

THE EFFECT OF SYNTACTIC PATTERN FREQUENCY ON RECALL.
A COMPARISON OF NATIVE AND NON-NATIVE SPEAKERS OF
ENGLISH AS A FUNCTION OF PROGRESSIVE EXPERIENCE IN
THE ACQUISITION OF ENGLISH AS A SECOND LANGUAGE

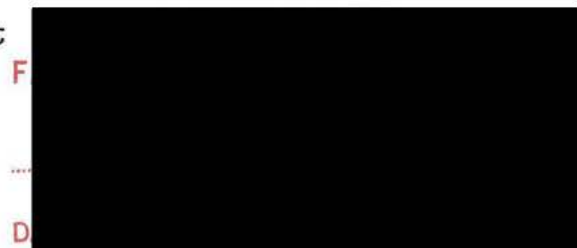
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We accept this thesis as conforming
to the required standard



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ABSTRACT

An experiment was performed to establish the effect of the relative frequency of syntactic patterns on recall and to identify differentiating levels in the linguistic behaviour of native speakers of English and speakers with differing backgrounds and at different stages of acquiring English as a second language. A set of 36 sequences, systematically varied in regard to high or low frequency of occurrence statistically quantified for Canadian English, order of presentation, and length of delay task, was presented in writing, in one of two counterbalanced arrangements of 18 sequences, to each of 64 university students. The subjects were instructed to reproduce the stimuli in writing on signal after a distracting task of counting aloud backwards from 100; the delay intervals were 6 seconds and 20 seconds. There were four groups of 16 students, differentiated as to native language, length of experience in English, and linguistic background, which were tested in a two within and two between $2 \times 2 \times 4 \times 2$ design with two repeated measures.

The results supported the hypothesis that high frequency of occurrence would facilitate recall. Significantly superior scores were obtained in the reproduction of high frequency than of low frequency syntactic patterns for all

subjects ($p < .0001$). As expected, performance following the short delay task revealed a significant increase in recall compared to the long interference task at the $p < .0001$ level. In respect to order of presentation and a possible practice effect for the second of the two tests each subject performed, results showed that only when the long delay task was done first and the short delay task second did a significant improvement in recall occur, at the $p < .0001$ level. (A slight improvement, but of no significance, was noted when the short task preceded the long task.)

The study also demonstrated differentiating levels of performance for the four linguistic groups at $p < .008$. The native Canadian English speakers achieved a significantly higher recall than two non-native groups of linguistically unrelated speakers, divided by length of experience into junior and senior. The fourth group of French Canadian speakers did not differ significantly from the native speakers of English, attesting to the shared linguistic and cultural features of the two related languages, English and French. Only on the purely vocabulary measure did the more experienced senior non-native group achieve recall of similar rank to the French Canadian and less different from the native speakers. Syntactic patterning was shown to be a more elusive feature of the language than vocabulary per se.

Finally the parameter of the high to low frequency

recall differential was found to be a sensitive indicator of length of experience in English, regardless of actual rate of recall. The length of experience was reflected more nearly as the differential became narrower with increasing exposure to English. This was a more effective measure of the degree of linguistic acculturation and of the levels of linguistic behaviour of the intermediate and advanced student of English as a second language.

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CHAPTER I

INTRODUCTION

Research Background

First Language Acquisition and Processing

A tremendous body of literature is now available treating the acquisition of English as a first language. The material concerns three main areas of investigation: a basic theory of language learning, child acquisition of language and investigation of psycholinguistic processes manifested by speakers with adult competence

Learning theories. An important segment of the literature concerns the theories to account for language learning. The stimulus-response theory propounded by Thorndike and Skinner (Horman, 1970, p.259f) and the imitation theory put forward by Mowrer and Lewis (ibid., p.264ff) illustrate the empiricist school. The followers of the transformational generative theory of grammar subscribe to the innate capacity theory of language acquisition. Lenneberg (1964, 1966, 1967) postulates that man has an innate genetic predisposition to speech, independent from intelligence, but related to neurological and physical maturational "milestones." McNeill (1966a, 1966b) has described the learning process as "language creation." He suggests that

a child's systematic usage of words is evidence of an early classification system and that the child is abstracting grammatical structures and that he is operating on the basis of a universal hierarchy of categories "that are part of the child's innate endowment" (1966a, p.35). The child, like a Linguistic Acquisition Device (LAD), processes primary linguistic data as input and formulates a hypothesis, based on the knowledge of the innate linguistic universals, as output. As further observations lead to changes in the hypotheses, the child progresses step by step to adult linguistic ability. Chomsky (1968, pp.66-68) describes the acquisition process as a "theory construction," and concludes that the child must possess "intrinsic properties of mental organization" since he learns the underlying theory without instruction. Chomsky calls the "knowledge" of a language possessed by a speaker his linguistic "competence," which is systematized in a set of rules of "generative grammar"; this set of "beliefs" constitutes the theory of his language, and so language acquisition is the discovery of this theory.

Longitudinal studies of child language. A well documented area of interest has been the collection of samples of successive linguistic growth in longitudinal studies of children. The main concern was to ascertain the stages in the development of competence in the child speaker, since his performance stems from it. The phonological stages have been observed by Weir (1966) and Lewis (1951) in

the intonation patterns of infants, babbling and auditory feedback by Fry (1966, p.189) and Carroll (1960, p.337), echolalia by Brain (1961, p.316), and phonemic patterning by Jacobson and Halle (1956), who set up an order of development of phonemic structure according to linguistic universals by successive oppositions of various distinctive features. Lieberman (1952) describes the parameters of acoustic perception of phonemes and words, while Templin (1966) shows that articulation difficulties slow down development of morphology and affect type of word associations.

The syntactic development of child speech has been traced in the work of Brown and Fraser (1963); they described early sentences as "telegraphic," a term accepted by McNeill (1966, pp.18-24), who categorizes child speech as a "generic type" developed by means of a "simple grammar derived by primitive rules of their own." Although the child has a limited memory span (two digits at age two), he does not abbreviate adult sentences, but used "pivot" and "open" class words in a system of his own. Klima and Bellugi (1969) support the view that children's sentences are "not just an imperfect copy of the adult's," and claim that child speech has its own systematicity. Brown (1957) studying linguistic determinism found "that English speaking children take class membership as a clue to the meaning of a word, and so make use of the semantic distinctiveness of the parts of speech." Brown (1958) also points out the consequences of the naming

practices of adults on the cognitive development of the child, as he establishes hierarchies when learning to differentiate concepts such as "papa," "man," or "Mr. Jones." Berko (1958) substantiated that children aged four to seven years possessed morphological rules, operating in a clearly limited fashion, consistently using the most productive forms and increasing variants with age. Brown and Berko (1960, pp.1-14) asserted that "as utilization of syntax develops in children, syntactic similarity in words becomes an increasingly important determinant of word association," and that this change is "a consequence of the child's gradual organization of his vocabulary into the syntactic classes called parts-of-speech." They found that homogeneous responses by part of speech and correct usage increased with age and so demonstrated the child's developing awareness of syntax.

Once the child has mastered the base structure, he begins to venture into the area of transformations. Bellugi (1964) traces such growth in a study of development of negation from a rudimentary "no" by successive transformational approximations to only two transformations by Period 4. The new process relieves the load on memory and speeds communication. To McNeill it suggests that "grammatical relations also are a part of innate linguistic ability" (1966, p.45). Menyuk (1964) notes that children have alternating rules of grammar at any given stage, gradually

eliminating approximations and increasing the number of varying types of structures and the frequency with which they are used. More recently Menyuk (1969, pp.110-125) presented a detailed summary of research on child language, assessing it in a framework of transformational generative grammar, from base structures, through transformations, to general grammatical competence. Included is a fine analysis resulting from her study in 1963 of how utterances composed of varying grammatical structures are understood, reproduced, and spontaneously produced by children.

Other researchers have stressed the importance of understanding as a necessary prerequisite to speech development, just as essential as the initial hearing of speech. Lenneberg (1967) gives priority to comprehension over motor skills based on his study of subjects who understood, yet could not learn to speak (1962), and suggests that understanding is probably separate from speech. Fraser, Bellugi, and Brown (1963), investigating the role of understanding in production, affirmed that comprehension (passive control) occurred earlier in development than production (active control). McNeill (1966, pp.76-80) pointed out that competence cannot be divided into active or passive but is itself the feature which is used in both kinds of performance: comprehension (decoding) and production (encoding). He deduced from this experiment that production placed a greater load on memory than comprehension.

Experiments on linguistic competence. Psycholinguists have performed many experiments to test theories related to base structure, number of transformations involved in creating and processing a sentence, and the amount of embedding in a sentence, as they affect the performance of the language user in decoding and encoding. Saporta (1961), Lyons (1966), Jacobovits and Miron (1967), and Horman (1970) cover the field with selections from journals and scholarly publications in the areas now included under psycholinguistics: the nature and study of language, speech perception, sequential organization of linguistic events, semantics and meaning, bilingualism, pathology of speech behaviour, and relation of language to cognition. (References to specific articles will be made where pertinent to the present study.)

Second Language Acquisition and Bilingualism

In second language learning the pattern of acquisition is dependent upon circumstances in contrast to the almost universal pattern of first language acquisition. Records of bilingualism from infancy have been provided by Leopold (1939-1950) and Ronjat (1913) about children unaware of the duality of their language systems. Haugen (1961) classifies bilinguals according to the age at which the second language is learned: "infant bilingualism" implies simultaneous learning of both languages and differentiation of them according to context, the conversant or community; "childhood bilingualism" occurs after first language is well

established but mental plasticity is still favourable for learning a second language; "adolescent" or "adult bilingualism" which is associated with a comparative lack of success (Lenneberg notes that lateralization of brain function at about puberty signals the end of a "critical period best suited to language acquisition," 1966, pp.235-240). Haugen (1961, p.400) also reports on measures of proficiency proposed by Weinreich, Osgood and Lambert: a bilingual quotient, a scale of eight stages of language proficiency, speed of reaction time and word association tests respectively. "A profile of learning emerged showing that vocabulary building came first and associational aspects of culture last."

The co-existence of two linguistic systems in one individual demands the ability to keep them apart and use them in appropriate situations both in decoding and encoding. Ervin and Osgood (1954) established a distinction between "compound" bilingualism, where two sets of linguistic signs are associated with the same set of representational mediational processes (or meanings), and "coordinate" bilingualism, where two sets of linguistic signs are associated with two separate sets of representational processes. Lambert, Havelka and Crosby (1958) describe the acquisition contexts associated with "compound/coordinate" systems as "fused/separate" contexts. Their experiment confirmed "that separated contexts comparatively increased the associative

independence of translated equivalents of the bilingual's two languages . . . the semantic differences between translated equivalents was comparatively increased. Equal facility of code switching (translating) was shown for both groups." Weinreich (1953, pp.63-71) analyzed the mechanisms and structural causes of interference of languages in contact and tabulated them (1953, p.388); interference is seen as a feature of the "compound" system, where cultural similarities cause confusions in meanings, and a sign in one language is interpreted as its translation equivalent in the other. Weinreich concludes that "a comprehensive theory of bilingualism ought to account for both the effectively separated use of the two languages and for interference of the languages with one another" (1953, p.71).

Bilingual Behaviour

The work of Haugen and Weinreich providing major reviews of the literature has been mentioned. Another noteworthy survey, in this case of multilingualism, is written by Vildomec in 1963. Vildomec traces influences on the mother tongue and conversely on the foreign language, and mutual interference of languages in a multilingual speaker; written texts and oral samples are analyzed in a variety of languages, and finally results of questionnaires from sixty subjects detailing learning methods, media of instruction, thought, speech, and causes of difficulties with languages are summarized. This book however, lacks the careful

empirical approach employed in other research.

The bulk of experimental literature deals with bilinguals who are considered to have attained a fairly high level of mastery of both languages. Lambert (1953, 1955) showed that speed of reaction time indicated linguistic dominance for a language; Mackey (1956, 1962) set out a framework for the description of bilingualism; Lambert et al. (1958) found support for the "compound coordinate" distinction; Lambert, Havelka and Gardner (1959) found that facility on six tests correlated with reaction time speed as indicator of linguistic dominance. Only one study deals with aspects of language acquisition: Lambert (1956) used association responses to stimulus words and found that students at various stages of progress approach more closely the behaviour of native speakers; significant differences existed between beginners, advanced graduate students, and native speakers respectively. Kolers (1963, 1965, 1967) approached the question from the point of view of discovering differences within one speaker of two languages rather than comparing different speakers of two languages. Kolers (1963), using interlingual word associations, confirmed the "separate" hypothesis for coding and storing of bilingual experiences separately in each language. As only twenty per cent of the associations were "shared" for the inter- and intralingual tasks, the data were interpreted to mean that experiences are not stored in common in some supralinguistic

form. Using colour coding lists, Kolers (1965) found that "mental activities and contexts, learned in one context, are not necessarily available in another," thus again supporting the difference between the two kinds of bilingualism. The experiment on interlingual facilitation (1966) revealed a facilitating effect of repetition upon recall occurring interlingually. The probability of recalling a word when it and its translating are presented $\frac{n}{2}$ times in each of a bilingual's languages is approximately equal to its unilingual presentation n times. It appears that conceptual identity of the words in the two languages permitted the facilitation. This facilitation suggests there is a shared property across languages in spite of the separateness of coding and storage, "that property is their meaning" (Kolers, 1966, p.319). Mackey is another author who has studied learning of the second language (1965) in bilingual Canada, and published a longitudinal study of 2,000 French Canadians (Mackey, 1966).

Need for Research with "New"
Speakers of a Second Language

It is evident that only a small proportion of the psycholinguistic investigations compared speakers in the process of acquiring a second language; most studies examined the consequences of the type of bilingual acquisition. A study of subjects at varying levels of development in a second language is presented here in the hope of adding

further documentation about the stages of second language acquisition. Since various stages in the acquisition of a second language are of particular interest, the subjects, all university students, were separated into groups with approximately the same experience in English as a second language, or as a native language. (The experience and background of the four groups is discussed in Chapter II.)

The experiment was set up to explore the effect of the length of exposure to a new linguistic medium on the speaker-learner of the second language. Would he show increasing awareness of syntactic or other linguistic features with longer experience in the new medium as the native learners in the Brown and Berko study did? The learner of a second language is not necessarily doing so in an exclusively formal situation; much of the "learning" takes place in his daily communicative acts with others. Therefore consideration must be given to the linguist's evaluation of the role of environmental factors.

Environmental Factors

As noted before, the research centred around the psychological reality of competence is extensive, although to some degree contradictory. In contrast, little attention has been given by transformational grammarians to the effect of external environmental factors on verbal behaviour.

Environment is defined as the linguistic context in which a subject exists; it refers to the "stream of language" (the

input) which affects and helps to shape the subject's linguistic competence. Linguists who feel that some aspects of language development (such as syntax) cannot be accounted for by operant conditioning acknowledge that:

Any theory of any part of language acquisition requires an external model. No child is born speaking a natural language: he must hear it first (Smith & Miller, 1966, p.351).

The need to assess the nature of environmental factors is stressed by Menyuk (1969, p.6).

However, we can pursue this question by describing in detail, rather than grossly, the structure of the utterances used by children during the physiological maturational period critical in the language acquisition process and the structure of the utterances presented to the child in the primary linguistic data during this period. We may thus determine the effect of the environmental linguistic conditions on the linguistic performance of the child.

The effect of the environmental linguistic conditions on the performance of the second language user was chosen to be tested. In English an environmental linguistic factor of considerable importance is word order: it plays a crucial role in the production and comprehension of sentences. Consider, for example, Tom hit Mary and Mary hit Tom, or John eats apples and Apples eats John. Not only does word order determine semantic interpretation, but to some degree the usage of a particular part of speech also determines the probability of the order of appearance of certain word types. This latter consideration is to a large extent influenced by the so-called normal patterns of usage, as well as by

intrinsic constraints of the grammar. Miller and Selfridge (1953) found that percentage of word lists recalled increased as the order of approximation to the statistical structure of English increased in a given sample regardless of the length of the passage; recall decreased as the length of the passage increased, but the relative recall rates reflected the degree of contextual bonds. They found that "the longer the passage the greater is the usefulness of contextual associations." Since their lists were 10, 20, 30, and 50 words long they decided "that all orders of approximations less than the full text were nonsense," and yet when the order of approximation extended over five or six words the gibberish "was as easily recalled as actual text. They concluded that it is these familiar dependencies rather than the meaning per se that facilitate learning" (Saporta, 1961, pp.203-205).

Word order in English most reflects the structure of the utterance presented to the learner in the primary linguistic data encountered in the environmental linguistic conditions mentioned by Menyuk. Some syntactic orders in English occur more frequently than others, and may help constitute the "familiar dependencies" noted by Miller and Selfridge. Therefore, the relative frequency with which certain orders of parts of speech usually occur can be said to constitute primary linguistic data contributing to the environmental linguistic conditions affecting the performance

of the language learner. The effect of the relative frequency of syntactic patterns on recall by native and non-native speakers of English is the subject investigated in the present experiment. We could attempt to construct those patterns which a native speaker considers frequent, however ascertaining statistically which patterns actually occur more frequently than others is preferable in order to develop stimulus materials.

