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UNIVERSITÉ D'OTTAWA
UNIVERSITY OF OTTAWA

READING IN L1, L2, AND FL: A VARIABLE-TREATMENT STUDY

Badia Zerhouni

**Thesis submitted to
the School of Graduate Studies and Research
in partial fulfillment of the requirements for
the degree of Doctor of Philosophy
in Linguistics**



**University of Ottawa
July 1996**



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**To the memory of my mother
Fatma Bennani**

**To the memory of my father
Abdessalam Zerhouni**

**To the memory of my brother
Mohammed Zerhouni**

May they all Rest in Peace

ABSTRACT

The present study investigated the effects of four independent variables on free immediate recall of four texts: (1) background knowledge, (2) the global structure of the texts, (3) the propositional structure of the texts, and (4) subjects' second/foreign language proficiency level. Two texts, Text F and Text M discussed topics related to humanities; the other two, Text S and Text E, discussed topics related to science. The four texts had each a different global structure, and were divided into four propositional levels. Three linguistic groups were involved in the study: (1) L1 group (Canadian anglophones), (2) L2 group (Canadian francophones), and (3) FL (Iranian, Serbian, and Moroccan learners of English as a second/foreign language). The three groups consisted of both humanities and science subjects. They were all university students either at the graduate or undergraduate level.

The major findings of the present study are as follows: (1) Background knowledge was, to a considerable extent, a determining factor in comprehension and recall of information by subjects, but interest in and motivation for the topic/content of reading were also important factors, (2) Global structure of the texts did not seem to have any determining effects on comprehension and recall of information. Subjects who identified the correct global structure of the texts did not yield different recalls from those who did not identify the correct structure, or those who did not provide a structure at all. Also, there did not seem to be any important interactions between the type of global structure and the topic of the text. (3) Propositional structure produced a variety of significant results. Results of all the groups combined for each of the texts used in the study indicated respect of the hierarchy principle. However, analysis of results at the paragraph level of each text indicated that propositional recall was not always consistent with the hierarchy principle. This analysis also indicated some effects of the serial position principle. (4) Language proficiency also yielded somewhat mixed results. On the one hand, it was shown to be a determining factor in comprehension and recall of information in that higher proficiency

levels performed better than lower ones, and L1 and L2 were both superior to FL. On the other hand, it was shown that there were cases of nonsignificant differences between higher and lower proficiency levels, and between L1, L2, and FL. There were also occurrences of superior performances among L2 and FL subjects over L1 subjects.

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CHAPTER I

INTRODUCTION

1.1 Rationale for Investigating Reading

In 1908 Huey characterized reading as "the most remarkable specific performance that civilization has learned in all its history" as quoted in Singer and Ruddell (1985: 8). This statement attests to the important role of this skill in the progress that humanity has achieved throughout history. Today reading has become a vital skill that one needs to develop in order to be able to survive in modern society. People need to read directions, warnings, signs, notices, prescriptions, legal documents, information documents, newspapers, and so forth, on a daily basis. These activities are generally taken for granted. Unfortunately, they are often a source of embarrassment for the illiterate who always need other people's help to understand any type of written information. As Rayner and Pollatsek (1989: preface) put it "reading is a highly complex skill that is a prerequisite to success in our society.....where so much information is communicated in written form."

Reading is also the most important skill for one's intellectual growth. It is mainly through reading that people can progress in their fields of interest. At school, most learning is acquired through reading, and understandably, given the amount of information that students need to learn on their own. Teachers can only provide some guidance, but they cannot provide students with all the information that they need. The best service that teachers could provide their students is to teach them strategies that would help them to become skilled independent readers so that they are able to access all types of materials on their own.

Such is the case for the learning of most disciplines including second and foreign language learning. The present study has chosen to focus on reading in general but with

particular focus on reading English as a second (L2) or foreign language (FL). The motivation for the study is the conviction of the importance of reading not only in learning the target language (TL) along with the target culture, but also in opening new horizons for interested students who desire to continue learning through the TL on their own. Reading is especially important for EFL learners, given the fact that they live in their own communities and thus have little exposure to the TL outside the classroom. In such contexts, reading materials are usually available whereas listening materials and native speakers with whom they can interact may only be available by chance. This is why the main emphasis in most EFL programs is usually on the written skills, especially reading. Alderson states, "In many parts of the world a reading knowledge of a foreign language is often important to academic studies, professional success, and personal development. This is particularly true of English as so much professional, technical and scientific literature is published in English." (1984: 1)

Another reason why reading is particularly important for FL learners is that it is the only skill that they can develop and use on their own later in life, provided that they have had some previous training on how to become independent readers. Finally, reading is an important predictor of language learners' overall proficiency (Henning, 1975). Therefore, one way of developing proficiency in a FL is through development of the reading skill.

Reading in a FL, however, is often a source of difficulty for learners. The problems that they encounter are due to a multitude of factors including lack of appropriate reading strategies, linguistic difficulties, lack of background knowledge related to the topic of the target passage or to its global structure, to name only a few. Research (e.g., Bartlett, 1978; Carrell, 1985; Floyd and Carrell, 1987; Raymond, 1993) has shown, however, that learners can overcome their difficulties when they receive the appropriate training.

1. 2 Justification for the Present Study

The major area of investigation of the present thesis is reading in general, with a focus on reading in L2 and FL. It aims particularly at investigating the impact of four different variables on L2 and FL readers' recall of four expository texts, using an L1 group as a ceiling for the expectations of L2 and FL performance. The variables are: background knowledge, global structure, propositional level, and linguistic proficiency. The study will look at how each variable affects recall independently, and how these variables interact in recall. Each of these variables has been shown by research to have a significant effect on comprehension and recall. However, few studies have looked at the interaction of these variables in the process of comprehension and recall. Hence, the idea of investigating the effect of the above-mentioned combination of variables on the subjects' recalls, which can be justified by the complexity of the reading comprehension process, and by the fact that studies which focused on one variable yielded conflicting results, very likely because different readers rely on different strategies or schemata in their comprehension process.

Most studies reported in the literature focused on the effect of one variable. Some have investigated the interaction of two variables. A review of the literature has not revealed any study which has investigated the combination of variables being proposed in the present thesis. These studies can be divided into four major types: (1) studies that looked at the effect of prior knowledge, (2) studies that looked at the effect of text structure, (3) studies that looked at the interaction between prior knowledge and text structure, (4) studies that looked at the impact of language proficiency in L2/FL reading, and (5) studies that looked at the interaction of prior knowledge and overall aptitude. The extent of the literature for each of these types is outlined in brief below. The areas will be discussed in detail in Chapter 2.

(1) Studies that looked at the effect of prior knowledge including general knowledge, culture-specific knowledge, and domain-specific knowledge. The major

research includes the following: Anderson, Reynolds, Schallert, and Goetz (1977); Reynolds, Taylor, Steffensen, Shirey, and Anderson (1982); Lipson (1983); Steffensen, Joag-dev, and Anderson (1979); Schank and Abelson (1977); Winograd (1975); Anderson, Spiro, and Anderson (1978); Chi (1978); Chi, Feltovich, and Glaser (1981); Means and Voss (1985); Osterloh, 1980; Carrell (1981); Johnson, 1981; Steffensen (1988), Mohammed and Swales (1984); Alderson and Urquhart (1985); Strother and Ulijn (1987) as cited in Carrell (1989); Omaggio (1979); Adams (1982); Johnson (1982); Hudson (1982); Carrell and Wallace (1983); Lee (1986); Floyd and Carrell (1987).

(2) Studies that looked at the effect of text structure. The influence of text structure on comprehension has been looked at from the perspective of organization (e.g., Danner, 1976; Kintsch, Mandel, and Kozminsky, 1977; Kintsch, 1977; Kintsch and Yarbrough, 1982, Meyer, 1975a, 1977, 1984, 1985; Meyer and Freedle, 1984; Carrell, 1984; Carrell, 1985; Carrell, 1988), and from the perspective of what may be termed the hierarchy principle which states that information contained at the high levels of a text structure is better remembered than information at the lower levels. This phenomenon has been recognized for both narrative and expository texts (Rumelhart, 1977; Mandler and Johnson, 1977; Thorndyke, 1977; Kintsch and Keenan, 1973; Kintsch, Kozminsky, Streby, McKoon, and Keenan, 1975; Meyer, 1975, 1977).

(3) Studies that looked at the interaction between prior knowledge and text structure. These include: Meyer (1987); Olhausen and Roller (1988); McKeown, Beck and Sinatra (1992); Roller (1990); Carrell (1987); Salager-Meyer (1991).

(4) Studies that looked at the impact of L2/FL readers' language proficiency on reading comprehension. This type of study includes: Aronson-Berman (1978, 1980); Blau (1982); Bhatia (1983); Strother and Ulijn (1987); Ulijn and Strother (1990); Leow (1993); Cziko (1978); Ulijn (1978, 1980); Clarke (1979); Hudson (1982); Barnett (1986); Devine (1987); Eskey (1988); Carrell (1991).

(5) Studies that looked at the interaction between prior knowledge and overall aptitude (e. g. Schneider, Körkel, and Weinert, 1989).

Most studies have thus focused either on prior knowledge or text structure. Linguistic proficiency has received less attention, and few studies have considered the interaction of more than two variables.

1.3 Pilot Study

The present research will replicate, in part, a pilot study that was conducted for my second doctoral exam. In that study, three groups of subjects (L1, L2, and FL) read two texts, a humanities-oriented text (Text F) and a science-oriented text (Text S) and produced an immediate recall. The primary objectives of the study were to investigate the effects of the following variables on comprehension and recall of the information contained in the two texts: (a) background knowledge of the topics discussed in the texts, (b) the global structure of the texts, (c) the propositional structure, and (d) subjects' level of language proficiency.

The results appearing below strongly suggest that these variables did generally have an effect.

(1) The familiarity with the topic was a determining factor for the number of idea units recalled. The humanities-oriented text (Text F) yielded a better recall than the science-oriented text (Text S), most possibly because the majority of candidates had an academic background in humanities rather than science, and therefore had more background knowledge in the former than in the latter text. Second, the majority of science subjects in the FL group had better recall of Text S, again most probably because they had a richer background in topics related to science than in those related to humanities. Third, even though L2 subjects had higher second language proficiency, and yielded better recall of Text F than the FL group, the results for Text S were equal for

both groups. The FL group moreover had greater recall of primary propositions, possibly because of the presence of science subjects in this group as opposed to the L2 group.

(2) The type of global structure used to organize the text had an impact on the amount and type of information recalled. First, the fact that Text F yielded greater recall than Text S could also be accounted for by the organizational pattern of Text F (according to Meyer's (1984) cumulative scale. It is quite possible that the problem-solution global structure of Text F provided the reader with facilitative clues for both comprehension and recall because it had more organizational components than the description/collection structure of Text S (Meyer and Freedle, 1984, Carrell, 1984a). Second, some science subjects found Text F easier to recall than Text S in spite of their stronger background in science topics; here again the organizational factor could have played a part in obtaining such results.

(3) The level of proposition in the structure was a determining factor in recall. Thus, the general trend was for higher level propositions which contain the most important information to be more frequently recalled than lower level propositions. For instance, primary propositions in both texts yielded the highest recall of the three groups. In Text F, propositional recall was consistent with the hierarchy principle, i.e., the higher the level of the proposition the better the recall (Kintsch et al.1975; Meyer and Freedle, 1984). Text S had both primary and secondary propositions equally recalled, but both were more highly recalled than tertiary and quaternary propositions. The analysis of the results by individual groups, however, was more puzzling, as higher level propositions were not systematically better recalled than their subordinate ones. Thus, for L1, recall of primary and secondary propositions in Text S was equal; for L2, recall of secondary propositions was greater than primary propositions; and for FL, recall of quaternary propositions in Text F was better than the higher level propositions. The problem was even more prominent in analysis of recall of individual propositions. A closer look at each individual paragraph revealed that in many cases, subordinate propositions yielded

higher recall than the superordinate ones. The question of why the study yielded results which might be considered surprising could also be considered from the perspective of readers' competence. In the pilot study, it was found that generally L1 subjects had a higher recall of the top-level propositions than did the other two groups. These L1 subjects had the advantage of reading and recalling the information in their native language, as opposed to their L2 and FL peers. Given the many years of reading experience in their L1, one would expect it to be easier for them to perform the task than for the nonnative speakers. The most disadvantaged group, on the other hand, was the FL group because the subjects had to both read and recall the texts in English, as opposed to L2 subjects, Canadian Francophones, who were allowed to write their recall protocols in their native language. Other perspectives that have already been discussed have to do with the nature of the topic and the type of discourse structure used in the organization of the texts. It was concluded that higher propositions are more prominent when the topic is more familiar or relevant to readers, and when the top-level structure of the text was of the more organized type. This is quite possibly one of the significant reasons why Text F yielded a better recall of higher propositions than Text S.

(4) Language proficiency was found to be a generally significant variable for comprehension and retrieval of information. The results have shown that the L1 group had the best performance in both texts, and that the L2 group obtained a higher overall mean than FL group. However, because of the presence of subjects with background knowledge in science among the FL group, performance in Text S yielded equal results for both the L2 and the FL groups, but in fact the FL subjects had a higher recall of the top-level propositions of this text than the L2 group. If language proficiency were not a determining factor in the results of the pilot study, no recall differences would have been observed among L1 and L2 subjects since discussions with the subjects revealed that both groups found Text F more familiar than Text S, and had similar reactions concerning the organization of the two texts. In addition, both groups have similar educational

backgrounds and, to a certain extent, share many cultural features. The most prominent factor that distinguishes between the L1 and L2 groups therefore is language proficiency. Another point that seems to favor the language proficiency effect is related to the differential recall of information by L2 subjects. Except for a few cases, the best recalls were produced by those subjects who ranked themselves as highly proficient in English or claimed to be balanced bilinguals. Finally, if the impact of language proficiency were not significant, the FL group would have obtained the best results in Text S, as it was the only group which combined both science and humanities subjects. This was not the case obviously, since the L1 group outperformed both the L2 and FL groups in the two texts. However, a seemingly problematic issue for the prediction concerning language proficiency is the recall differential within each group, as shown by the results, and the fact that some subjects from the L2 and FL groups performed better than subjects from the L1 group. Here, other variables such as interest in and motivation for the topics as well as the tasks performed may have played a role in the obtained results. It was concluded that further research was needed to confirm these findings, and this is partly the aim of the present thesis.

1.4 Limitations of the Study

The present study was limited to university-level subjects: native anglophones, native francophones who speak English as L2, and a FL group including Iranian, Serbian, and Moroccan subjects studying English as a FL. All volunteered to participate in the experiment. The study mostly took place in a formal setting, i. e., the subjects did the tasks in a classroom under the supervision of the researcher. Some subjects found it more convenient to do the tasks at home, however, they were advised to follow closely the instructions provided in the package.

The analysis of the recall protocols was limited to the propositions found in the target texts. Inferences or elaborations added by the subjects are considered to be beyond the scope of this study.

The rest of the thesis will consist of five chapters. Chapter II: The Review of Related Literature. Chapter III: Methodology of the Study. Chapter IV: Statistical Analysis. Chapter V: Discussion. Chapter VI: Conclusions.

CHAPTER II

THE REVIEW OF RELATED LITERATURE

This chapter will discuss both theoretical and empirical issues related to the topic of the thesis.

2.0 Theories and Models of Reading

This section will discuss the major theoretical trends that have directed research in reading, and the models that developed from these theoretical trends.

2.1 Theoretical Trends in Reading

Research on reading as a scientific area of investigation is relatively new. It seems to have been initiated by a French oculist, Emile L. Javal (1879), who studied the perceptual processes involved in reading, i.e., eye movements and fixations. At the beginning of the twentieth century, Huey (1908), as mentioned in Rayner and Pollatsek (1989), studied both perceptual and cognitive aspects of reading, and was the first to recognize reading as a complex cognitive activity.

In 1917, Thorndike published an article "Reading as reasoning: A study of mistakes in paragraph reading" which views reading as reasoning, and comprehending a passage as solving a problem in mathematics. According to this view, readers accept that texts fall into categories of formulas, such as problem-solution or question-answer, etc. (Singer, 1985; Alderson and Urquhart, 1984). Meyer (1975, 1985), also adopts this principle in her studies of the rhetorical organizational patterns of texts and the impact of such patterns on readers' comprehension and recall.

However, interest in reading as a cognitive process began to decline in the 1920s because of the impact of both Skinnerian behavioristic psychology (Rayner and Pollatsek,

1989:5), and Bloomfieldian structural linguistics, two anti-mentalistic schools which drew on the positivist school of thought. This school believes only in observable, verifiable phenomena, and dismisses the study of cognitive processes such as thinking, reasoning, interpreting, or "mentalistic constructs" such as the mind or consciousness, because they are not observable, and therefore not worth studying (Ozman and Craver, 1990).

In such a framework, reading was given a secondary status, as it only developed as a result of the mastery of the spoken skills. It was conceived of primarily as a perceptual process which consists of decoding the printed stimuli. The reader was viewed as passively transferring his/her previous linguistic knowledge from the spoken mode to the written one (Richards and Rodgers, 1986; Silberstein, 1987; Rayner and Pollatsek, 1989; Cornaire, 1991).

The behavioristic/structuralist view of language and language learning was challenged by the chomskyan revolution at the beginning of the 1960s. Chomsky's new insights revolutionized both the fields of linguistics and psycholinguistics. Basing his thinking on rationalism, a philosophical school which "sought universal truths or ideas by which a coherent system and structure of knowledge could be deduced" (Ozman and Craver, 1990: 10), Chomsky claimed that the behavioristic principles cannot account for how the human mind processes language. For him and his followers, language and mind are closely related. Language is a system governed by abstract rules, and humans have mental properties that predispose them to acquire that system. These abstract rules allow speakers to use language creatively (Stern, 1983; Richards and Rodgers, 1986). This theoretical trend gave new impetus to the study of the cognitive processes involved in language acquisition/learning. Interest in the study of reading as a cognitive process was renewed under the influence of this theory (e.g., Orasanu and Penney, 1986; Silberstein, 1987; Rayner and Pollatsek, 1989).

Psychologists also reflected the renewed interest in cognitive processes. Bruner (1957) studied the mind and contended that it was basically an "inference machine" which interprets and organizes new stimuli in terms of its existing knowledge (Orasanu and Penney, 1989: 4). Orasanu and Penney (1986) claim that Bruner's observations laid the ground for an interpretation of reading as an inferential process.

Recently, reading research has seen another theoretical shift from the influence of cognitive paradigms to connectionist models, under the influence of computer science research. Such models, as Stanovich (1992) contends, are empirically oriented and are very critical of top-down models that developed within the psycholinguistic framework, and in a way, mark a shift back to bottom-up models of reading.

2.2 Models of Reading

Reading theorists, in general, classify reading models into three major categories: bottom-up, top-down, and interactive models (e.g., Rayner and Pollatsek, 1989; Barnett, 1989; Cornaire, 1991; Wolf and Vellutino, 1993). Bottom-up and top-down models are also referred to as stimulus-driven and context-driven respectively (Wolf and Vellutino, 1993). According to Rayner and Pollatsek (1989), these models are only general frameworks which provide biases concerning which aspects of reading are most important.

Each category of models focuses on particular aspects assumed by its proponents to play the major role in the reading process. Thus, the bottom-up models put more focus on the lower level or decoding skills believed to be the determining factors in text comprehension and therefore the skills to be mastered if one is to become a skilled reader (e.g., Gough, 1985; LaBerge and Samuels, 1985). The top-down models (e.g., Goodman, 1967, 1968; Smith, 1971, 1975; Coady, 1979), on the other hand, focus on higher level skills such as anticipation, prediction, hypothesis formation/testing, and so forth as the most important factors in reading comprehension and acquiring competency in the skill

of reading. And the interactive models hold that both types of skills are important and that they do interact in the process of comprehension, therefore readers must be competent in both skills to be able to read successfully.

2.2.1 BOTTOM-UP AND TOP-DOWN MODELS

2.2.1.1 Bottom-up/Stimulus-driven models

Bottom-up models are those which begin with the printed stimuli and proceed upwards toward meaning. Thus, the process is unidirectional as higher level processes are not supposed to have any impact on lower level processes (Cormaire 1991:22). Meaning, then, is text-bound, and the reader's task is to recognize that meaning. The reader is not supposed to play an active role in the comprehension process by referring to his/her background knowledge, for example (Gough, 1985; LaBerge and Samuel's, 1985). Bottom-up models have been criticized because of their atomistic view of reading. They put emphasis on recognition of letter features, letters, and words, and neglect the ultimate goal of any reading operation, comprehension of the meaning of the text. With the advent of the psycholinguistic approach (Goodman, 1967; Smith, 1971), reading became more of a conceptual process than a perceptual one.

2.2.1.2 Top-down/Context-driven Models

Top-down models, according to Wolf and Vellutino (1993: 371), are holistic and assign to linguistic context a major role in word recognition. These models assume that in the process of reading comprehension, the reader continuously forms hypotheses tested against further information to be either confirmed or rejected. The reader is assumed to start the reading process with some general idea of what the text is going to be about, based on his/her background knowledge. The primary objective of the reader is, then, comprehension of the content of the text (Cormaire, 1991: 23).

Goodman (1967, 1968) is considered to be one of the pioneers of the top-down models. He was particularly concerned with the application of the principles of cognitive psycholinguistics to the reading process. He views reading as a "psycholinguistic game" in which the reader tries to reconstruct the message intended by the author (Coady, 1971: 5). The reader is thus perceived as an active participant in the reading process.

Smith (1971, 1975) also analyses the reading process within the top-down framework. He contends that the reading activity relies primarily on prediction, which, as he claims, "is routinely practiced in reading by beginners as well as fluent readers." (1975: 305). The essence of Smith's conceptualisation of the reading process, as summed up in Barnett (1989: 20) is that it is purposeful, selective, based on comprehension, and anticipatory. These basic principles are essentially the same as those held and defended by Goodman.

2.2.1.3 Criticism of Top-down Models

Most criticism addressed to these models comes from researchers who have adopted interactive models of reading based on connectionist theory. The interactive models claim that there is interaction between low-level and top-level processes in reading, even though they differ in the way they view this interaction. Perfetti (1985), Rayner and Pollatsek (1989), Stanovich (1992) and Kintsch (1994) contend that empirical research has provided evidence that seems to contradict the hypothesis-testing principle of the top-down models. Recent research on eye movement, for example, indicates that the majority of words are fixated, which contradicts Smith's (1975) assumption that reading is a selective process. Empirical research has also provided evidence that the visual processing of printed information is very rapid and that guessing plays only a minimal role in the reading process. Thus, evidence from recent research seems to provide more support for the bottom-up models than was the case in the past. However,

proponents of the interactive models still believe that top-down processes also play a role in reading.

2.2.2 INTERACTIVE MODELS

The problem of the bottom-up or information-processing (Stanovich, 1992: 25) and top-down or hypothesis testing models (Rayner and Pollatsek, 1989) is their respective partial view of reading. This is in line with Rayner and Pollatsek's (1989) contention that models of reading are only general frameworks which focus on different important aspects of reading. Researchers (e.g., Rumelhart, 1976; Just and Carpenter, 1980, 1987; McClelland, 1986, as cited in Rayner and Pollatsek, 1989) who were not satisfied with this partial conceptualisation of reading have suggested a more general view which holds that both bottom-up and top-down processes play a role in reading. Comprehension is based on interaction between these processes.

Cornaire (1991) suggests that the interactive models could be divided into two categories: a weakly interactive category which is basically bottom-up but still assumes that top-down processes exert some influence (e.g. Perfetti, 1985; Rayner and Pollatsek, 1989); and a strongly interactive category which assumes that the two types of processes are used interdependently (e.g. Rumelhart, 1977a; McClelland and Rumelhart, 1981; Rumelhart and McClelland, 1982; Kintsch and van Dijk, 1978; Stanovich, 1980). Critics of this second category, according to Rayner and Pollatsek (1989), argue that these models are "unconstrained" and cannot make clear predictions as to what the outcomes of an experiment might be, contrary to models of the more bottom-up category.

The second type of interactive models are at the heart of what came to be known as schema theory, described by Stanovich (1992) as a constructivist model. Constructivism, according to this author, emphasizes the fact that comprehension is based on an interaction between the reader's background knowledge and the information included in the text. This view of comprehension is shared by various researchers (e.g.

Rumelhart, 1977, Schank and Abelson, 1977; Pichert and Anderson, 1977; Kintsch and van Dijk, 1978; Anderson and Pearson, 1984; Anderson 1994). This view assumes that in the process of comprehension, the reader continuously shifts back and forth from the input data to his background knowledge.

2.3 Schema Theory

According to Anderson and Pearson (1984), the notion of schema comes from Gestalt theory which holds a holistic view of human experiences. Thus the whole is not the sum total of its parts, or as stated by Anderson and Pearson (1984: 256) "the properties of a whole experience cannot be inferred from its parts." Another main principle of the Gestalt theory is that mental organization is "dynamic." This implies that the mind can organize data spontaneously in a coherent manner (Hill, 1963; Anderson and Pearson, 1984).

Bartlett (1932) was the first to use the concept of "schema" to account for the reader's interaction with the information of the text (Meyer, 1977; Rumelhart, 1980; Anderson and Pearson, 1984; Schallert, 1982; Carrell, 1984; Adams and Collins, 1985). He defined schema as "the active organisation of past reactions, or past experiences" which influences the reader's perception of new data (as cited in Anderson and Pearson, 1984: 257). Thus, new information is subsumed into prior schemata (Meyer, 1977: 311). His empirical data are based on a study of recall of a North-American Indian folktale "The War of the Ghosts" by college level subjects. He reported many distortions of the original story in the subjects' recalls, especially with longer intervals between recall and the reading of the story. These distortions result from interference of the readers' background knowledge in retrieval of the original information. However, details that were consistent with readers' prior knowledge were better recalled.

Anderson and Pearson (1984: 258) claim that Bartlett remained vague about how schemata function. The first fully-fledged theories of schema emerged in the late 1970s,

resulting from developments in human information processing (i.e., simulations of human cognition, e. g., Minsky, 1975; Winograd, 1975, cited in Anderson and Pearson, 1984: 259), cognitive psychology, and linguistics (Adams and Collins, 1985). According to Adams and Collins (1985), Frames Theory (Minsky, 1975; Charniak, 1975), Script Theory (Schank and Abelson 1977, Leibert, 1977), and Schema Theory (Rumelhart and Ortony, 1976, Rumelhart, 1980) share the same principles, even though they are named differently. An earlier theory that took the lead in advocating many similar principles is Ausubel's (1960, and Ausubel and Fitzgerald, 1962) theory of Advance Organizers.

2.4 What is Schema Theory?

Schema theory is generally defined as a model of human knowledge, i.e., a theory about the structure of human knowledge as it is represented in memory (Rumelhart, 1980 b; Pearson and Stephen 1994). Some define schemata as units or "containers" of knowledge (i. e., concepts related to objects, situations, actions, events, sequences of actions and events, etc.) plus information about how that knowledge is to be used. In addition, schemata are thought to contain information about the network of interrelations between the schemata or between the constituents of each schema (Rumelhart, 1980 b; Pearson and Stephen, 1994). In this view schemata are structured in a hierarchy, going from general to specific concepts. Elements of a schema are referred to as "slots" (Minsky, 1975, in Adams and Collins, 1985). Samuels (1994), on the other hand, claims that a schema is broader in scope than a concept, a general frame to which narrower and more specific concepts are related.

2.5 Related Theories

2.5.1 ADVANCE ORGANIZERS

Ausubel's theory of Advance Organizers (1960: 267) holds the hypothesis that learning and retention of new material is facilitated when general concepts related to the

topic are introduced to the learners prior to the target material. These concepts are called "Advance Organizers," and described as "relevant subsuming concepts" under which more specific or "less inclusive concepts are subsumed." Their main function is "to bridge the gap between what the learner already knows and what he needs to know before he can successfully learn the task at hand" (Ausubel, 1968: 148, in Anderson, 1994: 480). According to this theory, new meaningful material will be incorporated into the learner's cognitive structure if it can be related to some already existing concepts of a more general nature.

2.5.2 SCRIPT THEORY

Script Theory of Schank and Abelson (1977) also emphasizes the impact of prior knowledge on comprehension and learning new information. It is assumed that texts do not contain all the information needed for comprehension. According to Bower et.al. (in Ruddell et.al.1994), Schank and Abelson (1977) proposed their script theory to account for readers' expansions on the texts. This theory proposes that people's knowledge is organised around everyday situations with "routine activities" such as "going to a restaurant," "riding a bus," "visiting a dentist," and so forth. The concept of script is used "to refer to the memory structure that a person has encoding his general knowledge of a certain situation-action routine" (Bower et al. 1994: 538).

The scripts are assumed to serve the functions of the planning and execution of activities. They are also used in understanding. The reader, for example, uses a text's headings to activate the general script of a given activity (e.g. the restaurant), then, he/she instantiates the general script by filling in the slots from the details mentioned in the text.

2.6 Schema Theory and Reading

2.6.1 THE ROLE OF SCHEMATA IN READING

Within the Schema theoretical framework, reading comprehension is perceived as the process of finding a "configuration" of schemata which represent adequately the information described in the reading material (Rumelhart, 1980 b). A reader will achieve comprehension if he/she can activate the appropriate schemata that correspond to the ones described by the author. The reader has to account for all input information (Adams and Collins, 1985). Rumelhart accounts for lack of comprehension on the part of the reader in three ways: (1) the reader does not have the appropriate schemata, (2) the text does not provide sufficient clues to enable the reader to activate the appropriate schemata, (3) the reader finds a logical interpretation of the text which is different from the one intended by the author (1980 b: 47-48).

Schemata are the basis for perception, comprehension and recall of the information. Rumelhart distinguishes between two types of schemata: (1) higher level schemata and (2) lower level schemata. These correspond to two types of information processing mechanisms labelled as data-driven/bottom-up processing and conceptually-driven/top-down processing, respectively (Rumelhart, 1980; Adams and Collins, 1985). The bottom-up processes involve textual information including morphemes, words, phrases, sentences, etc., and the reader's knowledge of these elements. The top-down processes involve the reader's background knowledge, including general knowledge of the world, knowledge about the topic of reading, and expectations. These two types of processing, according to Rumelhart (1976, in Adams and Collins, 1985) should be coordinated at all levels of analysis when readers are trying to construct the meaning of the text. Reading is thus both a perceptual and conceptual process (Rumelhart, 1977a: 573)

Schemata serve four main functions (Rumelhart, 1980: 45). (1) Schemata play a role in perception: the individual parts are only perceived in the context of the whole. (2)

Schemata play a role in comprehension of discourse. Thus, a reader is said to have understood a given text when he/she has found "a configuration of schemata" that accounts adequately for that text. (3) Schemata play a role in remembering. The reader's recall of a text is based on the schemata that were activated during reading and interpretation of that text, which "suggests that we remember our interpretations of an event or text rather than the text or event itself" (Rumelhart 1980: 49). (4) Schemata play a role in learning, i.e. the development of new schemata.

Within this framework, reading is perceived as a process of meaning construction in which the reader actively interacts with the text, relying both on the information included in the text (bottom-up processing) and his prior knowledge (top-down processing). van Dijk and Kintsch (1983; and Kintsch, 1994), for example, contend that during comprehension, readers construct a model of the text, called "situational model" which results from interaction between discourse and readers' world knowledge, and that it is through this knowledge that readers can infer implicit information. It is thus assumed that the meaning does not reside in the text but in the text-reader interaction.

2.6.2 EMPIRICAL STUDIES ON CONTENT/CULTURAL SCHEMATA

Schema Theory emphasis on the role of readers' prior knowledge in the process of reading comprehension and retrieval of information has triggered researchers' interest in testing this assumption through empirical studies. Ohlhausen and Roller (1988: 70) identify four major types of studies concerning research on content schemata: (1) studies that used ambiguous texts to demonstrate the effect of prior knowledge on the interpretation of the content of the text (e.g. Anderson, Reynolds, Schallert, and Goetz, 1977; Reynolds, Taylor, Steffensen, Shirey, and Anderson, 1982); (2) studies on the effect of cultural schemata on text interpretation (e.g. Lipson, 1983; Steffensen, Joag-dev, and Anderson (1979); (3) studies in artificial intelligence which highlighted the importance of domain-specific knowledge in learning and reasoning (e.g. Schank and

Abelson, 1977; Winograd, 1975); (4) studies that used experts and novices and which showed the impact of both the amount and structure of prior knowledge on interpretation of textual information and task performance (e.g. Anderson, Spiro, and Anderson, 1978; Chi, 1978; Chi, Feltovich, and Glaser, 1981; Means and Voss, 1985).

A classic study, according to Anderson (1994), is one that was conducted by Bransford and Johnson (1972). This study consisted in making subjects read paragraphs written in such a way that readers could not figure out a schema that would correspond to the information. The subjects rated these paragraphs as difficult to comprehend, and yielded a poor recall of them. However, in a second phase of the experiment, subjects who received these same paragraphs with a drawing that suggested the appropriate context found the paragraphs more comprehensible, and could recall more information from them than did subjects who received a nonsuggestive drawing or no drawing at all. In this same study, a paragraph, that was also rated as incomprehensible by most subjects, became comprehensible once subjects were told that the paragraph was about "Washing Clothes." This helped them activate the schemata corresponding to the information in the paragraph (Rumelhart: 1980 b; Anderson and Pearson, 1984). It was concluded that activation of the appropriate schema to account for the relationships between the elements of a text was a critical aspect of reading comprehension.

Other studies that have used texts which could have multiple interpretations have shown that readers tend to activate the schemata that correspond to their discipline when dealing with such texts. For example, Anderson, Reynolds, Schallert, and Goetz (1977, cited in Anderson and Pearson, 1984: 270), presented college students from two different disciplines: physical education and music, with two texts. Each text could be interpreted from two different perspectives. One text could be interpreted as related to sports, and the other text as related to music. In their interpretation of these texts, subjects activated the schemata that were consistent with their field of study.

Another important study on the impact of prior knowledge was conducted by Chiesi, Spilich, and Voss (1979, in Anderson, 1994: 472). Chiesi et.al. gave readers with different levels of knowledge of baseball a text on "half-inning from a fictitious baseball game." Not surprisingly, readers with higher level knowledge of baseball yielded better recall, and made more correct inferences from the text than did readers with lower knowledge.

There is evidence that children also rely on their background knowledge to interpret information. Pearson, Hansen, and Gordon (1979) and Nicholson and Imlah (1981), both cited in Anderson and Pearson (1984: 271), found that children's prior knowledge of the topic of reading had an influence on their answers to inference questions. Pearson et. al. (1979), for instance, found that children with better background knowledge had higher ability to handle inference questions. Nicholson and Imlah (1981), on the other hand, found that children who were familiar with the topic of reading relied more on their prior knowledge than on information in the text, when they were asked to answer inference questions.

Schneider, Körkel, and Weinert (1989) conducted two studies to examine the respective impact of domain-specific knowledge and overall aptitude on text comprehension and text memory. The group of subjects involved in the studies included experts and novices in soccer, and each subgroup of experts and novices was subcategorized into high- and low-aptitude readers. The results of the two studies showed that, regardless of age and overall aptitude level, the expert group outperformed the novice group in both comprehension and memory tasks related to a soccer game story, indicating thus the greater impact of prior knowledge.

In a recent study, Symons and Pressley (1993) tested the effect of prior knowledge on search and extraction of information from text. They found that students were more successful at searching and extracting the appropriate information after being exposed to material related to their psychology course than before. Three groups of

students were compared in location and extraction of information related to material covered in Fall and Spring terms. Students tested in January and May were better at locating answers to questions related to course material covered in the Fall than were September students. May students located the information related to Spring-term course material better than either September or January students. These improvements at locating information did not extend to other courses.

Steffenson, Joag-dev, and Anderson (1979) conducted a classic study which demonstrated the importance of relevant cultural background knowledge for the reader. The experiment required subjects from the United States and India to read letters about weddings in their respective cultures. They found that subjects spent less time reading the text related to their own culture, recalled more information, and drew more appropriate inferences than when they read the text related to the foreign culture. Also, subjects tended to interpret the foreign culture text according to their own cultural background.

In a more recent study on the impact of the native culture on reading, Harris, Lee, Hansley, and Schoen (1988) made American subjects read four stories about daily activities such as "riding a city bus," "buying a record album," "having breakfast," and "buying travel tickets." Each story had two versions: one version corresponding to North-American cultural scripts, and the other to some foreign culture that was unfamiliar to the readers. The researchers found that the subjects had a tendency to use their own cultural scripts to interpret the stories related to a foreign culture, and that this effect was "most strongly observed after one week" (Harris et. al., 1988: 413).

Chakir and Farghal (1991) have investigated the effect of prior knowledge on the activation of what they have termed "marked" (general) or "unmarked" (specific) schemata. The authors made both L1 (an American group) and L2 (Jordanian groups speaking ESL) subjects read a contextless passage and provide three answers for each of two questions about the passage. The answers had to be ordered according to their "likelihood." (p. 206). According to the findings, most subjects' first choice corresponded

to the general or "unmarked" schema of the text, "jail-related schema," regardless of their cultural background. This schema was inferred from key lexical items such as "escape, hold, and lock" found in the text. The alternative choices, however, were more culture-specific. Thus, the American group, for example, activated the wrestling schema to account for the text, whereas the Jordanian groups activated an "attitudinal/emotive" schema. The main outcome of the study, however, is that unmarked schemata are more salient than the marked ones.

The authors interpret these results as supporting their notion of markedness. They also argue that since the text had no title, subjects used bottom-up processing such as exploring key lexical items to help them find the appropriate general or "unmarked" schema of the text and to activate the lower schemata corresponding to the ideas developed in the text. Thus, the processing was viewed to be more of a bottom-up than a top-down one.

In conclusion, research on the effect of prior knowledge has used three types of text: obscure texts for which it was difficult to assign a schema (e.g., Bransford and Johnson, 1972), ambiguous texts which could have multiple interpretations (e.g., Anderson, Reynolds, Schallert, and Goetz, 1977), and texts that could be interpreted from two perspectives (e.g., Pichert and Anderson, 1977; Anderson and Pichert, 1978), as cited in Abela and Hasher (1983), and Sadoski, Paivio, and Goetz (1991). The studies summarized above provide supporting evidence for the schema theory assumption that prior knowledge has a positive influence on reading comprehension. Some recent studies, however, tried to cast doubt on the validity of the findings of the above studies, as will be discussed in the section on schema theory criticism.

