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# Metalinguistic abilities in literate adults

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# METALINGUISTIC ABILITIES IN LITERATE ADULTS

by

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A dissertation submitted to the Graduate Faculty in Linguistics in partial fulfillment of the requirements for the degree of Doctor of Philosophy, The City University of New York.

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Abstract

METALINGUISTIC ABILITIES IN LITERATE ADULTS

by

Kristine Cecilie Gjerlow-Johnson

Adviser: Professor Loraine K. Obler

Metalinguistic ability is demonstrated when a speaker evaluates or manipulates the **form** of some linguistic unit in a language, as distinct from its content. This can occur at any linguistic level. Words can be considered for their phonological shape, rather than their meaning. A sentence can be judged for well-formedness or intonational pattern rather than for semantic content.

Linguists have reported informally that native speakers are **not** all equally able to comment on structural properties of language. Moreover, even a survey of the existing literature on metalinguistic ability reveals studies in which subjects demonstrate obvious differences in ability.

The focus of this dissertation is an investigation of the variability in the metalinguistic performance of a large population of literate adults. In order to study both differences between groups and individual performance on a wide range of tasks, a two-stage research design was employed.

In Phase I, large groups of Graduate Students, High School Seniors and Adults with High School Education were given three metalinguistic tasks: one phonological, one morphological and one syntactic. The phonological task required subjects to add or delete phonemes in words to yield other words. The morphologyical task required manipulation of nonsense words presented in context. The syntactic task elicited well-formedness judgments, first bimodally and then on a relative scale.

In Phase II, a smaller group of subjects with outstanding Phase I metalinguistic performance was given seven other metalinguistic tasks requiring:

1) syllable counting
2) segment counting
3) analyzing and synthesizing polymorphemic words
4) representing intuitions about syntactic structure
5) paraphrasing nonsense compounds
6) repeating sentential **intonation** patterns
7) detecting sentential ambiguity

Significant differences between groups formed on education, age, sex and familial handedness were found. More educated subjects performed better on the phonology, morphology and syntax tasks. Age was found to have a positive effect on morphological ability. There was a tendency for male subjects to out-perform female subjects on the phonology task. Right-handed subjects with no left-handed family members achieved better average syntax and morphology scores than did right-handers with familial sinistrality. Subjects were not found to be consistent in their metalinguistic performance across tasks.

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*For T.J.*

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# CHAPTER ONE

# INTRODUCTION

Metalinguistic ability is demonstrated when a speaker of some language evaluates or manipulates the form of some linguistic unit in that language, as distinct from its content. This can occur at any linguistic level. Words can be considered for their phonological shape, rather than their meaning. A sentence can be judged for well-formedness or intonational pattern rather than for semantic content.

Analysis of performance on metalinguistic tasks can have a number of important implications. Performance on metalinguistic tasks has been used to make inferences about damage to the grammar of aphasic patients (e.g. Zurif, Caramazza & Meyerson 1972). The field linguist relies on native speaker judgments of grammaticality in developing his or her theory of the grammar of the language under study. Some approaches to literacy instruction for children and adults include attempts to increase metalinguistic awareness (e.g. Rosner 1987). And yet, despite the important uses made of metalinguistic testing, to my knowledge, no comprehensive investigation of metalinguistic

abilities in normal, literate adults has been carried out.

In early research on transformational-generative grammar, there is often an assumption that all speaker/hearers of a given dialect possessed essentially the same grammar of that dialect. This sometimes led to the further assumption that all speaker/hearers were equally able to use that grammar to perform such metalinguistic tasks as making grammaticality judgments. For example, Putnam (1961:40) states:

> *"Even a person of very low-grade intelligence normally learns both to speak his particular dialect grammatically and to recognize deviations from grammaticalness ... a moron whose parents happen to speak the prestige dialect may have serious vocabulary deficiencies. He too learns to speak the prestige dialect and to feel that there is something wrong with sentences which deviate from the grammatical regularities of the prestige dialect..."*

Linguists have reported informally, however, that native speakers are **not** all equally able to comment on structural properties of language. And, even a survey of the existing literature on metalinguistic ability reveals studies in which subjects demonstrate obvious differences in ability.

The focus of this dissertation is an investigation of the variability in the metalinguistic performance of a large population of literate adults. Questions of possible educational, psychological, and neurological correlates of metalinguistic talent are examined. A profile of the particularly talented and the particularly untalented subject is developed.

In Chapter Two, relevant studies from four bodies of literature will be reviewed. First, studies of the development of pertinent abilities in children

will be discussed. Many, but not all, of these suggest a uniform end level. Some (e.g. Ryan and Ledger 1984) specifically refer to an adult level. Few used an adult control group.

Second, various studies on the relationship between literacy learning and metalinguistic ability are reviewed. These include reports on childhood and adult learners. Metalinguistic ability is variously considered to be a pre-requisite for literacy, a direct consequence of literacy and inter-dependent with literacy.

In the third review section, studies on the metalinguistic abilities of aphasic patients will be reviewed. These provide information on possible dissociation of linguistic and metalinguistic ability. They are also interesting for their assumptions about the metalinguistic ability of unimpaired literate adults.

Finally, a survey of the limited literature on the metalinguistic abilities of unimpaired, literate adult native speakers is presented. In this final survey, the focus will be the presentation of conflicting results regarding variation in adult metalinguistic ability and the articulation of the unanswered questions to be addressed in the present study. The following specific hypotheses will be developed:

1) Groups of unimpaired literate adult native speakers will vary significantly in their metalinguistic ability.
    a) Metalinguistic ability will increase with education.
    b) Differences between groups defined by age will be

attributable to educational or reading skill differences.

c) Metalinguistic ability will be at the extreme ends of the range in subjects with unusual brain organization as marked by certain familial factors.

2) The performance of individual subjects on metalinguistic tasks will be consistent across tasks. Based on the literature, we expect metalinguistic ability to correlate with various aspects of cognitive profile and to therefore be constant across linguistic levels. Specifically:

a) Subjects with general intellectual ability will exhibit high metalinguistic ability

b) Subjects with high levels of linguistic ability will also demonstrate high levels of metalinguistic ability.

c) Subjects with low rigidity will have high metalinguistic ability.

d) Field dependent subjects will exhibit low metalinguistic ability.

In Chapter Three a description of the research methods for the present study is presented. In order to study both differences between groups, and individual performance on a wide range of tasks, a two-stage research design was employed.

In Phase I, large groups of Graduate Students, High School Seniors and Adults with High School Education were given three metalinguistic tasks: one phonological, one morphological and one syntactic. The phonological task

required subjects to add or delete phonemes in words to yield other words. The morphological task required manipulation of nonsense words presented in context. The syntactic task elicited well-formedness judgments, first bimodally and then on a relative scale.

A number of other evaluative measures were also included in this initial screening battery. Subjects were given a brief reading test and a test of psychological rigidity. They also completed a questionnaire concerning academic history and abilities as well as family health and handedness.

In Phase II, a smaller group of subjects with outstanding Phase I metalinguistic performance was given further metalinguistic tasks as well as further evaluative measures. The seven metalinguistic tasks required:

1) syllable counting
2) segment counting
3) analyzing and synthesizing polymorphemic words
4) representing intuitions about syntactic structure (phrase tree drawing)
5) paraphrasing nonsense compounds based on **stress**
6) abstracting and repeating sentential **intonation** patterns (reiterant speech)
7) detecting sentential ambiguity

A brief reading/writing test, a measure of field dependence, the Ravens Progressive Matrices and several sub-tasks from the Wechsler Adult Intelligence Scale (WAIS-R) were also administered.

The specific metalinguistic and linguistic tasks, standardized tests, and questionnaires which were used are described in Chapter Three and, with the exception of the standardized tests, are reproduced in Appendix 1 (Phase I)

and Appendix 2 (Phase II).

Chapter Four summarizes the results of all of the tests administered. Significant differences between groups formed on education, age, sex and familial handedness were found. Subjects were not found to be particularly consistent in their metalinguistic performance. Interesting correlations among metalinguistic tasks and between specific metalinguistic tasks and other evaluative measures were, however, found.

Chapter Five summarizes the results of the study with respect to its specific research questions. Suggestions are made as to possible reasons for the pattern of results obtained. Directions for future research are also suggested.

# CHAPTER TWO

# LITERATURE REVIEW

In the following sections, four related sets of studies will be reviewed. Studies of children's development of metalinguistic ability show that children begin to manipulate the **form** of language, at many linguistic levels, at an early age. The question of the existence of a uniform "adult" level of metalinguistic competency is raised.

The second group of studies investigates the relationship between metalinguistic ability and literacy.

The focus in reviewing these studies is on establishing the linguistic levels for which metalinguistic ability has been associated with reading skill.

The review of the literature on metalinguistic abilities of aphasic patients in the third section reveals a lack of consensus on the double dissociability of linguistic and metalinguistic ability.

In the fourth section, studies on metalinguistic ability in unimpaired literate adult native speakers are reviewed. Issues of other abilities and subject

characteristics associated with metalinguistic ability are discussed.

Finally, evidence from studies of metalinguistic ability in these four populations are compared, unanswered questions are articulated and the specific research hypotheses for the present study are elaborated.

## 2.1 Children's Development of Metalinguistic Ability

Some authors have placed the beginning of metalinguistic development as early as one-and-a-half or two years of age. In monolingual children, Clark (1978) reported on children's spontaneous repairs of their own utterances as well as "sound practice" at this early age.[1]

The literature on bilingual children is a particularly rich source for instances of early metalinguistic ability (Leopold 1949, Ronjat 1913, Slobin 1978, McDaniel 1982). The trilingual twins described in the McDaniel study were aware of the existence of different languages well before the age of two. They had developed a method of asking adults to supply a word in one of their three languages when they knew it in one of the others as illustrated in the following conversation which occurred when the twins were 1;5:

```
Jessica: [to McDaniel after having hid an object]  Nie
         ma? I a pas? ['All gone?'(Polish)-'All
         gone?'(Occitan)]
McDaniel: All gone.
Jessica:  All gone [repeated several times].
```

Evidence of more explicit analysis of linguistic units was found as

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[1]My younger son's favorite word at age 1:6 was "ridiculous", which he pronounced [dɪkələs]. He would very happily comply with requests to "say [ridɪkjuləs]" but consistently refused requests that he "say [dɪkələs]".

the twins grew older. The following excerpt from McDaniel 1982 illustrates metalinguistic awareness on the phonological, and morphological levels as well as awareness of the arbitrariness of linguistic signs:

> ". . . At age 4;3 Jessica reflected on the difference between the 'r' sound in her father's dialect of Occitan (which she used) and the dialect spoken in her nursery school in Besiers:
>
> Jessica: [slowly, to herself] encara encara encara [with the Besiers uvular 'r'; encara (Occitan) = 'more']
> DM: What?
> Jessica: Nuria says different than Pair. [Nuria was the nursery school teacher.]
> DM: Which word?
> Jessica: No, everything.
> DM: You mean she says [ʁ] when Pair says [r]?
> Jessica: Yeah.
>
> . . . In some cases they expressed the notion of arbitrariness almost explicitly, as in the following example at age 3;7:
>
> Jessica: How do you say 'sister' in Romani?
> DM: 'Phen.' [[pʰen]]
> Jessica: Just like in English for something to write. And how do you say 'pen' in Romani?
>
> . . . The following interaction at age 4;4 began without reference to any prior discussion:
>
> Ellen: [to DM] What 'gram' ('grand') means by itself?
> DM: Big or great.
> Jessica: 'Gram' is a little like 'gran.' For 'grandmother' you say 'gram' and for 'grandfather' you say 'gran'.

In addition to beginning reflection on arbitrariness and structural properties of language at an earlier age, bilingual children have also been shown to have greater metalinguistic ability in the four through nine year old age range (Ben-Zeev 1972, 1977; Ianco-Worall 1972). In these studies, the

bilinguals were compared with a monolingual control group which was matched for age, sex, social class and intelligence.

If, as Ben-Zeev (1972) suggests, bilingual children have greater metalinguistic ability because of having had to analyze their two languages, we might expect adults who report successful foreign language learning experiences to share this advantage.

Monolingual children have also been shown to have considerable metalinguistic ability. Zei (1977) reported successful description of articulatory events by five year old subjects in response to the question "What happens in your mouth when you say ___?" Zurhova (1973) reported on the ability of three and four year-olds to pronounce the initial phoneme in a word when provided with a model (b-b-b-bear). Four and five year olds in her study could perform the task without a model.

In contrast to the Zurhova study, Liberman et al. (1974) found that none of their twenty nursery school children could learn to tap once for each phoneme, given individual sounds and two and three phoneme words. The ability to carry out this task was present in only 17% of their kindergarten group, but 70% of the first grade group. In their study, syllable segmentation abilities appeared earlier. Forty-six percent of the nursery school children tested were able to achieve criterion (six consecutive correct responses) segmenting words with one, two or three syllables. Forty-eight percent of the kindergarten children and ninety percent of the first graders were able to learn

to correctly "tap once for each syllable". One may ask whether the remaining ten percent will soon acquire the skill, or whether it is possible to enter literate adulthood without this ability.

Children demonstrate unconscious knowledge of the morphological rules of their language when they produce "over-regular" forms such as English "comed" for came. Children as young as three attempt to analyze complex words into component morphemes. My three-year-old daughter responded to the announcement of a family trip to Pennsylvania with: "Then we can bring pencils. I don't have any vania toys. I don't know what one is!" Experimental evidence confirming this concept of the young child as morphologist has appeared consistently over the last thirty years (see for example Bogayavlensky 1957, Gleason 1958, Gleitman 1972, Clark 1978, Mattingly 1984).

Whereas adult syntactic awareness is routinely evaluated by considering performance on judgment tasks, children's syntactic awareness has more frequently been assessed through a number of other kinds of tasks. In their review of the literature on children's ability to attend to sentence structure, Ryan and Ledger (1984) discuss a number of these: Imitation tasks (Bohannon 1975); Games in which the subject is to attribute ill-formed sentences to a picture of a child and well-formed sentences to a picture of an adult (Scholl & Ryan, 1975, 1980); comprehension tasks (Emerson 1979), and correction tasks (Beilin 1975; Ryan & Ledger 1979).

In many cases these other tasks were used to supplement

information gathered in judgment tasks. In others, the subjects were below the age of six, the age at which conventional wisdom holds that the ability to give reliable well-formedness judgments emerges. New methods being developed by McDaniel and Cairns (1990) for working with younger subjects have, however, yielded reliable well-formedness judgments from children between the ages of 3;8 and 5;4.[2] The authors report that the range of talent for intuition giving is the same for the young children in their study as for their adult controls.

## 2.2 Metalinguistic Ability and Literacy

The complexities of the relations between learning to read, skilled reading and various levels of metalinguistic ability and awareness have yet to be untangled. I present here a small sample of the literature investigating these connections in childhood and adult learners.

### 2.2.1 Metalinguistic Ability and Literacy in Children

Mattingly (1984, 12) has suggested that metalinguistic awareness is a prerequisite for reading success. He makes the claim that not all speakers acquire the same or equivalent grammars of their language. He writes:

> *. . . the grammatical knowledge a language learner is potentially capable of acquiring far exceeds the functional requirements of performance. But if this is so, we should not find it surprising that some speaker-hearers continue acquiring the grammar of their language indefinitely, while others essentially abandon language acquisition once the performance*

---

[2]My older daughter was a pilot subject when she was three and a half. She moved from accepting almost all of the strings presented in the training session to confidently asserting that The tree is red was correct but Climbing the lion is the tree up was "not right" in the beginning of the second session.

> *mechanisms are adequately equipped for the purposes of ordinary communication.*

After arguing for the essentially morphophonemic nature of the alphabetic orthography, he makes his ideas on the connection between "early abandonment" of language acquisition and reading difficulty explicit by offering the following conjecture (p. 24):

> *The child who is still actively acquiring language at the time he begins to read will be relatively mature phonologically, so that the orthography will correspond to a considerable extent with his morphophonemic representations. Having access to these representations, he will be linguistically aware, and the orthography will seem to him a plausible way of representing sentences. . . . Moreover, he will, as a linguist, see that reading is a source of fresh data. If he does not already have the morphophonemic forms /hēl/ and /hēl+ɵ / in his lexicon, and the associated rules in his phonology, the orthographic forms heal and health will prompt him to revise his grammar accordingly. Thus, the linguistic curiosity that has motivated his continuing language acquisition will motivate his learning to read as well.*
> *On the other hand, the child who is no longer very actively acquiring language will surely find learning to read very difficult and unsatisfying. His morphophonemic representations will be less mature than they might be, so that the discrepancies between the orthography and the morphophonemic representations will be substantial. . . . Finally, since his capacity for language learning will not have been recently exercised, he may well have lost some of his ability to analyze a sentence on the basis of its lexical content.*

While certainly not all investigators would agree with Mattingly's assertion that six year olds may have abandoned the process of language acquisition, few would disagree that metalinguistic ability and reading ability have a mutually beneficial relationship.

Stanovich (1982) reports that poor readers have increased difficulty in naming pseudowords; demonstrating a lack of phonological metalinguistic

ability. Stanovich, Cunningham & Feeman (1984) demonstrate correlations between phonological awareness and decoding speed as well as listening comprehension. Finally, Bowey (1986) reports that good and poor decoders differ significantly in their syntactic awareness as measured by their ability to imitate and correct errors.

There is, then, some evidence in the literature for relations between reading ability and metalinguistic awareness at many linguistic levels. Phonological, morphological and syntactic metalinguistic ability have all been associated with reading skill.