Rationale of the Experiment

Data Base

A quantified base was used to establish stimulus materials. A study by K. H. Booth (1967) provides verified linguistic evidence about the linguistic environment encountered by students--written English in an expository style. Using a 20,000 word corpus from the text of the 1962 Canada Yearbook, Booth accumulated statistical data on the structure of the English and French language. The object was to examine sequences of grammatical types occurring within sentences. Coding each word for one of sixteen grammatical classes, sentence cards were produced in which each word was represented only by its code; from these glossaries were assembled listing groups of one, two, three, and five words by frequency of occurrence for each syntactic sequence. On analyzing the relative rates of frequency and the range of distribution, it is evident that some orders occur much more

frequently than others. The sequences of five words occurring over a hundred times were defined as high frequency, and those less than ten times as low frequency; three of each were selected to be filled with appropriate lexical items to be presented to the subjects. In this way a corpus from real context was the base for the experimental stimuli, formulated according to attested patterns of usage, rather than the carefully modelled sentence structures usually listed in second language textbooks.

Processes Involved

Language events can be classified into two main behavioural processes: decoding and encoding. Osgood and Jenkins (1965) describe language decoding as the process in human communication whereby patterns of stimulation (auditory or visual) elicit certain representational mechanisms (ideas or meanings) through the operation of a complicated nervous system. Language encoding is the process by which a speaker's intentions are coded into vocal sounds for a given language (expression of ideas) by a gradually changing series of stages. Meham (1969, p.4) notes that these activities take place on three levels: phonological, semantic, and grammatical. Moulton (1966, pp.24-42) describes the semantic and grammatical processes.

In semantic encoding the speaker wishing to describe the color of some object must shape his idea to fit the semantic system of English color terms. Since this is like putting a message into proper shape to fit a code, we call this process "semantic encoding." Every message has

to undergo semantic encoding before it can be sent.

Grammatical encoding comes into play once the speaker has found the proper semantic units to express his thought; he must next arrange them in the particular way that his language requires, and so follow the grammatical scheme of his language. (In English see example of word order above.)

Semantic decoding is the task of recognizing enough bits of information in the entire code to enable the speaker to match the code with a concept which he has previously learned. . . . A tentatively decoded message "I'll senate by air mail." . . . The item 'senate' is marked as noun, whereas the code tells us that in "I'll X by Y", X must be a verb. . . . A quick check in the semantic code tells us that 'to senate by mail' just doesn't make sense and past experience tells that in speech we drop the final /d/ and /n/ [sic] of 'send', we come to the conclusion the message was "I'll send it by air mail."

In grammatical decoding the message is received as a sequence of phonemes, and is being passed along from the phonological to the grammatical code. The hearer now must group the phonemes into grammatical units of various sizes and morphemes to sentences. He matches it against his own built-in code (which must essentially be the same as A's) and decodes it in this way.

Moulton's example of semantic decoding shows the utilization not only of the speaker's semantic knowledge, but also of grammatical concepts he has stored about the functions of nouns and verbs in their appropriate structural slots. We can see how intimately the semantic and syntactic processes are linked through internalized competence by the language user during the act of communication; a contrast to the previously postulated grammarian's abstract separation of syntax and semantics in formal theory.

Syntactic Structure as a Construct

In this study it is assumed that the meaning of a

sentence is not merely the sum of its lexical items and their semantic values, but that as Fries stated (1961, pp.9-11), "in every utterance there are meanings that are not carried by the various meanings of the individual words nor by a 'fusion of the particular meanings of each word.' These utterance meanings, not carried by the words themselves, constitute a special layer of meaning, here called 'structural meanings' in distinction from 'lexical meanings'." Fries then gives three differing arrangements of nonsense words (morphologically inflected for English) in statement, question and command orders and concludes:

Structural meanings are not just vague meanings conveyed by the context in general. They are quite sharp and clear, a necessary part of every utterance, and are definitely conveyed from speaker to hearer (or writer to reader), not by lexical meanings of the words themselves, but by the contrastive arrangements of words and forms. . . . The important matter for us is to know how the speaker of English knows the difference between them. What are the signals . . . the significant contrasts that English uses to signal statement, question, or command? The native speaker responds to the structural signals without being aware they learned them.

Previously in his Structure of English, Fries (1952, p.212) set out his definition of a "modification" as basic to his theory: it is not merely the meaning of the content words used, but consists of a "structure composed of formal units in characteristic arrangements." The meaning of each structure was defined quite precisely by Fries according to the classes of the words which were combined. For example:

Class 4 word modifying a Class 1 word means "identification," as in "the above discussion" or "the flat upstairs."

Fries, we see, views the grammatical patterns of English as a system of signals for essential structural meanings; for the speaker in the act of communication it is the meaning signalled by a pattern that is important, not the pattern or the meaning in isolation.

Syntactic structure then can be considered a linguistic construct with psychological reality for the language user. We suspect that the high frequency syntactic patterns might have greater cohesion than the low frequency patterns because if a structural pattern occurs often, it is probably close to one of the "contrastive arrangements" which signals appropriate structural meanings. The fact that we chose five word sequences brings us to a unit of language processing shown to reflect familiar patterns by Miller and Selfridge (1953). Another way of viewing structural cohesion is by analyzing the immediate constituents and their groupings. Let us examine the syntactic patterns used in this study.

In the experiment three high frequency and three low frequency sequences were used as models to be filled with lexical items. Let us select a sample of each sequence for discussion; Sets 1, 2, and 3 are high frequency, and Sets 4, 5, and 6 are low frequency. (Stimulus materials are explained

in Chapter II and listed in Appendix A.)

Set 1: "name of the yellow church"

Set 2: "from the gentle master to"

Set 3: "school for the island of"

Set 4: "for church but a yellow"

Set 5: "with gentle masters march in"

Set 6: "school would prepare by guessing"

These sets are arranged in descending order of frequency, with the first three all over 100 and the last three all at the lowest rate of 8. By examining the cohesion of the constituent elements of the six sequences, we discover that Set 1 can function as a complete nominal phrase, which would account for its high frequency of occurrence and its meaningfulness. Set 2 consists of four words forming a prepositional phrase, followed by a preposition, which to the experienced subject signals the beginning of a new and predictable set of constituents. Set 3 begins with a four word nominal phrase, with another prepositional phrase to come, as indicated by the last lexical item, a preposition. In Sets 2 and 3 the cut between the penultimate noun and the final preposition is a very familiar one to the language user and should cause him little interference in recall. In Set 4 the cut is after the second word and although we can predict that a noun will ultimately occur after the final adjective "yellow," the elements preceding the sequence are hard to predict. Similarly, the words in Set 5 cannot be

analyzed as immediate constituents; the break comes after the noun, which here cannot serve as subject for the following verb, because it is part of a prepositional phrase, and so we have a high degree of unpredictability as to the items which might precede or continue the sequence. The language user can probably construct a context to serve Sets 4 and 5, but he would need more time to do so than for the high frequency sets. Set 6 is somewhat unique, in that being low frequency it still contains rather homogeneous constituents, but incomplete in this instance; here we have noun and verb in close to subject with predicate position, which though considerably less frequent than nominal constructions per se, serves as an important focus of sentence structure, and is structurally codable by the language user.

Booth's frequency ratings for five of the six sequences correlate favourably with structural cohesion; the three high frequency sequences have a considerable degree of cohesion and two of the low frequency sequences are somewhat disjointed. This correlation, in turn, is reflected in meaningfulness to the language user and greater ease in codability and storage. It is proposed that at all these levels familiarity with structure, operationalized as frequency of occurrence will facilitate recall performance, and that the dominance of the frequently occurring syntactic patterns will be demonstrated.

Choice of Task

Short term retention of verbal material has been studied from many points of view and is considered to be a reliable indicator of linguistic processes. Miller (1956) concluded that the capacity of short term memory is constant and independent of the type of material being remembered; this capacity is quantified as "seven plus or minus two 'chunks' of material." Therefore, using five word syntactic sequences will not place an undue burden on the memory of the subjects, nor will they be too easy. In order to prevent perfect recall or mere imitation of the sequences a distracting delay task was devised to be performed by the subjects before recall was permitted.

Like most cognitive activity, short term memory has been shown to be sensitive to linguistic structure: for example, recall varies with meaningfulness as measured by association value (Peterson, Peterson & Miller, 1961); Murdock and vom Saal (1967) showed that there is better recall for trigrams taken from single categories than for those taken from different categories; Henley et al. (1968) revealed the influence of semantic features of kinship terms on short term memory, finding recall poorer for triads differing in three features, rather than only two features. For all these experiments short term memory served as a reliable tool of investigation.

In addition, evidence indicates that the recall of

utterances can be dependent on their underlying structure, rather than characteristics such as length. Savin and Perchonock (1965) found that more "storage space" was required for certain types of sentences (passive, negative, WH-questions) than others regardless of their length. The acoustic signal, too, is perceived in a manner that has little to do with the physical parameters of the signal, but is dependent on the underlying structure of the signal (Lieberman, 1965). Menyuk (1969, p.10) posits three questions concerning the changes in the structure of memory for language during the maturational period:

Is it the length of the derivational history of a sentence which affects recall? Is it the types of operations involved in the derivation which affect recall? Is it aspects of a sentence which are found in its surface structure which affect recall?

The present study addresses itself to aspects of surface structure insofar as it uses syntactic arrangements manifested in the surface structure. However, it is on the basis of the frequency of occurrence of the five word sequence, that we expect differences in recall rates to be shown. Although the sequences themselves do not form sentences, they exhibit various degrees of cohesion and they can be elements of meaningful sentences; they can thus be described as "grammatical," with each word serving as a 'chunk' of information. Short term memory is an effective vehicle for a presentation, distracting task and recall experiment because it will be sensitive to the effect of

syntactic structural variations on the performance by the language user.

The Experiment

Purpose of the Experiment

One purpose of the experiment was to demonstrate the dominance of the frequently occurring syntactic patterns (sequences) over the infrequent ones, as reflected in the recall rate of high frequency and low frequency stimulus sequences. The structural elements of the sequences were predetermined by the Booth data, but the vocabulary was selected by the experimenter. In order to minimize the influence of lexical features, words of a common high frequency were selected. The same content words were used (where applicable) matching low frequency and high frequency samples. This way the lexical semantics were kept as similar as possible for the contrasting syntactic arrangements, and differences in response by the subjects could be attributed to the impact of the syntactic aspects of the sequences on recall rather than to lexical content. (Details of vocabulary selection are discussed in Chapter II.)

Another principal aim of this study was to discover and describe stages in the development of learners of a second language, in this case, English. Three groups of subjects were chosen to identify differing stages of second language development. Each group contained subjects with a

similar length of stay in an English speaking community and with similar linguistic backgrounds identified with that group, e.g. Romance or Tibeto-Chinese. Chronologically there were three types: undergraduates participating in summer immersion courses; students attending full-time first year courses, "juniors"; and students in third, fourth and graduate programmes, "seniors." The fourth group was made up of first year native Canadian English speakers. The summer students were French Canadian, while the "juniors" and "seniors" were mostly Asian non-native speakers of English.

Since the data were derived from written material it was decided to retain this mode of presentation and response. The performance measure, therefore, was written recall. It was necessary to insert a task between presenting the sequences and their recall in order to inhibit rehearsal and immediate, almost perfect recall. Counting backwards from one hundred was chosen as sufficiently engrossing, and at the same time manageable in non-native speakers, to be the distracting task. The question immediately arose as to the amount of interference that the length of the delaying counting would cause; therefore, two time durations were selected, twenty seconds and six seconds of counting backwards from one hundred, to be performed as repeated measures by all subjects. To control for order effect, half of the subjects did the long task first, while the other half took

the short task first. Every subject then performed two tests differentiated by length of delay task. The two tests were made up of different stimulus sequences, each containing nine high frequency and nine low frequency patterns in randomized orders.

Hypotheses

On the basis of the hypothesis that the speaker-hearer's familiarity with structure, operationalized as high frequency of occurrence would facilitate performance, it was expected that all subjects would have a higher rate of recall for high frequency syntactic sequences than for low frequency patterns.

Secondly, all subjects would also perform significantly better with the short rather than the long delay task.

The third prediction for all subjects was that they would score better on the task they performed second, even though none of the sequences were repeated from task to task, because of a practice effect.

The fourth hypothesis is the one of most interest to the investigator of second language acquisition: it concerns the expected achievement levels of the various groups: a) the native English speakers were predicted to perform best and to provide a "norm" for comparison with the non-native subjects. b) The senior non-native subjects, with longest exposure to an English medium, were expected to be next in rank on the basis of their "experience"; however, their

"advantage" would be tempered by the fact that their native language is not related to the Indo-European language family. c) The native French summer students and the "junior" non-native group of Asian origin, both at the first year university level, were expected to contrast on the basis of language background, not on length of stay in the English medium. Due to the relation of French and English in a language family with similar structuring and vocabulary, interference of the subject's two language systems would be less, and therefore it was assumed that the French would score higher than the "junior" non-native group; the French subjects were expected to score below the native English subjects. d) The junior non-native group would achieve the smallest scores.

The last prediction concerns size of the difference between the score on the high frequency sequences and the low frequency sequences; what we might call the high-low distinction. It is expected that the least experienced (or least advanced in language development) subjects would exhibit the greatest differential because the less exposure a subject had to the linguistic environment the less he would have encountered both the frequent and infrequent combinations. Obviously there would be a greater lack of exposure to the infrequently occurring patterns, and the less experienced subject would score considerably lower on the low frequency sequences in relation to his recall for the high frequency

patterns which became relatively prominent in a more limited exposure to the linguistic environment. So the least experienced subjects would have the greatest high-low distinction and also the smallest recall rate for the low frequency syntactic orders.

CHAPTER II

METHOD

Stimulus Materials

A set of 36 differing five-word strings were presented to the subjects for recall. These sequences were made up by forming six distinct lexical exemplifications (strings) for each of the syntactic patterns which were selected from the data in the Booth (1967) investigation. Booth found 400 possible five-word arrangements ranging in frequency rates from 8 times to 157 times in a corpus of 20,000 words. The orders occurring more than 100 times per 20,000 words were defined as high frequency, and those appearing less than 10 times as low frequency. Three of each frequency type were selected at random to be filled with appropriate lexical items for presentation to the subjects. They are listed below with the frequency of occurrence in brackets and coded by part of speech: noun (N), adjective (A), preposition (P), determiner (D), connector (C), verb (V), preverb (Z), and auxiliary (X). They are also coded by set number for reference.

<u>High Frequency</u>	<u>Low Frequency</u>
Set 1: NPDAN (155)	Set 4: PNCDA (8)
Set 2: PDANP (131)	Set 5: PANVP (8)
Set 3: NPDNP (117)	Set 6: NXVZV (8)

These word orders constituted the six syntactic sets in the experiment.

In order to make the recall vocabulary of each stimulus sequence of approximately the same degree of difficulty, the lexical items used to fill the slots of the examples were chosen from words appearing with the same high frequency in written English, a hundred times or more per million (Thorndike & Lorge, 1944). The lexical items for the 18 high frequency stimulus sequences were chosen first, and then the 18 corresponding low frequency samples were formed, using the same vocabulary for the nouns and adjectives and filling new part of speech slots with new items. The determiner, of course, had only two variants, "a/n and the," as did the preverbs, "by and to." The prepositions varied randomly throughout. For example:

High Frequency Stimulus

SET 1:
1.5 year with a true end

SET 3:
3.1 base of the ship under

Low Frequency Stimulus

SET 4:
4.5 by year but a true

SET 6:
6.1 base have gone to help

No content words were repeated within the 18 high frequency or within the 18 low frequency samples. The subjects also received pre-test training of six trial sequences, so one sample for each syntactic pattern was prepared with differing lexical choices from the experiment proper. The full list of all stimulus sequences is found in Appendix A.

The experiment tested processing of written materials,

therefore the stimulus sequences were typed in capital letters on three by five inch cards for presentation and the performance measure was written recall. The subjects recorded their responses on mimeographed forms with five blank spaces in a line provided for each sequence.

Meaningfulness Ratings

To determine if a relationship exists between the frequency of occurrence of a sequence and meaningfulness, ratings for meaningfulness of the 36 test and 6 pre-test sequences were obtained. Fifty-three first year students at the University of Victoria rated these stimuli on a seven point scale from "not/least meaningful" to "totally meaningful." The sequences were typed on one page and permuted in such a way that no syntactic pattern was presented twice in succession. Beside each sequence seven blanks were placed for the ratings (see sample page in Appendix B). Mean ratings for the 53 subjects for each syntactic set were calculated; they appear in Table I.

A one-way analysis of variance of the meaningfulness ratings showed significant differences between the means of the six syntactic sets: $p < .001$ (see Appendix C), confirming the expectation that subjects would react differently to the high frequency and low frequency structures. Using the mean square error from the ANOVA table, the meaningfulness mean for the high frequency sets and the mean for the low frequency sets were compared; they differed significantly,

TABLE I
Means and Standard Deviations for
Meaningfulness Ratings of Syntactic Sets

	<u>Mean</u>	<u>sd</u>		<u>Mean</u>	<u>sd</u>
Set 1	5.40	1.05	Set 4	2.92	1.06
Set 2	4.04	1.21	Set 5	3.12	0.99
Set 3	4.38	1.14	Set 6	4.21	1.07
High Fr.	4.60	1.28	Low Fr.	3.42	1.18

(Based on a 1-7 scale)

$F_{.95}(1, 255) = 3.84, p < .05$.^{*} This finding added support to the suggestion that high frequency orders exhibited more cohesion and codability than low frequency orders.

