HIERARCHICAL PROCESSING IN ADOLESCENTS: A COMPARISON OF NONVERBAL AND VERBAL TASKS

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HIERARCHICAL PROCESSING IN ADOLESCENTS:

A COMPARISON OF NONVERBAL

AND VERBAL TASKS

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CHAPTER I

INTRODUCTION

Children diagnosed with language disorders as preschoolers often continue to evidence language impairments in later school years. The type of language deficit may change over the child's life span, moving from the spoken domain to the written domain. Adolescents with learning disabilities typically display literate language impairments also. Those language difficulties may appear in comprehension tasks (reading) and/or production tasks (writing and spelling).

Both diagnostic groups may appear to perform adequately on spoken language tasks throughout the early school years (K-3rd grades). Problems surface in later school years, corresponding with the increased reliance on literate language forms for knowledge acquisition and demonstration. These literate skills become crucial by approximately the fourth grade (Simon, 1985).

As grade level increases, the abstract nature of spoken language required in academic activities increases; abstract spoken language includes the use of figurative language and metalinguistic terms/knowledge. During school years following the third grade, difficulties in spoken language

contexts which require abstract knowledge may pose special problems for language impaired or learning-disabled students. However, spoken language problems may not be observed by the linguistically untrained observer during conversational, "chatty" interactions. Writing and reading tasks remain the most obviously impaired to a majority of observers.

The Construct of Specific Language Impairment

Several diagnostic labels for children/adolescents with language difficulties have been used in research and clinical literature, including language disordered, language impaired (LI), specifically language impaired (SLI), and language learning disabled (LLD). Recently, the term specific language impairment has increasingly been seen and several papers have attempted to clarify the construct.

Specific language impairment (SLI) is defined as "a set of conditions where language ability is considerably more depressed than non-verbal intelligence" (Leonard, 1991). Two notions figure prominently in the current definition of specific language impairment (SLI), including 1) the exclusionary nature of the definition of SLI and 2) the increasingly small discrepancies required for SLI diagnosis. A diagnosis of language impairment is made based on a comparison of student performance on language testing (usually standardized) with mental ability (usually IQ scores) (Leonard, 1991). However, the child must not exhibit

frank neurological signs or have a history of head trauma, epilepsy, or other evidence of neurological impairment. Any such frank neurological etiologies exclude the child from an SLI diagnosis. Researchers have also lowered the required discrepancy between nonverbal mental age and language performance required for SLI diagnosis. The relaxed discrepancy requirement results in children with increasingly mild language deficits being diagnosed as SLI.

Specific language impairment has been considered a heterogenous diagnostic grouping. The category of specific language impairment is thought to consist of subgroupings of individuals. Individuals in each subgroup are thought to demonstrate characteristic language difficulties.

Numerous studies conducted in the eighties have concentrated on defining the subgroups of SLI children (Aram & Nation, 1975; Rapin & Allen, 1983; Wilson & Risucci, 1986). Such studies have been concerned with describing and explaining specific language impairment, but have predominantly examined abilities of pre-school and early school-age subjects. Few studies have described adolescent subgroup behaviors.

Explaining Specific Language Impairment

Johnston (1991) maintained that all behaviors had a neurological or psychological correlate, including linguistic behaviors. Johnston used the terms primary cause and proximal cause to organize causation studies related to language impairments. A primary cause included a

pathological etiology or genetic endowment. Proximal causation included mental processes such as auditory perception or symbolic function.

Early studies concerning primary causes of language based disorders included examination of genetic factors, inborn errors of metabolism, infections, and neurological morphology (Johnston, 1991). Subjects with frank neurological signs or history of brain trauma are excluded from SLI diagnosis, so obvious medical etiologies would not be present. Therefore, the increasingly exclusionary definition of SLI in research literature would make identification of any primary causes more difficult, due to the exclusion of easily observed medical symptoms. Johnston suggests moving from a search for a primary cause (medical etiology) to examining proximal causes and developing performance profiles for certain language impaired subgroups.

Johnston (1991) saw mental processing abilities (proximal) as causal factors affecting observable behaviors, such as linguistic output. A performance profile should include these mental processing abilities, specific language abilities, and nonverbal abilities. Johnston (1988) encouraged a search for relationships between these observable behaviors.

Proximal causation research consisted of two major branches. Those branches included mental processes and cognitive abilities. Mental processing tasks, such as those of Tallal, Stark and others, involved primarily bottom-up

processing tasks with temporal constraints. Cognitive ability research included studies of symbolic function and cognitive concept, cognitive style, automatic/purposive processing, and hierarchical structuring. Proximal causation studies have included verbal and nonverbal stimuli These studies have attempted to establish relationships between cognitive abilities or processes and nonverbal/verbal behaviors.

Researchers within the last decade have begun to examine specific mental processes or cognitive factors that could underlie particular linguistic skills. These cognitive factors might not be differentiated on many verbally based IQ tests, such as the WISC-R and WAIS. Aram (1991) suggests that causal cognitive factors could assist the speech-language pathologist in several ways: 1) knowing a cause might instigate a better intervention plan, 2) informing parents and other professionals about causation following consultation, and 3) early intervention to lessen severity of future language impairments. Cognitive ability research is most relevant to this thesis study of hierarchical processing in nonverbal and verbal tasks.

Temporal Processing Deficit Hypotheses

Mental processing studies have concentrated on processing ability utilizing peripheral sensory tasks. Tallal and other researchers have studied rapid processing of auditory and visual stimuli. These studies investigated low level, bottom-up processing of both verbal and nonverbal

stimuli.

Tallal and numerous colleagues have explored children's abilities to perceive rapidly sequenced events, including alternating sets of nonverbal visual and auditory signals (Tallal & Piercy, 1973; Tallal, Stark, Kallman, & Mellits, 1981; Tallal, Stark, & Mellits, 1985). Tallal & Piercy (1973) studied 12 developmentally aphasic children ages 6-9 years and 12 normal language matches. They devised two tasks involving presentation of auditory stimuli and visual stimuli. First subjects were required to select two buttons corresponding to complex tones presented auditorily. The researchers examined pattern and tone discrimination with increasingly shorter inter-stimulus intervals (ISI) and tone durations. Then they examined auditory memory abilities for different series of these tones. The visual experiment involved examination of the same discrimination and memory skills for different light flashes (two shades of green).

They found that aphasic and normal language subjects performed similarly for tone discrimination at the longest tone duration and ISI. However, with shorter tone durations or ISIs, aphasics were significantly less accurate. Aphasic auditory memory performance did not improve with increased length of tone duration or ISI. No significant group differences were found in visual tasks. The researchers theorized that aphasics had difficulty with rapid auditory processing. However, aphasic auditory memory scores remained low even with slower presentation, which might indicate a specific defect in auditory memory. Difficulty

with speech perception could be a result of poor phoneme perception. Phonemes are the speech sounds that make words and they are sound stimuli of short durations in extremely rapid sequences (short ISIs). Poor speech perception could interfere with language development in young children, who cannot perceive words or discriminate specific sounds.

Tallal et al. (1981) examined nonverbal perceptual abilities of normal language and language impaired children. A subject group of 35 language impaired and 38 normal language children, ages 5-9 years, participated in auditory, visual, and auditory/visual tasks. For each modality stimuli (two complex tones, two nonsense visual symbols, and one tone plus a white light flash), five subtests were conducted. They included the following: detection, association/discrimination, sequencing, rate processing, and serial memory. Tallal and Piercy's repetition method (Tallal & Piercy, 1973) was used for testing. Language impaired (LI) subjects produced lower scores on sequencing tasks, rate processing tasks, and serial memory tasks with auditory and visual stimuli. All of these processing difficulties involved the perception of brief events presented either simultaneously or sequentially. Such a processing difficulty could affect spoken language skills, as described earlier. Speech sounds are short in duration and rapidly sequenced to form recognizable words. Subjects must process such short bursts of sound rapidly to process speech and comprehend a message. This perceptual theory of cognitive deficit does not clearly explain the syntactic

writing difficulties of language impaired children.

Cognitive Explanations

Studies with language impaired children indicate conceptual deficiencies on a variety of cognitive tasks. On the surface, these findings appear to be at odds with the ability of SLI children to perform within normal limits on a nonverbal IQ test. However, the types of tasks that make up nonverbal IQ tests are limited in scope. Indeed, Kamhi, Minor, and Mauer (1990) demonstrated that SLI children up until the age of 9 could score within normal range by passing only the first 13 perceptual match items on the Test of Nonverbal Intelligence (TONI). Adolescents, like children, may perform within normal limits on performance IQ measures; nevertheless, they may perform differently on cognitive domains/tasks outside the realm of standardized performance measures.

Symbolic Function and Cognitive Concepts. Symbolic function is one prominent cognitive candidate for explaining specific language impairment. Piaget makes the assertion that language development is tied to a more general symbolic ability to represent the external environment. The symbolic cognitive domain would affect both spoken and written language abilities, due to the symbolic nature of language itself. Observable behaviors that might indicate this underlying symbolic cognitive domain include gestural communication and mental imagery.

An example is the work of Thal and Bates (1988) who compared the imitation of symbolic communicative gestures in nine language-delayed toddlers (18-32 months) with age-matched and language-matched toddlers. The researchers devised a "lexical" task (imitation of single gestures) and a "structural" task (imitation of a series of gestures within a narrative script). The language-delayed group performed like younger, language-matched children on the lexical task. There was no difference in structural task imitation abilities for the three groups. Thal and Bates suggest a retrieval problem in these late-talking children. They hypothesized that the same gestural repertoire existed for all groups, but was less accessible for the late talkers due to the limited contextual support in the "lexical" task. Whether difficulty is due to retrieval or repertoire formation problems is unclear from this study and bears further examination (Johnston, 1988).

Kamhi (1981) also looked at symbolic abilities in language impaired children with mental ages between 4;6 and 6;0 years and MA matched normal language children. Subjects participated in six Piagetian cognitive tasks. Three tasks assessed mental imagery (Haptic Recognition, Water Level, and Mental Displacement) and three assessed development of class, number, and order concepts (Classification, Number Conservation, and Linear Order). Results showed statistically significant differences in the nonverbal symbolic skills of the language impaired group on Haptic Recognition only. Haptic Recognition involved feeling

shielded geometric shapes and then selecting a picture that matches the shape. Combined scores on all tasks resulted in age-matched subjects, language impaired subjects and language-matched subjects performing in that order; however, these composite scores for each subject did not exhibit statistically significant differences. Despite normal nonverbal IQ scores, the language impaired subjects demonstrated deficient nonverbal symbolic concepts when compared with the two matched groups. The language impaired subjects' more accurate performances when compared with younger language-matched subjects indicated that these concepts were not as delayed as language abilities. It should be noted that both of these studies dealt with young children, before significant literate language development occurred.

Researchers have analyzed cognitive concept formation in language impaired children through the use of both verbal and nonverbal tasks. Johnston and Smith (1989) evaluated the ability of 10 language impaired and 10 normal language children, ages 3;6 to 5;9, to infer color and size attributes and dimensions. Nonverbal and verbal tasks were presented in a selection format. Subjects were to imitate an object selection in the nonverbal trials and to select an object following verbal instructions in the verbal trials. Subjects were to select objects according to the three concepts (color, size, and dimension) requested by the examiner (either nonverbally or verbally). Compared to normals, the language impaired children performed poorly on

both task types. Language impaired children also had more difficulty with size concepts than with color concepts. The language impaired subjects could make a decision based on identity of objects, but reasoning for selection of ordinally based size attributes was more difficult.

Johnston and Ramstad (1983) used Piagetian activities in a study of seven language impaired children with normal performance IQs on the WISC-R. The children ranged in age from 10;4 to 12;1 years. Conceptual tasks included Haptic Recognition, Order, Horizontal and Vertical Axis, Additive Classifications, Similar and Belonging, Some and All, Singular Class, Conservation, Seriation, Class Inclusion, Addition and Subtraction of Number, Multiplication of Number, and Fractions. The language impaired subjects performed below expected stages on the Piagetian tasks. Imagistic tasks (requiring the subject to anticipate and imagine physical states across transformations) were most difficult, as opposed to the highly verbal tasks (requiring answers to relatively complex verbal questions). These children yielded normal nonverbal IQ scores, but conceptual deficits were apparent. These deficits were most apparent on less verbally based tasks, eliminating the language impairment as the reason for lower task performances.

Symbolic research models have immediate implications for written language studies due to the symbolic nature of writing (graphemes used as symbols). However, the studies found in literature to date concern young pre-literate

children. The examination of Piagetian symbolic function is best suited to the young subject, just developing literate forms. The adolescent, however, has passed a period of initial symbolic development.

Cognitive Style. Research reviewed above has explored symbolic function and cognitive concept formation in young language impaired children before significant written language development. In the following paragraphs, research with older adolescents concerning cognitive style and written language are explored.

Kagan (1980) evaluated cognitive style as related to written syntactic complexity in secondary and post-secondary students. Cognitive styles are sets of dichotomous categories, indicating the way information is processed. Each constituent of the dichotomy is an opposite approach to information processing. People exhibit different combinations of cognitive styles on specific style tasks.

Kagan's subjects participated in three tests of cognitive style and a controlled paragraph writing sample. Kagan found that frequency measures of specific syntactic structures (coordination, unbound description-final position, embedding, elongation, and prepositions) significantly correlated with two cognitive styles (field-independence and reflectivity). Field-independence/field-embeddedness is a dichotomy representing the "ability to disassociate/associate figures embedded in a complex field" (Kagan, 1980).

Reflectivity/impulsivity is a dichotomy representing "a tendency to respond slowly/quickly to stimuli (Kagan, 1980). Field embeddedness and reflectivity are typically analytical cognitive styles of processing visual information.

Kagan's study results indicated that there was a tie between analytical cognitive style and syntactic complexity. However, few studies have been conducted to corroborate these findings. It is questionable whether dichotomous measures of a cognitive style can completely identify the complex cognitive activities inherent in writing.

Automatic/Purposive Processing. An additional cognitive ability study includes Ceci's work (1982, 1983) concerning automatic and purposive semantic processing in language-learning disabled (LLD) and normal 10-year-old students in visual and auditory tasks. As defined by Ceci,

> Automatic semantic processing refers to involuntary processing of some aspects of an auditory or visual stimulus' meaning. It is a by-product of perception and normally occurs without intention or awareness. Purposive semantic processing refers to voluntary allocation of attention to the meaning of a stimulus. This process presumably places demands on a limited-capacity working memory (Ceci, 1983).

Purposive processing would be found in tasks requiring identification of rapidly presented pictures, with an accompanying unrelated or neutral semantic prime. Response time would be slower with an incorrect prime (e.g., This is a fruit, when presenting a horse picture). The subject would have to devote more attention to processing the

incorrect verbal prime and the unexpected picture. Neutral primes such as This is something you know can be used also. A subject's response time would increase if an accurate semantic prime was presented auditorily (e.g., This is an animal), before showing a picture of a dog. The automatic processing tasks used semantically related primes, while purposive processing tasks used semantically unrelated primes.

Tasks similar to the examples above were provided for all subjects. Speed in identifying word versus non-word visual stimuli presented rapidly was also measured (Ceci, 1982). Ceci found that all subjects could automatically process linguistic information at similar ability levels. He noted that 10-year-old LLD subjects were less accurate and took greater amounts of time on a purposive task than their chronological age matches. They performed similarly to 4-year-old normal children.

Ceci's study indicated that there were some processing differences between groups of LLD and normal students at 10 years of age. These studies dealt with both verbal and nonverbal stimuli in auditory and visual presentation modes. Tasks concentrated on comprehension of limited verbal units with no production components.

Hierarchical Structuring. Several researchers have begun to explore the hierarchical processing abilities of children and adolescents with specific language impairments, targeting written language correlations. Hierarchical

structuring involves the ability to interrupt the construction of a model or sentence, as opposed to following a sequential order for constituent placement. A hierarchical strategy for constructing a mobile, for example, would involve alternately adding right, then left sections of each node in the mobile. Certain researchers (Cromer, 1978a, 1978b, 1983; Greenfield & Schneider, 1977; Grossman, 1980) propose that hierarchical processing disabilities may produce the language impairments of adolescents, particularly those with written syntax difficulties.

Greenfield and Schneider (1977) conducted a developmental study with middle-class children and adolescents ages 3-11 years, using a nonverbal construction task. The task required children to construct a tree structure exactly like a model displayed in front of them, using plastic straws. Subjects were then asked to use a "harder" process for constructing the model. If subjects did not spontaneously use at least one interruption on the second trial, a hierarchical construction was modeled. Then a completely serial construction sequence was modeled and subjects made a third construction. The researchers examined the complex hierarchical organization of the finished structures and the construction process. In particular they noted interruption of constituent units in the construction process.

By six years of age, 90% of the subjects could produce an accurate mobile replica. Complexity of the structures

(determined using a devised measure of degrees) increased from ages 3 to 6, leveling off with completely accurate mobiles at ages 7+. The analysis of the construction process centered on the 6-11 year-olds, who could accurately produce the whole mobile. The youngest subjects worked from the bottom of the model and up, crossing to the opposite side. None of the older subjects used this completely serial approach. The 9 and 11-year-olds primarily began at the top of the model, indicating awareness of a hierarchical design. They worked from superordinate to subordinate nodes. Number of interruptions or shifts from one side to the next increased with age, with the 11-year-olds producing twice as many shifts as the 6-year-olds.

All subjects used primarily serial constructions in the initial trial, though they could produce at least one shift, after demonstration, on the second trial. Subjects apparently utilized the more comfortable construction mode initially. According to Greenfield and Schneider's findings, use of a hierarchical strategy in this construction task increased with age. However, ability to use this process following a demonstration did not mean the hierarchical skill would be used spontaneously by subjects.

The researchers' literature review cited increasing hierarchical complexity in children's nonverbal actions with age. They speculated on a possible relationship between nonverbal hierarchical increases and language complexity increases with age in normally developing children. The researchers also speculated that center-embedded relative

clauses were the most hierarchical in nature, due to their interruption of the main clause.

Several studies assess nonverbal and verbal hierarchical abilities in aphasic adolescents. Cromer (1978b, 1983), also interested in the relationship between language problems and hierarchical processing, has studied children identified as developmentally dysphasic. Developmental dysphasia generally indicates slow or faulty development of language in children with no evidence of gross neurological or psychiatric disability (Zangwill, 1978). The most handicapping features of this disorder are educational and social in nature. Developmental dysphasia was initially categorized as a spoken language deficit, but Cromer began to examine the written syntactic abilities of these children.

Cromer (1978b) studied the written syntactic productions of 10 severely aphasic children ages 7;6 to 16;0. Nonverbal IQs were within normal limits. Subjects had been instructed in reading and writing at a residential school in England. Subjects were required to watch a mimed puppet show and produce a written summary of what they saw. Each child was allowed 45 minutes to write, with only six subjects producing analyzable samples.

Cromer examined the syntax of written samples from the perspective that each element of a sentence is interrelated, either on an equal status or a lesser status (coordination vs. subordination). He believed that any structure that interrupted between the subject-verb, or interrupted the

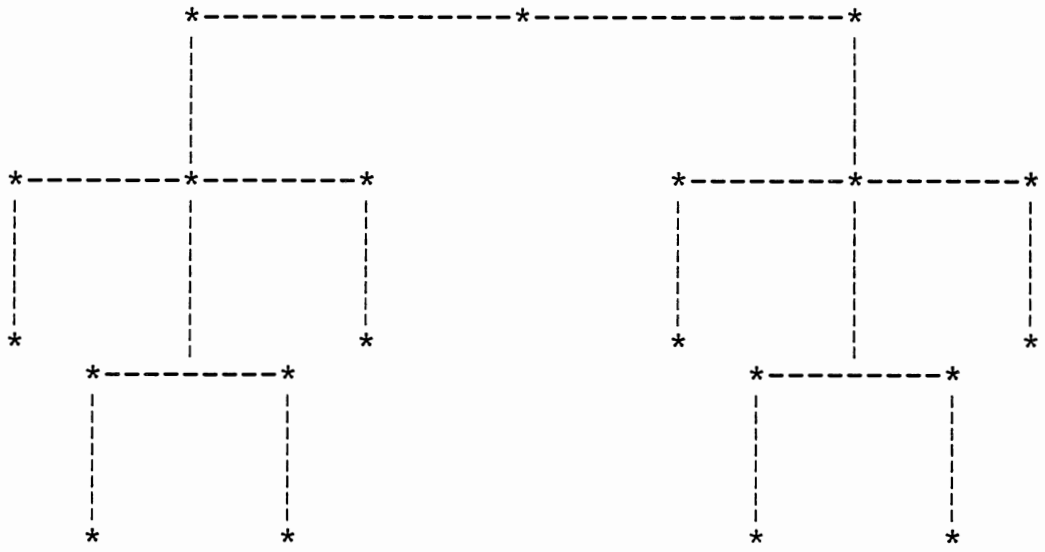
serial order of a comment required hierarchical planning. Cromer identified embedded structures and interrupters such as relative clauses, conjunctions joining two subjects or two verbs with the same subject, and extended adjective sequences as hierarchical syntactic structures. Using frequency counts, Cromer found these syntactic structures deficient in sampled dysphasic writing.

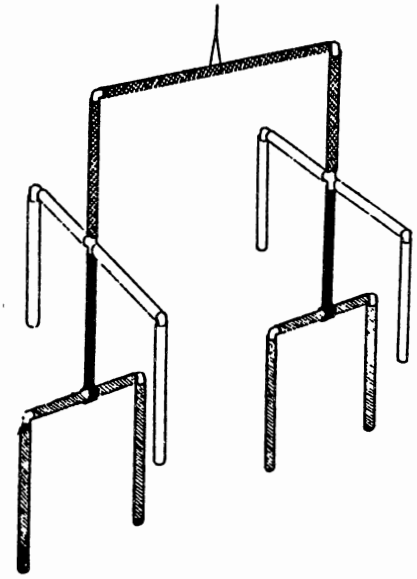
He reasoned that if the aphasic language impairment was based on an auditory processing problem, as commonly thought, then syntax would resemble that of profoundly congenitally deaf students. Congenitally deaf subjects were shown the same puppet show and samples were analyzed in the same manner. Aphasic subjects produced fewer sentence types and verb types in comparison to the congenitally deaf subject samples. Aphasics also lacked instances of negative structures, question structures, qualifying adjectives or complement clauses. Deaf subject samples contained 35.9% of embedded or conjoined structures, whereas aphasic subject samples contained only 12.0%. Since the aphasic writing did not resemble that of the profoundly deaf, Cromer surmised that the disorder was based on a different problem. A deficit in general cognitive ability to hierarchically process information might be a possible proximal cause of language impairment. However, it would be difficult to make generalized assumptions on the written abilities of aphasic children as a group based on only six samples. Likewise, the educational experiences of the deaf subjects would affect their written performance in comparison with the

aphasics.

Cromer (1983) next looked at the hierarchical planning abilities of aphasic children with convulsive disorder through non-verbal construction and drawing tasks, as devised by Greenfield and Schneider (1977). Examples of the mobile and tree diagrams used are found in Figure 1. Subjects included five receptive aphasics, seven expressive aphasics, 12 profoundly deaf children, and 12 non-disabled children. Ages ranged from 9;6 to 16;4. Children were first asked to construct a straw mobile figure and to draw a tree figure. The hypothesis was that children would first follow the easier serial method to construct these figures. This was the case. Next, the examiner demonstrated a sequence of constructions or drawings which required hierarchical planning. Children were asked to reproduce this method of construction.

Cromer found that aphasic children demonstrated an inability to construct these figures in a sequence requiring hierarchical planning. Profoundly deaf and normal children did significantly better in this area. Cromer linked this planning deficit to aspects of language disorder found in the aphasic group. Cromer noted that one aphasic subject did not experience hierarchical construction difficulties. This subject did not produce a written sample similar to the other aphasic subjects. In Cromer's study, extent of deaf subject training in American Sign Language was not detailed. This manual communication system, with hierarchical referential systems utilizing space, could have influenced





Source: Cromer, R. F. (1983).Hierarchical planning disability in the drawings and constructions of a special group of severly aphasic children. Brain and Cognition, 2, 144-164.

Figure 1. Line Drawing and Three Dimensional Model.

hierarchical and writing performances in deaf subjects.

Cromer's findings support the earlier work of Grossman(1980), who found hierarchical planning deficits in a subject population of Broca's aphasics. Grossman used a similar non-linguistic tree drawing with a population of Broca's aphasic adults. Twenty-eight aphasics and five control subjects between the ages of 40 and 60 years were included in this study. Grossman noted that Broca's aphasics did not demonstrate deficiencies in geometric figures and drawings (not hierarchically organized). However, this population did experience difficulty in demonstrating comprehension of sentences with hierarchical syntax. Grossman wanted to determine if these subjects would demonstrate difficulty with hierarchically organized tree structures, given their linguistic difficulties.

All subjects were asked to reproduce two tree structures from tongue depressors, using their preferred hand. One tree structure was symmetrical and one was asymmetrical. Each subject was given two opportunities for construction, once from memory following a 30 second examiner demonstration, and once copied independently from a model.

Two hierarchical structures were analyzed: 1) whether the structure produced was hierarchical (had subordinated units to a superordinate unit) and 2) whether sticks were placed in a hierarchical fashion (shifts from one side to the next). The Broca's aphasics could not recall the hierarchical method of tree construction, and reverted to a

serial method of drawing. They reproduced the constructions symmetrically, and maintained their serial constructions under both memory and copy conditions. Grossman suggested a central component for hierarchical processing, which would underlie both nonverbal abilities and verbal sentence formulation.

In addition to drawing and construction tasks, rhythm has also been used as an indicator of hierarchical structure in speech behavior. Martin (1972) supports the idea of rhythm as a relative timing factor between adjacent or non-adjacent elements in a sequence. The construction of a rhythm requires hierarchical processing or processing of the overall product, as opposed to processing sequentially, beat by beat. Each beat would not receive equal emphasis, because some would be subordinated. Rhythm, then, could serve as a non-linguistic measure of hierarchical processing abilities.

Studies by Lea (1975, 1980) indicate a high correlation between language ability and rhythmic ability in language and speech disordered children. Such hierarchical processing deficits could underlie significant language and speech disorders, in both aphasic study subjects and in language impaired children.

Hierarchical Requirements of Written Text

For researchers interested in the hierarchical structuring deficit hypothesis as an explanation of language

impairment, written language is a potentially fruitful area of study. Written language is different from spoken language in a variety of areas. At a very basic level, reading and writing must be systematically taught to a child, whereas spoken language is acquired with indirect modeling and exposure.

Differences in the real time processing constraints of spoken and written language also exist. Spoken language requires rapid lexical and syntactic formulation decisions; in written language there is more time for these processes. Spoken language allows no opportunity for elaborate revision. Once produced, speech is not easily reviewed or revised, as the written word may be. There is greater opportunity for elaborate planning in the written mode, though some formal speeches also utilize this production stage.

Halliday (1987) outlined structural consequences of real-time processing differences in speaking versus writing. He stated that written grammar tended to have an "integrated" quality, through the use of predominantly written methods. These methods included: 1) use of more nominalization, in which a lexical verb was used as a noun or a noun premodifier, 2) use of more attributive adjectives, 3) use of more complement clauses, and 4) use of more relative clauses. These written methods required the interruption of the main clause with additional information (e.g., an adjective or a relative clause). This interruption was a hierarchical process and required the

working memory and reviewing opportunities available in the written mode. Halliday (1987) examples included a more "written" form, Every previous visit had left me with a sense of the risk to others in further attempts at action on my part. Structures such as previous, of the risk, to others, in further attempts, at action, and on my part are not clausal elements, but add valuable information. Spoken language was as complex, but most information was placed in clause complexes. These complexes tended to be organized with new and important information located at the end of a clause complex. An example of the more "spoken" form was Whenever I'd visited there before I'd end up feeling that other people might get hurt if I tried to do anything more. This sentence expressed the same information, but used four clauses tied together.

Halliday (1987) noted that there were syntactic differences in the complexity of spoken and written language. The use of certain hierarchical forms, such as nominalization and embedded relative clauses, differed in Halliday's comparisons of spoken and written language. However, one does not observe such contrasts in the speaking and writing of very young children (7-years-old or younger). Therefore, it must be assumed that written and spoken language differences develop over time. That development is explored below.

Development of Distinctively Written Form

Halliday (1987), as mentioned above, compared lexical

density and grammatical complexity in written and spoken language samples. He observed that spoken language was a linking of ideas by juxtaposition and intonation, to form clause complexes. He proposed that speech was just as complex as writing, though the complexity was of a different nature, possibly more sequential. He suggested that spoken language analyzed in other studies (Chafe, 1982; Gillam & Johnston, 1989), using written language grammars as a performance norm, necessarily suffered in comparison.

Halliday found that written language contained lexically dense nominal groups. Such nominal groups were achieved by taking information that could be used as a subject-predicate clause and transferring the information to a nominal group. Nominal group expansion mechanisms included nominalization, postnominal prepositional phrases, and adjectives. These noun phrase expansion mechanisms were hierarchical in nature, due to their interruption of a noun phrase within the independent clause.