The bi-directionality of the relation between metalinguistic ability and reading skill has also been discussed in the literature on children's language. Bradley and Bryant (1978) studied six and ten year olds who were reading at the same level. The ten year olds were markedly inferior on tests of phonological metalinguistic ability. The ten year olds were functioning at a considerably higher intellectual level, and had had more years of exposure to reading. This difference would, then, be consistent with a "phonological skill" separable from reading experience and important for reading skill.

### 2.2.2 Metalinguistic Ability and Literacy in Adults

Since learning to read in Western society is generally a product of exposure to the educational system and generally occurs between the ages of five and seven, research on Western children cannot conclusively distinguish between the hypothesis that metalinguistic ability arises spontaneously with

normal development and the hypothesis that metalinguistic abilities arise only as a result of learning to read.

Morais et al. (1979) studied two groups of thirty adult native speakers of Portuguese. One group was completely illiterate. The other group had learned to read after age fifteen. Half of each group was given a phoneme deletion task and half a phoneme addition task. For each task some of the twenty trials required adding or deleting the initial phoneme of a non-word to yield another non-word. In others, the initial phoneme of a word was to be added/deleted to yield another real word. An initial fifteen introductory trials involved non-words which became words with the initial phoneme added/deleted. For the non-word trials, which give the clearest indication of segmenting ability, illiterate subjects averaged only nineteen percent correct in both the addition and deletion tasks. Fifty percent of the illiterate subjects failed on all of the non-word trials. In contrast, the literate group averaged seventy-one percent correct on the phoneme addition task and seventy-three percent correct on the phoneme deletion task. Thus the authors demonstrate that the ability to demonstrate awareness of speech as a sequence of phones does not arise spontaneously.

Scholes and Willis (1988a) extend this generalization to awareness of other linguistic units. In the experiment reported on in their 1988 paper, the performance of illiterate adults on morphology and syntax tasks was compared with the performance of pre-literate and newly literate children. Although the

adults outperformed the "poor" third grade readers on some subtasks, their performance never reached the level of the "good" third grade readers.

On the morphological task, their thirty illiterate adult native speakers of English identified correctly only twenty-nine percent of the base words inside such complex words as misspelling, discovery and reaction. Poor third grade readers averaged only fourteen percent correct. "Good" third grade readers averaged fifty-six percent correct and average fifth graders, eighty-two percent correct.

In their test of syntactic comprehension, Scholes and Willis (1988) presented the following questions orally to their subjects:

> If Mary is pushed by John, who does the pushing?
> If it's Mary who is pushed by John, who does the pushing?
> If a boy who is talking to a girl rides a bicycle, who rides a bicycle?
> If a young man who is following an old lady talking to a neighbor carrying a child rides a bicycle, who rides a bicycle?
> If John promises Bill to go away, who goes away?

The illiterate adults had a mean correct response rate no greater than chance (fifty-seven percent). Literate third and fifth graders averaged seventy percent correct. Scholes and Willis analyze the errors made as reflecting a grammar based on adjacency and sequence. They distinguish extensional lexical items (those which refer to things in the world) from intensional ones (the meanings of which are determined by their function in the language itself). They claim that illiterate native speakers fail to process intensional words or morphemes.

In this article they make the claim that awareness of units of linguistic analysis is determined by literacy:

> *Recent research with pre-literate and illiterate speakers of English and illiterate speakers of other languages shows quite convincingly that all native speakers of a language do not share a knowledge of phonemes. Our work on the morphology and syntax of English . . . further suggests that knowledge of these components of grammar is similarly derived from the presence or absence of the ability to read.* (p.35)

However, in a later paper on a university population (see below) they make it clear that metalinguistic ability is a consequence not simply of learning to read. In Scholes and Willis (1988b), metalinguistic ability is associated with being a particularly sophisticated kind of reader; one who carefully attends to "intensional" lexical items.

Ferguson (1981) investigated the ability of adults of various literacy levels to segment speech. The sixty monolingual adults in the study were divided into three groups. The non-literate group had an average reading level of 2.7. The semi-literate group had an average reading level of 5.8. The literate control group had an average reading level of 9.0. Segmentation ability on the word, syllable and phoneme level was found to correlate significantly with reading level, not with years of schooling or general intellectual ability.

Greenberg (1987) tested the metalinguistic abilities of 120 adults; 30 at each of four literacy levels: low, mid, high and literate. Her metalinguistic tasks included word, syllable and phoneme segmentation, sentential well-formedness and synonymy judgments, and phonotactic judgments. Her results

indicate a significant difference in general metalinguistic ability among the four groups. Mean scores for all tasks increased as reading level rose.

In addition to the initial evaluation of metalinguistic ability, Greenberg also conducted a longitudinal study in which the thirty low-level readers were retested after six months. More subjects with above average metalinguistic ability improved in their reading than did subjects with below average metalinguistic ability. Further, the above-average group achieved greater reading gain. Thus the bi-directionality of the beneficial relationship between metalinguistic and reading ability is established for adult literacy learners as well.

Several of the studies reviewed above tested metalinguistic ability at more than one linguistic level. Each of these found equivalent associations of reading ability and metalinguistic ability at each level.

## 2.3 The Study of Metalinguistic Ability in Aphasics

Metalinguistic tasks have not traditionally been a part of the evaluation of linguistic deficit in aphasia. Such tasks have, however, been used with this population recently and have yielded interesting results.

Several researchers have reported success in obtaining near normal well-formedness judgments from patients with agrammatic output and impaired comprehension (Linebarger, Schwartz and Saffran 1983; Wulfeck 1984; Saddy in preparation). This leads to the curious conclusion that persons with these kinds of deficits may have access to grammatical analysis but not make use of

this information for comprehension or production.

Rosenthal and Goldblum (1987) however, present convincing arguments that agrammatic comprehension itself, in fact, requires the same kind of grammatical analysis required by the Linebarger et al. judgment task. Their claim is that in order to "ignore" functors, these words must first be identified as such. For example, "till" must be characterized as noun, verb, preposition or conjunction. If they are correct, then the data from the Linebarger et al. study demonstrate parallel linguistic and metalinguistic ability.

Zurif, Caramazza and Myerson (1972) reported on their study of the ability of three Broca's aphasics and three non-neurological control patients to provide judgments on the syntactic structure of well-formed English sentences. Their particular metalinguistic paradigm involved presenting subjects with all of the possible triads of words in a sentence and asking the subject to judge which two of the three "go best together" in that sentence. These individual judgments were then the input to a hierarchical scaling procedure which generated what is essentially a subjective phrase marker for each sentence. The more often a subject had indicated that a particular pair of words "goes together", the more compact the node joining them.

The "phrase markers" derived from the three non-neurological control patients were reminiscent of the linguist's phrase markers for those sentences. In contrast, the "trees" derived from the judgments of their Broca's patients linked only the content words consistently. Functors received

inconsistent treatment. Two articles might be joined together or perhaps joined with a main verb. Zurif et al. took this to be evidence that the grammatical competence of these patients was impaired in much the same way as their performance.

In a later study, Zurif and Caramazza (1975) reported a replication of these findings. They also reported data from "mixed" aphasics, who share the telegraphic speech of the Broca's aphasic but also have marked comprehension difficulty. Both groups of aphasics were "abnormal" in their grouping of articles. The Broca's aphasics were, however, able to integrate semantically important functors into appropriate units; the "mixed" aphasics were not. Again, metalinguistic deficit and linguistic deficit were found to be parallel.

Using a similar metalinguistic paradigm, Kolk and van Grunsven (1984) tested the sentence structure judgments of two non-agrammatic and four agrammatic patients. The non-agrammatic patients produced subjective phrase markers in which the function words and adjectives were only loosely related to the rest of the sentence. The agrammatic patients produced structures which were fully normal.

The authors conclude that failure to make judgments which project linguistically motivated constituents does not necessarily indicate a lack of available constituent structure information. The non-agrammatic patients were, after all, able to draw on syntactic information for both production and

comprehension. Additionally, the agrammatic output of the Broca's aphasics did not preclude their making judgments which yielded "normal" phrase trees. This can be considered evidence for the double dissociability of linguistic and metalinguistic ability.

Kolk and van Grunsven suggest that patients with a linguistic deficit may have a set to attend to the meaning of the sentence whereas normals will make their judgments based on syntactic structure. For their data, this possibility is rendered all the more likely by their practice triads. These consisted of three words, two of which had a strong semantic association (e.g. son-wood-parents). The small numbers of subjects in these studies also leave open the possibility of pre-morbid variation in metalinguistic ability.

The use of metalinguistic tasks in the evaluation of linguistic deficit in agrammatism has not led to clear answers about the nature of this deficit. Zurif et al. used their metalinguistic data to suggest that agrammatics had impaired competence as well as performance. Kolk and van Grunsven's data indicate that this indirect method of obtaining intuitions may not tap linguistic competence. Linebarger, Schwartz and Saffran's use of a more direct measure yielded results which implied preserved competence. Rosenthal and Goldblum argue that the **production** data from these patients evidences the same degree of preserved competence as does their metalinguistic data. A clearer understanding of the nature of metalinguistic abilities in normals is a pre-requisite to increased understanding of these abilities in other populations.

## 2.4 Unimpaired Literate Adult Native Speakers

The metalinguistic abilities of unimpaired literate adult native speakers are rarely an object of study. Groups of such adults are, however, frequently used as control groups in studies of other groups.

For example, Zurif, Caramazza and Myerson (1972) compared the results of a hierarchical cluster analysis of aphasic patients' relatedness judgments with those of normal subjects, noting no significant differences among their normals.

Greenberg (1987) described differences in metalinguistic awareness among second language learners of varying proficiency levels. She compared these groups to a group of monolingual college students among whom she found no noteworthy differences.

Hamilton (1985) compared children's ability to define words with that of adults. He found no evidence for the "adult level" described in Papandropoulou and Sinclair (1974). Adults gave a range of definitions which were similar to those of children at each of the developmental stages described in Papandropoulou and Sinclair.

McDaniel and McKee (1989) tested the prohibition against strong crossover in children and an adult control group. McDaniel and Cairns (1990) elicited linguistic intuitions from young children and compared these children with adults. Maxfield and McDaniel (1991) reported on children's judgments on parasitic gap sentences, comparing them with adult controls. In each of

these studies, the authors noted that qualitatively, if not quantitatively, adults and children behaved in very similar ways.

The unimpaired literate adult native speakers in the above-mentioned studies functioned as control groups. The possibility of variability among these adults was therefore simply not addressed.[3]

There is another set of studies in which literate adults serve as the experimental group. These are studies in which the well-formedness judgments themselves are the object of study.

In the early days of judgment elicitation as a research technique, there was a flurry of studies which questioned the validity of naive informant intuitions. Maclay and Sleator, 1960; Hill, 1961; Coleman, 1965; Quirk and Svartvik, 1966 and others (see Chauderon 1983 for a fuller listing and comparison with the use of judgments in L2 research) experimented with native speaker ability to distinguish groups of sentences considered different by linguists. These authors generally conceeded the value of native speaker intuitions but urged caution in their interpretation.

Other linguists have accepted the primacy of native speaker judgments as the data for linguistic theory and have used these intuitions in order to shed light on some question of theoretical syntax (see Mohan 1979 for a review and discussion).

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[3]Although certainly any of these researchers would have noticed large differences among their control subjects.

Only a handful of studies on the metalinguistic ability of literate adult native speakers address the question of variation in sub-populations. Gleitman and Gleitman, in their 1971 volume, Phrase and Paraphrase: some innovative uses of language, compare the ability of subjects from three different (literate) educational groups to provide paraphrases for "nonsense" compounds. Group A consisted of graduate students and Ph.D.'s; group B, of undergraduates and college graduates with no plans for graduate work and group C, of secretaries with high school degrees and no intention of going to college. The subjects were asked to provide paraphrases for such compounds as bird-house black and their responses were scored for number of errors as well as error type. The mean error rate per item was 13% for group A, 45% for group B and 62% for group C. There was no overlap at all between groups A and C and almost no overlap between groups A and B. The group A errors tended to be minor errors such as providing a paraphrase which would have been correct had the word order been different (e.g. giving "a bird-house that has a boot in it" as a response for bird-house boot). In group C there were more "errors of chaos" (e.g. giving "a house for a black bird" as a response for bird-house black) and also more "errors of format" (e.g. giving "wash the house-bird!" as a response for bird wash-house).

Although the differences between the groups in the Gleitman and Gleitman study are quite striking and cannot be attributed to unusually good or poor performance by some few individuals, we can still see that level of

education completed does not account for all of the variation in abilities. The A group scores actually ranged from about 5 wrong to about 35 wrong out of 110. The range of C group scores was from about 65 wrong to about 105 wrong.

Since only one area of metalinguistic ability was investigated in this study, the question of a more general association of education and metalinguistic ability is left open. Gleitman and Gleitman themselves raise the possibility that their paraphrase task may have been as much a test of intelligence as of metalinguistic ability.

One study which describes variation in the metalinguistic abilities of subjects within a single educational group is Scholes and Willis (1988). The authors gave eighty undergraduates a reading skills test, a phoneme deletion task, a morphological analysis task and an oral comprehension (syntax) task. They divided their subjects into three groups based on the reading skills test. They discovered that those subjects with low reading ability also tend to employ word order strategies in comprehending complex sentences. These same low-skilled-readers also had the most difficulty with the phoneme deletion task, accounting for a disproportionately large number of errors.

Even in this group consisting of low-skilled readers with oral language comprehension difficulties, it is nevertheless clear that the problem was not one of understanding the instructions for the task since on those trials where it was possible to provide either a phonological response

(e.g. thought - /t/ = **thaw**) or an orthographic one (e.g. thought - t = **though**), the low-skilled readers had the highest number of phonological responses.

Bever et al. (1990) explored the question of possible differences in native speaker judgments in neurologically defined sub-populations. They found consistent, significant differences between right handed subjects with no familial left handedness and right handed subjects with close relatives who are left handed. As had been the case in their earlier investigation of on-line processing (Bever et al. 1987), subjects with no familial sinistrality evidenced greater use of syntactic structure in performing these judgment tasks.

The idea that not all people share a common cerebral organization is a relatively old one. For example, Zurif and Bryden (1969) reported that for their subjects, who were all male, right-handers and left-handers without left-handed family members showed right ear and right visual half-field effects for linguistic stimuli. Familial left-handers showed some left advantage.

Lake and Bryden (1976) demonstrated the effect of <u>familial</u> as opposed to personal handedness on ear advantage for CV syllables in dichotic listening tasks. They noted that this effect was <u>different</u> for their male vs. female subjects. Regardless of their own handedness, females with left-handed family members showed atypical <u>left</u> ear advantage for CV syllables. Males with left-handed family members showed strong and consistent right ear superiority.

Andrews (1977) demonstrated that lateralization of language

functions, as measured by accuracy in reporting tachistoscopically presented trigrams, is associated with family history of handedness and not personal handedness. These associations are stronger for males than females.[4]

The newer aspect of the discussion, in Cowart (1990), for example, is the explanation of the difference between right-handers with and without family history of left handedness with reference to the emerging literature on the neurological correlates of talent.

### 2.4.1 Neurological Correlates of Talent

N. Geschwind (Geschwind and Behan 1982; Geschwind 1984; Geschwind and Galaburda 1985) put forward a theory of talent as the "overdevelopment" of some particular brain area. He correlates this "overdevelopment" with "underdevelopment" of some adjacent or homologous brain area and with a family history of immune responses like asthma and allergies (along with many other so-called "Geschwind factors").[5]

Smith, Meyers and Kline (1989) also found handedness differences associated with immune disorders, learning disorders and talent in math, art and music. Stuttering and asthma were found to be (weakly) associated with strong left-handedness.

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[4]For a more complete discussion on sex, familial handedness and visual field asymmetry, see Healy (1980).

[5]Geschwind did not specifically address verbal talents in his published works. However, as any brain area might be the sight of unusual cell migration, it seems reasonable to investigate the extension of the "pathology of superiority" concept to language talents. (See also Fein and Obler, 1988)

In Geschwind and Galaburda (1985), the authors discuss possible biologic mechanisms by which various patterns of cerebral organization might arise. They suggest that many phenomena can be explained by assuming that the usual course of fetal development can be altered somewhat by presence of and fetal sensitivity to some male factor - probably testosterone. They intend their hypothesis on lateralization to account for the following:

> *(1) Left-handedness is usually found to be more common in men than in women.*
> *(2) The developmental disorders of language, speech, cognition, and emotion, eg, stuttering, dyslexia, and autism are strongly male predominant.*
> *(3) Women are on the average superior in verbal talents while men tend on the average to be better at spatial functions.*
> *(4) Left-handers of both sexes and those with learning disabilities often exhibit superior right-hemisphere functions.*
> *(5) Left-handedness and ambidexterity are more frequent in the developmental disorders of childhood.*
> *(6) Certain diseases are more common in non-right-handers, eg, immune disorders. (p.431)*

None of the phenomena listed above have been accepted without controversy. The assertion concerning male/female differences in verbal and spatial talents is perhaps the most controversial.

Maccoby and Jacklin (1974) critically reviewed a great deal of the literature on the psychology of sex differences. They found fault with a large number of studies attributing different skills or levels of skills to men and women. They did, however, consider the female advantage on verbal tasks and the male advantage on spatial tasks to be robust.

Buffrey and Gray (1972) suggest a biological explanation for these differences. Drawing on evidence from other mammalian species, the authors

contend that these differences are rooted in the "division of labour between the sexes in reproductive behavior."

