically significant differences between group means based on ANOVAs, p < .05.
Table 7

Means, Standard Deviations, and SMDs for Age Levels for All Subjects

<table>
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<th>Dependent Measure</th>
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<th>10 years</th>
<th>SMD</th>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>8v.9</td>
</tr>
<tr>
<td>Revision Behaviors</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>% Substitutions</td>
<td>55.27</td>
<td>61.28</td>
<td>42.99</td>
<td>.27</td>
</tr>
<tr>
<td>(22.10)</td>
<td>(21.75)</td>
<td>(19.86)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>% Expansions</td>
<td>32.91</td>
<td>26.04</td>
<td>39.75</td>
<td>-.34</td>
</tr>
<tr>
<td>(15.26)</td>
<td>(21.39)</td>
<td>(21.85)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>% Incomplete Words</td>
<td>11.81</td>
<td>12.68</td>
<td>17.26</td>
<td>.06</td>
</tr>
<tr>
<td>(14.54)</td>
<td>(14.60)</td>
<td>(14.75)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Words</td>
<td>7.42</td>
<td>7.73</td>
<td>9.46</td>
<td>.07</td>
</tr>
<tr>
<td>(4.25)</td>
<td>(4.26)</td>
<td>(5.31)</td>
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</tr>
<tr>
<td>Syntax Scores</td>
<td></td>
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<tr>
<td>Words/T Unit</td>
<td>7.86</td>
<td>7.86</td>
<td>8.47</td>
<td>.00</td>
</tr>
<tr>
<td>(1.05)</td>
<td>(1.01)</td>
<td>(.73)</td>
<td></td>
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</tr>
<tr>
<td>W/Clause</td>
<td>6.98</td>
<td>7.09</td>
<td>7.31</td>
<td>.14</td>
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<tr>
<td>(.78)</td>
<td>(.87)</td>
<td>(.63)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Clauses/T Unit</td>
<td>1.13</td>
<td>1.11</td>
<td>1.16</td>
<td>-.22</td>
</tr>
<tr>
<td>(.09)</td>
<td>(.07)</td>
<td>(.11)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>DSS Score</td>
<td>8.80</td>
<td>8.09</td>
<td>9.34</td>
<td>-.36</td>
</tr>
<tr>
<td>(1.90)</td>
<td>(1.91)</td>
<td>(2.06)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note. Standard deviations are in parentheses. SMDs were computed using standard deviations for all 78 subjects. Cohen's (1988) standards of .2 as a small effect size, .5 as a medium effect size, and .8 as a large effect size were used to judge the magnitude of SMDs. *St. sig. differences between group means based on ANOVAs, p < .05.
REFERENCES


APPENDICES
Appendix A

Sample Developmental Sentence Scoring

DEVELOPMENTAL SENTENCE SCORING

Child's Name: J.P. #56

Date of Sample:

C.A.: ______________________


1. (The big frog did) a boy got a little frog

2. They went for a (r) walk riding a little turtle

3. And the big boy kicked the little frog (out) off

4. The little boy sat in the mud crying

5. And the boy said: "(Go home)"

6. So, (he) the frog jumped on a rock (like he did) he

7. (and) didn't go home and kicked the baby frog off

8. And the, and one of the animals told him

9. And he couldn't find the little frog

10. So he went home crying

11. And the frog still sorry that he didn't mean (to)

12. And they (it) it sounded like a baby frog

13. And the baby frog jumped in the window

14. And, um, they started to be friends

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315. ___/___ = 9.36
### Appendix B

**Examples and Definitions of Revision Behaviors**

<table>
<thead>
<tr>
<th>Revision Category</th>
<th>Examples</th>
<th>Definition</th>
</tr>
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<tbody>
<tr>
<td>Substitution</td>
<td>(Going on) -have a vacation (Him) -he ran home (These) -he’s painting and he’s playing</td>
<td>a. replacement of word(s) with word(s) serving same role in constituent b. other than at utterance beginning, demonstrative pron. modifier or article replaced by pronoun in head noun position</td>
</tr>
<tr>
<td>Expansion</td>
<td>Get (my toy) -my big red toy He hit (the ba-) -the big ball</td>
<td>a. morpheme(s) not in original utterance is added b. word was terminated before completion, to insert word(s), then initial word is completed</td>
</tr>
<tr>
<td>Incomplete Words</td>
<td>Because (da) -he thinks somebody comed I think (b) -he could put (the g) -the boy on (h) -the girl</td>
<td>part of word produced which is not part-word repetition, interjection (uh, er), or expansion (b) above</td>
</tr>
<tr>
<td></td>
<td>It's the (pol) -fireman</td>
<td></td>
</tr>
</tbody>
</table>