Researchers have examined the syntactic differences existing within spoken and written language production, both with children and adolescents developing language normally, and those diagnosed as LLD or SLI (Scott, 1988; Scott & Klutsenbaker, 1989; Halliday, 1987; Gillam & Johnston, 1989; Scott, 1984; Loban, 1976; Hunt, 1965). Studies show that most children produce speech with higher levels of complexity than their writing until the age of 10 years (Gillam & Johnston, 1989; Scott, 1984). After 10 years of age, children with normally developing language produce

written samples with greater syntactic complexity. Kroll (1981) described four phases of spoken/written language development, based on stylistic and syntactic considerations. The first was the preparation phase in which children concentrated on spelling and writing mechanics. Their productions were shorter with grammatical errors of omission. In this phase, written language was inferior to spoken language. The second phase was the consolidation phase in which written and spoken language closely resembled each other. Subjects produced writing that sounded like their speech. The third phase, the differentiation phase, usually occurred at age 9 or 10. At this phase typically written structures emerged in writing and spoken structures appeared less frequently in writing. Such written structures included more subordinate clauses and passive verbs. At phase four, the integration phase, subjects could move easily between written and spoken forms, adapting them to meet their writing goals. The hierarchical forms noted in the previous section (nominalizations and embedded relative clauses) would initially appear in the differentiation phase. Use of these structures would be expected to increase with age, throughout these writing phases.

Further evidence of a developmental progression in textual hierarchical processing comes from a recent study by Scott and Klutsenbaker (1989). The researchers used a film summarization task to analyze naturalistic writing in normal language and language-learning disabled (LLD) subjects.

Subjects included three 11-year-olds, two 14-year-olds, and two 21-year-olds. Two 11-year-olds and one 14-year-old were diagnosed as LLD. Scott presented four 15-20 minute videotapes from different genres (two expository and two narrative) as stimuli. Then subjects were asked to summarize what they had learned. This reduced the amount of information that the subjects had to produce independently, decreasing the processing load. By using the film stimuli, all subjects also possessed a common knowledge about the topic. However, it must be assumed that short term memory and auditory comprehension played a significant part in the information acquisition.

Scott collected spoken summaries, followed by short distractor activities (approximately 10 minute delays). Following the distractor activity, written scripts were collected, decreasing the influence of the spoken productions. The researchers performed a descriptive analysis of subordinate clause types, mean lengths, verb phrase expansion methods (passives, modals, etc.), noun phrase expansion methods (post-nominal prepositional phrases, nominalization, adjective series, etc.), and literary lexicon (general vocabulary, specific vocabulary, pronouns, etc.). Comparisons for these specific forms were made between only spoken and written summary sentences expressing similar content. In other words, a comparison was made to determine how each subject expressed the same topic in both modes (spoken versus written).

Scott and Klutsenbaker found that age and ability

factors affected both written syntactic structures and summarization content in adolescent writing. Subject scores on written nominal structures organized the group according to age and ability exactly as would be expected. They found that all students produced syntactic subordination.

Expanded noun phrases were typical of written text and were influenced by the age of the writer. The 21-year-olds produced ten times the number of noun phrase expansions as the 11-year-olds. However, the 11-year-olds did use at least one such noun phrase expansion, indicating the emerging use of this more written form. Examples of noun phrase expansions found in written film summaries and their spoken counterparts are listed below:

Nominalization (verb used as noun in written summary)

-/it starts **to flashflood**/ spoken summary

-/**flashflooding** occurs/ written summary

Nominalization (verb used as noun premodifier)

-/and then one day this goat **ran away** from their farm/ spoken summary

-/one day he chases a **runaway** goat up a mountain/ written summary

Prepositional phrase as a noun phrase postmodifier

-/and then bees and everything will come get nector stuff/ spoken summary

-/bees come to feed off the nector **in the flowers**/ written summary

Postmodifying relative (and other) clauses

-/sometimes **they have rainstorms** even/ spoken summary

-/rainstorms **that occur...**/ written summary

Nouns (potentially modifiable) versus pronouns (not modifiable)

-/**it's** about this guy/ spoken summary

-/**this story** is about the guy/ written summary

Literary lexicon

-/and then one day he was taking the sheep to the pasture to let them **eat**/ spoken summary

-/one day when Yanis was taking the sheep **graze...**/ written summary

Lexically specific terms were used to a greater degree in written samples as well. Two forms rarely found in the younger subject and language impaired subject samples included nominalization (verb to noun and verb to noun premodifier) and literary lexicon.

The developmental information in this section was derived from naturalistic samples, in which the child was presented with some stimulus (a film) and asked to speak or write about it for a certain amount of time. However, many different writing tasks have been devised to assess written hierarchical processing.

Methods of Assessing Hierarchical Processing in Written Text

Assessment tasks for written syntax can be viewed across a continuum of control. This continuum is based on the amount of control exerted upon the types of syntactic structures, the organization, and the content that subjects

produce. Three assessment tasks useful in examining written hierarchical syntax are described below, including a naturalistic summary writing task, a mildly controlled matrix task, and a controlled sentence combining task.

Naturalistic Samples

A naturalistic sample would include language obtained by simply introducing a topic and asking the subject to write or speak on that topic. Such tasks are thought to indicate typical subject language performance. As an example, story telling/writing tasks have been used with a wide variety of age groups.

Recently, researchers such as Scott (1987) have stressed the importance of using expository text samples to assess writing, particularly with older adolescents. Expository text predominates in the science and social studies courses for the older adolescents; therefore, these expository text samples would closely resemble school writing assignments for this adolescent group.

Additionally, certain types of expository text would lend themselves to specific written forms. A descriptive text would presumably elicit use of adjectives, relative clauses, and prepositional phrases. However, use of a less controlled naturalistic task can result in a limited number of target structures for analysis. In written language studies, structures such as embedded relative clauses and postnominal prepositional phrases are low-frequency; therefore, analysis of these forms would be limited.

In a naturalistic sample, no constraints are placed upon the types of syntax that subjects produce. However, naturalistic samples may control for the amount of information a subject must supply in the writing task. An opinion essay might require knowledge of a particular topic (such as writing on the death penalty), whereas a book report or film summary requires less previous knowledge. It must be assumed that summaries are dependent on the amount of information a subject is able to extract from the stimuli. For example, watching a film requires auditory comprehension, sufficient attention span, and short-term memory. Summary writing is a typical task in the adolescent school years (as seen in short descriptive reports and book reports). Scott and Klutsenbaker (1989) utilized such a film summary task and found that age and ability determined performance on the summary task, much as expected.

Matrix Task

While syntax is one example of hierarchical processing, other studies indicate that hierarchical and simultaneous processing also influence the organization of information within a text. The ability to combine more than two elements or "chunks" of information and to use cohesive devices is dependent in part on hierarchical planning, or the act of subordinating and coordinating information. Working memory plays a part in this composition also.

A matrix task is a mildly controlled assessment task for syntactic forms, with a limited amount of information

provided to the writer. Subjects may use syntax of their own choosing to form the sentences. However, this is a difficult task due to the amount of text that must be independently generated by subjects and due to the novel format of the task. It places greater text generation requirements on the subject with increased processing load for the novel task format. Bereiter and Scardamalia (1987) developed this task for examining textual hierarchical processing. Their method used a matrix of information which children had to combine in a sentence or short paragraph. Additionally, subjects were asked to write a short thesis on a presented topic. The researchers devised developmental levels for analyzing these tasks. The levels were based on how many units of information or ideas the children combined at one time. Figure 2 illustrates an example of such a matrix of information and possible verbal solutions for that matrix. Note in figure 2 that a level 1 solution consists of single simple sentences with only one idea unit expressed per sentence. At level 2, the author ties the ideas of temperature and fruit crop together using the conjunctive <u>and</u>. At level 3 the author uses a conjunctive <u>so</u> to indicate a logical relationship (idea 1) between temperature (idea 2) and fruit crop (idea 3). In a level 4 construction, one complex sentence expresses six ideas with a coordinated sentence. In their research using the matrix task, Bereiter and Scardamalia found that the ability to handle six elements of information at a level 4 solution was found in seventh grade samples on a limited basis only. No

	STATE	
	Michigan	California
TEMPERATURE	cool	warm
FRUIT CROP	apples	oranges

Level 1: "In the state of Michigan the temperature is cool. In the state of Michigan the fruit crop is apples. In the state of California the temperature is warm. In the state of California the fruit crop is oranges."

There is no integration of information units within the matrix, or no idea coordination/subordination.

Level 2: "In Michigan the temperature is cool and the fruit crop is apples. In California the temperature is warm and the fruit crop is oranges."

Two units of information are integrated or coordinated in one sentence.

Level 3: "In Michigan the temperature is cool so their fruit crop is apples. In California the temperature is warm so their fruit crop is oranges."

Three units of information are coordinated in each sentence.

Level 4: In Michigan's cool temperature they harvest apples but with California's warm temperature oranges may be grown."

Information from each of four units is considered simultaneously.

Source: Bereiter, C., & Scardamalia, M. (1987). How children cope with the processing demands of coordinating ideas in writing. In C. Bereiter & M. Scardamalia. The psychology of written composition (pp. 155-176). Hillsdale, NJ: Lawrence Erlbaum Associates.

Figure 2. Sample Matrix and Possible Solutions (Bereiter & Scardamalia, 1987).

level 4 solutions were found in fifth grade writing.

Researchers also utilized this coordination/subordination level analysis in spontaneous samples. Yau and Bereiter (cited in Bereiter & Scardamalia, 1987) noted that level 5 solutions were found in 19-year-old writers' spontaneous samples. They hypothesized that due to working memory limitations, level 5 constructions would be about the highest level that writers could attain. The matrix task is slightly more controlled than the naturalistic writing. Specific ideas are supplied and subjects are asked to write a sentence or series of sentences. However, the task is not designed to produce a specific syntactic structure. Subjects select the methods for creating different levels of idea coordination/subordination.

Sentence Combining Task

Numerous studies (Combs, 1976; Daiker, Kerek, & Morenberg, 1978, 1979; Mellon, 1969; O'Hare, 1971; Strong, 1976) have utilized analysis of sentence combining activities to indicate syntactic ability. At this level, input information was controlled and researchers could collect large numbers of performance examples in a relatively short time period.

Some of the earliest studies on sentence combining dealt with assessing the practicality of teaching written grammatical structures using combinational tasks (Mellon, 1969; O'Hare, 1971). In these initial studies, sentence

combining tasks did train specific syntactic structures in seventh grade subjects. Some limited generalization of these structures to the naturalistic writing of the individual also occurred.

Numerous studies have examined the efficiency of sentence combining as a diagnostic measure, including a review by Brown and Brown (1983). They support findings that sentence combining is an adequate, efficient tool for syntactic diagnosis if syntactic targets are not cued. Students must also fulfill a range of writing intents (to influence, to empathize, to distance oneself from audience) during the combining task to provide a wide evaluative context with stimuli longer than isolated sentences (text level). In sentence combining, students demonstrate some amount of composing and editing skill, but are not required to provide the content of the message. Providing content places burden on processing in naturalistic writing, and may interfere with use of all possible syntactic structures that the writer is familiar with.

Sentence combining allows for control of specific target syntactic structures, such as embedded relative clauses. This task requires little previous knowledge to create content in the writing task. Sentence combining can also be used to obtain spoken samples, but is typically used with written language studies.

Problems with Previous Studies

It is important to remember that cognitive processes

are numerous and there are undoubtedly many causative factors contributing to literate language deficits. Research of primary and proximal causes in language impaired populations has so far failed to predict specific types of language deficiencies (Johnston, 1988). Deficiencies in the rapid processing of auditory stimuli, for example, do not predict specific language deficiencies that a child will have, only that language deficiencies of some type are likely. None of the models have been shown to separate language impaired groups into diagnostic subgroups, demonstrating unique sets of language weaknesses.

Additionally, many cognitive ability studies have dealt with children before the development of significant written language skills. Few nonverbal hierarchical studies have included adolescent subjects and writing tasks.

In preliminary research, Cromer, Grossman, and others have found that nonverbal hierarchical structuring disability and a deficiency in written embedded syntactic complexity tend to appear together in aphasic children and adults. No studies concerning nonverbal and verbal measures thought to share hierarchical processing requirements have been conducted with language impaired adolescents. Furthermore, no controlled language measures and naturalistic tasks have been used in combination to determine linguistic correlates for this hierarchical processing.

Purpose of Present Study

If a correlation could be discovered between certain nonverbal tasks, cognitive abilities, and linguistic skills, a diagnostic battery might be developed to assess these areas. Such a nonverbal diagnostic battery applied early in language development might be used to predict later language difficulties. Early intervention could be utilized targeting the mental process, thus increasing linguistic foundations for later development.

The current hypothesis contains two points:
1) Adolescents exhibiting normal language skills will perform at higher levels on nonverbal measures of hierarchical processing. Adolescents diagnosed with a language impairment will perform at lower levels on nonverbal measures of hierarchical processing.
2) Low levels of performance on nonverbal measures of hierarchical processing will correspond with deficits in written syntactic structures related to that hierarchical processing, as reflected by an inability to produce relative clauses and noun phrase postmodifying structures in sentence combining tasks. In written matrix tasks, low levels of non-linguistic hierarchical performance will correspond with lack of relative clause embedding and noun phrase postmodification. Those matrix writing samples would also lack idea subordination, a hierarchical task. Naturalistic writing samples will evidence lack of relative clause

embedding and lack of noun-phrase prepositional postmodification.

CHAPTER II

METHOD

Subjects

Twelve students comprised two test groups, a group of six adolescents with language impairments (LI) and a group of six adolescents with normal language abilities (NL). The subjects were matched for age and gender. Age matching was within ± 6 months. All subjects were between the ages of 12 and 14 years, with an LI mean age of 13;3 years and NL mean age of 13;2 years. All attended Oklahoma schools. One adolescent was in sixth grade and 12;2 years old. Three NL and three LI subjects were female and three NL-three LI subjects were male. Seven students (3NL, 4LI) were in seventh grade and ranged from 12;4 to 13;9 years. Four students (3NL, 1LI) were in the eighth grade and were 13;5 to 13;6 years of age. Students attended six different school systems; however, all schools followed Oklahoma state curriculum requirements.

All subjects met the following criteria: 1) nonverbal intelligence within one standard deviation below the mean (85+) as determined by the Test of Non-Verbal Intelligence-II (TONI-II) (Brown, Sherbenou, & Johnsen, 1982), and 2) hearing results on an air conduction screening

at 20db HL (ANSI 1969) or better between 500 and 6000Hz. Hearing screening was conducted by the examiner using a portable Beltone 12D audiometer in a quiet testing room. None of the children had a history of other physical or emotional disorders affecting language performance according to parent interview. LI determination was based on language assessment performed by certified speech-language pathologists and contained in school or clinic records. Two LI subjects were receiving language remediation services in a metropolitan school district. Scores below one standard deviation on one language test within a test battery were required for language services in that school; the test battery included the Test of Written Language-II, the Fullerton Test of Adolescent Language-Revised , and the Lindamood Auditory Conceptualization Test. The remaining four LI subjects were receiving language remediation services at a university clinic. These subjects received a score below one standard deviation on at least one language test in the following battery of standardized tests: 1) the Lindamood Auditory Conceptualization Test, 2) the Word, and 3) the Analysis of the Language of Learning. Normal students had no developmental history of language impairment or educational history of academic failure, as determined by parental report. All normal group members were in regular class placements with average (C) or better grades.

The students were not informed of their group placement or the criteria for group selections. Experimental numbers were assigned to subject information and samples for

confidentiality purposes. Only the examiner knew subject names in connection with this information. No subject names were used in the report. Videotapes and audiotapes were viewed only by the examiner and those Speech-Language Pathologists assessing intra-judge reliability. No identifying information was connected with the tapes or writing samples. Table 1 shows sex, age, grade, TONI-II, and school information for each subject.

Procedures

Institutional Review Board forms are located in Appendix A to substantiate permission for use of the following subject pools and procedures. The experiment consisted of four verbal hierarchical processing tasks and a non-verbal hierarchical processing task, outlined below:

Task

Verbal hierarchical processing

1) film summation task (spoken)
2) film summation task (written)
3) sentence combining task (written)
4) matrix task (written)

Non-verbal hierarchical processing

mobile construction

All verbal tasks were selected and designed to encourage production of the targeted hierarchical syntactic forms (embedded relative clauses and post-nominal prepositional phrases). The film summaries were naturalistic tasks. The written sentence combining

Table 1

Sex, Age, Grade, and TONI-II Quotient for Each Subject

LI Subjects						NL Subjects					
Subj	Sex	Age	Gr	T/II	School	Subj	Sex	Age	Gr	T/II	School
LI1	M	12;2	6	87	A	NL1	M	12;4	7	107	D
LI2	M	13;0	7	105	B	NL2	M	12;6	7	120	D
LI3	M	13;10	7	105	C	NL3	M	13;5	7	114	F
LI4	F	13;3	7	94	D	NL4	F	13;5	7	120	C
LI5	F	13;5	8	97	E	NL5	F	13;9	8	95	F
LI6	F	13;9	7	105	D	NL6	F	13;9	8	118	F

and matrix tasks were controlled elicitation tasks.

General Testing Procedures

Experimental tasks were administered to all subjects in a quiet room free of distractions. All experimental tasks were presented by the examiner (a second year graduate student in Speech-Language Pathology). Four subjects (2NL and 2LI) were tested in groups of two for sentence combining and matrix tasks. All remaining tasks were presented individually. Subjects were offered a 5-10 minute break every 30 minutes or as needed. A soda was supplied during the testing situation. Experimental tasks required 2-3 hours. Two LI subjects and their NL matches completed the experimental tasks in two test sessions. The remaining subjects completed experimental tasks in one test session. Tasks were presented in the order outlined. The only time limit restrictions applied to the spoken film summary (speaking for at least 5 minutes) and the written film summary (writing for not more than 30 minutes) to offer a mild control for length of samples.

Verbal Hierarchical Processing Tasks

Summary Tasks (Spoken and Written). The only spoken task was administered individually and designed to assess the frequency of occurrence of hierarchical forms in a spoken monologue. The children gave a spoken summary of the film The Desert (Casden, 1980) immediately following its viewing. The Desert is a short descriptive film concerning

the desert environment, plant life, and animal life, lasting approximately 15 minutes. The descriptive expository film was selected to decrease use of chronological forms. The description film could also elicit more adjective series, prepositions, and other noun phrase expansions which interrupt an independent clause and are, therefore, hierarchical.

Each child had to speak for at least five minutes on the subject and the sample was audiotaped. If samples were less than five minutes long, the examiner provided certain prompt questions. Student responses were transcribed verbatim. Garbled or unintelligible utterances were deleted from analysis. Words such as false starts, repetitions of words or phrases, nonlinguistic vocalizations (i.e., uh, um), and word tangles were deleted from analysis (see Hubbell, 1988, for further definition of maze utterances).

After producing a spoken summary of The Desert, subjects were engaged in a distractor conversation for seven to ten minutes. Then they were asked to produce a written summary of the film, given 5 minutes for planning and 15 minutes for writing. Subjects could request extra writing time if necessary.

Summary Analysis (Spoken and Written). Spoken and written samples were segmented into T-units for analysis. The T-unit is a terminable unit, defined as a single main clause plus any other subordinated clauses attached to or embedded within that main clause (Hunt, 1970). In future

discussion, the terms T-unit and sentence may be used interchangeably. Total number of T-units, total number of words, average number of words per T-unit, average number of words per clause, and total number of clauses were calculated. A subordination index for each sample was obtained by dividing the total number of clauses by total number of T-units. Subordinate clause types and numbers were obtained, including relative, nominal, and adverbial clauses.

Some normative comparisons were made for overall measures. Normative information was drawn from Scott's review (1988) of large-sample studies of spoken and written output in school-age children and adolescents. Data reviewed in Scott (1988) was derived from either conversational or narrative discourse, whereas the present study sampled informational discourse. Genre (narrative versus expository) effects have been noted for average sentence length measures, so these normative comparisons are made cautiously. When possible this researcher averaged the scores at each grade level for all studies reported in Scott's (1988) table. These are called possible projected scores. All studies reported in Scott's overview were conducted with normal language subjects and norms were reported according to grade levels. Portions of Scott's original tables and averaged (projected) scores used in this study are listed in Appendix B.

Hierarchical syntactic analysis focused on counts of center-embedded relative clauses, total relative clauses

(right or center-embedded), and post-nominal prepositional phrases. Cromer considered center-embedded relative clauses hierarchical in nature. This study took a broader view of hierarchical structures. Right-branching relative clauses would also be considered hierarchical, however, because information coded in a separate clause could be embedded via a relative clause regardless of whether that clauses postmodifier was a subject (center-embedded) or an object (right-branching) nominal. Examples of those syntactic structures are listed below:

Center-embedded relative clauses:

a. The girl <u>that works with Mary</u> moved here from Nebraska last month.

b. The dog <u>that lives down the street</u> bit two people last year.

Right-branching relative clauses:

a. That family lives by the lake <u>which is 3 miles away</u>.

b. I knew the old man <u>who fed the stray dog</u>.

Post-nominal prepositional phrases:

a. That man <u>in the coat with the crazy hat</u> asked me for directions.

b. That book <u>with the blue cover in my backpack</u> has the homework assignment that's due today.

c. I am very tired, because the robins <u>in the tree outside my window</u> woke me this morning.

Frequency of occurrence of total relative clauses and center-embedded relative clauses was normalized for sample

size by dividing total number of target relative clauses by the total number of clauses in the sample. Prepositional phrases were simply tallied according to number of occurrences.

Spoken and Written Summary Comparisons. Three comparisons were made between spoken and written summaries, including 1) distribution of subordination types, 2) typically spoken and written forms, and 3) common topics. Descriptive results of the comparisons were presented in Appendix C. A comparison of the spoken and written summaries was made to determine any sample differences attributable to written versus spoken modalities. Such differences should be present in the writing of adolescents twelve years old or older.

First an analysis of the distribution of subordinate types was conducted. Methods similar to those in Scott and Klutsenbaker (1989) were used, with examination of noun phrase and verb phrase expansions included in typically spoken and written form analyses. Typically spoken and written samples were compared for frequencies of the following types of subordinate clauses:

a) embedded relative clause (total)
b) embedded relative clause (preverbal, center embedded)
c) adverbial clause (total)
d) adverbial clause of condition
e) adverbial clause of reason

f) adverbial clause of result

g) adverbial clause of manner

h) adverbial clause of place

i) adverbial clause of time

j) nominal clause (object)

k) nominal clause (subject)

Counts were made for subordinator types also (i.e., that, when, if, and because subordinators and to-infinitives, nonfinites, or others).

A second spoken/written comparison centered on selected forms identified in the discourse literature as "typically spoken" or "typically written" (e.g., Biber, 1986). Analysis of the frequencies of typically spoken features appearing in both summaries included the following:

a) use of general vocabulary instead of specific terms, as for cactus with (There is **this plant** that stores water.)

b) use of contractions (It **doesn't** rain very often in the desert.)

c) use of stranded prepositions (The rain goes **inside**.)

d) use of third person pronouns (**He** hides in the daytime when it's hottest.)

e) use of first person pronouns (**I** thought the film was interesting.)

f) use of second person pronouns (**You** cannot live in the desert without some water.)

g) deletion of subordinator that (I think ___ the desert is a hard place to live.)

Typically written features examined included the following;

a) larger total number of adjectives

b) larger total number of prepositions

c) use of post-nominal preposition (The man **in the red jacket** went to school with me.)

d) nominalization-verb to noun premodifier (The **pouring** rains cause a flashflood.)

e) nominalization-verb to noun (The **flashflooding** occurs in the spring and fall.)

f) use of adjective series (The **funny little pig-like** animal digs in the ground.)

g) use of passive verbs (The desert **is formed** by erosion.)

h) use of specific vocabulary (The plants use a **tap root system** to absorb water.)

Decisions on general or specific vocabulary were made based on the information contained in the film. Specific vocabulary included scientific terms presented in the film, including adaptation, climate, plateaus, erosion, tap root system, food chain, predator, and others. General vocabulary would include general qualifiers (I think, sort of, etc.) and general words for specific information presented in the film (plants, store water, eat each other, things, etc.). From these analyses it could be determined if subjects made structural and stylistic adjustments which depended on modality.

A final spoken/written summary comparison concerned topic. This analysis was included to determine the extent

to which subjects included similar discourse content in their spoken and written summaries. Topics appearing in at least half of the spoken or written summaries were included in a simplistic topic outline. Totals for the various topics in each modality (spoken versus written) and in each ability group (NL versus LI) were noted.

Sentence Combining Task. A written sentence combining task provided a format for eliciting targeted center-embedded relative clauses and prepositional phrases post-modifying nominals. These were the same syntactic structures singled out for analysis in the spontaneous spoken and written summaries. As shown earlier, several discourse analysts have characterized written language as hierarchically structured via postnominal forms, including relative clauses and prepositional phrases.

Subjects were given sets of stimulus sentences, five with two sentences each and five with three sentences each. Embedded relative target sentences were taken from a master's thesis study conducted by Stokes (1990). Stokes devised sentence combining stimuli to assess the ability of such tasks to adequately group subjects according to language ability. Two test sets targeted second degree, postverbal, restrictive clauses. Three test sets targeted second degree, preverbal, restrictive clauses. Prepositional phrase target sets were devised by the examiner to assess a variety of familiar prepositions. Four of the prepositional target sets were preverbal and one was

postverbal. Two possible postnominal prepositional phrases were targeted to increase the likelihood that the low-frequency structure would be used. All prepositional sets were constructed to produce a target sentence of similar length to the relative clause target sentences. Three of the prepositional sets contained complex sentences to be incorporated with two simple sentences. Sentence combining stimuli, the target sentences, and descriptive information are listed in Appendix D.

Each subject was shown a short training exercise with examples of target structures. The training script is found in Appendix E. Subjects were then asked to combine each sentence group into one sentence, maintaining the information. The examiner read through the sentences for the subjects as many times as necessary. Subjects could request sentence clarification if required. The task required 15 to 30 minutes.

Sentence Combining Analysis. Subjects' sentence combinations were examined for the target structures in each set, either center-embedded relative clauses or noun phrase post-modifying prepositions. One point was awarded for each possible target structure. Five center-embedded relative clauses were possible and 10 target prepositional phrases were possible. Any other hierarchical syntactic structures used in the combinations were included in the sentence combining score. Other hierarchical syntax included nominal premodification or word alterations with fronting of a

subordinate clause. This provided a sentence combining score of 0 to 15.

Additionally, total numbers of center-embedded relative clauses and postnominal prepositional phrases were tallied for the sentence combining task, whether they were used in a targeted manner or not. An example of an ideally combined sentence with a center-embedded relative target includes the following, After Miss Jones sent the student **that was misbehaving** to the principal's office, the class calmed down. An example of an acceptably combined sentence, using correct syntax but not the target form, includes the following, After Miss Jones sent the **misbehaving** student to the principal's office, the class calmed down. The second example uses a nominalized noun premodifier (misbehaving) instead of the embedded relative clause, but is equally as hierarchical. An unacceptably combined sentence would include, After Miss Jones sent the student to the principal's office the class calmed down the student was misbehaving. In this example, the sentences are simply strung together, without use of coordination, subordination, or noun phrase expansion.

Matrix Task. Bereiter and Scardamalia (1987) view writing as a difficult task which demands coordination of complex ideas. They designed a format for evaluation of the structural means for combining ideas in writing. When shown related words in a matrix, subjects were asked to code the relational matrix information in written sentence form. The

resulting sentences were analyzed for hierarchical processing, as indicated by syntactic subordination of matrix information. Examples of such subordination methods were noted in Figure 2, (page 33).

Ten matrixes were constructed by the examiner using a form similar to those provided by Bereiter and Scardamalia (1987). The experimental matrixes are located in Appendix F, along with potential target solutions at each developmental level of coordination/subordination. Each matrix contained six words within three superordinate categories. For example, the words farm, cat, tame, zoo, lion, and wild are related according to the categories of place, animal, and type. Given a matrix containing three superordinate categories, subjects could create level 1 through level 4 solutions. Topics were selected for general informational value, so that little or no prior knowledge was necessary to understand relationships. The general information would be common to these children with similar educational systems and a common culture. In pilot testing, a 12 1/2 year old subject in a regular Oklahoma English class attempted these matrixes. Two matrixes provided difficulty for the pilot subject and were deleted from the set of stimuli.

A matrix was introduced to each subject and examples of level 1 and level 4 solutions were demonstrated. The training script is located in Appendix G. Subjects were asked to write their own solutions and were reminded that any number of solutions were acceptable. Subjects were

given the ten matrixes with 15 to 30 minutes to complete the task. All subjects completed the task within that 30 minutes.

Matrix Analysis. Subject responses were evaluated for level of idea coordination/subordination and for syntactic methods. Each matrix solution was assigned to a developmental level, following examples in Bereiter and Scardamalia (1987). A numeric value from 1 to 4 was awarded for each level, as shown below:

Level 1 = 1

Level 2 = 2

Level 3 = 3

Level 4 = 4

A point value was awarded for each of the ten matrixes and those points summed to give an overall score, with a possible range of 0 to 40.

Nonverbal Hierarchical Processing

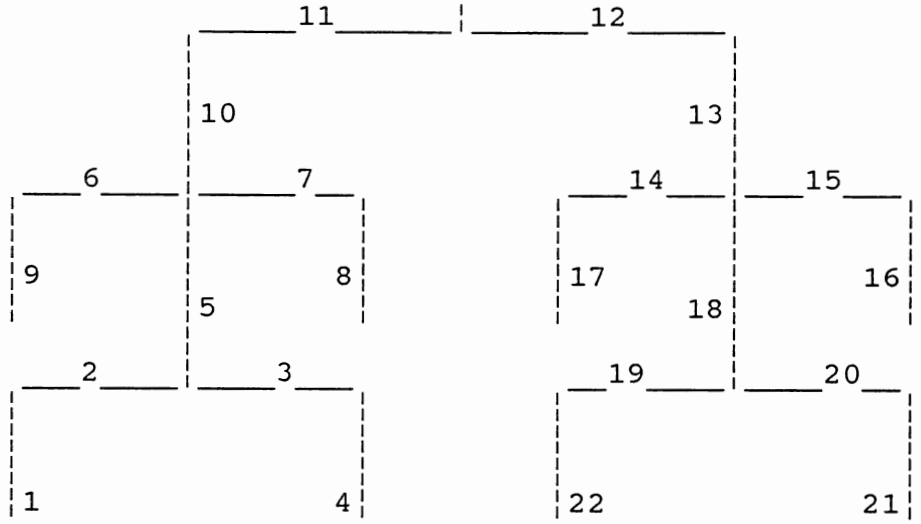
The subjects took part in a measure of non-verbal hierarchical processing designed and utilized by Greenfield and Schneider (1977) and Cromer (1983). Their procedures included constructing a three dimensional mobile, similar to the diagram found in Figure 1, (page 20).