Lips and Colwill (1978) emphasize the range of performance found for men and women. They point out that some women exceed the male mean for performance on spatial tasks and some men exceed the female mean for performance on verbal tasks.

Other researchers have attributed the difference in male and female performance on verbal and spatial tasks to differences in societal expectations. Archer and Lloyd (1985), for example, characterize the bulk of these differences as "gender" rather than "sex" differences.

Hyde (1981) reanalyzed the studies described in Maccoby and Jacklin (1974) using statistics which evaluated size rather than significance of differences. She found the differences in verbal ability, quantitative ability and visuo-spatial ability were all quite small.

Rosenthal and Rubin (1982), in a further meta-analysis of sex-difference studies, confirm Hyde's general conclusions. They do, however, insist on the practical importance of even these small differences.

Wattanawaha and Clements (1982) demonstrate that only certain kinds of visuo-spatial tasks yield sex differences. For almost two thirds of their visuo-spatial questions, no sex differences were found in their population of 2,346 seventh through ninth grade children.

Feingold (1988) demonstrates a precipitous decline in gender

differences in performance on aptitude tests in large samples of girls and boys from 1947 to 1983. The formerly large increase in differences between boys and girls during the High School years diminished over that same time period.

Jacklin (1989) assesses past research on gender differences in measured intellectual abilities. She finds little evidence for a biological difference and concludes that if "societal fairness were achieved, then tests of differences in intellectual abilities of males and females could be made equitable".

Geschwind and Galaburda suggested a subtle mechanism for neurological differentiation of the sexes. For example, rather than an all-or-nothing inheritance of a gene for "spatial ability", both sexes would have a chance for testosterone effect pre-natally to produce an "over-development" of right-hemisphere abilities. Male fetuses would have an increased incidence of this shift because of higher levels of testosterone after fetal testes begin producing their own hormones. This would seem a likely candidate for an explanation of small subtle sex differences which continue to be reported in the literature.

If metalinguistic ability is a particular talent, and cannot be wholly predicted by level of education, reading ability or other factors, we would possibly expect differences between subjects with anomalous dominance, associated with the presence of left-handers in the family, and those with standard dominance. We would also expect to find a greater number of

positive Geschwind factors (as determined by Geschwind's questionnaire) among both extremely talented and extremely untalented subjects. Male and female subjects might also be expected to perform differently.

### 2.4.2 Cognitive Factors and Metalinguistic Ability

Differences between groups of normal adults have also been found in studies on the correlation of cognitive factors and metalinguistic abilities. Since the early 1970's, there have been studies linking field independent cognitive style and the ability to "disambiguate" structurally ambiguous sentences (e.g. Goodman, 1971 and Lefever and Ehri, 1976). In the manual for the Embedded Figures Task (EFT: measure of field dependence or independence), Witkin et al. (1971) explain that:

> *. . . persons who have difficulty disembedding simple figures from complex designs in the EFT tend to do less well in solving that class of problems which require isolating an essential element from the context in which it is presented and using it in a different context.*

Since some of the metalinguistic tasks for the current study actually require the subject to restructure the stimuli (see segmenting and morphology tasks described in Chapter Three) and all metalinguistic tasks require the subject to consider linguistic entities divorced from their usual communicative context, it is plausible to predict a negative correlation between metalinguistic skill and field dependence (as measured by the Embedded Figures Test).

Brooks (1980) links cognitive rigidity with the inability to detect linguistic ambiguities. In a group of ninety-one college students, Brooks found

ambiguity detection to be significantly better in his ten least rigid subjects than in his ten most rigid subjects. A significant negative correlation ($r = -.53$, $p < .01$) between rigidity score and ability to detect lexical ambiguities was found. A trend in the same direction was found for the perception of structural ambiguities ($r = -.44$, $p = .026$).

For reasons discussed above, we expect that the facility to consider multiple possibilities for interpretation of linguistic stimuli will generalize to other metalinguistic tasks. That is, a negative correlation is expected for rigidity and metalinguistic skill.

## 2.5 The Present Study

The review of the children's literature demonstrated the early emergence of metalinguistic ability on many linguistic levels. Bilinguals were shown to have an advantage in the development of metalinguistic awareness. Many studies assumed an "adult" level of competence.

The literature on literacy for both children and adults suggests a connection between reading skill and metalinguistic ability. Those studies which employed more than one metalinguistic level found the relationship to hold across linguistic levels.

In the literature on the metalinguistic ability of aphasic patients, often linguistic and metalinguistic deficits are found to be parallel. There are, however, also reports of dissociation.

In studies providing information on the metalinguistic abilities of

unimpaired literate adult native speakers, conflicting results were found. In addition to studies which found no significant differences, studies which found differences between educational groups, inside single educational groups and between neurologically defined groups were reviewed.

Therefore, the following hypotheses will be tested:

1) Groups of unimpaired literate adult native speakers will vary significantly in their metalinguistic ability.
    a) Metalinguistic ability will increase with education.
    b) Since metalinguistic ability has not been found to arise spontaneously, we expect that differences between groups defined by age will be attributable to educational or reading skill differences.
    c) Metalinguistic ability will be at the extreme ends of the range in subjects with high numbers of familial Geschwind factors.
        i) significant differences may be found between groups defined on individual or familial handedness.
        ii) significant differences between male and female subjects may be found.
2) The performance of individual subjects on metalinguistic tasks will be consistent across tasks. Based on the literature, we expect metalinguistic ability to correlate with various aspects of cognitive profile and to

therefore be constant across linguistic levels. Specifically:

a) Subjects with general intellectual ability will exhibit high metalinguistic ability

b) Subjects with high levels of linguistic ability

i Skilled readers

ii Subjects reporting successful foreign language learning experience

iii Skilled writers

will also demonstrate high levels of metalinguistic ability.

c) Subjects with low rigidity will have high metalinguistic ability.

d) Field dependent subjects will exhibit low metalinguistic ability.

Hypothesis 1, regarding subgroup variation, was tested in an initial survey (Phase I) of a large group of subjects defined by age and education. Information on familial health and handedness was obtained. The performance of groups redefined based on this information was analyzed.

Hypothesis 2, concerning individual constancy in metalinguistic skill and the specific correlation of individual aspects of cognitive profile and metalinguistic ability, was examined through a second study. This second study (Phase II) involved analyzing the performance of particularly talented and particularly untalented subjects on a wider range of tasks.

# CHAPTER THREE

## METHODS

The major focus of this study was the evaluation of differences in metalinguistic ability among groups of adults. The study included three groups of subjects: High School Seniors, Graduate Students, and a Control Group. The Controls were matched for age to the Graduate Students and for education to the High School Seniors. Thus, the effect of age and education on metalinguistic ability as defined by our tasks was investigated. All three groups of subjects were given the same three metalinguistic tasks as well as certain standardized tests and questionnaires described below.

A second test battery, given only to those subjects who performed at the extreme ends of the range for their group on some metalinguistic task, allowed a closer examination of the correlations among various metalinguistic tasks. It was also possible to begin to develop an intellectual profile of subjects who were particularly talented or untalented on metalinguistic tasks.

## 3.1 Subjects

The subjects for the initial phase of this study were 128 paid volunteers. All were literate adults who reported themselves to be native speakers of English. Since the literacy criterion functioned only to exclude subjects with little or no literacy, a broad definition of literacy was used. Graduate students were assumed to be literate. Teachers and persons referring other subjects were asked if the potential subject could read.

### 3.1.1 High School Students

The subjects in Group 1 were 46 High School seniors. Of these, 42 were students at a Public High School in Long Island, New York. The other four were students at parochial schools on Staten Island, New York. The only criterion asked of their teachers was that they fulfill the literacy requirement. The High School group was selected to represent students with a broad range of academic achievement.

### 3.1.2 Control group

The subjects in Group 2 were 39 adults with High School Diplomas and no other academic degree. Subjects in this group came from neighborhood and church groups in Brooklyn and Staten Island, New York and through personal contacts. They ranged in age from 22 through 44. Their mean age was 33.

### 3.1.3 Graduate Students

The subjects in Group 3 were advanced graduate students (30 or more credits beyond the B.A.) from The Graduate School and University Center of the City of New York, New York University, The State University of Massachusetts at Amherst and Yale University. Some were solicited by other graduate students. Others responded to posters at their school. The posters advertised for advanced Graduate students who were native speakers of English to participate in a one hour research session, answering questions about themselves and about language. The subjects in this group ranged in age from 22 to 46 with a mean age of 29.

## 3.2 Assessment Measures

All of the subjects were given a one hour pencil-and-paper screening battery which consisted of two parts:

1) A demographic questionnaire, a brief reading test, a health and handedness questionnaire, and the Breskin Rigidity Task.

2) Three metalinguistic tasks.

The tasks in 1) were administered in order to provide necessary background information on the subjects. The tasks in 2) were used to identify subjects with an unusually high or low degree of metalinguistic ability to serve as subjects in the second phase of the study.

Each of the components of the screening battery is reproduced in Appendix One.

### 3.2.1 Assessing Subjects' History

The demographic questionnaire provided information about a subject's academic background and language history. We asked subjects to compare themselves to classmates on language abilities. In addition to these self ratings, we also obtained a gross measure of a subject's tendency to read for detail by administering an adapted version of the Scholes reading test (see below). All subjects also answered a Health and Handedness questionnaire.

#### 3.2.1.1 The Demographic Questionnaire

Subjects responded to a three page survey which covered three main topics. The first topic was academic background. On the first page, subjects provided their age, the language(s) they spoke natively, and any other languages they had some knowledge of. They then summarized their educational history and future educational plans.

The questions on academic background covered several topics including subjects studied, approximate grade-point average and future educational plans. The questions were designed to serve three purposes:

1) It seemed logical that there might be a difference in the performance of college-bound High School seniors and others. However, since all of our High School subjects reported that they planned to further their education, an analysis along these lines is not currently possible.

2) Since the selection criteria specified High School diploma but no other degree for inclusion in group two, we had individuals who had tried college but did not earn a degree, those who had completed post-High School vocational programs, and those who had not had any post-High School training. These questions allowed for an evaluation of the role of these small differences in education.

3) These questions also served to exclude Graduate Students who had knowledge of linguistic constructs such as "phoneme" or "well-formedness judgment". For the Graduate Student group, they were also used to insure a broad sampling of academic disciplines.

The second topic addressed in this portion of the survey was foreign language learning ability. Subjects were asked to describe any naturalistic acquisition of foreign languages after the sixth grade. They also rated, on a five point scale, their speaking, listening, reading, writing and pronunciation abilities in whichever language (other than English) they knew best. With respect to classroom learning of foreign languages, subjects were asked to compare themselves with classmates on a five point scale from much worse to much better. From these data, an overall foreign language score was derived. This number was the sum of the two rating scale averages with one point added for a positive language learning experience described in the open-ended questions and one point subtracted for a negative description.

Finally, this survey asked subjects to compare their overall English skills as well as specific reading and writing skills with those of their classmates on a five point scale from much worse to much better. They were also asked to give any information they remembered about when and how they learned to read. For the purposes of our present analyses, two numbers were used; the subject's self-ratings on overall English ability and on reading ability (much worse = -2 ... much better = 2)

### 3.2.1.2 The Reading Skills Test

The reading test was an adapted version of the Scholes and Willis (1988) Reading Skills Test. In our version, as in theirs, subjects are presented with twelve questions and are asked to circle the correct answer for each. The questions are constructed such that correct interpretation requires careful reading. The subject must process inflectional and other closed class morphemes. For example, questions two and nine (below) play on the difference between the phrases man-eating fish and man eating a fish:

2) What does a man-eating fish eat? MEN FISH

9) What does a man eating a fish eat? MEN FISH

The reading test was not formally timed, but subjects were asked to work through the page quickly, allowing no more than a minute or two for the entire page. Each subject's score was the number of correct responses.[1]

### 3.2.1.3 The Health and Handedness Questionnaire

All subjects also answered either a ten page or a twelve page Health and Handedness questionnaire. These questions evaluated individual and familial handedness using four pages of questions from the Edinburgh and Oldfield scale. Subjects answered specific questions about their own hand, eye

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[1]For questions six and ten (repeated below) we added the choice either to the Scholes and Willis answers. This was the only answer we accepted as correct for question ten.

6) If John fires Bill to get the account, who is supposed to get the account? JOHN BILL EITHER

10) If John hires Bill to get the account, who is supposed to get the account? JOHN BILL EITHER

and foot usage, as well as general questions concerning the handedness of parents, grandparents and siblings. They also provided a writing sample with each hand.

For the purposes of our analyses, subjects were considered right-handed if, for each of the activities questioned, they reported always or usually using the right hand. Familial handedness was considered mixed if any first or second degree relative was reported to be left-handed or ambidextrous.

The questionnaire also asked for information on "Geschwind factors" in the families of our subjects. Two pages were devoted to questions on subject's and familial hair and eye color. Three pages covered family history of immunological and/or endocrinological disorders. Since most of the questions concerning hormonal conditions involved fertility issues, these were given only to the Control and Graduate Student groups.[2] A "Geschwind factor total" was computed for each subject, scoring one point for each positive answer on the common sections.

The final page of the questionnaire allowed subjects to inform us of any other unusual aspects of their own or familial health history, including the occurrence of any unusual talents. The total number of talents each subject reported for him/herself was the final score derived from this survey data.

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[2]These two groups were also asked about offspring in the questions which concerned first degree relatives.

### 3.2.1.4 The Breskin Rigidity Measure

Since cognitive rigidity has been linked in the literature to inability to detect ambiguity (Brooks 1980), we wanted to investigate possible correlations between rigidity and other metalinguistic abilities. The Breskin Rigidity test was used as a measure of rigidity. Subjects are shown fifteen pairs of common abstract visual symbols and asked for each pair to choose the one they like better. In each pair, for one symbol, the parts of the symbol fit nicely into the whole, allowing a sense of "closure". The other symbol is not constructed in this way. More rigid subjects choose a greater number of symbols which adhere to the Gestalt course. For example, in the pair below, more rigid subjects will choose the figure on the left.

This task has been shown to differentiate between students in fields generally considered to attract more rigid (accounting and secretarial students) and less rigid (art) students. It has also been used to differentiate groups of art designers rated "more" and "less" rigid by an art director (Breskin, 1968).

### 3.2.2 The Metalinguistic Tasks

Three metalinguistic tasks were administered. Since we wanted to sample a broad range of language areas, we chose one task from each of three areas generally considered to be components of the grammar of any language:

phonology, morphology and syntax. The particular tasks used were chosen because they had been used with children and/or adults by other researchers and because it was possible to present them in a non-interactive format.

Our objective in administering these metalinguistic tasks was to locate those subjects who were inclined to "think like linguists"; who were able to manipulate the form of linguistic materials divorced from their usual communicative context. Our pilot work had indicated that for the phonology and morphology tasks, some illustrative examples were necessary in order for subjects to understand the task. Our instructions for each of the tasks were otherwise brief and simple (see Appendix One).

#### 3.2.2.1 The Phonology Task

In the phonology task, subjects were asked to imagine which English word(s) would result if one of the sounds which comprise a word were deleted or if a particular sound were added to the given word. This type of exercise is commonly used with young children to practice reading readiness skills. For example, in Program II: Auditory-motor Skills, a volume of the Perceptual Skills Curriculum (Rosner, 1987) used in many New York City classrooms, the following exercise descriptions are found:

F8: Given spoken 1-syllable word, repeat word omitting initial sound.

G8: Given spoken 1-syllable word, repeat, omitting final sound.

H8: Given spoken word, repeat, omitting one sound of a 2-consonant blend.

Working with literate adults, two modifications of this task suggested themselves. 1)The task could be presented in writing, with instructions for the subject to consider the sounds represented by the letters rather than the letters themselves. 2)Given this written presentation, the level of difficulty could be increased by choosing word/sound combinations where orthography and phonetic representation conflict.

Following Scholes and Willis (1988b), we designed our task to include examples of the type thought minus(-) 't' = thaw (not though) and straight -'r' = state. We also included examples which asked the subject to analyze the sub-components of a unit represented as a single entity either orthographically (text - 'k' = test) or even possibly phonetically (queen - 'w' = keen and chip - 't' = ship). There were examples which provided two "blanks", asking the subject to consider two possible placements for a sound (sue + 't' = suit or stew) and others which were straightforward in that there was no tension between orthography and phonology (spit - 'p' = sit).

The task contained a total of 37 items. The first 17 asked the subject to delete a sound. Of these, three were straightforward (ie. splash - 'p' = slash), eight required a change in the orthographic representation of the remaining sounds (ie. planned - 'n' = plaid) and six were further complicated in that the sound to be deleted was part of a "single" phonological or orthographic unit. The twenty items which required the subject to add a sound

consisted of five uncomplicated items (ie. top + 's' = stop or tops), ten items with orthographic/phonetic tension (ie. ocean + 'n' = notion) and five items in which the addition of the given sound made it necessary to reorganize two units into one (ie. coast + 'k' = coaxed, tap + "sh" = chap)

Subjects were given one point for each correct response. It seemed to us that subjects who filled in a wrong answer were demonstrating a particularly low degree of awareness (i.e. they did not realize as they wrote their answer that it did not work). They were therefore penalized one point for each wrong answer, such as planned - 'n' = plained.[3]

### 3.2.2.2 The Morphology Task

Our morphology task introduced "nonsense" words in the context of a story. Subjects were asked to fill in blanks later in the story by creating additional "nonsense" words through morphological manipulation of the "words" they had been given. Since Jean Berko-Gleason's (1958) invention of the famous "wug" test, which elicits the three plural allomorphs from young

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[3]For example 22: we're + 'k' = _____

we expected the answers weaker and queer. We also found the unexpected response work. This response is possibly the result of a misreading of we're as were. It is also possible that subjects read correctly but did not "hear" that we're + k = [wirk] as opposed to [wɝk]. Finally it is possible that a subject may have considered the pronunciation [wɚ] for we're; a pronunciation which although not possible in citation form, is possible in casual connected speech in some dialects. Since this response can reflect either a high or a low degree of awareness, we have decided to score it as a blank response (i.e. neither add nor subtract a point for this response).

children using pictures of imaginary creatures, similar tasks have been used to assess other aspects of children's developing morphology. For example, deVilliers and deVilliers (1974) report on their investigation of the development of past tense morphology using the "nonsense" word technique.