By arranging the sets in descending order of meaningfulness ratings the following results are obtained:

- Set 1: "moment for the busy people"
- Set 3: "paper from the captain with"
- Set 6: "paper has set to prove"
- Set 2: " with a few queens in"
- Set 5: "from few queens make into"
- Set 4: "from people and the busy"

(Remember Sets 1, 2, and 3 occur more than 100 times, and Sets 4, 5, and 6 occur 8 times.)

^{*}In this study the highest F value considered significant is the customary level of confidence, $p < .05$, which means that there is only a 5% possibility of differences due to chance.

Although the means for all high frequency sets and for all low frequency sets differed significantly, we can see that a low frequency set, Set 6, attained third place for meaningfulness over the high frequency Set 2; otherwise the high-low separation was observed in the ratings by the subjects. This effect was expected on the basis of the particular syntactic arrangement in Set 6, noun and verb in close to subject with predicate position, with high operational value for the language user, as discussed in Chapter I (p.20). In order to examine the relationship of the individual syntactic sets in regard to meaningfulness more closely, an a posteriori Newman-Keuls test for ordered means (see Kirk, 1968, pp.91-92) was performed using the results of the one-way analysis of variance for the means of the set ratings. Table II shows the degree of significant contrast between them.

The primacy of Set 1 is easily discernible. It differed significantly, $p < .01$, from all other sets, not only the low frequency sets, but also the other high frequency sets. Sets 3, 6, and 2 cluster in the four plus range and all have significant contrast to the low frequency sets, Sets 4 and 5, at the $p < .01$ level. Set 3, with second highest rating, differed in addition from Set 2 at the $p < .05$ level. (It is noteworthy that the three highest rated sets have nouns in first position, a fact which will be discussed in Chapter IV.) For reasons cited above, Set 6 did not differ

TABLE II

Newman-Keuls Multiple Comparison Test for Ordered Means
for Meaningfulness Rating Means by Syntactic Sets

Differences among Means for Meaningfulness						
SET MEANS	Set 4	Set 5	Set 2	Set 6	Set 3	Set 1
Set 4 2.921	--	.205	1.117**	1.293**	1.459**	2.482**
Set 5 3.126		--	.912**	1.088**	1.254**	2.277**
Set 2 4.038			--	.176	.342*	1.365**
Set 6 4.214				--	.166	1.189**
Set 3 4.380					--	1.023**
Set 1 5.403						--

*p<.05

**p<.01

with any significance from the high frequency Sets 2 and 3. The remaining low frequency arrangements, with little cohesion of constituent elements, did not show a significant difference between their means.

It is evident that while there is a relationship between meaningfulness and frequency of occurrence of a given syntactic pattern, it is not a perfect one; however, the rate of recall by the subjects should reflect these meaningfulness ratings to some extent.

Subjects

Sixty-four students at the University of Victoria served as subjects, forming four groups according to language background and experience, consisting of sixteen subjects each.

Group 1 was sixteen native speakers of English (seven male, nine female), all undergraduates attending a first year English course, English 110 or 120. They established a norm of expected performance or a measure of normal performance of native speakers.

Group 2 consisted of sixteen non-native speakers of English (thirteen male, three female), who were also undergraduates attending English 110 in their first year at university. Their average length of stay in an English community was 2.6 years, thus including some exposure to English in secondary school. (We refer to them as the junior non-native group.) All spoke an Asian native language:

fifteen were Chinese speakers (twelve from Hong Kong, one each from Taiwan, Malaysia, and Canton), and one was a Japanese speaker.

Group 3 was non-native students (thirteen male, three female), who had attended University of Victoria for three years or more, or were graduate students; eleven and five in each category respectively. Their average stay in an English speaking community was 4.3 years, and they comprise the senior non-native group. Native languages represented were: Chinese--ten; Japanese--two; Korean, German, Tagalog, and Indonesian, each one speaker.

Group 4 was all native speakers of French from Quebec (eight male, eight female), attending University of Victoria; three were second year undergraduates and thirteen came for a Summer Intensive English course; they too were of first or second year undergraduate level.

All subjects volunteered as a result of classroom appeal for participants in an experiment on retention of verbal material and were tested individually. Sex was not anticipated to be a relevant source of variation for the perception of syntactic cues at this late stage of linguistic maturation of the subjects. (Reid (1972) found sex not to be a significant variable in his experiment with undergraduates on discrimination of sentence types.)

Procedure

The students took part in the experiment individually.

The subjects were seated at a table facing the experimenter at the other side. First the procedural instructions were read out loud (see Appendix D) and then the six pre-test trials were given to familiarize the subjects with the procedure. The subjects had the opportunity to ask questions about the procedure before attempting the trial task. During the trials care was taken that the cards with the sequences were placed at the correct distance for reading by the subjects.

In a single trial the subject saw the five word sequence for one second; he then immediately began counting backwards from 100, as he had been instructed to do, until he was stopped with the spoken signal "Go," after an interval of 20 seconds for the long (L) task and an interval of 6 seconds for the short (S) task. All timings were done with a stopwatch by the experimenter. The subject was then given time to write down what he remembered of the sequence presentation; he was given as much time as he needed to recall what he had seen, to this extent he paced himself. Before proceeding to the next item, the subject covered the completed answers with a blank piece of cardboard. Half of the subjects (8) in each group did the long task first (L.1), and half performed the long task second (L.2), with the short task in the alternate position. There were eight subject sub-groups altogether.

In a complete test each subject was presented with

nine examples of high frequency and nine examples of low frequency sequences, making a total of eighteen stimuli per test. The 36 available sequences were arranged into two unique combinations in the following manner. Strings .1, .2, .3 of Sets 1, 2, and 3 were assembled with strings .4, .5, .6 of Sets 4, 5, and 6, constituting arrangements I and II. For arrangements III and IV the alternate strings .4, .5, .6 of Sets 1, 2, and 3 were used with strings .1, .2, .3 of Sets 4, 5, and 6. Each presentation order was in a different randomized pattern (see Appendix E).

Since every subject performed two experiments in one session, the arrangements were paired I and III, III and I, II and IV, IV and II. An added variation was the ordering of the long and short tasks; every possible arrangement occurred twice within the eight-member sub-groups, but they were assigned randomly to the subjects. (Arrangements I and II, or III and IV could not be combined because they used the same stimulus sequences.) To summarize, the following conditions prevailed for all cases:

- 1) Lexical content items were balanced across high and low frequency sequences.
- 2) Lexical items were not repeated within an arrangement.
- 3) No sequence was seen twice by any subject.

Statistical Design of the Experiment

A four factor factorial analysis of variance design

with two repeated measures factors and two between factors was used. The two repeated measures were: 1) length of delay task, two levels--long versus short; and 2) frequency of occurrence of sequences, two levels--high versus low. The between factors were: 1) language groups, four levels--native Group 1, junior non-native Group 2, senior non-native Group 3, French, Group 4; 2) order of presentation, two levels--Long 1st versus Long 2nd. A graphic realization of the data analysis design is seen in Table III.

TABLE III
Structure of Data Analysis

Group	Order	S#	LONG		SHORT	
			High fr. Set1.2.3.	Low fr. Set4.5.6.	High fr. Set1.2.3.	Low fr. Set4.5.6.
1	L.1	1	⋮	⋮	⋮	⋮
		8	⋮	⋮	⋮	⋮
	L.2	9	---	---	---	---
		16	---	---	---	---
2	L.1	17	---	---	---	---
		24	---	---	---	---
	L.2	25	---	---	---	---
		32	---	---	---	---
3	L.1	33	---	---	---	---
		40	---	---	---	---
	L.2	41	---	---	---	---
		48	---	---	---	---
4	L.1	49	---	---	---	---
		56	---	---	---	---
	L.2	57	---	---	---	---
		64	---	---	---	---

CHAPTER III

RESULTS

Scoring System

The subjects' scores were calculated by assigning a point for each word recalled correctly, regardless of position in the sequence; a total of these for a sequence constituted the raw score (R), for which a maximum of five points was possible. Another index was used by assigning an additional point per word placed correctly in the sequence; accounting for another five points over the R score, to make a total of ten points possible for the full score (SCO).

The scoring system designed to record all the variables for each subject is shown in Appendix F with the sample scoring sheet. Several features were chosen to be calculated by means of a Fortran program:

- 1) Means for recall of the high frequency and low frequency sequences in the long task and in the short task for SCO and R and for error types for each subject by groups were calculated. (For each subject's means of SCO and R by groups refer to Appendices H-1, 2, 3, and 4.) These high-low means were also calculated by group and sub-group.
- 2) Means for recall of each syntactic set, Set 1, 2, 3, 4, 5, and 6, for SCO and R for each subject in all groups,

distinguishing the long and short tasks were calculated.

(These set means were determined for comparison to the meaningfulness ratings established beforehand for each syntactic set and can be found in Appendix I.)

- 3) Means were determined for recall of each stimulus sequence for SCO, R, and error types, for the sub-groups L.1 and L.2 within the four groups and also for the groups 1, 2, 3, and 4.

Main Effect of Frequency of Occurrence

The dependent variable of principal importance was the effect of the frequency of syntactic orders on the recall rate by subjects. Using the high and low frequency SCO means of each subject a 2x2x4x2 analysis of variance was carried out to evaluate the effects of delay, frequency, language groups, and presentation order. (The complete table showing the factors of the main effect and the interactions is presented in Appendix J.) The values for SCO were used because they are a more sensitive indication of the response of the subjects. The sub-group and group means for SCO for the four factors are shown for reference in columns 1 to 4 of Table IV. Columns 5 and 6 give the means for all high frequency and all low frequency responses, regardless of the length of the delay task, columns 7 and 8 give the means of all long and all short tasks, regardless of frequency of occurrence, and column 9 gives the grand average for all conditions per sub-group, group, and all

TABLE IV

Mean Recall Full Scores for Stimulus Sequences as a Function of Delay Task,
High or Low Sequence Frequency, Groups, and Presentation Order

Group	Order	Long Delay		Short Delay		All	All	All	All	Grand Aver.
		High	Low	High	Low	High	Low	Long	Short	
1	L.1	6.97	5.47	7.95	7.17	7.46	6.32	6.22	7.56	6.89
	L.2	8.06	7.50	8.72	7.76	8.39	7.63	7.78	8.24	8.01
2	L.1	6.05	4.63	7.86	5.58	6.96	5.10	5.34	6.72	6.03
	L.2	6.96	5.43	6.24	4.44	6.60	4.94	6.19	5.34	5.77
3	L.1	5.93	5.32	7.61	6.01	6.77	5.67	5.63	6.81	6.22
	L.2	6.46	5.79	6.29	4.86	6.38	5.33	6.13	5.58	5.85
4	L.1	7.35	5.52	8.25	7.14	7.80	6.33	6.43	7.69	7.06
	L.2	7.54	6.03	7.49	6.15	7.51	6.09	6.79	6.82	6.80
1-4*	L.1	6.58	5.23	7.92	6.48	7.25	5.89	5.97	7.21	6.55
	L.2	7.25	6.19	7.18	5.81	7.22	6.00	6.74	6.57	6.61
1	1&2	7.51	6.49	8.33	7.47	7.92	6.98	7.00	7.90	7.45
2	1&2	6.51	5.03	7.05	5.01	6.78	5.02	5.77	6.03	5.90
3	1&2	6.22	5.62	7.01	5.50	6.62	5.56	5.92	6.66	6.09
4	1&2	7.44	5.77	7.87	6.65	7.66	6.21	6.61	7.26	6.93
1-4*	1&2	6.92	5.73	5.57	6.16	7.24	5.94	6.32	6.86	6.59

*collapsed

groups.

The results of the analysis of variance for the SCO measure brought out a main effect which strongly supports the first hypothesis. The effect of frequency of occurrence of syntactic patterns on recall was very significant: $F(1, 56) = 120.06$, $p < .0001$ (see Appendix J). Recall was higher when frequency of occurrence was high, as the mean SCO of 7.24 for all groups shows, and recall was much lower when frequency of occurrence was low, with a mean SCO of 5.94 (see bottom row of Table IV, columns 5 and 6). Similarly significant values resulted when a parallel test was run for the R means of each subject: $F(1, 56) = 104.71$, $p < .001$, for a high frequency mean of 3.81 and a low frequency mean of 3.23 for R for all groups out of the possible score of five points. (For analysis of variance of R means see Appendix K.) Both measures then confirmed the very significant main effect of high frequency of occurrence of syntactic patterns on recall with an F value of $p < .0001$ for all subjects.

Main Effect of Length of Delay Task

The second variable to have an expected main effect was the length of the delay task. The analysis of variance for SCO revealed a very significant effect of delay length on recall: $F(1, 56) = 24.71$, $p < .001$. The mean SCO for all groups for all conditions in the long task was 6.32 and for the short task 6.88. (For the R measure the mean for all

groups in the long task was 3.83 and in the short task 3.65 words recalled, regardless of order, with a very significant F value of $p < .001$.) This was a predicted main effect and can be seen graphically in Figure 1, where the SCO mean for all the groups collapsed (Gr1-4) appears in the central position between the means for each different language group.

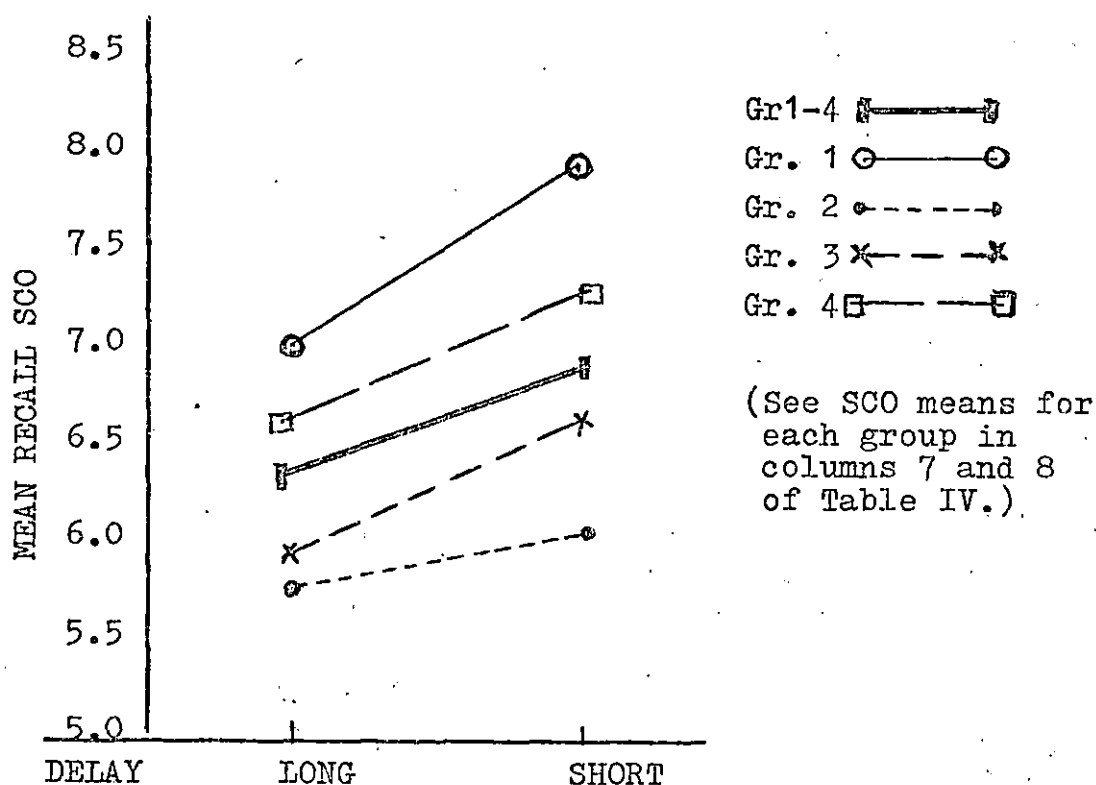


FIGURE 1. Mean Recall SCO as a Function of Delay Length for the Language Groups

It is evident that the four subject groups behaved in a relatively parallel fashion at different levels of achievement, and no interaction between groups and length of delay was expected; the F value of $p < .15$ (Appendix J) for

Length X Groups confirms it to be of no significance. All groups performed significantly better on the short rather than the long task.

Order of Presentation Effect

Investigation of the effect of order of presentation revealed no significance for the simple effect, with $p < .86$ for the SCO and $p < .76$ for the R values. For the interaction of order and groups the resulting F values were not significant, $p < .38$ for the SCO and $p < .45$ for the R measures. However, a very significant interaction took place between the variables of order of presentation and delay length, $F(1, 56) = 49.90$, $p < .0001$. In order to look more closely at the relationship of the two factors, a test of simple effects (see Kirk, 1968, pp.263-64) was calculated for these variables shown in Table V.