For this task, sequential construction was considered as a construction with no interruption of the nodes (⊓) and the branches of the structure. This means that each node and each branch was completed before going to the next

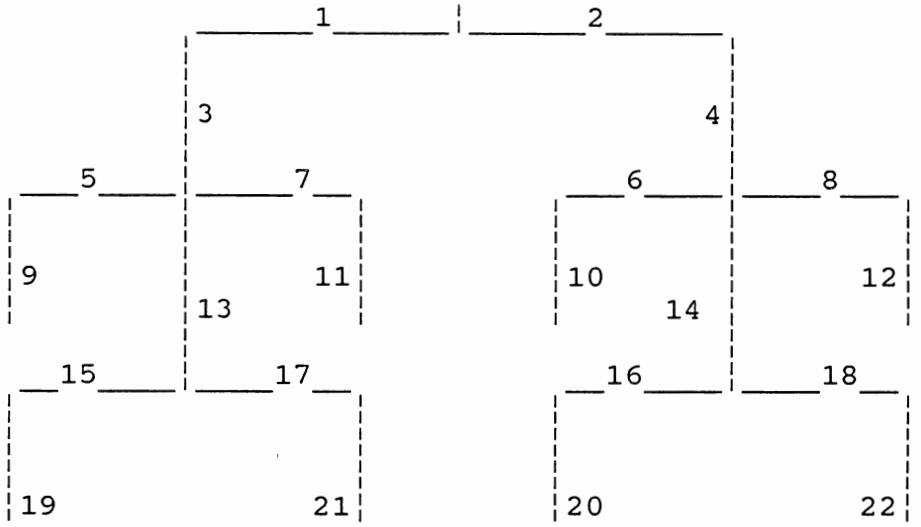
branch. Consequently, each node was joined as in a chain. A minimal hierarchical construction involves an interruption of at least one branch of the construction. The interruption is indicated by a switch to the opposite side of the mobile before the original node is complete. Figure 3 illustrates an uninterrupted construction, considered sequential, and a maximally interrupted construction, considered hierarchical. The numbers illustrate the order in which mobile constituents were added to the structure. All children were of adequate age to manipulate construction materials and reproduce the shapes accurately.

Mobile Construction Task. Subjects were provided with construction sticks and joints. A script of subject instructions is located in Appendix H. They were asked to copy a model mobile hanging in front of them, in any manner they desired. Then the examiner demonstrated a hierarchical method of construction, in which each node was interrupted with alternation from one side of the mobile to the other. The mobile was constructed by mirroring each side. The student was asked to use this same pattern in a second mobile construction immediately after the examiner's demonstration was completed.

Mobile Construction Analysis. Each construction was video-taped and a subject number assigned for identification purposes. Construction sticks were numbered in order of addition to the mobile during actual construction and then verified using the video-tapes. One point was awarded for



3a



3b

Source: Greenfield, P. M., & Schneider, L. (1977). Buidling a tree structure: The development of hierarchcial complexity and interrupted strategies in children's contruction activity. Developmental Psychology, 13(4), 299-313.

Figure 3. Minimally Interrupted (3a) and Maximally Interrupted (3b) Construction Strategies (Greenfield & Schneider, 1977).

each hierarchical break in the node by node construction, with a score of 0 to 20 possible. Hierarchical scores were obtained for initial construction and construction following examiner model. A learning/memory score was created by taking the difference of the second construction trial and the first construction trial. This is a measure of the amount of change in the hierarchical processes demonstrated on spontaneous (first) and imitation (second) trials.

In the discussion, the approach to construction was also addressed. The approach is influenced by the starting location from which a subject begins building. A bottom-up method, in which the subject begins with the lowest (subordinate) nodes of the mobile and works up, is considered a serial perspective. Greenfield and Schneider (1977) speculate that a bottom-up method demonstrates limited perception of the hierarchical structure of the mobile, with subordinate nodes connected to superordinate ones. A top-down method would then indicate an awareness of the general hierarchical structure of the mobile itself.

Reliability

Reliability measures for spoken transcription accuracy and mobile construction scoring were obtained. Two second-year graduate students in speech-language pathology transcribed two spoken summary samples. Agreement for word-by-word transcription on spoken summaries was 95%. A second examiner evaluated subject mobile construction for two samples and agreement for the order of numbers was 98%.

Ranking Trends

Subject rankings for twelve measures were tabulated. Those measures included A-L in the listing for statistics. The examiner noted trends in ranking position for individuals in the continuum subject group (all subjects combined, n=12). Trends were noted by creating 3 performance categories within the 12 rankings. A ranking from 1-4 was a high performance category. Rankings from 5-8 were within the middle performance group. Finally, rankings from 9-12 were within the low performance group. Measure rankings within one performance group for five measures would be considered a noteworthy scoring tendency. An individual subject's verbal hierarchical and nonverbal hierarchical rankings should cluster around one performance level in relation to the subject group.

Statistics

Leonard (1991) has suggested that language-learning disabled students fall on a continuum of language ability and should not be treated as a discrete, deficient group. Correlations were calculated for the whole subject group (n=12). Rank-order correlations were also attempted for each subject ability group (n=6), but were affected by ranking ties.

Due to the ordinal character of the ranking scores, the Spearman Rank-Order Correlation, a nonparametric measure of correlation, was selected for comparisons. The Spearman is

the counterpart of the Pearson r, used with linear data for ratio and interval scale data. Correlations for the subject continuum group were based on a two-tailed test with a sample size of 12 at .05 significance level. Correlations for each ability group were based on a two-tailed test with a sample size of 6 at significance level of .05.

Subject rankings were made according to directions in Haber and Runyon (1969). Rankings for total relative clause production in written and spoken summaries was based upon clausal frequency of occurrence, not actual numbers of relative clauses. Critical values for the rank-order correlation coefficients were found in Haber & Runyon (1969). Correlational coefficients were calculated for the following measures:

A) TONI-II scores (T/II)

B) first nonverbal (mobile construction) scores (1stNV)

C) difference of second and first nonverbal scores [a memory/learning measure] (2ndNV-1st)

D) sentence combining scores (SC)

E) matrix scores (MAT)

F) written summary subordination indexes (WS SI)

G) spoken summary subordination indexes (SS SI)

H) written summary-total relative clause frequencies (WS REL)

I) spoken summary-total relative clause frequencies (SS REL)

J) written summary mean sentence lengths (W ML)

K) spoken summary mean utterance lengths (S ML)

L) age (AGE)

Abbreviations for measures are found in parentheses above. These abbreviations are used in the tabular presentation of this information.

CHAPTER III

RESULTS

Results will be reported according to the outline below:

I. Verbal Tasks
   - A. Spoken and Written Summary Tasks
     1. Overall length and complexity measures, including overall length in words, number and length of T-units, subordination index
     2. Hierarchical syntax measures including frequency of selected syntactic forms
   - B. Sentence Combining
     1. Number and frequency of embedded relative clauses and post-nominal prepositional phrases
     2. Item analysis
   - C. Matrix
     1. Weighted scores for matrix levels (summation of assigned values for different levels produced within task)
     2. Numbers of combinatorial levels
     3. Syntactic methods

II. Nonverbal (Mobile Construction) Task
   - A. Hierarchical construction scores for initial mobile construction

B. Hierarchical construction scores for second mobile

C. Hierarchical learning/memory scores

III. Ranking Trends

IV. Rank-Order Correlational Coefficients

Scores for individual subjects are contained in separate tables for Appendix I. The only statistical results in the following sections included those for Spearman correlations. All other results in this chapter were discussed as trends in the data. The examiner sought out patterns in performance and, therefore, the results should be viewed cautiously, as they are based on examiner hypotheses.

Spoken and Written Summary Tasks

Overall Length and Complexity

Trends

1. Total Words: NL spoken and written summaries were equal. LI spoken summaries were twice the length of written summaries.

2. Mean Sentence Length: NL and LI spoken sentences were longer than written.

3. Mean Clause Length: NL spoken and written samples were longer than LI spoken and written samples. LI and NL written samples were longer than spoken samples.

4. Subordination Indexes: LI subordination indexes were higher than NL subordination indexes for spoken and written samples. Both NL and LI groups produced higher subordination indexes than Scott's (1988) norms.

Verbatim transcriptions of spoken and written summaries are located in Appendix J. All syntactic and lexical

examples provided in the summary analyses are taken from the subject samples in this appendix. Subject punctuation and spelling were preserved, but samples are presented in T-units as assigned by the examiner. Any examiner utterances appearing in spoken samples are contained within parentheses ( ). Words or phrases appearing within brackets { } were deleted from length, syntactic, and lexical analyses.

Table 2 presents the total number of words, sentences, and clauses, mean sentence and clause lengths, and subordination index for each subject's spoken summary. Table 3 presents the same information concerning written summary productions. Subordination indexes and mean sentence lengths were thought to reflect some hierarchical processing constituents and were therefore utilized in the correlational analysis. Total number of words and number of sentences were descriptive measures used in spoken/written sample comparisons only. Because the film summary task was unique to this study, no clear cut normative data exists for total length related to age and language ability. The two measures do relate to modality (spoken versus written) effects, and, therefore, were included in summary comparisons.

Four subjects (LI2, NL2, NL5, NL6) produced written summaries that were longer (**total number of words**) than spoken summaries. Subject NL4 produced summaries equal in length. It would be typical for adolescents 11+ years old to produce considerably longer spoken texts (Scott &

Table 2

Overall Length and Complexity for Spoken Summaries

	Spoken						
	NL1	NL2	NL3	NL4	NL5	NL6	Group Total
# of words	127	139	151	277	40	74	808
# of sent	12	13	14	26	6	15	86
ML in wds per sent	10.58	10.69	10.79	10.65	6.67	4.93	9.40
# of clauses	20	19	25	42	7	20	133
ML in wds per clause	6.35	7.32	6.04	6.60	5.71	3.7	6.08
Sub Index	1.67	1.46	1.79	1.62	1.17	1.33	1.55

	LI1	LI2	LI3	LI4	LI5	LI6	Group Total
# of words	88	108	496	330	389	281	1692
# of sent	9	18	51	34	37	30	179
ML in wds per sent	9.78	6.00	9.72	9.71	10.51	9.37	9.45
# of clauses	15	19	81	56	60	55	286

(Table 2 continues)

	Spoken						
	NL1	NL2	NL3	NL4	NL5	NL6	Group Total
ML in wds per clause	5.87	5.68	6.12	5.89	6.48	5.11	5.92
Sub Index	1.67	1.06	1.59	1.65	1.62	1.8	1.60

Table 3

Overall Length and Complexity for Written Summaries

	Written						
	NL1	NL2	NL3	NL4	NL5	NL6	Group Total
# of words	72	193	54	277	131	108	835
# of sent	10	21	8	28	14	10	91
ML in wds per sent	7.2	9.19	6.75	9.89	9.36	10.8	9.18
# of clauses	14	31	11	40	19	16	131
ML in wds per clause	5.14	6.23	4.91	6.93	6.89	6.75	6.37
Sub Index	1.4	1.48	1.38	1.43	1.36	1.6	1.44
	LI1	LI2	LI3	LI4	LI5	LI6	Group Total
# of words	47	156	77	150	207	230	867
# of sent	8	19	10	18	19	20	94
ML in wds per sent	5.88	8.21	7.7	8.33	10.89	11.5	9.22
# of clauses	12	22	15	30	37	36	152

(Table 3 continues)

	Written						
	NL1	NL2	NL3	NL4	NL5	NL6	Group Total
ML in wds per clause	3.92	7.09	5.13	5.00	5.59	6.39	5.70
Sub Index	1.5	1.16	1.5	1.67	1.95	1.8	1.62

Klutsenbaker, 1989), but this held true only for seven subjects.

Comparisons are made using projected normative data derived from Scott's (1988) research review. For that information and projected results, see Appendix B.

Mean for all **sentence lengths** in the spoken sample was 9.43 and 9.20 in the written sample. In group comparisons the NL mean for sentence length was 9.40 in the spoken sample and 9.18 in the written sample. Similar sentence lengths were produced by LI subjects. The LI subject mean for sentence length was 9.45 in the spoken sample and 9.22 in the written sample. Spoken and written sentence lengths for both groups were generally comparable to projected mean lengths for seventh graders (9.76 and 9.49). Subjects with lower mean lengths were found in both language ability groups (NL5, NL6, LI2 in spoken samples and NL1, NL3, LI1, and LI3 in written samples).

Unlike the sentence length measure, **clause length** favored the normal language subjects. **Mean clause length** for the NL subject group was 6.08 for spoken summaries and 6.37 for written summaries. Mean clause length for the LI subject group was 5.92 for spoken summaries and 5.70 for written summaries. Scott (1988) reported normative development of mean clause length from 5 words in 4th grade to 8 words in 8th grade in written samples. Few studies assess spoken clause length. Group written averages approach this projected result. Subjects with lower clause lengths were NL6 (spoken-3.7), NL3 (written-4.91), and LI1

(written-3.92).

The LI group produced higher **subordination indexes** (SI) for both samples with a mean of 1.60 for the spoken sample and 1.62 for the written sample. The normal language group produced a mean subordination index of 1.55 for the spoken sample and 1.44 for the written sample. Projected normative values would be 1.35 (spoken) and 1.28 (written). Average subordination indexes for both subject groups are above this expected norm. Possibly these higher subordination indexes are influenced by the expository structure of the sampling task. Projected norms were obtained on narrative texts. Only three of the NL group and 3 of the LI group produced higher subordination indexes in their written samples than their spoken samples. Only subjects NL5 (spoken-1.17) and LI2 (spoken-1.06 and written-1.16) produced significantly lower subordination indexes than projected norms.

It would be expected that comparison of mean sentence length and subordination index for each subject pairing would result in higher scores for the normal language group. In examining spoken summaries, four of the six subject pairings produced this result for mean sentence length. Pairings NL5/LI5 and NL6/LI6 contradicted this expectation. Three of six subject pairings (NL4/LI4, NL5/LI5, and NL6/LI6) included LI subordination indexes greater than NL subject results. In written sample evaluation, three pairings (NL3/LI3, NL5/LI5, and NL6/LI6) for sentence length and 5 pairings for subordination indexes were greater in LI subjects. Only subjects NL2/LI2 produced the expected

subordination index results.

Hierarchical Syntax

Trends

1. Low but equal frequencies of embedded relative clauses for NL and LI groups.
2. Low frequencies of postnominal prepositional phrases for NL and LI groups. More total written postnominal prepositional phrases produced by NL group subjects.

Table 4 indicates **frequencies of subordination** in the oral and written samples for center-embedded and total embedded relative clauses. Only subjects NL4, LI5, and LI6 produced center-embedded relative clauses in written summaries. These were limited productions with 1, 2, and 1 center-embedded relatives, respectively. In spoken summaries, NL4, LI4, LI5, and LI6 produced center-embedded relative clauses, with 2, 1, 1, and 1 clause respectively. Examples of these center-embedded relative clauses include the following:

"The animals **that live in the desert** are different from the zoo, I think." (LI4, written)

"The closest **I have been to one** is in New Mexico." (NL4, written)

Table 4 also indicates **total number of embedded relative clauses**, including center and right-embedded relatives. All subjects produced at least one relative clause in a summary, except for NL3. These were low-frequency structures. Normal language subjects produced

Table 4

Appearance Frequency of Embedded Relative Clauses in spoken and Written Summaries with Actual Counts in Parentheses (Normalized for Length of Text)

	Embedded Relative Clause Frequency			
Subject	SS Center	WS Center	SS Total	WS Total
NL1	. 050 (1)	0	.100 (2)	.143 (2)
NL2	0	0	.032 (1)	0
NL3	0	0	0	0
NL4	0	.050 (2)	.048 (2)	.100 (4)
NL5	0	0	0	.158 (3)
NL6	0	0	.050 (1)	.063 (1)
Total	1	2	6	.076 (10)
LI1	0	0	.067 (1)	0
LI2	0	0	0	.091 (2)
LI3	0	0	.185 (15)	.133 (2)
LI4	0	.033 (1)	.107 (6)	.167 (5)
LI5	.033 (2)	.027 (1)	.033 (2)	.027 (1)
LI6	.018 (1)	.028 (1)	.018 (1)	.028 (1)
Total	3	3	25	.072 (11)

fewer relative clauses than did language impaired subjects. The NL group produced 6 total relative clauses in the spoken summaries and 10 total relative clauses in the written summaries. The LI group produced 25 total relative clauses in the spoken summaries and 11 total relative clauses in the written summary. The greatest difference in the spoken summaries of the LI group (25) was due to a long spoken summary from LI3 with 15 relative clauses. Both language ability groups produced essentially the same numbers of relative clauses in spoken and written summaries, if NL3/LI3's totals are excluded. The LI group did produce more total relative clauses than did the NL group.

Table 5 indicates the **total number of postnominal prepositional phrases** produced in the spoken and written summaries. Relatively few postnominal prepositional phrases were produced in either summary. Four subjects produced post-nominal prepositions in spoken summaries (NL3, NL4, LI1, and LI4). Only 1, 1, 2, and 1 postnominal prepositions were produced respectively. An example produced by NL3 was, The name **of the movie** was The Desert. Only three subjects produced postnominal prepositions in written samples and all were members of the normal language group (NL4, NL5, and NL6). Subject NL4 produced the most phrases in a written summary with 8. An example of one such phrase from NL4's written summary was, The animals **in the desert** are numerous and are adapted to the climate. Such a limited production of prepositional phrases post-modifying nominals made a correlational evaluation impossible

Table 5

Total Postnominal Prepositional Phrases in Spoken and Written Summaries

	Post-Nominal Prepositional Phrases	
Subject	Spoken Summary	Written Summary
NL1	0	0
NL2	0	0
NL3	1	0
NL4	1	8
NL5	0	1
NL6	0	3
Total	2	12
LI1	2	0
LI2	0	0
LI3	0	0
LI4	1	0
LI5	0	0
LI6	0	0
Total	3	0

**Numbers represent all postnominal prepositions

for this category.

Sentence Combining Task

Sentence Combining Scores and Syntax

Trends

1. Sentence Combining Scores: Four NL subjects had highest sentence combining scores. Three LI subjects and one NL subject had the lowest sentence combining scores.

2. Total numbers of embedded relative clauses used by both groups were almost equal. Total numbers of postnominal prepositional phrases used by NL group was greater than by LI group.

3. Item Analysis: Subjects produced more ideally combined relative clause stimulus sentences than postnominal phrase stimulus sentences.

Subject responses are located in Appendix K with original spelling and punctuation. Examples in the following section are taken directly from this appendix. Table 6 indicates the total number of center-embedded relative clauses and postnominal prepositional phrases correctly used by each subject in the sentence combining task. Total counts also indicate center-embedded relative clauses or postnominal prepositional phrases used in all stimulus sentences, whether or not those were the targeted structures for the particular stimuli. Sentence combining scores with a possible 15 are also presented. The sentence combining score included all hierarchical syntax used in combining stimuli sentences. Four subjects in the normal language group produced the highest sentence combining scores (NL1, NL4, NL6, and NL5) of 10, 12, 10, and 10.

Table 6

Total Numbers of Embedded Relative Clauses and Postnominal Prepositional Phrases for Each Subject in a Sentence Combining Task

	NL1	NL2	NL3	NL4	NL5	NL6	Total
Rel Clause Total	5	2	0	6	3	4	20
Rel Clause Targeted	4	2	0	3	1	4	14
Post Nom Prep Total	5	3	0	5	5	5	23
Post Nom Prep Targeted	2	2	0	2	4	2	12
Sent Comb Score (15) (All Hier. Forms)	10	7	0	12	10	10	49/90

	LI1	LI2	LI3	LI4	LI5	LI6	Total
Rel Clause Total	1	3	4	0	4	3	15
Rel Clause Targeted	1	1	4	0	3	2	11
Post Nom Prep Total	1	4	1	0	4	0	10
Post Nom Prep Targeted	0	2	0	0	4	0	6
Sent Comb Score (15) (All Hier. Forms)	2	7	5	0	9	4	27/90

Subject LI5 produced the highest sentence combining score in the language impaired group with 9. The four lowest scores came from subjects NL3, LI4, LI1, and LI6, with 0, 0, 2, and 4.

Group differences were greatest in performance on post-nominal prepositional phrases. Five of the six normal language subjects (NL1, NL2, NL4, NL5, and NL6) utilized this form of noun phrase expansion, with 5, 3, 5, 5, and 5 total postnominal prepositions. Each of these five subjects used two such prepositions for the nominal, thereby completely matching the target combination at least once. An example of the complete target form would be NL2's solution, The bananas **in the basket from my mother** are not ripe yet, but they will be soon.

Four subjects in the language-impaired group (LI1, LI2, LI3, and LI5) used at least one prepositional phrase as nominal postmodifier in a sentence combining stimulus, with 1, 4, 1, and 1 occurrences. An example of a solution with only one preposition target was LI2's solution, The decorations **in the hall closet** are **for Mark's birthday**. Only one of these subjects (LI5) used two prepositions within a single target combination. When only one prepositional phrase was placed in the postnominal position of the noun phrase, the second target preposition was placed following the verb phrase, usually at the end of the sentence. Only LI2 and LI5 produced both postnominal prepositions in any target sentences (2 and 4).

There was not a large group difference in relative

clause production. NL subjects produced 20 total center-embedded relative clauses and LI subjects produced 15. When specifically targeted in a sentence, the NL subjects produced 14 center-embedded relatives and the LI subjects produced 11. Only subjects NL3 and LI4 produced no center-embedded relative clauses in any sentence combining stimuli.

Item Analysis

In order to determine the ability of each sentence combining stimulus to control for the target structure, an item analysis was conducted. Table 7 contains the percentage of acceptably and ideally combined samples for each stimulus sentence set in the sentence combining task and total subject results for each sentence. This table combines all subject responses. Sentences that were acceptably combined without using the desired target structure (a center-embedded relative clause or a postnominal prepositional phrase) were tabulated under the acceptable combinations. Performance for all subjects on the center-embedded relative stimulus sentences ranged from 66.7% to 83.3% acceptably combined. Ideally combined totals included only those samples using the desired target structure to combine the sentence. Performance ranged from 25% to 58.3% ideally combined center-embedded relative clause target sentences. Percentages for prepositional target sentences were slightly lower. Acceptable combinations ranged from 58.3% to 75% for all subjects. Ideally combined sentences were lower, ranging from 0%-25%.

Table 7

Percentage of Ideally Combined Sentences (Using Targeted Syntactic Structures) and Acceptably Combined Sentences (Using Alternative Syntactic Methods)

Stimulus number	Target struct	% (#) ideal comb.	% (#) accept comb.	Total combined
1	rel cl	33.3% (4/12)	33.3% (4/12)	66.7% (8/12)
2	prep	8.3% (1/12)	66.7% (8/12)	75.0% (9/12)
3	rel cl	50.0% (6/12)	33.3% (4/12)	83.3% (10/12)
4	rel cl	58.3% (7/12)	8.3% (1/12)	66.7% (8/12)
5	prep	16.7% (2/12)	58.3% (7/12)	75.0% (9/12)
6	prep	25.0% (3/12)	33.3% (4/12)	58.3% (7/12)
7	rel cl	25.0% (3/12)	50.0% (6/12)	75.0% (9/12)
8	rel cl	41.7% (5/12)	16.7% (2/12)	58.3% (7/12)
9	prep	0.0% (0/12)	75.0% (9/12)	75.0% (9/12)
10	prep	25.0% (3/12)	33.3% (4/12)	58.3% (7/12)
Totals		28.3% (34/120)	40.8% (49/120)	69.2% (83/120)

Table 8 lists syntactic methods for sentence combining stimuli in the NL group. All hierarchical syntactic structures counted in sentence combining scores were presented in bold type. Those that were target responses were starred (*) in the table. Across the 6 NL subjects, fourteen of 30 relative clause targets (5 stimulus sets x 6 subjects) were ideally combined, and another 9 used hierarchical structures (postnominal prepositions and 6 nominal premodifiers) for a total of 23/30 hierarchical solutions. The 5 nonhierarchical solutions involved conjunctions (but, and, or so). NL3 produced an example of a sentence set combined with a conjunction, We made the mess last night **but** because my mom wanted the mess cleaned up **so** we did it immediately. Responses on postnominal preposition targets were not as accurate as for center-embedded relative clauses. Twenty-four prepositional targets were not ideally combined. Subjects commonly used center-embedded relative clauses (6), a single post nominal preposition (8), a to-infinitive clause (3), or an and conjunction (2). An example of a center-embedded relative clause substitution was produced by NL5, The bananas **that are in the basket from my mom,** are not ripe yet. Subject NL6 produced the to-infinitive example, The bus leaves at 3:00 **to go across the river**. (These combinations were just as correct as target structures.)

Table 9 lists syntactic methods for sentence combining stimuli in the LI group. LI subjects produced fewer ideally

Table 8

Sentence Combining Results for Each Stimulus Item Within NL Subject Group

Target-Embedded Relative Clause

Subject	Stimulus Number 1	3	4	7	8	Total
NL1	***Em Rel**	**1 PNPrep**	***Em Rel**	***Em Rel**	***Em Rel**	5/5
NL2	----	***Em Rel**	***Em Rel**	**Nom Premod**	**Nom Premod**	4/5
NL3	But Conj	And Conj	And Conj	So Conj	----	0/5
NL4	***Em Rel**	**1 PNPrep**	***Em Rel**	**Nom Premod**	***Em Rel**	5/5
NL5	So Conj	**1 PNPrep**	***Em Rel**	**Nom Premod**	**Nom Premod**	4/5
NL6	***Em Rel**	***Em Rel**	***Em Rel**	**Nom Premod**	***Em Rel**	5/5
	3	5	5	5	5	23/30

Target-Post Nom Preposition

Subject	Stimulus Number 2	5	6	9	10	Total
NL1	**1PNPrep**	**1PNPrep 1Em Rel**	And Conj	1Post Verb Prep	***2PNPreps**	5/10
NL2	**1 PNPrep**	***2 PNPreps**	----	To-infin	----	3/10
NL3	----	And/But Conjs	----	-----	And Conj	0/10
NL4	**1PNPrep**	**1PNPrep 1Em Rel**	***2PNPreps**	**1Em Rel**	**1Em Rel**	7/10

(Table 8 continues)

Target-Post Nom Preposition

	Stimulus Number					
Subject	2	5	6	9	10	Total
NL5	***2PNPreps**	**1Em Rel**	**1Em Rel**	To-infin	***2PNPreps**	6/10
NL6	**1PNPrep**	**1PNPrep**	***2PNPreps**	To-infin	**1PNPrep**	5/10
Total	6	8	5	1	6	26/60

Table 9

Sentence Combining Results for Each Stimulus Item Within LI Subject Group

Target-Embedded Relative Clause

Subject	Stimulus Number 1	3	4	7	8	Total
LI1	----	***Em Rel**	----	----	----	1/5
LI2	And Conj	***Em Rel**	----	----	----	1/5
LI3	***Em Rel**	***Em Rel**	***Em Rel**	***Em Rel**	----	4/5
LI4	----	----	----	----	----	0/5
LI5	----	***Em Rel**	***Em Rel**	**Nom Premod**	***Em Rel**	4/5
LI6	**Wd Alt**	----	----	***Em Rel**	***2 Em Rel**	4/5
Target	2	4	2	3		14/30

Target-Post Nom Prepositions

Subject	Stimulus Number 2	5	6	9	10	Total
LI1	----	***1PNPrep**	And Conj	----	----	1/10
LI2	***1PNPrep**	**1 Em Rel *1PNPrep**	***2PNPreps**	**1 Em Rel**	----	6/10
LI3	**Adv Front**	----	***1PNPrep** But Conj	To-infin	----	2/10
LI4	----	----	----	----	----	0/10
LI5	**1 Em Rel**	***2PNPreps**	----	To-infin	***2PNPreps Post Verb**	5/10

(Table 9 continues)

Target-Post Nom Prepositions

Subject	Stimulus Number 2	5	6	9	10	Total
LI6	And Conj	----	----	And/But Conjs	Nom That And Conj	0/10
Target	2	5	1	2	2	12/60

combined sentences with center-embedded relative clause targets than the NL subjects. Notably, these subjects also produced fewer acceptable alternative combinations. Only three alternative combinations were noted, including use of an and conjunction, a nominalized premodifier, and a word alteration. The word alteration was **Because we made the mess last night**, my mom wants the mess cleaned up immediately. Unacceptable combinations utilized a tagged method, where stimulus sentences were simply joined together with no coordinators or subordinators. LI4 used this method in We made the mess last night my mom wanted the mess cleaned up we did it immediately. LI responses to postnominal prepositional stimuli were largely unacceptable. Varied syntactic forms were used in the acceptable but not ideally combined responses. Subjects used single postnominal prepositions (4), and conjunctions (4), but conjunctions (2), center-embedded relative clauses (3), -infinitive clauses (2), nominal that clauses (1), and adverbial fronting (1). LI3 produced adverbial fronting of the preposition in the sentence, **In the hall closet** there were decorations for Mark's birthday. Subject LI5 produced the to-infinitive, The bus leaves at 3:00 **to go** to the town across the river.