Research on reading within the framework of schema theory also looked at the effects of features of the text structure on readers' comprehension and recall of information.

2.6.3 TEXT STRUCTURE OR FORMAL SCHEMATA

Research suggests that text organization is one of the crucial variables in the reading process. Texts have specific features that determine how well they will be processed and understood by readers. These texts have been studied from different perspectives including their linguistic features (e.g. Harris, 1952, in Meyer and Rice, 1984); cohesion versus coherence (Halliday and Hassan, 1976); readability (e.g., Dale and Chall, 1948; Fry, 1968, Sticht, 1972, 1975, as cited in Anderson and Ambruster, 1986: 151; Miller and Kintsch, 1981); and overall structure of different types of texts such as narratives (e.g. Rumelhart , 1975; van Dijk, 1977; Kintsch, Mandel and Kozminsky, 1977; Kintsch and Greene, 1978, Thorndyke, 1977; Mandler and Johnson, 1977; Johnson and Mandler, 1980) and expository texts (Meyer, 1975, 1977; Meyer, Brandt, and Bluth, 1980; Meyer and Freedle, 1984; Kintsch, 1982b). The structure of text has also been studied from the perspective of Artificial Intelligence (e.g. Schank and Abelson, 1977).

The influence of text structure on comprehension has been looked at from the perspective of organization (e.g., Danner, 1976; Kintsch, Mandel, and Kozminsky, 1977; Kintsch, 1977; Kintsch and Yarbrough, 1982, Meyer, 1975a, 1977, 1984, 1985; Meyer and Freedle, 1984), and from the perspective of what may be termed the hierarchy principle which states that the higher level idea units of a text structure, which contain the most important information of the text, are better remembered than the lower level idea units which contain less important information. Kintsch et al., (1975) refer to this phenomenon as "levels effect" and Meyer (1977) as "the hierarchical structure" or "height of idea units." This phenomenon has been recognized for both narrative and expository texts (Rumelhart, 1977; Mandler and Johnson, 1977; Thorndyke, 1977; Kintsch and Keenan, 1973; Kintsch et.al. 1975; Meyer, 1975; 1977). Also, research by Meyer and her colleagues has suggested that the type of overall rhetorical structure of the text

determines the amount of information that will be recalled (e.g. Meyer and Freedle, 1984).

Before looking at text representation models, there will be a brief discussion of one of the key concepts used in text analysis: the proposition.

2.6.3.1 The Proposition.

The notion of proposition is used to mean different things by different researchers. Van Dijk and Kintsch (1983) summarize the various ways the term is used in different disciplines. Thus, in philosophy, the notion of proposition refers to an "abstract theoretical construct, which is used to identify the meaning, or what is expressed by a sentence under specific contextual restrictions (speaker, time, place), and which is related to truth values" (p. 111). For linguistics, the term is used to refer to the meaning of a declarative sentence. This meaning is thought to be the sum-total or the construction of the meanings of the component words and phrases of which the sentence is composed. "This construction is the output of the semantic interpretation rules, and follows the Fregean principle of functionality: the interpretation of composite expressions is a function of the interpretation of its component expressions" (p. 112). This principle, according to van Dijk and Kintsch, holds for philosophy, logic, linguistics and cognitive models. Modern logic defines the notion in referential or extensional terms: propositions are related to truth values, i. e. they can be either true or false. Truth values are "relative with respect to possible worlds, situations, language users or contexts" (p. 112). Finally, contextual semantics defines the proposition as "the set of possible worlds in which it is true", or as "a function from possible worlds to truth values" to which contextual features could be added as arguments, as defined by Montague (1974, in van Dijk and Kintsch, 1983:112).

Van Dijk and Kintsch (1983) adopt the view that a proposition is an "intensional" or a conceptual unit which corresponds "to the meaning of a sentence in linguistic theory,

and to the conceptual representation of a sentence in a cognitive model of language comprehension" (p. 112). They also view it as an "extensional" unit which refers to facts in some possible worlds. A simple proposition consists of a predicate and arguments (one or more). According to Lakoff (1987: 285) the proposition is structured in terms of a "part-whole schema" where the proposition itself is the whole and the predicate and arguments are the parts. The predicate is the basic element that holds the arguments together. The arguments are also connected through semantic relations such as agent, patient, location, etc. which are structurally represented by what Lakoff terms "link schemas".

Cognitive models have adopted the proposition as the semantic unit in discourse processing, and have developed propositional systems to represent meanings of texts. These systems are either represented graphically (e. g. Norman and Rumelhart, 1975; Schank, 1975; de Beaugrande, 1980), or as lists of propositions (e. g. Kintsch, 1974; Frederiksen, 1975, Meyer, 1975), as cited in van Dijk and Kintsch (1983: 38).

Proposition in the present study

Following the general cognitive models, this study also adopts the proposition as the semantic unit of text analysis for the researcher, and comprehension for the reader. For the purposes of this study, however, the proposition is defined basically as an idea unit representing the meaning of a sentence or clause, with the exception of the fourth propositional level, discussed below, which consists of atomic propositions representing exemplary detailed information such as dates, proper names, etc. This definition is based on van Dijk and Kintsch's (1983) view of propositions as schematic representations of the meaning of sentences (p. 138). As sentences may be either simple or complex, it follows that the propositions representing the meanings of those sentences may also be either simple or complex, as shown in van Dijk and Kintsch's schematic representation of the proposition (p. 138). Complex propositions are formed from simple ones through

operations of modification, quantification, complementation, conjunction, negation, etc. as stated by Lakoff (1987: 285).

In the present study, it is assumed that the text consists of a hierarchy of idea units representing four different levels: primary propositions (main ideas), secondary propositions (idea units that are directly subordinate of the main ideas), tertiary propositions (idea units that are subordinate to secondary propositions), and quaternary propositions (examples descending from the tertiary propositions or propositions which served in only an exemplary role for primary or secondary propositions).

Analysis of the texts into propositions was based on the assumption that each paragraph of the text consists of a central idea, a primary proposition, situated at the top level of the structure of the paragraph to which lower level ideas/propositions are subordinated. Each paragraph, thus, may contain a maximum of the four levels explained above or minimally three levels where either level 3 or level 4 was missing. The primary propositions of the whole text and the gist/main idea that sums up the whole text constitute the macropropositions (Meyer, 1975b; van Dijk and Kintsch 1983), i. e., the main ideas of the text.

Use of this method is corroborated by Christensen's (1965, 1966) idea (as explained in Meyer 1975b) that a paragraph consists of a "top-node" under which are found lower level nodes which dominate other lower level nodes until the whole paragraph has been represented in the content structure. The "jump" from the bottom levels of a subtree to another top-node of the content structure usually coincides with a new paragraph (Meyer 1975b: 41).

2.6.3.2 Text Representation Models

Two of the most influential and widely used models of text representation are Kintsch and van Dijk (1978; also van Dijk and Kintsch, 1983; Kintsch 1988) and Meyer (1975).

a. Kintsch and van Dijk model

The 1978 version of this model looks at the process by which the meaning of the text is extracted or constructed by the reader on the basis of both textual information and the reader's prior knowledge and experience. In their analysis of discourse, Kintsch and van Dijk (1978) assume that the surface structure of a text is interpreted as a set of propositions. These propositions are either explicit or implicit. Implicit propositions are inferred during the process of comprehension based on the context and the reader's prior knowledge. Kintsch and van Dijk distinguish between two basic levels, namely, the microstructure level and the macrostructure level.

At the microstructure level, the text is analyzed as a set of linear propositions which are put together into a coherent structure through coreferential expressions. This set of propositions constitute what is referred to as a "text base." (see v Dijk and Kintsch 1983: 11). It is held that the micropropositional structure is built up through processing cycles. At the macrostructure level, the propositions of the text base are connected to the topic of the discourse through semantic mapping rules or "macrorules" which reduce the text base information so that it only includes the gist of the text. Information is reduced by deletion, generalization, and construction. These macrorules operate under the control of a schema to preserve the gist of the text in question. The operation of macrorules also depends on the reader's world knowledge. It is, thus, assumed that readers have specific purposes or schemata in reading which constrain the application of the "macro-operators." It is because of these schemata that readers can determine which micropropositions are important and which are not. The role of the macrorules is therefore to recover the unifying topic of the text and its gist from the list of micropropositions.

Kintsch and van Dijk (1978) assume that discourse has schematic structures which have an important impact on both comprehension and production of discourse. Thus stories, for example, have a conventional structure or a "story schema" which

readers can recognize easily and which they use to comprehend and to recall the story. Different types of texts display different structures. Thus, an argumentative text, for example, is organized differently from a story or a scientific report. Readers have schemata that correspond to each type of text organisation. These schemata are reflected in readers' free recalls to such an extent that the summary of a story, for instance, will also have a narrative structure, and the same with other structure types. As noted by Kintsch and van Dijk (1978), psychologists, like anthropologists (e.g., Colby, 1973, in Kintsch and van Dijk, 1978) and linguists (e.g., Labov and Waletzky, 1967, in Kintsch and van Dijk, 1978) have given much attention to story schemata studied either within the present framework (Kintsch, 1977; Kintsch and Greene, 1978; van Dijk, 1977) or within the framework of "story grammar" (Mandler and Johnson, 1977; Rumelhart, 1975).

As mentioned above, Kintsch and van Dijk (1978) assume a levels effect in recall of propositions (Kintsch and Keenan, 1973; Kintsch et.al., 1975). In their model, it is suggested that the higher recall of the top-level propositions is due to the fact that they are processed more frequently than the lower level propositions, or because they stay longer in short-term memory than the lower ones.

According to Johnson-Laird (1983: 380-381), one main defect of Kintsch and van Dijk's (1978) model is its use of one propositional format to represent both microstructure and macrostructure. For example, there are counterexamples to the notion of co-reference which assumes that two arguments which overlap are coreferential. Thus, two propositional representations may be co-referential even if their arguments do not overlap. The model thus fails to distinguish between the "sense of a text" which is captured by its propositional representation, and "its significance (including what it refers to)" which is captured by a mental model.

Van Dijk and Kintsch (1983) and Kintsch (1988) can be considered as extensions of the (1978) model described above. They both maintain the existence of two levels of comprehension (i.e., microstructure and macrostructure levels). However, the (1983)

model is presented as basically "strategic", i. e., "dynamic, process-oriented model." (p. 4), as opposed to the (1978) model described as basically structural. It is claimed that comprehension proceeds through the application of a set of different strategies which "represent the procedural knowledge we have about understanding discourse" (p. 11). Discourse processing is assumed to start at the word level and to proceed upward to clauses, sentences, complex sentences, sentence sequences, to the more complex levels of textual structures. It is assumed that there is an ongoing interaction between these different units in the comprehension process. This is why the model is said to be "complexity oriented" (p. 10).

Two levels of comprehension are postulated in this model. The first level consists in encoding the textual input and the linguistic relations between units of the input, and in encoding both the semantic and the rhetorical structure of the text. This is the text base described by Kintsch and van Dijk (1978). The text base represents the semantic representation of the text (in episodic memory) "the model takes as its input a list of propositions that represent the meaning of a text." (Kintsch and van Dijk, 1978: 367). The second level of comprehension involves the elaboration of the information drawn from the text using inferences from prior knowledge. This results into the building of a coherent whole where the textual information is integrated with related information in the reader's general knowledge.

Thus, both the 1978 and the 1983 models postulate two levels of comprehension, where the first level consists in encoding textual information, and the second level consists in integrating the textual information with related information in the reader's background knowledge. The second level of comprehension corresponds to the notion of "situational model" introduced for the first time in the 1983 model.

The model proposed by Kintsch (1988) is basically bottom-up as opposed to expectation-driven models which claim that comprehension is basically a top-down process. The model is named "construction-integration" to emphasize the two phases that

are assumed to take place in the process of comprehension: (1) a construction process in which the comprehender constructs a text base using both textual information and general knowledge, and (2) an integration process where the comprehender "integrates" the textbase into a "coherent whole". Drawing on Rumelhart and McClelland's (1986) connectionist model of comprehension, Kintsch assumes that the comprehender's knowledge base is like a network of associations.

The textbase consists of the concepts and propositions of the text as well as the concepts and propositions that are closely associated to them in the general knowledge and which are activated regardless of the context, some additional inferences, and "connection strengths" between the concepts and propositions. The output is an "incoherent" and "inconsistent" structure which contains some irrelevant information that needs to be weeded out.

The integration phase takes care of these inconsistencies through more activation spreading. The nodes that are relevant are highly activated whereas those that are irrelevant have a low or zero activation value, and are therefore eliminated. The output is a coherent whole consisting of elements that are context-sensitive, and which include, in general, lexical concepts, text propositions, different types of inferences, and macropropositions.

According to Kintsch, the new aspect of this model is the expansion of the role of knowledge, in that the text structure consists not only of the relevant information but also nonrelevant information that is related to it in the general knowledge of the comprehender. Another new aspect of this model is that knowledge is no longer assumed to consist of "prestored structures" as proposed in the schema theory and related theories. Rather, it is assumed that knowledge structures (i. e. schemata) are generated according to the relevant context of each new task, thanks to a network of associations which has both positive and negative interconnections. Prestored structures are thought to be "too inflexible" to adapt to different types of contexts. This view about knowledge

organization in memory is also held by Iran-Nejad (1987) as will be discussed in the conclusion.

In the same spirit, Mandler (1984: 109), in her reaction to Alba and Hasher's (1983) criticism of schema theory related to the selection process, points out that during encoding, many schemata are simultaneously activated, and therefore, selection is not limited to the information that is directly relevant to one schema. On the other hand, it has been empirically proven that schemata play a selective role in information processing. Friedman (1979), as Mandler (1984: 109) points out, conducted a study on scene encoding which showed through eye movement that subjects' schemata controlled "the amount of attention that is given to various aspects of a situation"

Meyer presents a different view of how knowledge or text is structured focusing most of her research on expository texts.

b. Meyer

Meyer (1975) developed her prose analysis system based on the principles of Grimes' (1972, 1974) rhetorical relations and Fillmore's (1968) case grammar. Meyer's system has highlighted many important aspects of text structure, adopting the idea unit as the minimal unit of analysis. Her system describes two types of propositions. The first type are lexical propositions, where relations between individual words are defined by lexical predicates (e.g. verbs) and role relationships or case relationships. The second type of propositions are rhetorical propositions which specify relations between the ideas of the text at the macropropositional level. Such relations are labeled as rhetorical predicates (e.g. problem-solution, antecedent-consequent, etc.). These predicates are usually identified by some key words used by writers. Meyer's system yields a hierarchical structure where the idea units of the text are ordered according to their importance in conveying the message intended by the author. Meyer (1975) uses the

notion of top-level structure to refer to the rhetorical relation that governs the top third of the hierarchy.

Similar to Kintsch and van Dijk (1978), Meyer's model assumes a hierarchal order in recall of information from texts. She also contends that each text has a top-level structure which is its "overall organizing principle" and which determines how well it will be processed and recalled by readers. Meyer and Freedle (1984: 122) claim that for the writer as well as the reader "this organizing principle is the primary schema used to view the topic."

Meyer (1975, 1977; Meyer and Rice, 1982; Meyer and Freedle, 1984) has identified five different ways of organizing discourse. They include collection, description, causation, problem/solution, and comparison (in Meyer and Freedle, 1984). It is assumed that these top-level structures differ in their degree of organization evaluated in terms of the number of organizational components that they contain. Meyer and Freedle (1984: 123) placed these structures along a cumulative scale starting with description (elements grouped by association) as the least organized structure, followed by collection (elements grouped by sequence), then causation (elements grouped by time sequence and causally or semi-causally related), and at the end of the scale problem/solution as the most organized structure (has all the organizational components of causation in addition to an overlap between elements in the problem and elements in the solution). Comparison is placed on a separate scale as it differs from the other structures. Its elements are organized based on similarities and differences and not on the basis of time or causality.

2.6.3.3 Empirical Studies

a. The Hierarchy Principle

This principle has been supported by many empirical studies involving different types of texts such as stories and expository texts. Different researchers have tested the

validity of this principle (e.g., Mandler and Johnson, 1977; Rumelhart, 1977; Meyer, 1974, 1975, 1977; Thorndyke, 1977; Kintsch and Keenan, 1973; Kintsch et.al. 1975).

Researchers who have studied stories (e.g., Rumelhart, 1975, 1977; Kintsch and van Dijk, 1975; Mandler and Johnson, 1977; Thorndyke, 1977) have developed tree structures to represent the elements of the story and to show the different relationships between these elements or propositions. These structures represent the underlying meaning of the story (Thorndyke, 1977: 78), or to "relate the surface structure of the story to its underlying structure on which schemata are based." (Mandler and Johnson, 1977: 148). Such structures have been referred to as "story grammars" (e.g., Rumelhart, 1975; Thorndyke, 1977), "story schemata" (e.g., Rumelhart, 1975, 1977; Mandler and Johnson, 1977), or "text schemata" (e.g., Kintsch, Mandel, and Kozminsky, 1977). These researchers agree that the propositions that make up a story can be placed in different hierarchical levels depending on their importance in the development of the story. They also agreed that the propositions are related by their rhetorical functions (Pearson and Camperell, 1985).

The studies that have been conducted on comprehension and memorability of stories have shown that the hierarchical structure of the story plays a determining role in both processes. Rumelhart (1975, 1977, as cited in Singer, 1985), for example, has hypothesised that propositions are more likely to be recalled if they are placed high in the hierarchy, and that a subordinate proposition will be recalled only if the higher proposition is recalled as well. These predictions have been supported by Meyer and McConkie's findings (1973) according to Rumelhart (1977: 130-131).

Rumelhart's (1975) predictions have also been supported by Thorndyke's (1977) findings. Thorndyke tested both comprehension and recall of simple stories using different "experimental tasks" whereby he manipulated the structure of the story. He found that story facts memorability was contingent on their "centrality" in the hierarchical

structure of the story. Thus, facts that belonged to the top level of the hierarchy tended to be better recalled than facts that belonged to the lower levels.

Similar findings have been reported by Kintsch and Keenan (1973) and Kintsch, et al. (1975). Kintsch and Keenan tested the memorability of paragraphs that the researchers constructed from propositional bases. They found that superordinate propositions were more readily recalled than the subordinate ones. These results were replicated in Kintsch et al. (1975) where the levels effect was again found to be a determining factor in recall. Comparing the effects of the serial position of propositions with their position in the hierarchy of the paragraph structure on their recall, Kintsch et al. (1975) found that the primacy effect (recall of propositions in paragraph-initial position) had an impact only inasmuch as it coincided with a high hierarchical position. They concluded that the levels effect was a more "powerful determinant of recall" (p. 203).

Meyer (1971, 1975a, 1977), and Meyer and McConkie (1973) came to similar conclusions concerning the impact of the hierarchy of ideas on recall mostly in expository texts. Meyer (1977) reports inconsistent findings of studies that have been conducted on the serial position effect, and contends that the hierarchical level of ideas in a passage structure is a better determining factor for recall than the serial position principle, as the findings of Meyer and McConkie (1973) demonstrate. In that study, it was found that top-level ideas tend to be highly recalled whether they occur in initial, medial, or final position of a paragraph. This is similar to Kintsch et.al.'s (1975) finding.

Meyer (1977) conducted an experiment on the recall patterns of paragraphs with high and low levels of information. These paragraphs were inserted in two passages on the same topic. Recall of the high paragraph was consistently better than that of the low paragraph in three different recall conditions. It was concluded that higher level information was more likely to be recalled and retained over time than lower level information (p. 320). The hierarchy principle concerning propositional recall seems thus to enjoy much empirical support.

b. Rhetorical/Global Structure

Rhetorical structure is the overall structure used by authors to organize a text. Meyer (1975a, 1975b, 1984) uses the term "top-level" structure and van Dijk and Kintsch the term "superstructure" (1983: 16) to refer to this overall text structure. Research has investigated the impact of text structure type on recall. In narratives, this basically consisted of examining the impact of the violation of the conventional structure of the story on its memorability. Thorndyke (1977), for example, found that placing the theme or goal of a story at the end, contrary to conventional stories, or removing it altogether, had a negative effect on recall of the story. Thus stories whose "plot structure" was not easily inferred by the subjects yielded lower comprehension recall. Kintsch et.al. (1977), Kintsch and Greene, (1978) and Kintsch and Yarbrough (1982) tested the comprehensibility of scrambled stories or paragraphs.

Kintsch et.al. (1977) investigated the difference in recall between stories presented in their normal order and scrambled ones among college level subjects. Reading time conditions were either limited or unlimited. The authors report that even though the reading times were longer for the scrambled stories, the summaries written by subjects were the same in both cases when the original story was well-structured. However, when the original story was less well-structured, the summaries of scrambled stories were not as good as those of the normal story. Kintsch and Greene (1978) came to the same conclusions. Stories whose organization corresponded to the subjects' story schema yielded more "informative" and more "complete" recalls than stories with unfamiliar schema. It was concluded that there were culture-specific or underlying schemata that guided both comprehension and reconstruction of stories.

Kintsch and Yarbrough (1982) investigated performance on essays that were either well-formed or ill-formed. When comprehension was tested at the global level, subjects performed better on the well-structured essays. However, when comprehension

was tested more locally (e.g., cloze test), there was no difference of performance. This suggests that different strategies operate at the macrolevel comprehension.

In a more recent study, Duszak (1991) investigated the use of news schema among Polish, British, and American readers. Their task consisted of reconstructing a news story into its linear paragraph structure. She found that readers, in general, attempted to give the contents of the story a meaningful or "canonical" structure, thus providing further support for the above findings on scrambled stories. She also found that her subjects had "good intuition" of the underlying schemata used in organizing news stories. However, she also found a tendency among the readers to give the news story a narrative organizational structure, i.e., a more linear organization of events than usually found in news stories.

Another set of studies were conducted on the effect of the structure of expository texts on comprehension and recall, mainly by Meyer and her colleagues. For example, Meyer, Brandt, and Bluth (1980, as cited in Meyer, 1987) conducted an experiment in which they predicted that 9th grade students who are able to identify and use in their own protocols the organizational pattern used by the author would recall more information and discriminate between consistent/nonconsistent information than students who are not able to adopt this strategy. Their findings supported this prediction.

A study by Bartlett (1978, in Meyer, 1987) came to similar conclusions. She taught 9th graders how to recognize and use different types of expository text structures. In subsequent testing, she found that students who received the training were better at identifying and using the top-level structures for which they were trained, and recalled more information than students who received no training. On the other hand, Brandt (1978, in Meyer, 1987) investigated the impact of an advance organizer related to the top-level structure of the text on recall of comparative and descriptive texts. She came to three major findings: (1) more competent readers remembered more information from the comparative text whereas the less competent readers remembered more from the

descriptive text, (2) more competent readers were better at following the instructions to change the top-level structure of the text when they had to substitute the descriptive structure with the comparative one, and (3) recall was higher for comparative than for descriptive texts.

Meyer and Freedle (1984) conducted two experiments in which they looked at the impact of four types of top-level structures on text processing: comparison, problem/solution, causation, and description. The authors postulated that top-level structures that have more organizational components (e.g., comparison), as measured by a cumulative scale, would facilitate comprehension and retrieval of information better than less organizational top-level structures (e.g., description). They used texts with the same contents organized in four different ways. In accordance with the authors' prediction, the results indicate that comparison and causation had a more positive influence on both learning and comprehension than description, because they offer "more specified relationships among components for use during instantiation and storage of facts in memory" (p. 140). The authors' explanation of the results obtained in problem/solution, however, remained somewhat vague.

The general conclusion drawn by Meyer and colleagues is that readers who are aware of and follow the authors' top-level structures comprehend the text better, retain more information, especially the more important information, and are less prone to forgetting over time than readers who are not able to adopt this strategy.

c. The Interaction Between Prior Knowledge and Text Structure

Commenting on the interaction between prior knowledge of the topic/content of reading and top-level structure, Meyer (1987) postulates that it is likely that the top-level structure might be of less relevance to readers who are more familiar with the topic/content of the reading material. This means that such familiarity provides readers

with "cues and links" that facilitate text processing, independently from the facilitative cues provided by the text's organizational structure.

Ohlhausen and Roller (1988) investigated the interaction between text structure and content schemata. They prepared passages that allowed subjects to use both content and structure schemata (C/S), content schemata (C) alone, or structure schemata (S) alone. Results showed that, on the whole, subjects used the appropriate schemata for both the content (C) and structure (S) texts. This tendency grew with age. However scores on structure strategy were lower for C/S text, suggesting that when both schemata are available, readers rely more on content than structure schemata. It was concluded that both types of schemata operate in text processing.

More recently, McKeown, Beck, and Sinatra (1992) also investigated the interaction between prior knowledge and coherent versus less coherent text organizations on readers' comprehension. They found that "upgrading" the readers' background knowledge on the topic of reading had a more positive effect on subjects who read the more coherent (i.e., the revised) version of the text than on subjects who read the less coherent (original) version. Thus, the results seem to suggest that the effect of prior knowledge will only be beneficial if the text being processed is well-structured or "coherent enough to allow the reader to see the connection between the text information and previous knowledge" (p. 91).

In a review of the literature on prior knowledge, text structure, and how the two interact in reading comprehension and recall, Roller (1990) came to the conclusion that the impact of text structure on readers depends on their familiarity with the topic of the target text. Thus, if the topic is "moderately" unfamiliar, readers will use the text structure to help them draw the relations between the concepts discussed in the text. When the text topic is familiar, the readers will use their knowledge of the topic to draw the relations between the concepts. In this case, "the structural clues become redundant." When the topic is very unfamiliar, readers are not likely to rely on structural clues to draw

connections between concepts since they cannot isolate the concepts of a completely unfamiliar text.

Recently, Moravcsik and Kintsch (1993) conducted an interesting study that investigated the effects of three factors: Background knowledge, writing style (discourse quality), and reading skills on text comprehension. They tested the impact of background knowledge by presenting the subjects with texts that either included suggestive titles, unsuggestive titles, or no title at all. They tested the impact of writing style by using two versions of the same passages, a well-written helpful version, and a badly written misleading version. Both versions preserved the content of the original passages. Reading skills or abilities were determined by making the subjects read short passages and answer comprehension questions.

The results suggested that subjects with "high-knowledge" recalled more information than subjects with "low-level" knowledge. The impact of background knowledge was more particularly apparent in the readers' construction of a "situation model" which reflected a more profound level of understanding than simply forming a textbase, where the readers basically reproduce textual information without further elaboration. Concerning the impact of the writing style, the results showed that when language cues are used in a helpful way to distinguish between more important and less important content, the readers are still able to construct "adequate mental representations" of the passage content even in the absence of adequate background knowledge. However, in such case understanding was only superficial as the readers were unable to build an "appropriate situation model". The best results were obtained when the presence of background knowledge was combined with a helpful writing style; the worst results were obtained when neither of these conditions was present. Finally, the reading skills factor has also been shown to play a role in comprehension as the the more skilled readers retained more information than the less skilled ones. The most important finding about the impact of reading skills, according to the authors of the present study, is the fact that

no interaction was found between the reading skills factor and the other two factors: background knowledge and writing style.

To conclude, studies on the interaction between prior knowledge and text structure seem to yield conflicting findings. Some studies have demonstrated that familiarity with the topic of reading was a prerequisite to the use of text structure in the comprehension process, other studies demonstrated that "moderately unfamiliar" texts will make readers rely on text structure to draw connections between the elements of the text.

2.7 L2/FL Reading

Theory and practice in L2/FL reading are heavily influenced by trends in L1 reading. As noted by Barnett (1989: 36), "no fully defined model of L2 reading exists yet." Thus, in its brief history, L2/FL reading, following the path of L1 reading, has known important theoretical shifts which resulted in important changes in the classroom practices. In a survey of trends in FL reading, Ulijn (1980) comments that neither the grammar-translation method view of reading --as depending on the ability to translate lexical items and structures from L2 to L1 and to translate whole passages at advanced levels-- nor the audiolingual method view of reading as the ability to decode isolated words and sentences, stressed the importance of L2/FL reading as a fluent skill based on comprehension.

According to Silberstein (1987) the advent of the psycholinguistic approach to reading has marked an important shift in the conceptualisation of L2/FL reading. Researchers such as Clarke and Silberstein (1977), and Coady (1979) have considered the implications of the psycholinguistic approach principles to L2 reading pedagogy. According to Grabe (1991: 377), the 1980s era has known much extension of Goodman's and Smith's perspectives to ESL reading theory and practice.

Dissatisfaction with both the structural bottom-up approach and the psycholinguistic top-down approach has led L2 reading researchers and practitioners to adopt a more interactive approach. Most L2 reading research is now conducted within the schema theory framework (Barnett, 1989). This research has focused on different aspects of interaction: interaction between reader and text, and interaction between bottom-up and top-down processes. On the other hand, the studies conducted within the schematic-theoretic framework have focused on the impact of different types of schemata on L2 reading comprehension (Carrell, 1988). These studies have explored the role of "content," "formal," and "linguistic" schemata, either separately or in interaction.

2.8 Content Schemata

The impact of L2/FL readers' prior knowledge about the topic/content area of the reading material has been empirically supported. The studies on content schemata have explored different aspects of background knowledge. Some studies have looked at the effect of the cultural content of the text on readers (e.g. Steffensen et.al., 1979; Osterloh, 1980; Carrell, 1981; Johnson, 1981; Steffensen, 1988), other studies have looked at the impact of discipline-oriented content on readers (e.g., Mohammed and Swales, 1984; Alderson and Urquhart, 1985; Strother and Ulijn, 1987, as cited in Carrell, 1989). Some other studies have investigated the impact on comprehension of presence versus absence of schema inducing contexts such as pictures, titles, or statements related to the general theme of the passage, or providing students with cultural content schemata, etc. (e.g., Omaggio, 1979; Adams, 1982; Johnson, 1982; Hudson 1982; Carrell and Wallace, 1983; Lee, 1986; Floyd and Carrell, 1987; Hauptman, 1994). According to Hauptman, "signalling," i.e., the use of both "iconic" and "noniconic" contextual clues of a text, is the next "crucial" facilitative factor when background knowledge is not available to the reader (1994:5)

2.8.1 GENERAL CONTENT SCHEMATA

Adams (1982) tested the effects of the use of "script activators" as background knowledge, on her subjects' ability to recognize unfamiliar lexical items in texts written in both L1 and the FL. Her findings indicate that subjects who received the script activators prior to reading performed better than the subjects who did not receive those activators. The findings also indicate that subjects who read in their L1 (English) scored better than those who read in their FL (French).

Carrell and Wallace (1983) report on a study in which they investigated the impact of background knowledge on a native group and an ESL group. Their purpose was to see how two components of background knowledge: context and familiarity would influence reading both individually and in interaction. They found that nonnative subjects, at both the intermediate and advanced levels, contrary to the native subjects, do not seem to use context to anticipate the text's meaning and do not have a good sense of how easy or difficult a text is. These findings, according to Carrell and Wallace, are consistent with the findings of an earlier study by Carrell (1982) which considered "textual transparency," in addition to the other two components. That study demonstrated that the three components of background knowledge had a significant effect on recall by native speakers but not on ESL readers. The authors concluded that nonnative readers rely more on bottom-up processes.

Lee (1986) replicated Carrell's (1983) study. He aimed at testing her finding that prior knowledge had no significant effect on nonnative readers. Contrary to Carrell, Lee found that his American subjects, reading texts written in Spanish, used context (title and a picture page) to enhance understanding and recall of familiar topic/material. However, context did not seem to have an effect when the topic was unfamiliar, supposedly because the picture used to provide context was not suggestive and did not help students anticipate the topic. This is consistent with Omaggio's (1979) finding that only simple "prethematic" pictures, i.e., pictures that provide just enough information to be used in

the comprehension of the initial paragraph, are useful in providing readers with the necessary background to process the text more efficiently.

Carrell's (1983) finding has also been challenged by a more recent study conducted in a foreign context on Zimbabwean bilingual readers by Roller and Matambo (1992). Similarly to Lee (1986), this study demonstrated that the use of context had a facilitating effect on comprehension of the more familiar text "Washing clothes," but not on the processing of the less familiar text "Balloon Serenade," as the subjects who did not have a picture did better than those who had one.

To conclude, studies conducted on the impact of prior knowledge on L2/FL readers' comprehension yielded inconsistent findings. Further research is needed in the future before one can draw any final conclusions concerning this issue.

2.8.2 CULTURE-SPECIFIC SCHEMATA

The studies that have investigated the impact of cultural background have revealed an interference effect of the L2/FL readers' culture when they process unfamiliar texts loaded with the target culture (TC) whether the TC aspects are implicit or explicit. Steffensen, et al. (1979), as summed up in the previous section, revealed how each of the groups of subjects involved in their study interpreted the text about the foreign culture according to their own cultural background. Carrell (1981) came to similar conclusions.

Johnson (1981), on the other hand, investigated the combined effects of foreign cultural content and language complexity. She found that the cultural background of the stories (Iranian and American folklore) had more impact on the comprehension of her subjects (Iranian intermediate and advanced ESL students) than linguistic complexity, in that the level of comprehension of the revised (simplified) version of the Iranian folklore story was not necessarily better than that of the original story. However, the revised version of the American story was better understood than the original version. Her native control group (American subjects) had a better understanding of the original version of

both stories, which implies that they were more sensitive to the level of language complexity; however, similar to the Iranian group, their comprehension was also affected by the cultural origin of the stories.

In another study, Johnson (1982) found that teaching subjects the meanings of unfamiliar lexical items related to the topic of reading before they actually read the text did not affect comprehension in any significant way. However, prior experience with the cultural aspects discussed in the text was much more beneficial for comprehension.

Steffensen (1985) conducted cross-cultural studies on the interaction effects of cohesion, register and background knowledge on reading comprehension. Her findings indicate that readers with prior knowledge matching the text schema are better able to understand the content of the passage than readers without that knowledge. The findings also indicate an interaction between background knowledge and register throughout the text processing. Thus, the reading of some linguistic signals allows access to the appropriate schema. These in turn guide readers in further reading and constrain the understanding of ambiguous linguistic items. This results in the activation of further appropriate subschemata, and prevents activation of nonappropriate ones. There is also indication of an interaction between cohesion and background knowledge. Thus, lack of background knowledge, or the inability to access the appropriate underlying schema of the passage, hinders the processing of cohesive devices.

In another article, Steffensen (1988) suggested that an effective way of improving ESL students' reading comprehension cross-culturally is through the use of a "dialogue journal." In this journal, students are supposed to report to their teacher the difficulties they encounter at "understanding, remembering and recalling" unfamiliar cultural information, as well as their "interest and need" to learn about the TC. This two-way dialogue between the students and their teacher supposedly improves their understanding of the TC.

Floyd and Carrell (1987) also looked at ways of helping L2/FL students to cope with unfamiliar cultural information. In this study they used intermediate level ESL subjects who were divided into two groups. One group was taught the cultural background related to the material to be read, and the other one received no pre-reading preparation. Results indicated that the group who received the treatment prior to reading performed much better than the other group in both objective tests and free recall. It was concluded that background knowledge related to the material of reading can be effectively taught to ESL students.

Other studies have investigated the impact of culture-specific schemata and have also concluded that unfamiliarity with the cultural content of the reading material may lead L2/FL readers to misunderstand the content because of interference from their own cultural background. Some of these studies were conducted by Bensoussan (1986); Laufer and Sim (1985); Bernhardt (1986); and Parry (1987).

Thus, according to the studies described above, the findings concerning the influence of cultural schemata seem to be more consistent than the findings related to the impact of general content schemata.

2.8.3 DISCIPLINE-SPECIFIC SCHEMATA

Research on discipline-specific schemata has not enjoyed as much interest as those reviewed above. Alderson and Urquhart (1988), for example, tested the effect of discipline-related background knowledge on the performance of ESP/EST subjects on tests of reading comprehension. The authors found that background knowledge related to the academic field of study can positively influence reading comprehension. According to Carrell (1989), Mohammed and Swales (1984) as well as Strother and Ulijn (1987) have come to similar conclusions. Their results also demonstrated that reading material related to a familiar academic field of study is more easily understood and retrieved than

linguistically equivalent material related to an academic field that is less familiar to the students.

2.9 Formal Schemata

L1 studies have provided evidence that the rhetorical structure of texts had an effect on reading comprehension and recall. Similar studies have been conducted to test this effect on L2/FL readers. Carrell (1984) looked at how the story schema structure would affect comprehension of intermediate-level ESL students. She presented the subjects with a well-formed and an ill-formed version of the same story. Her findings indicate that comprehension, the quantity of recall, and the sequential order of recall are better when subjects read the version that respected the conventional structure of the story. She also found that subjects who read the ill-formed version attempted to restructure the story according to conventional order of stories in their recalls.

As cited in Carrell (1988), studies conducted on contrastive rhetoric by Kaplan (1966) also demonstrated that structural/formal schemata exert an influence on comprehension as well as production of written material among L2 learners (Ostler and Kaplan, 1982, in Carrell, 1988: 81). On the other hand, Hinds (1983, also cited in Carrell, 1988: 81) has demonstrated that "typical" Japanese and English text structures had different effects on different groups of readers.

Following Meyer and Freedle (1984), Carrell (1984b) investigated the impact of the four major structural schemata of expository texts, identified by Meyer (1975) as description, problem/solution, causation, and comparison, on ESL subjects' comprehension. Similarly to Meyer and Freedle (1984), Carrell found that the description rhetorical structure had less of a facilitative effect on recall than the other structures, described by Meyer as being more "tightly" organized. She also found that the different structures had different facilitative effects on subjects of different native languages, depending on which rhetorical structures are more common in their own culture. Finally,

she reported that most subjects failed to use the rhetorical structure of the texts they read in the organization of their own recall protocols. She concluded that the subjects were not able to recognize those rhetorical structures.