The order of presentation has a very marked effect of the length of the delay task. When the long task is performed first (L.1), the F value for the long-short contrast is very significant, $p < .001$; the subjects pooled across all groups perform much worse at the long task first, with a mean SCO 5.97, and much better on the short task second, with a mean SCO 7.21. (See Table IV, columns 7 and 8 in rows 9 and 10.) The converse condition occurs when the long task is done second; under those circumstances the long-short contrast is not significant. Although the subjects pooled across all groups showed a somewhat superior recall

TABLE V

Test of Simple Main Effects of Delay Length and
Presentation Order Using All Group SCO Means

DELAY		LONG	SHORT
ORDER	L.1	$\bar{X} = 5.97$	$\bar{X} = 7.21$
Long 1st		$\Sigma = 382.08$	$\Sigma = 461.44$
	L.2	$\bar{X} = 6.74$	$\bar{X} = 6.57$
Long 2nd		$\Sigma = 431.36$	$\Sigma = 420.48$

W1 = delay length

n = 64

E = .75

df = 56

RESULTS

F_{W1} at L.1 = 73.02***

F_{W1} at L.2 = 2.258 ns

$F(1, 56) = 7.08$ * $p < .01$

*** $p < .001$

for the long task second, with a mean SCO of 6.74, compared to a mean SCO of 6.51 for the short task first. Figure 2 illustrates the effect of the order of presentation on length of delay: the difficulty of the long task is accentuated at L.1 and diminished at L.2. By the same token, the short task when performed second, in conjunction with the long task first, effected much higher recall rate than when it was performed first. Thus, even though the main effect for the length of delay as a single variable was significant, this interaction indicates the importance of taking into account the effect of the order of presentation in this experiment. In Figure 2 the means SCO for all groups for all conditions performing the long task first (L.1) is contrasted with the mean SCO for the long task performed second (L.2), and with the means of the two tasks collapsed (L.1-.2).

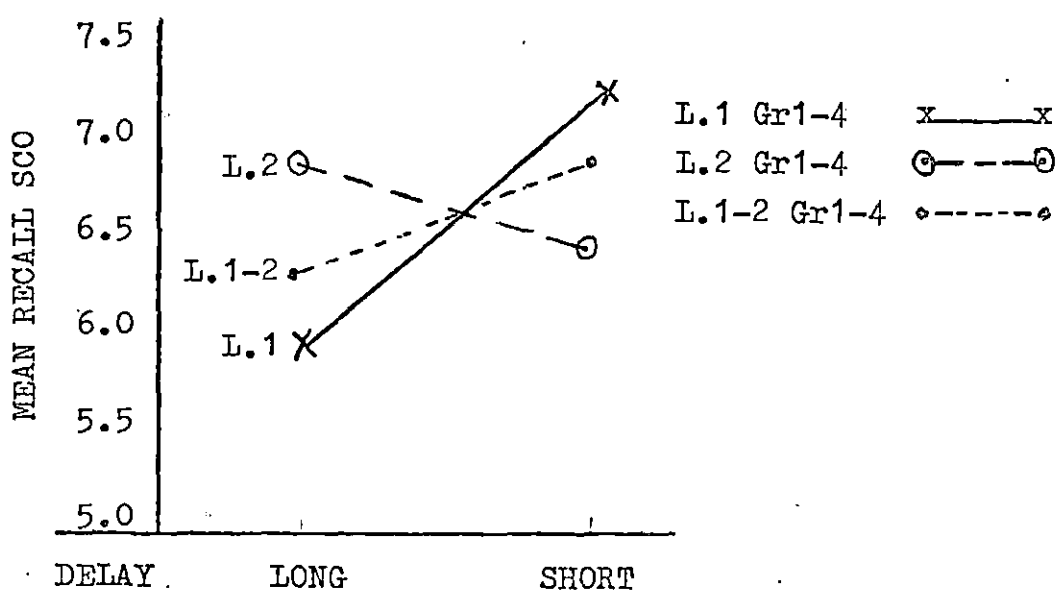


FIGURE 2. Interaction of Presentation Order and Delay Length Using Pooled Sub-Group SCO Means

Checking the R means for all groups in all conditions for this order of presentation and length of delay interaction revealed an F value at less than the $p < .0001$ level, closely correlated with the SCO measure. (The test for simple main effects and the calculations for R appear in Appendix L.) Recall for SCO, taking into account position of words in the syntactic patterns, was highly correlated to recall of words regardless of position, R, when influenced by the interaction of order of presentation and length of delay.

Differences Between Groups--Main Effect

In the analysis of variance of the high and low frequency means for SCO for each subject (Appendix J), a significant difference was obtained in the recall rate of the four subject groups: $F(3, 56) = 4.389$, $p < .008$. To investigate the relationships, an a posteriori Newman-Keuls test for ordered means using the grand means for each group for all conditions (see Table IV, column 9) for SCO was employed (Kirk, 1968, pp.91-92).

The means of the various subject groups fell almost into the order like that postulated by the hypothesis. The highest recall rate for SCO, 7.45, was attained by the native speakers of English, Group 1, and the lowest recall rate, SCO 5.90, by Group 2, the shorter residence junior non-native speakers, linguistically unrelated to English. By referring to Table VII, we note that both the linguisti-

TABLE VII

Newman-Keuls Multiple Comparison Test for
Ordered Means Using Group SCO Means

Means	Differences Among Recall SCO Means			
	Group 2 5.898	Group 3 6.087	Group 4 6.933	Group 1 7.450
Group 2:5.589 (jr. non-nat.)	---	.189	1.035	1.552**
Group 3:6.087 (sr. non-nat.)		----	.846	1.363**
Group 4:6.933 (French)			---	.517 ns
Group 1:7.450 (native)				---

*p<.05

**p<.025

For p<.05: W2= .98 W3=1.18 W4=1.30

For p<.01: W2=1.35 W3=1.49 W4=1.59

cally unrelated junior and senior Groups 2 and 3 differed significantly from the native speakers of English, $p < .025$ (see Table VII, Column 4, rows 1 and 2). Group 3, the more experienced senior speakers also with a native language linguistically unrelated to English, did perform better than the less experienced linguistically unrelated subjects in Group 2, but the difference between them was not statistically significant. (N.B. The average stay in an English environment for the junior first year university Group 2 was 2.6 years, and for the senior third year and up Group 3 it was 4.3 years.) The French speaking natives in Group 4 performed remarkably well, with a SCO mean of 6.93, and consequently do not differ significantly from the native English speakers, as one would have expected. The relationship of French and English in a language family apparently aided in the perception of the English patterns, by facilitating recall for the French speakers in processing the English syntactic sequences. Other contributing factors for this effect will be discussed in Chapter IV. This comparison for ordered means also points up a marginal relationship between French Group 4 and both non-native Groups 2 and 3: Group 2 to Group 4 value is 1.035, close to the $\alpha = .05$ critical value of 1.18, and Group 3 to Group 4 is .846 equally close to the $\alpha = .05$ critical value of .98. The French speaking group then, as predicted, is nearly significantly better in recall than the two non-native linguisti-

cally unrelated groups.

Since the results of the ordered means comparison for SCO proved to be so interesting, and the differences among groups for R were found to be significant at the $p < .006$ level (see Appendix K), the same Newman-Keuls test was carried out for the solely lexical R measure for group means, the results of which are to be found in Table VIII.

The pattern of significant findings was the same, except for a major shift for the senior non-native Group 3, when the recall rate was measured in terms of words alone. The senior Group 3 approaches the achievement of the French speaking Group 4, as the difference between them becomes non-significant on the R measure, changing from the previously marginally significant value on the SCO measure. By the same token, the significance of the contrast with the native Canadian English Group 1 is reduced from a level of $p < .025$ to $p < .05$.

Group Differences as Shown by Interactions

We have been discussing the differences between groups compared to each other on one level only. Often relevant contributing causes are discovered by noting the interactions between the component factors in an experimental situation. Therefore the interactions for groups and other factors were carefully examined. None occurred for groups and order of presentation, or for groups and length of delay. However, a marginally significant interaction for the SCO

TABLE VIII

Newman-Keuls Comparison Test for Ordered Means
Using Group R Means for All Conditions

Differences Among Means for R				
Means	Group 2 3.179	Group 3 3.319	Group 4 3.676	Group 1 3.899
Group 2:3.179 (jr. non-nat.)	---	.140	.497	.720***
Group 3:3.319 (sr. non-nat.)		---	<u>.357</u>	<u>.580*</u>
Group 4:3.676 (French)			---	.223
Group 1:3.899 (native)				---

 major shift from SCO

* $p < .05$ W2=.43 W3=.52 W4=.57

*** $p < .01$ W2=.58 W3=.65 W4=.71

measure was indicated for frequency of occurrence and groups $F(1, 3)=2.438$, $p<.074$ (see Appendix J). Because of the high correlation of the R measure, we checked that value also. It was found that for this same interaction a definitely significant difference was obtained: $F(1, 3)=3.318$, $p<.026$. This significant value gave the basis for performing a test of simple main effects of frequency of occurrence and groups. Another reason for looking into this interaction was that a varying rate of recall was expected from each group of subjects, not only in a general way, but also in regards to the high or low frequency of occurrence of the syntactic patterns. A test of simple main effects was done for both the SCO and the R measures (Kirk, 1968, pp.263-66). The two rates of results are incorporated in Table IX.

From the varying F values we can understand how the marginal interaction for the combined groups occurred for SCO and that the contrasts were more pronounced for the R measure. A graph of the interaction will assist in clarifying the relationship (see Figure 3).

Upon examination of the results of the simple effects test we see that all the groups show an F value which is significant for the high to low frequency contrast. The question here is one of the differences in sensitivity of the various groups to this high-low distinction. On the SCO measure Group 1, the native Canadian English speakers have

TABLE IX

Test of Simple Main Effects of Frequency of Syntactic
Sets and Groups, Using Group SCO and R Means

	SCO MEANS (Scale of 10)		R MEANS (Scale of 5)	
	High	Low	High	Low
MEANS OF				
Group 1 (native)	$\bar{X}=7.92$ $\Sigma=253.57$	$\bar{X}=6.98$ $\Sigma=223.23$	$\bar{X}=4.07$ $\Sigma=130.30$	$\bar{X}=3.73$ $\Sigma=119.20$
Group 2 (jr.non-nat.)	$\bar{X}=6.78$ $\Sigma=216.86$	$\bar{X}=5.02$ $\Sigma=160.64$	$\bar{X}=3.58$ $\Sigma=114.66$	$\bar{X}=2.78$ $\Sigma=88.80$
Group 3 (sr.non-nat.)	$\bar{X}=6.62$ $\Sigma=211.68$	$\bar{X}=5.56$ $\Sigma=177.88$	$\bar{X}=3.56$ $\Sigma=113.89$	$\bar{X}=3.08$ $\Sigma=98.56$
Group 4 (French)	$\bar{X}=7.66$ $\Sigma=244.99$	$\bar{X}=6.21$ $\Sigma=198.69$	$\bar{X}=4.02$ $\Sigma=128.67$	$\bar{X}=3.33$ $\Sigma=106.59$

n = 32

E = .90

df = 56

F (1, 56) = 7.08, p<.01

W2 = Frequency of Occurrence

RESULTS

F_{W2} at Gr.1 = 16.34**

F_{W2} at Gr.1 = 7.41

F_{W2} at Gr.2 = 56.13*****

F_{W2} at Gr.2 = 40.18

F_{W2} at Gr.3 = 21.09***

F_{W2} at Gr.3 = 21.72

F_{W2} at Gr.4 = 38.07****

F_{W2} at Gr.4 = 29.30

** p<.01

*** p<.005

**** p<.0005

***** p<.0001

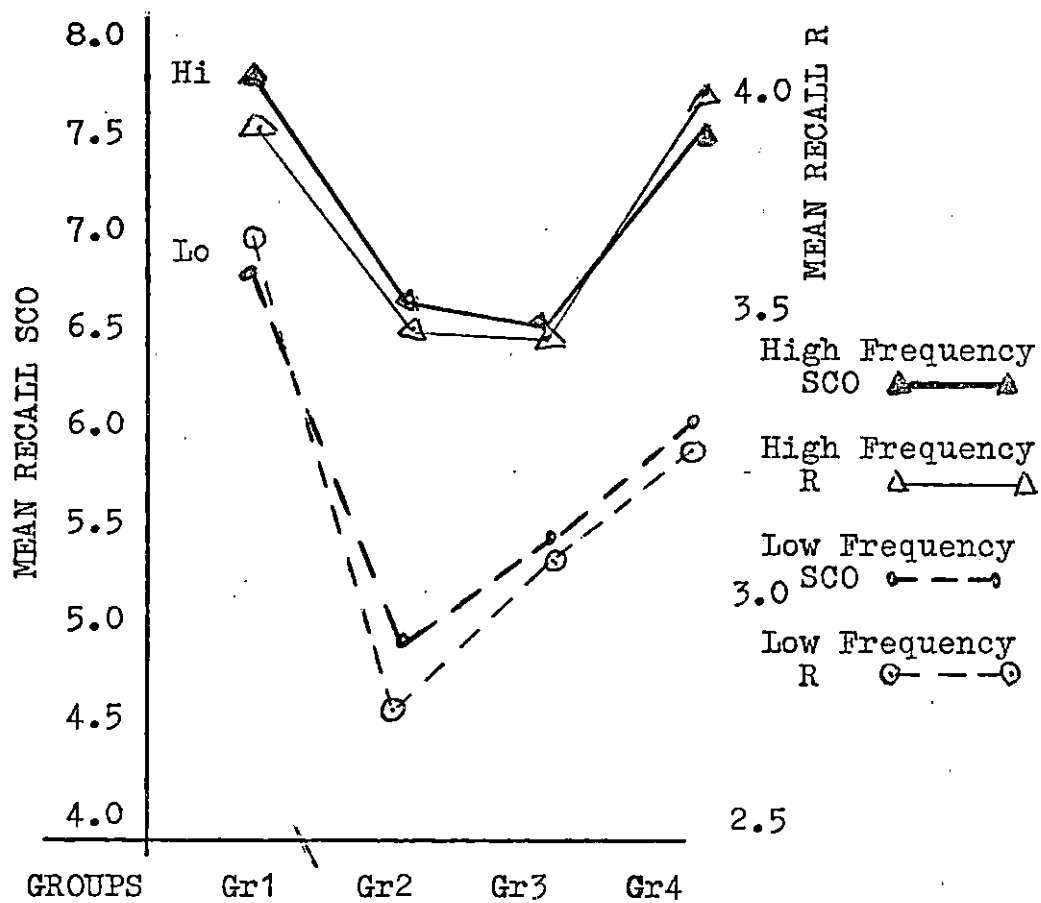


FIGURE 3. Interaction of Frequency of Occurrence of Syntactic Sets and of Language Groups as a Function of SCO Means and R Means

the lowest F value, 16.34 at $p < .01$. The junior non-native Group 2 earned an F value of 56.13, $p < .0001$, showing the greatest contrast to native Group 1, as predicted, and also the largest gap between the high-low recall rate. Group 3, with the longest period of residence in an English speaking community, displayed a differential akin to the native group, $F = 21.09$, $p < .0005$, compared to the native 16.34: as the narrowed distance in Figure 3 shows. The most interesting phenomenon occurs for the French speaking Group 4; they have the second highest F value, 38.07, $p < .0005$, and here on the high-low distinction behave most like the junior non-native Group 2, with the shorter period of residence in an English community. This is by no means illogical, because the French speaking group in fact had the shortest residence in an English environment of all the groups; thus, the French speaking Group 4 high-low gap is a good indicator of their experience with English.

An examination of the R relationships in Figure 3 clearly demonstrates why the interaction was significant. The native Group 1 differential is narrower, and the junior non-native Group 2 and the French speaking Group 4 gap is wider, reinforcing the validity of the high-low distinction measure, as an indicator of "native-like" skill. Although the recall rate for the French speaking Group 4 was near to the native Group 1, their high-low distinction indicates the shortness of their immersion in an English medium.

Syntactic Set Recall Rate Compared to
High and Low Frequency Rate

An analysis of variance based on the subjects' mean SCO per syntactic set established a basis for comparison with the high frequency and low frequency sequences (see Appendix M). For three main effects the F values for the recall rate by individual syntactic sets duplicated the significant very low probability values of the mean SCO's for high and low frequency sequences reported above. They were:

- 1) frequency of occurrence of syntactic sets, $p < .0001$;
- 2) length of delay task, $p < .0001$;
- 3) language groups (on one level), $p < .003$.

The marginal interaction of the language groups with frequency of occurrence (manifested by the high-low differential for the groups) was definitely not significant, when we viewed the groups as processing the six syntactic sequences separately: $F(1, 15) = .794$, $p < .68$ (see Appendix M). When each of the three high frequency and of the three low frequency sequences were tallied singly and not in two major groups, the high-low distinction measure was divided into too many components to show significant differences between the four groups.

Meaningfulness Ratings and Syntactic Recall Rate

In Chapter II the six syntactic sets were arranged by rank according to the meaningfulness ratings (on a scale

of 7) and then their means were tested for significant contrasts in Table II. For ease of reference we reprint the hierarchy in descending order, with two lexical samples per set.