Tables 8 and 9 illustrated that NL and LI subjects produced almost equal numbers of embedded relative clauses (20 and 15). However, there was a larger difference in postnominal prepositional phrase production within the ability groups. The LI subjects produced half as many

postnominal prepositional phrases (8) as embedded relative clauses (15). The NL group produced equal numbers of relative clauses and postnominal prepositions (20 of each). Therefore, performance on postnominal prepositional phrases in a sentence combining task (a controled language task) differentiated these two ability groups.

Matrix Task

Trends

1. Weighted Scores: Few group differences in matrix scores.
2. Syntactic Methods: Subjects used coordination with some instances of subordination (so) methods.

Weighted Scores

Subject solutions for the matrix task were recorded in Appendix L. Samples provided in the results were taken from this appendix. Author spelling and punctuation were preserved. Table 10 shows, for all subjects, the number of solutions at each level and the resulting weighted matrix scores. Three of the highest five scores on this task were obtained by subjects from the normal language group (NL4, NL1, and NL5) with scores of 32, 27, and 26, respectively.

Subjects LI3 and LI5 produced the highest matrix scores in the LI grouping. They produced a majority of level 3 solutions, with 8 and 6 respectively. LI3 produced one such level 3 solution in, Farm's have tame cat but the zoo ha wild lions.

Across all subjects, only 8 instances of level 4 combinations appeared. These level 4 solutions were primarily produced by one subject, NL4, with 5 instances. One example of these level 4 constructions was The dog is a mammal, so it has babies, but the crocodile is a reptile, so it lays eggs. Subjects NL1, LI2, and LI3 each produced one level 4 solution. The limited number of level 4 solutions would correspond with Bereiter & Scardamalia (1987) results indicating that few level 4 solutions were produced by the seventh grade students.

The majority of solutions were at levels two and three. These were two solution types not demonstrated by the examiner in the training session. Subject NL3 produced the lowest score with a 10, producing only level 1 solutions. This subject demonstrated low level performance on other written tasks as well.

Matrix Syntax

Syntax was not analyzed separately on the matrix task. It would be difficult to assign scores for this task, due to the numerous methods for combining the ideas. Several syntactic methods were used but certain trends were apparent. Level 1 constructions were accomplished by creating a simple sentence for each idea unit. An example would include the solution from NL3:

Wisconsin is in the north.

Florida is in the south.

In Wisconsin it is cool.

In Florida it is warm.

Table 10

Weighted Scores for Matrix Task and Level Totals for Each Subject

Subject	Level 1	Level 2	Level 3	Level 4	Weighted Scores
NL1	0	4	5	1	27
NL2	0	9	1	0	21
NL3	10	0	0	0	10
NL4	0	3	2	5	32
NL5	1	2	7	0	26
NL6	2.5	7.5	0	0	17.5
Group Total	13.5	25.5	15	6	133.5
LI1	3.5	5.5	1	0	17.5
LI2	1	7	1	1	22
LI3	0	1	8	1	30
LI4	6	3	1	0	15
LI5	0	4	6	0	26
LI6	0	9	1	0	21
Group Totals	10.5	30.5	18	2	131.5
Level Totals For All Subj.	24	55	33	8	

Level 2 solutions generally required 2 sentences with an and conjunction, as in this LI5 solution:

Wisconsin is in the north **and** is cool.

Florida is in the south **and** is warm.

A majority of level 3 solutions were produced with one complex sentence, including two compound independent clauses joined by the conjunction but. Subject LI2 produced an example of a level 3 solution:

In Wisconsin the location is north, **and** it's cool, **but** in Florida it's warm, **and** it's in the south.

Level 4 constructions require a subordinator indicating logical reason (so, since, because). Subject NL1 produced the following example of a level 4 solution:

Wisconsin is to the north **so** it's cooler, **but** Florida is to the south **so** it's warm.

In completing this task, subjects could develop one solution that met their desired goal and continue to use that method throughout the task. Subjects tended to do this, creating the clusters of solution levels in Table 10.

Mobile Construction Task

Trends

1. First Trial Scores: NL mean for first trial scores was higher than LI mean.
2. Second Trial Scores: NL mean score was higher than LI mean score. Subjects NL1, LI3, LI4, and LI5 demonstrated difficulty in imitating hierarchical construction process.
3. Learning/Memory Score: NL learning/memory score mean was higher than LI score mean.

Hierarchical Scores

Mobile diagrams and subject construction sequences for two trials are located in Appendix M. Hierarchical scores were derived from each subject mobile construction. Those scores are listed in Table 11. The first trial was considered the subject's preferential approach to the construction task. With a possible hierarchical score of 20 for each trial, a low score would indicate a sequential approach and a high score a hierarchical approach.

The highest hierarchical score on the first trial was a 13, indicating a hierarchical approach in approximately half of all opportunities. This was demonstrated by subject NL1. All other scores ranged from 8 to 0. Subjects clearly preferred to use a sequential or serial approach. No clear group effects were noted in this construction trial.

Not all subjects could correctly imitate the second construction method. Four subjects (NL1, LI3, LI4, and LI5) showed considerable trouble with this alternating pattern and reverted to a sequential mode of construction. Their second trial scores were 12, 16, 10, and 13, respectively. Five subjects imitated the construction perfectly (NL2, NL4, NL5, LI6, and NL6). Their second trial scores were 20s. Only one language impaired subject fell within this group.

Learning/Memory Scores

The difference in first and second trial scores was perceived as the subject's ability to learn and remember the pattern that the examiner demonstrated. This

Table 11

First, Second, and Learning/Memory Scores For Each Subject on the Mobile Construction (Out of Possible 20)

	NL1	NL2	NL3	NL4	NL5	NL6	Total
1st NV	13	0	1	4	6	2	26
2nd NV	12	20	19	20	20	20	111
Learning/ Memory	-1	20	18	16	14	18	85
	LI1	LI2	LI3	LI4	LI5	LI6	Total
1st NV	1	6	2	1	8	4	22
2nd NV	19	19	16	10	13	20	97
Learning/ Memory	18	13	14	9	5	16	75

learning/memory score is also listed in Table 11. Three subjects (LI4, LI5, and NL1) produced the lowest learning scores (9, 5, and -1). They demonstrated the greatest inability to reproduce the mobile in the demonstrated manner. The remaining subjects produced learning scores in a range from 16 to 20.

Ranking Trends

Trends

1. Three NL subjects were in the high performance group.
2. Four LI and one NL subject were in the middle performance group.
3. Two NL and Two LI subjects were in the low performance group.

Subjects performed within certain consistent levels on certain task measurements. Table 12 contains the rankings 8for the individuals as one group on twelve measures. The high score on each measure received a ranking of 1 and the remaining ranks were assigned in descending order. High (rankings 1-4), middle (rankings 5-8), and low (rankings 9-12) performance groups are listed below:

High- NL1, NL4, and NL6

Middle- NL2, LI2, LI3, LI5, and LI6

Low- NL3, NL5, LI1, and LI4

Subjects were assigned these performance levels if 5 or more measures had rankings in a certain level. Three normal language subjects performed at high levels on at least five measures, indicating an ability effect for high performance

levels across measures. Two language impaired and two normal language subjects consistently ranked at a low performance level on the measures. Therefore, ability effects were not noted for the middle and low performance levels. Age effects were not noted across these ranking trends.

Rank-Order Correlational Coefficients

Correlational coefficient matrixes for language impaired groups (n=6), normal language groups (n=6), and all subjects (n=12) are located in Appendix N. Abbreviations for measure categories used in coefficient matrixes and in the following text are listed below:

A) TONI-II scores = T/II

B) first mobile construction score = 1stNV

C) difference of second and first mobile constructions = 2ndNV-1st

D) sentence combining scores = SC

E) matrix scores = MAT

F) written summary subordination indexes = WS SI

G) spoken summary subordination indexes = SS SI

H) written summary total relative clause frequencies = WS REL

I) spoken summary total relative clause frequencies = SS REL

J) written summary mean sentence lengths = W ML

K) spoken summary mean utterance lengths = S ML

L) age (AGE)

Table 12

Subject Rankings in an Ability Continuum for Twelve Study Measures

Subject	Measure										
	A	B	C	D	E	F	G	H	I	J	K
NL1	5	1	12	3	3	9	3.5	3	3	10	4
NL2	7.5	12	1	6.5	7.5	7	9	11	8	6	2
NL3	4	10	3	11.5	12	10	2	11	11	11	1
NL4	1.5	5.5	5.5	1	1	8	6.5	5	6	4	3
NL5	10	3.5	7.5	3	4.5	11	11	2	11	5	10
NL6	3	7.5	3	3	9.5	4	10	7	5	3	12
LI1	12	10	3	10	9.5	5.5	3.5	11	4	12	6
LI2	7	3.5	9	6.5	6	12	12	6	11	8	11
LI3	7	7.5	7.5	8	2	5.5	8	4	1	9	7
LI4	11	10	10	11.5	11	3	5	1	2	7	8
LI5	9	2	11	5	4.5	1	6.5	9	7	2	5
LI6	7	5.5	5.5	9	7.5	12	1	8	9	1	9

A) TONI-II scores
B) First mobile construction scores
C) Difference of second and first mobile constructions
D) Sentence combining scores
E) Matrix scores
F) Written summary subordination indexes
G) Spoken summary subordination indexes
H) Written summary total relative clause frequencies
I) Spoken summary total relative clause frequencies
J) Written summary mean sentence lengths
K) Spoken summary mean sentence lengths

Correlational coefficients for the language-impaired subject group will be addressed first. The correlation coefficient was significant at the .05 level for the first nonverbal scores (1stNV) and sentence combining scores (SC) only. An LI subject's performance on a first nonverbal trial was related to performance on sentence combining stimuli. If moving to a less restrictive significance level of .10, there was a significant correlation between sentence combining scores and matrixes scores. Ability to combine sentences with hierarchical forms was in some way related to ability to produce higher level matrix solutions.

Significant correlation coefficients for the normal language group were limited also. A correlation at the significance level of .05 was found between first nonverbal scores and learning/memory scores; therefore some relationship existed between spontaneous use of hierarchical processes and the ability to accurately imitate the demonstrated hierarchical process on the second trial. A correlation at the same significance level was also found for first nonverbal scores and written summary relative clause frequencies. Moving to a .10 significance level, a significant correlation coefficient was obtained for the sentence combining and matrix task scores.

Assessing the subjects as a continuous single group at the .05 significance level, significant correlational coefficients were found between the following pairings:

a) first nonverbal scores (mobile construction trial one) and learning/memory scores

b) first nonverbal scores and sentence combining scores

c) first nonverbal scores and matrix scores

d) learning/memory scores and written summary relative clause frequencies

e) sentence combining scores and matrix scores

Correlational significance is difficult to determine due to the limited subject numbers and the tied rankings in a number of measurements. Significant correlations noted above should be interpreted cautiously.

CHAPTER IV

DISCUSSION

Results will be presented in relation to the purpose of this study. The purpose included determining a) if adolescents with no diagnosed language impairment would perform at higher levels on a nonverbal measure of hierarchical processing than adolescents with diagnosed language impairments and b) if low levels of performance on nonverbal measures of hierarchical processing would correspond with deficits in written syntactic structures thought to be related to that hierarchical processing. Notable verbal performances are discussed, as are spoken/written summary comparisons. Additional discussion includes the results in terms of clinical/research implications. Only Spearman Rank-Order Correlations were discussed in terms of statistical significance. All other discussion was based on trends in the data and should be viewed cautiously.

Nonverbal Task Performances And Study Purposes

Group totals on the first mobile trial were only slightly different, with a score of NL=26 and LI=22. However, one normal language subject (NL1) spontaneously

produced a hierarchical score 7 points higher than all other NL subjects, with a score of 13. If the highest NL and LI 1stNV scores are deleted from group totals (NL=13 and LI5=8), then total 1stNV scores for both ability groups are equal. These results for first trials would not indicate a difference in spontaneous hierarchical construction processes.

Both subject groups preferred a spontaneous serial or sequential construction method on initial trials. Greenfield and Schneider (1977) noted this spontaneous preference for sequential or serial construction methods, even though older students could easily imitate a hierarchical method. They hypothesized that subjects were acquiring the hierarchical skill, but preferred a more comfortable approach (sequential). This would appear to be the case for the NL subjects in the current study. The NL subjects were more accurate at reproducing a hierarchical construction process on trial 2 (total 111). Five NL subjects accurately reproduced the hierarchical mobile construction method (with scores of 20 or 19). LI subjects used a slightly less hierarchical process for the second trial (total 97). Only three LI subjects reproduced this construction process accurately (with a score of 19 or 20). These results indicate that three LI subjects might have a deficit in processing active hierarchical processes.

A third nonverbal measure included the difference in the second and first construction trials, considered a learning/memory measure. The learning/memory measure

indicates that the NL group (with a total 85) learned or remembered the hierarchical sequence more adequately than did the LI subjects (with a total 75). This also supports a possible deficit in LI perception of a hierarchical process. The construction was short and presented immediately before trial 2, with the model displayed during both trials. Therefore, it is doubtful that memory interfered with LI performance.

Hierarchical Skills and Language Performances

Greenfield and Schneider (1977) drew a parallel between minimal use of the hierarchical construction skill and reluctance to use unfamiliar language structures initially. Examples would include tendencies for school-age children (8+ years) to use S-V-O constructions in writing or speech, although they understand and have been exposed to other forms, albeit less familiar, such as passive sentences. The subjects in this study produced center-embedded relative clauses in a controlled writing task, but did not use those structures to the same level in spontaneous writing. They could produce the center-embedded form, but chose to use more familiar syntactic structures in spontaneous writing.

According to a Spearman Correlation, a significant relationship was noted between first nonverbal scores and sentence combining scores and between first nonverbal scores and matrix scores for all subjects. Learning/memory scores (on the mobile task) were significantly related to the

frequency of all embedded relative clauses in written film summaries. Performances on sentence combining and matrix tasks were also significantly related. This significance was noted when the language groups were collapsed into one larger group.

When the ability groups were assessed individually, the LI group did maintain a significant correlation between first nonverbal hierarchical scores and sentence combining scores at the .05 significance level. At the significance level of .05, the NL group's first nonverbal scores and learning/memory scores were related, as were first nonverbal scores and written summary relative clause frequencies.

Interestingly, the LI group's sentence combining scores (controlled language measures) were related to first nonverbal scores; whereas the NL group demonstrated significant relationship between written summary relative clause frequencies (naturalistic language measures) and first nonverbal scores. Possibly the sentence combining task, a controlled writing task, stressed the linguistic systems of these LI subjects. Therefore, the weaker verbal hierarchical processes of the LI group broke down.

A cautionary note should be made concerning Spearman Rank Order Correlations. Correlations indicate a significant relationship between measures; however, the nature of the relationship cannot be determined using this statistic. A researcher cannot draw the conclusion that one performance or score causes another. Additionally, the subject rankings for the Spearman contained numerous scoring

ties. This makes ranking less reliable. The limited subject numbers in the language ability groups (n=6) require the reader to cautiously accept these results. Trends in nonverbal and verbal hierarchical performance can be more easily identified when examining individual subject scores.

Individual Performances

Several subjects demonstrated nonverbal hierarchical processing difficulties in their methods of construction and in their nonverbal scores. Certain nonverbal scores were significantly related to verbal measures. Those relationships included a correlation between the first nonverbal scores and sentence combining scores and matrix scores and a correlation between learning/memory scores and written summary relative clause frequencies. There also appears to be a relationship between the approach to the construction task and verbal performance for specific subjects. The significance of this relationship was not determined with statistical tests. Greenfield and Schneider (1977) noted subjects ages 6-8 who began spontaneous serial mobile constructions (trial 1) with subordinate (lowest) nodes of the mobile. These subjects worked up one side of the mobile and across to the other. Older subjects began their spontaneous serial constructions (trial 1) with the superordinate or top node, working their way down one side of the mobile and then switching over to complete the other side. The researchers hypothesized that subjects beginning with superordinate nodes demonstrated an overall perception

of the mobile's hierarchical structure. Those beginning with the lowest nodes demonstrated no such hierarchical awareness.

Only two subjects (NL3 and LI3) demonstrated a bottom-up approach to the initial mobile construction. In a bottom-up approach, these subjects began constructing the bottom node of the mobile on one side, working up and across to the other side. The other ten subjects worked from the top nodes down. Subject NL3 attempted a bottom-up construction, building the left and then right halves of the mobile. NL3 then connected them at the highest level. NL3 demonstrated little difficulty with the modeled construction, producing a trial 2 score of 19. The subject was capable of using the hierarchical process, but did not do so spontaneously. His bottom-up construction might indicate a general deficit in hierarchical structuring awareness.

Subject NL3's verbal performance was also deficient in hierarchical structures. NL3 produced a sentence combining score of 0, lowest in the NL group. Such hierarchical structures were missing in NL3's spoken and written summaries also. Subject NL3 also produced the second lowest matrix task score (10) of all subjects, with 10 level 1 solutions. No idea coordination or subordination was present in the solutions, for example:

dogs are mammal

crocodiles are reptiles

dogs have babies

crocodiles are have eggs

Individually, subject NL3 performed exactly as a LI subject would be hypothesized to do.

Subject LI4 produced low scores on all three mobile measures designed to assess hierarchical processing. LI4 produced a score of 1 (with a LI group mean of 4) on the first mobile construction. LI4 produced the lowest score (10 with an LI group mean of 16) among all subjects on the second construction trial, which followed the hierarchical demonstration. Due to the subject's limited ability to imitate the hierarchical process, LI4 produced a lower learning/memory score of 9 when compared with the LI group mean of 13. Subject LI4 also produced low verbal scores on the controlled language task, when compared with other LI subjects. LI4 produced a sentence combining score of 0 (possible 15) and a matrix weighted score of 15 (possible 40). LI4 produced four right-embedded and one center-embedded relative clauses in the written summary task. Those relative clauses were simplistic and some might argue their labelling as relative clauses, as the example shows:

Also the drest is not a good place **to live** because you will get a sunbrune.

The clause in bold described the type of <u>place</u> and was labelled as a relative clause accordingly. In the controlled tasks stressing LI4's verbal system, performance was consistently low among all subjects. LI4's low verbal performance was tied to low nonverbal scores.

Subjects NL3 and LI4 consistently performed in the low category level on measure rankings. They produced low nonverbal hierarchical scores or interesting nonverbal hierarchical discrepancies (bottom-up approach) and consistently low verbal measures. Subject LI1 also performed at low levels on first nonverbal construction scores, sentence combining scores, matrix scores, written summary embedded relative clause frequencies, and written summary mean sentence lengths. On the first hierarchical score, subject LI1 produced a low score of (1) in relation to the LI group mean of 4. The sentence combining score (2/15) and matrix score (17.5/40) were also low. This subject's performance, as well as the performance of NL3 and LI4, supports the significant relationship between nonverbal hierarchical scores and verbal tasks (sentence combining and matrix), shown by the Spearman correlation.

There were discrepancies between nonverbal performances (bottom-up versus top-down approaches and the three construction measures) and verbal scores (written summary, sentence combining and matrix scores) for certain subjects, without regard to language ability groupings. Those discrepancies are described in the following paragraphs.

Subject LI3 began mobile construction at the bottom levels of the mobile, as described in the discussion of NL3's performance. LI3's verbal performance did not parallel NL3's, however. LI3's sentence combining score was 5, coming from center-embedded relative clauses. No hierarchical structures were produced in the written

summary. However, LI3 did produce the second highest matrix score (30 with a possible 40). He produced primarily level 3 solutions, with two complex sentences conjoined by but. This would be a serial, conjunctive syntactic form. All idea units were coordinated. It appears that LI3 had difficulty with hierarchical construction and with hierarchical syntactic structures, but not with idea coordination. Idea subordination was seen only once, with a level 4 solution.

NL1 and LI5 produced the lowest scores (12 and 13) on the second mobile construction trial, which followed the hierarchical demonstration. Interestingly, however, both subjects used comparatively high levels of hierarchical processes in initial trials with scores of 13 and 8 (NL mean=4 and LI mean=4). Both subjects produced the two most hierarchical spontaneous mobile constructions among all subjects. Learning/memory scores for both subjects were comparatively low (-1 and 5), indicating difficulty in imitating the completely hierarchical construction process. Basically, nonverbal performance was inconsistent for both subjects. Verbal scores did not parallel low nonverbal scores. Corresponding sentence combining scores for these subjects were 10 and 9, respectively (NL group mean=8 and LI group mean=5). Corresponding matrix scores consisted of 27 and 26. Subjects NL1 and LI5 produced relatively high matrix scores, but these scores were produced using coordinated syntactic structures (a serial method). NL1 produced one level 4 solution, using the subordinator so.

Subjects NL1 and LI5 could produce hierarchical verbal structures when the task was controlled, as in sentence combining. However, neither subject produced subordinated structures in the less controlled matrix task. These subjects might possess hierarchical processing abilities, but these are not spontaneously utilized by subjects NL1 and LI5.

Nonverbal and verbal tasks indicated high performance ranking in one group of subjects across several study measures. Subjects NL1 and NL6 produced high nonverbal and verbal scores in relation to all other subjects. Subjects NL1 and NL6 produced high first nonverbal scores and learning/memory scores, respectively. These subjects also produced high sentence combining scores (10/15 for both subjects). NL1 produced a high matrix score of 27, but NL6 produced a comparatively mid-range score of 17.5. Additionally, NL1 produced a proportionately high total number of embedded relative clauses in the written summary. Scores on nonverbal measures correlated with verbal task scores, although there were slight discrepancies in high versus middle range performances for these individuals. In both cases, however, the sentence combining task score was high if the first or second mobile trial was high. The performance variability was due to results on the naturalistic film summaries and the less controlled matrix tasks. As Greenfield and Schneider (1977) speculated, these normal language subjects might have used a more comfortable (non-hierarchical) syntactic form in less controlled

activities; however, when presented with a controlled task requiring this hierarchical form, the subjects possessed the ability to accurately use the hierarchical forms (center-embedded relative clauses and postnominal prepositional phrase).

Subject NL4 was excluded from the high performance group discussion due to an absence of high mobile task (a nonverbal hierarchical task) scores which would correspond with the high verbal measures. NL4's TONI-II score, a standardized measure of nonverbal intelligence, was high.

Developmental Perspectives

Subjects in Greenfield and Schneider (1977) accurately imitated hierarchical construction methods by 11 years of age. All current study subjects were at least 12 years old and would be expected to imitate methods accurately. The youngest NL subject (NL1) demonstrated difficulty with the imitative task (trial 2) and produced a low learning/memory score. However, other subjects of similar ages (NL2 and LI1) performed within group means on these measures. Therefore, it is assumed that NL1's performance was due to individual difference, not exclusively age factors.

Sentence Combining Performances

Treated as one subject group (n=12), sentence combining scores were significantly related to performance on the first nonverbal task and on the matrix task. Examined as a separate ability group (n=6) the LI subjects' scores on the

first nonverbal task and sentence combining task were significantly related.

NL subject sentence combining scores were higher than those of the LI subjects. A total group sentence combining score for NL subjects was 49 (possible 90) and 27 for the LI subjects. The significant performance difference was in use of postnominal prepositional phrases. NL subjects produced more postnominal prepositions in written summary tasks also. When combining counts of all postnominal prepositions produced in the sentence combining task, whether a target structure or not, the NL group produced 23, compared to the LI subjects total of 10. LI subjects typically used single postnominal prepositions in targets with the second preposition added postverbally. An example would be LI2's, The decorations **in the hall closet** are **for Mark's birthday**. Three center-embedded relative clauses were produced as substitutes for the postnominal prepositions in the LI group. NL subjects produced six center-embedded relative clauses instead of targeted postnominal prepositional phrases, resulting in a performance difference. When LI subjects could not acceptably combine sentences, they used a tag method of linking sentences, as LI4 demonstrated, The girl wore the pink dress last year, If the girl goes to the prom, I won't go. Because LI subjects used fewer total postnominal prepositions in sentence combining and written summary tasks, this might indicate a general hierarchical syntax deficit.

Subject groups produced closer numbers of target

center-embedded clauses with 14 (NL) and 11 (LI) than postnominal prepositional phrases. The fact that LI subjects as a group could demonstrate use of the center-embedded relative hierarchical structures indicates some functioning level of hierarchical ability. Postnominal prepositional phrases carry information that could be expressed in embedded relative clause forms, with deletion of the subject and verb constituents. Perhaps decreased postnominal prepositions in the LI group were due to the general low frequency of this structure in the writings of all adolescents with developing writing skills. These postnominal prepositional phrases are more problematic for the NL subjects, compared to embedded relative clause frequencies, so they would be even more problematic for the LI subjects. That would explain the LI subjects' use of other syntactic forms, including three embedded relative clauses, to combine prepositional target stimuli.

Limited production of postnominal prepositional phrases for both groups, when compared to center-embedded relative clause production, illustrated the fact that the prepositional nominalizing structures are difficult to "force" in a sentence combining task. NL subjects did produce six nominalized premodifiers instead of the targeted embedded relative clauses. Only one LI subject (LI5) produced a nominalized premodifier. This agrees with the limited noun phrase expansion that the LI subjects demonstrated in the written summaries. Due to their spontaneous use in these sentences, nominalized premodifiers

might be a good target for controlled writing tasks addressing hierarchical structures in the future.

Individual Performances

Subjects LI4 and NL3 produced no acceptable combinations of sentences. Subject LI4 produced a low score on the second mobile construction, with the hierarchical process model. LI4's second nonverbal score was a 10 out of 20 and the learning score was a 9. Subject NL3 scored high learning and 2nd nonverbal scores, but began the 1st construction at the bottom of the mobile. This indicated a sequential perception of the mobile and its construction. Both subjects exhibited difficulty in nonverbal hierarchical construction and in hierarchical sentence combinations.

Subjects with low second mobile scores (NL1, LI3, and LI5) performed differently on the sentence combining target structures. They produced 4, 4, and 3 center-embedded relative clauses and 5, 1, and 4 postnominal prepositions, respectively. Therefore, not all subjects produced low nonverbal and verbal sentence combining hierarchical scores. Correspondence of these scores depended on the individual subject.

Developmental Perspectives

A majority of postnominal prepositions in the written summary were produced by the older NL group members (13;5 to 13;9 years). This structure would be expected in the writing of older students, at 12 years or more. This form

was more difficult for both groups, particularly the younger subjects in each.

Matrix Performances

Matrix scores were significantly related to first nonverbal scores in the whole group (n=12). However, no clear group language ability effects were noted on the matrix task. The two lowest scores on this task were produced by subjects NL3 and LI4, with scores of 10 and 15, respectively. These subjects also produced the lowest second nonverbal scores and sentence combining scores. Subject NL3 produced all level 1 solutions, seizing upon a simple sentence pattern. Subject LI4 produced primarily simple sentences (6). Both subjects have demonstrated consistent deficits in nonverbal and verbal hierarchical scores. They did not coordinate or subordinate ideas.

The majority of matrix solutions for all subjects were level 2 and 3, with level 1 a close third. This would indicate that the training script, which used a level one and level four example, did not influence responses to a great degree. Level 2 and level 3 syntactic solutions used primarily and conjunctions, or two coordinated sentences joined by a coordinating but. The matrix task, a low control task, resulted in primarily coordinated (levels 1, 2, and 3) solutions (total 112), as opposed to subordinated (level 4) solutions (total 8). Subjects appeared to use linguistic structures most comfortable for them (earlier appearing) in a novel writing task.

Individual Performances

Subjects NL3 and LI4 produced the lowest matrix scores (10 and 15). These subjects also demonstrated certain nonverbal hierarchical difficulties. NL3 used the bottom-up (serial) construction pattern on trial 1. Subject LI4 produced a low hierarchical score on the second trial, demonstrating difficulty imitating a nonverbal hierarchical process. These scores also corresponded with poor sentence combining scores and a possible generalized hierarchical deficit.

Developmental Perspectives

Age did not appear to influence weighted matrix task scores. Youngest subjects produced middle to high range scores. However, overall numbers of levels did appear to exhibit developmental effects. Matrix performance supported Bereiter and Scardamalia studies. They found limited production of level four texts by the seventh grade. In this study, level four productions ranged from sixth through seventh grade subjects, but were very limited (8/120). Level four productions were not ability specific, but overall performance was.

Clinical/Research Implications

No group trends in nonverbal hierarchical construction were noted. Performance was not totally dependent on group membership, as indicated by the subjects with poor second

hierarchical scores (NL1, LI3, LI4, and LI5), although three of four lowest scores belonged to LI subjects. First hierarchical scores were not discriminatory measures, due to most subjects' tendencies to spontaneously use a comfortable construction method (serial). Non-statistical analyses of the study results indicate ties between performance on nonverbal and verbal hierarchical tasks, but only for three specific subjects (NL3, LI3, and LI4) who fell at the lower end of the subject performance range. Performance on controlled writing tasks illustrated such ties best, with performance on the most controlled verbal task (sentence combining) most beneficial. The expository summary task failed to provide additional evidence of a hierarchical syntactic deficit in subjects NL3, LI3, and LI4.

Comparison of spoken and written summaries supported information found in Scott and Klutsenbaker (1989). Noun phrase expansion was predominantly used by NL subjects. This noun phrase expansion is a typically written method for providing information without increasing syntactic subordination indexes. Postnominal preposition performance on the sentence combining task also indicated this decreased use of noun phrase expansion in the LI group.