One study which uses this technique with adults is Scholes and Willis (1988b). The authors used stories without pictures to present made-up words and were able to test for more complicated morphological processes such as compounding.

In our study, subjects were presented with five stories with six "nonsense" words and a total of twenty items to create. All of the "nonsense" words obeyed English phonotactic/orthographic constraints. The following morphological manipulations were required by the five stories:

| | |
|---|---|
| 1) singular noun --> | plural noun (zar --> zars) |
| | adjective (zarry) |
| | comparative (zarrier) |
| | superlative (zarriest) |
| 2) noun --> | verb-gerund (bliff--> bliffing) |
| | -past (bliffed) |
| | -future (bliff) |
| | agentive noun (bliffer) |
| noun,noun --> | compound noun (bliff,sogs --> bliffsogs) |
| 3) noun --> | adjective (finum --> finual/finumly) |
| noun --> | other derivative noun (senum)[4] |

[4]This item requires an analysis of the internal structure of the "nonsense word". For the reader's convenience, this test item is repeated here (See Appendix One for entire task.): "If five years equal one finum and six years equal one sinum, then seven years equal one _____." (possible answer: senum)

| | |
|---|---|
| 4) agentive noun --> | verb (bealer --> beals)<br>noun (bealth/bealthiness)<br>adjective (bealthy) |
| 5) adjective --> | verb-infin. (flarkable--> flark)<br>-gerund (flarking)<br>noun (flarkability) |

Each of the subject's responses was given a score from zero to three, depending on the number of the following criteria the answer satisfies:

a) Subject has chosen the appropriate root.

b) Subject's response is the correct part of speech.

c) Subject has used an analogy suggested by the text.

For example, the first story begins:

> *"A new kind of cat is being bred. They are born with zig-zag stripes. We'll call this kind of stripe a zar. If a cat has more than one zar, it has many _____."*

The response zars satisfies all three criteria. Examples of two point responses are given in (1a-c).

1a) fiegs (b&c but not a)[5]

b) zaring (a&c but not b)

c) antizars (a&b but not c).

One point responses satisfy only one criterion (for example, antizarful would satisfy only criterion a). Zero point responses are blanks as well as "words" which satisfy none of the criteria (e.g. antifiegful). The rare cases which were

[5]In cases such as this, it is not possible to determine the intended part of speech (fiegs could be a noun or a verb). Subjects were only penalized when it was not possible to interpret their answer as being the correct part of speech.

unclear were scored by two other linguists and discussed until concensus was reached.

### 3.2.2.3 The Syntax Task

The Syntax task elicited well-formedness judgments for 60 strings of English words. Subjects were asked to "circle all of the sentences which seem like possible English sentences . . . ". The sentences were of three types:

1. Unarguably "grammatical" sentences. (e.g. The teacher put the chalk in the box.)

2. Sentences with grammaticality/acceptability tension. These came from two sources. Cowart (in preparation) reports on subjects' judgments of well-formedness for sentences obeying and not obeying subjacency. We chose those grammatical sentences most likely to be rated unacceptable by Cowart's subjects and also those ungrammatical sentences most likely to be rated acceptable. Other sentences came from Spencer's (1973) report on subjects' judgments on sentences used in the early transformational literature being at variance with judgments reported by linguists in these early works. Again, we chose sentences from the extremes in both studies; that is, "ungrammatical" sentences which were frequently judged to be well-formed (e.g. What did the newspaper print Allison's photo of?) and "grammatical" sentences frequently judged to be ill-formed (e.g. Where did the students sing Dylan's songs about freedom?)

3. Unarguably ungrammatical sentences (e.g. Who what where saw?)

After subjects had circled all of the strings which they considered to be sentences of English, instructions on the following page asked them to rate each of the sentences they had not circled as to its degree of "awkwardness": 1 = only slightly odd, 2 = totally unacceptable.

The goal of scoring for this task was to quantify discrepancies

between linguists' assessment of the target sentences and each subject's assessment.

Sentences in category 1. were given an experimenter rating of 0. Sentences in category 2. which were considered by linguists to be well-formed were also given an experimenter rating of 0. The remaining sentences in category 2. were given an experimenter rating of 1. Sentences in category 3. were given an experimenter rating of 2.

Using 0 for the circled sentences and 1 or 2 for the others, we determined a subject rating for each of the sentences. The subject's total score for this task was the sum of the absolute value of the differences between the experimenter ratings and the subjects' ratings for each of the sixty strings.

## 3.3 Selection Criteria for Phase II

In order to address other issues in metalinguistic ability with a smaller group of particularly talented and particularly untalented subjects, subjects of various types were needed. Examining the distribution of metalinguistic scores revealed that the top scorers were Graduate Students and the lowest scorers were High School students. In order to interview talented High School students and untalented Graduate Students, selection criteria were applied separately for each of the three groups.

For each of the metalinguistic tasks, a group mean was determined for each group. For the starred tasks/groups in the list below, it was possible to identify between one and three subjects who had scored two or more

standard deviations below the mean for their group.[6]

1) High School Seniors with high phonology scores.
2) High School Seniors with low phonology scores.*
3) High School Seniors with high morphology scores.
4) High School Seniors with low morphology scores.*
5) High School Seniors with high syntax scores.
6) High School Seniors with low syntax scores.*
7) Control Subjects with high phonology scores.
8) Control Subjects with low phonology scores.
9) Control Subjects with high morphology scores.
10) Control Subjects with low morphology scores.*
11) Control Subjects with high syntax scores.
12) Control Subjects with low syntax scores.
13) Graduate Students with high phonology scores.
14) Graduate Students with low phonology scores.*
15) Graduate Students with high morphology scores.
16) Graduate Students with low morphology scores.*
17) Graduate Students with high syntax scores.
18) Graduate Students with low syntax scores.

All of these outliers were invited to participate in a further study. In addition to these subjects, we also contacted subjects in each of the remaining categories. We simply selected the subjects who had the highest and lowest scores for each task/group. In each case, subjects' scores were at least one standard deviation above or below the mean. The distribution of scores was such that there were between one and three subjects at the extreme ends of the range for each task/group.

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[6]For all tasks, either the group mean was less than two standard deviations below the ceiling or no subjects performed well enough to be two standard deviations above the mean.

## 3.4 Testing of Talented and Untalented Subjects

Using the method described above, we identified twenty four possible subjects for inclusion in the second phase of this study. Subjects were informed that because their responses had been particularly interesting, we wanted them to participate in a four hour interview in which we would be "playing more language games" and also looking at visual patterns. They were offered seventy five dollars for their participation. Four subjects declined to participate. The remaining twenty subjects were interviewed and given the test battery described below. The testing took place at a location of the subject's choosing. In each case it was a quiet setting with as few opportunities for interruption as possible. Tasks were administered in two two-hour sessions on the same day. A break (one half to one hour) was scheduled between the two sessions. Other breaks were allowed between tasks at the subjects' request.

### 3.4.1 The Standardized Tests

In the first two-hour session, subjects were given several standardized tests: The Raven's Progressive Matrices, six subtests from the WAIS-R and the twelve item version of The Embedded Figures task.

#### 3.4.1.1 The Raven's Progressive Matrices

We included the Raven's Progressive Matrices (Raven's 1938) in our test battery because we wanted to assess subjects' intellectual abilities without simultaneously drawing on linguistic or metalinguistic ability. In this test, subjects are presented with a large patterned picture. One section of the

pattern is missing. The subject chooses from among multiple choice options the small picture he/she feels will best complete the pattern. According to the manual which accompanies the 1988 edition, the Standard Progressive Matrices (SPM)

> *is a test of a person's capacity at the time of the test to apprehend meaningless figures presented for his observation, see the relations between them, conceive the nature of the figure completing the relations presented, and, by doing so, develop a systematic method of reasoning. The scale consists of sixty problems divided into six sets of twelve. In each set, the first problem is as nearly as possible self-evident. The problems which follow become progressively more difficult. The order of the items provides the standard training in the method of working. The five sets provide five opportunities for grasping the method and five progressive assessments of a person's capacity for intellectual activity.*
>
> *(p.2)*

The method for administering this test is determined by the instructions given in the manual (SPM2): "All subjects, whatever their age, are given exactly the same series of problems in the same order and asked to work at their own speed, without interruption, from the beginning to the end of the scale." The subject's raw score is simply the number of correct answers. The manual provides norms by age group which are used to determine a subject's percentile ranking. In addition, total scores are checked for consistency by comparing subject's score on each of the five sets with the score normally expected on that set for persons with the same total score.

#### 3.4.1.2 The Wechsler Adult Intelligence Scale (WAIS-R)

In contrast to the SPM, the WAIS-R includes not only non-verbal performance subtasks, but also six verbal subtasks which examine ability

through a linguistic medium. Some of the six verbal subtests even demand a certain amount of metalinguistic ability. For example, the Vocabulary subtest not only tests for a subject's familiarity with the lexical items, it awards points differentially depending on the quality of the definition given.

Those tests which correlate most strongly with "general ability" were administered. From the verbal subtests, Vocabulary, Information, Comprehension, Arithmetic and Similarities were chosen. From among the performance subtests, only Block Design was given. The tests were administered according to the usual method for giving the WAIS-R. They were presented in the standard order; the six subtests not used were simply omitted.

The subtests administered are described below. All of the descriptions are after Lezak (1983):

1) Information. The twenty-five information subtest items test general knowledge. "The items are arranged in order of difficulty from the four simplest, which all but severely retarded or organically impaired persons answer correctly, to the most difficult, which only few adults pass." (p. 256) The first question asks "Where does the sun rise?". The last question asks "Who wrote Faust?". The test is discontinued after five consecutive failures. One point is scored for each correct answer.

2) Vocabulary. This subtest consists of thirty-five words arranged in order of difficulty. For all of our subjects, the usual procedure of beginning administration with the fourth item, winter, was followed. The test continues until the subject fails five consecutive words or until the last words (audacious, tirade) have been administered. "The subject can obtain one or two points for each acceptable definition, depending on its accuracy, precision, and aptness." (p. 270)

3) Block Design. This is a construction test. The subject manipulates four or nine identical red and white blocks to create a design. The

instructor provides models for the first two items. Subjects work from pictures for the remaining seven items. All items are timed. Subjects can earn bonus points for speed on items 3-9. The test is discontinued after three failures.
"Block Design is generally recognized as the best measure of visuo-spatial organization in the Wechsler scales. It reflects general ability to a moderate extent so that intellectually capable but academically or culturally limited persons frequently obtain their highest score on this test." (p.279)

4) Arithmetic. This subtest consists of fourteen items arranged in order of difficulty. For all of our subjects, the usual procedure of beginning administration with the third item (How much is five dollars plus four dollars?) was followed. All of the items from 3-14 are timed, with fifteen second limits for the first four and longer limits for the more difficult items. For example, item 14 has a 120 second time limit. It asks "If eight machines are needed to do a job in six days, how many machines would be needed to do the job in one half day?". The test is discontinued after four consecutive failures. Subjects score one point for each correct answer, with bonus points awarded for rapid responses on the last four items.

5) Comprehension. "This subtest includes two kinds of open-ended questions: [13] test common-sense judgement and practical reasoning, and the other three ask for the meaning of proverbs. Comprehension items range in difficulty from a common-sense question passed by all non-defective adults to a proverb that is fully understood by fewer than 22% of adults.(Matarazzo, 1972)" (p.259)
An example of the common sense type question is: "What is the right thing to do if while in the theater, you are the first person to see smoke and fire?". One of the proverbs given is "One swallow doesn't make a Summer."
Subjects "can earn one or two points for each question, depending on the extent to which the answer is either particular and concrete or general and abstract." (p. 260)

6) Similarities. "This is a test of verbal concept formation. The subject must explain what each of a pair of words has in common. The word pairs range in difficulty from the simplest ('orange-banana'), which only retarded or impaired adults fail, to the most difficult [...'praise-punishment'...]. The test begins with the first item for all subjects and is discontinued after four failures." (p. 265)
Subjects score zero, one or two points for each of the fourteen items, depending on the quality of the answer given.

We considered the various subtests of the WAIS-R to measure ability to manipulate various kinds of information rather than measuring a unitary "intelligence". As we did not intend to use the WAIS-R scores to project an overall I.Q. score, and pilot subjects had been particularly uncomfortable with the idea of a formal I.Q. test, subjects were told that we wanted to see whether "the kind of answers you gave on the language games has anything to do with how you do on school-type tests." The Information subtest was described as being like a Social Studies/Science test. The Vocabulary, Block Design, and Arithmetic subtests were described as being like English, Visual and Math tests respectively. The Comprehension subtest was described as being like a test of Common Sense. With this exception, instructions were given as per the WAIS-R manual.

#### 3.4.1.3 The Embedded Figures Task

Research beginning in the early 1970's has linked field independent cognitive style and the ability to "disambiguate" structurally ambiguous sentences (e.g. Goodman, 1971 and Lefever and Ehri, 1976). In light of this research, we felt it could be important to investigate the link between field dependence/independence and other metalinguistic skills.

The terms "field dependent" and "field independent" describe two ends of a continuum. For people who are "field dependent", perception of the parts of a field is greatly influenced by the overall organization of the field. "Field independent" people experience the parts of a field as discrete, with

context playing a less important role. Earlier instruments used to assess subjects' place along this continuum include the Rod-and-Frame Test (Witkin, 1948) and the Body-Adjustment Task (Witkin, 1949). The Embedded Figures Task (EFT) correlates highly with these other tasks and is portable as well as easy to administer. As described in the EFT Manual (Witkin, et al. 1971), the

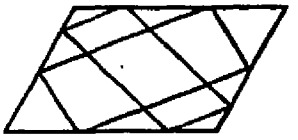
> *EFT is a perceptual test. The subject's task on each trial is to locate a previously seen simple figure within a larger complex figure which has been so organized as to obscure or embed the sought-after simple figure.*

Each subject was given the same twelve figures and the same practice trial. Instructions were given as directed by the EFT Manual. Subjects were allowed up to three minutes to find each figure and were encouraged to look at the simple figure again if they had forgotten what it looked like. One subject became so frustrated with her lack of ability to find the simple figures that it became necessary to use the instructions for the children's version of the task. Approving comments were made when she found some part of the figure. She was shown the simple figures she failed to locate within the three minute limit after the watch had been stopped.

For each trial, the number of seconds to a correct solution was recorded with a stopwatch. The watch was stopped during the times when subjects were looking at simple figures for a second or subsequent time. As directed by the manual, failed trials were scored as 180 seconds. Subject's overall score for the EFT is the mean solution time across trials. The complex

figure and simple figure for trial number six are reproduced below:[7]

Complex figure:



Simple figure to be found in the complex figure:

### 3.4.2 The Metalinguistic Battery

In the second two-hour session, subjects were given seven metalinguistic tasks. Some used new tools to evaluate the same skills as the initial screening test. Phoneme counting, for example, requires perception of the word as a sequence of individual phones in much the same way as did the initial phonology task. Others explored new aspects of a previously tested linguistic domain (e.g. questions of structure in syntax or of prosody in phonology). All metalinguistic tasks from the second phase of the study are reproduced in Appendix Two.

Tasks were given in the order in which they are described below. We began with syllable counting because research with many different

[7]Trial six is presented in black and white as illustrated above. In all other trials, color is used to obscure the simple figure.

populations has shown that this skill is one of the easier metalinguistic abilities to acquire. It also provided an analogy for describing the process of phoneme segmentation, a much more difficult task. The order of the remaining tasks was chosen to provide an alternation of independent and interactive work.

#### 3.4.2.1 The Syllable Counting Task

This task required subjects to enumerate the syllables or "groups of sounds" contained inside longer words. Subjects were asked to repeat a word after the examiner, tapping once for each syllable as it is spoken. The procedure was demonstrated using the words 'but', 'butter' and 'butterfly'. For 'butter', two possible syllabifications were illustrated. Subjects were given a set of four practice items (two monosyllabic words and two with two syllables) and were provided with feedback on these items.

There were twenty-four test items; five monosyllables, six words with two syllables, seven with three and six with four. The twenty four items were presented in the same pseudo-random order to each subject. Subjects heard each word read once by the examiner. The number of taps made during the subject's first repetition of the word was recorded. Any attempts at correcting responses were also recorded. Using the last response given, subjects were given one point for each of the words for which they determined the correct number of syllables. Subjects' score for this task was the total number of

correct responses.[8]

Two of the test items (area and stereo) contained two adjacent vowels, which our pilot study had shown to be difficult for people with low metalinguistic ability. For one item (slammed), the orthographic shape of the word suggested a different number of syllables than the actual phonetic shape (two vs. one). Otherwise, all of the test items were completely straightforward.