- Set 1: "moment for the busy people"
"name of the yellow church"
- Set 3: "paper from the captain with"
"school for the island of"
- Set 6: "paper has set to prove"
"school would prepare by guessing"
- Set 2: "with a few queens in"
"from the gentle master to"
- Set 5: "from few queens make into"
"with gentle masters march in"
- Set 4: "from people and the busy"
"for church but a yellow"

Having ascertained the SCO recall means for each of the six syntactic sets (on a scale of 10), we compared the hierarchy of rankings resulting from the SCO measure for the sets with the meaningfulness order. The relationship is set out in Table X.

There is strong evidence of the effect of high frequency of Set 1 and Set 3 on the subjects' processing; both rank first and second respectively. However, the high frequency Set 2, and low frequency Set 6 interchange in the third and fourth positions. The other two low frequency Sets 4 and 5 alternate in fifth and sixth position. The question naturally arises whether the R measure for words only would reinforce either of these rankings. Using the

TABLE X
 Syntactic Set Rankings as a Function of SCO
 Means and Meaningfulness Ratings

RANK	SCO		MEANINGFULNESS			
	Freq.	Mean	Freq.	Mean		
1st	Set 1	high	7.77	Set 1	high	5.40
2nd	Set 3	high	7.47	Set 3	high	4.38
3rd	Set 2	high	6.49	Set 6	<u>low</u>	4.21
4th	Set 6	low	6.32	Set 2	<u>high</u>	4.04
5th	Set 4	low	6.09	Set 5	low	3.13
6th	Set 5	low	5.31	Set 4	low	2.92
	(Scale of 10)			(Scale of 7)		

TABLE XI
 Syntactic Set Rankings as a Function of R Means

RANK			
1st	Set 1	high fr.	4.02
2nd	Set 3	high fr.	3.96
3rd	Set 2	high fr.	3.42
4th	Set 4	low fr.	3.39
5th	Set 6	low fr.	3.38
6th	Set 5	low fr.	2.85
	(Scale of 5)		

analysis of variance for R for subjects per syntactic set, the results shown in Table XI were found.

In this case Sets 1, 2, and 3 retain the top three slots and Set 5 remains sixth, as in the SCO ranking, but Set 4 is ranked fourth and Set 6 is ranked fifth, reversing the SCO positions of these sets. The SCO and R results are closer to the ordering by frequency of occurrence, keeping all high frequency sequences, Sets 1, 2, and 3, separated from the low frequency sequences, Sets 4, 5, and 6.

Both the performance recall measures reflect the effect of the frequency of syntactic patterns on the language user, so again the primary hypothesis is confirmed, suggesting that the frequency of occurrence is influential on the short term memory processes.

CHAPTER IV

DISCUSSION

The data obtained in the study were subjected to a series of different analyses, each following from an hypothesis; we shall examine the results in respect to these as they were posited.

Hypothesis One

All subjects were expected to achieve higher recall for high frequency of occurrence, syntactic patterns than for low frequency patterns on the basis that the speaker-hearer's familiarity with structure operationalized as high frequency of occurrence would facilitate performance. The difference in recall for the high frequency and low frequency patterns was found to be significant at the $p < .0001$ level for both SCO and R measures. The likelihood of this difference being due to chance is negligible. The means for SCO were: high frequency 7.24, low frequency 5.94; the means for R were: high frequency 3.81, low frequency 3.23.

This confirms the suggestion that the relationship between structure and the frequency of occurrence of syntactic combinations is not trivial for the language user. The cohesion of immediate constituents is also reflected in this measure; the more cohesive patterns were recalled with

greater ease. The relationship between frequency of occurrence and conditional probabilities also can be considered in the light of information and communication theory. Natural language depends a great deal on redundancy to ensure that the message is transmitted. Zipf (1949) formulated the well known principle of "least effort" comparing the rank order of word frequency with frequency of occurrence; a small portion of the lexicon is used very frequently whereas many lexical items occur infrequently. The same was found by Booth (1967) in regard to frequency of syntactic patterns. Only seven of the four hundred^d five-word patterns discovered occurred more than one hundred times, but eighty-seven patterns appeared less than ten times. The rate of recall of high frequency combinations and their own high incidence of usage indicate ease of codability for the language user and the significance of the underlying syntactic structure for processing of information. Fries's postulate that the "structural meanings" are the effective tools of communication in English is corroborated by our findings.

In regard to the sequential organization of linguistic events we see that structural sequences in natural language exhibit certain probabilities of word order. Miller (1953b) provides examples of conditional probabilities on the phonological and syntactic levels: 1) g must be followed by u in English orthography; 2) in "I hope we will see you

again very _____," the context drastically reduces our freedom of selection of the last item. In both cases redundancy is maximal and is reflected in the sequential order of probability. Miller and Selfridge (1953a) showed that prior learning of the structural patterns and transitional probabilities (of English) for words of fifth-order of approximation affected not only the learning of natural arrangements but also "nonsense" arrangements (in Saporta, 1961, p.204). The point is made that "meaningful material is easy to learn, not because it is meaningful per se, but because it preserves the short range associations that are familiar to the subjects. By shifting the problem from 'meaning' to degree of 'contextual constraint' the whole area is reopened to experimental investigation." Miller asks, "How does the span of immediate memory vary with the order of approximation? Is the superiority of recall a function of the order of approximation of the materials to the statistical structure of English? Can differences in learning and recalling different orders of approximation be demonstrated as a function of age?" We have answered the first two questions, 1) Short term memory did indeed reflect a significant difference in the recall of high frequency and low frequency syntactic patterns; 2) Our data were based on a quantified statistical study which was not available in 1953, and is probably more reliable than Miller and Selfridge's method of deriving approximations, and are addressing ourselves to the

third in terms of second language acquisition. Hypothesis one is confirmed. The dominance of the high frequency patterns is clearly evident.

Hypothesis Two

All subjects were expected to perform better with the short delay task than with the long delay task, because when the interference is lessened recall is facilitated. The difference in recall rate for the long and short task was found to be significant at the $p < .0001$ level, again on both the SCO and R measures at equally significant probability ratings. (The means are: SCO--long 6.32 versus short 6.86, and for R--long 3.38 versus short 3.65.) The familiar increase in items correctly recalled as a function of a shorter retention interval is consistent with experiments on short term memory and has been noted by Murdock and vom Saal (1967) and Henley et al (1968). The ability of the subjects to retain more material after a short delay task simply reveals factors usually associated with learning and performance situations. Hypothesis two is confirmed.

Hypothesis Three

All subjects, it was predicted, would find the second task easier than the first task, because of a practice effect. For the main effect of whether a task was first or second the difference in performance was found to be of no significance at the $p < .85$ level for SCO and $p < .76$ for the R measure. This finding is quite logical when we take into

account the fact that the tasks following one another were never the same delay length, but alternated between the long and short delay task.

There was, however, a very significant interaction for factors of length and order of presentation at the $p < .0001$ level, when the long task was performed first, mean SCO 5.97, R 3.24, and the short task done second, mean SCO 7.21, and R 3.79 (see Figure 2). In the reverse order of presentation when the short task preceded the long task the difference in recall was found to be not significant. Even though the stimulus sequences used in each task were different, an effect of repetition has to be viewed as part of the picture, because the syntactic patterns per se were being repeated from task to task. Miller and McKean (1964), in their study on relations between sentences, assert "that repetition requires subjects to attend more to grammatical structure"; this tendency in the present experiment would have particular potency, because of the focus on syntactic structure built into the stimulus sequences. Another way of explaining the effect of repetition is to consider it a manifestation of duration of presentation. Waugh (1963) found that the amount of time for which an item was presented determined its probability of recall. Similarly Kolers (1966), in a study on bilingualism, confirmed a facilitating effect of repetition of items across two languages. The second presentation of the task can be seen as another way

of distributing time, or increasing duration for better recall. Hypothesis three is confirmed.

Hypothesis Four

The hierarchy of expected rate of achievement for the groups in descending order was predicted: a) the native Canadian English Group 1; b) the senior non-native Group 3; c) the French Canadian Group 4; d) the junior non-native Group 2. The aim of the study was to establish whether a difference existed on this parameter in the performance of native and non-native speakers, and to identify stages of development as a learner progresses in experience in a second language. The analysis of variance for the grand averages of groups on the SCO and R measures revealed significant differences among the groups at the $p < .008$ and $p < .006$ levels respectively. The a posteriori Newman-Keuls tests on both measures allowed us to assess the extent of the variations between the groups. The native Group 1 was significantly different from the two non-native groups, junior Group 2 and senior Group 3. However, the native Group 1 was not significantly better than the French Canadian Group 4. There was no statistically significant difference between the junior and senior non-native Groups 2 and 3. The French Canadian Group 4 also attained a marginally significant superiority over the junior non-native Group 2 on both measures, but only on the SCO measure over the senior non-native Group 3. Table XII summarizes the statistical findings

of the two Newman-Keuls tests.

TABLE XII

Differences in Group Relationships on SCO and R Measures

SCO:	Fr.N ⁻	Jr.Sr ⁻	Jr.Fr [*]	Sr.Fr [*]	Jr.N ^{***}	Sr.N ^{***}
R:	Fr.N ⁻	Jr.Sr ⁻	Jr.Fr [*]	<u>Sr.Fr⁻</u>	<u>Jr.N^{****}</u>	<u>Sr.N^{**}</u>

The shifts in relationships are underlined.

Legend: n.s.⁻

- * almost $p < .05$
- ** $p < .05$
- *** $p < .025$
- **** $p < .01$

The question might well be asked, why take the time and space to analyze the two measures when they appear to be so highly correlated? Because they are to some extent indicators of the processes involved in the decoding and encoding of the linguistic message: the semantic or lexical components are seen in R, and the syntactic features are evidenced in the SCO measure. Whereas the senior non-native Group 3 clusters closely to the junior non-native Group 2 and French Canadian Group 4 clusters with native Group 1 on the SCO measure, the major shift of senior non-native Group 3 away from junior Group 2 to a position of no significance with French Canadian Group 4 and smaller F value with the native Group 1 on the R measure demonstrates that on vocabulary recall as a separated factor the non-native group with

longer exposure to an English speaking medium (4.3 years for Group 3 to 2.6 years for Group 2) does achieve progressively higher score. On the SCO measure reflecting syntactic patterning the difference in length is not yet manifested between the junior and senior non-native Groups 2 and 3.

Lambert (1956, p.103) compares a battery of measures of developmental changes for groups of undergraduate and graduate students of French as a second language. He found that the graduates were significantly better than undergraduates on four vocabulary oriented factors, fairly close to the performance of native French speakers; on the six 'cultural' measures, such as habitual French word order or form of association, the graduates remained close to the undergraduates and differed from the native French. Thus the improvement of the senior Group 3 over junior Group 2 on the R or vocabulary measure can be seen as evidence of Lambert's claim that the vocabulary 'barrier' is easier to overcome than the cultural barrier, which is more resistant to assimilation. Syntactic patterning like habitual word order in French can be viewed as belonging in Lambert's "cultural" parameters of language skills. We should also note that Lambert's graduates were in fact committed to intensive study of the French language, and our senior subjects were students of various disciplines from the physical and social sciences with no one in the humanities or English literature, a fact which might in part account for the non-significant

differences between junior and senior non-native groups.

A manifestation of cultural factors is the high recall rate of the French Canadian Group 4. The fact that they hardly experience any cultural shock on visiting English speaking Canada, as well as the linguistic family relation of French to English probably contributed to their ease of recall of English material. The French Canadian receives a good deal of exposure to communication in English through the media intended for bilingual Canada, and even by way of bilingual labelling of products for sale everywhere. An additional individual difference should be included in the assessment of the French Canadian group; these subjects were members of a fairly select high achieving academic population, some were pre-medical students and obviously they possessed high motivation for learning; as they took the trouble to come for a special immersion course. The resident native students encompassed a more varied sample of academic abilities, since sixty-three per cent of them (10/16) attended the basic composition course English 110; possibly students chosen from more advanced English classes might have scored higher.

The native Canadian English and the French Canadian groups did score significantly better than the non-native junior and senior groups, and progressive development was shown by the senior group on the vocabulary measure. Hypothesis four is confirmed in several aspects:

Hypothesis Five

On the basis that more experience would be necessary in order to encounter, learn, and incorporate the less frequent syntactic patterns and that the more frequent patterns therefore would be learned and become more automatic first, it was reasoned that less experienced subjects would exhibit greater high-low distinction than more experienced subjects.

Our analysis of variance for the high and low frequency sequences showed a marginally significant interaction on the SCO measure for frequency of occurrence, and groups ($p < .07$) and a definitely significant interaction for the R measure at the $p < .02$ level. The simple effects tests for the two interacting factors established the levels of significance of the high-low distinction for each of the groups; all were significant but the values varied markedly (see Table IX). Figure 3 graphs the extent of the high-low gap for the four groups and shows that the vocabulary measure R intensifies the differences. Junior non-native Group 2 has the highest differential (or F value), French Group 4 is next, then senior non-native Group 3, and finally native Group 1 has the lowest differential. In the high-low differential the length of experience is reflected more nearly than by the recall rate; in the case of the French Canadian Group 4, their brief experience is evidenced in a sizeable 'gap' compared to the smaller high-low distinction of the more experienced senior non-native Group 3. Their cultural

advantage still keeps them at a superior rank over the in fact more experienced (in terms of time) junior non-native Group 2. On this measure of high-low distinction we have an indicator at a significant level between senior and junior non-native Groups 3 and 2; the length of exposure is reflected here on this more subtle and more sensitive facet of linguistic performance. Hypothesis five is confirmed.

Meaningfulness Ratings and Syntactic Set Recall Rate

A comparison of the rankings of the six syntactic patterns by recall rate to ranking by meaningfulness rating disclosed one point of difference (see Tables X and XI), in that Set 6, a low frequency pattern, intruded into the top three ranks on the meaningfulness measure. Both the performance measures of SCO and R revealed the high frequency patterns, Sets 1, 2, and 3, as dominant over the low frequency patterns, Sets 4, 5, and 6. This agreement of the two measures is not surprising, as there was a high degree of correlation between them; the results of calculations derived from the meaningfulness (M), SCO and R means for syntactic sets is shown in Table XIII.

TABLE XIII

Correlation of M, SCO and R Measures for Syntactic Sets

	M	SCO	R
M	1.000		
SCO	0.8514	1.000	
R	0.7685	0.9866	1.000

Differentiating the two measures was worthwhile, because in some instances the R, vocabulary measure, is more sensitive to differences between groups and made it possible to discover parameters of interest in the developmental aspects of second language acquisition. In the case of the ranking of syntactic sets the R values rated Set 6 below Set 4 in contrast to the SCO ranking of Set 6 above Set 4. In Table XIV the comparative rankings of the syntactic sets by the three measures are summarized.

TABLE XIV

Comparative Ranking of Syntactic Sets for M, SCO and R

	1st	2nd	3rd	4th	5th	6th
M	Set 1	Set 3	Set 6	Set 2	Set 5	Set 4
SCO	Set 1	Set 3	Set 2	Set 6	Set 4	Set 5
R	Set 1	Set 3	Set 2	Set 4	Set 6	Set 5

First let us consider the intrusion of Set 6 into top ranks on the meaningfulness ratings. The stimulus sequences were rated by a separate group of subjects, who consciously assessed the value of each sequence for meaningfulness and had time to do the task at normal processing speeds. In the meaningfulness hierarchy of syntactic sets, the top three sets were found to begin with nouns (see p.31). Lambert and Paivio (1956) found that, contrary to expectations from language habits, noun-adjective groupings of words were

learned more easily than the words in the reverse, adjective-noun order. They suggested that "nouns serve as 'conceptual pegs' from which their modifiers can be hung." Paivio (1963) believes nouns to be better 'pegs' than adjectives because of their superior ability "to elicit images to mediate response retrieval." The facilitating role of mediating imagery was investigated by Yuille, Paivio and Lambert (1969) in a learning situation for two linguistic populations, English and French. Noun-adjective recall was superior to adjective-noun recall for all combinations of word imagery (i), except for a definite increase in recall for low (i) noun-high (i) adjective combinations; the same results occurred in English and French. These findings gave them evidence that imagery is a very potent variable in verbal learning.

The meaningfulness rankings reflect some of the other factors operant in verbal processing when the subjects evaluated the sequences. In contrast, on the recall task the subjects had no time to judge the stimulus sequences and so respond primarily to the underlying structure as manifested in the frequency of occurrence of the sequences. Possibly the imagery potency of words like "rain" and "deep" in stimulus sequences 1.4 and 4.4 facilitated recall for Set 4 on the vocabulary measure R bringing Set 4 into fourth place, as compared to fifth place for SCO. The lexical items in this study were controlled for frequency but not for

imagery, therefore to manipulate the imagery variable, it would be necessary to establish ratings first and design the stimuli accordingly. We do have the recall rates for each stimulus sequence in our computer printout and can assess the difference in recall rate for the individual stimuli in comparison to the individual meaningfulness ratings already calculated at some future date.