Results of this study are tentative, due to the limited subject numbers, but would appear to support further study of nonverbal/verbal hierarchical correlations. Statistical analysis using the Spearman Rank-Order Correlation was difficult with certain measures. There were frequent ties in rankings. With only 12 subjects or 6 in each group, this

complicates computations. Further studies should include a larger number of subjects. This would facilitate statistical analysis and a wider continuum of language abilities. Few ability effects were noted in this study, using only 12 subjects.

The nonverbal task was beneficial due to second trial measures; however, first constructions were not particularly enlightening, due to tendencies to use more familiar processes (serial construction) which resulted in ceiling effects. One nonverbal hierarchical task was not enough to completely assess subject abilities. Nonverbal performance on a battery of tasks would be most revealing.

Verbal tasks differed in their ability to address study questions. An alternative spontaneous language task might best target hierarchical syntactic structures. The descriptive expository genre failed to produce high numbers of center-embedded clauses or noun phrase expansions. An opinion essay or compare/contrast sample might produce higher numbers of target structures, if the writer was required to separate or differentiate several ideas, theories or characteristics. A narrative writing sample might elicit these hierarchical structures if the story consisted of several easily confuseable characters. The writers would have to use descriptive forms (relative clauses, noun premodifying prepositional phrases and adjective series, etc.) to establish character identities. An informational historic piece might require character differentiations.

The sentence combining task produced greatest differences in group performance. Sentence combining stimuli also produced the greatest difficulty for certain subjects with nonverbal hierarchical construction deficits (NL3 and LI4). The extra stress placed on the linguistic system produced the greatest performance differences. Sentence combining could be used to evaluate other hierarchical syntactic forms (e.g., nominal premodifier or nominalization), eliciting large numbers of these forms.

The novel matrix task has proved beneficial in hierarchical studies with this age group. The performance in the LI group was not severely affected by language difficulties. An LI subject produced the second highest matrix score (LI3). Task performance was not revealing in terms of target syntactic structures. However, it displayed tendencies to relate unconnected ideas (level 1 solutions) or serially coordinated ideas (levels 2 and 3 solutions) in subjects with nonverbal hierarchical deficits. Future studies could count only those subordinated solutions for hierarchical scores.

Conclusion

A comparison of nonverbal and verbal hierarchical processing resulted in the identification of three subjects (NL3, LI1, and LI4) with deficient nonverbal and verbal hierarchical processing skills. Similarly, three subjects (NL1, NL4, and NL6) performed at consistently high levels across study measures. High performance subjects NL1 and

NL6 demonstrated high scores on at least one nonverbal (mobile construction) measure and corresponding verbal measures. Comparison of the language ability groups produced no definite performance trend similar to those from the individual analysis.

Study subjects performed along a continuum on nonverbal and verbal tasks, with high, middle, and low performance groups. This continuum effect would be expected, according to Johnston's (1991) theory, in a group that has been defined by exclusions. The twelve subjects demonstrated no frank neurological etiologies, which would be expected to cause severe differences in language performance.

The sentence combining task was significantly related to nonverbal task scores. This task also produced the highest frequencies of target hierarchical structures (center-embedded relative clauses and postnominal prepositional phrases). The matrix task was not statistically related to nonverbal performance. However, non-statistical evaluation of the data indicated that high nonverbal performances and high matrix scores consistently appeared together. The film summary did not elicit center-embedded relative clauses or postnominal prepositional phrases in significant numbers for hierarchical analysis. A spontaneous sample that required clarification of ideas, opinions, or characters might best elicit these forms. A battery of nonverbal tasks designed to assess hierarchical processing and a battery of verbal

tasks similar to the ones in this study might best organize subjects along a language ability continuum.

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APPENDIXES

APPENDIX A

INSTITUTIONAL REVIEW BOARD FORMS

OKLAHOMA STATE UNIVERSITY
INSTITUTIONAL REVIEW BOARD
FOR HUMAN SUBJECTS RESEARCH

Proposal Title: Hierarchical Processing in Adolescents: Comparison of Nonverbal and Verbal Tasks

Principal Investigator: C. Scott/K. Klutsenbaker

Date: 7-31-91 IRB # AS-92-003

This application has been reviewed by the IRB and

Processed as: Exempt [ ] Expedite [XX] Full Board Review [ ]

Renewal or Continuation [ ]

Approval Status Recommended by Reviewer(s):

Approved [XX] Deferred for Revision [ ]

Approved with Provision [ ] Disapproved [ ]

Approval status subject to review by full Institutional Review Board at next meeting, 2nd and 4th Thursday of each month.

Comments, Modifications/Conditions for Approval or Reason for Deferral or Disapproval:

Reviewers offer the following comments:

1. The cover letter to the parent or guardian is technical and in the argot of of the researcher. If I were a parent I would want a more straightforward explanation.
2. Item #8 suggests the research is of a sensitive or personal nature. The cover letter and documentation does not make mention of this except by inference.
3. The sample is very small; the data from a single deviant subject could have a pronounced effect on group averages.
4. Normally a proposal refers to work that is planned to be done in the furture. This proposal is written in the past tense, implying that it has already been done.
5. The groups are selected in terms of language ability (which probably includes the use of hierarchical linguistic processing). So, it should not surprise us to find that the three groups differ along the lines expected. Other measures such as vocabulary, spelling ability, etc. may predict the outcome just as well.
6. Although the mobile task has been used by other investigators, the Lypothesized link to language would seem to be difficult to established, given the lack of normative data on this task (we don't know haw difficult the task is for 12-14 year-olds, or how normal children differ from learning disabled on it). This problem might be overcome by using subscales of the Wechler that focus on perceptual motor functions, such as the Block Designs.

Signature: _____ Date: 9-6-91

Chair of Institutional Review Board

APPENDIX B

PORTIONS OF SCOTT'S RESEARCH REVIEW

TABLES AND PROJECTED NORMS

Table 13

Scott's Research Review for Spoken/Written Texts with Average T-Unit Lengths in Fifth through Eighth Grade Subjects and Projected Norms

Research Project	Average T-Unit Length For Grade Levels			
	5	6	7	8
a*(S)	8.82	9.82	9.72	10.71
a (W)	8.76	9.04	8.98	10.37
b (S)	8.90		9.80	
b (W)	9.34		9.99	
c (S)		9.03		
d (S)		8.10		
e (W)				11.50
f (W)		7.32		10.34
g (W)	8.81		8.53	11.68
h (W)				10.70 11.40
	Projected Norms			
(S)	8.86	9.43	9.76	10.71
(W)	8.97	8.15	9.17	11.00

* (a) Loban (1976): N = 35 at each grade. Data also available for high and low language ability groups. Ages unavailable. Spoken: adult-child formal interview. Written: school compositions.
(b) O'Donnell and colleagues (1967): N = 30 at each grade. Ages available. Spoken and written: retelling/rewriting of silent fable (narrative).

(Table 13 continues)

(c) Klecan-Acker and Hedrick (1985): N = 24 at each grade. Retelling of a favorite film (narrative).
(d) Scott (1984). N = 25 10-year-olds, 29 12-year-olds. Retelling of a favorite book, TV episode, film (narrative).
(e) Hunt (1965): N = 18 at each grade. School compositions.
(f) Hunt (1970): N = 50 at each grade. Sentence combining exercise.
(g) Morris and Crump (1982): N = 18 at each age (9.6, 11.25, 12.54, 14.08 years). Rewriting of silent film (narrative).
(h) Richardson and colleagues (1976): N = 257 11-year-old boys, 264 11-year-old girls. School compositions.

S = spoken; W = written. The d, f, and g projects reported data for age only. The data were entered in the table using the following formula: Grade = Age - 6 Years.

Table 14

Scott's Research Review for Spoken/Written Texts with Average Subordination Indexes for Fifth through Eighth Grade Subjects and Projected Norms

Research Project	Average Subordination Indexes for Grade Levels			
	5	6	7	8
a* (S)	1.29	1.37	1.35	1.39
a (W)	1.21	1.29	1.28	1.50
b (S)		1.28		
c (S)		1.39		
d (W)				1.42
e (W)		1.24		1.46
f (W)				1.67 1.34 1.52
Projected Norms				
(S)	1.29	1.35	1.35	1.39
(W)	1.21	1.27	1.28	1.49

*(a) Loban (1976): Loban reported this ration as the number of subordinate clauses/sentence. The figures have been converted to number subordinate plus main clauses/sentence for purposes of comparison with other projects.
(b) Klecan-Acker (1985): See Table 14.
(c) Scott (1984): See Table 14.
(d) Hunt (1965): See Table 14.
(e) Hunt (1970): See Table 14.
(f) Rubin (1982): N = 18 at each grade. Persuasive writing task.

S = spoken; W = written. The subordination index is the number of subordinate and main clauses per T-unit.

APPENDIX C

SPOKEN AND WRITTEN SUMMARY COMPARISONS

Typically, you would expect the writing of poor writers and of those with hierarchical processing deficits to resemble speech. The written syntax of good writers would involve more complex, embedded and hierarchical syntactic structures, differing significantly from speech. Spoken text was collected to determine if written/spoken similarities did exist for poorer writers, but not for good writers.

Trends

1. Overall Length: LI group produced spoken samples twice the length of written samples.
2. Mean Clause Length: NL mean clauses were longer than spoken clauses.
3. Subordination Indexes: Six subjects (NL/LI mix) produced written samples with higher subordination indexes than spoken samples.
4. Syntax: LI subjects produced higher frequencies of relative clauses in written than spoken samples. NL subjects produced higher frequencies of relative and adverbial clauses in written samples than spoken samples, with higher frequencies of nominal clauses in spoken samples.

Overall Length and Complexity Measures

The language groups differed in the **length of written production compared to spoken production**. Whereas normal language subjects wrote and spoke approximately equal texts (in **total number of words**), the language impaired group wrote, on the average, half the volume that they spoke. Seven subjects produced spoken summaries longer than written

summaries. Several subjects contradicted this expectation.

Complexity differences were also found between ability groups in the spoken and written summaries. **Total number of clauses** differed between spoken and written summaries in the LI group. Total clause count for the LI group written summaries (152) was half the size of the spoken summary clause count (286). A modal difference was not seen in clause counts of NL summaries, with 133 spoken clauses and 131 written clauses. **Mean clause length** for written summaries was longer in NL samples, but not in LI samples. All subjects produced samples with instances of subordination (SI > 1). Six subjects (LI2, LI4, LI5, NL2, NL5, and NL6) produced written summaries with larger **subordination indexes** than their spoken summaries. One subject (NL1) produced spoken/written summaries with identical subordination indexes.

Typically Spoken Versus Written Characteristics

Spoken and written summaries were collected in order to assess the divergent development of spoken and written language modes in the two subject groups. Comparisons included analyses of **subordination types and frequencies** for spoken and written samples, use of **typically spoken or written syntactic and lexical forms**, and **common topics** appearing in spoken and written texts.

First, a count of all **subordination types** was made. Tables 15 and 16 contain information on frequency of

occurrence for subordinate clauses in both samples for NL and LI subjects. These frequencies were normalized for total clause lengths of individual samples.

All subjects except NL3 produced at least one embedded relative clause (right or center) in either a written or spoken summary. Relatively few center-embedded relative clauses were produced by either group, as discussed earlier. The NL group produced .045 and .076 frequencies of total relative clauses in spoken and written samples, respectively. The LI group produced a higher frequency of total relative clauses in spoken samples (.087 for spoken versus .072 for written), differing from NL group performance. Relative clauses used subordinator that or nonfinite constructions primarily. Examples are listed below:

> ...and some of them had vertical roots **which** were like tap roots.../ NL4-spoken
>
> the movie was about The Desert, and the animals, plants, and the rivers **that** are in the desert/ NL5-spoken
>
> ...and I respect the animals **that** live there.../ LI4-spoken
>
> The movie "The Desert" was a film explaining the part of the desert **that** most people don't see./
>
> The cactuse looks deffrent because they are branchs stin (sticking) out./ LI4-written

Note an exception to the that subordinator and nonfinite constructions in the example which. These alternative

Table 15

Occurrence Frequencies for Subordinate Clauses in Spoken and Written NL Summaries with Actual Counts in Parentheses (Normalized for Length of Text)

Sub Clause Type	Subjects NL1	NL2	NL3	NL4	NL5	NL6	Total
A) Rel-Total							
SS	.100 (2)	.032 (1)	0	.048 (2)	0	.050 (1)	.045 (6)
WS	.143 (2)	0	0	.100 (4)	.158 (3)	.063 (1)	.076 (10)
B) Rel-Center							
SS	.050 (2)	0	0	0	0	0	.015 (2)
WS	0	.032 (1)	0	.050 (2)	0	0	.023 (3)
C) Adv-Total							
SS	0	.105 (2)	.200 (5)	.071 (3)	0	0	.075 (10)
WS	.143 (2)	.194 (6)	.091 (1)	.025 (1)	.053 (1)	.125 (2)	.099 (13)
D) Adv-Condition							
SS	0	0	.040 (1)	0	0	0	.008 (1)
WS	0	0	0	0	0	0	0
E) Adv-Reason							
SS	0	.105 (2)	.080 (2)	.048 (2)	0	0	.045 (6)
WS	.071 (1)	.032 (1)	0	.025 (1)	.053 (1)	.125 (2)	.046 (6)
F) Adv-Result							
SS	0	0	0	0	0	0	0
WS	0	.129 (4)	0	0	0	0	.031 (4)

(Table 15 continues)

Sub Clause Type	Subjects NL1	NL2	NL3	NL4	NL5	NL6	Total
G) Adv-Manner							
SS	0	0	0	0	0	0	0
WS	.071 (1)	.032 (1)	0	0	0	0	.015 (2)
H) Adv-Place							
SS	0	0	.080 (2)	.024 (1)	0	0	.023 (3)
WS	0	0	.091 (1)	0	0	0	.008 (1)
I) Adv-Time							
SS	0	0	0	0	0	0	0
WS	0	0		0	0	0	0
J) Nom-Obj.							
SS	.200 (4)	.158 (3)	.040 (1)	.214 (9)	.143 (1)	0	.135 (18)
WS	0	.129 (4)	0	0	.053 (1)	.125 (2)	.053 (7)
K) Nom-Subj.							
SS	0	0	0	.024 (1)	0	0	.008 (1)
WS	0	0	0	0	0	0	0

(A) Relative Clauses (Total)
(B) Relative Center-Emedded Clauses
(C) Adverbial Clauses (Total)
(D) Adverbial Clauses of Condition
(E) Adverbial Clauses of Reason
(F) Adverbial Clauses of Result
(G) Adverbial Clauses of Manner
(H) Adverbial Clauses of Place
(I) Adverbial Clauses of Time
(J) Nominal Clauses (Object)
(K) Nominal Clauses (Subject)

Table 16

Occurrence Frequencies for Subordinate Clauses in Spoken and Written LI Summaries With Actual Counts in Parentheses (Normalized for Length of Text)

Sub Clause Type	Subjects						
	LI1	LI2	LI3	LI4	LI5	LI6	Total
A) Rel-Total							
SS	.067 (1)	0	.185 (15)	.107 (6)	.033 (2)	.018 (1)	.087 (25)
WS	0	.091 (2)	.133 (2)	.167 (5)	.027 (1)	.028 (1)	.072 (11)
B) Rel-Center							
SS	0	0	0	0	.033 (2)	.018 (1)	.010 (3)
WS	0	0	0	.033 (1)	.027 (1)	.028 (1)	.020 (3)
C) Adv-Total							
SS	.200 (3)	.105 (2)	.049 (4)	.196 (11)	.167 (10)	.128 (7)	.129 (37)
WS	.250 (3)	.136 (3)	.067 (1)	.167 (5)	.243 (9)	.194 (7)	.184 (28)
D) Adv-Condition							
SS	0	.053 (1)	.012 (1)	.018 (1)	0	.036 (2)	.017 (5)
WS	0	.045 (1)	0	.067 (2)	0	.028 (1)	.026 (4)
E) Adv-Reason							
SS	.067 (1)	0	.037 (3)	.089 (5)	.117 (7)	.055 (3)	.066 (19)
WS	.250 (3)	.091 (2)	0	.067 (2)	.162 (6)	.139 (5)	.118 (18)

(Table 16 continues)

Sub Clause Type	Subjects						
	LI1	LI2	LI3	LI4	LI5	LI6	Total
G) Adv-Manner							
SS	.067 (1)	0	0	.036 (2)	0	.036 (2)	.017 (5)
WS	0	0	0	0	.027 (1)	.028 (1)	.013 (2)
H) Adv-Place							
SS	0	0	0	.036 (2)	.050 (3)	0	.017 (5)
WS	0	0	0	.033 (1)	.027 (1)	0	.013 (2)
I) Adv-Time							
SS	.067 (1)	.053 (1)	0	0	0	0	.007 (2)
WS	0	0	0	0	0	0	0
J) Nom-Obj.							
SS	.067 (1)	0	.049 (4)	0	.150 (9)	0	.049 (14)
WS	0	0	.067 (1)	0	.081 (3)	.028 (1)	.033 (5)
K) Nom-Subj.							
SS	0	0	.025 (2)	0	0	0	.007 (2)
WS	0	0	0	0	0	0	0

(A) Relative Clauses (Total)
(B) Relative Center-Emedded Clauses
(C) Adverbial Clauses
(D) Adverbial Clauses of Condition
(E) Adverbial Clauses of Reason
(F) Adverbial Clauses of Result
(G) Adverbial Clauses of Manner
(H) Adverbial Clauses of Place
(I) Adverbial Clauses of Time
(J) Nominal Clauses (Object)
(K) Nominal Clauses (Subject)

clauses are indicators of increasing writing skill.

Table 15 indicates that NL subjects produced higher frequencies of adverbial and nominal clauses than relatives in the spoken summaries. NL subjects also produced higher frequencies of adverbial clauses in the written summary total. Types of adverbial clauses included primarily reason and manner in both modes. The high frequency of reason adverbials was characterized by the subordinator because or by to-infinitive constructions, as in the examples listed below:

> ...birds would build a nest in them **to keep out** predators.../ NL3-spoken
>
> When it rains, it usually floods **because** the soil cannot hold all of the water..../ NL2-written
>
> The other kind has vertical roots **to "tap"** water from deep below the surface./ NL4-written

LI subjects produced more varieties of adverbial clauses than did the NL groups in both spoken and written summaries. Adverbials of condition, reason, manner, place, and time appeared in higher frequencies for both LI summary groups. Greater varieties of adverbials are noted in written development (Scott, 1988). Reason adverbials were most frequently produced and usually subordinated by because. Examples included:

> ...and plants use their roots **to go** down in the ground.../ LI6-spoken (adv reason)
>
> The bird lay their eggs here **because** the needles keep away the snakes and other things./ LI5-written (adv

reason)

Adverbials of time were characterized by the subordinator when and were used more frequently by the LI group (.007), though rarely used. Condition adverbials were characterized by an if subordinator. An example of an if construction is LI2's spoken sentence, yeah and **if it does rain**, it rains hard/.

The NL group produced relatively higher frequencies of nominal object clauses than did LI subjects in both spoken and written summaries. These subjects produced .135 and .053 nominal object frequencies for spoken and written summaries, compared with .049 and .033 for LI subjects. Nominal object clauses were formed primarily by using how, that, or to-infinitive structures. Examples of nominal constructions include:

...ok it was about the desert and **how** animals adapt to the desert climate and the holes and everything for shade.../

NL1-spoken

...and it went on and said **that** there most people think [**that** there aren't very many animals in the desert].../

NL4-spoken

Plants haff **to stor** water or get taps./ LI3-written

Few subjects produced nominal clauses fulfilling a subject role in the independent clause. This clause type is characteristic of older writing samples. Subjects NL4 and LI3 produced 1 and 2 nominal subjects respectively. The

three nominal subjects were produced in spoken summaries only. One example of a nominal subject clause is LI3's spoken sample, ...**what desert is most famous for** is lizards...,/ with the wh- nominal.

Generally, there were minimal differences in the types of subordination that the NL group used in spoken versus written summaries. The NL group used only slightly more relative clauses and adverbial clauses in the written summary. NL subjects used twice as many nominal object clauses in the spoken summary than in the written. The LI subject group produced greater frequencies of relative clauses, adverbial clauses, and nominal object clauses in the spoken summaries. These group differences in subordination production indicated the different stages in writing development. The NL subjects were beginning to use proportionately more relative and adverbial clauses in writing. The LI subjects produced more subordinate forms in their speaking, with proportionately fewer subordinates in their written than spoken summaries.

The second analysis included various forms cited by Biber (1986), Halliday (1987), Scott and Klutsenbaker (1989), and others as typically spoken or written. This included the use of specific syntactic and lexical features in both summaries. **Typically spoken syntactic and lexical features** are listed in Table 17, with spoken, and then written totals appearing for each subject (S/W). These totals are not normalized for length of text. Note that use of contractions, the second measure listed in Table 17, is

reported in a percentage. This percentage of occurrence was obtained by dividing total number of contractions used by total number of contraction possibilities.

Certain spoken features, including general vocabulary, contractions, and third person pronouns appeared in greater numbers in the spoken summaries of a majority of NL group samples (4 or more). General vocabulary and third person pronouns were used to greater degrees in a majority of spoken LI samples. Examination of group totals indicated that all spoken features, with the exception of second preposition you, were found to greater degrees in the NL spoken samples. The same is true for the LI spoken features, with the exception of deleted subordinator that and second person pronoun you.

General vocabulary included the use of nondefinitive wording (weird animals/ NL1-spoken and the soil doesn't **soak it up**/ LI5-spoken) and general hedges (I think, sort of, and or something). NL subjects typically used more general terms in spoken summaries. Three LI subjects used general terms more exclusively in spoken summaries (LI3, LI4, and LI5).

All subjects but NL5 used contractions to greater degrees in spoken summaries. However, 8/12 subjects did use contractions in written summaries to some extent (13-66%). Instances of deleting a subordinator that were generally limited in this study. Subjects NL4 (4-spoken and 2-written), LI1 (1-spoken), and LI5 (4-spoken and 2-written) deleted subordinating that in samples. An example

Table 17

Numbers of Typically Spoken Lexical and Syntactic Features in Spoken and Written Summaries (S/W) for Each Subject (Not Normalized for Length of Text)

	NL1	NL2	NL3	NL4	NL5	NL6	Total
Gen Vocab	4/1	3/2	6/1	10/1	0/0	6/1	29/6
*Contr	100/66	100/0	100/0	75/13	0/66	100/25	
Del That	0/0	0/0	0/0	4/2	0/0	0/0	4/2
Strand Prep	2/0	2/1	3/0	3/3	0/0	0/1	10/5
3rd Per Pron	6/2	4/9	19/5	26/7	5/5	10/8	70/36
Rep Pron	1/0	0/0	1/0	0/0	0/0	0/0	2/0
I	0/0	0/0	0/0	2/1	0/0	0/0	2/1
You	0/0	0/0	0/0	0/1	0/1	0/0	0/2
	LI1	LI2	LI3	LI4	LI5	LI6	Total
Gen Vocab	1/1	0/1	10/0	9/1	18/1	2/3	40/7
*Contr	100/50	86/50	83/0	83/25	89/0	69/46	
Del That	1/0	0/0	0/1	0/0	4/2	2/5	7/8
Strand Prep	0/2	1/1	4/0	2/2	3/2	7/2	17/9
3rd Per Pron	5/4	7/2	31/1	24/11	45/16	30/17	142/51

(Table 17 continues)

	NL1	NL2	NL3	NL4	NL5	NL6	Total
Rep Pron	0/0	0/0	0/0	1/0	3/1	1/0	5/1
I	1/0	2/2	6/0	5/0	0/0	0/0	14/2
You	0/0	0/0	2/0	0/1	0/0	0/2	2/3

* information presented in percentage of contraction opportunitiesauxiliaries and copulas).

of a sentence with deletion of the that subordinator is:

...and what I thought was interesting was when it said ___ it rained heavily.../ (NL4-spoken)

Third person pronoun counts included 70 for spoken NL summaries, 36 for written NL summaries, 142 for spoken LI summaries, and 51 for written LI summaries. LI subjects used more third person pronouns, representing the movie (**it** talked about the desert/ NL5-spoken), animals (and that's how **they** get **their** food/ LI4-spoken), and plants (and then **they** will either store the water/ LI3-spoken). First person pronouns (I) and second person pronouns (you) were used infrequently in these samples. NL4 used I three times (2-S and 1-W) and you once in the written summary. NL5 used you once in the written summary. More LI subjects used the pronoun I in spoken summaries (LI1, LI2, LI3, and LI4). Only subject LI2 used pronoun I in the written summary. Subjects LI3, LI4, and LI6 used pronoun you in summaries, with LI4 and LI6 using you in written summaries.

Ability groups differed only on use of contractions and third and first person pronouns. However, totals were not normalized for text lengths. If it could be assumed that totals for LI written summaries would double with normalization (due to written summaries half the length of NL summaries), then LI spoken and written differences were not that large.

Typically written syntactic and lexical features are listed in Table 18. Evaluation of typically written forms

Table 18

Numbers of Typically Written Lexical and Syntactic Features in Spoken and Written Summaries (S/W) for Each Subject (Not Normalized for Length of Text)

	NL1	NL2	NL3	NL4	NL5	NL6	Total
Total Adj	6/7	11/13	7/8	17/38	1/12	10/10	52/88
Total Prep	7/6	14/18	8/4	24/24	4/19	7/12	64/83
Post Nom Prep	0/0	1/2	2/0	4/2	0/1	0/2	7/7
Nom Premod	0/0	0/0	0/0	0/1	0/0	0/1	0/2
Nom Noun	0/0	2/1	2/1	2/0	0/1	0/1	6/4
Adj Series	0/0	0/0	0/1	0/2	0/0	0/1	0/4
Pass	2/1	0/1	1/1	1/1	0/0	0/1	4/5
Spec Vocab	2/6	2/9	3/2	4/14	0/1	0/3	11/35
	LI1	LI2	LI3	LI4	LI5	LI6	Total
Total Adj	4/9	7/8	43/8	11/13	17/21	16/13	98/72
Total Prep	5/5	4/14	35/4	24/8	24/19	21/21	113/71
Post Nom Prep	0/0	3/0	2/0	1/0	0/0	1/0	7/0
Nom Premod	0/0	0/0	0/0	0/0	0/0	0/2	0/2

(Table 18 continues)

	NL1	NL2	NL3	NL4	NL5	NL6	Total
Nom Noun	0/0	1/0	1/2	0/0	0/0	1/1	3/3
Adj Series	0/0	0/0	1/0	0/0	0/0	0/1	1/1
Pass	0/0	1/1	1/1	0/0	1/2	0/4	3/8
Spec Vocab	0/0	0/0	0/0	1/0	1/0	5/3	7/3

provided a greater group difference in the film summaries. NL subjects tended to produce more of these features in the appropriate summary mode. The typically written features examined in this comparison were low-frequency in nature, as opposed to the high-frequency, typically spoken features. Total adjectives and prepositional phrases were higher in NL written summaries. NL subjects produced 52 spoken prepositional phrases and 88 written phrases. LI subjects produced more total adjectives and prepositional phrases in adjectives in spoken and written summaries, respectively. LI subjects produced 113 and 71 prepositions in spoken and written summaries. However, LI spoken summaries were almost twice the length of written summaries, whereas NL summaries were equal in length. If total counts for LI written summaries were doubled, as a text equalizer, LI subjects would have produced more prepositions and adjectives in written summaries.

Nominalized premodifiers appeared equally in both group samples, with two in NL written summaries and two in LI written summaries. An example of a nominalized premodifier spoken samples. LI subjects produced 98 and 72 total is found in NL6's written sample, ...so they won't take there **stored** water./

Nominalized nouns appeared in larger numbers than did nominalized premodifiers for both groups. NL subjects produced six nominalized nouns in spoken summaries and four nominalized nouns in written summaries. LI subjects produced three nominalized nouns in spoken summaries and

three nominalized nouns in written summaries. An example of a nominalized noun is found in NL2's written summary, ...so there is a **flashflood**/. The NL group produced more spoken sample nominalized nouns.

Adjective series are methods of expanding noun phrases. There were few incidences of 2+ adjectives modifying a noun. NL subjects produced four series of adjectives in the written summaries and none in the spoken summaries. LI subjects only produced one series in each summary. One example of the limited adjective series is NL3's written summary, Cactus are made of **long wood** stemes/.

Passive verb constructions were more prevalent in written summaries for both groups. NL subjects produced a total of four and five passives in spoken and written summaries, respectively. LI subjects produced larger modal differences, with three and eight passives for spoken and written summaries. Subject LI6 produced the written passive construction, Derest **is filled** with lot of plots (plants)/.

NL subjects produced more specialized lexical structures or vocabulary in written summaries (11 spoken and 35 written). This included terms such as climate, plateau, and tap root system. LI subjects did not produce such modal differences. The LI subjects produced seven spoken and three written specialized lexical terms.