In another study, Carrell (1985) demonstrated that intermediate-level ESL readers, like native speakers, also benefit from a training in the top-level structures of expository text. The findings indicate that students who received the training could recall more information, suggesting that the use of knowledge about these structures enable students to better guide and organize their interaction with the text.

A more recent study on the effect of training in expository text structure on L2 discourse comprehension has been conducted by Raymond (1993). The study investigated the impact of such training on native English speakers learning French as L2. It was found that less proficient readers, who did not use the structure strategy, performed better after the training in the use of text structure, suggesting that they benefited from the training and that the use of the strategy has effective impact on comprehension and recall. The more proficient readers, on the other hand, seemed to be aware of the use of the structure strategy before the training.

Carrell (1992) looked at the impact of L2 students' awareness of text structure on their recall of expository texts. She conducted her study on forty-five ESL high-intermediate level students speaking different native languages. Subjects had to read and recall two expository texts with different rhetorical structures: comparison/contrast and collection of description. She measured subjects' awareness of text structure through the use of such structure in the recall protocols they produced and their recognition of the structure through a direct question. Her results showed that there was a relationship between awareness and recall. Students who used the same structure as the original texts in the organization of their recall protocols not only recalled more information, but also more of the "top-level and the high-level" ideas from the texts than students who used a different organization. However, "the recognition measure" showed no such relation

between the amount and type of information recalled and structure awareness. On the other hand, even though the types of text structures had no apparent effects on the amount of information recalled, the text with the comparison/contrast structure yielded a better recall of the top-level idea units than the description text.

2.9.1 INTERACTION BETWEEN CONTENT AND FORMAL SCHEMATA

Carrell (1987) showed how formal schemata interact with content/knowledge schemata. She demonstrated that reading comprehension is generally good when both types of schemata are familiar to the reader. When both content and structure are unfamiliar, reading is generally difficult. In conditions where either content or structure was unfamiliar, the content variable seemed to be a stronger determining factor for comprehension.

In a more recent study, Salager-Meyer (1991) has shown that for high-intermediate and advanced ESL readers, familiarity with the topic/content of the reading material is a more determining factor of comprehension than other variables including text structure. She also demonstrated that readers' use of the structure of expository text appears to depend on other variables including the levels of language proficiency and world knowledge. Her results demonstrate that structural information is more important for readers with lower language proficiency level when the content of the text is either unfamiliar or moderately familiar.

Thus, both Carrell (1987) and Salager-Meyer (1991) have demonstrated that content is a more important factor in L2/FL reading comprehension. Findings concerning the use of text structure strategy by L2/FL readers are not conclusive.

2.10 Linguistic Schemata

Language proficiency is one of the important variables in L2/FL reading. Researchers hold different opinions about the extent to which this variable determines

success in reading. The general tendency among L2 reading researchers since the advent of the psycholinguistic approach of reading has been to deemphasize the role of low level decoding skills and to emphasize that of higher level processes. This general tendency has changed somewhat lately, in part because research has demonstrated the importance of low level skills for L2 reading, but also because of the impact of current trends in L1 reading research which mark a shift back to a more bottom-up approach, albeit still interactive (e.g., Perfetti, 1985; Tannenhaus, 1988; Kintsch, 1988; Rayner and Pollatsek, 1989).

L2 reading research concerning the role of language proficiency mostly looked at the impact of text simplification on reading comprehension (e.g., Aronson-Berman, 1978, 1980; Blau, 1982; Bhatia, 1983; Strother and Ulijn, 1987; Ulijn and Strother, 1990; Leow, 1993), and the impact of overall language proficiency on reading comprehension (e.g., Cziko, 1978; Ulijn, 1978, 1980; Clarke, 1979; Hudson, 1982; Barnett, 1986; Devine, 1987; Eskey 1988; Carrell, 1991). The findings of these studies are not consistent.

Concerning simplification, for example, Aronson-Berman (1978) found that FL readers understood the simplified text better than the nonsimplified one. Bhatia (1983) reports other studies which came to the same conclusion, leading him to conclude that legal text simplification mainly at the formal level was beneficial for beginning and intermediate level students. Most other studies on simplification, however, report no effect on reading comprehension. Blau (1982), for example, found that complex sentences yielded higher comprehension scores than simplified short sentences. Ulijn and Strother (1990) demonstrated that syntax complexity had no significant effect on comprehension level. The group of subjects who read the simplified version of a computer science text and those who read the original version showed no significant differences in their comprehension levels. The authors concluded that the conceptual and lexical aspects of the reading material are more determining factors for reading

comprehension among L2/FL readers. Leow (1993) also came to the conclusion that syntactic simplification does not have a "facilitating effect on learners' intake" (p. 333).

Other studies have indicated that the level of language proficiency has an impact on the reading behaviors and the level of comprehension of L2/FL students. Cziko (1978, as cited in Hudson, 1982), suggests that most of the problems encountered by nonnative readers may emanate from their inability to make adequate use of the linguistic constraints (e.g., syntactic, semantic, and discourse constraints) of the text. He concluded that there should be renewed interest in the decoding skills, especially for readers who are either beginning or intermediate. Cziko (1978) also found that advanced L2 readers have the same reading habits as L1 readers.

Clarke (1980) reports similar findings. He holds that language proficiency has a powerful impact on reading behaviors of L2 readers. His study has shown that proficient L2 readers, as do proficient L1 readers, rely more on top-level processing. However, limited language proficiency in L2 "short circuits" the good reader's strategies leading him/her to be more reliant on the bottom-up processing. He concludes that language skills are very important for effective and efficient reading and holds that his findings are supportive of some researchers' attempts to integrate reading skills with language development (e.g., Eskey, 1973; Baudoin et.al., 1977; Clarke and Silberstein, 1977, as cited in Clarke, 1980).

Hudson (1982) looks at the interaction between language proficiency level and the role of schema activation in L2 reading by adult ESL subjects who are proficient L1 readers. The results demonstrate that L2 readers with advanced proficiency level have better abilities to activate/form schemata from the printed information and to relate those schemata to their background knowledge than readers at lower proficiency levels. Thus, here again the role of language proficiency in comprehension is found to be important, even though Hudson's findings also indicated that limited language proficiency could be overridden by the ability to activate the appropriate schemata. Induced schemata were

found to allow access to some low level linguistic processing which would not have happened otherwise.

Barnett (1986) observes that most literature dealing with reading classroom practices stresses vocabulary more than grammar. To test whether there is a justification for such an emphasis, Barnett conducted a research study in which she tested vocabulary, grammar, and comprehension through cloze test, multiple choice, and recall protocols of stories among U.S university students learning French as a FL. Her findings indicate that both syntactic and vocabulary knowledge were important for reading comprehension, and that the two skills interact with each other during the comprehension process.

Devine (1987) investigated the interaction between language proficiency and reading development among ESL students in a longitudinal study. Throughout the academic year, the subjects' changes both in reading behaviors and language proficiency were recorded. Devine's findings provide further support for the relationship between language proficiency level and reading ability. However, she reports a lack of correlation between improvements in discrete grammar and vocabulary tests and advances in reading ability. She concludes that the teaching of grammar and vocabulary to improve reading could only be effective if taught within an integrative approach.

Eskey (1988) adopts a more bottom-up view of L2 reading. Following L1 researchers such as Perfetti (1985), Rayner and Pollatsek (1989), for example, Eskey supports the notion that low level skills have a major role to play in the reading process, especially in L2 reading. He holds that good readers decode most words and syntactic structures that they encounter in the printed text through an automatic identification which requires little conscious effort. Guessing through context or background knowledge, thus, plays little part in the low level processing skills. Automaticity in word identification is assumed to free the mind so that the reader can devote more attention to top-level processing. Eskey concludes that fluency in reading depends both on gaining mastery in the decoding skills and the ability to relate the textual information to

background knowledge. Interactive models, according to him, are most appropriate as they accommodate both perceptual and cognitive processes involved in reading.

Carrell (1991) investigated the effects of L2 proficiency and reading ability in L1 on reading comprehension in L2. She predicted that, taken individually, each of these variables would significantly affect reading in L2. However, she did not make any predictions concerning their combined effects. It was her purpose of the present study to find out if the two variables taken together would affect L2 readers' performance. She combined ESL native speakers of Spanish and American subjects taking Spanish as a FL. The subjects were at different proficiency levels in their respective L2/FL. The results indicated that both language proficiency and L1 reading ability are significant factors in L2/FL reading. The two factors, however, exerted different effects on the two groups of subjects. For the ESL group, ability in L1 reading was a relatively more pertinent factor than language proficiency, whereas for the American group taking Spanish, language proficiency was relatively more important than L1 reading ability.

Even though the findings concerning the linguistic schemata are not consistent, this paper assumes that linguistic proficiency plays an important role in L2 reading comprehension, and that L2/FL readers will only be able to make an optimal use of the background knowledge and text structure variables if they can decode the textual information adequately.

To conclude, despite conflicting findings, the research studies summarized above have demonstrated that the three types of schemata have an important role to play in L2/FL reading development, both individually and in interaction.

2.11 Conclusion

This review has discussed theoretical and practical trends in L1 and L2/FL reading. There was focus on schema theory because it is the most widespread theory adopted in current research in both L1 and L2/FL reading. Because this theory enjoys

much empirical support, it has been chosen as a theoretical framework for the present study. Even though schema theory is basically a top-down approach, it is flexible enough to accommodate an interactive approach to reading where there is equal emphasis on perceptual linguistic processes and conceptual comprehension processes, both critical for achievement of reading competence in L2/FL.

Schema theory has been subject to much criticism lately. It is being questioned on both theoretical and empirical grounds (e.g., Alba and Hasher, 1983; Garnham, 1985; Perfetti, 1985; Iran-Nejad, 1987, 1989; Kintsch, 1988; Rayner and Pollatsek, 1989; Schacter, 1989; Sadoski et.al., 1991; Carver, 1992; Norris and Phillips, 1994).

Most of these critics point to the vagueness that characterizes schema theory (e.g., Brown (1979, in Sadoski et.al. 1991; Alba and Hasher, 1983; Garnham, 1985; Iran-Nejad, 1987, Sadoski et.al., 1991). According to Iran-Nejad, the vague character of the term schema was pointed out by Bartlett (1932) himself, who stated that he "disliked" the term schema because it is "at once too definite and too sketchy" (in Iran-Nejad, 1987: 121). Sadoski et.al. (1991) point out that this vagueness resulted in a confusing multitude of definitions and metaphors used by different researchers to define the term schema, and the features of schema theory. The same authors claim that there is also confusion concerning "the nature of the knowledge that constitutes a schema" (p. 466).

Iran-Nejad (1987) criticizes the schema theorists' belief that schemata are "relatively permanent" knowledge structures. Stressing the transient/dynamic character of the human cognitive structure, Iran-Nejad notes that the term schema would be better defined as "an emergent transient gestalt" (p. 114) which is generated by its elements, rather than a static structure or a "collection of discrete concepts" (p. 114).

Alba and Hasher (1983) critically review the encoding and retrieval processes posited by schema theory. Encoding processes are selection, abstraction, integration, and interpretation, and the retrieval process is reconstruction. The authors conclude that "memory for complex events is far more detailed than schematic processes would allow"

(p. 225). It seems, thus, that people remember much more information than assumed by schema theory, i.e., information not related to the schema activated during the processing phase. They also claim that readers use interpretations less often than assumed by schema theory. They hold that recall is determined by circumstances related to the processes that operate during retrieval, such as the types of connections made by readers during encoding, rehearsal processes, cuing, task instructions, etc.

Sadoski et.al., (1991) criticize schema theory on empirical grounds. Considering the types of texts used in schema theory studies, the authors question the "validity and generalizability" of findings based on studies that used obscure, ambiguous, or multiple interpretation texts, which are not found in normal reading situations. Like Alba and Hasher, (1983), they conclude that the evidence provided by the findings of "key" studies often cited in support of schema theory are mostly due to the research methods used in these studies. Replications with other methods would yield different results. Sadoski et al. (1991) propose an alternative cognition theory named "dual coding theory" which, as they claim, is able to account for the effects of prior knowledge as well as other effects without the flaws from which schema theory suffers.

Carver (1992) criticizes schema theory's emphasis on the impact of prediction activities, prior knowledge, and text structure, on reading comprehension. Carver holds that such variables are irrelevant to what he qualifies as "normal, typical, or ordinary reading-called rauding" (p. 165). According to his rauding theory, normal reading depends on the readers' general reading ability for comprehension, involves no learning or memorization, and makes little use of prior knowledge. However, the reading of difficult material may involve the three variables mentioned above.

Norris and Philips (1994) question the idea of using pre-reading activities to provide readers with relevant background knowledge before reading takes place. They note that the advocated use of such activities only serves to lead readers to a misconception about the nature of reading. They claim that relevance of knowledge will

only depend on the readers' own interpretations of the text in the course of reading. Readers cannot evaluate what knowledge is relevant before interpreting a text. They propose a "perspectival view of reading" which considers the inferencing abilities of readers much more important for reading than the possession of relevant background knowledge. According to this conception of reading, providing readers with background knowledge prior to reading would short circuit their interpreting abilities, in a way. When no prior knowledge is provided, readers use their inferencing ability to construct their own interpretations of the reading material by integrating textual information with their prior knowledge about the content of the text.

Schema theory has also been criticized for its emphasis on top-down processing at the expense of bottom-up processing (e.g., Perfetti, 1985; Kintsch, 1983, 1988; Rayner and Pollatsek, 1989). This criticism is based on empirical evidence provided by research on eye movement that the majority of readers, regardless of age and reading competence, process most words they encounter in a text (Just and Carpenter, 1980, cited in Kintsch, 1988). This attests to the prevalence of the use of bottom-up processes in reading.

According to Kintsch (1988), emphasis on top-down processing is a difficult idea to make work at the computational level. He notes that schemas (including scripts and frames), as originally defined, are not "workable" notions because "if they are powerful enough, they are too inflexible, and if they are general enough, they fail in their constraining function" (p. 164). To solve the problem, Kintsch (1988) proposes a construction-integration model which depicts two phases in text processing, a construction phase where the propositional base of a text is constructed based on context-free bottom-up processing, and an integration phase where the propositional base is "edited and integrated" into a "coherent whole" through top-down processing. Text bases are built based on both textual information and the reader's prior knowledge, including knowledge about language and about the world.

According to the criticism presented above, schema theory suffers from many drawbacks that seem to cast doubt on its plausibility as a theoretical framework for research on reading. One should keep in mind, however, that much of the above criticism does not seem to be well founded either because it is limited in its scope, and so does not present the picture in its totality, or does not seem to offer any better alternative to a theory that has guided research in reading for over a decade.

Thus, Iran-Nejad's (1987) rejection of the interpretation of a schema as a relatively permanent structure does not account for readers' tendency to recall scrambled stories according to the conventional story structure. That structure cannot have been generated from the text itself since its elements are presented in disorder. In such case, it seems more plausible to assume that readers have a specific pattern in their cognitive structure that corresponds to story structure. The same explanation could account for the tendency to interpret a text according to patterns/values of one's own culture. It is also plausible to account for generation of the "correct" structure of disordered stories and interpretation of texts according to one's cultural patterns in terms of inferential thinking. However, inferences can only be made based on some prior knowledge of story structure and one's cultural values/patterns.

At the same time, it is also reasonable to recognize that our knowledge structure based on schemata should be flexible enough to adapt to new situations and contexts, otherwise it would be difficult to account for the dynamism of the human mind and its ability to organize itself, as pointed out by Piaget (in Mandler, 1984: 113). Therefore, definition of schemata, as suggested by Iran-Nejad (1987), should emphasize their dynamic character in order to account for acquisition of new information and its interaction with the already acquired one.

It has also been suggested in the literature that there are general patterns or schemata which guide our information processing, and which correspond to what is referred to as prototypes, i.e., "schemata of the most characteristic members" of a natural

category (Rosch, 1976, in Johnson-Laird, 1983:190). The variables of this prototypical schema are instantiated by elements contained in the new information. In this regard, Johnson-Laird (1983:190) pointed out that "a concept might be represented by a schema, and moreover, a schema that specifies, not a set of necessary and sufficient conditions, but the typical or default characteristics of the items it subsumes."

Alba and Hasher (1983) and Sadoski et.al. (1991) point out that key studies which provide most evidence in support of schema theory relied on the use of ambiguous or multi interpretation texts. They argue that the use of such texts casts doubt on the "validity and generalisability" of these studies' findings. One could counteract this argument by pointing out that most theories use "research devices or methods" that are likely to validate their underlying assumptions, and therefore schema theory is not an exception. On the other hand, ambiguity is an inherent characteristic of human language, including written language. The reader's challenge is to work through that ambiguity to construct the meaning of the text. It is Kintsch's (1994) contention that a text that has too large an overlap with the reader's knowledge is likely to cause boredom. A text, therefore, has to be challenging enough "to stimulate readers' active inferencing" (p.302) . Finally, and most importantly, schema theory has also received support from various studies that used "normal" texts and integrative tasks such as recall of the text.

On her part, Mandler (1984: 109) also disagrees with Alba and Hasher' s (1983: 204) criticism of schema theory when they stated that, because of the operation of the processes of selection, abstraction, interpretation, and integration in the encoding of information, as assumed by schema theory, "only the information that is relevant and important to the activated schema will be encoded." According to Mandler, this is not quite so because of the simultaneous activation of more than one schema during information encoding, which entails that selection is not limited to the information that is directly relevant to one schema.

Carver's (1992) criticism of schema theory is based on a very artificial distinction between "rauding," which is based on the reader's general reading ability, and the other type of reading which involves learning and memorization. According to him, rauding does not involve prior knowledge and prediction activities, which seems to be unlikely. It is hard to imagine any kind of reading for meaning which does not involve interaction between the text and the reader's knowledge. One should note also that Carver seems to have a narrow conception of reading ability.

Norris and Phillips' (1994) argument that readers' inferencing abilities are more important than prior knowledge seems contradictory. Readers can only make inferences based on some overlap between textual information and their prior knowledge. As Mandler (1984: 110) points out, inferences related to a particular event sequence, and which are necessary for the comprehension of such events, are made based on the activation of the general or abstract schema that underlies these events. The authors might, however, make a point when they argue that too much emphasis on pre-reading activities may be detrimental to the readers' ability to make their own interpretations of the text.

The most plausible criticism addressed to schema theory is the one related to the vagueness of the theory in certain respects, especially as concerns the definition of a schema. Also, the emphasis of the theory on top-down processing has been largely contradicted by empirical studies, even though very proficient adult readers would seem to rely more on top-down processes. Finally, the basic flaw of the theory is its inability to account for how knowledge that does not correspond to any schema in the reader's cognitive structure is processed. In other words, it does not address the question of how new schemata are formed.

A concluding note is that as long as the new alternatives used to criticize schema theory are not largely validated by empirical studies, schema theory will continue to be

the most theoretically and empirically sound theory of reading, especially since most of these alternatives still stress the importance of prior knowledge, inferencing, etc.

CHAPTER III

METHODOLOGY

3.1 Objectives of the Study

The present study has four primary objectives. The first primary objective is to investigate the impact of the readers' schemata on their comprehension of four texts, each on a different topic. In particular, the study aims at investigating the impact of content schemata (i.e., the readers' prior knowledge of the topics/content of the two texts) on comprehension as measured by the number and types of propositions recalled. The second primary objective is to study possible effects of the global structure of the texts on the subjects' recall, and the interaction between the overall structure and the content of the texts. The third primary objective is to study the impact of the propositional structure of the texts on recall. The fourth primary objective is to investigate the effect of language proficiency on propositional recall.

There are at least three secondary methodological objectives for this study. First, the study aims at testing various hypotheses concerning text structure. In particular, it examines the extent to which (some particular aspects of) Meyer's (1975a) and Kintsch and van Dijk's (1978; van Dijk and Kintsch, 1983; Kintsch, 1988) theories of text structure are appropriate for second and foreign language readers. Second, the study investigates the use of the recall protocol as a tool for measuring text comprehension. Finally, this study considers the appropriacy of propositional analysis in second/foreign language reading.

3.2 Subjects

Three different groups of subjects were involved in this study: L1 group (N=24), native English speakers who also served as a ceiling for the expectations of L2 and FL performance; L2 group (N=23), Canadian-Francophones for whom English is a second language; and FL group (N=145), consisting of 1 Serbian and 6 Iranian students at the University of Ottawa representing the expert user/comprehender level explained below, and 138 Moroccan university students of English as a foreign language, all of whom represent the good user/comprehender and fairly competent user/comprehender levels (See below.). Each group consisted of young adults, 80 males and 112 females, involved in academic specializations in both the humanities (N=113) and sciences (N=79). Data was collected from the Moroccan subjects in the Fall, 1995 semester during a special data-collecting trip to Morocco.

The breakdown by area of specialization of the subjects for each of the two groups used in the study is as follows:

Subject Group	Linguistic Group	N	Area of Specialization
Humanities Group	L1	1	Philosophy
		2	Law
		16	Linguistics/Education
	L2	2	Translation
		1	Political Science
		1	Administration
		1	Visual Arts
	FL	17	Linguistics/Education
		5	Linguistics
		1	Psychology
		66	English Literature
	(sub-total: 113)		
Science Group	L1	5	Science
	L2	1	Science
	FL	1	Medicine
		7	Biology
		21	Technical Management
		26	Agronomy/Agriculture
	FL	18	Engineering
		(sub-total: 79)	

The L2 and FL subjects were placed in one of the following three proficiency levels in English based on a performance grid developed for the present study: Level A, expert user/comprehender; Level B, good user/comprehender; Level C, fairly competent user/comprehender. Assignment to levels was based on information collected from the subjects concerning their experience with the English language either as an L2, a FL, or as a language of instruction. Subjects doing their doctoral programs where English is the basic language of instruction were categorized as expert or very good users (level A), whether they belonged to L2 or FL groups. These subjects generally ranked themselves as highly proficient. Some subjects from the L2 group assessed themselves as "balanced bilinguals" in English and French, even if they were not involved in doctoral programs. One should mention at this point that the linguistic environment in Ottawa is particularly interesting in that most people feel comfortable using both languages on an equal basis for all types of purposes. Other L2 subjects, however, were not as comfortable in English. They were involved in English learning programs either at the high-intermediate or the intermediate levels (levels B and C) at the Second Language Institute of the University of Ottawa.

The Moroccan group represented two levels ranging from B to C depending on their academic specializations and their university level. Students involved in the Licence (BA) program in English language and literature were assigned to levels B or C. Level B for students at the fourth (i.e., last year) of the program (a 17 hours/week of English instruction), and for students at the third year of the program (a 17 hours/ week of English instruction), and Level C for those at the second year of the program (a 16 hours/week of English instruction). Subjects involved in science specializations start taking English as a FL for two hours a week beginning from the first year of their respective programs. This is equivalent to about sixty hours a year. Based on this information, subjects involved in the agricultural program were divided as follows: Level B for students in the fifth year of the program (60 hours x 5 years of study) and level C for students in the fourth year (60

x 4 years of study). Subjects specializing in engineering were assigned to Levels B or C: B for students in the fifth/last year, and C for students in the second year of the program. Subjects specializing in techniques of management were all in the second year of their program (the program lasts for two years only) and were placed at Level C (60 hours a year x 2 years of study). The case of biology subjects was somewhat problematic because their department does not offer any English language courses. Students generally depend on their own means to study English in order to manage their readings in English. Since these subjects are considered to be generally less proficient in English, they were placed at Level C except for one who did his Ph. D in the United States and was very fluent in English, and was thus placed at level B.

In addition to the English classes that the Moroccan students have at the university level, they all study English for the last three years of high school where students in the humanities take 6 hours a week, and those in science 5 hours a week. It should also be noted that the Moroccan educational system establishes uniform programs that are taught in all educational institutions of the country. This means that all students at a given level receive the same training.

The above grouping of L2/FL subjects into the three proficiency levels could not be based on a standardized test due to practical considerations which made it impossible to have the subjects do the test before the experiment.

3.3 Materials

Four different texts were used in this study (See Appendix B). Two were on topics related to humanities: Text F which discussed the feminization of academe in the United States, and Text M which discussed the situation of black women under slavery in the United States, and the other two on topics related to science: Text E which discussed two theories of evolution, and Text S which discussed the history of the development of flight. In addition to the difference in topics, the texts differed also in their global

structures. In each pair of humanities and science texts, one text was well organized and the other was less well organized, in accordance with Meyer's (1984) cumulative scale of organizational patterns. The aim of using this variety of topics and rhetorical structures was to investigate how these two aspects of text interact in subjects' recall.

Each text was then analyzed in terms of its propositional structure following closely the surface structure of the text. A preliminary propositional analysis was done by this researcher and my research supervisor. Next, a group of 19 English speaking doctoral students in humanities (linguistics, education and philosophy) were asked to indicate for each text: (1) what were the individual propositions, (2) at what level in a hierarchy of four levels each proposition would be, and (3) what the top-level/rhetorical structure of each text was. The four hierarchical levels of propositions were explained as being primary propositions (PIs), main ideas of the text; secondary propositions (PIIs), ideas of relative importance which are direct descendants of the main ideas; tertiary propositions (PIIIs), ideas of considerably less importance which are descendants of the secondary propositions; and quaternary propositions (PIVs), examples descending from tertiary propositions or propositions which serve in only an exemplary role for primary or secondary propositions. (See Appendix C for examples.) The final accepted propositional structure for each text, then, was the result of agreement between the original analyses and the graduate students' analyses. In a few cases, where there was lack of agreement, the problem was presented to 6 more expert readers who became the final arbiters.

In order to determine the global structure, the subjects were given a list of Meyer's five basic global structures along with explanations for each structure, and were asked to choose the most appropriate one for each text. The final decision concerning the appropriate global structures of the texts was reached following the same procedure as the one for propositional structure.

Based on research findings that the subjects' reading time increased as a function of the number of propositions being processed (Kintsch and Keenan, 1973), it was

decided to use propositional equivalence to establish text difficulty equivalence. Text S served as the base for the desired number and types of propositions. The other three texts were cut so that they were equivalent to Text S. The four texts, thus, consisted of the same number of propositions at each of the four levels of the hierarchy described above. The length of each text and the number and level of the propositions in each text are summarized in Table 1 below.

Table 1: Text length and number and type of proposition for each text.

	Text F	Text S	Text M	Text E
No of words	673	669	674	895
No of PIs	7	7	7	7
No of PIIIs	23	23	23	23
No of PIHIs	26	26	26	26
No of PIVs	22	22	22	22
TOT. NO. OF PROPS	78	78	78	78

Van Dijk and Kintsch (1983: 45) define readability as the "relative ease" with which texts can be read and recalled as measured by the reading time for each recalled proposition. This was based on experiments conducted by Kintsch and Vipond (1979) and Miller and Kintsch (1980). Kintsch and Vipond (1979) criticized the traditional readability formulas as being limited to superficial aspects of texts such as vocabulary density and rarity, the number of words, and the length of sentences. Such superficial aspects cannot account for the underlying meaning of texts and therefore remain insufficient measures of reading ease/difficulty. According to Meyer (1975b: 8) these formulas are also unable to deal with "the manner in which the content is organized to convey meaning."

3.4 Experimental Design

The present study follows a variable-treatment design. It was conducted in group sessions where each subject was randomly given one science text and one humanities text. Thus all four texts were used, but each half of a group read and recalled a different but equivalent pair of texts. Each subject, thus, read and recalled two texts, and identified the global structure of those texts. Subjects were allowed a maximum of two hours to complete the tasks.

The independent variables of the study were of two types: stimulus-related variables which are theory-derived, and subject-related variables. Stimulus-related variables were (1) Propositional Structure of texts, and (2) Global Structure of texts. These two variables are widely used in the field of cognitive theory, and are held to determine comprehension and retrieval of textual information. Propositional structure shows the different hierarchical levels of the propositions contained in a text. Global structure shows how the text is unified as a coherent piece of discourse under an overall organizing structure. Subject-related variables were (1) subjects' background knowledge related to the topics discussed in the texts, and (2) the subjects' second/foreign language proficiency level.

The dependent variables were (1) the subjects' recall of each of the two texts as measured by the number and types of propositions recalled in the recall protocols, and (2) the subjects' identification of the texts' rhetorical structures.

3.5 Procedure

The study was conducted in a two-hour session for each group. Subjects received a package containing a general information sheet, two texts, each followed by a summary sheet on which they were to do a recall protocol of the text, and paper on which they could take notes while reading. The L2 and FL groups also received a questionnaire and a self-assessment grid to fill out which elicited information on their linguistic and

educational backgrounds, their proficiency in English, and their degree of familiarity with the topics of the texts, as well as the types of materials they prefer to read in L1 or L2/FL.

The subjects were asked to read each text, taking notes if they wished, and then to write down everything they could remember using their own words or words from the text, without referring back to the texts or their notes. They were free to write their recalls in outline and/or point form if they so preferred. They were also given the choice of using either English, French or both languages while writing their recall protocols. Finally, subjects were asked to identify a global structure used by the author in the organization of the text. To help them identify this discourse structure, a list of Meyer's five basic structures along with explanations for each structure were provided to them.

Some subjects from each group preferred to do the tasks at home as the time set for the formal sessions was not convenient for them. However, they were asked not to do the tasks if they thought they would not respect the instructions that came with the package.

3.6 Research Questions

The present study attempted to answer the following Research Questions:

1. Do subjects with background training in the Humanities perform better on the humanities-oriented texts than on the science-oriented texts, as measured by a recall protocol?
2. Do subjects with background training in Science perform better on the science-oriented texts than on the humanities-oriented texts, as measured by a recall protocol?
3. Does the global structure of the texts have an impact on the subjects' recall, as measured by a recall protocol? In other words, do subjects who identify the correct global structure of the texts recall more information or more important information than subjects who identify a different structure? and do subjects who use in their own recall protocols the same global structure as the one used by the author of the target text recall more

information or more important information than subjects who use a different global structure?

4. Is there any interaction between the global structure of the text and the familiarity of the text content, as measured by a recall protocol?

5. What types of recall patterns at the propositional levels do the four texts yield?

6. Does language proficiency have an impact on subjects' recall? More specifically, do higher linguistic proficiency levels in both second language (L2) and foreign language (FL) perform better than lower levels? and do native language (L1) subjects perform better than either the second language (L2), or the foreign language (FL) subjects, as measured by a recall protocol?

7. Do L1, L2 and FL subjects exhibit similarities or differences, as measured by a recall protocol?

3.7 Scoring

The written protocols were scored for the number and types of propositions recalled, as well as the global structures identified. Each recalled primary proposition was given 4 points, each secondary proposition 2 points, each tertiary 1 point and each recalled quaternary proposition 0.5 point. The differences between these values were meant to reflect the different hierarchical levels of the propositions. The global structure identified was allotted 10 per cent of the total number of points obtained by the candidate for each text. The number of points obtained was calculated and the resulting percentage counted as the score of the candidate for a given text.

To ensure intra-rater reliability, protocols from each separate text were scored separately. Each recall protocol was read twice and compared to the propositional structure established for the text before being scored. Sometimes, it was necessary to compare recalls to each other to avoid any inconsistencies. When all recall protocols were

scored, 20 copies from each text were chosen randomly and scored again to ensure consistency.

3.8 Statistical Analysis

The results obtained were submitted to analyses of variance or t-tests. Three types of results were discussed: (1) how each group performed on each text (intra-text results), (2) how the groups' performance on the texts read compared (inter-text results), and (3) how the three groups compared (inter-group results).

CHAPTER IV

STATISTICAL ANALYSIS

4.0 Introduction

The independent variables in the present study are four-fold: background, proficiency, global structure and propositional structure. The dependent variables are of two types: the subjects' recalls (i.e., one for each text) and the subjects' identification of two of the text's global structures.

Three types of results are reported below: (1) intra-text results (i.e., those which explain how each group performed on each text); (2) inter-text results (i.e., those which compare performances on each of the two texts); and (3) inter-group results (i.e., those which compare the performances of each group). When all subjects are combined, results will be reported for both Science Texts (Texts S and E) together under the text label of "SC" and for both Humanities Texts (Texts F and M) together under the text label of "HUM." These will be compared to the performance of subjects in each of Text Groups 1 and 2 using results for the texts for each group. Text Group 1 consisted of Text S (the Science text) and Text F (the Humanities text), whereas Text Group 2 consisted of Text E (the Science text and Text m (the Humanities text).

All statistical analyses were run on a Macintosh computer using the statistical software, Statview (version 4.0). Two types of statistical analyses were conducted on the data collected. First, recall results were submitted to analysis of variance – repeated measures. When significant interactions were found, ANOVA post-hoc analyses were performed in order to determine exactly where the differences occurred. Second, paired t-tests were performed on the propositional levels in order to determine if significant differences existed between propositional recall levels (see Table 2).

Table 2: Means and Standard Deviations by Text, Linguistic Group and Proposition Level.

P-LVL	TEXT	L1			L2			FL			Total		
		$\bar{X}$	S.D.	Sig	$\bar{X}$	S.D.	Sig	$\bar{X}$	S.D.	Sig	$\bar{X}$	S.D.	Sig
PI	SC	60.11	28.87		40.37	24.61		32.22	20.79		36.60	24.13	
	HUM	62.11	22.61		51.55	19.61	*	30.14	20.62		36.75	23.86	
	S	45.45	29.15		28.57	17.07		27.95	18.10		30.06	20.04	
	F	57.14	16.90	*	51.42	15.08	*	30.81	17.30		37.05	19.72	
	E	72.52	22.93		62.50	21.51		36.59	22.33	**	43.76	25.98	**
PII	M	67.03	26.33		51.78	27.46		29.94	23.47		36.93	27.50	
	SC	46.37	18.38		37.42	18.98		20.15	12.61	**	25.49	17.19	
	HUM	50.72	16.45		41.58	15.88		17.87	12.79		24.81	18.43	
	S	44.66	18.14		33.03	18.65		21.37	11.69	**	25.77	15.72	
	F	49.01	17.07		40.29	14.55		17.27	11.78		24.35	17.54	
PIII	E	47.82	19.19		45.65	17.85		18.94	13.42		25.20	18.69	
	M	52.17	16.46		44.02	18.94		18.46	13.76		25.30	19.40	
	SC	31.57	22.48		26.92	18.62		10.74	10.14		15.28	15.61	
	HUM	31.09	16.07		25.92	16.40		11.64	10.74		15.78	14.28	
	S	28.67	22.77		26.41	18.66		13.00	9.82		16.85	14.71	
PIV	F	27.97	16.94		21.02	16.69		10.78	10.79		14.31	13.89	*
	E	34.02	22.85		27.88	19.79		8.37	9.95		13.58	16.46	
	M	33.72	15.47		35.09	11.88		12.64	10.67	*	17.47	14.55	*
	SC	18.18	19.51		17.19	14.24		6.05	8.09		8.90	11.99	
	HUM	25.00	20.23		20.55	12.08		6.39	9.36		10.41	13.76	
TOT	S	21.48	24.90		20.60	14.25		5.68	8.52		9.74	13.87	
	F	25.20	18.10		23.03	12.08		4.79	5.70		9.87	12.29	
	E	15.38	13.95		10.79	12.61		6.41	7.68		8.02	9.64	
	M	24.82	22.62	*	15.90	17.00		7.97	11.75		10.97	15.19	*
	SC	43.58	19.21		33.70	16.36		19.56	10.92		24.26	15.48	
TOT	HUM	46.54	15.72		38.34	14.26		18.37	11.76		24.38	16.43	
	S	38.82	20.09		29.12	15.55		19.45	10.20		23.11	14.01	
	F	43.77	14.38		36.87	12.37	*	17.78	9.93		23.62	14.63	
	E	47.60	18.25		42.28	15.12		19.67	11.65		25.46	16.86	
	M	48.89	16.98		41.10	17.87		18.95	13.37		24.98	18.17	

*: p. < .05 (HUM>SC; F>S; M>E)

** : p. < .05 (SC>HUM; S>F; E>M)

Results are presented below using figures as a visual means of representing the multitude of analyses conducted. The figures are given in the body of the thesis and Tables 3 – 17 which present the pertinent statistical information for the ANOVAs and the t-tests are found in the Appendix.

4.1 Background

In the following sections, results will be reported in three different forms: 1) at the intra-textual level, i.e., how each background group (Humanities (H) and Science (S)) performed on the Science texts and how each performed on the Humanities texts at each of the propositional levels; 2) at the inter-textual level, i.e., a comparison of performances on the Science texts with that on the Humanities texts; 3) at the inter-background group level, i.e., how subjects of Background H compare to those of Background S. (See Figure 1 for Intra-Text results for Inter-background groups)

4.1.1 RESULTS FOR ALL LINGUISTIC GROUPS COMBINED: ALL SUBJECTS, TEXT

GROUP 1 (S/F), TEXT GROUP 2 (E/M)

4.1.1.1 Intra-text Results

a. Science Texts: SC, S, and E

Recall results of the Science texts (see Figure 1 and Table 3) showed that in combined Text SC and individual Text S, Background H performed significantly better than Background S in PII. At the other propositional levels and in overall recall, there were no significant differences between the two groups. Performance on Text E showed no significant differences between Background H and Background S either at propositional levels or in overall recall.

b. Humanities Texts: HUM, F, and M

Recall results of the Humanities texts (see Figure 1 and Table 3) showed that in combined Text HUM and individual Texts F and M, performance of Background H was systematically better than the performance of Background S. The differences between the two groups were significant for PI, PII, PIII, and overall recall for Texts HUM and M, and for PI, PII, and overall recall for Text F.