In our discussion of decoding and encoding processes attention was drawn to the close interlacing of the semantic and syntactic features of language (pp.16-18). Recent research has extended Fries's notion of "utterance" or "structural meanings" resulting from the combination of the semantic and syntactic levels. Baker et al. (1973) say that "since it is the meaning conventionally associated with a pattern that has relevance for the language user, not the pattern itself, there is no such thing in ordinary language use as semantically empty syntax." Two kinds of meaning are thus distinguished by them: that associated with the lexical content of a sentence, "semantics of content, S(c)," and that associated with its syntactic configuration, "semantics of type, S(t)." They assert that "it is these which are the effective independent variables in any sentence complexity study, and that these features are independently manipulable, whereas syntax and semantics per se are not." Note that Baker et al. call these independent variables "semantics" of one or other type.

Reid (1972, p.22) believes that the dichotomy between syntax and semantics, "though legitimate for linguistic analysts, seems to have no relevance for the ordinary language user. What he is engaged in, when he converses, is some highly complex interplay of lexico-semantic and syntactosemantic processing." Assuming the latter mode to be involved in the apprehension of sentence types, Reid found that Mood and Modality were marked features, whereas Voice was unmarked. He suggests that it is not the syntactic differences alone which account for those distinctions but that the syntactosemantic utterance context of the sentence needs to be taken into account in linguistic theory. Reid points out that it is easy to achieve lexical variation through word substitution in fixed frames, but that syntactic structure and sentential meaning appear to be so interwoven as to preclude varying syntax while holding semantics constant (1972, p.21).

If we apply the S(c) and S(t) distinction to our data, we find that each of the six patterns chosen represents one type of S(t), and that the lexical items which filled it constitute the S(c) meaning component of the sequence. The S(t)s of our sequences were predetermined by the purpose of the experiment and the Booth data, but the vocabulary was chosen from equally frequent items (AA in Thorndike & Lorge, 1944), and carefully counterbalanced between high and low frequency sequences, using the same lexical items for the

same part of speech slots wherever possible. Thus, the high frequency and the low frequency sequences could be said to carry a similar $S(c)$, or "lexical burden," and the deduction can be made that the variance in the recall rate was due to the structural patterns or $S(t)s$, to which the individual attached meaning; Fries's "structural meanings" carried the message to the subjects and appear to have psychological reality for the language user. (A study with the intent of manipulating these factors in a controlled manner would no doubt prove rewarding.)

CHAPTER V

SUMMARY AND CONCLUSIONS

The effect of environmental linguistic factors, in English manifested as word order with attendant structural meaning for specific syntactic patterns, was operationalized for cohesion and codability as frequency of occurrence of a given syntactic sequence. Four groups of sixteen subjects, differentiated as to native language, length of experience in English, and linguistic background were compared for recall rate, with the aim of discovering parameters of performance indicative of various developmental levels in English as a second language.

In this experiment written stimulus sequences were used according to the method of complete presentation and delayed reproduction. The subjects read the sequences and then attempted to reproduce them in writing after a delaying counting task. The 64 subjects were sub-grouped by linguistic background in a two within and two between $2 \times 2 \times 4 \times 2$ design with two repeated measures. A set of 36 sequences, in one of two counterbalanced arrangements of 18 sequences (each in two random orderings), systematically varied in regard to length of delay, frequency of occurrence and order of presentation, constituted the material processed by each subject.

The impact of frequency is clear cut and suggests that prior familiarity and learning of structural patterns affected the reproduction of the verbal material. The Booth data identified certain patterns of parts of speech which are favoured and which seem to be more readily perceived and retained by the subjects in the study. This result supports the hypothesis that the environmental linguistic conditions affect the linguistic performance of the language user. All the sequences were grammatically "correct," so it was not grammaticalness which was operating, but rather familiarity with usual underlying patterns of expression that affected the subjects' verbal performance. Thus the primacy of the language users' familiarity with structure operationalized as high frequency of occurrence is shown to be a psychological reality for the individual. Theoretically a limitless potential exists for the creative use of language yet, in practice individuals are conditioned by the normal, habitual and frequently occurring patterns.

The expectation that a shorter distracting task would improve recall was strongly confirmed, and similarly in regard to order of presentation the subjects' second test results showed a higher rate of recall, especially when the long delay task was done first. Repetition of the endeavour focussed the subjects' attention on the structural features, aiding the perception of the verbal material, and perhaps even the attainment of a concept of the patterns by the

subjects.

The use of the recall rate of stimuli structured in the above fashion was shown to be applicable in ascertaining stages of development of speakers of English as a second language, as well as in determining differences between native and non-native speakers of English.

A significant difference appeared to split the linguistically non-related junior and senior Groups 2 and 3 from the French Canadian (though of short experience in an English medium) and Canadian English participants in Groups 4 and 1, when the SCO measure was used reflecting the full syntactic pattern in recall. On the vocabulary oriented measure R, a distinct level of achievement by the senior non-native Group 3 was perceived in its shift towards the French Canadian Group 4, as of not significantly different from each other. The vocabulary measure appears to be sensitive to changes when the differences in experience are not great. Even though statistically significant differences were not found between the two non-native groups of short and longer exposure to English, or between the French Canadian and native English groups, a progressive increase in recall indicated a general developmental trend upwards.

The final hypothesis revealed the dimension most likely to reflect the depth of immersion or exposure to the second language. In this case, English, it appears to be the high frequency-low frequency distinction or "gap" which

indicates the degree of familiarity with the language. The native speaker of English exhibits the smallest differential and the least experienced bilingual has the largest distance in recall rate between the two frequencies. By this more subtle and less obvious feature of language processing we can observe the subject becoming increasingly advanced in a language. The process is not entirely unlike first language acquisition. We see the child amassing a vocabulary used in his early grammatical system, and then the child incorporates the more complex aspects of the linguistic system into his competence by continuing socialization and maturation. The second language learner also makes the fastest strides in the area of vocabulary growth, but the significant improvement occurs with the incorporation of the underlying linguistic patterns which he can acquire through exposure to the linguistic environment in context of experience, thus becoming acculturated. The measures discussed in this work are not suggested as sole parameters of performance or ability, and though they can be used as part of a measure of a bilingual's ability they tell us something about the impact of structure on the language user and allow us to examine some of the factors involved in linguistic processing.

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APPENDIX A

The Stimulus Sequences, Coded by Set and
Example Number as Used in Computer Program

High Frequency

Set 1: NPDAN (155)

- 1.1 moment for the busy people
- 1.2 name of the yellow church
- 1.3 interest in the important union
- 1.4 rain in the deep sky
- 1.5 year with a true end
- 1.6 question about the modern sense

Set 2: PDANP (131)

- 2.1 from the gentle master to
- 2.2 with a few queens in
- 2.3 over the seven letters by
- 2.4 for the possible condition of
- 2.5 into an open hand over
- 2.6 for the white company with

Set 3: NPDNP (117)

- 3.1 base of the ship under
- 3.2 paper from the captain with
- 3.3 form of the trade by
- 3.4 dream of the grass above
- 3.5 use of the evening for
- 3.6 school for the island of

Low Frequency

Set 4: PNCDA (8)

- 4.1 from people and the busy
- 4.2 for church but a yellow
- 4.3 of interest but the important
- 4.4 under rain and the deep
- 4.5 by year but a true
- 4.6 with sense and a modern

Set 5: PANVP (8)

- 5.1 with gentle masters march in
- 5.2 from few queens make into
- 5.3 above seven letters increases for
- 5.4 with possible condition accepts for
- 5.5 in open hand wrote above
- 5.6 for white company come into

Set 6: NXVZV (8)

- 6.1 base have gone to help
- 6.2 paper has set to prove
- 6.3 trade would complete by selling
- 6.4 grass will follow to cover
- 6.5 evening will hurry to carry
- 6.6 school would prepare by guessing

Trial Pre-test Stimuli (Roman Numerals Correspond to Set Type)

- i) art in the clean industry
- ii) over the old tree from
- iii) hill by the circle of

- iv) with mother but the black
- v) by kind letter sends to
- vi) material will keep by discovering

Each sequence was uniquely coded so that the computer program could be devised to keep track of every sequence separately, or by sets for each subject or groups of subjects.

APPENDIX C

One Way Analysis of Variance of Meaningful
Ratings on Six Syntactic Sets (All Within)

Source	<u>df</u>	SS	MS	F	Prob
Subjects	52	238.96			
Syntactic sets	5	216.54	43.31	81.064	0.000000
Error types X <u>Ss</u>	260	130.83	.50		
W	265	347.37			
TSQ/N=	5122.72				
N =	318				
SST =	586.33				

APPENDIX D

Instructions to Subjects

First Task

This is an experiment designed to investigate how we remember verbal material. I am going to show you a series of cards, each of which has some words printed on it. Your task will be to write down what you saw after a given time period. I will show you each card for one second only. As soon as the card is removed, you are to begin counting backwards from 100 aloud. It is very important that you start counting out loud immediately after I have shown you each card. I will stop you after 20 (6) seconds and you will be given time then to write what you saw before the next card is shown.

Remember, you should look at the card, then start counting backwards from 100 out loud right away until you are stopped and then write down what you saw. After you have written each answer, please cover it with this piece of cardboard before moving on to the next.

The first few will be practice items, so you'll have a chance to see how it goes. Are there any questions?

Second Task

In the second part of the experiment we follow the same procedure as in the first part, only this time the counting backwards will last .6 (20) seconds.

APPENDIX E

Four Randomized Orders of Presentation

Order I	Order II	Order III	Order IV
I	IV	II	V
IV	I	V	II
V	II	III	VI
II	V	IV	III
III	VI	VI	I
VI	III	I	IV
4.4	1.1	4.1	3.4
1.1	4.4	1.4	4.1
1.2	4.5	1.5	4.2
4.5	1.2	4.2	1.5
4.6	1.3	4.3	1.6
1.3	4.6	1.6	4.3
2.1	5.4	2.4	5.1
5.4	2.1	5.1	2.4
5.5	2.1	5.2	2.5
2.2	5.5	2.5	5.2
2.3	5.6	2.6	5.3
5.6	2.3	5.3	2.6
6.4	3.1	6.1	3.4
3.1	6.4	3.4	6.1
3.2	6.5	3.5	6.2
6.5	3.2	6.2	3.5
6.6	3.3	6.3	3.6
3.3	6.6	3.6	6.3

APPENDIX F

Scoring System and Sample Scoring Sheet

The scoring system was designed to record all the variables to be measured for each subject: group, student number, length of delay, presentation order, arrangement of sequences, stimulus sequence, full score, raw score, and errors as described in Chapter I. Each subject's results were entered on an eighty-column IBM sheet in digits, using columns 1-39 for the long task, columns 40-71 for the short task, and columns 73-80 for the personal data on subjects.

(Sample scoring sheet is displayed in this appendix.)

Eighteen data cards were punched for each subject for use in computing the scores.

KEY TO SYMBOLS

G: group

ST: S number

ØRD: 1st L task = 1

S task = 2

2nd Presentation Order 1 or 2

3rd Arrangement type

SEQ: Stimulus sequence

SCO: Full score out of 10

R: Raw score out of 5

N: Nil, forgot word

C: content, substitute same part of speech

F: function

T: insert or omit determiner

W

SP: spelling error or addition of S

SC: scramble--misplaced word
CØ: recall of word from previous sequence
WR: completely wrong item
SS: semantic substitution; making "sense" or normal
arrangements
IN: years in English medium of instruction
FO: formal study of English
AB: residence abroad
PR: proficiency score in English

APPENDIX F SAMPLE SCORING SHEET

Francis Chinn
H.K. Biology

UNIVERSITY OF VICTORIA

80 COLUMN ENTRY

1	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80																		
C	S	RD	SEQ	SC	R	N	C	F	I	OSP	SC	C	W	R	S	S	AD	SEQ	SC	R	N	C	F	I	OSP	SC	C	W	R	S	S	INF	AB	IPR
2	8	111	11	5	3	1				1				2	23	14	5	3	1											2	11	289		
2	8	111	12	8	4		1							2	23	15	10	5																
2	8	111	13	4	2	3								2	23	16	10	5																
2	8	111	21	8	4		1							2	23	24	11	1	4							1								
2	8	111	22	10	5									2	23	25	8	4					1											
2	8	111	23	3	2	1		2	0					2	23	26	8	4					1											
2	8	111	31	6	3			1				3		2	23	34	6	3					1	1			1							
2	8	111	32	5	3	1		1				1		2	23	35	5	3				1		1	2			1						
2	8	111	33	7	3			1			1			2	23	36	10	5																
2	8	111	44	6	4			1				2		2	23	41	5	3	1						2		1							
2	8	111	45	6	3	2						1		2	23	42	10	5																
2	8	111	46	4	2			1						2	23	43	2	1	4															
2	8	111	54	4	2	1		1	1				1	2	23	51	8	4			1			1										
2	8	111	55	0	0	5								2	23	52	8	4				1												
2	8	111	56	4	2	1		2						2	23	53	7	3				1		1										
2	8	111	64	1	1	4								2	23	61	5	3			1				1		1	1						
2	8	111	65	4	3			1				2	1	2	23	62	10	5																
2	8	111	66	7	3	1					1			2	23	63	2	1	3					1	1									

C1 - business

G6 - prepared

H1 - general - gentle
G1 - semi - zone
G3 - completely

A4 - glass
H3 - increase

S1 - 2nd, Univ.

APPENDIX G SAMPLE STUDENT COMPUTER PRINTOUT

PAGE 41

GROUP 3 STUDENT 1

8 8 3 81

ORDER 111

ORDER 123

SEQUENCE	SCO	R	N	C	F	I	O	SP	SC	CO	WR	SS	SEQUENCE	SCO	R	N	C	F	I	O	SP	SC	CO	WR	SS
11	10	5	0	0	0	0	0	0	0	0	0	0	14	10	5	0	0	0	0	0	0	0	0	0	0
12	6	3	0	1	1	0	0	0	0	2	0	0	15	10	5	0	0	0	0	0	0	0	0	0	0
13	8	4	0	1	0	0	0	0	0	1	0	0	16	6	3	0	1	1	0	0	0	0	0	0	0
21	8	4	0	1	0	0	0	0	0	1	0	0	24	1	1	1	0	0	0	0	0	0	3	3	0
22	10	5	0	0	0	0	0	0	0	0	0	0	25	3	3	1	0	0	0	0	1	1	0	0	0
23	0	0	0	1	2	0	0	0	0	3	2	1	26	4	4	0	0	1	0	0	0	2	0	0	1
31	8	4	0	1	0	1	0	0	0	2	0	0	34	10	5	0	0	0	0	0	0	0	0	0	0
32	8	5	0	0	0	0	0	0	2	0	0	0	35	10	5	0	0	0	0	0	0	0	0	0	0
33	1	1	1	1	0	0	0	1	2	0	2	0	36	7	4	0	0	1	0	0	0	1	0	1	0

HI-F AVERAGES

SCO	R	N	C	F	I	O	SP	SC	CO	WR	SS	SCO	R	N	C	F	I	O	SP	SC	CO	WR	SS
6.56	3.44	0.11	0.67	0.33	0.11	0.0	0.11	0.44	0.78	0.67	0.11	6.78	3.89	0.22	0.11	0.33	0.0	0.0	0.11	0.44	0.33	0.56	0.11

SEQUENCE	SCO	R	N	C	F	I	O	SP	SC	CO	WR	SS	SEQUENCE	SCO	R	N	C	F	I	O	SP	SC	CO	WR	SS
44	7	4	0	0	1	1	0	0	0	0	0	0	41	9	5	0	0	0	1	0	0	0	0	0	0
45	4	2	2	0	1	0	0	0	0	0	0	0	42	5	3	0	0	1	0	0	0	2	0	1	1
46	5	3	2	0	0	0	0	0	1	0	0	0	43	7	4	0	0	0	0	0	0	0	0	0	0
54	1	1	1	0	1	0	0	1	2	0	1	1	51	10	5	0	0	0	0	0	0	0	0	0	0
55	2	1	3	0	1	0	0	0	0	0	0	0	52	7	4	1	0	0	0	0	0	0	0	0	0
56	2	1	4	0	0	0	0	0	0	0	0	0	53	2	2	3	0	0	0	0	0	0	0	0	0
64	4	3	2	0	0	0	0	0	2	0	0	1	61	6	3	2	0	0	0	0	0	0	0	0	0
65	9	5	0	0	0	0	0	0	0	0	1	0	62	1	1	1	0	0	0	0	1	0	0	2	0
66	8	4	0	1	0	0	0	0	0	0	0	0	63	0	0	1	0	0	0	0	0	4	4	4	1

LO-F AVERAGES

SCO	R	N	C	F	I	O	SP	SC	CO	WR	SS	SCO	R	N	C	F	I	O	SP	SC	CO	WR	SS
4.67	2.67	1.56	0.11	0.44	0.11	0.0	0.11	0.56	0.0	0.22	0.22	5.22	3.00	0.89	0.0	0.11	0.11	0.0	0.11	0.57	0.44	0.78	0.22