The third and final analysis is concerned with **topic**. Table 19 contains the most prevalent topics included in each summary for all subjects and the number of samples

Table 19

Common Topics Presented in a Majority of Written and Spoken Summaries

	Spoken	Written
Introduction	8/12 (2LI,6NL)	6/12 (2LI,4NL)
Desert Description		
Rain and Flooding	11/12 (5LI,6NL)	9/12 (3LI,6NL)
Underground Water	7/12 (3LI,4NL)	8/12 (4LI,4NL)
Plants		
Cactus Store Water	8/12 (4LI,4NL)	8/12 (4LI,4NL)
Tap Root Systems	7/12 (4LI,3NL)	0
Needle Protection	7/12 (4LI,3NL)	7/12 (4LI,3NL)
Animals		
Night/Day Activity	0	7/12 (3LI,4NL)
Cooler Underground	6/12 (4LI,2NL)	7/12 (3LI,4NL)
Birds Use Cactus	7/12 (5LI,2NL)	0
Animal Examples	6/12 (4LI,2NL)	0
Food Chain		
Animals Eat Others	6/12 (4LI,2NL)	0
Conclusion	2/12 (2LI,0NL)	3/12 (1LI,2NL)
Totals	(41LI, 34NL)	(24LI, 31NL)

containing those topics. There were 12 broad topics consistently discussed by a majority of subjects. The introductory section appeared to a greater extent in the spoken summaries and was most prevalent in the NL group samples. A concluding section was less prevalent than the introduction in both sample modes. Interestingly, two LI subjects included a conclusion in the spoken sample, but no NL group members did. Two minor topics (bird nesting habits and animal examples) and one major subject (the food chain) were included in at least half of the spoken samples, but were deleted from all written samples.

Discussion of Spoken and Written Summary Comparisons

A significant relationship was found only between learning/memory scores on the mobile construction task and written summary relative clause frequencies. All other measures, including subordination indexes and mean sentence lengths were not significantly related to nonverbal measures.

This speaks to the nature of this descriptive expository text influencing written samples. The descriptive stimulus resulted in higher frequencies for adverbial and nominal clauses. Even adjective series premodifying nouns, which would be expected in descriptive summaries, did not appear in subject samples. The film text did not contain characters or concepts that would easily be confused; therefore, it was not necessary for the writers to

distinguish between subjects, using noun phrase expansions or embedded relative clauses.

Overall Length and Complexity

As noted previously, overall length and complexity measures in spoken and written summaries were not significantly related to nonverbal scores. However, there are certain non-statistical observations that bear discussion for descriptive purposes.

NL subjects produced longer written compared to spoken summaries, which would not be expected. Scott and Klutsenbaker's (1989) study indicated that written summaries were considerably shorter in total length than spoken summaries for both NL and LI subjects. The LI group produced the more typical proportion of written to spoken words. Two NL subject (NL5 and NL6) were reluctant to discuss the film, and required excessive prodding. Their spoken samples were short and affected overall group measures.

Mean sentence length and mean clause length have been considered measures of overall complexity. Mean sentence length did not accurately differentiate subjects according to age or language ability. However, mean clause length was the best differentiator of ability groups. LI clauses for both summary modes were slightly shorter than those of the NL group. Clause length increases with nominal phrase expansion methods, which appear in later phases of writing development. Additionally, the NL subjects produced longer

written clauses than spoken clauses; conversely, LI subjects produced longer spoken clauses than written clauses. This indicates a greater degree of developmental differentiation for spoken and written language in NL subject samples. LI subjects did not demonstrate the same degree of writing development as an ability group.

Subordination indexes did not differentiate language ability groups in the manner expected. Subordination indexes for written summaries were above expected levels, according to a tabulation of studies in Scott's review (1988). This could be due to the narrative genre typical of Scott's reviewed studies, as opposed to the expository genre of the present study. The descriptive text would allow for large numbers of adverbial clauses and nominal object clauses. Most of the subordination was of a simple type (because, when, and to-infinitive). Subordination indexes do not differentiate between types of subordination (low-frequency forms such as nominal subject clauses or high-frequency forms such as nominal object clauses). A subject could produce a high subordination index, but do so using only the earliest appearing and most common types of subordination. Qualitatively, this would result in a more simplistic written sample. Relatively few low-frequency structures, such as the nominal subject form, were found in this study, although subordination indexes were at or above expected levels.

It was expected that NL subjects would produce summaries with higher subordination indexes than LI

subjects. This was not the case. This could be explained by the fact that LI subjects produced higher proportional frequencies of the developmentally lower adverbial and nominal clauses in written summaries. These were of the previously mentioned high frequency types. NL subjects, however, used higher numbers of structures which contribute to hierarchical noun phrase expansion, including total adjectives (NL-88, LI-72), total prepositions (NL-83, LI-71), postnominal prepositions (NL-7, LI-2), nominalized nouns (NL-4, LI-3), and adjective series (NL-4, LI-1). Scott and Klutsenbaker (1989) noted that these noun phrase expansions did not lead to an increased subordination index, but did add the same types of information as contained in some subordinate clauses. Such processes might explain the language ability differences in subordination indexes.

Typically Spoken and Written Features

Typically spoken and written features (total adjectives and prepositions, postnominal prepositions, nominalized nouns, adjective series, and general/specific vocabulary) figured prominently in the possible explanation of NL/LI subordination indexes. Other noteworthy features include use of contractions (spoken) and first, second, and third person pronouns (spoken).

Contractions are distinctly spoken features, but are not preferred in formal written texts. The NL subjects appeared to recognize the mode restrictions placed on contractions, with higher percentage of occurrence in most

spoken samples (100%/66%, 100%/0%, 100%/0, 75%/13%, 0%/66%, 100%/25%). However, subjects NL1 and NL5 used relatively high percentages of contractions in their written samples. Possibly these subjects are still developing awareness of written and spoken stylistic differences. Perhaps they did not consciously attend to this stylistic difference. If not consciously aware of the style rule, the subjects would not make a specific effort to use the appropriate form. Notably, no subject attempted to revise or edit samples, even provided with that extra time. LI subjects demonstrated similar use of contractions in spoken/written samples (100%/50%, 86%/50%, 83%/0%, 83%/25%, 89%/0%, and 69%/46%). However, four LI subjects demonstrated relatively high percentages of written contractions also. Possibly the extra stress of written mode on an impaired linguistic system decreases attention to stylistic features.

Use of first and second person pronouns in written samples is a significant stylistic feature. Use of pronouns I and you indicate a personal writing style, not usually typical of descriptive expository writing. Even normal language subjects with relatively advanced writing skills used such personal styles. Examples include the following:

> The closest I have been to one is in New Mexico./ NL4-written
>
> ...and sometimes you will see plants bye other plants/ LI6-written

These pronouns result in a more spoken and informal style. Subjects from both ability groups used these pronouns.

This indicates continuing development of written language style. LI subjects used significantly more third person pronouns in both summary modes. This led to a preponderance of structures such as the following:

In the desert it does not rain very much./ NL2-written

So the animals love it when it rains./ LI4-written

Nouns such as desert, animals, and plants are named by pronouns they and their. Examples include a sentence discussing plants and a sentence discussing animals:

They are used for food./ LI5-written

...and they dig in the ground for food./ NL5-written

Use of these pronouns decreases the number of noun phrase expansions possible in a written text. With the use of specific nouns, a writer can use modifying adjective series and prepositional phrases.

Basically, all subjects presented written and spoken summaries characteristic of other seventh grade subjects. These writers are experimenting with different types of subordination. It was interesting that the NL group was using significantly more noun-phrase expansion methods. They would appear to be increasing the number of specifically written features that dominate higher level writing. The fact that both groups still have significant numbers of spoken features appearing in their writing indicates continued writing development.

Common Spoken and Written Topics

Subjects discussed a core number of topics in spoken and written summaries. The appearance of bird and animal descriptions and the food chain topic in the spoken summaries might be tied to usage of general versus specific vocabulary. These topics require use of specific vocabulary, including such terms as adaptation, predator, food web, and specific animal names. Subjects discussed these topics in generalized terms in spoken summaries. An example was LI5's, /and I guess they eat each other/, when discussing the food chain in the desert. The subjects, particularly LI subjects, might not have had the lexical competence to discuss these topics in written samples. Another explanation could be that these topics were addressed in the last half of the film. Subjects could have experienced decreased auditory attention in the final half of the film. Topics such as desert composition and formation, which includes technical terms such as climate, plateau, and erosion, were included in 9/12 written samples.

APPENDIX D

SENTENCE COMBINING STIMULI AND DESCRIPTIONS

1. Because my mom wanted the mess that we made last night cleaned up, we did it immediately. (3 cl, 13 w)

   Because my mom wanted the mess cleaned up, we did it immediately.
   We made the mess last night.
   [Relative, 2nd degree, postverbal, restrictive]

2. The box of decorations in the hall closet is for Mark's birthday. (1 cl, 12 w)

   The box has decorations.
   The decorations are for Mark's birthday.
   The box is in the hall closet.
   [Post-nominal prepositional phrases, preverbal]

3. Even though the dog that lives across the street looks friendly, he may be dangerous. (3 cl, 15 w)

   Even though the dog looks friendly, he may be dangerous.
   The dog lives across the street.
   [Relative, 2nd degree, preverbal, restrictive]

4. If the girl who wore the pink dress last year goes to the prom, I won't go. (3 cl, 17 w)

   The girl wore the pink dress last year.
   If the girl goes to the prom, I won't go.
   [Relative, 2nd degree, preverbal, restrictive]

5. The bananas in the basket from my mother are not ripe yet, but they will be soon. (2 cl, 17 w)

   The bananas are not ripe yet, but they will be soon.
   The basket is from my mother.
   The bananas are in the basket.
   [Post-nominal prepositional phrases, preverbal]

6. That book about Abraham Lincoln's life before the Civil War has 300 pages, so I don't want it. (2 cl, 18 w)

   That book is about Abraham Lincoln's life.
   That book is about his life before the Civil War.
   That book has 300 pages, so I don't want it.
   [Post-nominal prepositional phrases, preverbal]

7. After Miss Jones sent the student who was misbehaving to the principal's office, the class calmed down. (3 cl, 15 w)

After Miss Jones sent the student to the principal's office, the class calmed down.
The student was misbehaving.
[Relative clause, 2nd degree, postverbal, restrictive)

8. Whether the show that is rated PG will come to our theatre next week is questionable. (3 cl, 16 w)

Whether the show will come to our theatre next week is questionable.
The show is rated PG.
[Relative clause, 2nd degree, preverbal, restrictive)

9. The bus to the town across the river leaves at 3:00. (1 cl, 11 w)

The bus goes to the town.
The bus leaves at 3:00.
The town is across the river.
[Post-nominal prepositional phrases, preverbal]

10. Mother told me that the boxes under the bed in her room held my birthday presents. (2 cl, 16 w)

The boxes were under the bed.
Mother told me that the boxes held my birthday presents.
The boxes were in her room.
[Post-nominal prepositional phrases, postverbal]

APPENDIX E

SENTENCE COMBINING INSTRUCTIONS

From examiner to subject:

Next I am going to give you sets of sentences.

I want you to make one sentence out of each set. Keep all the information that you think is important. As an example, look at this.

a.) The girl sat next to me.
The girl was cheating on the test.

I would combine these sentences somehow, not just by adding an and or but. I would write:

The girl who sat next to me was cheating on the test.

See how all the information is still in the sentence? I took out some words, but added or changed others.

Another example would be:

b.) The dog was very hungry.
The dog waited impatiently by its food dish.

How would you combine these sentences? One way to write this would be:

The dog, which was very hungry, waited impatiently by its food dish.

Another way might be:

The dog waiting impatiently by its dish was very hungry.

There are many different ways to combine this information. Here's another example set.

c.) The computer is in my office.
The computer is not working.
The computer is on the middle desk.

The computer on the middle desk in my office is not working.

APPENDIX F

MATRIX STIMULI AND POSSIBLE SOLUTION SENTENCES

1.

	PLACE	
	Farm	Zoo
ANIMAL	cat	lion
TYPE	tame	wild

Matrix #1:
A cat is a tame animal. A farm is a place where cats live. A lion is a wild animal. A zoo is a place where lions live. (level 1)

A cat is a tame animal and a cat lives on a farm. A lion is a wild animal and a lion lives in a zoo. (level 2)

A cat is tame, so it lives on a farm. A lion is wild, so it lives in a zoo. (level 3)

A cat is tame and may live on a farm, but a lion is wild, so it must live in a zoo. (level 4)

2.

	STATE	
	Wisconsin	Florida
LOCATION	north	south
TEMPERATURE	cool	warm

Matrix #2:
Wisconsin is a state in the north. Wisconsin's temperature is cool. Florida is a state in the south. Florida's temperature is warm. (level 1)

Wisconsin is north and Wisconsin is cool. Florida is south and Florida is warm. (level 2)

Wisconsin is northern, so it's temperature is cool. Florida is southern, so it's temperature is warm. (level 3)

Wisconsin is a cool northern state, but Florida is a warm southern state. (level 4)

3.

	ANIMAL	
	dog	crocodile
ANIMAL TYPE	mammal	reptile
TYPE OF OFFSPRING	babies	eggs

Matrix #3:
A dog is an animal that is mammalian. A dog has babies. A crocodile is an animal that is reptilian. A crocodile lays eggs. (level 1)

A dog is a mammal and a dog has babies. A crocodile is a reptile and a crocodile lays eggs. (level 2)

A dog is a mammal, so it has babies. A crocodile is a reptile, so it lays eggs. (level 3)

A dog is a mammal, so it has babies, but a crocodile is a reptile, so it lays eggs. (level 4)

4.

	CITY	
	Tulsa	Paris
COUNTRY	United States	France
LANGUAGE	English	French

Matrix #4:
Tulsa is a city in the United States. In Tulsa, english is the language spoken. Paris is a city in France. In Paris, french is the language spoken. (level 1)

Tulsa is in the United States and english is spoken there. Paris is in France and french is spoken there. (level 2)

Tulsa is in the United States, so english is spoken there. Paris is in France, so french is spoken there. (level 3)

Tulsa is in the United States, so english is spoken there, but Paris is in France, so french is spoken there. (level 4)

5.

	STATE	
	Florida	Colorado
TEMPERATURE	warm	cold
POPULAR SPORT	water skiing	snow skiing

Matrix #5:
Florida is a warm state. In Florida water skiing is a popular sport. Colorado is a cold state. In Colorado snow skiing is a popular sport. (level 1)

Florida is warm and water skiing is a popular sport in Florida.
Colorado is cold and snow skiing is a popular sport in Colorado.
(level 2)

Florida is warm, so water skiing is a popular sport there.
Colorado is cold, so snow skiing is a popular sport there.
(level 3)

It's warm in Florida, so water skiing is popular, but it's cold in Colorado, so snow skiing is popular. (level 4)

6.

	ANIMAL	
	cow	seal
HOME	land	ocean
FOOD	grass	fish

Matrix #6:
A cow is an animal that lives on land. A cow eats grass. A seal is an animal that lives in the ocean. A seal eats fish. (level 1)

A cow lives on land and a cow eats grass. A seal lives in the ocean and a seal eats fish. (level 2)

A cow lives on land, so it eats grass. A seal lives in the ocean, so it eats fish. (level 3)

A cow lives on land, so it eats grass, but a seal lives in the ocean, so it eats fish. (level 4)

7.

	PLACE	
	Brazil	Nevada
AMOUNT OF MOISTURE	wet	dry
LAND TYPE	jungle	desert

Matrix #7:
Brazil is a place that is wet. Brazil's lands have jungles. Nevada is a place that is dry. Nevada's lands have deserts. (level 1)

Brazil is a wet place and Brazil has jungles. Nevada is a dry place and Nevada has deserts. (level 2)

Brazil is wet, so it has jungle land. Nevada is dry, so it has desert land. (level 3)

Brazil is wet, so it has jungles, but Nevada is dry, so it has deserts. (level 4)

8.

	LAND TYPE	
	jungle	desert
AMOUNT OF MOISTURE	wet	dry
PLANT LIFE	ferns	cacti

Matrix #8:
A jungle is a wet place. A jungle grows ferns as plant life. A desert is a dry place. A desert grows cacti as plant life. (level 1)

A jungle is wet and a jungle has ferns. A desert is dry and a desert has cacti. (level 2)

A jungle is wet, so it has ferns. A desert is dry, so it has cacti. (level 3)

A jungle is wet, so it has ferns, but a desert is dry, so it has cacti. (level 4)

9

	BIRD	
	ostrich	robin
FLYING ABILITY	can't	can
NESTING PLACE	land	tree

Matrix #9:
An ostrich is a bird that can't fly. An ostrich makes its nest on the ground. A robin is a bird that can fly. A robin makes its nest in a tree. (level 1)

An ostrich can't fly and an ostrich makes its nest on the ground. A robin can fly and a robin makes its nest in a tree. (level 2)

An ostrich can't fly, so it makes its nest on the ground. A robin can fly, so it makes its nest in the tree. (level 3)

An ostrich can't fly, so it makes its nest on the ground, but a robin can fly, so it makes its nest in a tree. (level 4)

10.

	ANIMAL	
	horse	seal
LIMBS	legs	flippers
MOVEMENT	running	swimming

Matrix #10:
A horse is an animal that has legs. A horse moves by running. A seal is an animal that has flippers. A seal moves by swimming. (level 1)

A horse has legs and a horse runs. A seal has flippers and a seal swims. (level 2)

A horse has legs, so it runs. A seal has flippers, so it swims. (level 3)

A horse has legs,so it runs, but a seal has flippers, so it swims. (level 4)

APPENDIX G

MATRIX INSTRUCTIONS

Examiner addressing subject:

The first thing I want you to do uses a matrix. A matrix is like a table with some information in each square. Let me show you how you read a matrix.

	State	
	Michigan	California
Temperature	cool	warm
Fruit Crop	apples	oranges

This matrix has information about two states, Michigan and California, and crop growing. In Michigan it's cool. That's what this cool across from temperature means. In California, what's the temperature?

OK. At harvest time what do they grow?

How do you know what is grown and where?

Good. Now you can use all this information in a couple of sentences.

a.) "In Michigan the temperature is cool. In Michigan they grow apples. In California the temperature is warm. In California they grow oranges."

Or you could write:

b.) "In Michigan, it's cool, so they grow apples, but in California it's warm, so they grow oranges."

You can put this information together in many different ways. Look at each matrix. If you have questions about any words, please ask me. Remember that punctuation and spelling do not matter. You have about thirty minutes.

APPENDIX H

MOBILE CONSTRUCTION

INSTRUCTIONS

Now I want you to make a mobile for me. I will be videotaping your hands while you put the mobile together. It needs to look just like the one hanging here. Take your time. After you're finished, I will have you make one more.

Great. Ok, now I want you to watch me. I will put the mobile together like this. See, I am using a pattern.

Ok, now you put them together like I did.

APPENDIX I

INDIVIDUAL SCORES FOR STUDY MEASURES

Table 20

Individual Scores for Subject NL1 on Selected Study Measures

Measure	Score
Age	12;4
Sex	M
Grade	7
TONI-II	107
1stNV	13/20
2ndNV	12/20
Learning/ Memory	-1
Sentence Combining	10/15
Matrix Weighted	27/40

	Summary Mode	
	WS	SS
Total # of Words	72	127
Total # of Sent.	10	12
Mean Sent. Length	7.2	10.58
Total # of Clauses	14	20
Mean Clause Length	5.14	6.35
Subordination Index	1.4	1.67
Total Relative Clause Frequency	.143	.100
Postnominal Preposition Count	0	0

Table 21

Individual Scores for Subject NL2 on Selected Study Measures

Measure	Score
Age	12;6
Sex	M
Grade	7
TONI-II	120
1stNV	0/20
2ndNV	20/20
Learning/ Memory	20
Sentence Combining	7/15
Matrix Weighted	21/40

	Summary Mode	
	WS	SS
Total # of Words	193	139
Total # of Sent.	21	13
Mean Sent. Length	9.19	10.69
Total # of Clauses	31	19
Mean Clause Length	6.23	7.32
Subordination Index	1.48	1.46
Relative Clause Frequency	0	.032
Postnominal Preposition Count	0	0

Table 22

Individual Scores for Subject NL3 on Selected Study Measures

Measure	Score
Age	13;5
Sex	M
Grade	7
TONI-II	114
1stNV	1/20
2ndNV	19/20
Learning/ Memory	18
Sentence Combining	0/15
Matrix Weighted	10/40

	Summary Mode	
	WS	SS
Total # of Words	54	151
Total # of Sent.	8	14
Mean Sent. Length	6.75	10.79
Total # of Clauses	11	25
Mean Clause Length	4.91	6.04
Subordination Index	1.38	1.79
Relative Clause Frequency	0	0
Postnominal Preposition Count	0	1

Table 23

Individual Scores for Subject NL4 on Selected Study Measures

Measure	Score
Age	13;5
Sex	F
Grade	7
TONI-II	120
1stNV	4/20
2ndNV	20/20
Learning/ Memory	16
Sentence Combining	12/15
Matrix Weighted	32/40

	Summary Mode	
	WS	SS
Total # of Words	277	277
Total # of Sent.	28	26
Mean Sent. Length	9.89	10.65
Total # of Clauses	40	42
Mean Clause Length	6.93	6.60
Subordination Index	1.43	1.62
Relative Clause Frequency	.100	.048
Postnominal Preposition Count	8	1

Table 24

Individual Scores for Subject NL5 on Selected Study Measures

Measure	Score
Age	13;9
Sex	F
Grade	8
TONI-II	95
1stNV	6/20
2ndNV	20/20
Learning/ Memory	14
Sentence Combining	10/15
Matrix Weighted	26/40

	Summary Mode	
	WS	SS
Total # of Words	131	40
Total # of Sent.	14	6
Mean Sent. Length	9.36	6.67
Total # of Clauses	19	7
Mean Clause Length	6.89	5.71
Subordination Index	1.36	1.17
Relative Clause Frequency	.158	0
Postnominal Preposition Count	1	0

Table 25

Individual Scores for Subject NL6 on Selected Study Measures

Measure	Score
Age	13;9
Sex	F
Grade	8
TONI-II	118
1stNV	2/20
2ndNV	20/20
Learning/ Memory	18
Sentence Combining	10/20
Matrix Weighted	17.5/40

	Summary Mode	
	WS	SS
Total # of Words	108	74
Total # of Sent.	10	15
Mean Sent. Length	10.8	4.93
Total # of Clauses	16	20
Mean Clause Length	6.75	3.70
Subordination Index	1.60	1.33
Relative Clause Frequency	.063	.050
Postnominal Preposition Count	3	0

Table 26

Individual Scores for Subject LI1 on Selected Study Measures

Measure	Score
Age	12;2
Sex	M
Grade	6
TONI-II	87
1stNV	1/20
2ndNV	19/20
Learning/ Memory	18
Sentence Combining	2/15
Matrix Weighted	17.5 /40

	Summary Mode	
	WS	SS
Total # of Words	47	88
Total # of Sent.	8	9
Mean Sent. Length	5.88	9.78
Total # of Clauses	12	15
Mean Clause Length	3.92	5.87
Subordination Index	1.50	1.67
Relative Clause Frequency	0	.067
Postnominal Preposition Count	0	2

Table 27

Individual Scores for Subject LI2 on Selected Study Measures

Measure	Score
Age	13;0
Sex	M
Grade	7
TONI-II	105
1stNV	6/20
2ndNV	19/20
Learning/ Memory	13
Sentence Combining	7/15
Matrix Weighted	22/40

	Summary Mode	
	WS	SS
Total # of Words	156	108
Total # of Sent.	19	18
Mean Sent. Length	8.21	6.00
Total # of Clauses	22	19
Mean Clause Length	7.09	5.68
Subordination Index	1.16	1.06
Relative Clause Frequency	.091	0
Postnominal Preposition Count	0	0

Table 28

Individual Scores for Subject LI3 on Selected Study Measures

Measure	Score
Age	13;10
Sex	M
Grade	7
TONI-II	105
1stNV	2/20
2ndNV	16/20
Learning/ Memory	14
Sentence Combining	5/15
Matrix Weighted	30/40

	Summary Mode	
	WS	SS
Total # of Words	77	496
Total # of Sent.	10	51
Mean Sent. Length	7.70	9.72
Total # of Clauses	15	81
Mean Clause Length	5.13	6.12
Subordination Index	1.50	1.59
Relative Clause Frequency	.133	.185
Postnominal Preposition Count	0	0

Table 29

Individual Scores for Subject LI4 on Selected Study Measures

Measure	Score
Age	13;3
Sex	F
Grade	7
TONI-II	94
1stNV	1/20
2ndNV	10/20
Learning/ Memory	9
Sentence Combining	0/15
Matrix Weighted	15/40

	Summary Mode	
	WS	SS
Total # of Words	150	330
Total # of Sent.	18	34
Mean Sent. Length	8.33	9.71
Total # of Clauses	30	56
Mean Clause Length	5.00	5.89
Subordination Index	1.67	1.65
Relative Clause Frequency	.167	.107
Postnominal Preposition Count	0	12

Table 30

Individual Scores for Subject LI5 on Selected Study Measures

Measure	Score
Age	13;5
Sex	F
Grade	8
TONI-II	97
1stNV	8/20
2ndNV	13/20
Learning/ Memory	5
Sentence Combining	9/15
Matrix Weighted	26/40

	Summary Mode	
	WS	SS
Total # of Words	207	389
Total # of Sent.	19	37
Mean Sent. Length	10.89	10.51
Total # of Clauses	37	60
Mean Clause Length	5.59	6.48
Subordination Index	1.95	1.62
Relative Clause Frequency	.027	.033
Postnominal Preposition Count	0	0

Table 31

Individual Scores for Subject LI6 on Selected Study Measures

Measure	Score
Age	13;9
Sex	F
Grade	7
TONI-II	105
1stNV	4/20
2ndNV	20/20
Learning/ Memory	16
Sentence Combining	4/15
Matrix Weighted	21/40

	Summary Mode	
	WS	SS
Total # of Words	230	281
Total # of Sent.	20	30
Mean Sent. Length	11.5	9.37
Total # of Clauses	36	55
Mean Clause Length	6.39	5.11
Subordination Index	1.80	1.80
Relative Clause Frequency	.028	.018
Postnominal Preposition Count	0	0

APPENDIX J

SPOKEN AND WRITTEN SUMMARIES

FOR EACH SUBJECT

LI1 Spoken Summary

1. {um} they talked about how {um} the cactus {um um} like save water from rain/

2. and they have spikes on them because that way predators can't get the water/

3. and {um} animals will dig down into the dirt where they'll be cool/

4. and {um} some {um} things would eat {um} plants/

5. and other animals would eat that for the meat for a food chain/

6. that's about all I can remember/

(Does it ever rain in the desert?)

yes

(What happens when it rains?)

7. {um the} it rains so much that the {um} earth {don't} can't absorb it that fast/

8. so it floods/

(how else do the plants get along without much water, besides storing it?)

9. {um} the roots will go down into the soil to get {um} water /

LI1 Written Summary

1. Catisis icsorb [absorb] the water into there trunks./

2. catisis have nidles on them so that no pratders [predators] could get the water./

3. and some animles just eat plants /

4. and others will eat them/

5. and that startes a food chane./

6. Some animmls dig in the ground becase it is a bawt

[about] 25 dugres [degrees] cooler./

7. and some go in to holls [holes] to find food./

8. and if its empte they stay in there./

LI2 Spoken Summary

1. {um} I {um} saw some lizards and {um} spiders/

2. and {there} some of them were tarantulas/

(yeah, the bigger ones)

3. and I saw a wolf and um cactuses where birds lived and ate off of/

4. and {and} there's not much rainfall {and and} /

(so, is there no water at all in the desert?)

5. {um} there's some/

6. {um} and the plants are spread far apart/

7. they can get more water/

8. {um} and there's mice/

9. and there's snakes/

10. and {um} snakes eat the mice/

11. and there is vultures/

12. and {and} there's mesas and cliff and waterfalls and {um}/

(what do the animals do about the heat in the^_ desert?)

13. some of them dig holes and go underground/

14. and some {some} of them find caves/

15. and some animals go under a {a} cliff/
16. and they can find shade {um}/

(Does it ever rain in the desert?)

17. Yeah and if it does rain it rains hard/

18. and sometimes there's flashflooding/

LI2 Written Summary

1. When I saw the movie I saw a few lizards that ate cactuses./

2. There were some terantioulas/

3. and they ate insects and dug into the ground for a home./

4. There were wolfs and pigs./

5. The plants were spread apart/

6. so they could get more water./

7. Sometimes there was flash flooding/

8. and sometimes the rain would come down hard but not for a long time./

9. There were rivers and water falls coming off the cliffs./

10. Voltures would eat off of dead animals./

11. Snakes would eat mice./

12. The mice would dig a hole in the ground for protection./

13. Birds would eat off of plants and live in the plants./

14. The birds would make their nest in a cactus /

15. so preditors couldn't get the eggs./

16. Animals would hide in things or under things to keep out of the hot sun./

17. Wolfs would hide under a cliff./

18. A skunk would dig a hole/

19. or a badger would to find prey./

LI3 Spoken Summary

1. the first part was about plants {how they ta will}/

2. mostly the first part was how the {um} water and all

that comes up/

3. when the clouds get up to like the mountains {all} just about all the mositure's gone/

4. and then it goes down and gets hot/

5. so they don't get a lot of water/

6. and when they do they store it in like the inside of it {with the}/

7. and to protect themselves from {getting like people} the animals eating their moisture they have um spikes and stuff/

8. but some of the birds use that for protections, doves/

9. but there's this one lizard I forget its name that {steal} eats this certain type of plant that keeps their thorns farther apart/

10. it will eat that/

11. I'd hate to be the roof of its mouth/

12. but they'll eat it/

13. and then {and} they will {um some they they will} either store the water/

14. or some plants would drive like big roots down to the ground to absorb the moisture/

15. {that would} that is called the {um} tap {wa} water line/

16. I learned that in science/

17. anyway and then {and what I believe} what the basic of the desert is it all circles around the web of living/

18. {some} like {some insects} some insects even feed on other insects/

19. I can give you the black widow/

20. and a lot of other {insects} spiders feed on bugs/

21. but {the main thing that the desert has out of most} what desert is most famous for is lizards/

22. and {animals} all animals {ea} either feed on other

animals or on plants/

23. {um when the um how um} another thing how the desert was made was by corrosion/

24. and {all corrosion} corrosion if you look up the definition is fungus something that devours something that is dead /

25. basically that's the definition/

26. {um} back to the animal {um those} the film really talked about water/

27. the water is the main thing

28. I mean that's gotta be there no matter what/

29. water has to be with it /

30. so I'd say the two main basic ideas of it was water the food web/

31. those are the two main ideas/

32. then it went on/

33. and {they ta} they talked a lot about some of the animals how they survive mainly.