#### 3.4.2.2 The Segment Counting Task

The second subtask tested the subject's ability to analyze words as strings of phonemes. Very young children play language games which demonstrate the ability to segment words, at least partially, into phonemes.[9] Yet, it seems particularly difficult to bring this kind of knowledge into consciousness. This task was therefor designed to give quite a bit of explicit training. The training is done in stages so that information can be obtained both on initial level of awareness of words as a sequence of phones and on the ability to achieve such awareness.

The subjects were given instruction and practice on segmenting using the words a, two, tooth, boot, boo, at, fat, tea and food. Although these words provided examples of words where the number of graphemes differed

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[8]Since there were approximately the same number of correct and incorrect responses being changed, the choice to use last responses was essentially an arbitrary one.

[9]My son, for example, made up alliterative names for family members (e.g. mommy-mu, nanny-nu, Raymon-ru) at age 1:8. In response to this one of the adults began calling him Torsten-ku, which was promptly corrected.

from the number of phonemes, there were no examples of consonant clusters in any position.

Subjects were then asked to determine the number of sounds in each of twenty-four English words. The instructions explained that after the first three sets of six words, there would be an additional two practice items, in order to "refresh their memories", "whether or not [they were] having trouble with this exercise". It was suggested that they actually speak the segments while tapping once for each.[10]

In the first group of six words, subjects encountered one medial cluster and one initial cluster. The first set of practice words allowed for instruction and practice using words like catnap, into and seldom in order to provide examples of medial clusters being correctly segmented. First, correct segmentation was modeled. Then feedback was provided on the subject's segmentation attempts in these practice trials.

The second set of six words contained one medial cluster, one initial cluster and one final cluster. The practice words after this set included instruction and practice with words like trap, strap, frill and stiff; illustrating the isolation of components of initial clusters.

In the third set there were two initial clusters and two final clusters.

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[10]This suggestion was made on the basis of a pre-trial experiment in which three literate adults averaged 5 errors out of 14 items while using the tap only method. One of these subjects improved greatly when actually trying to articulate the sound while tapping. The others improved slightly.

The practice after this set contained words such as plan, plant[11], part and flask, providing examples of correctly segmented initial and final clusters. By way of illustration, the last set of six was as follows: frame, screamed, ponds, suit, jinx and slew.

Subjects were provided with feedback only on their performance on practice trials. As in the syllable counting task, the number of taps made during the subject's first repetition of the word was recorded. Any attempts at correcting responses were also recorded. Using the last response given (again, an arbitrary decision), subjects were given one point per correct response as their score for this task.

#### 3.4.2.3 The Morphology Task

In the morphology task subjects were asked to determine which morphologically complex English word they could create given an English root and two morphologically complex English words from which to select an additional morpheme. In the instructions, subjects are told that they will "be using pieces of words to make other words." In each case, they are given "two words to choose parts from and another word to build onto". As practice items, they are given the words 'dislike' and 'unhappy' and asked to make a new word first with 'fortunate' (unfortunate) and then with 'approve' (disapprove).

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[11]All of the subjects are speakers of dialects in which plan and plant are phonetically distinct.

The twenty four test items consisted of twelve word-pairs, each presented twice with two different "words to build onto". Fourteen of the pairs contain only suffixes, four only prefixes and six, both suffixes and prefixes. All subjects heard the test items presented in the same pseudo-random order.

In ten of the twenty four cases, the two word-pair items involved roots from different parts of speech. The target root belonged to one of these categories. For example, given readable (verb --> adjective) and oddity (adjective --> noun) with the target root scarce, only "scarcity" is possible since scarce is an adjective.

For the remaining fourteen, both word-pair morphological processes operated on the same part of speech. For example, glorious and boyish are both examples of noun to adjective derivation. However, given the target root joy, a noun, it is still the case that only one answer, joyous, is possible.

The same twenty-four test items were presented twice in the same order to all subjects. Initially, subjects heard the test items presented on tape. The items were presented the same way each time: WORD 1, WORD 2; Make a new word with TARGET ROOT. There were three seconds between the test items.

After hearing the tape, subjects were given the same items on paper, with no time pressure. In this way, we could be sure that poor performance on the taped version was due to an inability to do the morphological work required in the time provided and not due to unfamiliarity with the target

words.

The two conditions were scored separately, with one point per correct response given in both cases. Since many subjects initially had trouble adjusting to the quick pace of the tape, we allowed the tape to be restarted after the second test item and we excluded the first two items from scoring.

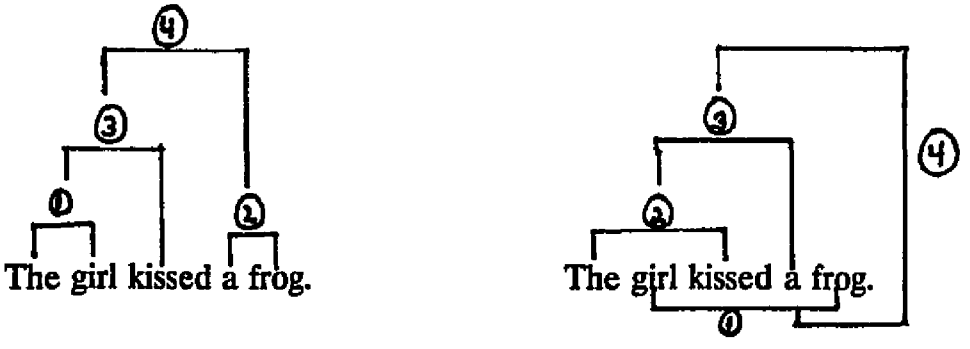
#### 3.4.2.4 The Phrase Tree Task

This task examined subjects' ability to represent intuitions regarding the syntactic structure of four English sentences. Although the construction of linguistic theories does not depend on native speaker judgments about structure, the idea that naive informants might have intuitions as to the structure of sentences in their native languages is not an original one. Many experimenters have worked with tasks which were designed to access precisely these intuitions, indirectly. For example, both Zurif et al. (1972) and Kolk and van Grunsven (1984) used a technique in which subjects were asked to pair two out of three words in a sentence, with all possible triplets presented. They used the frequency with which words were paired to measure the extent to which subjects were making use of structural information. Zurif found unusual inability to associate words in a sentence based on their syntactic position to be common in patients with left brain damage. Kolk and van Grunsven also find a range in ability to make syntax-based associations, however, they did not find low ability associated with left brain damage.

Our task attempted to teach subjects to represent their intuitions

about structure directly. Subjects were trained to indicate the structure of sentences by "drawing lines connecting each next pair of closely associated units until all of the units have been included". The order in which the associations were made was indicated by numbers written above each connecting line. The "sentences" in the training exercise consisted of "words" made out of varying lengths of different colored cardboard. The possibilities for associating units based on color and based on length were illustrated. The subject practiced the diagram drawing technique on a new "color-sentence" and received feedback. The subject was then given four English sentences to diagram.

A syntactic approach to this task would result in a subject diagram which looked much like a linguist's Phrase Marker for that sentence. A semantic, lexical category, or inconsistent approach would result in a diagram in which many of the lines crossed. Subjects were given one point for each line drawn within the maximal projection (~phrasal category) of a lexical item. Two actual subject responses are given below. Note that for the response on the right, the article and main verb are associated, just as they were for the Broca's patient in Zurif et al. (1972).



### 3.4.2.5 The Stress Task

In this task, subjects were asked to provide written paraphrases for novel compound nouns presented orally. As discussed by Gleitman and Gleitman (1971), this is a difficult task. It requires sensitivity to stress patterns, recognition of the lexical category of the words in the compound, and the ability to express the meaning of the compound in a new way.

Our version of the task presented twenty-four of the compounds from the Gleitman and Gleitman (1971) study. All contained the words 'bird' and 'house' as well as one word from the following list: kill, wash, foot, boot, thin, black and bright. Each sequence was taped with either 132 or 213 stress. Each was read twice with the same intonation pattern. All subjects heard the same tape.

The instructions asked the subjects to listen to "the words and the way they are said". Practice examples included familiar compounds (blackboard eraser (213) vs. black board-eraser (132)), unusual compounds (old mouse-school vs. old-mouse school) and anomalous compounds (school old-mouse vs. school-old mouse). Test items included no familiar compounds and only two of the merely unusual type.

Experience with pilot subjects had demonstrated that subjects were more comfortable writing nonsensical paraphrases for our compounds when the examiner was not present. Subjects were given instructions on how to pause the tape between test items and the examiner left the room while they wrote.

Subjects were given one point for each compound correctly paraphrased. For example, for item twenty-three, bright bird-house, a one point response might be gaily colored home for birds. Paraphrases which were ambiguous between correct and incorrect interpretations of the compound given its stress pattern were scored as correct (e.g. house for bird that is bright for item twenty-three).

The types of errors made by each subject were also noted. Following Gleitman and Gleitman (1971), paraphrases which would be correct for a compound which had the same words but the other stress pattern were coded as **Errors of Stress** (e.g. house for smart birds which would be correct for bright-bird house but **not** for item twenty-three: bright bird-house ). Paraphrases which were appropriate for the same words spoken in a different order were coded as **Errors of Order** (e.g. as bright as a bird house which would be correct for bird-house bright). **Errors of Chaos** are those paraphrases which could only be correct for the given lexical items spoken in a different order and with a different stress pattern (eg. bird that lives in a bright house which could only be correct for bright-house bird). **Errors of Format** are non-paraphrases (e.g. Is the bird-house bright ? for item twenty-three). **Balks** are missing responses as well as responses which consist of the three lexical items written down with no indication of a possible interpretation for the compound (e.g. bright bird house).

### 3.4.2.6 The Intonation Task

In this reiterant speech task, sentences were read aloud with normal intonation. Subjects were requested to repeat each sentence, preserving stress and intonation contours, but replacing each syllable of actual phonemic content with some nonsense syllable. Linguists investigating adult abilities to perform this type of task have reported great inter-subject variation (Harris p.c.)

To obtain a gross measure of ability to produce reiterant speech, subjects were presented with twelve sentences which ranged in length from six to fifteen syllables. All were chosen from a children's toy catalog. Incomplete or syntactically complex sentences were not chosen. Each sentence was played on tape and the subject was requested to repeat "that same sentence using the syllable 'ba' to replace all of the syllables in the sentence." The procedure was illustrated by the examiner, using the sentence "Mary had a little lamb", repeated as ba-ba-ba-ba-ba-ba-ba. Feedback was provided for the two practice sentences (one read aloud and one from the tape).

The examiner scored subjects' responses onto a score sheet. For each sentence it was possible to earn one point for repeating the correct number of syllables and another for having the major stresses correctly placed. Correctness of the responses was determined by the examiner who had trained in distinguishing correct and incorrect responses using taped materials gathered during the pilot study.

#### 3.4.2.7 The Ambiguity Detection Task

Eighteen sentences, ranging from obviously through subtly ambiguous were selected from Brooks' 1980 study. Six of these were (obvious) lexical ambiguities (e.g. The driver took the right turn at the intersection). The others included both relational (e.g. The chickens are ready to eat.) and structural (e.g. The doorman hit the man with the stick.) ambiguities. We interspersed six unambiguous sentences with these (e.g. They went to the zoo and saw the elephants and the monkeys.)

The sentences were presented on a typewritten page with instructions for the subject to "mark with an 'x' those which have more than one meaning." After the subjects had completed this page, they were requested to explain the two or more meanings for the sentences they had marked. One point was scored for each ambiguity correctly detected and explained.

### 3.4.3 Evaluating Subjects' Reading and Writing Ability

The mutually beneficial relationship of metalinguistic ability and reading ability has been demonstrated in adults with low literacy skills (Greenberg, 1987). In order to evaluate this relationship in literate subjects, a brief reading and writing test was administered.

#### 3.4.3.1 The Reading Task

An article about the strike against Greyhound was selected from the New York Times. Subjects were asked to read the article at their usual reading pace. They were told that after they had finished reading, the

examiner would remove the article and they would be asked to answer questions about it. Subjects' reading times were noted.

### 3.4.3.2 The Writing Task

Subjects answered three questions in writing. One dealt with material presented at the beginning of the article, one with material from the middle and one with material from the closing paragraphs. Each of these three questions could only be answered from the article; general knowledge about the Greyhound strike was insufficient for an answer.

The first three questions required a sentence or phrase for a response. The fourth item asked subjects to write "a brief essay defending either the labor or the management position in [the] strike." None of the written responses were timed.

#### 3.4.3.2.1 Evaluation of Written Work.

Subjects' written work was typed exactly as it had been written (i.e. spelling and other errors were retained.) Each subject's work was evaluated by three different credentialed English teachers, each of whom had at least five years teaching experience. The teachers were asked to rate each subject's writing on a six point scale for each of the criteria listed in 2a-f.

2a) The answers to questions 1-3 reflect a good understanding of the article.
b) The essay argues clearly for either labor or management.
c) The essay is well organized.
d) A variety of grammatical structures are used.
e) Spelling, punctuation & capitalization are generally correct.
f) This person writes well.

Each rater assigned a score between one and six for each subject for each of these criteria. The score used for analysis in this study is the subject's average score for each criterion across the three raters.

3.4.3.2.2 Inter-rater Reliability. Inter-rater reliability was determined as follows. For each subject, the score given by each of the three raters was compared for each criterion. The criterion was considered to show 100% reliability if all three raters gave the subject the same score or scores within one point. A reliability of 67% meant that two out of three raters had assigned scores which were within one point of each other. Zero reliability indicated a subject/criterion for which none of the raters agreed within a one point tolerance. The mean reliability for all subjects/criteria was 98.4%.

# CHAPTER FOUR

# RESULTS

This chapter presents the results of ANOVAs and two-tailed T tests for all between group differences. The results of correlation procedures are also used in developing a profile of subjects with high and low degrees of metalinguistic ability.

## 4.1 Between Groups Differences

The central hypothesis tested by this study is that groups of literate adults will differ significantly in their ability to perform metalinguistic tasks (Hypothesis 1). This hypothesis is confirmed by many of the specific analyses described below. That is, there were significant differences between the metalinguistic performances of various groups on the Phase I metalinguistic tasks.

### 4.1.1 Metalinguistic Ability and Education

The hypothesis that metalinguistic ability would increase with education (Hypothesis 1A) was tested by comparing the performance of the Graduate Students and Controls on each of the metalinguistic tasks from the

screening battery. The forty-three Graduate students performed significantly better than the thirty-nine age-matched controls (who had only High School Diplomas) on all three tasks. Thus, the data support hypothesis 1A for the three metalinguistic tasks from the initial study. Table 1 reports these results.

The literature reviewed in Chapter Two suggested that male and female subjects might not contribute equally to such effects. In order to investigate this possibility, for each of the results reported, male and female subjects are considered together and separately. A fuller discussion of sex differences is found in section 4.1.3.

Looking at male subjects only, all of the effects of education on metalinguistic ability remain significant. For female subjects, the effect of education is significant for the Phonology and Morphology tasks but not for the Syntax task. These results are presented in Tables 2 and 3.

### 4.1.2 Metalinguistic Ability and Age

Table 4 presents the results of a two-tailed T test, analyzing the effect of age on metalinguistic ability. We had not expected that metalinguistic ability would change with age in the age range sampled. We predicted that any significant differences found between the metalinguistic performance of High School seniors and older High School graduates would be attributable to educational or reading skill differences (Hypothesis 1B). However, the Control subjects, who had essentially the same amount of education as the High School subjects, but were sixteen years older on average, performed significantly better

on the Morphology task than those younger students.

Comparing male and female subjects separately, we found no differences as a result of age for the male subjects (See Table 5). For the female subjects, we found the significantly better performance on the part of the older subjects for the Morphology task. We also found a trend toward poorer performance on the Phonology task for the older female subjects ($t = 1.96$ $p = .055$ two-tailed). Table 6 presents these results.

Some subjects in the Control group had had a bit of education beyond the High School level. The Control group had also achieved a significantly higher mean on the Scholes reading test. The differences in metalinguistic performance cannot, however, be attributed to these facts. The same analyses were performed using only the twenty-five Control subjects who had no education beyond High School. This eliminated significant reading score differences between the groups. For the whole group, the difference in Morphology scores remained significant ($t = 3.22$ $p = .002$). There was also a significant difference in Phonology scores, with the High School students obtaining a higher mean (17.85 vs. 13.28, $t = -2.31$ $p = .024$). These same differences remained significant when female subjects were considered separately. For male subjects, again, no significant differences obtained. This confirms that, at least for female subjects, hypothesis 1B is not supported by our data. For female subjects in the age range we sampled, we found both improvement (Morphology) and deterioration (Phonology) of metalinguistic

ability with age. These changes were not attributable to education or reading skill differences.

### 4.1.3 Metalinguistic Ability, Sex and Familial "Geschwind Factors"

Geschwind's theory on hormonal causes of unusual brain organization suggests that males and females might exhibit different patterns of ability. Because differences were found in the significance of the effects of Age and of Education for male vs. female subjects, an analysis was performed to determine the significance of the effect of sex on metalinguistic ability. Table 7 presents the results of a two-tailed T test comparing the performance of male and female subjects for the three metalinguistic tasks from the screening battery. Male subjects had a significantly higher mean score on the Phonology task. A breakdown of the subjects by educational/age group shows no significant differences between the males and females of any one group for any task. For the Phonology task, both the Controls ($t = 1.90$ $p = .066$) and the Graduate students ($t = 2.01$ $p = .051$) show trends toward higher means for the males. We address the question of possible causes for these differences in Chapter Five.