Figure 1: Intra-Text Results for Inter-Background Groups

GROUPS	TEXTS → PROP ↓	SC	HUM	S	F	E	M
All grps	PI		****H		****H		****H
	PII	****H	****H	**H	****H		**H
	PIII		***H				****H
	PIV						
	Overall		****H		****H		****H
L1	PI						
	PII						
	PIII	*S				**S	
	PIV						
	Overall						
L2	PI						
	PII						
	PIII						
	PIV						
	Overall						
FL	PI		****H		**H		****H
	PII		****H		***H		***H
	PIII		***H		*H		**H
	PIV						
	Overall		****H		****H		****H
L2/FL	PI		****H		****H		****H
	PII	****H	****H	****H	****H		***H
	PIII	**H	**H				***H
	PIV						
	Overall	****H	****H		****H		****H

H: H > S

S: S > H

*: p < .05; **: p < .01 ***: p < .001 ****: p < .0001

4.1.1.2 Inter-text and Inter-group Results

Results for the combined groups (see Figure 2) on Texts SC and HUM showed no significant differences between the Science texts and the Humanities texts either propositionally or in overall recall. Results for the combined backgrounds for Text Group 1, however, showed a significant superiority of the Humanities text over the Scientific at the PI level (i.e., FPI over SPI), and the scientific over the humanities at the PIII level (i.e., SPIII over FPIII). A comparison of Text Group 2 (i. e., Texts E/M) for the two

background groups together showed no significant differences between the two texts in overall recall. Yet, at the propositional level, Text E (the Scientific text) yielded a significantly higher recall of PI than Text M (the Humanities text), and Text M yielded a significantly higher recall of PIII and PIV.

Figure 2. Inter-Text Results for Combined Background Groups.

		L1	L2	FL	FL/L2	TOTAL
Comb. Text Gps	N	24	23	145	168	192
SC-I vs. HUM-I						
SC-II vs. HUM-II						
SC-III vs. HUM-III						
SC-IV vs. HUM-IV						
SC-Tot vs. HUM-Tot						
Text Group 1.	N	11	15	72	87	98
S-I vs. F-I						
S-II vs. F-II						
S-III vs. F-III						
S-IV vs. F-IV						
S-Tot vs. F-Tot						
Text Group 2.	N	13	8	73	81	94
E-I vs. M-I						
E-II vs. M-II						
E-III vs. M-III						
E-IV vs. M-IV						
E-Tot vs. M-Tot						

	Sig. Diff. : p. <.05 (HUM>SCI; F>S; M>E)
	Sig. Diff.: p. <.05 (SCI>HUM; S>F; E>M)

Total performance of each background group on the combined Text Group SC/HUM and individual Text Groups 1 (S/F) and 2 (E/M) showed a significant superiority of Background H over Background S at propositional levels PI, PII, PIII, and in overall recall. There were no significant differences between the two background groups at the PIV level.

4.1.2 L1 RESULTS: COMBINED TEXT GROUPS, TEXT GROUP 1 (S/F), TEXT GROUP 2 (E/M)

4.1.2.1 Intra-text Results

a. Science Texts: SC, S, and E

The recall patterns of the Science texts (see Figure 1 and Table 3) showed that performance on Text SC and Text E yielded a significant superiority of Background S over Background H in PIII, while the other propositional levels and overall recall did not yield any significant differences between the two background groups. However, PI and overall recall showed that Background S was superior to Background H in PI and overall recall, even though not quite at the .05 level of significance. As for performance on Text S, there were no significant differences between Background H and Background S, although here again, S appeared to do slightly better than H in PI, PII, and overall recall but not quite significantly.

b. Humanities Texts: HUM, F, and M

Recall results were exactly the same in the three cases of the individual text subgroups and the combined humanities group. Performances on Texts HUM, F, and M did not yield any significant differences between the two background groups either at propositional levels or in overall recall. In Text F, however, Background H did show a stronger trend in PII which approached significance.

4.1.2.2 Inter-text and Inter-group Results

For the L1 subjects, recall results at the inter-textual level (see Figure 2 and Table 3) yielded different patterns. Performance of the combined Backgrounds on Text Group SC/HUM and Text Group 2 (E/M) showed no significant differences between the Science and Humanities texts at the propositional levels PI, PII, PIII, and in overall recall. However, the results showed a significant superiority of Texts HUM and M (the

Humanities text) over Texts SC and E (the Science texts), respectively, at the PIV level. Recall results of Text Group 1 (S/F) for the combined background groups showed a significant superiority of the Humanities text F over the Science text S at the PI level.

Total performance of each group on combined Text Group SC/HUM and individual Text Group 2 E/M showed a significant superiority of Background over H in PIH. In Text Group SC/HUM, however, PI and overall recall also revealed some superiority of Background S over H, although not quite at the .05 level of significance. Inter-background group results for Text Group 1 (S/F) showed no significant differences between the two background groups, either propositionally or in overall recall.

4.1.3 L2 RESULTS: COMBINED TEXT GROUPS, TEXT GROUP 1 (S/F), TEXT GROUP 2 (E/M)

4.1.3.1 Intra-text Results

a. Science Texts: SC, S, and E

For both the combined text groups and Text Group 2 (see Figure 1 and Table 3), there were no significant differences in performances on Text SC and Text E, respectively, between Background H and S either propositionally or in overall recall. (Text Group 1 did not include any subjects with Background S).

b. Humanities Texts: HUM, F, and M

In both the combined Text HUM, and individual Text M, there were no significant differences between the performances of the two background groups either propositionally or in overall recall. (Text Group 1 did not include any subjects with Background S).

4.1.3.2 Inter-text and Inter-group Results

Results of the two Background groups combined (see Figure 2 and Table 3) on each text of the pairs SC/HUM and S/F showed a significant superiority of PI and overall recall in both Text HUM and Text F over PI and overall recall in Science Texts SC and S respectively. Results for the combined backgrounds on each text of the pair E/M, however, showed no significant differences between the two texts either propositionally or in overall recall.

Performance of each background group on combined Text Group SC/HUM and Text Group 2 (E/M) showed no significant differences between Backgrounds S and H either propositionally or in overall recall.

4.1.4 FL RESULTS: COMBINED TEXT GROUPS, TEXT GROUP 1 (S/F), TEXT GROUP 2 (E/M)

4.1.4.1 Intra-text Results

a. Science Texts: SC, S, and E

Performance of FL subjects on the Science texts (see Figure 1 and Table 3) showed that in combined Text SC and individual Texts S and E, there were no significant differences between the two Backgrounds either propositionally or in overall recall.

b. Humanities Texts: HUM, F, and M

Performances on the Humanities texts: HUM, F, and M yielded the same results (see Figure 1 and Table 3). In each case, Background H was significantly superior to Background S in PI, PII, PIII, and overall recall. Recall of PIV did not yield any significant differences between the two background groups.

4.1.4.2 Inter-text and Inter-group Results

Inter-textual results (see Figure 2 and Table 3) showed that total performance of the combined background groups on combined text Group SC/HUM and Text Group 1 (S/F) yielded no significant differences between the two texts in each pair in PI, PIII, PIV, and overall recall. However, there was a significant superiority of SCPII and SPII (the Science texts) over HUMPII and FPII (the Humanities texts) respectively. As for performance on Text Group 2, texts (E/M) for the combined backgrounds, there was a significant superiority of the Science text at the PI level (i. e., EPI over MPI), and of the Humanities text at the PIII level (i. e., MPIII over EPIII).

Inter-group results showed that for the FL subjects, total performance on Text Group SC/HUM, and Text Groups 1 (S/F) and 2 (E/M) yielded a significant superiority of Background H over Background S at propositional levels PI, PII, PIII, and in overall recall. Performance on PIV did not show any significant differences between the two background groups in any of the three Text Groups.

4.1 5 FL/L2 RESULTS: COMBINED TEXT GROUPS, TEXT GROUP 1 (S/F), TEXT GROUP 2 (E/M)

4.1.5.1 Intra-text Results

a. Science Texts: SC, S, and E

When combining FL and L2 subjects (see Figure 1 and Table 3), performance of Background H on Text SC was significantly superior to that of Background S in PII, PIII, and overall recall. At the PI level, however, Background H was slightly inferior to Group S. In Text S, Background H did significantly better in recall of PII, but there were no significant differences between the two Bckgrounds at the other propositional levels and overall recall. Recall results of Text E showed no significant differences between Backgrounds H and S either propositionally or in overall recall.

b. Humanities Texts: HUM, F, and M

Performances on combined Text HUM and individual Text M were similar (see Figure 1 and Table 3). In both cases, Background H performed better than Background S at propositional levels PI, PII, PIII, and in overall recall. Performance at the PIV level, however, did not yield any significant differences between the two background groups. In Text F, performance of Background H was significantly better at the PI, PII and overall recall levels.

4.1.5.2 Inter-text and Inter-group Results

Inter-textual results (see Figure 2 and Table 3) were different in the three cases of the combined text groups and the individual sub-groups. Recall results of each text of the pair SC/HUM for the combined backgrounds showed no significant differences between the two texts either at propositional levels or in overall recall. Recall results of both backgrounds together for each text of the Text Group 1 (S/F) showed a significant superiority of the Humanities texts at the PI level, i.e., FPI over SPI, and of the Science texts at the PIII level, i.e., SPIII over FPIII. Similarly, for Text Group 2 (E/M), total performance of the two backgrounds together showed a significant superiority of the Science text at the PI level, i.e., EPI over MPI, and of the Humanities text at the PIII level, i.e., MPIII over EPIII.

The inter-group results showed that in combined Text Group SC/HUM and individual Text Group 2 (E/M), Background H outperformed Background S at the PI, PII, PIII, and overall recall levels, but there were no significant differences between the two background groups at the PIV level. As for total performance on Text Group 1 (S/F), Background H was superior to Background S at the PI, PII, and overall recall, while PIII and PIV did not yield any significant differences between the two Backgrounds.

4.2 Global Structure (GS)

In general, the correct GS was identified by a small number of subjects for each of the groups involved and each of the four texts used in the present study. The majority of subjects, thus, either identified the GS incorrectly, or did not provide a GS at all. On the other hand, most of the subjects who were able to identify the correct GS did not yield the best recall protocols. Some of them yielded the lowest recall protocols. In general, there were no significant recall differences between the subjects who provided the correct GS, those who provided the incorrect GS, and those who did not provide a GS at all. There were cases, however, where such differences existed as will be shown below, but the significant superiority never concerned the correct structure. In the results reported below, the groups will be combined into larger ones for conciseness.

4.2.1 TEXT GROUP 1 (S/F): ALL SUBJECTS, L1, L2, AND FL

a. Text S: (GS: Collection)

Text S has a GS which corresponds to what Meyer (1975b, 1984) identifies as "collection", characterized by elements of the text which are grouped by sequence. In the case of Text S, the sequence is chronological.

The correct GS was identified by 15 out of a total of 97 subjects for all language groups. Among L1 subjects, the correct GS was identified by 3 out of a total of 11 subjects. For L2, it was not identified at all, and for FL subjects, it was identified by 12 out of a total of 71 subjects. For all language groups combined, L1, and FL, no significant differences were found in propositional recall or overall recall between subjects who identified the correct GS, those who chose the incorrect GS, and those who did not provide a GS at all. Among L1 subjects, however, those with the correct GS yielded a relatively low recall compared to subjects who identified a different structure or did not provide a structure at all.

b. Text F: (GS: Problem/Solution)

Text F has a GS which corresponds to what Meyer (1975b, 1984) identifies as "Problem/Solution". According to this structure, the elements of a text are causally related in addition to the fact that there is an overlap between elements in the problem and elements in the solution.

The correct structure was identified by 18 out of a total of 97 subjects for the whole text group. Among L1 subjects, the correct structure was identified by 4 out a total of 11. For L2, it was not identified at all. And for FL, it was identified by 14 out of a total of 70 subjects. For all language groups combined and for FL subjects, the differences between those who chose the correct GS and those who chose the incorrect GS or did not provide a GS at all were not significant. However, there were significant differences between subjects with and without the correct GS in L1 and L2.

4.2.2 TEXT GROUP 1 (S/F): FL/L2 COMBINED

a. Text S

The correct structure was identified by 12 subjects out of a total of 86 subjects. There were no significant differences between subjects with the correct structure, and those with the incorrect one or without a GS at all.

b. Text F

14 out a total of 86 subjects provided the correct GS. Again there were no significant differences between the groups with correct, incorrect, or no GS at all either propositionally or in overall recall.

4.2.3 TEXT GROUP 2: (E/M): ALL LINGUISTIC GROUPS, L1, L2, FL

a. Text E: (GS: Comparison)

Text E compares two points of view related to evolution, and therefore has a GS which corresponds to what Meyer (1975b, 1984) refers to as "comparison". In comparison, the elements of texts are organized based on similarities and differences.

The correct structure was identified by 18 out of a total of 94 subjects for all linguistic groups. In L1, 3 out of a total of 13 subjects identified the correct GS. In L2, the correct structure was identified by 1 out of a total of 8 subjects. And in FL, it was identified by 14 out of a total of 73 subjects. There were no significant differences between subjects with different GSs for both all linguistic groups combined and individual linguistic groups L1, L2, FL, and FL/L2 combined.

b. Text M: (GS:Description)

Text M has a global structure which corresponds to what Meyer (1975b, Meyer and Freedle, 1984) refers to as "description", or a combination of description and collection. Texts organized by description have their elements grouped by association, where some elements are subordinated to other elements. Text M describes events related to the history of slavery in the United States without any chronological order or any dates and names provided. Description is classified by Meyer as the least organizational GS.

The correct GS was identified by 19 out of a total of 94 subjects. In L1, The correct structure was identified by 6 subjects out of a total of 13 subjects. In L2, it was identified by 1 out of a total of 8 subjects. In FL, it was identified by 14 out of a total of 73 subjects. For L1 and FL, there were no significant differences in recall of subjects who identified the right GS, subjects who did not provide a GS at all, and subjects who chose the incorrect GS.

4.2.4 TEXT GROUP 2 (E/M): FL/L2 COMBINED

a Text E

The correct GS was identified by 15 subjects out of a total of 81. There were significant differences between subjects with and without the correct GS.

b. Text M

13 subjects out of a total of 81 identified the right GS. There were no significant differences between subjects who identified the correct GS, those who provided the incorrect GS, and those who did not provide a GS at all.

4.3 Proficiency

In the following sections, results of analyses measuring any interaction between L2 or FL proficiency and propositional levels recalled will be discussed in two general ways: 1) by linguistic group and 2) by background group and linguistic group. L1 results are thus omitted from this section.

In the first instance, results will be reported first for L2 subjects, then for FL subjects and finally for a combined FL/L2 group. In the second group of results, the linguistic groups are themselves further divided into each of the background groups. Consequently, results are reported for Background H L2 subjects for FL and for combined FL/L2 subjects. For Background S subjects, only FL results are reported since there were no Background S L2 subjects in Text Group 1 and only one in Text Group 2.

Recall results of proficiency mainly showed significant differences between Levels A and B, and A and C in the FL group. In most cases, Levels B and C were not significantly different. Proficiency levels of the L2 group, A and B, did not perform differently. The results will be discussed at the intra-textual and inter-textual levels. (See Figure 2 for Intra-Text and Inter-Text proficiency results by background group)

4.3.1 L2 RESULTS: ALL SUBJECTS, TEXT GROUP 1 (S/F), AND TEXT GROUP 2 (E/M)

4.3.1.1 Intra-text Results

a. Science Texts: SC, S, and E

Recall results (see Figure 3 and Table 4) of the combined Science Texts SC and those for individual Texts S and E did not yield any significant differences between the two proficiency levels A and B either propositionally or in overall recall.

b. Humanity Texts: HUM, F, and M

Performance results of the combined Humanities Texts and likewise for the individual Texts F and M yielded the same pattern as those of the Science texts. There were no significant differences between the two proficiency levels either propositionally or in overall recall.

4.3.1.2 Inter-text and Inter-level Results

The performance of the two proficiency levels together on each pair of texts (see Figure 4 and Table 4) showed a significant superiority of Text HUM over Text SC at the PI level only, a significant superiority of Text F (the Humanities text) over Text S (the Science text) in PI and overall recall, and no significant differences between Text E (the Humanities text) and Text M, either propositionally or in overall recall.

The total performance of each proficiency level on each Text Group pair together yielded no significant differences between Levels A and B either propositionally or in overall recall. Thus, for L2 subjects, combined Text Group SC/HUM, and individual Text Groups 1 (S/F) and 2 (E/M) yielded the same inter-level performance results.

S	(Ttxts S/F)	B > C										
		A > B										
		A > C										
	E-FL (Ttxts E/M)	B > C										
		A > B										
		A > C										
	E&S-FL/L2 (Sc/Hum)	B > C										
		A > B										
		A > C										
	S-FL/L2 (Ttxts S/F)	B > C										
		A > B										
		A > C										

Bk H	E&S-L2 (Sc/Hum)	A > B										
		A > C										
		B > C										
	S-L2 (Ttxts S/F)	A > B										
		A > C										
		B > C										
	E-L2 (Ttxts E/M)	A > B										
		A > C										
		B > C										
	E&S-FL (Sc/Hum)	A > B										
		A > C										
		B > C										
	S-FL (Ttxts S/F)	A > B										
		A > C										
		B > C										
	E-FL (Ttxts E/M)	A > B										
		A > C										
		B > C										
	E&S-FL/L2 (Sc/Hum)	A > B										
		A > C										
		B > C										
	S-FL/L2 (Ttxts S/F)	A > B										
		A > C										
		B > C										
	E-FL/L2 (Ttxts E/M)	A > B										
		A > C										
		B > C										

	Difference significance: p. <.05
	Difference significance: p. <.06
	Difference significance: p. <.07

Figure 4. Inter-Text and Inter-Level Results by Proficiency Level

		PROPS→					TEXTS→	SCI+HUM/S+F/E+M				
		PI	PII	PIII	PIV	o'all	PROPS→	PI	PII	PIII	PIV	o'all
Bk H & S	E&S-L2 ScvsHum						A>B					
		SC>HU					A>C					
		HU>SC					B>C					
	S-L2 S vs F						A>B					
		S>F					A>C					
		F>S					B>C					
	E-L2 E vs M						A>B					
		E>M					A>C					
		M>E					B>C					
	E&S-FL ScvsHum						A>B					
		SC>HU					A>C					
		HU>SC					B>C					
	S-FL S vs F						A>B					
		S>F					A>C					
		F>S					B>C					
	E-FL E vs M						A>B					
		E>M					A>C					
		M>E					B>C					
	E&S-FL/L2 ScvsHum						A>B					
		SC>HU					A>C					
		HU>SC					B>C					
	S-FL/L2 S vs F						A>B					
		S>F					A>C					
		F>S					B>C					
	E-FL/L2 E vs M						A>B					
		E>M					A>C					
		M>E					B>C					
Bk S	E&S-L2 ScvsHum						A>B					
		SC>HU					A>C					
		HU>SC					B>C					
	S-L2 S vs F						A>B					
		S>F					A>C					
		F>S					B>C					
	E-L2 E vs M						A>B					
		E>M					A>C					
		M>E					B>C					
	E&S-FL ScvsHum						A>B					
		SC>HU					A>C					
		HU>SC					B>C					
	S-FL S vs F						A>B					
		S>F					A>C					
		F>S					B>C					

Bk H	E-FL E vs M	E>M						A>B					
		M>E						A>C					
								B>C					
	E&S- FL/L2 ScvsHum	SC>HU						A>B					
								A>C					
		HU>SC						B>C					
	S-FL/L2 S vs F	S>F						A>B					
		F>S						A>C					
								B>C					
	E-FL/L2 E vs M	E>M						A>B					
		M>E						A>C					
								B>C					
	E&S-L2 ScvsHum	SC>HU						A>B					
								A>C					
		HU>SC						B>C					
	S-L2 S vs F	S>F						A>B					
		F>S						A>C					
								B>C					
	E-L2 E vs M	E>M						A>B					
		M>E						A>C					
								B>C					
	E&S-FL ScvsHum	SC>HU						A>B					
								A>C					
		HU>SC						B>C					
	S-FL S vs F	S>F						A>B					
		F>S						A>C					
								B>C					
	E-FL E vs M	E>M						A>B					
		M>E						A>C					
								B>C					
	E&S- FL/L2 ScvsHum	SC>HU						A>B					
								A>C					
		HU>SC						B>C					
	S-FL/L2 S vs F	S>F						A>B					
		F>S						A>C					
								B>C					
	E-FL/L2 E vs M	E>M						A>B					
		M>E						A>C					
								B>C					

Diff. Sig.: p. <.05; HU>SC, F>S, M>E

Diff. sig.: p. <.05; A>B, A>C, B>C

Diff. sig.: p. <.05; SC>HU, S>F, E>M

4.3.2 FL RESULTS: ALL SUBJECTS, TEXT GROUP 1 (S/F) AND TEXT GROUP 2 (E/M)

4.3.2.1 Intra-text Results

a. Science Texts: SC, S, and E

Recall results (see Figure 3 and Table 4) showed that for the combined Text SC, performance of Level A was significantly superior to that of Level C at the PI level. Performances of A and B showed no significant differences either propositionally or in overall recall. Recall results of Texts S and E yielded no significant differences between Levels A, B, and C.

b. Humanities Texts: HUM, F, and M

In Text HUM, performance on PI yielded a nearly significant ($p < .0767$) superiority of Level A over Levels B and C. The other propositional levels did not yield any significant differences between the three proficiency levels. Performance on Texts F and M did not show any significant differences between the three proficiency levels either propositionally or in overall recall.

4.3.2.2 Inter-text and Inter-level Results

Inter-textual results (see Figure 4 and Table 4) showed that total performance of the three proficiency levels on each pair of texts (SC/HUM, Text Group 1-S/F, Text Group 2-E/M) yielded a significant superiority of Texts SC and S over Texts HUM and F respectively in PII only, and a significant superiority of Text E over Text M in PI, and of Text M over Text E in PIII. The other propositional levels and overall recall for the three pairs of texts did not yield any significant differences.

Performance of each proficiency level on both Text Group SC/HUM yielded a nearly significant superiority ($p < .0767$) of A over B and C at PI level. The other

propositional levels and overall recall did not yield any significant differences between the three propositional levels, even though overall recall showed some superiority of level A over B and C, and of B over C, but not quite significantly. Performances on Text Group 1 (S/F) and Text Group 2 (E/M) did not yield any significant differences between Levels A, B and C.

4.3.3 FL/L2 RESULTS COMBINED: ALL SUBJECTS, TEXT GROUP 1 (S/F) AND TEXT GROUP 2 (E/M)

When FL and L2 subjects were combined, the results (see Figure 3 and Table 4) showed more occurrences of significant differences between the different proficiency levels than there were for each linguistic group separately.

4.3.3.1 Intra-text Results

a. Science Texts: SC, S, and E

Performance on combined Science Texts SC was similar to that on individual Text S in that significant interactions were found between proficiency and propositional recall. There was a significant superiority of Level A over Levels B and C at the PI and overall recall levels, but there were no significant differences between B and C either propositionally or in overall recall. Text E yielded no significant differences between the three proficiency levels either propositionally or in overall recall.

b. Humanities Texts: HUM, F, and M

Recall results of combined Humanities Text HUM and individual Text F showed a significant superiority of Level A over Levels B and C in PI and overall recall, and B over C in overall recall. There were no significant differences between the proficiency levels at the other propositional levels. As for Text M, performances of the three

proficiency levels did not reveal any significant differences either propositionally or in overall recall.

4.3.3.2 Inter-text and Inter-level Results

Total performance of the three proficiency levels on each pair of texts (see Figure 4 and Table 4) yielded no significant differences between Texts SC and Text HUM either propositionally or in overall recall. Text F (the Humanities text) was significantly superior to Text S in PI only, but Text E (the Science text) was significantly superior to Text M in PI, and Text M to Text E in PIII.

Recall results of each proficiency level for the combined Text Group SC/HUM yielded a superior performance of Level A over B and C at the PI and overall recall levels, and of B over C in overall recall. Text Group 1 (S/F) yielded a significant superiority of A over B and C at the PI, PII, and overall recall levels, and of B over C at the PII and overall recall levels. As for Text Group 2 (E/M), there were no significant differences between Levels A, B and C either propositionally or in overall recall.

4.3.4 L2 RESULTS FOR BACKGROUND H: ALL SUBJECTS, TEXT GROUP 1 (S/F), TEXT GROUP 2 (E/M)

4.3.4.1 Intra-text Results

a. Science Texts: SC, S, and E

L2 performances (see Figure 3 and Table 4) on combined Science texts, SC, and individual Texts S and E among Background H subjects yielded no significant differences between A and B either propositionally or in overall recall.

b. Humanities Texts: HUM, Text F, and Text M

L2 performance results on combined Humanities texts, HUM, and individual Texts F and M were similar in that no significant differences showed between the two proficiency levels either propositionally or in overall recall.

4.3.4.2 Inter-text and Inter-level Results

Inter-textual results (see Figure 4 and Table 4) showed that the total performance of the two proficiency levels on combined Text Group SC/HUM yielded a significant superiority of Text HUM over SC in PI only. Overall recall of the two texts yielded a superiority of Text HUM over SC which approached the .05 significance level. Performance on Text Group 1 (S/F) yielded a significant superiority of Text F over S in PI and overall recall, while performance in Text Group 2 (E/M) did not show any significant differences between the two texts either propositionally or in overall recall.

The total performance of each proficiency level for combined Text Groups (SC/HUM) and Text Groups 1 (S/F) and 2 (E/M) yielded no significant differences between the two proficiency levels either propositionally or in overall recall.

4.3.5 FL RESULTS FOR BACKGROUND H: ALL SUBJECTS, TEXT GROUP 1 (S/F), TEXT GROUP 2 (E/M)

4.3.5.1 Intra-text Results

a. Science Texts: SC, S, and E

Among FL Background H subjects, performance results (see Figure 3 and Table 4) on combined Text SC, and individual Texts S and E showed no significant differences between the proficiency levels either propositionally or in overall recall.

b. Humanities Texts: HUM, F, and M

Recall results of the Humanities texts were different from those of the Science texts. Thus, performance on combined Text HUM and individual Text F showed that Level A was significantly better than Level B in PI and overall recall. The other propositional levels did not yield any significant differences between the two proficiency levels. Performance on Text M, on the other hand, showed no significant differences between the two proficiency levels.

4.3.5.2 Inter-text and Inter-level Results

The inter-textual results (see Figure 4 and Table 4) showed a significant superiority of Text HUM over Text SC in PI, PIII, and overall recall, while Text M was significantly better than Text E in PII, PIII, and overall recall, but there were no significant differences at the other propositional levels. Performances on Text S and Text F were not significantly different either propositionally or in overall recall.

The total performance of each proficiency level for combined Text Group (SC/HUM) and Text Group 1 (S/F) yielded a significant superiority of A over B in PI and overall recall, while PII and PIII did not yield any significant differences between A and B. Total performance of each proficiency level for Text Group 2 (E/M) showed no significant differences between A and B either propositionally or in overall recall.

4.3.6 FL/L2 RESULTS FOR BACKGROUND H: ALL SUBJECTS, TEXT GROUP 1 (S/F), TEXT GROUP 2 (E/M)

4.3.6.1 Intra-text Results

a. Science Texts: SC, S, and E

Recall results (see Figure 3 and Table 4) of combined Science texts SC showed a significant superiority of Level A over Level B at propositional level PI, but no significant differences at the other propositional levels and overall recall. Recall results of Text S

showed a significant superiority of Level A over Level B in overall recall, but no significant differences at the propositional levels. Recall results of Text E did not yield any significant differences between the two proficiency levels.

b. Humanities Texts: HUM, F, and M

Performance results of combined Text HUM, and individual Text F showed a significant superiority of Level A over Level B at the PI level, and no significant differences between A and B at the other propositional levels and overall recall. Text M, on the other hand, showed no significant differences between the two proficiency levels either propositionally or in overall recall.

4.3.6.2 Inter-text and Inter-level Results

Recall results at the inter-textual level (see Figure 4 and Table 4) yielded a significant superiority of Text HUM over Text SC in PI, PII, PIII, and overall recall. Performance on PIV was equal for the two texts. Text F was significantly superior to Text S in PI and overall recall. The two texts were almost equal at the other propositional level. And Text M was significantly superior to Text E in PII, PIII, and overall recall.

Performance of each proficiency level on the combined Text Groups (SC/HUM) and Text Group 1 (S/F) yielded a significant superiority of A over B at the PI level, but no significant differences at the other propositional levels. Total performance on Text Group 2 (E/M) did not yield any significant differences between the two proficiency levels either propositionally or in overall recall.

4.3.7 FL RESULTS FOR BACKGROUND S: ALL SUBJECTS, TEXT GROUP 1 (S/F), TEXT GROUP 2 (E/M)

In this case, L2 was omitted for the Text Group 1 Background S and for the Text Group 2 Background S reports because there were no science subjects in the former, and only one subject in the latter text group.

4.3.7.1 Intra-text Results

a. Science Texts: SC, S, and E

Interaction results between proficiency and recall (see Figure 3 and Table 4) based on performance on Text SC showed that Level A was significantly superior to Levels B and C in PI, PII, and overall recall. Performance on PIII and PIV did not yield any significant differences between the proficiency levels. Level B was significantly superior to C in overall recall, but there were no significant differences between B and C at the propositional levels. Recall results of Text S showed that Level A was significantly superior to Levels B and C in PI, PIV, and overall recall. PII and PIII did not yield any significant differences between the three proficiency levels, and there were no significant differences between B and C either propositionally or in overall recall. As for performance on Text E, there was a significant superiority of Level A over Levels B and C, and Level B over C in PI and overall recall. The other propositional levels did not yield any significant differences between the three proficiency levels.

b. Humanities Texts: HUM, F, and M

Recall results of Text HUM showed that performance of Level A was significantly superior to that of Levels B and C in PI, PII, and overall recall. PIII and PIV did not yield any significant differences between the three proficiency levels. Levels B and C were not significantly different either propositionally or in overall recall. Performance on Text F showed that Level A was significantly superior to Levels B and C

in PII and overall recall, but there were no significant differences between the proficiency levels at the other propositional levels, and Levels B and C were not significantly different either propositionally or in overall recall. Performance on Text M showed that Level A was significantly superior to Levels B and C in PI, PII, and overall recall, and B to C in PI and overall recall. The other propositional levels did not show any significant differences between the three levels.

4.3.7.2 Inter-text and Inter-level Results

Inter-textual results showed (see Figure 4 and Table 4) that Text SC yielded a significantly higher recall than Text HUM in PI, PII, PIII, and overall recall. PIV was equally recalled in the two texts. The Science text in Text Group 1, Text S was significantly superior to the Humanities text, Text F, in PII, PIII, and overall recall. In Text group 2, the Science text, Text E, outperformed the Humanities text, Text M, in PI, PII, and overall recall.

Total performance of each proficiency level for the Combined Text Group (SC/HUM) and Text Groups 1 (S/F) and 2 (E/M) showed that Level A yielded a significantly higher recall than B and C at propositional levels PI, PII, and overall recall but no significant differences between the three proficiency levels in PIII and PIV. Performances of B and C on combined Text Group SC/HUM and individual Text Group 2 (E/M) showed a significant superiority of B over C in PI and overall recall, but no significant differences at the other propositional levels. As for performance on Text Group 1 (S/F), B and C performed equally both propositionally and in overall recall.

4.4 Propositional Structure

Results of propositional recall (see Figure 5 and Tables 5–16) showed a general tendency among the subjects of the different groups involved to yield a better recall of higher-level propositions than the lower-level ones at the intra-textual level. Inter-textual

results, on the other hand, did not yield much difference in recall between the Humanities and Science texts involved in each Text Group. These results are discussed below by combined groups.

4.4.1 RESULTS FOR COMBINED BACKGROUNDS: COMBINED LINGUISTIC GROUPS; L1, L2, FL AND FL+ L2

4.4.1.1 Intra-text Results

a. Science Texts: SC, S, and E

Recall results (see Figure 5 and Tables 5–9) of combined science Texts SC by all the linguistic groups combined and by individual groups L1 and FL and FL/L2 combined showed that propositions were recalled according to their level in the hierarchy. Thus, PI was significantly superior to PII, followed by PIII, and then PIV yielding the lowest recall. Performance of L2 subjects, however, showed no significant difference between PI and PII although both PI and PII were significantly superior to PIII which was significantly higher than PIV. Recall results of individual Text S by the linguistic groups combined, FL, and FL/L2 combined also showed that propositions were recalled according to their level in the hierarchy. Performances of L1 and L2 groups, however, were different. Thus, the L1 group recall did not show any significant differences between PI and PII, although both PI and PII were significantly superior to lower-level propositions, and the L2 group recall showed no significant differences between PI and PII, PIII, and PIV, but PII was significantly superior to PIII, and PIII to PIV. Recall of Text E, on the other hand, showed that for all the linguistic groups combined, and for each individual group and FL/L2 combined performance respected the hierarchical order of propositions in that higher-level propositions were significantly superior to lower-level ones.

Figure 5. Comparison of Propositional Recall for All Text Groups by Combined Background Groups for Each Language Group.

Texts Props.			L1	L2	FL	FL/L2	TOTAL
COMB TEXT GROUPS	N		24	23	145	168	192
	SC	I vs. II					
		I vs. III					
		I vs. IV					
		II vs. III					
		II vs. IV					
		III vs. IV					
	HU	I vs. II					
		I vs. III					
		I vs. IV					
		II vs. III					
		II vs. IV					
		III vs. IV					
TEXT GROUP 1	N		11	15	72	87	98
	S	I vs. II					
		I vs. III					
		I vs. IV					
		II vs. III					
		II vs. IV					
		III vs. IV					
	F	I vs. II					
		I vs. III					
		I vs. IV					
		II vs. III					
		II vs. IV					
		III vs. IV					
TEXT GROUP 2	N		13	8	73	81	94
	E	I vs. II					
		I vs. III					
		I vs. IV					
		II vs. III					
		II vs. IV					
		III vs. IV					
	M	I vs. II					
		I vs. III					
		I vs. IV					
		II vs. III					
		II vs. IV					
		III vs. IV					

Diff. Sg.: $p < 0.5$; Higher Props > Lower Props

b. Humanities Texts: HUM, F, and M

Recall results of the combined humanities Texts HUM by all the linguistic groups combined, and the individual groups L1, L2, FL, and FL/L2 combined yielded a significantly superior recall of higher propositions over lower propositions. Recall of Text F and Text M showed different patterns. Performance on Text F by all linguistic groups combined, and the individual groups FL and FL/L2 combined, yielded a recall which respected the hierarchical order of propositional levels. The L1 group, on the other hand, showed no significant differences between PI and PII, and between PIII and PIV, while the L2 group showed no significant differences between PIII and PIV. Performance on Text M by the combined linguistic groups, and the individual groups L1, FL, and FL/L2 combined showed a significant superiority of higher-level propositions over lower-level ones. The recall results of L2, however, did not yield any significant differences between PII and PIII, and between PIII and PIV.

4.4.1.2 Inter-text Results

Inter-textual results (see Figure 2) of combined Text Group SC/HUM, did not show any significant differences between the two texts either propositionally or in overall recall when the three linguistic groups were combined and when FL and L2 were combined. However, individual groups L1, L2 and FL performed differently. L1 group performance showed no significant differences between Text SC and Text HUM in PI, PII, PIII, and overall recall. However, at the PIV level, Text HUM was significantly higher than Text SC. Performance of L2 group showed no significant differences between the two texts in PII, PIII, PIV, and overall recall. However, at the PI level, Text HUM was significantly higher than Text SC. Performance of FL group did not yield any significant differences between the two texts in PI, PIII and PIV. However, at the PII level, Text SC was significantly higher than Text HUM.

Inter-textual results of individual Text Groups 1 (S/F) and 2 (E/M) yielded different recall patterns. The results of Text Group S/F for all linguistic groups combined showed a significant superiority of Text F over Text S in PI, and a significant superiority of Text S over Text F in PIII. Individual linguistic groups, however, yielded different recalls. Thus, while L1 showed no significant differences between the two texts, L2 performed significantly better on Text F at the PI and overall recall levels, FL performed significantly better on Text S at the PII level, and FL/L2 combined showed a significant superiority of Text F over S in PI, and of Text S over F in PIII. Inter-textual recall of Text Group E/M also yielded differences between the groups. Thus, for the three linguistic groups combined, and for FL/L2 combined, Text E was significantly superior to M in PI, and Text M was significantly superior to E in PIII and PIV. As for the individual linguistic groups, L1 showed a significant superiority of Text M over E in PIV, L2 showed no significant differences in recall of the two texts, and FL showed a significant superiority of Text E over M in PI and of Text M over E in PIII.

4.4.2 RESULTS OF BACKGROUND H: COMBINED LINGUISTIC GROUPS; L1, L2, FL, AND FL+L2

4.4.2.1 Intra-text Results

a. Science Texts: SC, S, and E

Intra-textual results of Text SC (see Figure 6 and Tables 10–14) showed a significant superiority of higher propositions over lower ones in performances of all linguistic groups combined, the individual groups L1 and FL, and FL/L2 combined. Thus, PI yielded the highest recall, followed by PII, PIII, and PIV with the lowest recall. L2, group, however, yielded a different pattern. There was no significant difference between PI and PII although both PI and PII were significantly higher than PIII which yielded a significantly higher recall than PIV. Recall of Text S by the combined linguistic

groups showed no significant difference between PI and PII, but both PI and PII were significantly superior to lower-level propositions. Recall of individual linguistic groups yielded different patterns. L1 group showed no significant differences between PI and PII, and between PI and PIII, however, PI was significantly superior to PIV, PII to PIII, and PIII to PIV. L2 group, on the other hand, showed no significant differences between PI and the lower-level propositions, but PII was significantly superior to PIII, and PIII to PIV. Recall by FL and FL/L2 combined did not yield any significant difference between PI and PII, but PI was significantly superior to PIII and PIV, PII to PIII, and PIII to PIV. Recall pattern of Text E showed a systematic respect of the hierarchical levels of propositions by all linguistic groups combined, and the individual linguistic groups L1, L2, FL, and FL/L2 combined.

b. Humanities Texts: HUM, F, and M

Intra-textual results of Text HUM (see Figure 6 and Tables 10–14) yielded the same pattern for the three combined linguistic groups and for each group separately. PI yielded the best recall, followed by PII, PIII, and then PIV at the lowest level. Text F yielded different recall patterns. Performance of the three linguistic groups combined, FL, and FL/L2 combined respected the hierarchical structure of the text in that higher-level propositions were significantly better than lower-level propositions. Recall by L1 group did not yield any significant differences between PI and PII, and between PIII and PIV, and recall by L2 group showed no significant difference between PIII and PIV. Recall of Text M, however, was more consistent. For all linguistic groups combined, and individual groups L1, FL, and FL/L2 combined, the propositions were recalled according to their levels in the hierarchy. L2 group, showed no significant differences between PI and PII, although both PI and PII were significantly superior to PIII, and PIII to PIV.