				MEANS			
GROUP NO.	STUDENT ORDER NO.	STUDENT NO.		HIGH SCORE RAW		LOW SCORE RAW	
1	111 223	1	LONG	8.00	4.11	4.00	2.67
			SHORT	8.78	4.44	7.67	3.78
1	111 223	3	LONG	7.56	4.44	4.44	3.11
			SHORT	9.22	4.67	7.39	4.22
1	112 224	2	LONG	6.44	3.22	5.44	2.78
			SHORT	9.78	4.89	8.11	4.22
1	113 221	5	LONG	8.67	4.33	7.00	3.78
			SHORT	8.33	4.22	7.78	4.22
1	113 221	7	LONG	7.11	3.78	7.22	3.78
			SHORT	7.78	4.00	7.67	4.00
1	113 221	13	LONG	2.22	1.44	2.33	1.44
			SHORT	2.67	1.78	3.00	2.00
1	114 222	4	LONG	10.00	5.00	8.11	4.33
			SHORT	10.00	5.00	9.22	4.67
1	114 222	6	LONG	5.78	3.00	5.22	2.78
			SHORT	7.00	3.56	6.00	3.44
1	121 213	10	LONG	8.89	4.44	8.56	4.33
			SHORT	8.67	4.56	9.22	4.67
1	122 214	8	LONG	8.89	4.67	8.00	4.22
			SHORT	8.67	4.44	8.44	4.44
1	122 214	9	LONG	8.78	4.44	7.56	4.00
			SHORT	8.22	4.33	7.78	3.89
1	122 214	11	LONG	7.56	3.89	5.44	2.89
			SHORT	9.44	4.78	6.67	3.33
1	122 214	12	LONG	6.11	3.11	6.67	3.56
			SHORT	6.67	3.78	6.33	3.56
1	123 213	15	LONG	9.56	4.89	10.00	5.00
			SHORT	9.44	4.22	10.00	5.00
1	124 212	14	LONG	7.22	3.67	6.22	3.33
			SHORT	8.67	4.33	5.56	3.44
1	124 212	16	LONG	7.44	3.89	7.56	4.00
			SHORT	10.00	5.00	8.11	4.33

PAGE 40		MEANS					
GROUP NO.	STUDENT ORDER NO.	STUDENT NO.		HIGH SCORE RAW		LOW SCORE RAW	
2	111	3	LONG	9.33	4.78	6.78	3.44
	223		SHORT	9.11	4.56	7.44	4.00
2	111	8	LONG	6.22	3.22	4.00	2.22
	223		SHORT	7.00	3.67	6.33	3.22
2	112	1	LONG	5.00	2.67	3.56	2.00
	224		SHORT	7.44	3.89	4.22	2.56
2	112	6	LONG	3.78	2.44	2.22	1.44
	224		SHORT	6.00	3.44	5.11	2.56
2	113	12	LONG	6.44	3.22	5.67	2.89
	221		SHORT	8.89	4.44	5.22	2.89
2	113	16	LONG	6.22	3.11	4.11	2.33
	221		SHORT	7.22	4.00	5.33	2.78
2	114	10	LONG	6.00	3.11	4.22	2.56
	222		SHORT	8.56	4.33	4.56	2.78
2	114	14	LONG	5.44	2.78	6.44	3.56
	222		SHORT	8.67	4.44	6.44	3.78
2	121	2	LONG	7.56	3.78	7.89	4.33
	213		SHORT	5.67	3.22	5.00	2.78
2	121	7	LONG	7.11	3.89	5.33	2.78
	213		SHORT	6.67	3.67	3.00	1.78
2	122	4	LONG	5.67	3.22	5.67	3.22
	214		SHORT	5.22	2.89	4.33	2.56
2	122	5	LONG	8.44	4.22	4.33	2.56
	214		SHORT	6.56	3.56	5.89	3.00
2	123	11	LONG	7.44	3.89	6.00	3.22
	211		SHORT	6.44	3.33	4.33	2.56
2	123	15	LONG	4.11	2.44	3.33	1.78
	211		SHORT	5.44	3.33	3.33	1.89
2	124	9	LONG	7.00	3.67	5.22	3.00
	212		SHORT	6.44	3.44	4.78	2.67
2	124	13	LONG	8.33	4.22	5.67	2.89
	212		SHORT	7.44	3.78	4.89	2.78

PAGE		60		MEANS			
GROUP NO.	STUDENT ORDER	STUDENT NO.		HIGH SCORE RAW		LOW SCORE RAW	
3	111	1	LONG	6.56	3.44	4.67	2.67
	123		SHORT	6.78	3.89	5.22	3.00
3	111	4	LONG	3.22	2.11	3.78	2.22
	223		SHORT	7.78	4.00	4.89	3.00
3	111	7	LONG	5.89	3.33	5.11	2.89
	223		SHORT	8.89	4.44	5.33	3.00
3	112	2	LONG	3.11	1.78	4.11	2.22
	224		SHORT	5.11	3.44	4.78	2.78
3	112	3	LONG	9.56	4.78	9.44	4.89
	224		SHORT	9.56	4.22	9.44	4.33
3	113	6	LONG	5.11	2.89	5.89	3.22
	221		SHORT	8.00	4.22	5.22	3.00
3	114	5	LONG	6.89	3.89	3.22	1.89
	222		SHORT	7.44	4.22	6.67	3.67
3	114	8	LONG	7.44	4.00	6.33	3.33
	222		SHORT	7.33	3.78	7.56	4.00
3	121	9	LONG	7.89	4.00	7.00	3.67
	213		SHORT	8.11	4.22	7.33	3.89
3	121	11	LONG	5.11	2.89	4.33	2.56
	213		SHORT	8.22	4.22	4.11	2.33
3	122	10	LONG	7.56	3.89	6.89	3.67
	214		SHORT	6.22	3.56	5.22	3.00
3	122	12	LONG	8.78	4.44	7.89	4.22
	214		SHORT	7.11	3.89	5.44	3.22
3	122	16	LONG	8.00	4.00	6.22	3.44
	214		SHORT	8.00	4.11	6.22	3.44
3	123	14	LONG	6.11	3.33	5.67	3.22
	211		SHORT	4.78	2.67	4.67	2.67
3	123	15	LONG	5.56	3.11	5.33	3.00
	211		SHORT	5.11	2.78	3.11	1.89
3	124	13	LONG	2.67	1.78	4.00	2.33
	212		SHORT	3.78	2.56	2.78	1.89

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MEANS

GROUP NO.	ORDER	STUDENT NO.		HIGH		LOW	
				SCORE	RAW	SCORE	RAW
4	111 223	1	LONG	5.22	3.00	3.56	2.00
			SHORT	8.33	4.22	5.67	3.11
4	111 223	3	LONG	8.44	4.22	7.56	4.11
			SHORT	9.56	4.78	9.11	4.78
4	112 224	2	LONG	7.56	3.89	3.78	2.00
			SHORT	6.67	3.56	5.11	3.00
4	112 224	4	LONG	8.11	4.33	7.78	4.00
			SHORT	9.11	4.67	8.00	4.22
4	113 221	5	LONG	6.44	3.56	4.67	2.56
			SHORT	8.89	4.44	6.00	3.44
4	113 221	7	LONG	7.11	3.67	5.56	2.78
			SHORT	7.11	3.67	8.44	3.67
4	114 222	6	LONG	7.67	4.22	3.67	2.22
			SHORT	6.33	3.44	5.56	3.11
4	114 222	8	LONG	8.22	4.22	7.56	3.89
			SHORT	10.00	5.00	9.22	4.78
4	121 213	9	LONG	5.00	3.00	4.00	2.33
			SHORT	4.00	2.44	5.00	2.78
4	121 213	11	LONG	9.78	4.89	8.56	4.78
			SHORT	10.00	5.00	8.33	4.56
4	122 214	10	LONG	7.00	3.67	6.22	3.56
			SHORT	8.33	4.44	4.89	2.78
4	122 214	12	LONG	8.78	4.56	4.89	2.67
			SHORT	7.11	3.89	5.11	3.00
4	123 211	13	LONG	8.11	4.11	8.44	4.11
			SHORT	8.00	4.11	8.00	4.11
4	123 211	15	LONG	7.56	4.00	5.33	3.11
			SHORT	7.67	4.11	6.00	3.22
4	124 212	14	LONG	7.11	3.89	5.78	2.89
			SHORT	7.22	3.67	6.67	3.67
4	124 212	16	LONG	7.00	3.89	5.00	2.56
			SHORT	7.56	4.11	5.22	2.78

APPENDIX I - 1

GROUP 1 - INDIVIDUAL STUDENT'S MEANS AS A FUNCTION OF SYNTACTIC SETS. FOR SCO AND R.

					SET1		SET2		SET3		SET4		SET5		SET6		
					SCO	R	SCO	R	SCO	R	SCO	R	SCO	R	SCO	R	
GR	1	ST	1	ORD	111	8.33	4.33	7.33	3.67	8.33	4.33	4.67	2.67	4.00	3.67	3.33	1.67
GR	1	ST	1	ORD	223	9.33	4.67	7.33	3.67	9.67	5.00	8.00	4.00	7.33	3.33	7.67	4.00
GR	1	ST	3	ORD	111	7.00	3.67	9.33	5.00	6.33	4.67	4.67	3.00	5.33	3.33	3.33	3.00
GR	1	ST	3	ORD	223	9.00	4.67	8.67	4.33	10.00	5.00	6.00	4.00	8.33	4.00	9.33	4.67
GR	1	ST	2	ORD	112	5.33	2.67	6.67	3.33	7.33	3.67	6.00	3.00	3.67	2.00	6.67	3.33
GR	1	ST	2	ORD	224	10.00	5.00	9.33	4.67	10.00	5.00	9.00	4.67	10.00	5.00	5.33	3.00
GR	1	ST	5	ORD	113	8.00	4.00	8.00	4.00	10.00	5.00	6.67	4.00	4.33	2.33	10.00	5.00
GR	1	ST	5	ORD	221	8.67	4.33	8.67	4.33	7.67	4.00	7.00	4.00	6.33	3.67	10.00	5.00
GR	1	ST	7	ORD	113	5.33	3.33	6.67	3.33	9.33	4.67	8.33	4.33	4.00	2.33	9.33	4.67
GR	1	ST	7	ORD	221	10.00	5.00	4.67	2.67	8.67	4.33	7.67	4.00	7.00	3.67	8.33	4.33
GR	1	ST	13	ORD	113	1.67	1.00	1.33	1.00	3.67	2.33	2.00	1.33	3.33	1.67	1.67	1.33
GR	1	ST	13	ORD	221	4.00	2.33	1.67	1.00	2.33	2.00	2.67	2.00	3.67	2.00	2.67	2.00
GR	1	ST	4	ORD	114	10.00	5.00	10.00	5.00	10.00	5.00	7.67	4.33	7.33	4.00	9.33	4.67
GR	1	ST	4	ORD	222	10.00	5.00	10.00	5.00	10.00	5.00	10.00	5.00	9.33	4.00	9.33	5.00
GR	1	ST	6	ORD	114	6.00	3.33	4.67	2.33	6.67	3.33	5.67	3.00	3.33	2.00	6.67	3.33
GR	1	ST	6	ORD	222	8.67	4.33	7.67	4.00	4.67	2.33	7.00	4.33	5.33	3.00	5.67	3.00
GR	1	ST	10	ORD	121	9.33	4.67	8.67	4.33	8.67	4.33	8.67	4.33	7.67	4.00	9.33	4.67
GR	1	ST	10	ORD	213	10.00	5.00	6.67	4.00	9.33	4.67	9.00	4.67	9.33	4.67	9.33	4.67
GR	1	ST	8	ORD	122	9.67	5.00	9.33	4.67	7.67	4.33	7.67	4.00	7.33	4.00	9.00	4.67
GR	1	ST	8	ORD	214	10.00	5.00	7.67	3.67	8.33	4.67	9.00	4.67	8.00	4.33	8.33	4.33
GR	1	ST	9	ORD	122	10.00	5.00	9.00	4.33	7.33	4.00	10.00	5.00	7.33	4.00	5.33	3.00
GR	1	ST	9	ORD	214	9.33	4.33	6.33	3.67	10.00	5.00	8.00	4.00	7.00	3.33	8.33	4.33
GR	1	ST	11	ORD	122	9.00	4.67	5.67	3.00	9.00	4.00	5.33	3.00	4.67	2.33	6.33	3.33
GR	1	ST	11	ORD	214	9.33	4.67	10.00	5.00	9.00	4.67	8.00	4.00	7.33	3.67	4.67	2.33
GR	1	ST	12	ORD	122	7.67	4.00	4.67	2.33	6.00	3.00	4.67	2.67	6.67	3.67	8.67	4.33
GR	1	ST	12	ORD	214	6.00	3.67	6.00	3.33	8.00	4.33	4.67	3.33	7.33	3.67	7.00	3.67
GR	1	ST	15	ORD	123	9.67	5.00	9.00	4.67	10.00	5.00	10.00	5.00	10.00	5.00	10.00	5.00
GR	1	ST	15	ORD	213	8.33	4.33	10.00	5.00	10.00	3.33	10.00	5.00	10.00	5.00	10.00	5.00
GR	1	ST	14	ORD	124	7.33	3.67	5.00	2.67	9.33	4.67	6.33	3.33	6.33	3.33	6.00	3.33
GR	1	ST	14	ORD	212	8.67	4.33	8.67	4.33	8.67	4.33	6.00	4.00	3.33	2.33	7.33	4.00
GR	1	ST	16	ORD	124	7.33	4.00	6.67	3.33	8.33	4.33	7.33	4.33	8.00	4.00	7.33	3.67
GR	1	ST	16	ORD	212	10.00	5.00	10.00	5.00	10.00	5.00	7.33	4.00	9.33	4.67	7.67	4.33

APPENDIX I-2

GROUP 2

					SET 1		SET 2		SET 3		SET 4		SET 5		SET 6		
					SCO	R	SCO	R	SCO	R	SCO	R	SCO	R	SCO	R	
GR	2	ST	3	ORD	111	8.67	4.67	9.33	4.67	10.00	5.00	5.00	3.00	9.00	4.00	3.00	1.67
GR	2	ST	3	ORD	223	9.33	4.67	8.00	4.00	10.00	5.00	7.00	3.67	7.00	3.67	5.33	3.00
GR	2	ST	8	ORD	111	5.67	3.00	7.00	3.67	6.00	3.00	5.33	3.00	2.67	1.33	5.00	3.00
GR	2	ST	8	ORD	223	8.33	4.33	5.67	3.00	7.00	3.67	5.67	3.00	7.67	3.67	8.00	4.33
GR	2	ST	1	ORD	112	7.00	4.00	6.00	3.00	2.00	1.00	5.67	3.00	1.67	1.00	3.00	1.67
GR	2	ST	1	ORD	224	9.33	4.67	6.33	3.33	6.67	3.67	4.00	2.67	6.00	3.33	2.67	1.67
GR	2	ST	6	ORD	112	3.67	2.67	4.00	2.00	3.67	2.67	2.33	1.67	0.67	0.67	5.67	3.00
GR	2	ST	6	ORD	0	6.67	3.67	6.33	3.33	5.00	3.33	3.33	2.00	4.33	2.00	6.67	3.00
GR	2	ST	12	ORD	113	6.67	3.33	4.00	2.00	8.67	4.33	6.00	3.00	3.00	1.67	5.67	3.00
GR	2	ST	12	ORD	221	8.00	4.00	10.00	5.00	8.67	4.33	4.33	2.67	4.00	2.33	6.33	3.33
GR	2	ST	15	ORD	113	6.67	3.33	6.00	3.00	6.00	3.00	3.33	2.33	2.33	1.00	7.33	4.00
GR	2	ST	16	ORD	221	9.33	4.67	5.33	3.33	7.00	4.00	7.00	3.67	6.33	3.33	5.33	2.67
GR	2	ST	10	ORD	114	6.00	3.33	4.67	2.33	7.33	3.67	5.67	3.67	3.00	2.00	4.33	2.00
GR	2	ST	10	ORD	222	8.67	4.33	8.67	4.33	8.33	4.33	5.67	4.00	4.00	2.00	2.00	1.33
GR	2	ST	14	ORD	114	6.00	3.00	2.67	1.33	7.67	4.00	5.67	3.33	6.67	3.67	5.67	3.00
GR	2	ST	14	ORD	222	7.33	4.00	10.00	5.00	8.67	4.33	7.67	4.33	6.00	3.33	5.67	3.33
GR	2	ST	2	ORD	121	7.67	4.00	7.67	4.00	7.33	3.33	8.33	4.67	7.67	4.33	8.00	4.33
GR	2	ST	2	ORD	213	9.33	4.67	3.33	2.67	4.33	2.33	7.00	4.00	3.33	2.00	5.00	3.00
GR	2	ST	7	ORD	121	6.33	3.67	6.33	3.67	8.67	4.33	5.00	2.67	5.00	2.67	6.00	3.00
GR	2	ST	7	ORD	213	4.67	2.67	6.33	3.33	9.00	5.00	2.33	1.67	1.67	1.00	5.00	2.33
GR	2	ST	4	ORD	122	8.00	4.33	4.67	2.67	4.33	2.67	6.00	3.67	4.33	2.33	7.00	3.67
GR	2	ST	4	ORD	214	3.67	2.33	7.33	3.67	4.67	2.67	7.00	3.67	3.67	2.00	3.00	2.33
GR	2	ST	5	ORD	122	7.67	3.67	9.33	5.00	8.33	4.00	4.00	2.67	4.67	2.67	4.67	2.67
GR	2	ST	5	ORD	214	6.67	3.33	4.67	3.00	8.33	4.33	7.33	4.00	3.00	1.67	6.00	3.00
GR	2	ST	11	ORD	123	9.33	4.67	4.00	2.33	9.00	4.67	7.33	4.00	3.00	1.67	7.67	3.67
GR	2	ST	11	ORD	211	9.33	4.67	5.67	2.67	4.33	2.67	4.33	3.00	3.33	1.67	5.67	3.00
GR	2	ST	15	ORD	123	2.00	1.67	5.33	3.00	5.00	2.67	2.67	1.67	4.00	2.00	4.33	2.33
GR	2	ST	15	ORD	211	8.00	4.67	3.00	1.67	5.33	3.67	3.67	2.33	3.00	1.67	4.00	2.00
GR	2	ST	9	ORD	124	8.67	4.67	4.67	2.33	7.67	4.00	4.67	2.67	6.67	3.67	3.33	2.00
GR	2	ST	9	ORD	212	6.00	3.00	6.33	3.33	7.00	4.00	4.67	2.67	3.00	2.00	6.00	3.00
GR	2	ST	13	ORD	124	8.67	4.33	6.33	3.33	10.00	5.00	7.00	4.00	5.00	2.33	5.00	2.67
GR	2	ST	13	ORD	212	8.33	4.00	7.00	3.33	7.00	4.00	5.33	3.33	4.33	2.33	4.33	2.33