In addition to sex effects, if metalinguistic ability is neurologically supported by brain structures sensitive to "Geschwind Factors", persons with anomalous dominance should perform exceptionally on metalinguistic tasks. Anomalous dominance is marked by the presence of left-handed first or second

degree relatives.

The subject population in this study did not contain the necessary number of left-handers with and without familial sinistrality to analyze statistically the effect of familial handedness on metalinguistic performance in left-handers. Left-handers as a group did not perform significantly differently from right-handers with or without familial sinistrality.

The effect of familial handedness on the metalinguistic ability of right-handed subjects is presented in Table 8. Subjects with no left-handed first or second degree relatives performed significantly better than those subjects with such relatives on the Syntax task ($p = .005$).[1] For the Morphology task, a less strong, but still significant effect in the same direction was noted ($p = .020$). An analysis of each of the age/educational groups separately showed the effect on Syntax for the High School seniors and for the Graduate Students but not for the Controls. The effect on performance on the morphology task was found only for the High School subjects. If male and female subjects are considered separately, there are no significant effects of familial handedness on metalinguistic ability for males. For females, both the effect on Syntax and the effect on Morphology are significant at the .05 level. These data confirm the hypothesis that familial handedness may have a significant effect on metalinguistic ability (Hypothesis 1Ci).

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[1]Analysis of a scatter plot of the scores for each group separately shows that this effect was not the result of those subjects with mixed familial handedness having scores at both extremes.

The hypothesis that metalinguistic ability would be at the extreme ends of the range in subjects with high numbers of familial Geschwind factors (Hypothesis 1C) was not confirmed. The six subjects with the highest number of Geschwind factors (GTOTAL) were compared with the other subjects. Only one of the six had been asked to return for Phase II because of high or low scores. The performance of the others was "average" on all three tasks.

The alternative hypothesis that high numbers of Geschwind factors would be found in the families of subjects with high and low levels of metalinguistic ability was tested by a series of Analyses of Variance using average number of Geschwind factors (GTOTAL) as the criterion variable. For each of the three initial metalinguistic tasks, the GTOTAL of subjects with high, low and average scores was compared. None of these analyses yielded a significant F value. Means and Standard Deviations for each group are given in Table Nine. For the breakdown by Phonology score, $F = 2.13$. For Morphology and for Syntax, $F < 1$.

Geschwind's "pathology of superiority" theory suggests that for some abilities, **both** exceptional talent **and** exceptional difficulty will be associated with frequent occurrence of "Geschwind Factors" in the family. We therefore combined the high and low scoring groups for each of the three initial tasks and performed a two-tailed T test comparing the mean Geschwind score of these "exceptional" subjects to the mean scores for the average scorers. These analyses also yielded no significant results (see Table 10). Hypothesis 1C is not

supported by the data.

It is possible that subjects with extreme talents or deficits in other areas and concomitantly high GTOTALs were masking a significant relationship between GTOTAL and metalinguistic ability. This will be discussed more fully in Chapter Five.

## 4.2 The Talented and Untalented Subjects

The hypothesis that, by virtue of their intellectual profile, individual subjects would be consistent in their metalinguistic performance across tasks (Hypothesis 2) was tested first by evaluating the performance of subjects on the Phase I tasks. The value of Phase I task performance in predicting Phase II performance was also considered.

### 4.2.1 Consistent Metalinguistic Performance

Considering the three Phase I tasks alone, strong correlation among tasks is found (see Table 11). However, despite this significant correlation, it was not the case that subjects who were exceptionally talented at one task were necessarily exceptionally talented at either of the other Phase I tasks or at any of the seven metalinguistic tasks from Phase II. In fact, of the twenty subjects who participated in the second half of the study, one had two particularly high Phase I scores, two had two particularly low Phase I scores and two had one high score and one low score. The remaining fifteen subjects had only one high or low score.

Table 12 presents the scores for all metalinguistic tasks for each of

the 20 subjects who participated in Phase II. These data show that subjects who were called back because of an excellent score did not necessarily perform well on all Phase II tasks. For example, High School Senior # 118, in Phase II because of an excellent Phase I Phonology score (31/38), scored only 9 out of 24 on the Phase II Segment Counting task. The same was true of low scorers. For example, Control # 203 scored 0 out of 38 on the Phase I Phonology task but scored 18 out of 24 on the Phase II Segment Counting task.

The subjects from Phase II constitute an unusual group for statistical analysis, since it is a small group in which each subject was asked to participate in the second study for a different reason. However, since each of the subjects **did** have some non-outstanding score(s) in the initial battery, there were high, low, and average scorers for each of the Phase I tasks in the Phase II group. The correlations discussed below are intended to illustrate the clusters of characteristics which frequently co-occurred in this population. While they are useful in developing a sense of the shape of the data, they are only very cautiously generalizable to a less selected population.

Subjects' performance on the Phase I tasks could not be used to predict performance on all of the tasks from the second phase of the study. Scores on the initial Phonology task correlated strongly with the taped version of the Morphology task ($r=.70$). Less strong but still significant correlations were found with the Stress Interpretation task ($r=.65$) and the Ambiguity Detection task ($r=.56$). Scores on the initial Morphology task correlated

strongly with the Stress Interpretation (r=.74) and Ambiguity Detection (r=.78) tasks. Less strong but still significant correlation was found with both versions of the Phase II Morphology task (r=.65 taped, r=.61 paper). Scores on the initial Syntax task did not correlate significantly with performance on any metalinguistic task from the second phase. The r values for all correlations between Phase I and Phase II metalinguistic tasks are given in Table 13.

Table 14 presents the results of correlation procedures for the tasks from Phase II. The Phrase Tree task, which asked subjects to diagram their subjective impressions of "relatedness" between words in sentences correlated significantly with no other Phase II metalinguistic task. The Syllable Counting task correlated significantly only with the Stress Interpretation task (r=.72). Of the remaining fifteen possible correlations between Phase II tasks all were significant at least at the .05 (trend) level (including four at .001 and seven at the .01 level).

Of the fifty-five correlations presented in Tables 11, 13 and 14, only twenty-two (2/5) reach significance at the .01 level. An additional nine pairs show trends ($p<.05$). Thus the data do not support a strong form of Hypothesis 2. It is often the case that subjects' scores on one metalinguistic task will account for a percentage of the variability in scores on another metalinguistic task. However, performance on other metalinguistic tasks rarely accounts for more than fifty percent of the variation in scores on a task and never accounts for more than seventy-one percent.

In addition to the above analyses of performance on the metalinguistic tasks, we also examined a cross-tabulation of all scores from Phase II broken down by selection criteria. In other words, we compared the performance of subjects who were asked to participate in Phase II because of a particularly high score on a task with those subjects who had been invited to participate because of a particularly low score on that same task. For the most part, the talented and untalented subjects showed an overlap in their scores on other metalinguistic tasks. However, there were some tasks for which some groups of subjects did not overlap. All low scorers on the initial Morphology task scored lower on the initial Phonology task than any of the high-scorers. These same untalented morphologists also all had lower scores on the Stress Interpretation task than did the talented morphologists. Also, all of the Phase II subjects with high phonology scores received high scores on the Syllable Counting task, whereas the low scorers were mixed in their ability to count syllables. This last fact is consistent with the hierarchy of difficulty discussed in the literature on children's acquisition of metalinguistic ability (Liberman et al. 1974) and in the literature on adults who are learning to read (Greenberg 1987).

### 4.2.2 Metalinguistic Ability and Intellectual Ability

The hypothesis that metalinguistic ability would be associated with general intellectual ability was tested by examining the extent to which each of the metalinguistic tasks correlated with the administered subtests of the WAIS-

R and with subjects' percentile score for the Raven's Matrices. The results of these correlation procedures are given in Table 15.

In light of the lack of constancy in subjects' metalinguistic scores, the following sections report on the correlation of aspects of subject's intellectual profile and performance on specific metalinguistic tasks.

Raven's percentile correlated significantly ($p<.01$) with the initial morphology task, the Segment Counting task and the taped version of the Phase II morphology task. It correlated strongly ($p<.001$) with the Stress Interpretation and Ambiguity Detection tasks.

The Information subtest from the WAIS-R correlated significantly with the initial morphology task, the taped version of the Phase II morphology task, the Stress Interpretation task, the Reiterent Speech Task and the Ambiguity Detection task.

The Vocabulary subtest correlated significantly with the paper version of the Phase II morphology task and the Reiterent Speech task. It correlated strongly with the initial morphology task, the taped version of the Phase II morphology task, the Stress Interpretation task and the Ambiguity Detection task.

The Block Design subtest correlated significantly with the initial morphology task, the Stress Interpretation task and the Reiterent Speech task. It correlated strongly with the taped version of the Phase II morphology task.

The Arithmetic subtest correlated significantly with the Segment

Counting Reiterent Speech and Ambiguity detection tasks. It correlated strongly with the taped version of the Phase II morphology task and with the Stress interpretation task.

The Comprehension subtest correlated significantly with the initial morphology task, the Segment Counting task, the paper version of the Phase II morphology task the Stress Interpretation task and the Reiterent Speech task. It correlated strongly with the taped version of the Phase II morphology task and the Ambiguity Detection task.

The Similarities subtest correlated significantly with the initial morphology task, both versions of the Phase II morphology task and the Stress Interpretation task. It correlated strongly with the Ambiguity Detection task.

There were, then, three metalinguistic tasks in the battery (Phase II morphology task (taped version), Stress Interpretation and Ambiguity Detection) which correlated at least at the .01 level of significance with all of the standardized measures of intellectual ability obtained. On the other hand, four of the metalinguistic tasks (the initial phonology and syntax tasks, the Syllable Counting task and the Phrase Tree task) did not correlate significantly with any of these standardized tests (although syntax was the only task not to even show trends). Hypothesis 2A is only partially supported. That is, for some tasks, especially those relating to word formation rules, metalinguistic ability is associated with general intellectual ability. For other tasks, this association is not found. This is discussed more fully in Chapter Five.

Tables 16 through 19 report the correlation of metalinguistic ability and specific linguistic abilities (Hypothesis 2B). These correlation procedures tested the following hypotheses:

2Bi) Skilled readers will have high metalinguistic ability.
2Bii) Subjects reporting successful Foreign language learning experiences will have high metalinguistic ability.
2Biii) Skilled writers will have high metalinguistic ability.

The correlation of reading ability and subjects' performance on the Phase I metalinguistic tasks is reported in Table 16. Reading skill as measured by this study is not consistently correlated with metalinguistic ability. Hypothesis 2B does find some support in the data with respect to certain reading skill indicators/metalinguistic tasks. For the initial group of 128 subjects, there were two reading skill indicators: subjects' subjective evaluation of their own reading skill as compared to their classmates and subjects' score on the adapted Scholes reading test. In addition to the question on reading skill, subjects were asked when they had learned to read. Self-Evaluation as a skilled reader correlated significantly ($p<.01$) only with the morphology task. Subjects' self identification as **early** readers correlated with the three tasks in much the same way. Scholes test scores correlated strongly ($p<.001$) with all three metalinguistic tasks.

For the smaller group ($n=20$) of Phase II subjects, we had two additional reading measures. Each subject's composition was rated as to the extent to which it "reflected a good understanding of" the article which they had read. Their reading of the article was also timed. Although there were four

metalinguistic tasks which showed trends toward negative correlation with reading time, none of these reached significance. Rater evaluation of subjects' ability to express understanding of read materials in their writing was a better predictor of metalinguistic ability. It correlated strongly ($p < .001$) with the taped version of the Phase II morphology task and the Ambiguity Detection task. It also correlated less strongly but still significantly with the Stress Interpretation and Reiterent Speech tasks.

In the smaller group of exceptional subjects from Phase II, Scholes test scores became a less reliable predictor of metalinguistic ability. Of the initial three tasks, only morphology correlated significantly with Scholes score. Both versions of the Phase II morphology task correlated significantly with Scholes scores. The strongest correlation with Scholes score was found for the Stress Interpretation task ($r=.70$, $p<.001$). Correlation procedures for Self-Evaluation of reading skill and metalinguistic ability yielded only trends for this group of subjects. In fact, for this group, self-identification as an early reader correlated more strongly and with more metalinguistic tasks than did self-evaluation of reading skill. These results are given in Table 17.

The initial group of 128 subjects had also been asked to compare themselves to their classmates on overall English skills and on foreign language learning ability. These subjective impressions of language abilities did not account for a large percentage of the variation in metalinguistic ability. For perceived English language ability, significant correlation with initial phonology

score ($r=.24$, $p<.01$) and with initial morphology score ($r=.30$, $p<.001$) was found. Hypothesis 2Bii was, however, not supported. Perceived foreign language learning ability showed a trend toward positive correlation with initial phonology score only, and even this did not reach significance.[2] These results are presented in Table 18.

Subjects' writing ability was evaluated on the basis of the composition they wrote arguing for one of the sides in the Greyhound labor vs. management dispute. Raters scored each composition for the quality of the argument, the organization, grammar and punctuation they also provided an overall assessment of whether the subject "writes well". Each of these aspects of writing skill correlated significantly with four or more metalinguistic tasks. As was the case with measures of more general intellectual ability, some metalinguistic tasks correlated strongly with writing skills, some only a bit and some not at all. Specifically, the initial Morphology task, the taped version of the Phase II Morphology and the Ambiguity Detection tasks showed significant correlation with all aspects of writing skill. The initial Syntax task, the Syllable Counting task, the paper version of the Phase II Morphology task and the Phrase Tree task had, at most, trends toward correlation with writing skill. The other metalinguistic tasks provided a middle ground between these two extremes. Hypothesis 2Biii is partially supported by the data (see Table 19).

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[2]Correlation procedures for the metalinguistic tasks from Phase II only yielded significant correlation of reported foreign language learning ability and Syllable Counting score.

### 4.2.3 Metalinguistic Ability and Cognitive Profile

The literature suggests that low rigidity scores are associated with facility with ambiguity detection tasks. We hypothesized that this ability might extend to other metalinguistic tasks (Hypothesis 2C). In addition, a correlation between field independent style and metalinguistic ability was predicted (Hypothesis D).

Table 20 presents the results of correlation procedures investigating these connections. Low cognitive rigidity score, as determined by the Breskin test, was not found to be significantly correlated with metalinguistic ability for any of the tasks administered. Hypothesis 2C is not supported.

The Embedded Figures Task (EFT) yields a measure of field *dependence*. Therefore negative correlations were expected and obtained. Field *dependence* was very strongly negatively correlated with the taped version of the Phase II morphology task, the Stress Interpretation task, the Reiterent Speech task and the Ambiguity Detection task. It was less strongly but still significantly negatively associated with the initial Phonology and Morphology tasks as well as the Segment Counting Task and the paper version of the Phase II Morphology task. Hypothesis 2D is supported by the data.

# CHAPTER FIVE

# DISCUSSION

In this chapter, each of the significant differences between groups will be discussed in turn. General remarks on observed correlations will be made. In addition, the research questions posed in Chapter Two will be discussed in light of the findings of this study. Finally, directions for further research will be suggested.

## 5.1 Metalinguistic Ability and Education

The most stable and significant effect demonstrated in this study is the effect of education on metalinguistic ability. The Graduate students had significantly higher means on the Phase I Phonology, Morphology and Syntax tasks than did the Control group. This echoes the findings of Gleitman and Gleitman (1971). However, contrary to their findings, there was overlap between the educational groups in our study for all tasks. For the Phase I Phonology task, 101 of the 128 scores were in the overlapping range. Only 16 out of 85 less educated subjects scored lower than any Graduate student and only 11 out of 43 Graduate students scored higher than any subject in the other

groups[1].

For the Morphology task, 110 scores were in the overlapping range. Six High School/Control subjects scored below the lowest Graduate student and twelve Graduate students scored higher than any subject from the other two groups.

For the Syntax task, two High School students had the best scores. A Graduate student had the worst score. In spite of the fact that the distribution of Syntax scores among educational groups does not fit the distribution of Phonology and Morphology scores, an effect of education was nonetheless demonstrated.

The inclusion of perfectly ordinary and unarguably ungrammatical sentences in this task served to make bad scores less likely to be a reflection of differences in grammar and more likely to be a reflection of inability to give intuitions based on one's grammar. For example, one subject accepted:

1) What she condescended was to talk to us.
2) It is unclear how solved the problem.
3) John and Mike are a philosopher.
4) Was eaten the sandwich by the boy.
5) Where John did go yesterday.
6) Five pounds was weighed by the pumpkin.

but rejected:

1) What John wanted was a big raise.
2) The children hit each other.
3) She thought up a plan which was really complicated.
4) Something large must have fallen on these flowers.

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[1]It is also possible to make the same point using subjects from each group who are above/below the other group's means.

It is important to note that, in spite of the fact that marginal sentences were intentionally selected for this task, the group as a whole distinguished grammatical from ungrammatical sentences quite well. With only one exception, all of the well-formed sentences received better overall acceptability ratings than any of the ungrammatical sentences.

Subjects distinguished our "somewhat" from "very" ill-formed sentences less well. However, a post hoc analysis of subjects' responses as simple yes/no responses still yielded the same education effect described above.

In Phase II, there were not enough subjects from any one group to make possible a statistical analysis of variation between groups on metalinguistic tasks. In that we chose subjects from the extreme ends of the performance range for their groups, it is not surprising that for these tasks we also found overlap in scores.

For example, in our Stress task, the stimuli for which were chosen from the Gleitman and Gleitman test items, Graduate student scores ranged from thirteen correct to twenty-four correct out of a possible twenty-four. The other two groups ranged from zero through eighteen correct. Although only two High School student scores fell into the Graduate student range, six Graduate student scores were in the High School student range.