Figure 6. Comparison of Propositional Recall for All Text Groups by Background H for Each Language Group.

Texts Props.			L1	L2	FL	FL/L2	TOTAL
COMB TEXT GROUPS	N		24	23	145	168	192
	SC	I vs. II					
		I vs. III					
		I vs. IV					
		II vs. III					
		II vs. IV					
		III vs. IV					
	HU	I vs. II					
		I vs. III					
		I vs. IV					
		II vs. III					
		II vs. IV					
		III vs. IV					
TEXT GROUP 1	N		11	15	72	87	98
	S	I vs. II					
		I vs. III					
		I vs. IV					
		II vs. III					
		II vs. IV					
		III vs. IV					
	F	I vs. II					
		I vs. III					
		I vs. IV					
		II vs. III					
		II vs. IV					
		III vs. IV					
TEXT GROUP 2	N		13	8	73	81	94
	E	I vs. II					
		I vs. III					
		I vs. IV					
		II vs. III					
		II vs. IV					
		III vs. IV					
	M	I vs. II					
		I vs. III					
		I vs. IV					
		II vs. III					
		II vs. IV					
		III vs. IV					

Diff. Sig: $p < .05$; Higher Props > Lower Props

4.4.2.2 Inter-text Results

Inter-textual results of Text HUM (see Figure 7) showed different recall patterns in each case. When the groups were combined, and when FL/L2 were combined, Text HUM yielded a significant superiority over Text SC in PI, PII, PIII, and overall recall. There was no significant difference between the two texts in PIV. Performance of L1 group showed no significant differences between Texts SC and HUM either propositionally or in overall recall. Performance of L2 group showed a significantly higher recall of Text HUM over Text SC in PI and overall recall, but no significant differences between the two texts in recall of PII, PIII, and PIV. Performance of FL group showed a significant superiority of Text HUM over Text SC in PI, PIII, and overall recall, but no significant differences between the two texts in recall of PII and PIV.

Inter-textual results of individual Text Groups S/F and E/M also yielded different patterns. Thus for Text Group S/F, performance of all the linguistic groups combined, the individual group L2, and FL/L2 combined yielded a significant superiority of Text F over Text S in PI and overall recall, but no significant differences between the two texts in recall of PII, PIII, and PIV. Performance of L1 and FL groups, on the other hand, showed a significant superiority of Text F over Text S in PI, but no significant differences at the other levels. Inter-textual results of Text Group E/M for all linguistic groups combined, the individual group FL, and FL/L2 combined showed a significant superiority of Text M over Text E in PII, PIII, and overall recall. Performances of L1 and L2 groups, on the other hand, showed no significant differences between the two texts either propositionally or in overall recall.

4.4.3 RESULTS OF BACKGROUND S: FL

Both L1 and L2 were omitted from Background S group because they included very few subjects with Background S.

Figure 7. Inter-Text Results for Background H.

		L1	L2	FL	FL/L2	TOTAL
Comb. Text Gps	N	19	22	73	95	114
SC-I vs. HUM-I						
SC-II vs. HUM-II						
SC-III vs. HUM-III						
SC-IV vs. HUM-IV						
SC-Tot vs. HUM-Tot						
Text Group 1.	N	10	15	36	51	61
S-I vs. F-I						
S-II vs. F-II						
S-III vs. F-III						
S-IV vs. F-IV						
S-Tot vs. F-Tot						
Text Group 2	N	9	7	37	44	53
E-I vs. M-I						
E-II vs. M-II						
E-III vs. M-III						
E-IV vs. M-IV						
E-Tot vs. M-Tot						

Sig. Diff. : p. <.05 (HUM>SCI; F>S; M>E)

4.4.3.1 Intra-text Results

a. Science Texts: SC, S, and E

Performance on Texts SC and S (see Figure 8 and Tables 15 and 16) showed a significant superiority of higher propositions over lower ones. Thus, PI yielded the best performance, followed by PII, PIII, and then PIV with the lowest recall. Text E, however, did not show any significant difference between PIII and PIV, although propositional recall at the other levels respected the hierarchy in that higher-level propositions were significantly superior to lower-level ones.

b. Humanities Texts: HUM, F, and M

Recall of Text HUM also respected the hierarchy of text structure. Higher -level propositions were significantly better than lower-level ones. PI was the highest in recall,

followed by PII, PIII, and PIV. Performance on Texts F and M yielded the same results. There was no significant difference between PIII and PIV, but the other propositions were recalled according to their levels in the hierarchy of text structure.

4.4.3.2 Inter-text Results

Inter-textual results (see Figure 9) showed a significant superiority of science texts combined SC, and individual Texts S and E over humanities texts combined HUM, and Texts F and M, respectively, in PI, PII, PIII, and overall recall. There were no significant differences between the two texts of each Text Group in performance on PIV.

4.5 Inter-Group Results

Inter-Group results showed how the three linguistic groups, L1, L2, and FL compared in their performances on each text, both propositionally and at the overall recall level. The general tendency was for L1 to perform significantly better than both FL and L2, and for L2 to perform better than FL.

4.5.1 RESULTS FOR ALL LINGUISTIC GROUPS COMBINED: ALL SUBJECTS, TEXT

GROUP 1 (S/F), TEXT GROUP 2 (E/M)

4.5.1.1 Intra-text Results

a. Science Texts: SC, S, and E

Recall results (see Figure 10 and Table 17) of Text SC showed that L1 was significantly superior to L2 in PI and overall recall, and to FL at propositional levels PI, PII, PIV, and overall recall. L2, on the other hand, was significantly superior to FL in PII, PIV, and overall recall. Intra-textual results of Text S indicate a significant superiority of L1 over FL at propositional levels PI, PII, and overall recall, and of L2 over FL in PII, and overall recall. As for performance on Text E, L1 did significantly better than FL at

Figure 8. Comparison of Propositional Recall for All Text Groups by Background S and for each Linguistic Group

Texts Props.			L1	L2	FL	FL/L2	TOTAL
COMB TEXT GROUPS	N		5	1	72	73	78
	SC	I vs. II					
		I vs. III					
		I vs. IV					
		II vs. III					
		II vs. IV					
		III vs. IV					
	HU	I vs. II					
		I vs. III					
		I vs. IV					
		II vs. III					
		II vs. IV					
		III vs. IV					
TEXT GROUP 1	N		1		36	36	37
	S	I vs. II					
		I vs. III					
		I vs. IV					
		II vs. III					
		II vs. IV					
		III vs. IV					
	F	I vs. II					
		I vs. III					
		I vs. IV					
		II vs. III					
		II vs. IV					
		III vs. IV					
TEXT GROUP 2	N		4	1	36	36	41
	E	I vs. II					
		I vs. III					
		I vs. IV					
		II vs. III					
		II vs. IV					
		III vs. IV					
	M	I vs. II					
		I vs. III					
		I vs. IV					
		II vs. III					
		II vs. IV					
		III vs. IV					

Sig. Diff.: $p < .05$; Higher Props > Lower Props

Figure 9. Inter-Text Results for Background S.

		L1	L2	FL	FL/L2	TOTAL
Comb. Text Gps	N	5	1	72	73	78
SC-I vs. HUM-I						
SC-II vs. HUM-II						
SC-III vs. HUM-III						
SC-IV vs. HUM-IV						
SC-Tot vs. HUM-Tot						
Text Group 1.	N	1		36	36	37
S-I vs. F-I						
S-II vs. F-II						
S-III vs. F-III						
S-IV vs. F-IV						
S-Tot vs. F-Tot						
Text Group 2	N	4	1	36	37	41
E-I vs. M-I						
E-II vs. M-II						
E-III vs. M-III						
E-IV vs. M-IV						
E-Tot vs. M-Tot						

Sig. Diff.: p. <.05 (SC>HUM; S>F; E>M)

propositional level PIV, and L2 did better than FL in PII. There were no significant differences between L1 and L2 either propositionally or in overall recall.

b. Humanities Texts: HUM, F, and M

Recall results of combined Text HUM showed that both L1 and L2 performed significantly better than FL at propositional levels PI, PII, PIV, and overall recall. Text F, on the other hand, showed a significant superiority of L1 and L2 over FL in PI, PII, and overall recall. Performance on Text M showed a different pattern. Both L1 and L2 groups were significantly superior to FL in PIV. Performances on combined Text HUM, and individual Texts F and M yielded no significant differences between the L1 and L2 groups either propositionally or in overall recall.

Figure 10. Intra-text and Inter-Text Results for Inter-Linguistic Groups

P-LEVEL	TEXT	L1>FL	L1>L2	L2>FL	Cb.Lg. Gps.
PI	SC	*	*		
	HUM	*		*	
	SC+HUM	*		*	
	S	*			
	F	*		*	F>S
	S+F	*		*	
	E				E>M
	M				
	E+M	*			
PII	SC	*		*	
	HUM	*		*	
	SC/HUM	*		*	
	S	*		*	
	F	*		*	
	S/F	*		*	
	E				
	M				
	E/M	*			
PIII	SC				
	HUM				
	SC/HUM				
	S				F>S
	F				
	S/F				
	E				
	M				M>E
	E/M				
PIV	SC	*		*	
	HUM	*		*	
	SC/HUM	*		*	
	S				
	F				
	S/F				
	E	*			
	M	*		*	M>E
	E/M	*		*	
TOT	SC	*	*	*	
	HUM	*		*	
	SC/HUM	*	*	*	
	S	*		*	
	F	*		*	
	S/F	*		*	
	E				
	M				
	E/M	*			

*p. <.05

*p. <.07

4.5.1.2 Inter-text Results

Inter-textual results (see Figure 11 and Table 17) of combined Text Group SC/HUM indicated no significant differences in recall of the two texts either propositionally or in overall recall. Total performance of the three linguistic groups on Text Group 1 (S/F) showed a significantly higher recall of the Humanities text, Text F, over S in PI, and of the Science text, Text S, over Text F in PIII. There were no significant differences between the two texts at the other propositional levels and overall recall. Inter-textual results of Text Group 2 (E/M) yielded a significant superiority of Text E (the Science text) over Text M in PI, and of Text M (the Humanities text) over Text E in PIII and PIV.

Total performance of each linguistic group on the two texts of each Text Group showed that in combined Text Group SC/HUM, there was a significant superiority of L1 over FL at propositional levels PI, PII, and PIV, and in overall recall, and of L2 over FL in PII, PIV, and overall recall. Total Performance on the individual Text Group 1 (S/F) yielded a significant superiority of L1 and L2 over FL in PI, PII, and overall recall. As for total performance on Text Group 2 (E/M), both L1 and L2 groups were significantly superior to FL in PIV. Total performance on the three Text Groups yielded no significant differences between the L1 and L2 groups

4.5.2 RESULTS FOR BACKGROUND H: ALL SUBJECTS, TEXT GROUP 1 (S/F), TEXT GROUP 2 (E/M)

4.5.2.1 Intra-text Results

a. Science Texts: SC, S, and E

Performance on the Science texts, both combined, Text SC, and individually, Texts S and E, showed no significant differences between L1, L2 and FL either propositionally or in overall recall.

Figure 11. Inter-Text, Intra-Text and Inter-Linguistic Group Results for Combined Background Groups

Ling. Groups	Text Groups	TEXTS	PI	PII	PIII	PIV	TOTAL
L1/FL	Comb. Text Groups	SC					
		HUM					
		SC+HUM					
	Text Group 1	S					
		F					
		S+F					
	Text Group 2	E					
		M					
		E+M					
L1/L2	Comb. Text Groups	SC					
		HUM					
		SC+HUM					
	Text Group 1	S					
		F					
		S+F					
	Text Group 2	E					
		M					
		E+M					
L2/FL	Comb. Text Groups	SC					
		HUM					
		SC+HUM					
	Text Group 1	S					
		F					
		S+F					
	Text Group 2	E					
		M					
		E+M					
Combined Ling. Groups	Comb. Text Groups	SC					
		HUM					
	Text Group 1	S			F>S		
		F	F>S				
		E	E>M				
	Text Group 2	M			M>E	M>E	

Sig. Diff.: p. <.05 (L1>FL; L1>L2; L2>FL)

Sig. Diff.: p. <.07 (L1>FL; L1>L2; L2>FL)

b. Humanities Texts: HUM, F, and M

Performance on the Humanities texts both combined, Text HUM, and individually, Texts F and M, yielded no significant differences between the three linguistic groups either propositionally or in overall recall.

4.5.2.2 Inter-text Results

Performances of the three linguistic groups inter-textually yielded the following patterns. Total performance of the three linguistic groups on combined Text Group SC/HUM showed a significant superiority of Text HUM over SC in PI, PII, PIII, and overall recall. Their performance on Text Group 1 (S/F) showed a significant superiority of Text F over S (i.e., the Humanities text over the Science text) in PI and overall recall, while Text Group 2 (E/M) yielded a significant superiority of Text M (the Humanities text) over E at the PII, PIII levels, and overall recall.

The inter-group results for the total performance of each linguistic group on the two texts of each Text Group showed that for all text groups both combined, Text Group SC/HUM, and individually, Text Groups 1 (S/F) and Text Group 2 (E/M), there were no significant differences between the three linguistic groups either propositionally or in overall recall.

4.5.3 RESULTS FOR BACKGROUND S: ALL SUBJECTS, TEXT GROUP 1 (S/F), TEXT GROUP 2 (E/M)

The L2 group is omitted from this section because it consists of one science subject only. Therefore discussion will be limited to results of L1 and FL groups.

4.5.3.1 Intra-text Results

a. Science Texts: SC, S, and E

Performance (see Figure 12 and Table 17) on combined Text SC and individual Text E showed that L1 performed significantly better than FL at propositional levels PII, PIII, and PIV, while PI and overall recall yielded no significant differences between the three linguistic groups. As for Text S, no inter-group comparison between L1 and FL was possible because L1 had one subject only for Text Group 1 (S/F).

b. Humanities Texts: HUM, F, and M

Performance on combined Text HUM and individual Text M showed a significant superiority of L1 over FL in PII, PIII, and PIV. There were no significant differences between the two linguistic groups at the PI and overall recall levels. As for Text F, inter-group comparison was not possible because L1 had one subject only for Text Group 1 (S/F).

4.5.3.2 Inter-text Results

Inter-textual results (see Figure 12 and Table 17) of the three linguistic groups yielded the following patterns. Total performance of the three linguistic groups on combined Text Group SC/HUM showed a significant superiority of Text SC over HUM in PI, PII, PIII, and overall recall, but no significant difference between the two texts at the PIV level. Total performance on Text Group 1 (S/F), on the other hand, showed a significant superiority of Text S over F (i.e., of the Science text over the Humanities text) in PII, PIII, and overall recall, but no significant differences between the two texts at the PI and PIV levels. As for Text Group 2 (E/M), total performance of the three linguistic groups yielded a significant superiority of Text E over M (i.e., the Humanities over the Science text) in PI, PII, and overall recall, while there were no significant differences between the two texts at the PIII and PIV levels.

Figure 12: Inter-Text, Intra-Text and Inter-Linguistic Group Results for Background S.

Ling. Groups	Text Groups	TEXTS	PI	PII	PIII	PIV	TOTAL
L1/FL	Comb. Text Groups	SC					
		HUM					
		SC+HUM					
	Text Group 1	S					
		F					
		S+F					
	Text Group 2	E					
		M					
		E+M					
L1/L2	Comb. Text Groups	SC					
		HUM					
		SC+HUM					
	Text Group 1	S					
		F					
		S+F					
	Text Group 2	E					
		M					
		E+M					
L2/FL	Comb. Text Groups	SC					
		HUM					
		SC+HUM					
	Text Group 1	S					
		F					
		S+F					
	Text Group 2	E					
		M					
		E+M					
Combined Ling. Groups	Comb. Text Groups	SC					
		HUM					
	Text Group 1	S					
		F					
	Text Group 2	E					
		M					

Sig. Diff.: p. <.05 (L1>FL; L1>L2; L2>FL)

Sig. Diff.: p. <.05 (SC>HUM; S>F; E>M)

The inter-group results for the total performance of each linguistic group on the two texts of each Text Group showed that for Text Group SC/HUM and Text Group 2 (E/M), L1 was significantly superior to FL at propositional levels PII, PIII, and PIV, but there were no significant differences between the two linguistic groups at the PI and overall recall level. As for performance on Text Group 1 (S/F), it was not possible to establish any comparison between the two linguistic groups for the reasons mentioned above.

CHAPTER V

DISCUSSION

5.0 Introduction

Before drawing any conclusions concerning the results reported in Chapter IV, it is appropriate to consider the variables that could have played a part in obtaining such results. The present study investigated the effects of four independent variables on the recall of four texts: (1) background knowledge, (2) the global structure of the texts, (3) the propositional structure of the texts, and (4) L2/FL subjects' proficiency in English. Two texts: Text F and Text M discussed topics related to humanities; the other two: Text S and Text E, discussed topics related to science. The four texts had each a different global structure, and were divided into four propositional levels, as discussed in Chapter III. Three linguistic groups were involved in the study: (1) L1 group (Canadian anglophones), (2) L2 group (Canadian francophones), and (3) FL (Iranian, Serbian, and Moroccan learners of English as a second/foreign language). The three groups consisted of both humanities and science subjects. They were all university students either at the graduate or undergraduate level.

The results reported in Chapter IV will be discussed for each of the independent variables mentioned above. The results of each of the following variables showed differential recalls of the different propositional levels. In this regard, it should be pointed out that recall of PI is considered to be the most important as they contain the most prominent information in the texts. Recall of PII is less important than recall of PI, but still more important than that of PIII which contain less crucial information, or recall of PIV which are at the lowest informational level.

5.1 Background

As discussed in Chapter II, readers use both bottom-up and top-down processing to achieve comprehension of written discourse. According to Rumelhart (1980), top-down processes involve background knowledge, including readers' general knowledge of the world, and their knowledge of the topic of reading, as well as their expectations. Background knowledge presupposes the presence of content schemata which help readers not only extract information from the text being processed, but also actively interact with that text. Schema theory holds that comprehension in reading can only be achieved through interaction between textual information and the readers' content schemata, i.e., their prior knowledge about the content of the material being read (e.g. Rumelhart, 1980; Anderson and Pearson, 1984; Johnson, 1982; Adams, 1982; Carrell, 1983, 1987).

Kintsch and van Dijk (1978) and van Dijk and Kintsch (1983), for example, contend that during comprehension, readers construct a "situational model" of the text which results from interaction between textual information and the reader's world knowledge, and that it is through this knowledge that readers can infer the information left implicit by writers. Johnson-Laird (1983) holds the same assumption. Similarly to Kintsch and van Dijk (1978) and van Dijk and Kintsch (1983), he also distinguishes between two phases in discourse comprehension: a superficial phase which consists of constructing a propositional representation of discourse, and a deeper phase which consists of constructing a mental model using both propositional representation of the text and general knowledge of the reader which serves to make implicit inferences.

Kintsch's 1988 model, on the other hand, expands the role of readers' general knowledge as it holds that during the text base construction process, readers use textual information and information close to it in their general knowledge, even if it is irrelevant. The irrelevant information, however, is eliminated at the integration phase, leaving only information that is context-sensitive. On the other hand, Kintsch (1994) claims that learners will only interact with and learn from a given passage if it provides them with

opportunities to use their knowledge, i.e., the text has to be within their "zone of learning" (p. 300).

It is, thus, widely held that background knowledge or general knowledge constitutes one of the crucial variables in the comprehension and recall of discourse. Empirical investigation corroborates these assumptions. Many empirical studies have demonstrated the positive impact of background knowledge on both comprehension and retrieval of information (e.g. Brandsford and Johnson, 1972; Steffensen, Joag-Dev, and Anderson, 1979; Anderson, Reynolds, Schallert, and Goetz, 1977; Nicholson and Imlah, 1981; Symons and Pressley, 1993; etc.).

The present study mainly investigated the impact of subjects' familiarity with the topic of the reading material on their performance on the texts as a whole, and at the different propositional levels. The results obtained were somewhat mixed. Familiarity seemed to play a part in the obtained results, but it was not always the predominant factor. Interest in the topic, whether related or unrelated to background, also played a role in recall. There was a general tendency among subjects, however, to find more familiar topics also more interesting, thus, showing an interaction between background knowledge and interest. This is in accordance with Kintsch's 1980 assumption (as cited in Wade, Schraw, Buxton, and Hayes, 1993:106) that interest is enhanced by higher background knowledge of the material being processed. There were cases also of emotional reactions that seemed to affect subjects' recall. Interaction between affect and recall has been demonstrated empirically by Sadoski and Quast (1990), as cited in Wade et. al (1993: 93).

Recall results of the three linguistic groups combined (L1, L2, and FL) indicated, in general, a superior performance of Background Group H, the humanities group, over Background Group S, the science group, in both the Science and Humanities texts. However, while the superiority of Background Group H over S in the combined Humanities texts HUM was significant at propositional levels PI, PII, PIII, and overall

recall, its superiority in combined Science texts SC mainly concerned propositional levels PII and PIV. It is also important to note that performance of the two background groups on the Science texts indicated a systematic superiority of Background Group S over H at the PI level, even though not quite significantly.

Recall results of all groups combined for combined science texts, Text SC, reflected the results obtained in recall of Text S, where Background Group H outperformed Background Group S in PII and PIV. Performance on the other science text, Text E, however, did not yield any differences between the two background groups. General recall results of the combined humanities texts, Text HUM, reflected the same recall results as Text M where Background Group H was significantly higher than Background Group S at propositional levels PI, PII, PIII, and overall recall. In Text F, Background Group H was significantly superior at propositional levels PI and PII, and overall recall.

Recall results of the linguistic groups considered individually revealed different patterns. Before considering such results, it should be reminded that recall of higher-level propositions, especially PI, which contain the most prominent information in the texts is more important than recall of lower-level propositions which contain less important information.

5.1.1 THE L1 GROUP

In the L1 Group, Backgrounds S performed significantly better than Background H at propositional levels PIII of combined Science texts, Text SC, and individual Text E. The other propositional levels and overall recall of both Texts SC and E did not show any significant differences between the two Backgrounds. As for performance on Text S, there were no significant differences between the two Backgrounds either propositionally or in overall recall. However, both PI and overall recall of Text SC, and PI, PII, PIII, and overall recall of text S showed some superiority of Background S over H which approached significance, even though not quite at the .05 level. Recall of the Humanities texts, both combined, Text HUM, and individually, Texts F and M, did not show any significant differences between the two background groups.

The L1 group, thus, obtained results which were somewhat different from those of the three linguistic groups combined. Here, background knowledge, to a certain extent, seemed to play a role for Background Group S since its performance on Science texts was higher than performance of Background Group H. However, background knowledge did not seem to play a role for Background Group H whose performance on the Humanities texts was not significantly higher than performance of Background Group S.

What could be a logical explanation of such puzzling results? First, one should mention that even though Background Group H did not outperform Background Group S in the Humanities texts, inter-textual results showed that Background Group H generally yielded a higher propositional and overall recall of the Humanities texts than the Science texts, both combined, Text HUM, and individually, Texts F and M, even though not quite significantly. There was, however, a significantly superior recall of FPI over SPI. One could interpret such results as being due to the impact of background knowledge in humanities on performance of Background Group H. On the other hand, when one considers individual recall protocols, the level of comprehension and the quantity of propositions recalled in certain cases revealed a much higher performance on the

Humanities texts than the Science ones. In those cases, there was also a much higher number of inferences for the Humanities than the Science texts, even though inferences are not considered in the present study.

Recall results of Text Group 2 (E/M) by Background Group H showed a different pattern. Text E yielded a significantly higher recall of PI than Text M, but Text M was superior at the rest of propositional levels and overall recall, even though not quite significantly. The fact remains, however, that the most important information was more highly recalled in the Science text than in the Humanities text. These results become less surprising when one considers the subjects' different reactions to texts E and M. There was a general tendency among all L1 subjects, including the two background groups, to find Text E more familiar than Text M. The majority of subjects reported that the topic of the theory evolution discussed in Text E was part of the subject-matters which they studied either at high school or college level. On the other hand, most Background Group H subjects also found the same topic more interesting than the topic of the history of slavery in the United States discussed in Text M. So, interest in the topic of evolution may have had an impact on the higher recall of primary propositions of Text E than Text M by Background Group H (Mathewson, 1994: 1143). Mathewson defines interest as "a favorable attitude with high action readiness" implying that favorable attitudes of readers towards given content would enhance their readiness to take action to read more material treating the same content. In the case of the present study, interest is assumed to enhance the readers' ability to retain more information or more important information from texts that they find more appealing for some personal reason.

Interest and affect were not variables investigated in the present study. Nevertheless, they emerged as potential factors that could play a part in comprehension and recall. This belief was corroborated through subjects' reactions in their recalls of the different texts and the statements they provided in the questionnaire of how familiar or how interesting the texts were to them.

Reactions of Background Group H to Text Group 1 (S/F) were different. Most subjects reported that the topic of Text S was not of much relevance to them, and that even though the history of aircraft is interesting in itself, lack of background knowledge in the topic hindered their comprehension and recall of the information. The most negative aspect of this text, according to them, was the amount of technical information and specific details (e.g. dates, names, etc.). They found their experience with this text somewhat strenuous. The few subjects that did better on Text S either had some background in the topic (e.g. the L1 subject that had the best score in Text S said that the topic was familiar to her because of her parents' interest in aircraft), or found the topic more interesting than the topic of Text F (mostly the case of FL subjects). Most subjects in Background Group H reacted more positively to Text F. They found the topic more familiar and interesting than the topic of Text S because it debates a more current issue with which they are much more familiar than the one discussed in Text S. They also thought that Text F was relevant to their current status as university students since the topic is related to academia.

Background Group S had different reactions towards the four texts than Background Group H. Most Background Group S subjects reported that Science texts S and E were more familiar. It is interesting to note, however, that even though they found Text S and Text E more familiar than the humanities texts F and M, they did not find them more interesting. In fact, their most positive reactions concerned Text M. They mostly reported that the text was very informative and that they learned many unknown facts about the history of slavery in the United States and the black women's conditions under slavery. These subjects generally yielded good recalls of Text M, even though it was less familiar to them than Text E. These positive reactions to Text M may also partially account for the higher propositional and overall recall obtained by Background Group S in Text M compared to Text F, the other humanities text which obtained somewhat neutral reactions.

Familiarity with a given topic is not the only determining factor in comprehension and recall. As the above discussion reveals, interest in or motivation for the topic of the reading material is also an important factor to consider. A topic can only motivate readers if it is of some interest or relevance to them (Kintsch, 1977; Mathewson, 1985, 1994). Motivation may be due to different factors, one of which is relevance to one's field of study or field of personal interest.

5.1.2 THE L2 GROUP

Recall results of the L2 Group showed that performance of the whole group on Science texts combined, Text SC, and the humanities texts combined, Text HUM, yielded no significant differences between Backgrounds S and H. However, recall of Text HUM was significantly higher than recall of Text SC in PI and overall recall. These results were mainly affected by performance on Text Group S/F, which yielded a significantly superior recall of Text F over Text S in PI and overall recall. Finally, recall of Text Group 2 (E/M) did not yield any significant differences either between the two background groups or between the two texts.

The findings suggest that background was not a major factor in recall since total performance of the two background groups did not yield any significant differences between them. However, recall of the two humanities texts combined was significantly better than recall of the two Science texts combined. These results were mainly due to the higher performance on Text F than Text S. The higher recall of text F obtained, nonetheless, because there were no science subjects involved in Text Group S/F. Thus, background was in fact a major factor in the overall higher recall of the Humanities texts than Science texts by the L2 group. Based on subjects' comments written in their recalls and the questionnaire they had to fill out, it appeared that reactions to the four texts used in the study revealed a higher interest in text F compared to Text S. Some subjects from Background Group H, however, found that Text F was written in a difficult style which

hindered comprehension, even though they did better on Text F than S, and found the topic in F very interesting .

Reactions to Text Group E/M revealed that about half of the subjects found Text E more familiar because they studied the topic of the theory of evolution at college level. However, the subjects' recall of Text E was generally lower than recall of text M even though they claimed to be more familiar with the topic of Text E. On the other hand, Text M stimulated more positive reactions than Text E. Most subjects reported that the topic of Text M was very interesting. Similarly to L1 subjects, they also reported that the text was informative in that they learned many historical facts about black women's conditions under slavery in the United States.

5.1.3 THE FL GROUP

As the recall results presented in Chapter 4 showed, total performance of FL group on Text SC, Text S, and Text E did not yield any significant differences between the two background groups H and S. However, it was shown that for both Text SC and Text S, Background Group S was slightly superior in PI, and for Text E, it was slightly superior in PI and PIII. As for Texts HUM, F and M, Background Group H was significantly superior at propositional levels PI, PII, PIII, and overall recall. Comparison of recall of the two texts of each of the Text Groups SC/HUM, S/F, and E/M showed that the two texts in each Text Group, in general, were not significantly different except for a few cases: SCPII and SPII were higher than HUMPII and FPII respectively, and EPI was higher than MPI, but MPIII was higher than EPIII. Total performance of each background group on the two texts of each Text Group generally yielded a significant superiority of Background H over S.

Thus, the general pattern showed no significant differences between Background Groups H and S in recall of the Science texts, but a significantly higher performance of Background Group H over S in the Humanities texts. The performance results of

Background Group H, thus, seem to confirm the assumed impact of background knowledge on both comprehension and recall of reading material that is related to prior knowledge of readers. This is concluded because of the higher performance of Background Group H over S in the Humanities texts, and its higher performance on the Humanities texts than on the Science texts. The problem remains, however, that recall results of Background Group S do not seem to confirm the assumption.

One could try to account for such results by referring to the linguistic proficiency levels of the two background groups. As already mentioned in Chapter III, all FL subjects in the Humanities belong either to proficiency level A or B, while most subjects in the Sciences belong to proficiency level C. This fact should explain why Background Group H generally performed better than Background Group S in both Science and Humanities texts. One should, however, keep in mind that, while Background Group H was always significantly higher than S in the Humanities texts, it did not perform significantly better than S in the Science texts. On the other hand, for all Science texts, both combined (SC) and individually (S and E), Background Group S yielded a higher recall of PI than Background Group H, even though not quite significantly. From such results, one may conclude that background knowledge must have had a positive impact on comprehension and recall of Science texts by Background Group S. This conclusion is based, first, on the fact that performance of Background Group S on Science texts was generally higher than their performance on Humanities texts especially as concerns the most important information, even though not always significantly. Second, this conclusion is based on the fact that performance of the two background groups on Science texts yielded a slightly superior recall of PI by Background Group S, and no significant differences between the two background groups at the other propositional levels and overall recall, in spite of the lower proficiency level of Background Group S. To conclude, if background knowledge had had no impact on background subjects, they would not have performed systematically better on Science texts than Humanities texts, and they would have yielded

a significantly lower performance than Background Group H on Science texts, as they did on humanities texts, because of their lower proficiency level.

Furthermore, it should be added that all Moroccan FL science subjects are involved in programs of English for Specific Purposes (ESP) in which they are trained to read English texts related to their fields with a fair degree of comprehension even if the texts are sometimes beyond their ability to communicate information in oral discourse. It seems, thus, plausible to infer that this type of training made them develop top-down strategies that help them achieve comprehension in spite of lower-level linguistic difficulties. But this remains to be shown through future research. One possible consequence of such training might be the general tendency among Science subjects to be concise in their recalls of science texts by limiting themselves to the most important information in the texts. On the other hand, these subjects possess a scientific jargon that seems also to facilitate their comprehension of Science-related texts as compared to Humanities-related texts. This is why they were more at ease with all the technical information included in Text S than Humanities subjects who complained about this specific aspect of the text. Finally, it appears that more inferences were made in recalls of science texts by Background Group S than H, although no analyses were conducted to support this conclusion. An analysis of inferences was beyond the scope of the present study.

Performances of the two background groups, to a certain extent, reflected their reactions to the texts that they read. Thus, in general, Background H subjects reacted more positively to Humanities texts which they found more familiar and easier to understand than Science texts. Text M, particularly, was more familiar than any other text to most Humanities subjects because the topic of the history of slavery is discussed in their readings in American literature. It was also more appealing because of the feelings of sympathy it stimulated for the black slaves in general, and for the black women under slavery, in particular. Some subjects, thus, found the topic of Text M more interesting basically for affective reasons (Mathewson, 1994: 1144). Text F was also reported to be

familiar because it discusses the topic of feminization, an current issue which they encounter frequently in their readings. Reactions of Humanities subjects to science texts were not consistent. Text E, in general, was more familiar than Text S because the topic of the theory of evolution is treated in science courses at the high school level. Thus, most subjects have, at least, some background in the topic of Text E. Text S, on the other hand, was more familiar to some subjects because of a TV documentary they had watched, and which discussed the history of aircraft. The TV documentary apparently created schemata that helped them better understand the content of Text S.

Science subjects, on the other hand, found Science texts generally more familiar, even though not always more interesting, than Humanities texts. Comparison of reactions of Science subjects to the two Science texts revealed a tendency among biology and agriculture subjects to find Text E generally more familiar than Text S, and among engineering subjects to find Text S more familiar than Text E. This was reflected in their respective higher recalls of the more familiar text. Reactions to Humanities texts, on the other hand, showed a general preference for Text M, not only because it treated important historical facts, but also because of emotional reactions to the plight of black slaves at a given period of American history. Another plausible interpretation of the preference of Text M is the fact that it lended itself easily to some incorrect conclusions, giving some subjects the wrong impression that they were familiar with the topic. The text was, thus, sometimes interpreted as being related to the sufferings of Black Africans under British colonization, and their fleeing their countries to find justice in foreign countries. The tendency to make erroneous inferences, however, was generalized to the two Humanities texts. Some recall protocols of Text F, for example, consisted mainly of general ideas about women's education and feminization movements in many countries of the world. There were also emotional reactions from both males and females referring to the lack of justice that most women in developing countries suffer from.

To conclude, even though familiarity with the topic of the texts was an important issue in understanding and recall of information, interest, either for cognitive or affective reasons, was also an issue, even though the impact on both comprehension and recall of information was not always positive.

5.2 Global Structure

As discussed in Chapter II, the impact of global structure of texts on their memorability has been investigated by empirical studies which indicated that such an impact existed for both narrative and expository texts. Most research conducted on narrative texts tested the difference in recall between well-organized and less well-organized texts with the same content and indicated the better memorability of well-organized texts as compared to the less well-organized ones (e.g. Kintsch and Greene, 1978; Kintsch and Yarbough, 1982). Meyer, on the other hand, focused most of her research on expository texts. Research conducted by her and her colleagues (e.g. Meyer, Brandt, and Bluth, 1980; Meyer and Freedle, 1984) has indicated that the type of global structure of the text determines the amount and type of information recalled.

Meyer (1975) distinguished five global structures (GS) for organizing discourse. These structures are "collection", "causation", "response" (e.g., problem-solution), "comparison", and "description". Meyer and Freedle (1984) assume that readers use these structures as the primary schemata to view the topic in comprehension and recall. They also assume that structures with more organizational components provide readers with more facilitative cues for comprehension and recall.

The four texts used in the present study differ in their global structures. Text S has a collection structure where the historical events that led to the invention of aircraft are organized chronologically. Text F has a problem-solution overall structure where the problem of females outnumbering males in American educational institutions in the middle of the nineteenth century was finally solved by leaving education open to women

and introducing up-to-date programs to attract more male attendance. Text E has a comparison global structure where two points of view concerning the theory of evolution are compared. And, Text M has a description global structure where facts about the history of slavery in the United states are discussed without any particular chronological order.

According to Meyer and Freedle's cumulative scale, comparison has more organizational components than problem-solution, which in turn is more highly organized than collection, followed by description which comes at the bottom of the cumulative scale as it has less organizational components than any of the other structures (Meyer and Freedle, 1984, p.122-123). According to Meyer's cumulative scale, then, Text E should yield the best recall since it has a comparison GS, followed by Text F, organized by problem-solution, then Text S, organized by collection GS, and at the lowest level, Text M, which is organized by description. The recall results have yielded a different pattern, however, as the following discussion will show.

The present study investigated the impact of subjects' ability to identify the correct structure of the text on their comprehension as measured by free recall. To help the subjects identify this structure, a list of Meyer's five basic global structures of texts, along with explanations of each structure, were provided to them.

As was reported in Chapter IV, the correct global structure of each text was only identified by a small number of subjects for each of the four texts used in the study. In fact, the majority of subjects ignored the question related to the global structure identification, as if it were of much less importance than the task of comprehending and recalling the content of the texts. Such was the case with all the groups involved, whether they belonged to linguistic groups L1, L2, or FL, to Backgrounds S or H, or to proficiency levels A, B, or C. On the other hand, those subjects who managed to identify the correct GS did not yield the best recalls. In fact, most of them yielded lower recalls than subjects who did not provide a GS, or provided the incorrect one. The differences

between subjects with the correct, incorrect, or no GS were very rarely significant. There were only three cases of significant differences, but they did not concern the correct GS.

The present study also investigated how the global structure of the target texts affected both their propositional recall and overall recall. Recall of the four texts used in the present study, according to Meyer's cumulative scale should have been in the order mentioned above, where Text E would have supposedly yielded the highest recall, followed by Text F, then Text S, and finally Text M which should have yielded the lowest recall.

The actual results obtained, however, produced a varied pattern. When examining the propositional recall results, we see that on the one hand, at the PI level, Text E showed a significant superiority over the other three texts. On the other hand, Text S showed a significant superiority at the PII level over the other texts. At propositional levels PIII, and PIV, and in overall recall, however, total performance of all groups combined on each text yielded no significant differences between the four texts.

The results obtained for GS are, therefore, somewhat surprising as they seem to contradict, to a large extent, the findings of earlier research which indicated facilitating effects of text global structure recognition and use on both comprehension and recall of textual information. Meyer (1975, 1977, 1987) and her colleagues (e.g. Meyer, Brandt, and Bluth, 1980; Meyer and Freedle, 1984) concluded that readers who are aware of and follow the author's global structure comprehend the text better, retain more information, especially the most important information, and are less prone to forgetting over time than readers who are not able to adopt this strategy. The GS results of the present study do not seem to corroborate this conclusion as the best recalls were generally yielded by subjects who were not able to identify the correct GS used to organize the texts they read and recalled, while subjects who could identify the correct GS did not yield the best recalls.