APPENDIX I-3

GROUP 3

					SET 1		SET 2		SET 3		SET 4		SET 5		SET 6		
					SCO	R	SCO	R	SCO	R	SCO	R	SCO	R	SCO	R	
GR	3	ST	1	ORD	111	8.00	4.00	6.00	3.00	5.67	3.33	5.33	3.00	1.67	1.00	3.67	2.00
GR	3	ST	1	ORD	123	8.67	4.33	2.67	2.67	9.00	4.67	7.00	4.00	6.33	3.67	4.67	2.33
GR	3	ST	4	ORD	111	6.67	3.67	1.33	1.00	1.67	1.67	3.00	2.00	2.33	1.67	7.67	4.00
GR	3	ST	4	ORD	223	9.00	4.00	7.00	3.67	8.33	4.33	7.00	4.00	2.33	2.00	2.67	1.67
GR	3	ST	7	ORD	111	9.00	4.67	5.00	3.00	3.67	2.33	2.33	1.33	6.67	3.67	5.33	3.00
GR	3	ST	7	ORD	223	9.33	4.67	8.67	4.33	8.67	4.33	5.00	2.67	6.33	3.67	3.67	2.33
GR	3	ST	2	ORD	112	5.33	3.00	2.00	1.33	2.00	1.00	3.33	2.00	4.00	2.00	7.33	4.00
GR	3	ST	2	ORD	224	5.67	3.67	5.67	3.33	4.00	3.33	4.00	2.67	4.33	2.33	6.00	3.33
GR	3	ST	3	ORD	112	9.33	4.67	10.00	5.00	9.33	4.67	9.00	5.00	10.00	5.00	6.00	3.00
GR	3	ST	3	ORD	224	9.33	3.00	10.00	5.00	9.33	4.67	9.33	3.33	9.00	4.67	7.33	3.67
GR	3	ST	5	ORD	113	4.33	2.67	4.33	2.67	6.67	3.33	5.67	3.00	3.67	2.00	9.00	4.67
GR	3	ST	6	ORD	221	7.00	4.00	7.00	3.67	10.00	5.00	6.00	3.67	5.00	2.67	8.33	4.33
GR	3	ST	5	ORD	114	6.67	3.67	7.33	3.67	6.67	4.33	2.00	1.33	1.00	0.67	6.00	3.67
GR	3	ST	5	ORD	222	8.00	4.33	9.00	4.67	5.33	3.67	7.00	4.00	4.33	2.33	5.67	3.00
GR	3	ST	8	ORD	114	9.33	4.67	4.33	2.67	8.67	4.67	6.00	3.67	4.67	2.00	8.67	4.33
GR	3	ST	8	ORD	222	8.67	4.33	4.67	2.33	8.67	4.67	7.67	4.33	7.00	3.33	8.00	4.33
GR	3	ST	9	ORD	121	6.67	3.33	7.00	3.67	10.00	5.00	10.00	5.00	5.67	3.00	8.33	4.33
GR	3	ST	9	ORD	213	10.00	5.00	5.00	3.00	9.33	4.67	7.67	4.33	5.33	3.00	7.00	3.67
GR	3	ST	11	ORD	121	4.00	2.67	6.67	3.33	4.67	2.67	4.33	2.67	4.00	2.33	5.33	3.00
GR	3	ST	11	ORD	213	7.67	4.00	9.00	4.67	8.00	4.00	2.67	2.00	2.67	1.33	9.67	4.67
GR	3	ST	10	ORD	122	9.67	5.00	5.33	2.67	7.67	4.00	6.67	3.67	5.00	2.67	5.33	3.00
GR	3	ST	10	ORD	214	6.67	3.33	5.00	3.33	7.00	4.00	5.33	2.67	3.67	2.33	6.33	3.67
GR	3	ST	12	ORD	122	8.67	4.33	8.33	4.33	9.33	4.67	8.33	4.33	6.67	3.67	9.00	4.67
GR	3	ST	12	ORD	214	9.33	4.67	5.00	3.00	7.00	4.00	7.00	4.00	5.00	3.00	6.00	4.00
GR	3	ST	16	ORD	122	9.33	4.67	7.33	3.67	7.33	3.67	5.67	3.00	7.00	3.67	7.67	4.33
GR	3	ST	16	ORD	214	7.33	4.00	8.00	4.00	8.67	4.33	7.33	4.33	5.00	2.67	3.67	2.00
GR	3	ST	14	ORD	123	8.00	4.33	3.33	1.67	7.00	4.00	5.33	3.33	5.33	3.00	6.33	3.67
GR	3	ST	14	ORD	211	5.67	3.00	2.67	1.67	6.00	3.33	6.33	3.67	3.33	2.00	7.00	3.67
GR	3	ST	15	ORD	123	9.00	4.00	2.67	2.00	6.00	3.33	5.67	3.33	8.00	4.00	4.33	2.33
GR	3	ST	15	ORD	211	7.67	4.33	1.67	1.00	6.00	3.00	4.00	2.33	3.00	1.67	3.33	2.00
GR	3	ST	13	ORD	124	2.00	1.33	2.67	1.67	3.33	2.33	3.00	2.00	4.00	2.00	3.33	2.33
GR	3	ST	13	ORD	212	3.67	3.00	4.67	2.67	3.00	2.00	2.00	1.33	2.33	1.67	3.00	2.00

APPENDIX I-4

				SET 1		SET 2		SET 3		SET 4		SET 5		SET 6			
				SCO	R	SCO	R	SCO	R	SCO	R	SCO	R	SCO	R		
GR	4	ST	1	ORD	111	6.33	3.67	4.33	2.67	3.00	3.00	2.67	1.33	3.00	1.67	3.33	2.00
GR	4	ST	1	ORD	223	7.33	3.67	9.33	4.67	8.33	4.33	8.00	4.33	3.33	2.00	2.67	1.67
GR	4	ST	3	ORD	111	8.00	4.00	8.67	4.33	8.67	4.33	8.00	4.00	6.00	3.67	5.67	3.00
GR	4	ST	3	ORD	223	10.00	5.00	8.67	4.33	10.00	5.00	10.00	5.00	7.67	4.33	5.67	3.00
GR	4	ST	2	ORD	112	8.67	4.33	8.33	4.33	5.67	3.00	3.33	1.67	2.67	1.33	8.67	4.67
GR	4	ST	2	ORD	224	9.33	4.67	4.00	2.33	6.67	3.67	5.33	3.00	6.00	4.00	9.67	5.00
GR	4	ST	4	ORD	112	9.00	4.67	6.67	3.67	8.67	4.67	9.33	4.67	5.33	2.67	5.33	3.00
GR	4	ST	4	ORD	224	9.33	4.67	8.33	4.33	9.67	5.00	8.00	4.00	6.33	3.67	4.00	2.00
GR	4	ST	5	ORD	113	7.00	4.00	3.00	1.67	9.33	5.00	6.33	3.67	2.00	1.00	8.67	4.67
GR	4	ST	5	ORD	221	8.67	4.33	8.67	4.33	9.33	4.67	7.67	4.33	2.33	1.67	9.67	5.00
GR	4	ST	7	ORD	113	6.00	3.33	5.33	2.67	10.00	5.00	6.00	3.33	5.00	2.33	5.67	3.00
GR	4	ST	7	ORD	221	8.00	4.00	5.67	3.00	7.67	4.00	9.33	2.67	8.00	4.33	8.00	4.33
GR	4	ST	6	ORD	114	8.00	4.33	8.67	4.67	6.33	3.67	2.67	2.00	3.00	1.33	5.67	2.67
GR	4	ST	6	ORD	222	8.67	4.33	4.00	2.33	6.33	3.67	4.00	2.33	4.00	2.33	8.00	4.00
GR	4	ST	8	ORD	114	9.00	4.67	5.67	3.00	10.00	5.00	7.67	4.00	6.33	3.33	5.33	3.33
GR	4	ST	9	ORD	222	10.00	5.00	10.00	5.00	10.00	5.00	10.00	5.00	8.33	4.33	8.67	4.67
GR	4	ST	9	ORD	121	7.00	3.67	4.33	2.67	3.67	2.67	4.00	2.33	2.67	1.67	8.67	4.33
GR	4	ST	9	ORD	213	2.33	1.67	4.00	2.67	5.67	3.00	4.67	2.67	5.67	3.00	9.33	5.00
GR	4	ST	11	ORD	121	10.00	5.00	10.00	5.00	9.33	4.67	7.67	4.67	8.33	4.67	5.33	3.00
GR	4	ST	11	ORD	213	10.00	5.00	10.00	5.00	10.00	5.00	8.00	4.67	8.00	4.33	4.67	2.67
GR	4	ST	10	ORD	122	10.00	5.00	6.67	3.33	4.33	2.67	4.67	3.00	8.00	4.33	9.67	5.00
GR	4	ST	10	ORD	214	8.33	4.33	8.33	4.33	8.33	4.67	6.00	3.33	5.00	2.67	9.00	4.67
GR	4	ST	12	ORD	122	9.33	4.67	10.00	5.00	7.00	4.00	2.67	1.67	5.33	2.67	6.00	3.33
GR	4	ST	12	ORD	214	7.00	4.00	7.33	3.67	7.00	4.00	7.00	3.67	5.00	3.00	3.67	2.33
GR	4	ST	13	ORD	123	8.67	4.33	5.67	3.00	10.00	5.00	8.33	4.33	7.67	3.67	6.67	3.67
GR	4	ST	13	ORD	211	10.00	5.00	5.33	3.00	8.67	4.33	7.00	4.00	9.33	4.33	3.33	2.33
GR	4	ST	15	ORD	123	7.67	4.00	6.00	3.33	9.00	4.67	5.67	3.67	4.67	2.33	9.33	4.33
GR	4	ST	15	ORD	111	7.00	4.00	7.67	4.00	8.33	4.33	4.33	2.67	6.00	3.00	7.67	4.00
GR	4	ST	14	ORD	124	7.00	3.67	5.67	3.00	8.67	5.00	8.67	4.33	5.00	2.67	5.67	3.33
GR	4	ST	14	ORD	212	8.67	4.33	7.33	3.67	5.67	3.00	4.67	3.00	7.33	3.67	7.67	4.00
GR	4	ST	16	ORD	124	7.67	4.00	5.00	3.33	8.33	4.33	8.67	4.33	2.00	1.00	3.67	1.67
GR	4	ST	16	ORD	212	9.00	4.67	7.00	4.00	6.67	3.67	3.33	1.67	4.33	2.33	8.00	4.33

APPENDIX J

Complete Analysis of Variance as a Function of Groups,
Delay Task, Sequence Frequency and Presentation Order

Source	df	SS	MS	F	Prob.
Subjects	63	558.22			
Groups (G)	3	101.65	33.88	4.39	0.01
Order (O)	1	0.25	0.25	0.03	0.86
G x O	3	24.03	8.01	1.04	0.38
	56	432.29	7.72		
Delay (D)	1	18.52	18.52	24.71	0.00
D x G	3	4.12	1.37	1.83	0.15
D x O	1	37.39	37.39	49.90	0.00
D x G x O	3	4.35	1.45	1.93	0.13
	56	41.96	0.75		
Frequency (F)	1	108.54	108.54	120.06	0.00
F x G	3	6.61	2.20	2.44	0.07
F x O	1	0.41	0.41	0.45	0.51
F x G x O	3	0.34	0.11	0.13	0.94
	56	50.63	0.90		
D x F	1	0.74	0.74	1.82	0.30
D x F x G	3	4.76	1.59	2.31	0.09
D x F x O	1	0.40	0.40	0.59	0.45
D x F x G x O	3	1.54	0.51	0.75	0.53
	56	38.54	0.69		
	192	318.85			
TSQ/N =	11124.05				
N =	256				
SST =	877.07				

APPENDIX K

Complete Analysis of Variance for R Measure
as a Function of the Four Factors

Source	df	SS	MS	F	Prob.
Subjects	63	109.00			
Groups (G)	3	20.76	6.92	4.61	0.01
Order (O)	1	0.14	0.14	0.10	0.76
G x O	3	4.04	1.35	0.90	0.45
	56	84.05	1.50		
Delay (D)	1	4.70	4.70	26.84	0.00
D x G	3	0.53	0.18	1.01	0.39
D x O	1	7.57	7.57	43.20	0.00
D x G x O	3	1.28	0.43	2.44	0.07
	56	9.81	0.18		
Frequency (F)	1	21.61	21.61	104.74	0.00
F x G	3	2.05	0.68	3.32	0.03
F x O	1	0.07	0.07	0.34	0.56
F x G x O	3	0.04	0.01	0.61	0.98
	56	11.55	0.21		
D x F	1	0.11	0.11	0.81	0.37
D x F x G	3	1.44	0.48	3.53	0.02
D x F x O	1	0.17	0.17	1.27	0.27
D x F x G x O	3	0.26	0.09	0.63	0.60
	56	7.64	0.14		
	192	68.83			

TSQ/N = 3168.78

N = 256

SST = 177.83

APPENDIX L

Table VI

Test of Simple Main Effects of Delay Length
and Presentation Order Using Pooled R Means

ORDER	DELAY	
	Long	Short
Long 1st	$\bar{X} = 3.236$ $\Sigma = 207.104$	$\bar{X} = 3.793$ $\Sigma = 242.752$
Long 2nd	$\bar{X} = 3.570$ $\Sigma = 228.48$	$\bar{X} = 3.497$ $\Sigma = 223.808$

W1 = delay length

m = 64

E = .20

df = 56

RESULTS

F_{W1} at L.1 = 49.65****

F_{W1} at L.2 = .86ns

F (1, 56) = 7.08, *p<.01

****p<.0001

CALCULATIONS

$$SS_{W1} \text{ at L.1} = \frac{(207.104)^2}{64} + \frac{(242.752)^2}{64} - \frac{(449.856)^2}{128} = 9.927$$

$$F_{W1} \text{ at L.1} = \frac{9.93}{20} = 49.65****$$

$$SS_{W1} \text{ at L.2} = \frac{(228.48)^2}{64} + \frac{(223.808)^2}{64} - \frac{(452.288)^2}{128} = .1716$$

$$F_{W1} \text{ at L.2} = \frac{.172}{.20} = .86 \text{ ns}$$

APPENDIX M

Complete Analysis of Variance for Syntactic
Sequences on the SCO Measure

Source	df	SS	MS	F	Prob.
Subjects	63	1476.43			
Groups (G)	3	309.63	103.21	5.25	0.00
Order (O)	1	4.42	4.42	0.23	0.64
G x O	3	60.83	20.28	1.03	0.39
	56	1101.55	19.67		
Delay (D)	1	52.90	52.90	26.56	0.00
D x G	3	12.10	4.03	2.03	0.12
D x O	1	115.93	115.93	58.92	0.00
D x G x O	3	13.92	4.64	2.33	0.08
	56	111.57	1.99		
Frequency (F)	5	530.48	106.10	33.31	0.00
F x G	15	37.92	2.53	0.79	0.68
F x O	5	8.16	1.63	0.51	0.77
F x G x O	15	23.72	1.58	0.50	0.94
	280	891.98	3.19		
D x F	5	12.12	2.42	1.07	0.38
D x F x G	15	27.08	1.81	0.80	0.68
D x F x O	5	16.95	3.39	1.50	0.19
D x F x G x O	15	38.81	2.59	1.15	0.31
	280	632.28			
	704	2525.93			
TSQ/N =	33193.62				
N =	768				
SST =	4002.36				

VITA

Surname: KURTH Given Names: ERIKA MIRIAM

Place of Birth: PRAGUE CZECHOSLOVAKIA

Date of Birth: _____

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THE ACQUISITION OF ENGLISH AS A SECOND LANGUAGE

Author


ERIKA MIRIAM KURTH

Name

DECEMBER 1973

Date