34. the birds wouldn't live without the plants the food webs/

35. and when two plants grow together it's usually called the mother system cause the small plants take shade from the big plants/

36. and I got something to add to the film/

37. when they do that usually the smaller plant wi sometimes dies cause the bigger plant will mix in with its roots and take the moisture that the little roots wanted/

38. some little plants could be like fifteen /

39. but some of the other little plants could be like fifty/

40. so size doesn't mean everything/

41. and there's a certain plants that {um} has like a skin around it with wooden /

42. it's like pipes that go up it that {um} keep it in base/

43. that's all/

(anything else about the animals or anything?)

44. there's a lot of not scavengers/

45. that's mainly {that's mainly what} what it is/

46. there isn't a lot of killers/

47. just {the} the tarantula is a scavenger

48. {um} there's only one that I know of that might not be/

49. it's {um} the what are those the {um} coyote, fox, the rattlesnake,/

50. and doesn't the pig eat fruit the boar/

LI3 Written Summary

1. The desert was made by croesn [corrosion] and fluds [floods]./

2. Wen the chous [clouds] wint over the mout [mountains] morster [moisture] was lost./

3. So then the air got hot by the sun./

4. Plant haff to stor water or get taps./

5. Taps are were a long root gros down & gets water./

6. Plants prtet [protect] them sells [themselves] by having thors [thorns]./

7. All life bast [based] around the food web./

8. Some inses [insects] eat uther inses./

9. Many animals are skavengers./

10. the mane ied [idea] is water is like god./

the end

LI4 Spoken Summary

1. okay about the film it was talking about the desert and how the desert gets water/

2. that {um} clouds come by sometimes like invisible clouds or something like that comes by/

3. and it rains and all that/

4. and then the cactuses have flowers and stuff/

5. and then after that it dies a long time because it takes a while for another cloud to come in/

6. so the {ta ta} cactus deteriorates/

7. and the ribs of the cactus are out there falling for water/

8. and then they talked about like animals how they {um relate to respa} whatever you call it relate or respect {for the um} for the desert/

9. and then it was just talking about the desert how um creatures live there and how they like take the heat how they hunt for food which is at night/

10. {that's whe} at night its cool/

11. and in the daytime insects dig through the dirt/

12. and {um} like that thing that my Dad got hit by {um} scorpion {how the scorpion is that how you say it} scorpion goes under the {um} rocks cause there's a lot of rocks pebbles /

13. so that's how {the} some {in in} insects live/

14. others diggs /

15. so like the skunk and this other animal baracuda or something like that they dig/

16. and that's how they get their {um} food/

17. and others just hide under {ro um} shady areas or under cliffs/

18. and {and} another thing how the {um} plant that roots go into the soil/

19. and its like sticking in the soil or something/

20. and that's how they get their water/

21. and that's all I can remember /

22. I think it mainly talked about the cactuses how they're get the water/

23. how they and {and} other {birds} like birds plant their nests in the cactuses /

24. so the {um} enemies won't come and eat their eggs cause they'll get pricked by the thorns/

25. it showed what else did it show/

26. it showed a ugly spider/

27. and then they showed like a lizard eating a rat/

28. that was gross/

29. I think that I would not live in the desert cause it would be way too hot/

30. and I respect {the people that} the animals that live there/

LI4 Written Summary

1. The movie is about the dresert./

2. The dresart is ferier [very] hot place to be at./

3. The animals that live at the dres are diffent from the zoo I think./

4. The catus are fever [very] pertty plants when the [they] have flowers on them./

5. The catus has lungs when they don't have water {becaus} /

6. The catuse looks deffrent because they are branchs stin out./

7. Sometimes they have some strom [storms],/

8. but thay are implup strom [storms]./

9. The [there] are some animals {that} like the funture animals./

10. The dreset also has a water fall/

11. Some plants live neer the water fall./

12. The daytime the animals find a place to rest for the day./

13. At night they found there food./

14. Also the drest is not a good place to live beacause you will get a sunbrune!/

15. Some animals eat there male [meal] hole [whole]/

16. and some eat little by littel./

17. The rain comes when it whant to./

18. So the animals love it when it rains./

LI5 Spoken Summary

1. {i it} it's The Desert/

2. and then {it started out} it explained {how the} what made the desert like sand and gravel and the heat/

3. and then it went on to like how it rains there/

4. and when it rains like in the summer and the winter it rains really harsh and really a lot/

5. and then it just stops for a long time/

6. and the reason it's so hot because it rains in the mountains/

7. and then it goes down the eastward side to the desert/

8. I guess it just warms up by then/

9. and it tells about how {um} the animals survive like their food and stuff/

10. and they {um} survive on like water from the cactuses/

11. and that pig it eats the cactuses/

12. and {and} I guess they eat each other/

13. um and then it tells like {um how} how they survive in the heat/

14. and they dig like under the sand to keep cool/

15. and they go under rocks/

16. and they find other holes/

17. and when they do this like the skunk and the I don't know what else but they try to find each other/

18. they dig/

19. {um} and they also like get in caves and canyons and stuff/

20. and then {there is} like when it rains there {um} the soil doesn't really soak it in that much because I guess it's just not used to it/

21. and it just flows all over the place/

22. and {um} like the ants and spiders and stuff they have to get on tall things/

23. and really they're not used to it/

(and like the plants, what do they have to do to get water? They have different ways.)

24. {oh um} like the cactus it has like {um} like little bars around it /

25. and it stores water down in there/

26. and it opens up {it} the top opens up/

27. and water falls down in it/

28. and the cactuses are used for like birds to make their nest in

29. so like {um snuk um} skunks and {um} snakes cannot get to them through {the pine or} the needles/

30. and the needles are for {um} the cactuses

31. so they can keep their water and not all the animals eating them and everything/

32. oh and the reason they grow apart is because it doesn't rain that much/

33. and sometimes some cactuses grow together because like um they seed/

34. and then they bury I guess /

35. and then it grows like really close together and forms like a tree in the middle/

36. and it's called a mother tree/

(Is there anything else that would be important to mention?)

37. I mean there's like lakes there and water falls and stuff/

38. so it's not completely dry/

LI5 Written Summary

1. The film The Desert talked about the livestyles in the desert./

2. The desert is made up of rocks, sand, the hot weather, and little rain./

3. When it rains, it rains very harshly./

4. The film also talked about how catuses are used./

5. They are used for food,/

6. for an example the desert pig eats {for} them for water and for fulfiling./

7. The birds use them for making nests and having eggs./

8. The birds lay their eggs here because the nedales keep away the snakes and other things/

9. When it rains the catuses can hold water for the animals to drink./

10. Some alive catusas have nedales to keep their water./

11. Some people may think a desert has no lakes or ponds/

12. but they do./

13. The reason the desert is so hot it is because when the rain clouds come the [they] hit the west_ward side of the mountains/

14. then it rain in the mountains,/

15. after it rains in the mountains it goes out the eastward side./

16. The film also mention how animals keep cool./

17. Some animals keep cool by digging under the sand because under the sand it is 20 cool./

18. Other animals craw[l] under a rock, find another hole it craw[l] in, or go in a cave to get out of the extremaly hot sun./

19. May [many] animals know where to find food under the sand./

LI6 Spoken Summary

1. um let's see

2. the cactuses have stored water in it/

3. and {um they take or} some cactuses get really big fifty years or twenty years/

4. and they bloom flowers/

5. and {um} then let's see {the} what were they turtles they usually hide in their shell during the day/

6. and {um} animals dig under ground for twenty degrees {um} lower {de} gets cooler the farther you go/

7. and plants use their roots to go down in the ground to get water cause there water stored underneath the ground/

8. and then {um} let's see there's lots of plateaus/

9. and {when it} when it rains it pours/

10. and {um} the climates so hot it's not used to it/

11. and it causes lots of flooding and {um} takes I guess days for it to dry out/

12. and {um} animals hunt/

13. the let's see crabs or whatever they're called what are they called {um}

(scorpions or tarantulas?)

14. They're daddy long er what are they I don't remember/

(big spiders, tarantulas?)

15. {They it they} it's nasty how they eat/

16. they grab it with their paws and then just suck it in/

17. {um} the snakes {prac} they hiss up/

18. and {um} there's is water in it/

19. and there's water falls that fall down and make streams/

20. and there is plants living by it that are really

green compared to the ones out/

21. and they're spread out the plants in the desert/

22. that way they can absorb more {um} moisture and water/

23. and {um the ti uh} I guess they're coyotes hide underneath cliffs and caves/

24. and they practically build them theirselves/

25. and the birds build {um} nests inside plants and cactuses/

26. and the reason why they do that is for {um} shelter and water and food/

27. and the cactus is safe because of thorns from {ani} thirsty animals coming to get them/

28. and {um} the flowers on the cactuses are very pretty/

(Is there anything else?)

29. It's a very hot climate/

LI6 Written Summary

Derest

1. Derest is filled with lot of plots/

2. and it is from [formed] by the rain. /

3. When It rains it porles/

4. and the climet is so hot it can't adept to it/

5. and when it rain the plants take the water and store it/

6. and the flowers take water to/

7. and they don't want [wait] that long to bloom./

8. The animals have to hide underground and in cave's and it leges/

9. and if they dont they could die from the Blesting hot sun./

10. {The plant well} the cacatses have thorns to protect the water they store inside so that trusty [thirsty]

aminal won't kill them./

11. The farer an animal goes down the cooler it gets for them./

12. the plants are spaced apart for acobes and for water and feeding resons/

13. and sometimes you will see plants bye other plants/

14. the reson is for feeding and to help them several [survive] in the hot derst/

15. You will see most of the animals in the night and early morging time because it's the time to hunt for food and time to save there body heat./

16. Water is also found in the derest bye underground and water falls./

17. the rainstorm dont last very long becase for the climet and the plots are so tall it makes the rain not come down so much/

18. it never snows in the derest/

19. and Nevea and Calafina are just almost as bad as the derest.

NL1 Spoken Summary

1. Ok it was about the desert and {it um} how animals adapt to the desert climate and {um} the holes and everything for shade/

2. and like the plants they get eaten I guess/

3. and the people who eat the plants get eaten/

4. and that starts a food chain I guess and /

(what about rain in the desert?)

5. um during the summer and winter they get rain/

(what about plants and rain?)

6. they try to {um} get it I guess and store it and save up the moisture/

(what do animals do about the heat?)

7. they make holes/

8. and they try to hide in them for shade/

9. its like thirty degrees lower or something/

10. and there are these really weird animals that dig up the holes and try to get them/

11. I think skunks and badgers/

12. There's a lot of spiders and a dog or someting wolf scorpion *** cactuses/

NL1 Written Summary

1. The rain occurs in the summer and winter./

2. There's lots of plant life that absorb water and store it./

3. Animals adapt to the climate./

4. Insects eat plants,/

5. and animals eat insects, which starts the food chain./

6. The weather is hot./

7. The plants have a tap water system./

8. There are oasis' which supply rich vegatation for plants and animals./

9. Animals dig holes to get shade/

10. and it's about 30 s lower in the holes./

NL2 Spoken Summary

1. the cactuses and the animals have to adapt to the weather and climate and stuff/

2. the animals have to go find shade during the hottest part of the day/

3. and {some plants} the plants have to {um} protect their water and dig down with their roots to get water/

4. and {um} there's a lot of erosion/

5. and there's mostly like small animals in the desert like bugs/

6. there's a lot of {um} flashfloods because the {water um} soil can't hold all the water/

(they have needles and the roots. Do they get very

big?)

7. {um} most of them don't get very big /

8. {one can be} like a cactus can be about ten feet and fifty years/

(so is the desert totally dry?)

9. {um} no there's {um} underwater {um} rivers and springs/

10. and in the canyons there's water/

11. well in the mountains ther's like cold clouds that come over and snows and rainfall/

12. and then it goes down the mountain/

13. and it gets really warm like in New Mexico and Colorado/

NL2 Written Summary

1. In the desert all of the plants and animals have to adapt to the climate./

2. The plants adapt by protecting their water by needles or thorns./

3. The plants get the water by making their roots go deep into the soil./

4. The cactus has big poles in it/

5. and it stores up lots of water./

6. The animals have to adapt by finding a shaded spot in the hot part of the day./

7. The animals have to find water to live./

8. The plants and animals are in a food chain./

9. The food chain goes by the plants are eaten by planteaters/

10. and then a meateater eats it./

11. Then a bigger meateater eats him and so on./

12. In the desert it does not rain very much./

13. When it rains it usually floods because the soil

cannot hold all of the water/

14. so there is a flashflood./

15. There is rivers in the desert./

16. Some are under ground/

17. and some are not./

18. There are some oasis./

19. By the oasis the vegetation is better there./

20. There is also more trees there./

21. Most of the time the plants are not very close to each other because of the low rainfall./

NL3 Spoken Summary

1. The name of the movie was <u>The Desert</u>/

2. {it has like about} it's got plateaus and about er erosion and how they were formed/

3. and it tells about like {cactus} cactuses /

4. {on} birds would {um bi} build a nest in them to keep out predators from harming their eggs and their babies/

5. and {um} most animals will {um} find shelter {in the hot in during the} while the sun's out /

6. and then when it's cooler like the twilight hours and stuff they'll go out and {be} /

7. they be active and run around and stuff/

8. and cactuses are made of {like um wal uh there's the they have long there's} they're as long as the cactus is/

9. and they're made of wood and stems and stand/

10. then whenever it rains cactuses can {um} hold lots of water/

11. and {um} plants in the desert whenever it rains {um they they ca they can} they {seed} make seeds/

12. and then like {um} the skunks and {um} badgers will {will} dig in the ground until they can {find there}

find food/

13. and it {it} floods a lot there/

14. and {the rain} it just floods a lot/

NL3 Written Summary

1. Plaitowrs (plateaus) are formed from eroson./

2. Plantes make seedes when it raines./

3. Most anomales find shaed when it is hot/

4. but when it is cooler some anomales are playful./

5. Brids make thare homes in (cactus)/

6. so perateres can not kill them./

7. (Cactus) are made of long wood stemes /

8. and (cactus) can hold alot of water./

NL4 Spoken Summary

1. The movie was "The Desert"/

2. and it started out telling about how the desert was formed/

3. uh it rained on one side of the mountain/

4. and on the other side it was really dry/

5. and the hot winds blew /

6. then it went into the vegetation and how it was really different because the cactuses {where} some of them were really tall/

7. and they had horizontal roots to get a large amount of water/

8. so they were spread out/

9. and some of them had vertical roots {we} which were like tap roots/

10. so they could get water from really deep down/

11. and so they could store a lot of water/

12. and then to keep the water away from the

animals they have spines on them/

13. so the animals can't get to them/

14. well most of the animals can't /

15. but the birds use the cactuses for home {to keepaway} to keep the other animals away from their eggs/

16. and it went on and said that {there} most people think that there aren't very many animals in the desert/

17. but really there are a whole lot/

18. there's spiders and *** and birds and badgers/

19. and some of the animals there are in different climates too like wolf, coyotes /

20. and what I thought was interesting was when it said it rained heavily/

21. it showed this little amount of rain and said it was a flashflood/

22. so I was wondering if they thought the desert was some place it rained heavily/

23. like our flashfloods they'd be really suprised/

24. {and} but it did say that there were some sources of a lot of water/

25. but most of them were either underground or between canyon walls/

26. and that's about it/

NL4 Written Summary

1. The movie "The Desert" was a film explaining the part of the desert that most people don't see./

2. It began talking about the reason the desert is so dry./

3. Like how the rain is on one side of the mountains/

4. and how the air gets dry and hot as it passes over the desert region./

5. The desert's vegetation consists of a few grasses,/

6. but it mainly has cactuses./

7. There are many kinds of cactuses there./

8. They are the deserts "trees."/

9. The deserts cactuses are various./

10. One kind has horizontal roots to get water from all around./

11. That kind is spread out./

12. The other kind has vertical roots to "tap" water from deep below the surface./

13. The birds use cactuses for homes/

14. so other animals can't get their eggs. /

15. The animals in the desert are numorous and are adapted to the climate./

16. Yet when the day comes to a blistering hot temperature, the animals find a hole or cliff or something to cool off under./

17. There is a food chain in the desert, too. With the vultures at the top of it/

18. There are reptiles, rodents, birds, and animals./

19. Sounds complete to me./

20. The water system is thought of as absolutly "no rain". /

21. Yet that is not true./

22. There is some rain/

23. and where there is water you can tell./

24. There will be real trees there. like an oasis./

25. There are also small rivers and streams /

26. but most of them are either underground or between canyon walls./

27. The desert is a very mysterious and beautiful place./

28. The closest I have been to one is in New Mexico./

29. Even though it may not be plentiful, the desert has a world of its own./

NL5 Spoken Summary

1. {um} it talked about the desert and the animals and the plants/

2. it talked about how they survive and {um}/

(Is there no water in the desert?)

3. they have rivers underground and above ground/

(so what can plants do about water?)

4. they dig for it/

(does it ever rain in the desert?)

5. sometimes/

(what about animals? what do they do to live in the desert?)

6. {um} they eat other animals for food/

(do they use cactuses for anything?)

7. do they eat cactuses/

NL5 Written Summary

1. The movie was about the desert, and the animals, plants, and the rivers that are in the desert./

2. The animals crawl under rocks to get protection from the sun/

3. and they dig in the ground for food./

4. The plants grow from the water in ground /

5. and cactuses get water from the water that's all ready in them./

6. Most animals don't eat them because of there

poky needles./

7. There are few rivers in the desert./

8. Some of the rivers are underground/

9. other rivers are above ground./

10. There are water falls also./

11. Some animals can dig for the underground water/

12. others can get the water from the above ground water./

13. you can tell how much water is around by the amount of plants that grow near it./

14. The desert get very little rain./

NL6 Spoken Summary

1. It was about the desert and {th} animals and the plants and the rivers and {how they and} how they protect themselves {um} how the plants protect themselves from

other animals/

2. Like the cactuses have the sharp things I don't know /

3. so the plants can't get their water/

4. and there's not much rainfall/
5. and {um there's} there's some but not very much/

6. and then {the} there's underground rivers/

7. and there's waterfalls that are between canyon walls/

8.in the desert there's snakes and turtles skunks and um badgers/

(do they do anything special to live in the desert?)

9.{um} yeah they {they} dig for their food {their food}/

(what about the cactus? Do they have anything special besides protection to get water?)

10. They have {um} I don't know what they're called

something like ribs or something like that/

11. they have water/

12. the water goes in or whatever something/

13. the ribs suck in the water/

14. and the cactuses hold it for later/

NL6 Written Summary

1. This movie was about how the animals and plants protect their selfs./

2. The catuses have needles on them to protect them from the other animals /

3. so they won't take there stored water./

4. Lots of small insects hide them selves under rocks to protect them from the hot sun rays and the bigger animals./

5. The desert hardly has in rain,/

6. but it does rain every once in a while./

7. There is underground rivers and waterfalls between cannons./

8. So there is water for the animals./

9. All of the mountains and platues were formed by rerosion./

10. The desert is avery hard place for the animals and plants to get adapted to./

APPENDIX K

SENTENCE COMBINING SUBJECT SAMPLES

LI1

1. We made the mess last night mom wanted use to clean up we did.
2. The box that has decorations is Mark's.
3. The dog that lives across the street may be dangerous.
4. If the girl goes to the prom with the pink dress I won't go.
5. The bananas in the basket are not ripe but they will be soon and the basket is from my mother.
6. That book has 300 pages and it is about Abraham Lincoln before the Civil War.
7. The student was misbehaving miss Jones sent the student to the principal and the class calmed down.
8. The show is rated PG whethe the show will come is questionoble.
9. The bus leaves at 3:00 the bus goes to town the town is across the river.
10. The boxes that were under moms bed were my presents.

LI2

1. We made a mess last night and my mom wanted it cleaned up immediately.
2. The decorations in the hall closet are for Mark's birthday.
3. The dog that lives across the street looks friendly,

but he may be dangerous.

4. The girl that wore the pink dress last year, and goes to the prom I won't go.
5. The bananas in the basket that are for my mother are not ripe yet, but will be soon.
6. The book about Abraham Lincoln and his life before the civil war has 300 pages in it, so I don't want it.
7. The class calmed down after Miss Jones sent the student to the principles office.
8. The show that may come is questionable, the show is rated PG.
9. The bus that leaves at 3:00 is going to the town across the river.
10. Mother told me that my birthday presents are in her room under the bed.

LI3

1. The mess we mab last night owr mother made us clean up.
2. In the hall closet there were decorations for mark's birthday.
3. The dog that lives acrosst the street is dangerous.
4. The girl that wore the pink bress last year goes to the prom then I won't.
5. The bananas are not ripe but they will be ripe soon then we will poot the bananas in the basket for my mothers.
6. The boo is about Abrahan Lincoln and his life befor

the civil war but it has 300 pages so I won't get it.

7. The student that misbehav wint to the principal's office.
8. The show mite not come to or town even it is PG.
9. The bus most leva at 3 to cross the river to owr town.
10. The box under my mother's bed was my present.

LI4

1. We made the mess last night my mom wanted the mess cleaned up, we did it immedidiately.
2. The box is in the hall closet the box has decorations for Mark birthday.
3. The dog lives across the street Even though the dog looks friendly he may be dangerous.
4. The girl wore the pink dress last year, If the girl goes to the prom, I won't go.
5. The bananas are not ripe yet, but they will be soon, the bananas are in the basket if from my mother.
6. That book is about Abraham Lincoln's life before the Civil War the has 300 pages I don't won't it.
7. The student was misbehaving.
   After Miss. Jones sent the student to the principal's office the class calmed down.
8. Whether the show will come to our theatre next week is questionable rated PG.
9. The bus goes to the town leaves at 3:00 is across

the river.

10. The boxes were under the bed. Mother told me that the boxes held my birthday presents were in her room.

LI5

1. We made a mess, mom wanted it cleand up, so we did it immediately
2. The box that has decorations, and is the hall closet is for Mark's birthday
3. The dog that lives across the street looks friendly but may be dangerous.
4. If the girl who wore the pink dress last year goes to the the prom, I won't go.
5. The unripe bananas in the basket for my mother will be riped soon.
6. That book is about Abraham Lincoln's life before the Civil War is 300 pages long, so I don't want it
7. After Miss Jones sent the misbehaving student to the principal's office the class calmed down
8. Whether the show that's rated PG will come to our theatre next week is questionable.
9. The bus leaves at 3:00 to go to the town across the river.
10. Mother told me the boxes under her bed in her room held my birthday presents.

LI6

1. Because we made the mess last night my mom want's the mess cleaned up immediately.

2. The box has decorations in it and it is in the hall closet for Mark's birthday.
3. The dog may look nice but he may be dangerous the dog lives across the street.
4. The girl wore the pink dress last year if she goes to the prom I won't be going.
5. The bananas are not ripe yet, but they will be very soon and when they are ripe I am going to give them to my mom in the basket.
6. That book is about Abraham Lincoln's life and his life befor the Civil War that book also haves 300 page there for I will not read it.
7. Miss Jones sent a student that was misbehaving to the principal's office the class calmed down after she sent him to the principals office.
8. The show that may come to our theart that is PG is questionable.
9. The bus goes to the town and leaves around 3:00 but the town is across the river.
10. Mother said that in her room there was boxes under the bed and they were held for my birthday presents.

NL1

1. Because my mom wanted the mess we made last night cleaned up, we did it immediately.
2. The box in the hall closet has decorations for Mark's birthday.
3. Even though the dog across the street looks friendly, he may be dangerous.

4. If the girl who wore the pink dress last year goes to the prom, I won't go.
5. The bananas in the basket my mother gave me are not ripe yet, but they will be soon.
6. That book is about Abraham Lincoln's life before the Civil War and is 300 pages long, so I don't want it.
7. After Miss Jones sent the student who was misbehaving to the principal's office, the class calmed down.
8. Whether the show that is rated PG will come to our theatre next week is questionable.
9. The bus goes to the town across from the river at 3:00.
10. The boxes under the bed, and in her room were the boxes that held my birthday presents.

NL2

1. We made a mess last night and my mom wanted the mess cleaned up, we did it immediately.
2. The box in the hall closet has decorations for Mark's birthday.
3. The dog that lives across the street looks friendly but he may be dangerous.
4. If the girl who wore the pink dress last year goes to the prom, I won't go.
5. The bananas are in the basket from my mother are not ripe yet, but they will be soon.

6. The book is about Abraham Lincolns life before the Civil War has 300 pages, so I don't want it.
7. After Miss Jones sent the misbehaving student to the principal's office the class calmed down.
8. Whether the PG show will come to our theatre next week is questionable.
9. The bus leaves at 3:00 to go to town across the river.
10. The boxes were under the bed in my moms room that she told me that the boxes held my birthday presents.

NL3

1. We made the mess last night but because my mom wantd the mess cleaned up we did it immediately.
2. The box has decorations for Mark's birthday it is in the hall closet.
3. Even though the dog looks friendly he may be dangerous and he lives across the street.
4. The girl wore the pink dress last year and if she goes to the prom, I won't go.
5. The basket is from my mother and the bananas are in the basket but the bananas are not ripe yet, but they will be soon.
6. That book is about Abraham Lincoln's life before the Civil War it has 300 pages, so I don't want it.
7. The student was misbehaving so Miss Jones sent the student to the principal's office and the class calmed down.

8. Whether the show will come to our theatre next week is questionable it is rated PG.
9. The bus leaves at 3:00 to go to the town it is across the river.
10. The boxes were in her room under the bed and Mother told me that the boxes held my birthday presents.

NL4

1. Because my mom wanted the mess we made last night cleaned up, we did it immediately.
2. The box in the hall closet has decorations on it for Mark's birthday.
3. Even though the dog across the street looks friendly, he may be dangerous.
4. If the girl who wore the pink dress last year goes to the prom, I won't go.
5. The bananas in the basket my mother gave me are not ripe yet, but they will be soon.
6. That book about Abraham Lincoln's life before the Civil War has 300 pages, so I don't want it.
7. After Miss Jones sent the misbehaving student to the principle's office, the class calmed down.
8. Whether the show that is rated PG will come to our theatre next week is questionable.
9. The bus that leaves at 3:00 goes to the town across the river.
10. The boxes that mother told me held my birthday

presents, were under the bed in her room.

NL5

1. The mess we made last night my mom wanted it cleaned up immediately.
2. The box in the closet has decorations for Mark's birthday.
3. The dog lives across the street may look friendly but he may be dangerous.
4. I won't go to the prom if the girl who wore the pink dress last year goes.
5. The basket from my mom has bananas in it but they are not ripe yet.
6. The book about Abraham Lincoln's life before the Civil War has 300 pages in it so I don't want it.
7. The class calmed down after Miss Jones sent a misbehaving student to the office.
8. The show that was rated PG should come to the theater next week but its unquestionable.
9. The bus leaves at 3:00 to go across the river.
10. The boxes under my mother's bed held my birthday presents.

NL6

1. The mess we made last night my mom wanted it cleaned up immediately.
2. The box in the closet has decorations for Mark's birthday.

3. The dog lives across the street may look friendly but he may be dangerous.
4. I won't go to the prom if the girl who wore the pink dress last year goes.
5. The basket from my mom has bananas in it but they are not ripe yet.
6. The book about Abraham Lincoln's life before the Civil War has 300 pages in it so I don't want it.
7. The class calmed down after Miss Jones sent a misbehaving student to the office.
8. The show that was rated PG should come to the theater next week but its unquestionable.
9. The bus leaves at 3:00 to go across the river.
10. The boxes under my mother's bed held my birthday presents.