Other studies in the literature had findings similar to those of this study. A study conducted by Roen and Piché (1984: 21), for example, found an interaction between the

GS and content of texts. Their findings indicated a "non-significant but substantial (12 idea units) negative effect" of the presence of problem-solution GS on subjects' recall of "Neolithic Farming passages although not for the Neanderthal passages". They concluded that the effects of given GSs may be "context bound" and, consequently, "cannot be predicted across text types or topics". Horowitz (1984), as reported in Horowitz (1987: 134-146), replicated Meyer and Freedle's (1984) study. Horowitz investigated the effects of four types of GSs: list-structure, problem-solution, causation, and comparison on subjects' immediate and delayed recalls, as well as their judgments, of four versions of two different passages, organized according to the four above-mentioned GSs. Contrary to Meyer and Freedle (1984)'s findings, Horowitz's study did not indicate any major effect of any particular GS. Like Roen and Piché (1984), Horowitz also concluded that the effects of GS were dependent on the text topic as well as the textual context in which it was found. This, according to Horowitz, demonstrates the importance of both topic and content of texts in research on discourse recall.

In her conclusions, Horowitz mentioned that her study was limited to short passages that were only two or three paragraphs long, and that she could not predict whether her findings would be generalizable to longer passages with other topics and contents. The present study actually seems to extend Horowitz's findings to full longer texts discussing different topics.

The present study, however, showed mixed results concerning Meyer and Freedle's (1984) assumption that GSs with more organizational components provide readers with more facilitative cues for comprehension and recall. Thus, even though the four texts used in the study did not significantly differ in overall recall, Text E yielded the best recall of PI, i.e., the most important information in the text. This, at least to a certain extent, corroborates Meyer and Freedle's (1984) assumption, since Text E uses comparison, which is more highly organized than the other three GSs used for the other texts. However, recall of PI did not yield any significant differences between the other

three texts even though their GSs have differential organizing elements, which seems, at the same time, to contradict the same assumption.

It should be mentioned, however, that most subjects followed the GS of the target texts when they wrote their recalls, even though they were not able to recognize it explicitly. One might speculate that these subjects have an implicit knowledge of text GS or formal schemata which they are not able to bring to the conscious level. Evidence that such knowledge exists is that there were cases where subjects tried to restructure the texts which they read when they wrote their recalls. This occurred mostly with Text S where the events discussed in paragraphs 1 and 2 were reorganized in such a way as to show the real chronological order in which the events leading to aircraft invention occurred. There were also attempts to reorganize the order of events in Text M to make up for the poorer organization which characterized the original text. This is consistent with the assumption made by Horowitz (1982, as cited in Horowitz, 1985: 450) that proficient readers do not "always need to have a text pattern made explicit" and that "they are able to infer an overall structure for a text when one is not present."

In conclusion, the findings of the present study did not seem to support the assumptions of Meyer (1975, 1977, 1987) and her colleagues (e.g. Meyer, Brandt, and Bluth, 1980; Meyer and Freedle, 1984) concerning the positive effects of GS on comprehension and recall of discourse. The results obtained seemed to indicate that Background knowledge related to the topic of reading was a more predominant variable than GS. The case of Text M, the less well organized text in the series, is an extreme example of the predominance of topic familiarity over GS. This text yielded a good recall, especially of PI, in spite of its bad overall organization about which many subjects complained. Such results could be accounted for in terms of the familiarity of the topic, especially to humanities subjects, and also by the positive reactions that the topic of the text stimulated in most subjects. Further research is needed, however, to further

demonstrate how the two variables of global structure and background knowledge interact in readers' comprehension and recall of prose.

5.3 Propositional Structure

Related to the issue of the impact of discourse global structure on recall is the question of which propositions in the structural hierarchy of the text are recalled more frequently, and how propositions interact during comprehension and recall. Meyer (1975, 1977), Meyer and McConkie (1973), Kintsch and Keenan (1973), Kintsch (1974), and Kintsch et.al. (1975), assume a hierarchy principle effect on recall, according to which high level propositions, which are central to the message of the text, are more readily recalled than the lower level ones. This assumption appears to have direct implications for the present study.

The results of propositional recall reported in Chapter IV showed that in each recalled text, there was a general tendency among the subjects of all the different groups involved in the study to yield a better recall of higher-level propositions than lower-level ones. There were some cases, however, especially in individual subjects' recalls, where no significant differences resulted between recall of high-level propositions and their subordinate propositions, and cases where lower-level propositions yielded a higher recall than higher-level one. This was more frequent between propositions at the PI and PII levels, and propositions at the PIII and PIV levels. The case of the performance of the L2 subjects for Background H on Text S was unusual since it was the only case where results showed no significant differences between PI and the lower-level PII, PIII, and PIV subordinated to it. There were also few cases where PIII and PIV yielded higher recall than PI or PII. This type of result, however, occurred only at the level of individual subjects' recalls, and never for a whole group performance.

In what follows, it would be interesting to consider each text separately to see what type of performance each individual text yielded, and how their propositions interacted.

5.3.1 PROPOSITIONAL ANALYSIS OF TEXT S

Performance on Text S yielded different recall patterns between the paragraphs of the text. Thus, paragraph 1 yielded the best recall of PI, the second best recall of PII and PIV, and an average recall of PIII. Paragraph 2 yielded the third best recall of PI, the best recall of PII and PIII, and the third best recall of PIV. Paragraph 3 was low at all propositional levels. Paragraph 4 yielded a fairly good recall of PI and PII, the second highest recall of PIII, and the best recall of PIV. Paragraph 5 yielded the lowest recall of PI, an average recall of PII and PIII, and a very low recall of PIV. Paragraph 6 yielded the second best recall of PI, but the lowest recall of PII and PIV. Paragraph 6 had no PIII level. Finally, paragraph 7 yielded an average recall of PI and PII, but contained no PIII and PIV levels. Thus, on the whole, the paragraphs of the text were not all equally recalled. The best recalled paragraphs were the first, the second and the fourth ones. The other paragraphs yielded average or low recalls.

These recall differences can be accounted for by the type of information contained in these paragraphs. A close consideration of the text as a whole suggests that the best recalled PIs, i.e., the propositions which contained the most important information, were those of paragraphs 1, 2, and 6. This is justified by the crucial information that those PIs contained. Thus, the PI of the first paragraph introduced the beginning of the process of the invention of aircraft, the PI of the second paragraph introduced earlier attempts to fly and problems that hindered the achievement of flight, and the PI of the sixth paragraph introduced the outcome of the whole process which was the design and actual flight of the world's first powered aircraft. The PI of paragraph 7 also yielded a fairly good recall as it concluded the text. The PIs of paragraphs 3 and 4, and 5 contained information that

was not as crucial as that of the more highly recalled PIs of paragraphs 1,2, 6, and to a lesser extent 7.

Performance on lower-level propositions generally depended on how well their superordinate propositions were recalled. Thus, well recalled PIs generally triggered good recall of their subordinate propositions, and the same with PIIIs and PIIIs. However, there were cases where subordinate propositions were better recalled than their superordinate ones. Such cases occurred when the higher-level propositions contained some important general information that was further specified in the lower-level ones. This happened in paragraphs 4 and 5. Throughout the text, PIVs yielded low recall, except in paragraphs 1, 2, and 4 where they were subordinated to highly recalled propositions, and they themselves contained important details (e.g. names, dates, etc.)

General Trends in Recall of Text S

- a.** PIs were better recalled than PIIIs, and PIIIs were better recalled than PIIIs, themselves superior to PIVs, showing thus respect of the hierarchy principle.
- b.** PIs in the first, the second, and sixth paragraphs were the best recalled PIs throughout the text.
- c.** PIIIs of the first three paragraphs yielded higher recall than PIIIs in subsequent paragraphs.
- d.** PIIIs and PIIIs that were subordinated to highly recalled PIs and PIIIs respectively also yielded high recall. Some PIIIs and PIIIs, however, were more highly recalled than their superordinate propositions.
- e.** PIIIs and PIVs of paragraphs 1, 2, and 4 yielded higher recall than PIIIs of the other paragraphs
- f.** PIIIs and PIVs that were subordinated to well recalled higher propositions often also yielded high recall.

- g. The paragraphs that contained the most prominent information had the best recalled PIs.

5.3.2 PROPOSITIONAL ANALYSIS OF TEXT F

Similarly to Text S, Text F also yielded differential recall patterns of its paragraphs. Paragraph 1 yielded the best recall of PI, PII, and PIII, and the second best recall of PIV throughout the whole text. Paragraph 2 yielded the second best recall of PI and PIII. However, its PII and PIV ranked fourth and sixth respectively. Paragraph 3 had the third best recall of PI and the best recall of PIV. Its PII and PIII ranked fifth and fourth respectively. Recall of PI, PIII, and PIV in paragraph 4 was relatively low. Both its PI and PIII ranked sixth and PIV fourth, but PII yielded the second best recall throughout the whole text. Paragraph 5 yielded the fourth recall of PI, the third recall of both PIII and PIV, and the sixth in PII. Paragraph 6 yielded the lowest recall of PI and PII, and the fifth recall of PIV. It had no PIII level. Finally, Paragraph 7 yielded the fifth recall of both PI and PIII, and the the third in PII. It had no PIV level.

Thus, on the whole, the highest recall was yielded by the first paragraph, followed by the second and the the third paragraphs. Paragraph 7 was next, followed by paragraphs 4 and 5. The lowest recall was yielded by paragraph 6.

Such recall patterns both at the level of the whole paragraphs and their respective propositional levels reflected the differential degree of importance of information contained in each paragraph and each propositional level within each paragraph.

In this passage, the most important information (i.e., related to how the issue discussed in the text started, how it evolved, and how it was solved) is concentrated in the first three paragraphs, and to a certain extent, the last one. This was reflected in the higher recall yielded by the former paragraphs both at the overall and propositional levels. Thus, the first paragraph, for instance, yielded the best overall recall, and its propositions at each level, except the PIV level, were better recalled than propositions of the

corresponding levels in subsequent paragraphs. It was the most crucial paragraph of the whole text as it summed up much of the crucial information about the issue discussed in the text. Paragraphs 2 and 3 had their most important information concentrated in their PIs, but PIIs in paragraph 2, and PIVs in paragraph 3 were more highly recalled than their respective immediately superordinate propositions because they very possibly added further important specifications about those higher-level propositions.

In both paragraphs 4 and 7, recall of PIIs surpassed that of the PIs to which they were subordinated. This unusual order of propositional recall might be explained by the fact that in paragraph 4, the PIIs introduced new information related to the general problem contained in the higher proposition. This problem was one facing American universities by the growing body of female students in the mid-nineteenth century. As for paragraph 7, the higher recall of PIIs as compared to PIs could be because they further specified the more general information contained in their superordinate PI. The information contained in the last PII of this paragraph was related to the final decision adopted to solve the whole issue of male/female education in American colleges discussed throughout the text. So the information they contained was crucial. This shows that high-level propositions do not necessarily occur in paragraph initial position, as was the case in a study conducted by Kintsch, et.al. (1975).

Paragraphs 5 and 6 yielded the lowest recall both at the overall and the propositional levels. In fact, these paragraphs did not add any crucial information. They both basically recapitulated and commented on previously introduced information. PIVs, in general, yielded lower recall than their superordinate propositions, except in the case of paragraph 3 which yielded the best recall of PIVs throughout the text possibly because of the important details these PIVs contained.

General Trends in Recall of Text F

- a. PIs were better recalled than the lower-level propositions.

- b. PIs in the first three paragraphs were better recalled than PIs in subsequent paragraphs.**
- c. PIIIs subordinated to well-recalled PIs did also yield high recall.**
- d. Some PIIIs were recalled better than the PIs to which they were subordinated. This occurred in paragraphs 4 and 7. In each case, the highly recalled PII either directly preceded a PI to which it was connected in meaning or contained further/more specific information about the PI to which it was subordinated.**
- e. PIIIs which were subordinated to highly recalled PIs or PIIIs generally also yielded good recall. There were cases where PIIIs were more highly recalled than the PIs to which they were subordinated. This occurred in paragraphs 2 and 6.**
- f. Most PIVs yielded lower recall than the higher-level propositions to which they were subordinated. In paragraph 3, however, PIVs yielded higher recall than their superordinate PIIIs. Paragraph 3 yielded the best recall of PIVs, and paragraph 1 the second best recall. Those PIVs that were highly recalled either contained some important detail (e.g. an important date), or gave further or more specific information on a well-recalled higher proposition.**
- g. Paragraphs with more prominent information were better recalled than paragraphs with less prominent information.**

5.3.3 PROPOSITIONAL ANALYSIS OF TEXT E

Total performance on the propositional levels of Text E was in accordance with the hierarchy principle. High-level propositions were systematically superior to lower-level ones. However, performance at the level of each individual paragraph did not always respect the hierarchical order of propositions. Similarly to Texts S and F discussed above, the paragraphs of Text E also showed differential recall patterns.

Paragraph 1 yielded the highest recall of PI, the second highest recall of PII, the lowest recall of PIII, and the second best recall of PIV throughout the whole text. Paragraph 2 yielded the second best recall of PI, the best recall of PII and PIII, and the fourth recall of PIV. Paragraph 3 yielded a relatively low recall in general. Its PI and PII yielded the fifth and the sixth recalls respectively, while both PIII and PIV were third. Paragraph 4 yielded the lowest recall of PI, a low recall of PIII and zero recall of PIV, and yielded the fourth recall of PII. Paragraph 5 yielded the third recall of PI, the fifth recall of PII, the fourth recall of PIII, and zero recall of PIV. Paragraph 6 had the fourth recall of PI, the third recall of PII, the second recall of PIII and the fifth recall of PIV. Paragraph 7 yielded the last recall of PI and PII, the fifth recall of PIII and the best recall of PIV throughout the whole text.

Thus, the best recalled paragraphs, on the whole, were paragraph 2 at the top followed by paragraphs 1 and 6. The fourth best overall recall was yielded by paragraphs 3, followed by paragraphs 7, 5, and 4 yielding the fifth, sixth and last recall respectively. Paragraphs 1 and 2 discussed Lamarck's view concerning the theory of evolution. The rest of paragraphs discussed Darwin's view.

One might infer from such results of paragraph recall that Lamarck's view either stood out because unusual, was more important, or better understood than Darwin's view since paragraphs 1 and 2 devoted to Lamarck's view were more highly recalled than the other paragraphs devoted to Darwin. Judging by individual recalls, however, it was obvious that Darwin's view was familiar to many subjects and therefore well grasped by them. A more plausible explanation of the differential recall of the paragraphs is that, while the discussion of Lamarck's view was concentrated in paragraphs 1 and 2, discussion of Darwin's view was divided along the rest of the paragraphs. Therefore, it is the recall of all these paragraphs that should be compared to the recall of paragraphs 1 and 2.

The most crucial information concerning Darwin's view was given in paragraphs 3, 4, 5 and 6. Paragraph 3 discussed Darwin's first encounter with the notion of the danger of overpopulation; paragraphs 4 and 5 discussed the processes of natural and artificial selection; and paragraph 6 discussed Darwin's explanation of variations among the members of a given population, and why certain members survive and others don't. Finally, paragraph 7 discussed reactions to Darwin's theoretical views. In overall recall, paragraph 6 was the most highly recalled among these paragraphs, though it yielded a low recall of PIV. Paragraph 3 was next, followed by paragraph 7 which yielded the best recall of PIV, and then paragraph 4 with the lowest overall recall, and a better recall of PII than PI.

Similarly to Texts S and F, Text E propositional recall by individual paragraph also showed cases of higher recall of lower-level propositions than higher-level ones. This occurred in paragraphs 1, with PIV better recalled than PIII, paragraph 4, with PII higher than PI, and paragraph 7, with PIV higher than PII, and PIII. These results which seem to violate the hierarchy principle could be accounted for using the same type of arguments as used for the Texts S and F. In each of the above cases, higher recall of the lower-level propositions occurred when they added further important development of the higher-level propositions to which they were immediately subordinated, or to which their superordinate propositions themselves were subordinated, or when they directly preceded a higher proposition to which they were connected in meaning.

General Trends in the recall of Text E

- a. In overall recall of the whole text, propositions were recalled according to their level in the hierarchy.
- b. PIs and PIIs in the first two paragraphs were better recalled than PIs and PIIIs in subsequent paragraphs.

- c. Some PII's, PIII's, and PIV's yielded better recall than their superordinate propositions.
- d. The best recall of PIV's was yielded by paragraph 7 followed by paragraph 1. The middle paragraphs yielded a low or zero recall of PIV's.
- e. Paragraphs 1 and 2 yielded a higher recall than subsequent paragraphs.
- f. The middle paragraphs, i.e., 4 and 5, yielded lower recall than the paragraphs that preceded and followed them because they contained less important information.
- g. Paragraphs with more prominent information were better recalled than paragraphs with less prominent information.

5.3.4 PROPOSITIONAL ANALYSIS OF TEXT M

Total performance on Text M yielded a propositional recall that respected the hierarchy principle in that higher-level propositions were better recalled than lower-level ones. However, similar to the above-discussed texts, recall patterns of propositions of each individual paragraph also showed some inconsistencies.

Paragraph 1 of Text M yielded the best recall of PI and the lowest recall of PIV. Its PII and PIII were equally recalled and yielded an average recall compared to PII's and PIII's of subsequent paragraphs. Paragraph 1 had the fourth overall recall of the whole text. Paragraph 2 yielded the highest recall of PII and the next highest in PIII, but a rather average recall of PI, and a very low recall of PIV. It had the best overall recall of all the paragraphs of the text. Paragraph 3 had the second best recall of PI, the fourth recall of PII, the third recall of PIII, and a low recall of PIV. It yielded an overall recall that was almost equal to that of Paragraph 1. Paragraph 4 had the lowest recall of PI, but the second best recalls of PII and PIII, and a low recall of PIV. It yielded the second best overall recall. Paragraphs 5 and 6 yielded a similar pattern. Both yielded a rather low

recall of PI, PII, and PIII, but a high recall of PIV. Paragraph six had the highest recall of PIV, and paragraph 5 the second highest recall.

On the whole, the best recalled paragraphs were paragraphs 2 and 4, followed by paragraphs 6, 1, and 3, and at the lowest level, paragraph 5. Recall differences between paragraphs of Text E were not as big as in the other texts.

Paragraph 2 was best recalled because of the high performance on its PII and PIII levels. These propositions contained crucial information which further specified the idea expressed in PI related to whether or not slavery would continue after the Revolutionary War. This information was also crucial to the rest of the text. The same recall pattern was shown by paragraph 4 whose PII and PIII were also highly recalled because they provided further information about the idea expressed by the PI to which they were subordinated. This idea was related to the theory of the inferiority of blacks, and all of the paragraph 4 was an elaboration of the PI of paragraph 3, the second best recalled PI of the text, which was related to the lies that developed to justify the continuance of slavery. Paragraph 1 yielded the best recall at the PI level. This PI contained the most crucial information of the whole text. It actually introduced the topic of the text which was further discussed in subsequent paragraphs. The PII and PIII that were subordinated to this PI also yielded good recall. Paragraphs 5 and 6 did not contain much new information. They mainly provided further development of information that was already introduced in earlier paragraphs. They both yielded a high recall of PIV. These PIV gave many interesting details about the higher propositions of the two paragraphs. These details concerned certain characteristics of black women, and the black family life.

General Trends in the recall of Text M

- a.** Total performance on the text respected the hierarchy principle. Higher-level propositions were superior to lower-level propositions.

- b.** The most important higher-level information of the text was concentrated in paragraphs 1, 2, 3, and 4. The last two paragraphs contained less important higher-level information, but more important specific, lower-level information.
- c.** Paragraph 1 yielded the best recalled PI. This PI contained crucial information for the whole text.
- d.** Paragraphs 2 and 4 yielded the best recall of PII and PIII. These PII and PIII contained very important developments of the information contained in their superordinate propositions.
- e.** Recall differences between paragraphs of Text M were not as important as those of the other texts.

5.3.5 CONCLUSION

From the above discussion, it becomes apparent that the Research Question 5 (What types of recall patterns at the propositional levels do the four texts yield?) produced a variety of significant results. First, total performance on each of the four texts used in the present study indicated respect of the hierarchical levels of the propositions in that higher-level propositions yielded better recall than lower-level ones. Second, propositional recall at the level of individual paragraphs of each text was not always consistent with the total performance on the texts. As discussed above, in each text, there were paragraphs which yielded higher recall of lower-level propositions than superordinate ones.

Similarities of recall trends between the four texts at the paragraph level are quite apparent. First, in all texts, paragraph 1 yielded the highest recall of PI. Also, in all texts, except text M, paragraph 1 yielded the best overall recall and either the best or the second best recall of PII. Second, in all four texts, the first paragraphs generally yielded better recall of higher-level propositions than subsequent paragraphs. Third, the four texts

showed cases where propositions subordinated to highly recalled ones also yielded high recall. Fourth, in all four texts, there were cases of lower-level propositions yielding better recall than their superordinate ones. Fifth, in all the texts, there were paragraphs that yielded zero or very low recall of PIV, and other paragraphs which yielded very high recall of PIV. Finally, in all texts, paragraphs with more prominent information yielded either a better overall recall, or at least better recall of higher-level propositions.

There were also definite differences in recall of the four texts both at the paragraph level and the propositional level. Thus while S yielded the highest overall recall in paragraphs 1, 2, and 4, F yielded high recall in paragraphs 1, 2, and 3, Text E in paragraphs 1, 2, and 6, and Text M yielded its best recall in paragraphs 2, 4, and 6. At the propositional level, Text S yielded the highest recall of PI and the second highest recall of PIV in paragraph 1, and the highest recall of PII and PIII in paragraph 2. Text F had the best recall of PI, PII, and PIII yielded by paragraph 1, and the best recall of PIV yielded by paragraph 3. Text E had the best recall of PI, the second best recall of PII, and the best recall of PIV yielded by paragraph 1, and the best recall of PII and PIII yielded by paragraph 2. Text M had the best recall of PI yielded by paragraph 1, the best recall of PII and PIII yielded by paragraph 2 and the best recall of PIV yielded by paragraph 6.

How would one account for the recall patterns shown above? This question will be looked at in terms of two principles: the hierarchy principle and the serial position principle. The hierarchy principle, as explained in Chapter II, gives firm support to the data discussed above since total performance on the four texts showed that height determined recall at all propositional levels. Recall results of the texts at the paragraph level, as shown above, however, were not always consistent with this principle. Lack of this effect in most cases concerned differences between PII and PIII, and between PIII and PIV more than differences between PI and PII, even though such differences also existed. There were also cases of higher performance on PIV, the lowest propositional level than the higher propositional levels including PI.

One possible interpretation of this violation of the hierarchy principle is found in studies of such superior recall of lower-level propositions over higher-level ones and referred to as the "seductive details effects" (Wade, Schraw, Buxton and Hayes, 1993; Wade, Alexander, Schraw, and Kulikowich 1995). This effect attempts to explain how certain interesting but nonimportant details attract more attention on the part of readers and result in higher memorability than certain more important ideas in the texts for reasons of interest.

The serial position principle also partly accounts for the recall pattern reported in this study. According to Meyer (1977), this principle holds that people tend to recall the first few words of a list, i.e., "primacy effect" as well as the last few words, i.e., "recency effect" better than the ones in the middle. Concerning prose, Meyer (1977: 309) reports studies with contradictory findings. According to her, some studies (e.g., Frase, 1969; Kircher, 1971) found the first few sentences of a text to be better recalled, which supports the primacy effect principle, while other studies (e.g., Deese and Kaufman, 1957) reported both primacy and recency effects. Kintsch et al. (1974: 204) have reported an existence of a primacy effect for higher level propositions (levels 1 and 2), and its absence for lower levels. Thus, according to Kintsch et.al. (1974), primacy effect affected only information that was important for the text as a whole. They reported no evidence of a recency effect.

To some extent, the present study shows primacy effect and, to a small extent, recency effect, too. In the four texts, paragraph 1 yielded the best PI recall, and the best overall recall in Texts S, F, and E. This effect was extended to PII and PIII in Text F and PII and PIV in Text E. Paragraphs 2 in all the texts also generally yielded high recall of PII and PIII. This occurred in texts S, E and M.

Recency effect, on the other hand, occurred in Texts F, E and M. In Text F, the third best recall was yielded by paragraph 7. Text E had the best recalled PIV yielded by

paragraph 7, which also yielded an average recall of PIII. Text M also had the best recall of PIV yielded by its last paragraph.

The question, however, as raised by Kintsch et.al. (1974), is the extent to which the hierarchy principle effect interacts with the serial position effect. It is true that most propositions that have shown serial position effect were also high in the text structure, whether they happened to be in initial or final positions. But, it was also the case that lower propositions subordinated to them were highly recalled as well, contrary to Kintsch et al.'s (1974) findings. On the other hand, not all propositions that occurred in paragraph-initial position were highly recalled. As noted above, some PIs yielded lower recall than their subordinate propositions. This occurred in both Texts E and M in which PIV yielded better recall than their superordinate propositions, even though they were located in a lower position of the paragraph than the propositions to which they were subordinated.

In conclusion, the results of the present study, at least to a certain extent, support both the hierarchy and the serial position principles. The best results were obtained when the two principles were combined, but the hierarchy principle seems to be a more determining factor than the serial position principle.

5.4 Language Proficiency

As discussed in Chapter II, language proficiency has been widely shown to be one of the important variables in L2/FL reading. Reading specialists hold different opinions regarding this issue. Some assert that difficulties encountered in L2/FL reading are not due to language deficiencies but to basic reading problems, and that good L1 readers are also good L2/FL readers (e.g. Jolly, 1978; Coady, 1979, as cited in Alderson and Urquhart, 1984:2). Other researchers hold the opposite view that reading difficulties in L2/FL are predominantly due to language problems (Yorio, 1971, as cited in Alderson and Urquhart 1984:3). Empirical research that investigated the impact of language proficiency variable on L2/FL reading success yielded conflicting findings. Some studies

supported the assumption that language proficiency was a determining factor in L2/FL reading (e.g. Cziko, 1978; Clarke, 1980; Hudson, 1982), or that both language proficiency and skill in L1 reading were important factors (Carrell, 1991). Other studies demonstrated that the level of syntactic complexity of the reading material had no impact on L2/FL readers' comprehension (e.g. Ulijn and Strother, 1990; Leow, 1993).

The present study, on its part, investigated the impact of the linguistic proficiency level of L2/FL readers of English on their recall of fairly long texts that were either related or unrelated to their background knowledge. There were two proficiency levels for L2: A and B, and three proficiency levels for FL: A, B, and C. FL Background H group, however, included only levels A and B. The present study also looked at how the three linguistic groups (L1, L2, and FL) differed in their recalls, in order to determine whether the linguistic differences between these groups played a role in the type and amount of information that each group recalled.

The results reported in Chapter IV indicated that language proficiency, to a certain extent, was a determining factor in recall mainly as concerns the different proficiency levels of the FL group, and for the three linguistic groups when compared. However, as was pointed out in Chapter IV, recall results of language proficiency mainly showed significant differences between Levels A and B, and A and C. There were only few cases of significant differences between Levels B and C. As for the three linguistic groups involved in the study, there were more significant differences between L1 and FL, and between L2 and FL than between L1 and L2.

5.4.1 L2 AND FL PROFICIENCY LEVELS

5.4.1.1 L2 Group : Levels A and B

As reported in Chapter IV, L2 group results in both Science and Humanities texts showed no significant differences between Levels A and B. Background H subjects performed similarly to all subjects combined in both the Science and Humanities texts.

There were no significant differences between Levels A and B either propositionally or in overall recall. Recall that the L2 group was omitted from Background S as it had one science subject only.

5.4.1.2 FL Group : Levels A, B and C

Results reported in Chapter IV showed that FL group performance on the Science texts yielded a significant superiority of A over C in Texts SC at the PI level. Individual Texts S and E did not show any significant differences between the three proficiency levels. One should mention, however, that Level A did better than Levels B and C in PII and PIV of Text S, and PI and overall recall of Text E, approaching significance.

Performance on the Humanities texts showed that in Text HUM, A was significantly superior to B and C in PI, and B to C in overall recall, while performance on Texts F and M yielded no significant differences between the three proficiency levels. However, A was superior to B and C in overall recall of Text HUM, PI and overall recall of Text M, and PII of Text F, approaching significance.

Recall results of Background H showed that performance on Science texts SC, S, and E showed no significant differences between proficiency levels A and B (Background H, FL had no Level C subjects), either propositionally or in overall recall. Performance on the Humanities texts, however, showed some significant differences between the proficiency levels. Texts HUM and F yielded a significant superiority of A over B in PI and overall recall, while Text M did not yield any significant differences between A and B.

Recall results of Background S showed that in Text SC, A was significantly superior to B and C in PI, PII, and overall recall, and B to C in overall recall, while Text S yielded a significant superiority of A over B and C in PI, PII, PIV, and overall recall. As for text E, A outperformed both B and C in PI and overall recall. Performance of Background S on the Humanities texts showed that in Text HUM, A was significantly

superior to B and C in PI, PII, and overall recall, while in Text F, A was significantly superior to B and C in PII and overall recall. As for performance on Text M, it was shown that A was significantly superior to both B and C in PI, PII, and overall recall, and B to C in PI and overall recall.

Background S, thus, yielded more significant differences between the proficiency levels than Background H, or the two Backgrounds combined.

5.4.1.3 FL/L2 Groups combined: A, B, and C (A and B for Background H)

When both L2 and FL were combined, performance on Science texts showed that for both Texts SC and S, A was significantly superior to B and C at propositional level PI, and overall recall. Text E showed no significant differences between the three proficiency levels, but A was superior to B and C in PI, even though not quite significantly. As for performance on the Humanities texts, both combined Text HUM and individual Text F yielded a significant superiority of A over B and C at propositional level PI, and overall recall, and of B over C in overall recall. Text M, on the other hand, showed no significant differences between A, B, and C, but yielded some superiority of A over B and C in PI, approaching significance.

Performance of Background H for both L2 and FL groups combined showed that A was superior to B in Science texts SC and S. Thus, in combined Text SC, the significant differences concerned the propositional level PI only, even though performance on overall recall also showed that A did better than B, approaching significance. Text S, yielded a significant superiority of A over B in overall recall only. Performance on Text E, however, did not yield any significant differences between A and B. As for results of the Humanities texts, combined Text HUM and individual Text F showed a significant superiority of A over B at the PI level and overall recall, while Text M yielded no significant differences between A over B.

To summarize the above results, the general trends in performances of the three proficiency levels on both Science and Humanities texts suggest a general tendency for a significant superiority of (1) A over B for FL Background H group and FL/L2 groups combined, and (2) A over B and C for FL group combined, and FL/L2 combined, both propositionally and in overall recall. There were fewer significant differences between B and C.

5.4.2 INTER-LINGUISTIC GROUP RESULTS

The results reported in Chapter IV mainly showed a superior performance of both L1 and L2 over FL, while performances of L1 and L2 did not yield many significant differences. As pointed out earlier, these differences between the three linguistic groups might be due to differences in their linguistic proficiency. The three groups are compared below.

5.4.2.1 L1 Versus L2 Group: Text Groups SC/HUM, S/F, and E/M

Performance of L1 and L2 groups on both the Science and Humanities texts yielded only a few cases of significant differences between the two groups. Thus for the Science texts, for example, L1 and L2 were significantly different in Text SC only, with a significant superiority of L1 over L2 at the PI level and overall recall. As for the Humanities texts, L1 and L2 results showed no significant differences at all in any of the three texts. Results of Background H did not yield any significant differences between L1 and L2 either for the Science or the Humanities texts. As for performance of Background S, no comparison was drawn between the two groups because L2 had one science subject only.

5.4.2.2 L1 VERSUS FL GROUP: TEXT GROUPS SC/HUM, S/F, AND E/M

Performances of L1 and FL groups on the Science and Humanities texts yielded many significant differences between the two groups. Thus, for the Science texts, for example, Text SC yielded a significant superiority of L1 over FL in PI, PII, PIV, and overall recall; Text S yielded a significant superiority of L1 over FL in PI, PII, and overall recall; and Text E yielded a significant superiority of L1 over FL at the PIV level. As for performances of the two groups on the Humanities texts, L1 was significantly superior to FL in Text HUM at the PI, PII, PIV levels, and overall recall; in Text F, at the PI and PII levels, and overall recall; and in Text M at the PIV level.

Performance of Background H did not yield as any significant differences between the two Linguistic groups either in the Science or the Humanities texts. Performance of Background S, however, showed that L1 was significantly superior to FL in both Texts SC and E at propositional levels PII, PIII, and PIV. As for Text S, it was not possible to compare the two groups because the L1 group consisted of one subject only for Text Group 1 (S/F).

5.4.2.3 L2 Versus FL Group: Text Groups SC/HUM, S/F, and E/M

Results of FL and L2 for the Science and Humanities texts showed a significant superiority of L2 over FL in Texts SC in PII, PIV, and overall recall; and in Text S at the PII and overall recall levels. Performance on Text E did not yield any significant differences between L2 and FL groups. The Humanities texts results yielded a significant superiority of L2 over FL in Texts HUM at propositional levels PI, PII, PIV, and overall recall; and in Text F at propositional levels PI, PII, and overall recall. Performance on Text M did not yield any significant differences between the two linguistic groups.

Performance of Background H on both the Science and Humanities texts showed no significant differences between the two linguistic groups.

To summarize the above results, performances of the three linguistic groups revealed differences that showed superiority of both L1 and L2 over FL. The results also revealed few significant differences between L1 and L2.

5.4.3 LANGUAGE PROFICIENCY CONCLUSIONS

In conclusion, the results of the linguistic proficiency levels (A, B, C) for L2 and FL groups as well as those of the three linguistic groups (L1, L2, FL), to some extent, support the assumption that the level of language proficiency is one of the important factors in the amount and type of information recalled.

Results of Language proficiency for L2 did not reveal any significant differences between Level A and B. However, results of all FL subjects combined, and FL/L2 subjects combined, showed that A quite often surpassed B and C in the amount of information recalled. Comparison of performances of B and C with that of A revealed that differences between A, B, and C mostly concerned higher-level propositions. Looking at these differences between the three proficiency levels, one can see that in most cases, A was superior to B and/or C mainly at higher propositional levels, i.e., PI and/or PII levels which contained the most important information in the texts, and overall recall. The PIV level, i.e., the propositional level which contained the least important information of the texts, yielded very few cases of significant differences between the proficiency levels.

There were cases also where A and B or A and C were not significantly different either propositionally or in overall recall. This occurred in performance of all FL subjects combined in recall of Texts SC and E by A and B, and in recall of Text S by A, B, and C. This also occurred in recall of all the Science texts SC, S, and E, and the Humanities Text M by Background H where A and B performed equally. When FL and L2 were combined, A, B, and C performed equally on Texts E and M. At the same time, there were very few cases of significant differences between B and C.

Comparison of performances of the three linguistic groups (L1, L2, and FL) did not reveal much difference between L1 and L2. As the results showed, the only case where L1 outperformed L2 was in recall of PI and overall recall of Text SC when the two Background groups were combined. However, performances of the three linguistic groups revealed that both L1 and L2 groups recalled a higher amount of information than FL group. Results also revealed a general tendency for L1 and L2 groups to yield a better recall of the higher-level propositions (PI and PII) than FL group. There were also cases of significant superiority of L1 and L2 over FL at the PIV. However, when higher recall of PIV occurred, it was often combined with a superior recall of the higher-level propositions. On the whole, there were fewer cases of significant differences in performance on PIII than on the other propositional levels.

The results, thus, to some extent, provide a positive answer to Research Question 6 (*i.e., Does language proficiency have an impact on subjects' recall? More specifically, do higher linguistic proficiency levels in both second language (L2) and foreign language (FL) perform better than lower levels? and do native language (L1) subjects perform better than either the second language (L2), or the foreign language (FL) subjects, as measured by a recall protocol?*).

This seems to conflict with the assumption that background knowledge is a more important factor in recall of information than language proficiency level. According to this assumption, Background S should have done better than Background H in the Science texts, and Background H should have outperformed Background S in the Humanities texts, regardless of the linguistic proficiency level. Also, according to the same assumption, the FL group should have done better than both L1 and L2 groups in recall of Science texts SC, S, and E since the L1 and L2 groups had only a few subjects from science compared to the great number of science subjects in FL. This was not the case, of course.

Results of the present study, thus, seem to suggest that language proficiency is a fairly important variable in comprehension and recall of information. To some extent, language proficiency in the present study played a more determining role than Background. On the other hand, results of the present study suggest that proficiency level is also a more determining variable in comprehension and recall of information than text global structure overt identification. It should be reminded here that Meyer and her colleagues (e.g. Meyer, Brandt, and Bluth, 1980; Meyer and Freedle, 1984) strongly hold that global structure of texts is a primary factor in both the amount and type of information recalled. As mentioned earlier, this assumption was not corroborated by results of the present study. However, it was shown that readers made implicit use of global structure in their recalls, even though the majority could not explicitly identify it.

CHAPTER VI

CONCLUSIONS

6.1 Findings of the Study

The primary objectives of the present study were to investigate the effects of the following variables on comprehension and recall of the information contained in the four target texts used in the study: (a) subjects' prior knowledge of the topics/content of the texts, (b) the global structure of the texts and the interaction between the global structure and the content, (c) the propositional structure of the texts, and (d) subjects' language proficiency.

These variables formed the basis for the following Research Questions:

1. Do subjects with background training in the Humanities perform better on the humanities-oriented texts than on the science-oriented texts, as measured by a recall protocol?
2. Do subjects with background training in Science perform better on the science-oriented texts than on the humanities-oriented texts, as measured by a recall protocol?
3. Does the global structure of the texts have an impact on the subjects' recall, as measured by a recall protocol? In other words, do subjects who identify the correct global structure of the texts recall more information or more important information than subjects who identify a different structure? and do subjects who use in their own recall protocols the same global structure as the one used by the author of the target text recall more information or more important information than subjects who use a different global structure?
4. Is there any interaction between the global structure of the text and the familiarity of the text content, as measured by a recall protocol?
5. What types of recall patterns at the propositional levels do the four texts yield?