For the Stress task, it was clear that the eight Graduate students made fewer errors overall. Their proportion of **Errors of Order** and **Errors of**

Stress (the "almost right") answers was quite high compared to the pattern of errors by the eight High School students (39/62 compared to 39/152 for the High School students). Although the four Control subjects as a group also had more errors than the Graduate students, their error pattern more nearly resembled that of the Graduate students (46/79 "almost right" errors). This indicates that the Controls attended more successfully to structural aspects of the nonsense compounds than did the High School students.

Education was clearly associated with higher levels of skill for this task. The results are not, however, suggestive of an "all or none" ability which comes with higher levels of education. For all of the tasks in this study, it seems that there is no level of education necessary or sufficient for the development of metalinguistic ability.

Perhaps it is the case that rather than education producing an increase in metalinguistic ability, those persons who have this ability natively are more likely to succeed in school and continue their education.

An interesting question is whether particular fields of study attract more or less metalinguistically talented students. One might expect , for example, that the Arts and Sciences with their higher quantitative and visuo-spatial demands, would attract students with less verbal/metalinguistic skill.

This study was not designed for examining the effects of academic discipline on metalinguistic ability. An attempt was made to discover patterns of ability in students from different academic areas post hoc. Graduate

students were divided into Artists, Scientists, Applied Scientists and Social Scientists.

We would have needed a detailed questionnaire to determine whether each subject's discipline in fact reflected their major focus. For students in such areas as Art Theory or Interactive Telecommunications, we would need to know more about the person's work to confidently assign them to a category. It is only possible to say that no striking patterns emerged. Individual students from the Artist, Scientist and Social Scientist categories had both exceptionally high and exceptionally low scores on each of the Phase I tasks.

## 5.2 Metalinguistic Ability and Age

We had not expected any differences in the metalinguistic performance of High School Seniors as compared to somewhat older adults with High School diplomas. On the Syntax task, no significant differences were found. And yet, even when only those older subjects who had no training beyond High School were considered, the performance of the older group on the Morphology task was significantly better. It is possible that the natural increase of vocabulary during the life span, combined with more years of reading and more exposure to the particular patterns exploited by our test led to this effect.

The possibility that a connection exists between vocabulary growth and morphological metalinguistic ability is supported by our cross-tabulation

data. All subjects who returned for Phase II because of a high Morphology score had higher WAIS-R Vocabulary scores than any of the subjects who returned because of a low Morphology score.

Recall there was no significant difference for the Control vs. High School groups on the Phonology task. However, when only those controls who had no other training were compared with the High School students, a strong trend toward poorer performance by these Controls as compared to the High School students emerged. Perhaps phonological analysis of words is less a real-life language skill than is morphological analysis. The High School seniors, since they are still in school, may be more practiced in other, related activities, such as responding to teacher requests to "sound it out".

## 5.3 Metalinguistic Ability and Sex

In addition to the surprising findings on age, another unexpected finding was the better performance of male subjects on the initial phonology task. Traditionally, when sex differences are found for verbal tasks, they favor females (Maccoby and Jacklin 1974).

The small number of male Controls may have contributed to the strength of the effect of sex on phonological ability for all subject groups taken together. However, when the effect of sex was examined for each of the groups separately, only High School students showed no effect of sex. The other groups showed trends toward better performance by male subjects. The Phonology task may have been tapping some skill which interacts differently

with age for men and women.

An alternative explanation for the sex differences appearing in the Graduate and Control groups but not in the High School group is found in Rosenthal and Rubin (1982). Their meta-analysis of tests of intellectual abilities in boys and girls showed a rapid diminishing of sex differences in recent years. The speed of this decline in differences suggests a cultural rather than biological mechanism for change.

It is interesting to note that the task with the greatest sex bias (Phonology) did not correlate at all with measures of general intellectual ability, but did correlate with Embedded Figures Task (EFT) score. Historically, measures of field dependence/independence have shown women to be more field dependent. Perhaps both tests draw on some "problem solving" skill which, for cultural reasons, is more practiced in male subjects. Sherman (1967) argues that the EFT favors male subjects simply because of its visuo-spatial element and not because of its disambiguating component. If a connection between EFT performance and phonological disembedding skill could be established for a less selected population than that studied here, these data would provide a counter-argument.

In addition to the effect of sex on phonology, there were analyses of other effects which yielded different results for male and female subjects. Whereas female Controls performed better than female High School students on the morphology task, for males, there was no such difference. Possibly, the

men in this educational group are less likely than the women to continue reading and expanding their vocabulary.

Age was not shown to have an effect for any metalinguistic task when only males are considered. Two of the three initial metalinguistic tasks from Phase I show at least a trend when females are evaluated separately. The lack of consistent differences between male Control subjects and male High School students may well be attributable to the small number of male Controls. With only nine subjects in this sub-group, a lack of significant findings is not surprising.

## 5.4 Metalinguistic Ability and the Descriptive Statistics

The correlation between general intellectual ability and metalinguistic ability was very strong for each of the tasks which required sensitivity to word-formation rules. These included:

1) the initial morphology task in which subjects applied morphological rules to nonsense forms
2) both versions of the Phase II morphology task which required subjects to morphologically analyze two complex real words as well as derive a third complex word
3) the stress task which required subjects to interpret nonsense compounds based on the English rules for assigning stress in real compounds.

The strongest association with intellectual ability was found in the ambiguity

detection task. Although some of the ambiguities turned on grammatical relations, others required detection of two possible morphological analyses for individual words. It is possible that all four of these tasks tap a single ability.

It must, however, be noted that in the smaller study, it was not possible to analyze educational groups separately. Because of the expected correlation of education and intellectual ability, it is perhaps more interesting to note that there were a number of metalinguistic tasks which did not correlate significantly with intellectual ability (Phase I Phonology and Syntax; Syllable Counting and Phrase Tree drawing). This is consistent with the view of metalinguistic ability as a particular talent.

This study also provided some information on association of L1 linguistic ability and metalinguistic ability. Our measures of reading ability were all fairly informal. Still, subjects' self description as early or talented readers, their reading time, raters' assessment of their writing as reflecting a good understanding of the text and performance on our version of the Scholes reading test all correlated at at least the .05 level with more than one third of the metalinguistic tasks. This suggests that the beneficial relation of metalinguistic ability and reading ability in literacy learners continues to hold in literate populations.

The most striking overall lack of correlation was found for the Breskin Rigidity measure and the metalinguistic tasks. Our group (n=128) repeated Breskin's finding of a trend toward greater rigidity on the part of

male subjects (p=.079). The subjects in the Control group were also found to be significantly more rigid than the High School students (p=.000). In his investigation of ambiguity detecting abilities, Brooks (1980) was also not able to establish rigidity effects for his entire population. The effect only became obvious when he considered subjects at the extreme ends of the rigidity scale he had employed. Perhaps a more sensitive measure of rigidity which would have allowed us to evaluate subjects at the extreme ends of its scale would have yielded interesting correlations.

## 5.5 The Research Hypotheses Revisited

A brief summary of the results reported above is that our first hypothesis was confirmed whereas our second received only partial support from our data. Metalinguistic ability does vary significantly among groups of adults. Education frequently, but not always, had a significant effect. Contrary to our initial hypothesis, age did have a significant effect for some tasks. Groups defined on familial handedness and sex did perform significantly differently on some tasks.

The second major hypothesis concerned the constancy of metalinguistic ability across tasks. This was not supported by the data from this study. While it is possible to say that the most likely person to exhibit metalinguistic talent is the bright well-educated subject with strong L1 language skills and field independent style, the likelihood is not the same for all tasks and exceptions to this profile were found in both directions.

The hypothesis that groups of literate adult native speakers might vary in their ability to perform metalinguistic tasks was confirmed. Yet, for the three different linguistic levels tested in Phase I, the same between group differences were not always found.

For the Phonology task, education had a significant effect. Age and sex had notable, if not quite significant, effects. Familial handedness had no effect at all.

The effects of age and education on the Morphology task have been discussed above. An additional effect of familial handedness was noted for this task. Other studies have indicated familial sinistrality effects for word level tasks. Cowart (1988) cites a number of such studies from the late 1970s and early 1980s which use single words or single syllables as stimuli. However, such an effect for the morphological manipulation of nonsense words presented in context has not been reported (quite possibly not been investigated). The size of the effect in this study was small enough to warrant extreme caution in interpreting this finding pending replication.

A stronger effect of familial handedness was found for the Syntax task, with right-handed subjects with mixed familial handedness performing less well than subjects without left-handed family members. This is consonant with Cowart's (1988) finding that subjects with mixed familial handedness demonstrated less ready access to hierarchical representations necessary for syntactic analysis. Bever, Carrithers and Townsend (1987) also report that

right-handed subjects with left-handed family members were less sensitive to certain aspects of syntactic structure in a processing task.

A significant difference based on familial health history (GTOTAL) was not found for any task. It is important to note that, since Geschwind made no predictions with respect to metalinguistic ability, this has no bearing on the correctness of his "pathology of superiority" theory. It may also be that in a non-clinical population it is more difficult to obtain accurate family health history information than in a clinical one. It is also regrettably the case that the information on familial talents in our survey was not unambiguously interpretable. We were therefore not able to ascertain the extent to which other talents present in the "average" metalinguistic scorers masked any effect of GTOTAL on metalinguistic ability.

Metalinguistic abilities would seem to be a diverse lot. The ability to perform certain tasks well seemed to co-occur frequently in our subjects. However, different groupings of tasks were found in the correlations of performance on metalinguistic tasks with other evaluative measures and with demographic facts. Individual case studies provided evidence for the dissociability of each of the abilities we investigated. A fuller understanding of the properties shared by metalinguistic tasks awaits further research.

## 5.6 Suggestions for Future Research

Obviously, the differences among groups found in this study should serve as a caution for any study using data from metalinguistic tasks.

Assumptions about a uniform level of competence on the part of unimpaired literate adult native speakers are not warranted.

The fact that different metalinguistic tasks showed different correlations with each other as well as different patterns of correlation with other abilities indicates the need for a factor analytic study of metalinguistic tasks. It has been demonstrated that many phonological metalinguistic tasks share common properties (Lewkowicz 1980). Is this factor distinct from general intellectual ability as our data suggest? Does this factor operate across linguistic levels? Our data suggest that it does not.

Finally, the results with respect to familial sinistrality suggest the need for a study in which neurologically defined groups are balanced and can be better studied statistically.

# TABLES

Table 1
The Effect of Education on Metalinguistic Ability

| | Controls n=39 | | Grad Students n=43 | | |
|---|---|---|---|---|---|
| | mean | SD | mean | SD | t |
| phonology | 14.95 | 8.17 | 29.12 | 4.63 | 9.78 *** |
| morphology | 46.13 | 6.01 | 52.56 | 5.04 | 5.27 *** |
| syntax | 17.67 | 2.96 | 16.00 | 3.85 | 2.18 * |

key: * $p < .05$, ** $p < .01$, *** $p < .001$, two-tailed.

| Phase I | Task Name | Perfect Score |
|---|---|---|
| | phonology | 38 |
| | morphology | 60 |
| | syntax | 0 |

The reader is reminded that the scores for the syntax task represent a difference between linguists' evaluation of the test sentences and subjects' evaluation. Therefore, the lower the score, the better the performance.

Table 2
The Effect of Education on Metalinguistic Ability-Males Only

| | Controls n=9 | | Grad Students n=22 | | |
|---|---|---|---|---|---|
| | mean | SD | mean | SD | t |
| phonology | 19.33 | 7.28 | 30.45 | 2.18 | 6.62 *** |
| morphology | 45.33 | 5.05 | 52.95 | 5.52 | 3.57 ** |
| syntax | 17.89 | 2.26 | 15.55 | 2.81 | 2.22 * |

* $p < .05$, ** $p < .01$, *** $p < .001$, two-tailed

| Phase I | Task Name | Perfect Score |
|---|---|---|
| | phonology | 38 |
| | morphology | 60 |
| | syntax | 0 |

The reader is reminded that the scores for the syntax task represent a difference between linguists' evaluation of the test sentences and subjects' evaluation. Therefore, the lower the score, the better the performance.

Table 3
The Effect of Education on Metalinguistic Ability-Females Only

| | Controls n=30 | | Grad Students n=21 | | |
|---|---|---|---|---|---|
| | mean | SD | mean | SD | t |
| phonology | 13.63 | 8.07 | 27.71 | 5.99 | 6.79 *** |
| morphology | 46.37 | 6.33 | 52.14 | 4.59 | 3.57 ** |
| syntax | 17.60 | 3.17 | 16.48 | 4.74 | 1.02 |

key: * $p < .05$, ** $p < .01$, *** $p < .001$, two-tailed.

| Phase I | Task Name | Perfect Score |
|---|---|---|
| | phonology | 38 |
| | morphology | 60 |
| | syntax | 0 |

The reader is reminded that the scores for the syntax task represent a difference between linguists' evaluation of the test sentences and subjects' evaluation. Therefore, the lower the score, the better the performance.

Table 4
The Effect of Age on Metalinguistic Ability

| | High School n=46 | | Controls n=39 | | |
|---|---|---|---|---|---|
| | mean | SD | mean | SD | t |
| phonology | 17.85 | 8.09 | 14.95 | 8.17 | 1.64 |
| morphology | 40.76 | 7.35 | 46.13 | 6.01 | 3.64 *** |
| syntax | 18.89 | 4.86 | 17.67 | 2.96 | 1.37 |

key: * $p < .05$, ** $p < .01$, *** $p < .001$, two-tailed.

| Phase I | Task Name | Perfect Score |
|---|---|---|
| | phonology | 38 |
| | morphology | 60 |
| | syntax | 0 |

The reader is reminded that the scores for the syntax task represent a difference between linguists' evaluation of the test sentences and subjects' evaluation. Therefore, the lower the score, the better the performance.

Table 5
The Effect of Age on Metalinguistic Ability-Males Only

| | High School n=18 | | Controls n=9 | | |
|---|---|---|---|---|---|
| | mean | SD | mean | SD | t |
| phonology | 17.56 | 6.58 | 19.33 | 7.28 | 0.64 |
| morphology | 42.67 | 5.04 | 45.33 | 5.05 | 1.30 |
| syntax | 18.56 | 3.68 | 17.89 | 2.26 | 0.50 |

key: * $p < .05$, ** $p < .01$, *** $p < .001$, two-tailed.

| Phase I | Task Name | Perfect Score |
|---|---|---|
| | phonology | 38 |
| | morphology | 60 |
| | syntax | 0 |

The reader is reminded that the scores for the syntax task represent a difference between linguists' evaluation of the test sentences and subjects' evaluation. Therefore, the lower the score, the better the performance.

Table 6
The Effect of Age on Metalinguistic Ability-Females Only

| | High School n=28 | | Controls n=30 | | |
|---|---|---|---|---|---|
| | mean | SD | mean | SD | t |
| phonology | 18.04 | 9.04 | 13.63 | 8.07 | 1.96 ~ |
| morphology | 39.54 | 8.37 | 46.37 | 6.33 | 3.52 ** |
| syntax | 19.11 | 5.55 | 17.60 | 3.17 | 1.28 |

key: * $p < .05$, ** $p < .01$, *** $p < .001$, two-tailed.

| Phase I | Task Name | Perfect Score |
|---|---|---|
| | phonology | 38 |
| | morphology | 60 |
| | syntax | 0 |

The reader is reminded that the scores for the syntax task represent a difference between linguists' evaluation of the test sentences and subjects' evaluation. Therefore, the lower the score, the better the performance.

Table 7
The Effect of Sex on Metalinguistic Ability

| | Males n=49 | | Females n=79 | | |
|---|---|---|---|---|---|
| | mean | SD | mean | SD | t |
| phonology | 23.67 | 8.06 | 18.94 | 9.67 | 2.87 ** |
| morphology | 47.78 | 7.05 | 45.48 | 8.33 | 0.64 |
| syntax | 17.08* | 3.33 | 17.83 | 4.60 | 0.99 |

key: * $p < .05$, ** $p < .01$, *** $p < .001$, two-tailed.

| Phase I | Task Name | Perfect Score |
|---|---|---|
| | phonology | 38 |
| | morphology | 60 |
| | syntax | 0 |

The reader is reminded that the scores for the syntax task represent a difference between linguists' evaluation of the test sentences and subjects' evaluation. Therefore, the lower the score, the better the performance.

Table 8
The Effect of Familial Handedness on Metalinguistic Ability

| | Right Only n=62 | | Right Mixed n=45 | | |
|---|---|---|---|---|---|
| | mean | SD | mean | SD | t |
| phonology | 21.24 | 9.07 | 21.04 | 9.74 | 0.11 |
| morphology | 47.98 | 7.04 | 44.58 | 8.53 | 2.26 * |
| syntax | 16.71 | 3.80 | 18.98 | 4.23 | 2.84 ** |

ey: * $p < .05$, ** $p < .01$, *** $p < .001$, two-tailed.

| Phase I | Task Name | Perfect Score |
|---|---|---|
| | phonology | 38 |
| | morphology | 60 |
| | syntax | 0 |

The reader is reminded that the scores for the syntax task represent a difference between linguists' evaluation of the test sentences and subjects' evaluation. Therefore, the lower the score, the better the performance.