APPENDIX L

MATRIX SUBJECT SAMPLES

LI1

1. an cat at a farm is tam (level 1)

   lions that are in the zoo are wild (level 1)

2. wiscons in north is cool. (level 1)

   florida south is warm (level 1)

3. dogs are mammals and have babies (level 3)

   crocodiles are reptiles and lay eggs (level 3)

4. Tulsa is in the USA and we speke English. (level 2)

   Paris Fance they talk french. (level 1)

5. florida is warm and faverit sports are water skiing. (level 2)

   colorado is cold and a faverit sport is snow skiing. (level 2)

6. cows home is on land (level 1)

   they eat grass (level 1)

   seals live in the ocean and eat fish (level 2)

7. Brazil is wet and is a jungle (level 2)

   Nevada its dry and is a desert. (level 2)

8. A jungle is wet and they have ferns (level 2)

   a desert is dry and have cacti. (level 2)

9. a ostrich can't fly nests on land (level 1)

   robins can fly and nest in trees (level 2)

10. horses have legs and can run. (level 2)

    seals have flippers and can swim. (level 2)

LI2

1. On a farm there's a cat, and some animals are tame. (level 2)

In a zoo there's a lion, and they are wild. (level 2)

2. In Wisconsin the location is north, and it's cool, but in Florida it's warm, and it's in the south. (level 3)

3. A dog is a mamal. (level 1)

   A dog has babies. (level 1)

   A crocodile is a reptile. (level 1)

   A crocodile lays eggs. (level 1)

4. Tulsa is in the United States, and they speak English. (level 2)

   Paris is in France, and they speak French. (level 2)

5. In Florida it's warm. (level 1)

   In Florida people water ski. (level 1)

   In Colorado it's cold. (level 1)

   In Colorado people like to snow ski. (level 1)

6. A cow lives on land and eats grass. (level 2)

   A seal lives in the ocean and they eat fish. (level 2)

7. In Brazil it's wet. (level 1)

   In Brazil there's a jungle. (level 1)

   In Nevada it's dry. (level 1)

   In Nevada its a desert. (level 1)

8. In a jungle it's wet, and ferns grow in a jungle. (level 2)

   In the dessert it's dry, and cactuses grow in the desert. (level 2)

9. A ostrich can't fly, and it lays eggs on land. (level 2)

   A robin can fly, and it lays eggs in a tree. (level 2)

10. A horse has legs, and it runs. (level 2)

A seal has flippers, and it swims. level 2)

LI3

1. Farm's have tame cat but the zoo have wild lions. (level 3)
2. Wisconsi is nort so it is cool but Florida is south so it is warm. (level 4)
3. bog's are mamals that have babies but crocs are repliles that have eggs. (level 3)
4. Tulsa is in the U.S. and it speaks English but Paris is in France and it speaks French. (level 3)
5. Colorado is cooler but Florida is hot they both have skiing but Florida skis on water. (level 2)
6. Cows live on land and eat grass like seals live in the ocean and eat fish. (level 3)
7. Brazil is wet and has jungles but Nevada is dry and has deserts. (level 3)
8. Jungles are wet and has ferns but deserts are dry and has cactus. (level 3)
9. Ostrichs can't fly and their nests are on the ground but robins can fly and their nests are in a tree. (level 3)
10. Horses have feet and run fast like seals have flippers and swim fast. (level 3)

LI4

1. Cat's live on a farm (level 1)
   the cousins the lions live in the zoo. (level 1)
   Cast are tame, (level 1)
   the lion's are wild. (level 1)

2. Wisconsin is the north side (level 1)

   it is cool there, (level 1)

   Florida south side (level 1)

   it is warm there. (level 1)

3. Dogs are mammals (level 1)

   they have babes (level 1)

   Crocodile are reptile (level 1)

   they have eggs. (level 1)

4. Tulsa United States we speak english, (level 1)

   Pairs France they speak french. (level 1)

5. Florida it is warm up there (level 1)

   there favrite sport is water skiing. (level 1)

   Colorado it is cold but ther favrite sport is snow

   skiing. (level 2)

6. Cow ther home is land (level 1)

   they eat grass. (level 1)

   Seal they live in the ocean (level 1)

   they eat fish. (level 1)

7. Brazil is very wet and very jungle. (level 2)

   Nevada is very dry and desertly. (level 2)

8. Jungle is very wet a plant that lives there is ferns. (level 2)

   Desert is dry A plant that lives there is a cacti. (level 2)

9. Ostrich they don't now how to fly but they now how

   to run (level 1)

   they make ther nest on land. (level 1)

   Robin they can fly (level 1)

   they plant the nest on a tree. (level 1)

10. Horse have leg to run. (level 3)

    Seals have flipper to swim. (level 3)

LI5

1. One animal on a farm is a cat and it it is tame but the zoo animal, a lion is wild. (level 3)
2. Wisconsin is in the north and is cool. (level 2)

    Florida is in the south and is warm. (level 2)
3. A dog is a mammal and has babies, but the crocodile is a reptile and lays eggs. (level 3)
4. Tulsa is in the United States and people speak English but people in Paris, France speak French. (level 3)
5. In Florida is wram and a popular sport is water skiing but in Colorado it is cold and people love snow skiing there. (level 3)
6. A cow lives on land and eats grass. (level 2)

    A seal lives in the ocean a eats fish. (level 2)
7. In Brazil it's wet and like a jungle. (level 2)

    In Nevada it's dry and is like a desert. (level 2)
8. In the jungle it is wet and ferns grow there but in the desert it is dry and cacti grows there. (level 3)
9. An ostrich can't fly and their nesting place is on land. (level 2)

    Robins can fly and nest in a tree. (level 2)
10. Horses have legs and can run but the seal has flippers and they swim. (level 3)

LI6

1. The animal on the farm is a cat and it is tamed. (level 2)

   The animal in the zoo is wild and it's a lion. (level 2)

2. Wisconsin is north and cool. (level 2)

   Florida is south and warm. (level 2)

3. The dog has babies and the reptile has eggs. (level 2, incomplete)

4. Tulsa is in the United States and it language is

   English and Paris is in France and there language is

   French. (level 2)

5. Florida has warm temperature and a popular sport is

   waterskiing. (level 2)

   Colorado temperature is cold and a popular sport is

   snow skiing. (level 2)

6. Cow lives on land and eats grass but a seal lives in

   the ocean and eats fish. (level 3)

7. Brazil is wet and lands type is like a jungle. (level 2)

   Nevada is dry and their land type is like a desert. (level 2)

8. Jungle is wet and the plant life is ferns and the

   desert is dry and its plant life is cacties. (level 2)

9. Ostrich flying ability is that they cant fly and

   they live on land. (level 2)

   A robbin can fly and lives in trees. (level 2)

10. horse has legs and movement is running. (level 2)

    Seal has flippers and their movement is swimming. (level 2)

NL1

1. A cat lives on a farm and is tame. (level 2)

   A lion lives in the zoo and is wild. (level 2)

2. Wisconsin is to the north so it's cooler, but

   Florida is to the south so it's warm. (level 4)

3. A dog is a mammal so it has babies, but a crocodile

   is a reptile so it has eggs. (level 4)

4. Tulsa is in the U.S. so the people there speak

   English. (level 3)

   Paris is in France so the people speak French. (level 3)

5. Since it's warm in Florida, you can water ski. (level 3)

   Since it's cold in Colorado, you can snow ski. (level 3)

6. A cow lives on land and feeds on grass, but a seal

   lives in the ocean and feeds on fish. (level 3)

7. Brazil is wet and has jungles, but Nevada is dry and

   has deserts. (level 3)

8. A jungle is wet and there are ferns in a jungle. (level 2)

   A desert is dry and there are cacti in a desert. (level 2)

9. An ostrich can't fly and makes it's nest on land. (level 2)

   A robin can fly and makes it's nest in a trees. (level 2)

10. A horse has legs so it can run, a seal has flippers

    so it can swim. (level 3)

NL2

1. A tame cat lives on a farm. (level 2)

A wild lion lives in a zoo. (level 2)

2. Wisconsin is up north and is cool. (level 2)

   Florida is down south and is warm. (level 2)

3. Dogs are mammals and have babies. (level 2)

   Crocodiles are reptiles and have eggs. (level 2)

4. Tulsa is in the United States and speaks English. (level 2)

   Paris is in France and speaks French. (level 2)

5. In Florida it is warm and people water ski. (level 2)

   In Colorado it is cold and people snow ski. (level 2)

6. Cows eat grass and live on land. (level 2)

   Seals eat fish and live in the ocean. (level 2)

7. In Brazil it is wet and has lots of jungles. (level 2)

   Nevada it is dry and has desserts. (level 2)

8. Jungles are wet with ferns. (level 2)

   Deserts are dry with cacti. (level 2)

9. Ostrich can't fly and live on the ground. (level 2)

   Robin can fly and live in trees. (level 2)

10. Horses have legs so they can run. (level 3)

    Seals have flippers so they can swim. (level 3)

NL3

1. on some farms there are cates (level 1)

   in some zoo there are liones (level 1)

   some cates are tame (level 1)

   all liones are wild (level 1)

2. Wisconsin is in the north (level 1)

   Florida is in the south (level 1)

   in Wisconsin it is cool (level 1)

In Florida it is warm (level 1)

3. doges are mammal (level 1)

   crocodiles are reptiles (level 1)

   doges have babies (level 1)

   crocodiles have eggs (level 1)

4. Tulsa is in the united states (level 1)

   Paris is in France (level 1)

   Tulsa speackes English (level 1)

   paris speackes French (level 1)

5. Florida is warm (level 1)

   colorado is cold (level 1)

   Florida's popular sport is water skiing (level 1)

   colorado's popular sport is snow skiing (level 1)

6. a cow lives on land (level 1)

   a seal lives in the ocean (level 1)

   a cow eats grass (level 1)

   a seal eats fish (level 1)

7. Brazil is wet (level 1)

   Nevada is dry (level 1)

   Brazil is a jungle (level 1)

   Nevada is a desert (level 1)

8. a jungle is wet (level 1)

   a desert is dry (level 1)

   ferns gow in the jungle (level 1)

   cacti gow in the desert (level 1)

9. a ostrich can't fly (level 1)

   a robin can fly (level 1)

   a ostrich nest on land (level 1)

a robin nest in a tree (level 1)

10. a horse has legs (level 1)

    a seal has flippers (level 1)

    a horse can run (level 1)

    a seal can swim (level 1)

NL4

1. There are tame animals, like cats, on a farm, but in the zoo there are wild animals, like lions. (level 3)
2. Wisconsin is in the North, where it is cool, and Florida is in the south, where it is warm. (level 2)
3. The dog is a mammal, so it has babies, but the crocodile is a reptile, so it lays eggs. (level 4)
4. In cities in the United States, like Tulsa, they speak English, but in cities in France, like Paris, they speak French. (level 3)
5. In Florida where it is warm, water skiing is fun, but in cold places, like Colorado, snow skiing is better. (level 4)
6. A cow often eats grass off the land, but a seal will likely eat fish out of the ocean. (level 2)
7. The jungle in Brazil is wet, but the desert in Nevada is dry. (level 2)
8. Ferns will grow in the wet jungle, but in the dry desert, cacti grow better. (level 4)
9. An ostrich nests on land, because it can't fly, but a robin can, so it nest in trees. (level 4)

10.Horses are good at running because they have legs, while seals swim better with flippers. (level 4)

NL5

1. Cats live on farms, because they are tame. (level 3)
   Lions live in zoo's because they are wild. (level 3)
2. Wisconsin's cool, because it's in the north. (level 3)
   Florida's warm, because it's in the south. (level 3)
3. Dog's are mamals, they have babies. (level 1)
   Crocodiles are reptiles they have eggs. (level 1)
4. Tulsa's in the United State's, so they speak English. (level 3)
   Paris is in France, so they speak French. (level 3)
5. Florida's warm, so people go water skiing. (level 3)
   Colorado's cold, so people go snow skiing. (level 3)
6. Cows live on land and eat grass. (level 2)
   Seals live in the ocean and eat fish. (level 2)
7. Brazil is wet, and has jungles. (level 2)
   Nevada's dry and has deserts. (level 2)
8. Jungle's are wet, so they grow ferns. (level 3)
   Desert's are dry, so cactis live there. (level 3)
9. Ostriches can't fly, so they live on land. (level 3)
   Robin's can fly so they live in trees. (level 3)
10. Horses have legs to run with. (level 3)
    Seal's have flippers to swim with. (level 3)

NL6

1. On farms they have tame cats. (level 2)
   In zoos they have wild lions. (level 2)

2. Up north in Wisconsin it is cool. (level 2)
   Down south it is warm. (level 1)
3. Dogs are mamals and have babie. (level 2)
   Crocodile are reptiles and lay eggs. (level 2)
4. In the U.S. we speak English. (level 1)
   In France they speak French. (level 1)
5. In Florida were it is warm they water ski. (level 2)
   In Colorado were it is cold they snow ski. (level 2)
6. A cow lives on land and eats grass. (level 2)
   A seal lives in the ocean and eats fish. (level 2)
7. Brazil is wet like a jungle. (level 2)
   In Nevada it is dry like a desert. (level 2)
8. Jungles are wet and ferns grow there. (level 2)
   Deserts are dry and cat's live there. (level 2)
9. Ostrich live on land they can't fly. (level 1, level 1)
   Robins live in trees they fly. (level 1, level 1)
10. Horses have legs and run. (level 2)
    Seals have flippers and swim. (level 2)

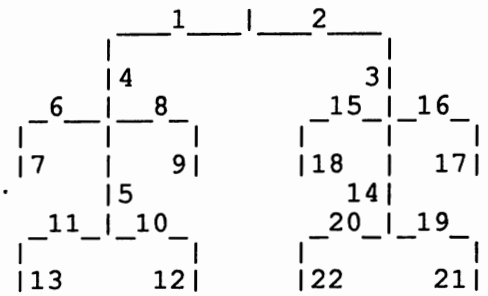
APPENDIX M

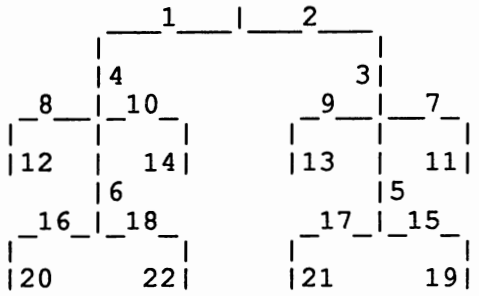
SUBJECT MOBILE CONSTRUCTIONS

First Construction

Second Construction

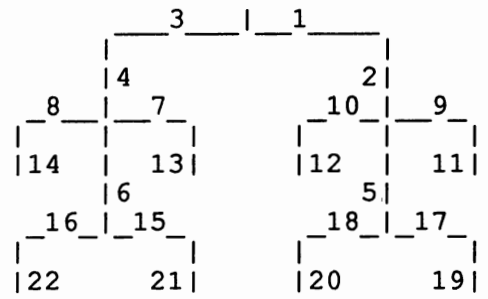
LI1

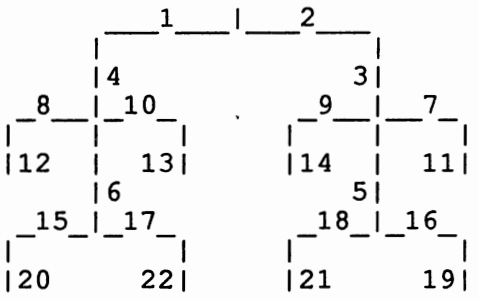




Scores 1 19

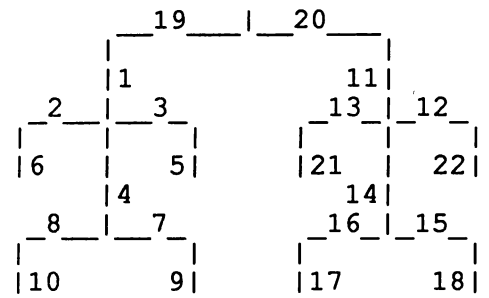
LI2

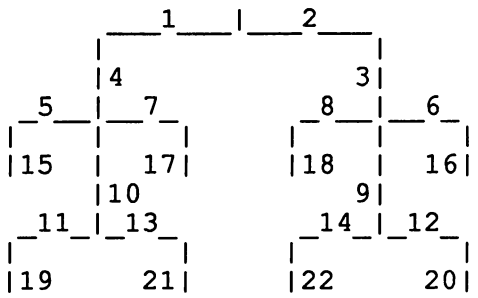




Scores 6 19

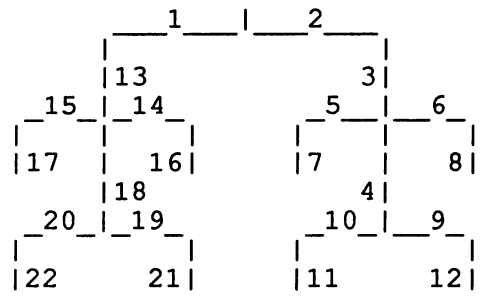
LI3

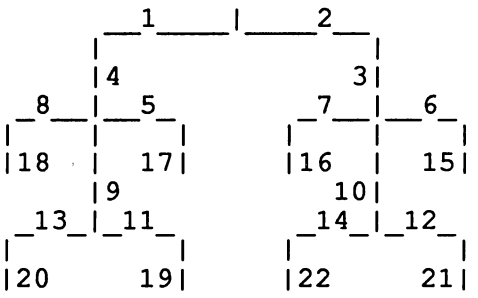




Scores 2 16

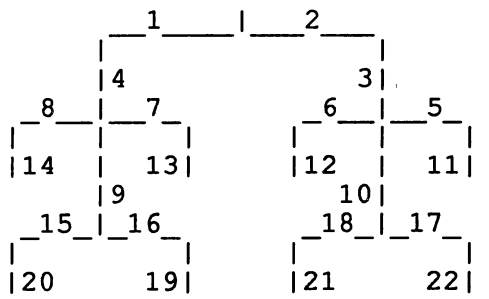
LI4

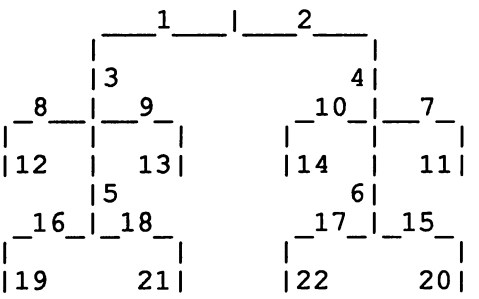




Scores 1 10

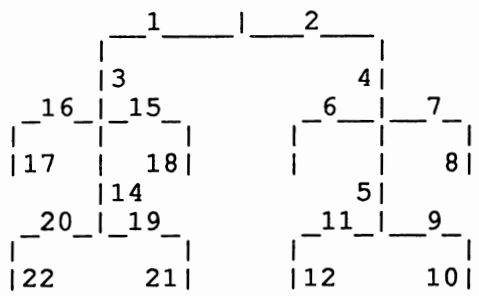
LI5

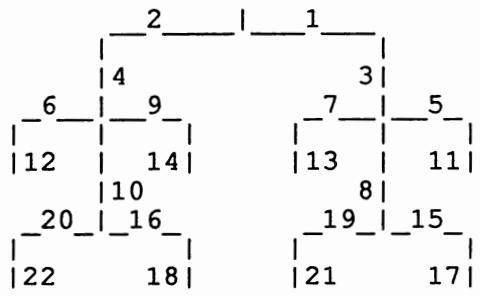




Scores 8 13

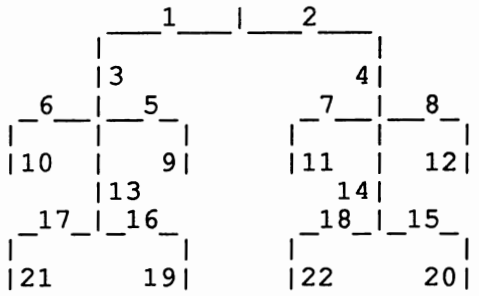
LI6

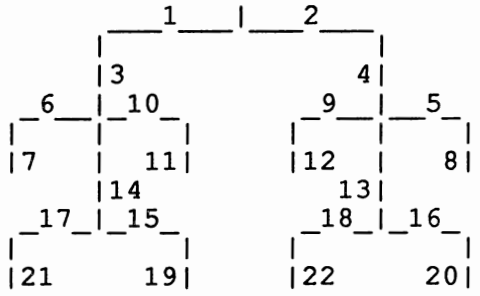




Scores 4 20

NL1





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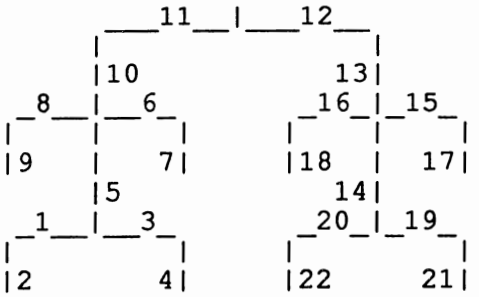

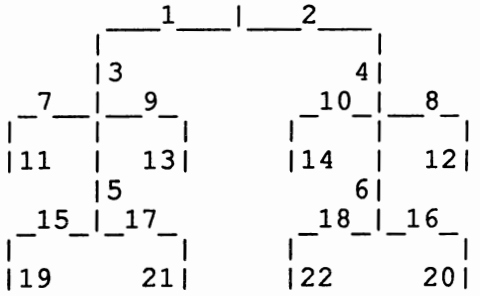

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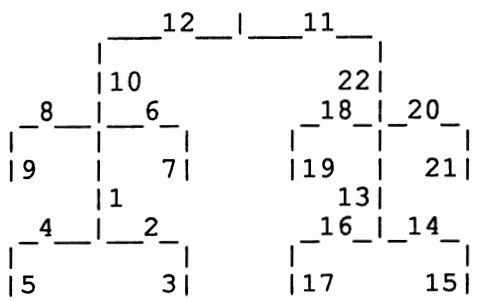

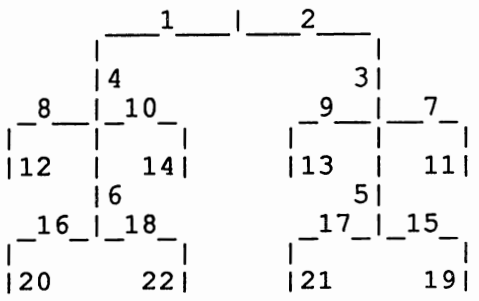

Scores 1 19

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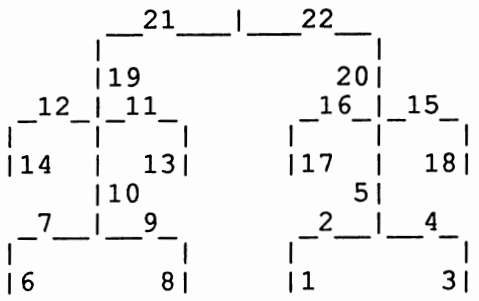
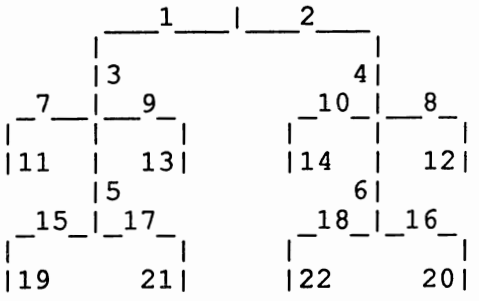
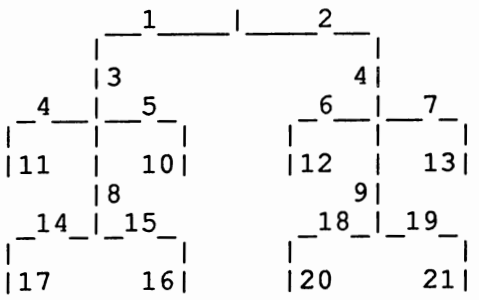
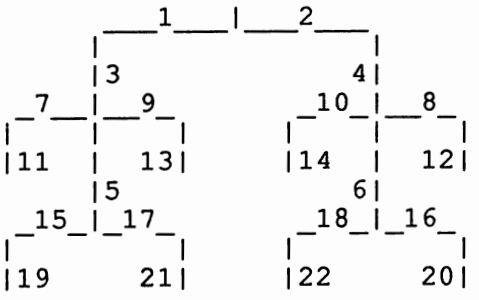




Scores 4 20

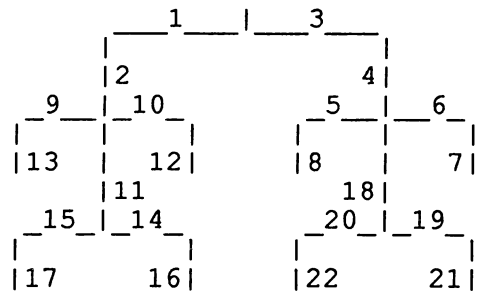
NL5

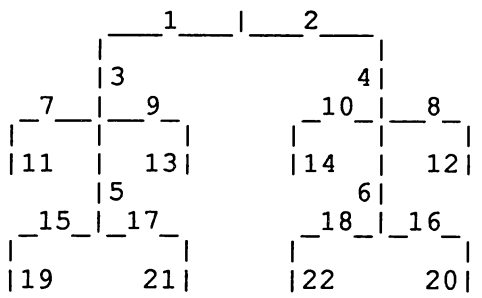




Scores 6 20

NL6





Scores 2 20

APPENDIX N

SPEARMAN RANK ORDER CORRELATIONAL COEFFICIENTS

SPEARMAN RANK-ORDER CORRELATIONAL COEFFICIENT

MATRIX FOR ALL SUBJECTS (n=12)

	A	B	C	D	E	F	G	H	I	J	K	L	
A	1	-.082	.423	.441	.198	-.220	-.098	-.215	-.381	.191	.390	.107	A
B	-.082	1	-.705	.615	.645	-.128	-.129	.425	-.117	.306	-.247	.149	B
C	.423	-.705	1	-.153	-.414	-.028	.040	-.636	-.224	-.035	.200	.056	C
D	.456	.615	-.153	1	.703	-.212	-.472	.308	-.031	.430	-.101	.119	D
E	.198	.645	-.414	.703	1	-.274	.017	.411	.180	.205	.068	.215	E
F	-.220	-.128	-.028	-.212	-.274	1	.364	-.135	.467	.495	-.100	.229	F
G	-.098	-.129	.040	-.472	.017	.364	1	-.248	.192	-.178	.472	-.154	G
H	.107	.425	-.636	.308	.411	-.135	-.248	1	.357	.077	-.399	.266	H
I	.170	-.117	-.224	-.031	.180	.467	.192	.357	1	-.217	.035	-.056	I
J	.191	.306	-.035	.430	.205	.495	-.178	.077	-.217	1	-.336	.524	J
K	.390	-.247	.203	-.101	.068	-.100	.472	-.399	.035	-.336	1	-.364	K
L	.107	.149	.056	.119	.215	.229	-.154	.266	-.056	.524	-.364	1	L

Two-tailed test at significance level of .05

A) TONI-II score
B) First nonverbal (mobile) hierarchical score
C) Learning/Memory score
D) Sentence combining score
E) Matrix score
F) Written summary subordination index
G) Spoken summary subordination index
H) Written summary total relative clause frequency
I) Spoken summary total relative clause frequency
J) Written summary mean sentence length
K) Spoken summary mean sentence length
L) Age

SPEARMAN RANK-ORDER CORRELATIONAL COEFFICIENT

MATRIX FOR NL SUBJECT GROUP (n=6)

	A	B	C	D	E	F	G	H	I	J	K	L	
A	1	.586	-.029	.543	.657	-.071	-.314	.371	-.257	.371	-.486	.657	A
B	.586	1	-.471	.929	.643	.300	-.386	-.214	-.614	.529	-.014	.271	B
C	-.029	-.471	1	-.429	-.200	-.357	.486	-.371	.029	-.429	-.143	-.143	C
D	.543	.929	-.429	1	.829	.100	-.600	-.257	-.429	.200	.143	.257	D
E	.657	.643	-.200	.829	1	-.014	-.600	-.029	.029	-.029	.200	.600	E
F	-.071	.300	-.357	.100	-.014	1	.529	-.186	.043	.757	.471	.414	F
G	-.314	-.386	.486	-.600	-.600	.529	1	-.371	.029	.314	.143	-.029	G
H	.371	-.214	-.371	-.257	-.029	-.186	-.371	1	.371	.086	-.486	.371	H
I	-.257	-.614	.029	-.429	.029	.043	.029	.371	1	-.429	.486	.314	I
J	.371	.529	-.429	.200	-.029	.757	.314	.086	-.429	1	-.200	.429	J
K	-.486	.014	-.143	.143	.200	.471	.143	-.486	.486	-.200	1	.029	K
L	.657	.271	-.143	.257	.600	.414	-.029	.371	.314	.429	.029	1	L

Two-tailed test at significance level of .05

A) TONI-II score
B) First nonverbal (mobile) hierarchical score
C) Learning/Memory score
D) Sentence combining score
E) Matrix score
F) Written summary subordination index
G) Spoken summary subordination index
H) Written summary total relative clause frequency
I) Spoken summary total relative clause frequency
J) Written summary mean sentence length
K) Spoken summary mean sentence length
L) Age

SPEARMAN RANK-ORDER CORRELATIONAL COEFFICIENT

MATRIX FOR LI SUBJECT GROUP (n=6)

	A	B	C	D	E	F	G	H	I	J	K	L	
A	1	-.614	.686	.157	.071	.714	.129	-.529	.200	.329	.357	-.143	A
B	-.614	1	-.957	.657	.657	-.429	-.086	.886	.414	.086	-.543	0	B
C	.686	-.957	1	-.443	-.614	.557	-.014	-.814	-.271	.071	.414	.129	C
D	.657	.657	-.443	1	.829	.200	-.257	.700	.529	.714	-.486	.257	D
E	.071	.657	-.614	.829	1	.086	-.086	.714	.414	.257	-.200	-.257	E
F	.714	-.429	.557	.200	.086	1	-.143	-.371	.586	.543	-.200	-.029	F
G	.129	-.086	-.014	-.257	-.086	.143	1	-.486	.129	.714	.714	-.600	G
H	-.529	.886	-.814	.700	.714	-.371	-.486	1	.243	.314	-.657	.171	H
I	.200	.414	-.271	.529	.414	.586	.129	.243	1	.300	-.414	-.329	I
J	.329	.086	.071	.714	.257	.543	-.714	.314	.300	1	-.714	.629	J
K	.357	-.543	.414	-.486	-.200	-.200	.714	-.657	-.414	-.714	1	.486	K
L	-.143	0	.129	.257	-.257	-.029	-.600	.171	-.329	.629	-.486	1	L

Two-tailed test at significance level of .05

A) TONI-II score
B) First nonverbal (mobile) hierarchical score
C) Learning/Memory score
D) Sentence combining score
E) Matrix score
F) Written summary subordination index
G) Spoken summary subordination index
H) Written summary total relative clause frequency
I) Spoken summary total relative clause frequency
J) Written summary mean sentence length
K) Spoken summary mean sentence length
L) Age

VITA

Kendra R. Klutsenbaker

Candidate for the Degree of

Master of Art

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Major Field: Speech

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Professional Experience: Graduate Assistant, Department of Speech Pathology and Audiology, Oklahoma State University, August 1989 to August 1991.