6. Does language proficiency have an impact on subjects' recall? More specifically, do higher linguistic proficiency levels in both second language (L2) and foreign language (FL) perform better than lower levels? and do native language (L1) subjects perform better than either the second language (L2), or the foreign language (FL) subjects, as measured by a recall protocol?

7. Do L1, L2 and FL subjects exhibit similarities or differences, as measured by a recall protocol?

6.1.1 BACKGROUND KNOWLEDGE: Research Questions 1 and 2 (*Do subjects with background training in the Humanities perform better on the humanities-oriented texts than on the science-oriented texts, as measured by a recall protocol? and (2) Do subjects with background training in Science perform better on the science-oriented texts than on the humanities-oriented texts, as measured by a recall protocols?*)

Investigation of the impact of background knowledge, more particularly subjects' familiarity with the topic of the texts on comprehension and recall of information yielded somewhat mixed results. Familiarity played a part, but it was not the only determining factor. Interest and affect were also important factors in the results obtained. Evidence that familiarity determined the amount and type of information recalled is shown in the significant superiority of L1 Background S over H in PIII, and its nearly significant superiority in PI (the propositional level which contained the most prominent information of the texts) and overall recall, showing thus the role of familiarity in retaining both higher-level and lower-level information. Background H, on the other hand, performed better on the Humanities than the Science texts. L2 (Background S and Background H) group, performed generally better on the Humanities texts, especially as concerns PI and overall recall levels. This was most probably due to the fact that the L2 group consisted mainly of humanities subjects. Backgrounds S and H in FL were not significantly different in their performance on the Science texts, but Background S showed a slightly

better performance than H on PI, i.e., the propositions that contained the most prominent information of the texts. However, Background H showed a significant superiority over S in all the Humanities texts at both higher-level and lower-level propositions. On the other hand, Background H yielded a better performance on the Humanities than Science texts. Finally, as was mentioned earlier in this discussion, Text E yielded the highest recall of PI, most probably because it was the most familiar text to the majority of subjects involved in the study.

It can therefore be concluded that familiarity with the topic of reading determines to a fairly large extent the amount and/or type of information retained by subjects. However, familiarity seemed to interact with two other related variables, interest and affect. It was shown that subjects' reactions to the texts that they read, either out of cognitive or emotional interest for the information that those texts contained, had an impact not only on the amount but also the type of information recalled. For example, most reactions were stimulated by Text M which yielded a high recall in general, and a high recall of certain specific details that were related to the characteristics of the black woman and the black family life under slavery. Another variable which interacted with background was, as one would expect, linguistic proficiency.

6.1.2 THE TYPE OF GLOBAL STRUCTURE: Research Questions 3, and 4 (i.e., *Does the global structure of the texts have an impact on the subjects' recall, as measured by a recall protocol? In other words, do subjects who identify the correct global structure of the texts recall more information or more important information than subjects who identify a different structure? and do subjects who use in their own recall protocols the same global structure as the one used by the author of the target text recall more information or more important information than subjects who use a different global structure? and Is there any interaction between the global structure of the text and the familiarity of the text content, as measured by a recall protocol?*)

The findings of the present study showed that the overt recognition of the GS as well as the type of GS used to organize the text did not seem to have much impact on the amount and type of information recalled. These results seem to contradict findings of earlier research (e.g Meyer, 1975, 1977, 1987; and Meyer, Brandt, and Bluth, 1980; Meyer and Freedle, 1984) which demonstrated that the use and recognition of global structure had a facilitating effect on comprehension and recall of textual information.

The results reported in Chapter IV indicated that a great number of subjects with both high and low recalls did not provide the correct global structure or did not provide a global structure at all. On the other hand, most subjects, whether they yielded good or poor recalls, followed the same organizational patterns as those of the original texts that they read. On the whole, therefore, the use and recognition of global structure of the texts did not seem to determine comprehension and recall of the information that they contained. These findings are corroborated by findings of other empirical studies (e.g. Horowitz, 1984 as reported in Horowitz, 1987: 134-146).

At the same time, and as mentioned earlier, the present study showed mixed results concerning Meyer and Freedle's (1984) assumption that GSs with more organizational components provide readers with more facilitative cues for comprehension and recall. It was shown that Text E in the present study yielded the best recall of PI, i.e., the most important information in the text, even though it did not differ from the other texts in overall recall. This could be interpreted as being due to its global structure, comparison, which is more highly organized than the other three GSs used for the other texts. The other texts, however, did not show any significant differences in recall of their respective PIs, even though they had GSs with differential organizing components.

The findings of the present study, thus, did not show much interaction between the global structure of the texts and their propositional structure, in that there was no particular GS that had more impact on recall of the higher-level propositions than the

lower-level ones, except for the mixed case of Text E reported above. Also, topic seemed to override GS in subjects' performances on the different texts.

In conclusion, then, GS was a much less important factor in the obtained results than the other variables investigated by the present study.

6.1.3 PROPOSITIONAL STRUCTURE: Research Question 5 (i.e., *What types of recall patterns at the propositional levels do the four texts yield?*)

The findings of the present study indicated that propositional structure of the texts has been a determining factor in recall. Thus, the general trend was for higher-level propositions to be more frequently recalled than lower-level propositions. For instance, and as was shown in Chapter IV, total performance of all the groups together on each text yielded a consistent respect of the hierarchy principle. PIs were systematically better recalled than PII, PII than PIII, and PIII than PIV which yielded the lowest recall. The same results were obtained in the recall of combined Text Group SC/HUM by Background H, both for all linguistic groups combined, for FL/L2 combined, and when the linguistic groups were considered individually. An exceptional case, however, was the L2 group which did not yield any significant differences between PI and PII in Text SC, but it was mentioned that both PI and PII were superior to lower-level propositions. Background S, which consisted mainly of FL subjects, obtained the same results.

Recall of individual texts by separate linguistic groups was shown to be also consistent with the hierarchy principle, except for a few cases. Thus, recall of Text S by L1 subjects did not yield any significant differences between PI and PII, and recall of the same text by the L2 group yielded no significant differences between PI and PII, PIII, and PIV. There were also a few occurrences of nonsignificant differences in recall of lower-level propositions PIII and PIV. Recall of the separate texts by both Background H and S also showed respect for the hierarchy principle, except for few cases similar to the ones reported above for individual linguistic groups.

The analysis of the results by individual paragraphs of each text, however, has been more puzzling, as higher-level propositions were not systematically better recalled than their subordinate ones. Some tentative answers related the higher recall of some subordinate propositions to the type of information that they included, which in general was either a crucial development of the information provided by superordinate propositions, or an introduction of some important information in subsequent higher-level propositions.

One should also account for the differences in interpropositional recall by the different groups involved. The general trends showed a better recall of higher-level propositions by higher linguistic proficiency levels than lower-level ones, by the L1 and L2 groups as opposed to the FL group, and to some extent the by the L1 group in contrast to the L2 group. Proficiency, thus, interacted positively with propositional structure since higher proficiency levels recalled more higher-level propositions.

The hierarchy principle also generally interacted positively with background knowledge. It was shown that Background H yielded a significantly better recall of higher-level propositions in the humanities than the science texts. Moreover, Background H superiority over Background S in the humanities texts mainly concerned the higher-level propositions. Background S subjects also showed a tendency to perform better on the science than the humanities texts, especially at the PI level, and to perform better than Background H on the PI level of the science texts, even though not quite significantly.

In conclusion, the findings of the present study provided firm support to the widely held hierarchy principle (Kintsch et al. 1975; Meyer and Freedle, 1984) which assumes that higher-level information contained in the hierarchically higher propositions is better and more frequently recalled than lower-level information contained in hierarchically lower propositions; i.e., the higher the level of the proposition the better the recall.

6.1.4 LANGUAGE PROFICIENCY: Research Questions 5 and 6 (i.e., *Does language proficiency have an impact on subjects' recall? More specifically, do higher linguistic proficiency levels in both second language (L2) and foreign language (FL) perform better than lower levels? and do native language (L1) subjects perform better than either the second language (L2), or the foreign language (FL) subjects, as measured by a recall protocol? and Do L1, L2 and FL subjects exhibit similarities or differences, as measured by a recall protocol?*)

The findings of the present study indicated that language proficiency was generally a significant variable for comprehension and retrieval of information. First, the results of performances of the three linguistic groups have shown that the L1 group had the best performance in all texts, and that the L2 group obtained a higher mean both propositionally and in overall recall than the FL group. Second, performances of the different linguistic proficiency levels in the FL group indicated that the general trend was for higher proficiency levels to outperform lower levels both propositionally and at the overall recall level.

When one looks at the interaction between language proficiency and Background, the results seem to favor language proficiency, to some extent. This conclusion is supported by evidence from the superior performance of the L1 over the FL group in the Science texts even though the FL subjects generally had stronger science background than L1 subjects. The L2 group is not considered here since it had only one science subject.

Moreover, performances of FL Background H and Background S provided further evidence that language proficiency was a more important variable in recall of information than background. This is concluded because Background H outperformed Background S in both the Humanities and the Science texts, most probably because all Background H belonged to proficiency levels A and B, whereas the majority of Background S subjects belonged to level C, with a few at Level B. If background were a more determining factor

than proficiency, the FL group would have yielded a superior performance on the Science texts than the L1 group, and FL Background S a superior performance than Background H.

However, a seemingly problematic issue for the prediction concerning language proficiency are the more or less equal results obtained by both the L1 and L2 groups, even though the L1 group would have been expected to yield better results than the L2 group. Also, L1 subjects had the advantage of both reading the texts and writing their recalls in their first language; L2 subjects, however, had to read in English, but they could write their recalls either in English, their second language, or French, their native language. This did not seem to make much of a difference between the two groups. Another problematic issue for the above prediction is the recall differential within each linguistic group, as shown by the results, and the fact that some subjects from the L2 and FL groups performed much better than some subjects from the L1 group. Here, other variables such as background, interest in and motivation for the topics as well as the tasks performed may have played a role in the obtained results, as mentioned earlier.

To conclude, the findings in the present study concerning language proficiency seem to be nonconclusive. On the one hand, there is evidence in favor of the assumed effects of language proficiency. This seems to be consistent with findings of previous research (e.g. Cziko, 1978; Clarke, 1980; Hudson, 1982) discussed earlier in section 4.0 (see summary below). On the other hand, there are cases that seem to contradict this assumption and to support the opposite view that language proficiency is not an important factor in L2/FL reading (e.g. Ulijn and Strother, 1990; Leow, 1993), (see summary below).

6.2 Summary of the Findings of the Present Study

The major findings of the present study are as follows:

(1) Background knowledge was, to a considerable extent, a determining factor in comprehension and recall of information by subjects, but interest in and motivation for the topic/content of reading were also important factors. Further research is needed to investigate how the familiarity with the topic/content of texts interacts with readers' interest and emotional feelings for the topic (Mathewson, 1985, 1994).

(2) Global structure of the texts as well as the subjects' ability to label it overtly did not seem to have any determining effects on comprehension and recall of information. Subjects who identified the correct global structure of the texts did not yield different recalls from those who did not identify the correct structure, or those who did not provide a structure at all. Also, there did not seem to be any important interactions between the type of global structure and the topic of the text. Thus, in the present study, good organization did not seem to facilitate comprehension of less familiar topic/content. This occurred in performance on Text F, a well organized text that was unfamiliar to many subjects. On the other hand, poor organization did not seem to hinder comprehension of less familiar topic/content. This occurred in performance on Text M. In the latter case, even though the text was poorly organized, and the topic was not familiar to a certain number of subjects, they nonetheless yielded good recalls very possibly because of the interest that the topic stimulated in them. Future research should investigate the interaction between familiarity, interest, and global structure in recall of information.

(3) Propositional structure produced a variety of significant results. Results of all the groups combined for each of the texts used in the study indicated respect of the hierarchy principle. However, analysis of results at the paragraph level of each text indicated that propositional recall was not always consistent with the hierarchy principle. This analysis also indicated some effects of the serial position principle. Future research

is needed to investigate the interaction between the hierarchy and the serial position principles (Kintsch et al. 1974).

(4) Language proficiency also yielded somewhat mixed results. On the one hand, language proficiency was shown to be a determining factor in comprehension and recall of information contained in the texts. Thus, the results showed that the L1 group yielded the best recalls, closely followed by the L2 group, and both the L1 and L2 groups yielded significantly higher recalls than FL subjects. This was interpreted as being due to their differential proficiency levels. The results also showed that higher proficiency levels within the FL group performed significantly better than lower proficiency levels. Language proficiency, on the other hand, did not always seem to be the most determining factor. It was shown that there were cases of nonsignificant differences between A and B, and A and C, and that Levels B and C yielded few cases of significant differences in spite of the linguistic proficiency differences between A and B, A and C, and B and C. Another problem concerning the impact of language proficiency were the occurrences of superior performances among L2 and FL subjects over L1 subjects within the same background group, which would seem to eliminate the possibility of background impact on the obtained results. This appears to be a problematic issue for the assumed powerful effect of language proficiency on comprehension and recall of information. It was concluded, then, that other factors might also have played a role in obtaining the present results. Such factors might be the motivation for the tasks being performed, the strategies used in reading, the type of material that the subjects prefer to read, the amount of reading that they do on a daily basis, etc. Further research is needed to investigate how language proficiency interacts with such outside factors.

The findings of the present study seem to be consistent to a considerable extent with the findings of the Pilot Study reported at the beginning of the thesis. Thus, in both cases, background knowledge, propositional structure, and linguistic proficiency were important factors in both comprehension and recall of information. However, the two

studies yielded contradictory findings concerning global structure which was found to be a determining variable in the pilot study, as opposed to the present study.

To conclude, if one had to order the investigated variables according to the extent of their impact on the subjects' performance in the present study, propositional structure would be ranked as the most determining variable, followed by language proficiency as the second most important variable, then background knowledge as the third variable. Global structure would be ranked last because it had no impact at all on the obtained results.

6.3 Implications for Future Research

Further research is certainly needed to confirm the findings of the present studies. As discussed above, the results that were obtained for each of the variables investigated by the present study indicated a variety of implications for future research. Thus, for background, further research is needed to investigate how the readers' familiarity with the topic/content of texts interacts with their interest for and emotional reactions to the topic and how this interaction affects their performance. As was mentioned earlier, interest and affect are two variables that have their impact on readers' performance, and which, according to Mathewson (1994), have not received much attention on the part of researchers.

The results that were obtained for the global structure variable were surprising in that they contradicted findings of earlier research which indicated facilitative effects of this variable on readers' performance. It was therefore concluded that further research was needed to confirm or disconfirm the present findings, and to investigate the interaction of global structure with other variables including topic familiarity and interest/motivation for the topic, as well as the effects of such interaction on readers' comprehension and recall of information.

Investigation of the effect of the hierarchy principle indicated respect of this principle in propositional recall to a considerable extent. However, as there were also effects of the serial position principle on subjects' performance, it was concluded that further research was needed to investigate how the two principles interact in readers' performance.

Finally, investigation of language proficiency provided support for the assumed impact of this variable on comprehension and recall of information. However, there were also cases where language proficiency did not seem to be the determining variable. It was concluded that further research was needed to investigate the interaction between language proficiency and outside factors that might play a part in how readers perform. Such factors might be the motivation for the tasks being performed, the strategies used in reading, the type of material that the subjects prefer to read, the amount of reading that they do on a daily basis, the cultural differences between subjects, etc.

Besides these major issues, other interesting issues were revealed which were related to the differences in performance of Backgrounds S and H. First, L1 science subjects yielded a somewhat higher recall of the science texts than the humanities subjects, while at the same time there were no significant differences between the two background groups in their performance on the humanities texts, with some slight superiority of the science subjects. This is an interesting finding that certainly needs further investigation to determine the major factors that could have played a part in such results.

There were also differences in recall of Backgrounds S and H in the FL group. As mentioned earlier, there was a trend among science subjects, especially for science texts, towards conciseness in that most of their recalls were limited to the main ideas of the texts as expressed in higher-level propositions. This was interpreted as probably due to differences in training of the two backgrounds in their respective English classes. It is quite possible that science subjects developed strategies whereby they relied more on top-

down processes than bottom-up processes to overcome weaknesses in language proficiency. Further research is needed to investigate the different strategies used by science and humanities subjects and to confirm or disconfirm these speculations.

The results of the present study concerning FL group revealed a higher performance of Background H over S in both Science and Humanities texts. This was accounted for in terms of the differences in language proficiency levels between the two groups. At the same time, the results would probably have been different if the science group were homogeneous in terms of the domain of studies and the topic of the Science texts were directly related to that domain. This is an interesting question to investigate in future research.

Another interesting issue to investigate would be comparative reading performances of the same subjects in both their L1 and L2/FL. It would have been interesting, especially as concerns the FL group in the present study, to see how they would have performed on the same texts read in their L1 too.

6. 4 Limitations of the present study

Problems with the present study were related to a variety of factors including (1) **Conditions of the experiment.** In the present study, conditions of the experiment were not the same for all subjects. Those who performed the tasks in a formal setting suffered from some outside factors such as noise, and inevitable time limits imposed by class shifts. Subjects who performed the tasks at home, on the other hand, had a better chance to do the tasks at their own rate without any outside pressure. The problem with these two different types of conditions is the differential impact that they might have had on subjects' performances. For more consistent results, future research should provide the same conditions for all subjects. There were also problems related to the negative attitudes of some subjects towards the experiment, especially those who performed in formal settings. They might have felt they were being tested by an outsider in their

reading ability or in their language skills through reading, in spite of reassurances that this was only an experiment for a Ph.D dissertation.

(2) Isolation of the effects of the different variables involved. The present study was basically a variable-treatment study which investigated the impact of four different variables on subjects' performances. In spite of the many positive aspects of the combination of all these variables, it was not always possible to determine which variable had the strongest or weakest effect on subjects' recall. It seems possible that the results obtained were a combination of the simultaneous effects of different variables.

(3) Other intervening variables. The results obtained may have been affected by other interfering variables which were not considered in the present study. Such variables as reading strategies, personal learning styles, personal experience in reading, including the amount of reading done on a daily basis and the type of material read, subjects' attitudes towards the tasks performed, and so forth, are part of each reader's background that may readily affect his/her performance on any given text.

(4) Language of recall protocols. The results obtained may have been affected by the fact that FL subjects had to write their recalls either in French, their L2, or in English, their FL. For some reason, some of them felt compelled to write their recall protocols in English, in spite of their limited language proficiency, and in spite of the choice that they were given to use either French or English. This may have resulted in poorer recalls than those written in French. On the other hand, both the L1 and L2 groups had the choice to write their protocols in their native languages, and the L1 had the advantage of both reading and writing their recalls in their native language.

(5) Global structure. The results obtained for global structure may have been affected by the fact that the explanations provided for the different structures were not sufficiently clear for subjects, or that for lack of time the subjects did not bother to read those explanations carefully enough. It would also be interesting to investigate how training

sessions in these structures would affect subjects' identification of the global structures of the texts and the amount and type of information that they would recall.

(6) Results of Background S for both L1 and L2 subjects. The small number of science subjects, compared to humanities subjects, in both L1 and L2 groups certainly may have affected the results of Background S and the results of the group as a whole. An equal number of science and humanities subjects would possibly have revealed different inter-background group results for L1 and L2.

(7) Number of subjects. The small number of L1 and L2 subjects, compared to FL subjects may have affected the results obtained for the three linguistic groups involved.

APPENDIX A**TABLES**

Table 3. ANOVA – Repeated Measures – for Interaction Between Recall and Background (Between Factor)

Grouping Factors	Repeated Measure	DF	Sum of Squares	Mean Square	F-Value	P-Value
Gp S/E-All	SC vs HU (Tot)	1	2753.12	2753.12	60.31	<.0001
Gp S/E-All	SC vs HU (P1)	1	9835.38	9835.38	37.40	<.0001
Gp S/E-All	SC vs HU (P2)	1	2372.21	2372.21	30.83	<.0001
Gp S/E-All	SC vs HU (P3)	1	854.72	854.72	12.23	.0006
Gp S-All	S vs F (Tot)	1	1405.77	1405.77	32.98	<.0001
Gp S-All	S vs F (P1)	1	3894.84	3894.84	21.12	<.0001
Gp S-All	S vs F (P2)	1	1837.80	1837.80	23.65	<.0001
Gp E-All	E vs M (Tot)	1	1327.31	1327.31	26.68	<.0001
Gp E-All	E vs M (P1)	1	5215.07	5215.07	17.13	<.0001
Gp E-All	E vs M (P2)	1	716.86	716.86	9.53	.002
Gp E-All	E vs M (P3)	1	846.50	846.50	17.65	<.0001
Gp E/S-L1	SC vs HU (P3)	1	501.04	501.04	4.10	.05
Gp E-L1	E vs M (P3)	1	836.05	836.05	12.20	.005
Gp E/S-FL	SC vs HU (Tot)	1	1945.93	1945.93	48.76	<.0001
Gp E/S-FL	SC vs HU (P1)	1	7057.06	7057.06	24.88	<.001
Gp E/S-FL	SC vs HU (P2)	1	1597.09	1597.09	26.00	<.0001
Gp E/S-FL	SC vs HU (P3)	1	731.71	731.71	14.36	.0002
Gp S-FL	S vs F (Tot)	1	706.31	706.31	19.69	<.0001
Gp S-FL	S vs F (P1)	1	1647.05	1647.05	8.00	.006
Gp S-FL	S vs F (P2)	1	840.16	840.16	13.27	.0005
Gp S-FL	S vs F (P3)	1	321.84	321.84	5.54	.02
Gp E-FL	E vs M (Tot)	1	1277.32	1277.32	28.85	<.0001
Gp E-FL	E vs M (P1)	1	6176.30	6176.30	20.11	<.0001
Gp E-FL	E vs M (P2)	1	750.15	750.15	12.93	.0006
Gp E-FL	E vs M (P3)	1	339.62	339.62	10.47	.0018
GpE/SFL/L2	SC vs HU (Tot)	1	2470.93	2470.93	58.24	<.0001
GpE/SFL/L2	SC vs HU (P1)	1	9237.59	9237.59	34.19	<.0001
GpE/SFL/L2	SC vs HU (P2)	1	2223.12	2223.12	32.49	<.0001
GpE/SFL/L2	SC vs HU (P3)	1	606.22	606.22	9.75	.002
Gp S FL/L2	S vs F (Tot)	1	1125.52	1125.52	27.85	<.0001
Gp S FL/L2	S vs F (P1)	1	3176.47	3176.47	16.36	.0001
Gp S FL/L2	S vs F (P2)	1	1414.94	1414.94	18.76	<.0001
Gp E FL/L2	E vs M (Tot)	1	1343.79	1343.79	29.50	<.0001
Gp E FL/L2	E vs M (P1)	1	5775.58	5775.58	18.65	<.0001
Gp E FL/L2	E vs M (P2)	1	868.52	868.52	14.18	.0003
Gp E FL/L2	E vs M (P3)	1	473.01	473.01	12.19	.0008

Table 4. ANOVA – Repeated Measures – for Interaction Between Recall and Proficiency
(Between Factor)

Grouping Factors	Repeated Measure	DF	Sum of Squares	Mean Square	F-Value	P-Value
Gp E/S FL	SC vs HU (P1)	2	1635.36	817.68	2.61	.07
GpE/SFL/L2	SC vs HU (Tot)	2	374.80	187.40	3.38	.03
GpE/SFL/L2	SC vs HU (P1)	2	3000.58	1500.29	4.84	.009
Gp S-FL/L2	S vs F (Tot)	2	308.83	154.41	3.05	.05
Gp S-FL/L2	S vs F (P1)	2	1385.29	692.64	3.17	.04
Gp S-FL/L2	S vs F (P3)	2	570.01	285.00	3.30	.04
GpE/SFLBH	SC vs HU (Tot)	1	132.34	132.34	3.64	.06
GpE/SFLBH	SC vs HU (P1)	1	1342.63	1342.63	6.10	.01
Gp S-FL BH	S vs F (Tot)	1	128.51	128.51	3.34	.07
Gp S-FL BH	S vs F (P1)	1	1033.16	1033.16	5.74	.02
Gp E/S-FL/L2 BH	SC vs HU (P1)	1	1716.44	1716.44	7.62	.007
GpS FL/L2 BH	S vs F (Tot)	1	149.54	149.54	3.31	.07
Gp S FL/L2BH	S vs F (P1)	1	1664.71	1664.71	10.72	.001
Gp E/SFLBS	SC vs HU (Tot)	2	575.02	287.51	8.06	.0007
Gp E/SFLBS	SC vs HU (P1)	2	3180.52	1590.26	5.86	.004
Gp E/SFLBS	SC vs HU (P2)	2	290.29	145.14	2.78	.06
Gp S FL BS	S vs F (Tot)	2	287.12	143.56	6.00	.006
Gp S FL BS	S vs F (P1)	2	1043.10	521.55	2.78	.07
Gp S FL BS	S vs F (P4)	2	323.83	161.19	6.97	.003
Gp E FL BS	E vs M (Tot)	2	619.33	309.67	7.88	.006
Gp E FL BS	E vs M (P1)	2	3708.19	1854.09	7.29	.002
Gp E FL BS	E vs M (P2)	2	442.20	221.10	4.23	.02

Table 5. Paired t-test – for Interaction Between Recall and Propositional Structure (Between Factor) for All Subjects

Grouping Factors	Variables	Mean Diff	DF	T-Value	P-Value
Gp S/E-All	SC1 vs SC2	11.10	191	8.14	<.0001
Gp S/E-All	SC1 vs SC3	21.32	191	13.62	<.0001
Gp S/E-All	SC1 vs SC4	27.70	191	16.49	<.0001
Gp S/E-All	SC2 vs SC3	10.21	191	12.70	<.0001
Gp S/E-All	SC2 vs SC4	16.59	191	16.27	<.0001
Gp S/E-All	SC3 vs SC4	6.38	191	8.78	<.0001
Gp S/E-All	HU1 vs HU2	11.93	191	10.52	<.0001
Gp S/E-All	HU1 vs HU3	20.97	191	15.81	<.0001
Gp S/E-All	HU1 vs HU4	26.33	191	18.43	<.0001
Gp S/E-All	HU2 vs HU3	9.03	191	10.31	<.0001
Gp S/E-All	HU2 vs HU4	14.40	191	14.56	<.0001
Gp S/E-All	HU3 vs HU4	5.36	191	6.28	<.0001
Gp S-All	S1 vs S2	3.96	97	2.47	.01
Gp S-All	S1 vs S3	12.82	97	6.94	<.0001
Gp S-All	S1 vs S4	19.99	97	9.70	<.0001
Gp S-All	S2 vs S3	8.86	97	8.07	<.0001
Gp S-All	S2 vs S4	16.03	97	11.93	<.0001
Gp S-All	S3 vs S4	7.17	97	7.95	<.0001
Gp S-All	F1 vs F2	12.44	97	8.60	<.0001
Gp S-All	F1 vs F3	22.77	97	13.16	<.0001
Gp S-All	F1 vs F4	27.12	97	16.14	<.0001
Gp S-All	F2 vs F3	10.20	97	7.52	<.0001
Gp S-All	F2 vs F4	14.47	97	11.15	<.0001
Gp S-All	F3 vs F4	4.33	97	3.39	.001
Gp E-All	E1 vs E2	18.56	93	9.48	<.0001
Gp E-All	E1 vs E3	30.18	93	13.61	<.0001
Gp E-All	E1 vs E4	35.74	93	14.76	<.0001
Gp E-All	E2 vs E3	11.62	93	9.97	<.0001
Gp E-All	E2 vs E4	17.18	93	11.11	<.0001
Gp E-All	E3 vs E4	5.55	93	4.84	<.0001
Gp E-All	M1 vs M2	11.62	93	6.58	<.0001
Gp E-All	M1 vs M3	19.45	93	9.59	<.0001
Gp E-All	M1 vs M4	25.95	93	11.20	<.0001
Gp E-All	M2 vs M3	7.82	93	7.07	<.0001
Gp E-All	M2 vs M4	14.32	93	9.50	<.0001
Gp E-All	M3 vs M4	6.49	93	5.70	<.0001

Table 6. Paired t-test – for Interaction Between Recall and Propositional Structure
(Between Factor) for L1 Group

Grouping Factors	Variables	Mean Diff	DF	T-Value	P-Value
Gp S/E-L1	SC1 vs SC2	13.74	23	3.03	.0059
Gp S/E-L1	SC1 vs SC3	28.54	23	5.83	<.0001
Gp S/E-L1	SC1 vs SC4	41.93	23	7.25	<.0001
Gp S/E-L1	SC2 vs SC3	14.80	23	5.32	<.0001
Gp S/E-L1	SC2 vs SC4	28.19	23	8.73	<.0001
Gp S/E-L1	SC3 vs SC4	13.38	23	5.42	<.0001
Gp S/E-L1	HU1 vs HU2	11.77	23	3.55	.0017
Gp S/E-L1	HU1 vs HU3	31.41	23	7.82	<.0001
Gp S/E-L1	HU1 vs HU4	37.50	23	9.54	<.0001
Gp S/E-L1	HU2 vs HU3	19.63	23	6.50	<.0001
Gp S/E-L1	HU2 vs HU4	25.72	23	8.21	<.0001
Gp S/E-L1	HU3 vs HU4	6.09	23	2.16	.04
Gp S-L1	S1 vs S3	16.78	10	2.41	.03
Gp S-L1	S1 vs S4	23.96	10	2.74	.002
Gp S-L1	S2 vs S3	15.99		3.65	.004
Gp S-L1	S2 vs S4	7.18	10	2.75	.02
Gp S-L1	S3 vs S4	7.17	10	7.95	<.0001
Gp S-L1	F1 vs F3	29.17	10	5.07	.0005
Gp S-L1	F1 vs F4	31.93	10	5.96	.0001
Gp S-L1	F2 vs F3	21.04	10	4.50	.001
Gp S-L1	F2 vs F4	23.80	10	5.83	.0002
Gp E-L1	E1 vs E2	24.70	12	4.86	.0004
Gp E-L1	E1 vs E3	38.50	12	6.74	<.0001
Gp E-L1	E1 vs E4	57.14	12	12.06	<.0001
Gp E-L1	E2 vs E3	13.80	12	3.73	.002
Gp E-L1	E2 vs E4	32.44	12	9.94	<.0001
Gp E-L1	E3 vs E4	18.63	12	5.44	.0001
Gp E-L1	M1 vs M2	14.85	12	2.98	.01
Gp E-L1	M1 vs M3	33.30	12	5.80	<.0001
Gp E-L1	M1 vs M4	42.20	12	7.65	<.0001
Gp E-L1	M2 vs M3	18.44	12	4.53	.0007
Gp E-L1	M2 vs M4	27.34	12	5.77	<.0001
Gp E-L1	M3 vs M4	8.90	12	2.57	.02

Table 7. Paired t-test – for Interaction Between Recall and Propositional Structure
(Between Factor) for L2 Group

Grouping Factors	Variables	Mean Diff	DF	T-Value	P-Value
Gp S/E-L2	SC1 vs SC3	13.45	22	2.45	.02
Gp S/E-L2	SC1 vs SC4	23.17	22	3.80	.001
Gp S/E-L2	SC2 vs SC3	10.50	22	3.62	.001
Gp S/E-L2	SC2 vs SC4	20.23	22	5.40	<.0001
Gp S/E-L2	SC3 vs SC4	9.72	22	3.61	.001
Gp S/E-L2	HU1 vs HU2	9.96	22	3.46	.002
Gp S/E-L2	HU1 vs HU3	25.63	22	6.38	<.0001
Gp S/E-L2	HU1 vs HU4	30.99	22	8.11	<.0001
Gp S/E-L2	HU2 vs HU3	15.66	22	5.87	<.0001
Gp S/E-L2	HU2 vs HU4	21.03	22	7.21	<.0001
Gp S-L2	S2 vs S3	6.63	14	2.09	.05
Gp S-L2	S2 vs S4	12.43	14	3.33	.004
Gp S-L2	S3 vs S4	5.80	14	2.31	.03
Gp S-L2	F1 vs F2	11.13	14	3.09	.007
Gp S-L2	F1 vs F3	30.40	14	6.84	<.0001
Gp S-L2	F1 vs F4	28.39	14	7.24	<.0001
Gp S-L2	F2 vs F3	19.26	14	6.07	<.0001
Gp S-L2	F2 vs F4	17.26	14	4.89	.0002
Gp E-L2	E1 vs E2	16.84	7	2.38	.04
Gp E-L2	E1 vs E3	34.61	7	3.75	.007
Gp E-L2	E1 vs E4	51.70	7	7.13	.0002
Gp E-L2	E2 vs E3	17.76	7	3.43	.01
Gp E-L2	E2 vs E4	34.85	7	6.63	.0003
Gp E-L2	E3 vs E4	17.08	7	3.11	.01
Gp E-L2	M1 vs M3	16.69	7	2.26	.05
Gp E-L2	M1 vs M4	35.87	7	4.31	.003
Gp E-L2	M2 vs M4	28.11	7	6.40	.0004
Gp E-L2	M3 vs M4	19.18	7	7.09	.0002

Table 8. Paired t-test – for Interaction Between Recall and Propositional Structure
(Between Factor) for FL Group

Grouping Factors	Variables	Mean Diff	DF	T-Value	P-Value
Gp S/E-FL	SC1 vs SC2	11.96	144	7.96	<.0001
Gp S/E-FL	SC1 vs SC3	21.37	144	12.75	<.0001
Gp S/E-FL	SC1 vs SC4	26.06	144	15.31	<.0001
Gp S/E-FL	SC2 vs SC3	9.40	144	11.25	<.0001
Gp S/E-FL	SC2 vs SC4	14.10	144	14.11	<.0001
Gp S/E-FL	SC3 vs SC4	4.69	144	6.61	<.0001
Gp S/E-FL	HU1 vs HU2	12.27	144	9.24	<.0001
Gp S/E-FL	HU1 vs HU3	18.50	144	12.82	<.0001
Gp S/E-FL	HU1 vs HU4	23.75	144	14.70	<.0001
Gp S/E-FL	HU2 vs HU3	6.22	144	7.43	<.0001
Gp S/E-FL	HU2 vs HU4	11.47	144	11.49	<.0001
Gp S/E-FL	HU3 vs HU4	5.25	144	6.00	<.0001
Gp S-FL	S1 vs S2	6.20	71	3.47	.0009
Gp S-FL	S1 vs S3	14.43	71	7.29	<.0001
Gp S-FL	S1 vs S4	21.89	71	10.22	<.0001
Gp S-FL	S2 vs S3	8.23	71	7.25	<.0001
Gp S-FL	S2 vs S4	15.69	71	11.27	<.0001
Gp S-FL	S3 vs S4	7.45	71	7.10	<.0001
Gp S-FL	F1 vs F2	13.39	70	7.82	<.0001
Gp S-FL	F1 vs F3	20.14	69	10.51	<.0001
Gp S-FL	F1 vs F4	26.11	70	13.16	<.0001
Gp S-FL	F2 vs F3	6.61	70	4.86	<.0001
Gp S-FL	F2 vs F4	12.47	71	8.83	<.0001
Gp S-FL	F3 vs F4	5.91	70	4.53	<.0001
Gp E-FL	E1 vs E2	17.65	72	7.92	<.0001
Gp E-FL	E1 vs E3	28.21	72	11.47	<.0001
Gp E-FL	E1 vs E4	30.18	72	11.77	<.0001
Gp E-FL	E2 vs E3	10.56	72	8.66	<.0001
Gp E-FL	E2 vs E4	12.52	72	8.83	<.0001
Gp E-FL	E3 vs E4	1.96	72	2.31	.02
Gp E-FL	M1 vs M2	11.47	72	5.64	<.0001
Gp E-FL	M1 vs M3	17.29	72	7.94	<.0001
Gp E-FL	M1 vs M4	21.97	72	8.78	<.0001
Gp E-FL	M2 vs M3	5.81	72	5.72	<.0001
Gp E-FL	M2 vs M4	10.49	72	7.42	<.0001
Gp E-FL	M3 vs M4	4.67	72	3.92	.0002

Table 9. Paired t-test – for Interaction Between Recall and Propositional Structure
(Between Factor) for FL/L2 Groups Combined

Grouping Factors	Variables	Mean Diff	DF	T-Value	P-Value
Gp S/E-FL/L2	SC1 vs SC2	10.73	167	7.55	<.0001
Gp S/E-FL/L2	SC1 vs SC3	20.29	167	12.39	<.0001
Gp S/E-FL/L2	SC1 vs SC4	25.67	167	15.25	<.0001
Gp S/E-FL/L2	SC2 vs SC3	9.55	167	11.65	<.0001
Gp S/E-FL/L2	SC2 vs SC4	14.94	167	14.77	<.0001
Gp S/E-FL/L2	SC3 vs SC4	5.38	167	1.44	<.0001
Gp S/E-FL/L2	HU1 vs HU2	11.96	167	9.87	<.0001
Gp S/E-FL/L2	HU1 vs HU3	19.47	167	14.22	<.0001
Gp S/E-FL/L2	HU1 vs HU4	24.74	167	16.52	<.0001
Gp S/E-FL/L2	HU2 vs HU3	7.51	167	8.90	<.0001
Gp S/E-FL/L2	HU2 vs HU4	12.78	167	13.04	<.0001
Gp S/E-FL/L2	HU3 vs HU4	5.26	167	5.89	<.0001
Gp S-FL/L2	S1 vs S2	4.36	86	2.64	.009
Gp S-FL/L2	S1 vs S3	12.32	86	6.49	<.0001
Gp S-FL/L2	S1 vs S4	19.49	86	9.46	<.0001
Gp S-FL/L2	S2 vs S3	7.95	86	7.37	<.0001
Gp S-FL/L2	S2 vs S4	15.13	86	11.49	<.0001
Gp S-FL/L2	S3 vs S4	7.17	86	7.42	<.0001
Gp S-FL/L2	F1 vs F2	13.00	85	8.43	<.0001
Gp S-FL/L2	F1 vs F3	21.95	84	12.18	<.0001
Gp S-FL/L2	F1 vs F4	26.51	85	14.99	<.0001
Gp S-FL/L2	F2 vs F3	8.81	85	6.54	<.0001
Gp S-FL/L2	F2 vs F4	13.29	86	10.05	<.0001
Gp S-FL/L2	F3 vs F4	4.53	85	3.42	<.0001
Gp E-FL/L2	E1 vs E2	17.57	80	8.32	<.0001
Gp E-FL/L2	E1 vs E3	28.85	80	12.10	<.0001
Gp E-FL/L2	E1 vs E4	32.30	80	12.86	<.0001
Gp E-FL/L2	E2 vs E3	11.27	80	9.22	<.0001
Gp E-FL/L2	E2 vs E4	14.73	80	9.22	<.0001
Gp E-FL/L2	E3 vs E4	3.45	80	3.30	.001
Gp E-FL/L2	M1 vs M2	11.11	80	5.86	<.0001
Gp E-FL/L2	M1 vs M3	17.23	80	8.30	<.0001
Gp E-FL/L2	M1 vs M4	23.34	80	9.62	<.0001
Gp E-FL/L2	M2 vs M3	6.12	80	6.14	<.0001
Gp E-FL/L2	M2 vs M4	12.22	80	8.38	<.0001
Gp E-FL/L2	M3 vs M4	6.10	80	5.07	<.0001