Table 9
Geschwind Factors in the Families of Talented and Untalented Subjects

| | Geschwind-factor Mean | Standard Deviation |
|---|---|---|
| low-phonology n=32 | 9.23 | 5.87 |
| mid-phonology n=66 | 9.27 | 6.23 |
| high-phonology n=30 | 6.87 | 3.00 |
| low-morphology n=29 | 8.93 | 5.32 |
| mid-morphology n=71 | 8.92 | 6.16 |
| high-morphology n=28 | 7.89 | 4.37 |
| low-syntax n=30 | 8.53 | 4.85 |
| mid-syntax n=69 | 8.64 | 5.96 |
| high-syntax n=29 | 9.00 | 5.64 |

| Phase I | Task Name | Perfect Score |
|---|---|---|
| | phonology | 38 |
| | morphology | 60 |
| | syntax | 0 |

The reader is reminded that the scores for the syntax task represent a difference between linguists' evaluation of the test sentences and subjects' evaluation. Therefore, the lower the score, the better the performance. In this table "low syntax" means poor performance (i.e. high score).

Table 10
Familial Geschwind Factors for Average vs. Exceptional Subjects

| | exceptional scorers | | average scorers | | |
|---|---|---|---|---|---|
| | mean | SD | mean | SD | t |
| phonology | 8.08 | 4.82 | 9.27 | 4.82 | .23 |
| morphology | 8.42 | 4.86 | 8.92 | 6.16 | .62 |
| syntax | 8.76 | 5.21 | 8.64 | 5.96 | .90 |

| Phase I | Task Name | Perfect Score |
|---|---|---|
| | phonology | 38 |
| | morphology | 60 |
| | syntax | 0 |

The reader is reminded that the scores for the syntax task represent a difference between linguists' evaluation of the test sentences and subjects' evaluation. Therefore, the lower the score, the better the performance.

The number of subjects in each category above is as follows:

| | Exceptional Scorers | Average Scorers |
|---|---|---|
| phonology | 62 | 66 |
| morphology | 57 | 71 |
| syntax | 59 | 69 |

Table 11
Correlation of Metalinguistic Tasks - Phase 1

| n=128 | phonology | morphology | syntax |
|---|---|---|---|
| phonology | | .59 ** | -.26 * |
| morphology | .59 ** | | -.35 ** |
| syntax | -.26 * | -.35 ** | |

key: ~p < .05 (trend), * p < .01, ** p < .001, one-tailed.

| Phase I | Task Name | Perfect Score |
|---|---|---|
| | phonology | 38 |
| | morphology | 60 |
| | syntax | 0 |

The reader is reminded that the scores for the syntax task represent a difference between linguists' evaluation of the test sentences and subjects' evaluation. Therefore, the lower the score, the better the performance.

Table 12

Performance of Phase II Subjects on All Metalinguistic Tasks

| | | Phase I | | | Phase II | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Subject ID # | Phonology | Morphology | Syntax | Sylcnt | Segcnt | Mortap | Mortap | Phrase | Stress | Inton | Ambig |
| High School Seniors | 106 | 10 | 22 | 23 | 23 | 11 | 8 | 20 | 8 | 0 | 0 | -2 |
| | 107 | 1 | 18 | 7 | 23 | 18 | 11 | 24 | 5 | 1 | 11 | -11 |
| | 118 | 31 | 49 | 17 | 24 | 9 | 15 | 23 | 14 | 3 | 19 | 4 |
| | 121 | 20 | 43 | 7 | 23 | 11 | 6 | 21 | 8 | 5 | 8 | -5 |
| | 123 | 20 | 51 | 8 | 24 | 21 | 14 | 24 | 1 | 18 | 18 | 13 |
| | 125 | 31 | 38 | 24 | 24 | 19 | 13 | 24 | 1 | 18 | 12 | 15 |
| | 130 | 16 | 57 | 28 | 24 | 21 | 15 | 24 | 1 | 8 | 14 | 10 |
| | 140 | 7 | 25 | 28 | 23 | 18 | 7 | 19 | 8 | 4 | 13 | -5 |
| Controls | 203 | 0 | 45 | 23 | 23 | 18 | 5 | 23 | 5 | 6 | 14 | 7 |
| | 219 | 12 | 47 | 12 | 22 | 23 | 14 | 24 | 16 | 7 | 18 | 10 |
| | 225 | 23 | 56 | 12 | 16 | 12 | 9 | 24 | 9 | 7 | 0 | -3 |
| | 238 | 1 | 41 | 20 | 19 | 12 | 12 | 22 | 12 | 9 | 0 | 4 |
| Graduate Students | 304 | 19 | 49 | 14 | 22 | 18 | 13 | 23 | 5 | 13 | 14 | 12 |
| | 308 | 26 | 58 | 9 | 24 | 17 | 17 | 24 | 11 | 22 | 18 | 12 |
| | 317 | 31 | 60 | 13 | 24 | 22 | 18 | 24 | 1 | 22 | 22 | 16 |
| | 325 | 28 | 60 | 10 | 24 | 23 | 19 | 24 | 18 | 16 | 18 | 15 |
| | 342 | 9 | 48 | 17 | 24 | 16 | 11 | 24 | 4 | 18 | 21 | 13 |
| | 344 | 30 | 53 | 28 | 24 | 23 | 16 | 24 | 18 | 23 | 23 | 12 |
| | 345 | 30 | 54 | 31 | 24 | 24 | 18 | 22 | 16 | 22 | 21 | 13 |
| | 352 | 38 | 57 | 17 | 24 | 23 | 17 | 24 | 14 | 24 | 20 | 16 |

Table 13
Correlation of Phase I and Phase II Metalinguistic Tasks

| n=20 | phonology | morphology | syntax |
|---|---|---|---|
| sylcnt | .30 | .07 | .14 |
| segcnt | .21 | .33 | .01 |
| mortap | .70 ** | .65 * | -.04 |
| morpap | .32 | .61 * | -.47 ~ |
| phrase trees | .24 | .18 | -.00 |
| stress | .65 * | .74 ** | -.01 |
| intonation | .48 ~ | .50 ~ | .02 |
| ambiguity | .56 * | .78 ** | .06 |

key: ~p < .05 (trend), * p < .01, ** p < .001, one-tailed.

| Phase I | Task Name | Perfect Score | Abbreviation |
|---|---|---|---|
| | phonology | 38 | ----- |
| | morphology | 60 | ----- |
| | syntax | 0 | ----- |
| Phase II: | syllable counting | 24 | sylcnt |
| | segment counting | 24 | segcnt |
| | morphology-tape | 22 | mortap |
| | morphology-paper | 24 | morpap |
| | phrase trees | 22 | ----- |
| | stress | 24 | ----- |
| | intonation | 24 | ----- |
| | ambiguity | 16 | ----- |

The reader is reminded that the scores for the syntax task represent a difference between linguists' evaluation of the test sentences and subjects' evaluation. Therefore, the lower the score, the better the performance.

Table 14
Correlation of Metalinguistic Tasks - Phase II

| n=20 | sylcnt | segcnt | mortap | morpap | phrase | stress | inton | ambig |
|---|---|---|---|---|---|---|---|---|
| sylcnt | | .39~ | .38~ | .05 | -.11 | .36 | .72** | .43~ |
| segcnt | .39~ | | .50~ | .39~ | .00 | .55* | .54* | .58* |
| mortap | .38~ | .50~ | | .53* | .30 | .71** | .62* | .71** |
| morpap | .05 | .39~ | .53* | | -.12 | .47~ | .40~ | .54* |
| phrase | -.11 | .00 | .30 | -.12 | | .03 | .10 | .03 |
| stress | .36 | .55* | .71** | .47~ | .03 | | .62* | .84** |
| inton | .72** | .54* | .62* | .40~ | .10 | .62* | | .65* |
| ambig | .43~ | .58* | .71** | .54* | .03 | .84** | .65* | |

key: ~p < .05 (trend), * p < .01, ** p < .001, one-tailed.

| | Task Name | Perfect Score | Abbreviation |
|---|---|---|---|
| Phase II: | syllable counting | 24 | sylcnt |
| | segment counting | 24 | segcnt |
| | morphology-tape | 22 | mortap |
| | morphology-paper | 24 | morpap |
| | phrase trees | 22 | phrase |
| | stress | 24 | ----- |
| | intonation | 24 | inton |
| | ambiguity | 16 | ambig |

Table 15
Correlation of Metalinguistic Tasks with WAIS-R and Ravens Scores

| n=20 | raven % | inform | vocab | blodes | arith | comp | simil |
|---|---|---|---|---|---|---|---|
| phono | .22 | .32 | .50 ~ | .42 ~ | .41 ~ | .45 ~ | .32 |
| morph | .58 * | .59 * | .78 ** | .52 * | .52 ~ | .63 * | .52 * |
| syntax | .15 | -.04 | -.06 | -.05 | -.14 | -.07 | -.08 |
| sylcnt | .18 | .24 | .28 | .30 | .34 | .40~ | .26 |
| segcnt | .60 * | .50 ~ | .42 ~ | .52 ~ | .52 * | .56 * | .40 ~ |
| mortap | .62 * | .65 * | .77 ** | .75 ** | .76 ** | .76 ** | .67 * |
| morpap | .43 ~ | .47 ~ | .64 * | .32 | .49 ~ | .63 * | .67* |
| phrase | .15 | .13 | .06 | .47 ~ | .14 | .08 | .03 |
| stress | .71 ** | .57 * | .74 ** | .65 * | .70 ** | .71 * | .67 * |
| inton | .42 ~ | .53 * | .65 * | .51 ~ | .60 * | .63 * | .47 ~ |
| ambig | .80 ** | .67 * | .87 ** | .64 * | .63 * | .80 ** | .70 ** |

key: ~p < .05 (trend), * p < .01, ** p < .001, one-tailed.

| | Task Name | Perfect Score | Abbreviation |
|---|---|---|---|
| Phase I | phonology | 38 | phono |
| | morphology | 60 | morph |
| | syntax | 0 | ----- |
| Phase II: | syllable counting | 24 | sylcnt |
| | segment counting | 24 | segcnt |
| | morphology-tape | 22 | mortap |
| | morphology-paper | 24 | morpap |
| | phrase trees | 22 | phrase |
| | stress | 24 | ----- |
| | intonation | 24 | inton |
| | ambiguity | 16 | ambig |

The reader is reminded that the scores for the syntax task represent a difference between linguists' evaluation of the test sentences and subjects' evaluation. Therefore, the lower the score, the better the performance.

Table 16
Correlation of Reading Measures and Metalinguistic Ability

| n=128 | SCHOLES | SELF-EVAL | EARLY |
|---|---|---|---|
| PHONOLOGY | .49 ** | .09 | .09 |
| MORPHOLOGY | .54 ** | .22 * | .21 * |
| SYNTAX | -.31 ** | -.08 | -.05 |

key: ~p < .05 (trend), * p < .01, ** p < .001, one-tailed.

| Phase I | Task Name | Perfect Score |
|---|---|---|
| | phonology | 38 |
| | morphology | 60 |
| | syntax | 0 |

The reader is reminded that the scores for the syntax task represent a difference between linguists' evaluation of the test sentences and subjects' evaluation. Therefore, the lower the score, the better the performance.

Table 17
Correlation of Reading Ability and Metalinguistic Ability

| n=20 | Scholes | SelfEval | Early | Rater | Time |
|---|---|---|---|---|---|
| phonology | .36 | .25 | .32 | .41 ~ | -.15 |
| morphology | .53 * | .37 | .51 * | .52 ~ | -.43 ~ |
| syntax | -.07 | -.20 | -.12 | .21 | -.20 |
| sylcnt | -.15 | .39 | .36 | .43 ~ | -.07 |
| segcnt | .51 ~ | .47 ~ | .56 * | .39 ~ | -.21 |
| morptap | .59 * | .43 ~ | .67 * | .77** | -.42 ~ |
| morpap | .64 * | .29 | .39 ~ | .41 ~ | -.09 |
| phrase tree | -.02 | .03 | .13 | .04 | -.19 |
| stress | .70 ** | .47 ~ | .45~ | .67 * | -.29 |
| intonation | .25 | .51 ~ | .55 * | .66 * | -.40 ~ |
| ambiguity | .48 ~ | .46 ~ | .52 ~ | .70 ** | -.46 ~ |

key: ~p < .05 (trend), * p < .01, ** p < .001, one-tailed.

| | Task Name | Perfect Score | Abbreviation |
|---|---|---|---|
| Phase I | phonology | 38 | ----- |
| | morphology | 60 | ----- |
| | syntax | 0 | ----- |
| Phase II: | syllable counting | 24 | sylcnt |
| | segment counting | 24 | segcnt |
| | morphology-tape | 22 | mortap |
| | morphology-paper | 24 | morpap |
| | phrase trees | 22 | ----- |
| | stress | 24 | ----- |
| | intonation | 24 | ----- |
| | ambiguity | 16 | ----- |

The reader is reminded that the scores for the syntax task represent a difference between linguists' evaluation of the test sentences and subjects' evaluation. Therefore, the lower the score, the better the performance.

Table 18
Correlation of Metalinguistic Ability and Perceived Language Ability

| n=128 | phonology | morphology | syntax |
|---|---|---|---|
| English | .24 * | .30 ** | .02 |
| Foreign Lang. | .19 ~ | .08 | .05 |

key: ~p < .05 (trend), * p < .01, ** p < .001, one-tailed.

| Phase I | Task Name | Perfect Score |
|---|---|---|
| | phonology | 38 |
| | morphology | 60 |
| | syntax | 0 |

The reader is reminded that the scores for the syntax task represent a difference between linguists' evaluation of the test sentences and subjects' evaluation. Therefore, the lower the score, the better the performance.

Table 19
Correlation of Writing Sample Evaluation and Metalinguistic Ability

| n=20 | argues | organizes | grammar | punctuat | wellwrit |
|---|---|---|---|---|---|
| phonology | .69 ** | .66 * | .69 * | .52 ~ | .46 ~ |
| morph | .72 ** | .66 * | .68 * | .76 ** | .65 * |
| syntax | -.07 | .12 | .14 | .17 | .31 |
| sylcnt | .21 | .47 ~ | .46 ~ | .11 | .34 |
| segcnt | .07 | .52 ~ | .57 * | .44 ~ | .54 * |
| mortap | .57 * | .83 ** | .86 ** | .69 * | .67 * |
| morpap | .47 ~ | .44 ~ | .43 ~ | .50 ~ | .40 ~ |
| phrase | .34 | .22 | .21 | .41 ~ | .26 |
| stress | .53 ~ | .69 * | .68 * | .57 * | .57 * |
| inton | .46 ~ | .67 * | .68 * | .43 ~ | .53 ~ |
| ambiguity | .53 * | .70 ** | .72 ** | .62 * | .68 * |

key: ~p < .05 (trend), * p < .01, ** p < .001, one-tailed.

| | Task Name | Perfect Score | Abbreviation |
|---|---|---|---|
| Phase I | phonology | 38 | ----- |
| | morphology | 60 | morph |
| | syntax | 0 | ----- |
| Phase II: | syllable counting | 24 | sylcnt |
| | segment counting | 24 | segcnt |
| | morphology-tape | 22 | mortap |
| | morphology-paper | 24 | morpap |
| | phrase trees | 22 | phrase |
| | stress | 24 | ----- |
| | intonation | 24 | inton |
| | ambiguity | 16 | ----- |

The reader is reminded that the scores for the syntax task represent a difference between linguists' evaluation of the test sentences and subjects' evaluation. Therefore, the lower the score, the better the performance.

Table 20
Correlation of Cognitive Measures and Metalinguistic Ability

| n=20 | Breskin's Rigidity | Embedded Figures |
|---|---|---|
| phonology | .16 | -.53 * |
| morphology | .36 | -.55 * |
| syntax | -.36 | .04 |
| syllable counting | -.22 | -.40 ~ |
| segment counting | -.22 | -.53 * |
| morphology-tape | .22 | -.91 ** |
| morphology-paper | .34 | -.55 * |
| phrase trees | -.10 | -.31 |
| stress | .20 | -.77 ** |
| intonation | -.03 | -.68 ** |
| ambiguity | .22 | -.73 ** |

key: ~p < .05 (trend), * p < .01, ** p < .001, one-tailed.

| | Task Name | Perfect Score |
|---|---|---|
| Phase I | phonology | 38 |
| | morphology | 60 |
| | syntax | 0 |
| Phase II: | syllable counting | 24 |
| | segment counting | 24 |
| | morphology-tape | 22 |
| | morphology-paper | 24 |
| | phrase trees | 22 |
| | stress | 24 |
| | intonation | 24 |
| | ambiguity | 16 |

The reader is reminded that the scores for the syntax task represent a difference between linguists' evaluation of the test sentences and subjects' evaluation. Therefore, the lower the score, the better the performance.

# APPENDIX 1

INFORMED CONSENT

I agree to participate in research on language conducted by Kristine C. Gjerlow-Johnson under the supervision of Dr. Helen S. Cairns and Dr. Loraine K. Obler.

Dr. Cairns is a professor in Communication Arts and Sciences at Queens College and can be reached at (718) 520-7353. Dr. Obler is a professor in Linguistics and in Speech and Hearing Sciences at the CUNY Graduate Center and can be reached at (212) 642-2366. You may also contact the Research Foundation of the City University of New York at (212) 840-4500 regarding this research.

I understand that I will be asked questions about the way words sound, the way sentences are put together and about other aspects of language. I will also be asked to provide information about myself, including a family health history. These tasks will take me about an hour to complete. I may be contacted and asked to participate in further research.

No report of any stage of this research will contain my name or any other identifying information.

I understand that my participation is voluntary and that I may cease participating at any time.

_____
Name

_____
Date

# APPENDIX 2

## WORKS CITED


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