Table 10. Paired t-test – for Interaction Between Recall and Propositional Structure
(Between Factor) for All Subjects, Background H

Grouping Factors	Variables	Mean Diff	DF	T-Value	P-Value
Gp S/E-All-BH	SC1 vs SC2	8.03	113	4.51	<.0001
Gp S/E-All-BH	SC1 vs SC3	19.27	113	9.00	<.0001
Gp S/E-All-BH	SC1 vs SC4	25.33	113	10.91	<.0001
Gp S/E-All-BH	SC2 vs SC3	11.24	113	10.24	<.0001
Gp S/E-All-BH	SC2 vs SC4	17.29	113	12.20	<.0001
Gp S/E-All-BH	SC3 vs SC4	6.05	113	6.44	<.0001
Gp S/E-All-BH	HU1 vs HU2	13.12	113	8.22	<.0001
Gp S/E-All-BH	HU1 vs HU3	24.83	113	14.07	<.0001
Gp S/E-All-BH	HU1 vs HU4	31.97	113	16.90	<.0001
Gp S/E-All-BH	HU2 vs HU3	11.71	113	10.16	<.0001
Gp S/E-All-BH	HU2 vs HU4	18.85	113	14.85	<.0001
Gp S/E-All-BH	HU3 vs HU4	7.14	113	6.02	<.0001
Gp S-All-BH	S1 vs S3	10.63	60	4.40	<.0001
Gp S-All-BH	S1 vs S4	16.29	60	6.15	<.0001
Gp S-All-BH	S2 vs S3	9.61	60	6.59	<.0001
Gp S-All-BH	S2 vs S4	15.90	60	8.31	<.0001
Gp S-All-BH	S3 vs S4	6.28	60	5.23	<.0001
Gp S-All-BH	F1 vs F2	11.48	60	5.90	<.0001
Gp S-All-BH	F1 vs F3	25.52	60	11.50	<.0001
Gp S-All-BH	F1 vs F4	30.14	60	14.40	<.0001
Gp S-All-BH	F2 vs F3	14.04	60	8.22	<.0001
Gp S-All-BH	F2 vs F4	18.66	60	11.74	<.0001
Gp S-All-BH	F3 vs F4	4.62	60	2.65	.01
Gp E-All-BH	E1 vs E2	17.57	80	8.32	<.0001
Gp E-All-BH	E1 vs E3	28.85	80	12.10	<.0001
Gp E-All-BH	E1 vs E4	32.30	80	12.86	<.0001
Gp E-All-BH	E2 vs E3	11.27	80	9.22	<.0001
Gp E-All-BH	E2 vs E4	14.73	80	9.22	<.0001
Gp E-All-BH	E3 vs E4	3.45	80	3.30	.001
Gp E-All-BH	M1 vs M2	11.11	80	5.86	<.0001
Gp E-All-BH	M1 vs M3	17.23	80	8.30	<.0001
Gp E-All-BH	M1 vs M4	23.34	80	9.62	<.0001
Gp E-All-BH	M2 vs M3	6.12	80	6.14	<.0001
Gp E-All-BH	M2 vs M4	12.22	80	8.38	<.0001
Gp E-All-BH	M3 vs M4	6.10	80	5.07	<.0001

Table 11. Paired t-test – for Interaction Between Recall and Propositional Structure
(Between Factor) for L1 Group, Background H

Grouping Factors	Variables	Mean Diff	DF	T-Value	P-Value
Gp S/E-L1-BH	SC1 vs SC2	10.36	18	2.07	.05
Gp S/E-L1-BH	SC1 vs SC3	27.47	18	4.62	.0002
Gp S/E-L1-BH	SC1 vs SC4	37.11	18	5.51	<.0001
Gp S/E-L1-BH	SC2 vs SC3	17.11	18	5.75	<.0001
Gp S/E-L1-BH	SC2 vs SC4	26.75	18	7.49	<.0001
Gp S/E-L1-BH	SC3 vs SC4	9.64	18	3.98	.0009
Gp S/E-L1-BH	HU1 vs HU2	11.34	18	3.22	.004
Gp S/E-L1-BH	HU1 vs HU3	30.65	18	6.63	<.0001
Gp S/E-L1-BH	HU1 vs HU4	36.43	18	7.76	<.0001
Gp S/E-L1-BH	HU2 vs HU3	19.31	18	6.14	<.0001
Gp S/E-L1-BH	HU2 vs HU4	25.08	18	8.20	<.0001
Gp S-L1-BH	S1 vs S4	19.15	9	2.27	.04
Gp S-L1-BH	S2 vs S3	15.30	9	3.20	.01
Gp S-L1-BH	S2 vs S4	20.33	9	3.72	.004
Gp S-L1-BH	S3 vs S4	5.03	9	3.08	.01
Gp S-L1-BH	F1 vs F3	30.98	9	5.13	.0006
Gp S-L1-BH	F2 vs F4	30.32	9	5.37	.0004
Gp S-L1-BH	F2 vs F3	23.41	9	5.25	.0005
Gp S-L1-BH	F2 vs F4	22.74	9	5.22	.0005
Gp E-L1-BH	E1 vs E2	23.18	8	4.17	.003
Gp E-L1-BH	E1 vs E3	42.30	8	5.83	.0004
Gp E-L1-BH	E1 vs E4	57.07	8	9.07	<.0001
Gp E-L1-BH	E2 vs E3	19.11	8	5.41	.0006
Gp E-L1-BH	E2 vs E4	33.88	8	10.12	<.0001
Gp E-L1-BH	E3 vs E4	14.76	8	3.45	.008
Gp E-L1-BH	M1 vs M2	15.52	8	2.91	.01
Gp E-L1-BH	M1 vs M3	30.28	8	4.05	.003
Gp E-L1-BH	M1 vs M4	43.21	8	5.89	.0004
Gp E-L1-BH	M2 vs M3	14.75	8	3.55	.007
Gp E-L1-BH	M2 vs M4	27.69	8	6.33	.0002
Gp E-L1-BH	M3 vs M4	12.93	8	3.34	.01

Table 12. Paired t-test – for Interaction Between Recall and Propositional Structure
(Between Factor) for L2 Group, Background H

Grouping Factors	Variables	Mean Diff	DF	T-Value	P-Value
Gp S/E-L2-BH	SC1 vs SC3	13.56	21	2.36	.02
Gp S/E-L2-BH	SC1 vs SC4	21.84	21	3.50	<.0001
Gp S/E-L2-BH	SC2 vs SC3	10.51	21	3.46	.002
Gp S/E-L2-BH	SC2 vs SC4	18.79	21	5.19	<.0001
Gp S/E-L2-BH	SC3 vs SC4	8.28	21	3.48	.002
Gp S/E-L2-BH	HU1 vs HU2	10.50	21	3.54	.001
Gp S/E-L2-BH	HU1 vs HU3	27.02	21	6.89	<.0001
Gp S/E-L2-BH	HU1 vs HU4	32.14	21	8.42	<.0001
Gp S/E-L2-BH	HU2 vs HU3	16.57	21	6.30	<.0001
Gp S/E-L2-BH	HU2 vs HU4	21.64	21	7.24	<.0001
Gp S-L2-BH	S2 vs S3	6.63	14	2.09	.05
Gp S-L2-BH	S2 vs S4	12.43	14	3.33	.004
Gp S-L2-BH	S3 vs S4	5.80	14	2.31	.03
Gp S-L2-BH	F1 vs F2	11.13	14	3.09	.007
Gp S-L2-BH	F1 vs F3	30.40	14	6.84	<.0001
Gp S-L2-BH	F1 vs F4	28.39	14	7.24	<.0001
Gp S-L2-BH	F2 vs F3	19.26	14	6.07	<.0001
Gp S-L2-BH	F2 vs F4	17.26	14	4.89	.0002
Gp E-L2-BH	E1 vs E2	19.16	6	2.48	.04
Gp E-L2-BH	E1 vs E3	37.99	6	3.84	.008
Gp E-L2-BH	E1 vs E4	51.57	6	6.16	.0008
Gp E-L2-BH	E2 vs E3	18.82	6	3.22	.01
Gp E-L2-BH	E2 vs E4	32.41	6	6.03	.0009
Gp E-L2-BH	E3 vs E4	13.58	6	2.79	.03
Gp E-L2-BH	M1 vs M3	19.93	6	2.61	.04
Gp E-L2-BH	M1 vs M4	40.16	6	4.89	.002
Gp E-L2-BH	M2 vs M3	10.79	6	2.58	.04
Gp E-L2-BH	M2 vs M4	31.02	6	8.19	.0002
Gp E-L2-BH	M3 vs M4	20.23	6	7.02	.0004

Table 13. Paired t-test – for Interaction Between Recall and Propositional Structure
(Between Factor) for FL Group, Background H

Grouping Factors	Variables	Mean Diff	DF	T-Value	P-Value
Gp S/E-FL-BH	SC1 vs SC2	8.92	72	4.20	<.0001
Gp S/E-FL-BH	SC1 vs SC3	18.86	72	7.94	<.0001
Gp S/E-FL-BH	SC1 vs SC4	23.31	72	9.33	<.0001
Gp S/E-FL-BH	SC2 vs SC3	9.94	72	8.35	<.0001
Gp S/E-FL-BH	SC2 vs SC4	14.38	72	6.22	<.0001
Gp S/E-FL-BH	SC3 vs SC4	4.44	72	9.10	<.0001
Gp S/E-FL-BH	HU1 vs HU2	14.37	72	6.70	<.0001
Gp S/E-FL-BH	HU1 vs HU3	22.64	72	10.46	<.0001
Gp S/E-FL-BH	HU1 vs HU4	30.76	72	12.59	<.0001
Gp S/E-FL-BH	HU2 vs HU3	8.27	72	6.68	<.0001
Gp S/E-FL-BH	HU2 vs HU4	16.39	72	10.81	<.0001
Gp S/E-FL-BH	HU3 vs HU4	8.12	72	6.34	<.0001
Gp S-FL-BH	S1 vs S3	13.20	35	4.60	<.0001
Gp S-FL-BH	S1 vs S4	20.04	35	5.93	<.0001
Gp S-FL-BH	S2 vs S3	9.28	35	5.86	<.0001
Gp S-FL-BH	S2 vs S4	16.12	35	6.65	<.0001
Gp S-FL-BH	S3 vs S4	6.83	35	3.99	.0003
Gp S-FL-BH	F1 vs F2	12.71	35	4.74	<.0001
Gp S-FL-BH	F1 vs F3	21.97	35	8.01	<.0001
Gp S-FL-BH	F1 vs F4	30.82	35	11.00	<.0001
Gp S-FL-BH	F2 vs F3	9.62	35	4.82	<.0001
Gp S-FL-BH	F2 vs F4	18.11	35	9.36	<.0001
Gp S-FL-BH	F3 vs F4	8.84	35	4.49	.01
Gp E-FL-BH	E1 vs E2	13.79	36	4.28	<.0001
Gp E-FL-BH	E1 vs E3	24.38	36	6.81	<.0001
Gp E-FL-BH	E1 vs E4	26.50	36	7.28	<.0001
Gp E-FL-BH	E2 vs E3	10.58	36	5.92	<.0001
Gp E-FL-BH	E2 vs E4	12.70	36	6.24	<.0001
Gp E-FL-BH	M1 vs M2	15.98	36	4.77	<.0001
Gp E-FL-BH	M1 vs M3	23.28	36	6.92	<.0001
Gp E-FL-BH	M1 vs M4	30.71	36	7.65	<.0001
Gp E-FL-BH	M2 vs M3	7.30	36	4.62	<.0001
Gp E-FL-BH	M2 vs M4	14.73	36	6.34	<.0001
Gp E-FL-BH	M3 vs M4	7.42	36	4.44	<.0001

Table 14. Paired t-test – for Interaction Between Recall and Propositional Structure
(Between Factor) for FL/L2 Group, Background H

Grouping Factors	Variables	Mean Diff	DF	T-Value	P-Value
Gp S/E-FL/L2-BH	SC1 vs SC2	7.56	94	3.98	<.0001
Gp S/E-FL/L2-BH	SC1 vs SC3	17.64	94	7.82	<.0001
Gp S/E-FL/L2-BH	SC1 vs SC4	22.97	94	9.64	<.0001
Gp S/E-FL/L2-BH	SC2 vs SC3	10.07	94	8.79	<.0001
Gp S/E-FL/L2-BH	SC2 vs SC4	15.40	94	10.42	<.0001
Gp S/E-FL/L2-BH	SC3 vs SC4	5.33	94	5.29	<.0001
Gp S/E-FL/L2-BH	HU1 vs HU2	13.47	94	7.54	<.0001
Gp S/E-FL/L2-BH	HU1 vs HU3	23.66	94	12.49	<.0001
Gp S/E-FL/L2-BH	HU1 vs HU4	31.08	94	15.04	<.0001
Gp S/E-FL/L2-BH	HU2 vs HU3	10.19	94	8.64	<.0001
Gp S/E-FL/L2-BH	HU2 vs HU4	17.61	94	12.89	<.0001
Gp S/E-FL/L2-BH	HU3 vs HU4	7.42	94	5.70	<.0001
Gp S-FL/L2-BH	S1 vs S3	9.95	50	3.89	.0003
Gp S-FL/L2-BH	S1 vs S4	16.48	50	5.63	<.0001
Gp S-FL/L2-BH	S2 vs S3	8.50	50	5.87	<.0001
Gp S-FL/L2-BH	S2 vs S4	15.03	50	7.42	<.0001
Gp S-FL/L2-BH	S3 vs S4	6.53	50	4.65	<.0001
Gp S-FL/L2-BH	F1 vs F2	12.25	50	5.69	<.0001
Gp S-FL/L2-BH	F1 vs F3	24.45	50	10.30	<.0001
Gp S-FL/L2-BH	F1 vs F4	30.11	50	13.25	<.0001
Gp S-FL/L2-BH	F2 vs F3	12.20	50	6.96	<.0001
Gp S-FL/L2-BH	F2 vs F4	17.86	50	10.53	<.0001
Gp S-FL/L2-BH	F3 vs F4	5.65	50	2.89	.005
Gp E-FL/L2-BH	E1 vs E2	14.65	43	4.95	<.0001
Gp E-FL/L2-BH	E1 vs E3	26.54	43	7.74	<.0001
Gp E-FL/L2-BH	E1 vs E4	30.49	43	8.51	<.0001
Gp E-FL/L2-BH	E2 vs E3	11.89	43	6.63	<.0001
Gp E-FL/L2-BH	E2 vs E4	15.83	43	7.25	<.0001
Gp E-FL/L2-BH	M1 vs M2	14.89	43	5.04	<.0001
Gp E-FL/L2-BH	M1 vs M3	22.75	43	7.46	<.0001
Gp E-FL/L2-BH	M1 vs M4	32.21	43	8.89	<.0001
Gp E-FL/L2-BH	M2 vs M3	7.86	43	5.31	<.0001
Gp E-FL/L2-BH	M2 vs M4	17.32	43	7.79	<.0001
Gp E-FL/L2-BH	M3 vs M4	9.46	43	5.80	<.0001

Table 15. Paired t-test – for Interaction Between Recall and Propositional Structure
(Between Factor) for All Subjects, Background S

Grouping Factors	Variables	Mean Diff	DF	T-Value	P-Value
Gp S/E-All-BS	SC1 vs SC2	15.60	77	7.69	<.0001
Gp S/E-All-BS	SC1 vs SC3	24.31	77	10.94	<.0001
Gp S/E-All-BS	SC1 vs SC4	31.17	77	13.39	<.0001
Gp S/E-All-BS	SC2 vs SC3	8.70	77	7.59	<.0001
Gp S/E-All-BS	SC2 vs SC4	15.57	77	10.97	<.0001
Gp S/E-All-BS	SC3 vs SC4	6.86	77	5.94	<.0001
Gp S/E-All-BS	HU1 vs HU2	10.20	77	6.67	<.0001
Gp S/E-All-BS	HU1 vs HU3	15.32	77	8.35	<.0001
Gp S/E-All-BS	HU1 vs HU4	18.09	77	9.95	<.0001
Gp S/E-All-BS	HU2 vs HU3	5.12	77	4.17	<.0001
Gp S/E-All-BS	HU2 vs HU4	7.89	77	6.26	<.0001
Gp S/E-All-BS	HU3 vs HU4	2.77	77	2.4	.01
Gp S-All-BS	S1 vs S2	8.81	36	3.59	.001
Gp S-All-BS	S1 vs S3	16.42	36	5.90	<.0001
Gp S-All-BS	S1 vs S4	25.06	36	8.67	<.0001
Gp S-All-BS	S2 vs S3	7.61	36	4.64	<.0001
Gp S-All-BS	S2 vs S4	16.24	36	9.65	<.0001
Gp S-All-BS	S3 vs S4	8.63	36	6.53	<.0001
Gp S-All-BS	F1 vs F2	14.07	36	6.75	<.0001
Gp S-All-BS	F1 vs F3	17.99	36	6.92	<.0001
Gp S-All-BS	F1 vs F4	22.00	36	8.34	<.0001
Gp S-All-BS	F2 vs F3	3.70	36	2.06	.04
Gp S-All-BS	F2 vs F4	7.57	36	4.40	<.0001
Gp S-All-BS	F3 vs F4	3.84	36	2.13	.03
Gp E-All-BS	E1 vs E2	21.73	40	7.57	<.0001
Gp E-All-BS	E1 vs E3	31.42	40	10.40	<.0001
Gp E-All-BS	E1 vs E4	36.69	40	10.84	<.0001
Gp E-All-BS	E2 vs E3	9.68	40	6.03	<.0001
Gp E-All-BS	E2 vs E4	14.95	40	6.65	<.0001
Gp E-All-BS	E3 vs E4	5.27	40	2.88	.006
Gp E-All-BS	M1 vs M2	7.27	40	3.44	.001
Gp E-All-BS	M1 vs M3	13.54	40	5.13	<.0001
Gp E-All-BS	M1 vs M4	15.44	40	6.50	<.0001
Gp E-All-BS	M2 vs M3	6.27	40	3.66	.0007
Gp E-All-BS	M2 vs M4	8.17	40	4.42	<.0001

Table 16. Paired t-test – for Interaction Between Recall and Propositional Structure
(Between Factor) for FL Group, Background S

Grouping Factors	Variables	Mean Diff	DF	T-Value	P-Value
Gp S/E-FL-BS	SC1 vs SC2	15.05	71	7.23	<.0001
Gp S/E-FL-BS	SC1 vs SC3	23.91	71	10.20	<.0001
Gp S/E-FL-BS	SC1 vs SC4	28.86	71	12.64	<.0001
Gp S/E-FL-BS	SC2 vs SC3	8.86	71	7.52	<.0001
Gp S/E-FL-BS	SC2 vs SC4	13.80	71	11.24	<.0001
Gp S/E-FL-BS	SC3 vs SC4	4.94	71	5.38	<.0001
Gp S/E-FL-BS	HU1 vs HU2	10.15	71	6.61	<.0001
Gp S/E-FL-BS	HU1 vs HU3	14.30	71	8.00	<.0001
Gp S/E-FL-BS	HU1 vs HU4	16.64	71	9.43	<.0001
Gp S/E-FL-BS	HU2 vs HU3	4.15	71	3.83	.0003
Gp S/E-FL-BS	HU2 vs HU4	6.48	71	6.44	<.0001
Gp S/E-FL-BS	HU3 vs HU4	2.33	71	2.12	.03
Gp S-FL-BS	S1 vs S2	8.48	35	3.40	.001
Gp S-FL-BS	S1 vs S3	15.67	35	5.68	<.0001
Gp S-FL-BS	S1 vs S4	23.75	35	8.97	<.0001
Gp S-FL-BS	S2 vs S3	7.18	35	4.41	<.0001
Gp S-FL-BS	S2 vs S4	15.26	35	10.86	<.0001
Gp S-FL-BS	S3 vs S4	8.08	35	6.55	<.0001
Gp S-FL-BS	F1 vs F2	14.09	34	6.56	<.0001
Gp S-FL-BS	F1 vs F3	18.19	33	6.81	<.0001
Gp S-FL-BS	F1 vs F4	21.26	34	8.16	<.0001
Gp S-FL-BS	F2 vs F3	3.88	34	2.11	.04
Gp S-FL-BS	F2 vs F4	6.83	35	4.29	.0001
Gp E-FL-BS	E1 vs E2	21.61	35	7.26	<.0001
Gp E-FL-BS	E1 vs E3	32.15	35	9.78	<.0001
Gp E-FL-BS	E1 vs E4	33.96	35	9.56	<.0001
Gp E-FL-BS	E2 vs E3	10.54	35	6.28	<.0001
Gp E-FL-BS	E2 vs E4	12.34	35	6.16	<.0001
Gp E-FL-BS	M1 vs M2	6.85	35	3.35	<.0001
Gp E-FL-BS	M1 vs M3	11.14	35	4.68	<.0001
Gp E-FL-BS	M1 vs M4	12.98	35	6.11	<.0001
Gp E-FL-BS	M2 vs M3	4.29	35	3.45	.001
Gp E-FL-BS	M2 vs M4	6.13	35	4.90	<.0001

Table 17. ANOVA – Repeated Measures – for Interaction Between Recall and L1/L2
(Between Factor)

Grouping Factors	Repeated Measure	DF	Sum of Squares	Mean Square	F-Value	P-Value
Gp S/E-All	SC vs HU (Tot)	2	456.94	228.47	3.93	.02
Gp S/E-All	SC vs HU (P1)	2	1784.83	892.41	2.90	.05
Gp S/E-All	SC vs HU (P2)	2	757.94	378.97	4.41	.01
Gp S/E-All	SC vs HU (P4)	2	475.89	237.94	3.73	.02
Gp S-All	S vs F (Tot)	2	673.69	336.84	6.63	.002
Gp S-All	S vs F (P1)	2	2607.47	1303.73	6.51	.002
Gp S-All	S vs F (P2)	2	1006.04	503.02	5.76	.004
Gp E-All	E vs M (P4)	2	363.41	181.70	2.64	.07
Gp E/S-BS	SC vs HU (P2)	2	369.31	184.65	2.80	.06
Gp E/S-BS	SC vs HU (P3)	2	307.66	153.83	3.04	.05
Gp E/S-BS	SC vs HU (P4)	2	262.83	131.41	3.09	.05
Gp E BS	E vs M (P2)	2	531.66	265.83	3.36	.04
Gp E BS	E vs M (P3)	2	672.50	336.25	10.75	.0002
Gp E BS	E vs M (P4)	2	275.77	137.88	2.64	.08

APPENDIX B

TEXTS

Text S:

Science and Technology: Getting Up, Up, and Away

Human beings first travelled successfully through the air on November 21, 1783, carried in a hot-air balloon. The brothers Etienne and Joseph Montgolfier had invented the balloon after observing that smoke from fire always flows upward. They made a small silk bag, trapped smoke in it, and watched the bag rise to the ceiling. Many experiments with larger bags followed, since the brothers thought it was the smoke, not the hot air, that made things rise. Finally they came up with a balloon that could carry two people in the large basket suspended beneath it.

The story of people's attempts to fly is filled with examples of the advance of science through observations and experiments. Long before the Montgolfier brothers' breakthrough, people had been proposing different ways of achieving flight. Most of the suggestions imitated the flight of birds. Unfortunately, the use of flapping wings to provide lift and thrust needs many special adaptations which are not suitable for people's bodies or heavy objects.

Another problem with people's early ideas about flight was that they considered air to be nothing. The idea of gliding or floating in air depends on thinking of air as a fluid. After people recognized that air has mass and takes up space, they realized it was possible to raise an object through air by making it lighter than air. This is the reason why the first successful flight was in a lighter-than-air craft: the Montgolfier's hot-air balloon.

After the invention of the hot-air balloon, people had lift. But they also needed thrust if they were to avoid being at the mercy of the winds. Using their previous experience with water craft, early inventors tried sails, oars, and paddle wheels for propelling their balloons through the air. None of these methods worked.

Another characteristic of ships—a streamlined shape—proved more valuable in the development of flying machines. This kind of shape allows a fluid to flow over a surface more smoothly than any other shape. A

streamlined object can move faster through a fluid in response to a given amount of thrust than a non-streamlined object .

By the early 1800's, all the scientific theory needed for the design of a people-carrying airplane was known. A British engineer, Sir George Cayley, conducted many experiments with model gliders during the nineteenth century. The problem, he wrote, was "to make a surface support a given weight by the application of sufficient power to overcome the resistance of the air." Cayley had both the theory and the design. What he lacked was technology. The vital element—a light but powerful engine—was still 50 years away.

A German inventor, Otto Lilienthal, experimented in the 1890's with different glider designs. On one occasion, he managed to glide over 300m. The problem he worked on was how to control a heavy flying craft and keep it stable in flight. Lilienthal's experiments provided the basis for the design of the first powered aircraft.

People, problems, and products finally came together between the time of Lilienthal and the Wright brothers, Orville and Wilbur. During that period, many technological developments occurred. Geologists were unearthing vast supplies of petroleum. Chemists were learning how to unlock its energy. Metallurgists were developing high-strength steels and light-weight aluminium. All these people's products were used in the production of a light, powerful internal combustion engine. It was the technological advance essential for controlled, powered flight.

The Wright brothers had read about Lilienthal's experiments. They had also designed and tested gliders of their own. In 1903, they designed and flew the world's first practical powered aircraft. Their discovery, like any scientific advance, was based on the work of others. However, the Wright brothers themselves made an important discovery as well. They learned how to balance and steer a flying machine.

The history of the development of flight clearly illustrates the nature of scientific investigation; the interaction of science, technology, and society; and the importance of people in the scientific enterprise.

TEXT F:**The Feminization of Academe**

American colleges once devoted themselves almost exclusively to the preparation of young men for the ministry and teaching. By the middle of the nineteenth century this practice appeared to be placing colleges in ever greater financial trouble. As commercial growth agitated a country in the midst of rapid industrial expansion, the country's young men sought business success and shunned both the ministry and teaching. With declining enrollments, colleges faced three alternatives: they could go bankrupt, they could open their doors to women, or they could revise their curricula to cater to the needs of youth determined to exploit the possibilities of an industrial society.

Turning to women seemed natural enough to many, though there was little precedent for it. As men focused their attention on commercial success, women came increasingly to be seen as the guardians of culture. Because colleges had long been the repositories of culture in America, women and colleges seemed ideally suited to one another. When schools opened their doors, women flocked to them. Some seeking training for careers as teachers, a very few hoping to break the barrier of such traditionally male domains as the ministry or medicine, and many more searching for literacy and artistic fulfillment. It seemed a happy marriage.

But at the same time that the colleges were encouraging the enrollment of young women, they were revamping their curricula in the hope of recapturing their male audience. Through courses in political science, economics, medicine, law, and business administration, college administrators sought to convince the public of the colleges' utilitarian character. Many colleges, emulating the example of European institutions, transformed themselves into universities with graduate departments and professional schools and began to argue that science could speed economic and social development.

These curricular and institutional innovations proved tremendously successful, but the success was tinged with irony. By welcoming young

women at the same time that they were altering their curricula to appeal to young men, universities found themselves with a growing female student body dedicated to an educational ideal that the university was trying to abandon. The danger, as many saw it, was that women would overrun the university and jeopardize the reform effort.

In 1902 fear gripped many at the University of Chicago, who foresaw the imminent feminization of their school. One professor, economist J. Lawrence Laughlin, sought to reassure his colleagues. He was aware that in the ten years since the university's opening, the female enrollment had increased from 25 percent to 50 percent of the student body, but he predicted that once the university's scientific programs and professional schools became firmly established the trend would be reversed.

On one level, the concern over female enrollment at Chicago, as well as Laughlin's reassurances, reflected the new university's parochial desire for status; but on another level it reflected the pervasive fear of feminization that plagued American society in the early twentieth century. As the economic change of a rapidly industrializing society brought social dislocation, Americans clung ever more tenaciously to their most basic assumptions about sexual identity and fought any changes in accepted sex-role divisions.

Education played a singularly important role in this drama because the special circumstances of the development of the university placed American higher education at the fulcrum of social change. No sooner had higher education been opened to women as a relatively unnecessary pursuit in a commercial, industrializing society, than it became clear to many that education could make a significant contribution to that industrialization. But by the time education's potential value was perceived, women had flooded the schools, filling 50 percent of the student body at many schools by 1900. Society was faced with two alternatives. It could acquiesce in the surrender of the education to women and thereby protect the separation of sexual spheres, but suffer the loss of a valuable institution for male training, or it could continue trying to make higher education more attractive to men and risk the danger to sex-role divisions posed by sexual integration. Apprehensively, society chose the latter alternative and accepted coeducation.

TEXT E:**Evolution: Two Different Views**

Jean Baptiste de Lamarck believed that every organism has its position on the “scale of nature”—with humans, of course firmly at the top, thereby revealed as the highest form of life. Lamarck also made the important observation that the fossil animals found in older layers of rock seemed to be somewhat simpler than those in more recently deposited rock. This difference suggested to him that the older ones had gradually given rise to the more recent ones (or become “higher”). He couldn’t immediately account for how such changes might have arisen, but he finally surmised that there was some “force of life” that caused an organism to generate new structures or organs to meet its biological needs. Once formed, such structures continued to develop through use, and their development in the parents was inherited by the offspring. In this way, he said, the structure became perfected in succeeding generations.

Lamarck’s most famous example of such change was his theory of how the giraffe developed a long neck. He maintained that the long neck evolved as each generation of giraffes stretched their necks in an effort to reach the topmost branches of trees. He argued that this effort altered the animals’ heredity materials so that a longer neck was passed along to the offspring. This example did not bring him great respect. In fact, it brought guffaws of derision and even today it is cited as a classic case of scientific error.

Whereas Lamarck’s arguments did little to persuade his lecture audiences, he did create some lively discussions in intellectual circles. Society at large, however, held to the firm conviction that each form of life had arisen through special creation.

In his readings, Darwin came across an old essay by the Reverend Thomas Malthus (1766-1834) that was probably the first clear warning of the dangers of human overpopulation. Malthus’ paper set Darwin to thinking. He calculated that even a pair of elephants, notoriously slow breeders, could produce 19 million progeny in only 750 years. Yet it seemed that through the years, the number of elephants on earth stayed about the same. Something was obviously interfering with their reproductive output. But was that “something” exerting an equal effect on all elephants, or did individuals differ in their ability to reproduce? Were some less successful at leaving offspring?

And if this were the case, Darwin wondered what factors determined which ones were to be successful.

Charles Darwin's ideas came to him in part because of his background as a country gentleman. He was familiar with the principles of artificial selection; he knew that through careful selection of animals for mating, breeders were able to accentuate desired characteristics in the offspring. For example, by mating only the offspring of the greatest milk producers, breeders could develop high-yield dairy cattle. And by carefully selecting only the offspring of good laying hens for breeding, they could eventually produce hens that were veritable egg-laying machines.

Darwin envisioned some sort of process of natural selection analogous to the artificial selection imposed by the breeders. However, he suggested that in nature, the animals that would reproduce were selected by the environment. He suggested that natural selection would be far less efficient than artificial selection since individuals with only somewhat less-desirable characteristics might be able to produce at least some offspring, and thus their traits would take longer to disappear from the population. (Of course, those individuals with traits totally out of keeping with their environment would leave no offspring at all; hence, those traits would more quickly disappear from the population.) On the other side of the coin, the traits of those individuals with some reproductive advantage could be expected to increase through the generations.

Natural selection, then came to be defined as the process through which those traits that encourage survival and reproduction are perpetuated and favored in a population as they replace those traits that are less reproductively advantageous.

Since the basis of natural selection depended on the fact that members of the population are all different, how do we explain why individuals in the population do, in fact, differ? In other words, why are the individuals different? Darwin proposed that such variations appear randomly—that no driving force, no direction, and no design are necessary. He decided that if some new variation provided an advantage that increased the reproductive output of its bearer, it would spread through future populations. This meant that if the long neck of the giraffe is inherited and is helpful in acquiring food, then the giraffes with longer necks will be better nourished, and thus will be more likely to have the energy to produce offspring. Among these offspring, he suggested, some will have longer necks than others, and these, in turn, will be more successful than their shorter-necked brothers and sisters. Since long-necked giraffes would be favored through the generations, the result

would be a general tendency for any generation to be composed of animals with longer necks than those of any preceding generation.

Darwin's ideas were greeted with enthusiasm in some quarters, but, needless to say, the response was not universal. He was forced to defend his idea of "descent with modification" not only against scientists who demanded hard evidence, but also against the attacks of philosophers, theologians, and a general public who thought the idea was heretical.

TEXT M:

Black Macho and the Myth of the Superwoman

As the function of the Southern white woman changed, the life of the black woman continued just as if the country were in the first stages of growth. She labored in the field beside her husband, developed muscles in her arms, bore the lash and the wrath of her master. Her labor and trials became inextricably associated with her skin color, even though not so long before, the colonial woman had not been much better off.

Whether slavery would continue seemed in doubt during the Revolutionary War and immediately afterward. The truth is that the Revolutionary forces had enlistment problems. When the British offered blacks freedom if they fought with them, the Revolutionaries had no choice but to enlist blacks too. Five thousand blacks, in integrated and all-blacks regiments, fought in the Revolutionary War. They did so because they believed it would win them their freedom. The Rights of Man, they had reason to assume, would be extended to them. After the war, when many masters did not make good their promises, many blacks escaped to Canada and to other territories. Others sued for their freedom in the American courts and won. The new government seriously considered the abolition of slavery, but because of cotton and tobacco it was not to be.

Gradually a network of lies developed to justify the continuance of the master/slave relationship, the selling of children away from their mothers, the separation of wives and husbands, the breeding of slaves like animals. After the constitutional ban on slave importation, which took effect in 1808, the market required that a brutal emphasis be placed upon the stud capabilities of the black man and upon the black woman's fertility. The theory of the inferiority of blacks began to be elaborated upon and to take hold. It was at this point that the black woman gained her reputation for invulnerability. She was the key to the labor supply. No one wished to admit that she felt like any woman would about the loss of her children, or that she had any particularly deep attachment to her husband, since he might also have to be sold. Her first duty had to be to the master of the house.

She was believed to be not only emotionally callous but physically invulnerable--stronger than white women and the physical equal of any man of her race. She was stronger than white women in order to justify her performing a kind of labor most white women were now presumed incapable of. She had to be considered at least the physical equal of the black man so that he would not feel justified in attempting to protect her.

It has become a national belief that because the black woman's master was the slaveowner, and not her husband, she became abusive of her husband, overly aggressive, bossy, domineering. But those who trace such characteristics in the contemporary black woman to her slave ancestry will have to find some other basis for their arguments. So far as circumstances would permit, she was a loyal, faithful and dutiful wife and mother. In partnership with her slave husband, the black woman slave fought to preserve her family, and everything that she did can be seen in that light. Her family structure was simply different from that of whites; it had no fewer rules and allowed women no greater measure of equality.

The work of historian Herbert Gutman has revealed that the threat slavery posed to the black family did not prompt the slaves to give up all hopes of family life but rather to value it above all else. For the black man and woman family life was their only daily refuge. It offered them companionship, some modicum of comfort, a positive and reinforcing view of themselves and the future. Gutman describes the slaves as having been considerably preoccupied not only with their husbands and wives and children but with their cousins, nieces and nephews, aunts and uncles and grandparents. Whenever it was possible, they maintained family ties across generations.

APPENDIX C
EXAMPLES OF PROPOSITIONS

Proposition Examples from Text S:
Science and Technology: Getting Up, Up, and Away (78 propositions; 669 words)

LEVEL	POINTS	PROPOSITIONS	PROP#
I	4	II. The story of people's attempts to fly is filled with examples of the advance of science through observations and experiments.	12
III	1	1. Long before the Montgolfier's breakthrough,	13
III	2	A. people had been proposing different ways of achieving flight.	14
III	2	B. Most of the suggestions imitated the flight of birds.	15
III	1	1. Unfortunately, the use of flapping wings ... needs many special adaptations	16
III	1	2. which are not suitable for people's bodies or heavy objects.	17
IV	.5	a. (flapping wings) to provide lift and thrust	18
III	2	C. Another problem with people's early ideas about flight was that they considered air to be nothing.	19
III	1	1. The idea of gliding or floating in air depends on thinking of air as fluid	20
III	1	2. After people recognized that air has mass (and takes up space,)	21
IV	.5	a. and takes up space.	22
III	1	3. they realized it was possible to raise an object through air	23
IV	.5	a. by making it lighter than air.	24
III	1	4. This is the reason why the first successful flight was in a lighter-than-air craft:	25
IV	.5	a. the Montgolfiers' hot-air balloon.	26

Proposition Examples from Text F:
The Feminization of Academe (78 propositions; 673 words)

LEVEL	POINT	PROPOSITIONS	PROP#
I	4	I. American colleges once devoted themselves [almost exclusively] to the preparation of young men for the ministry and teaching.	1.
IV	5	a. almost exclusively	2.
II	2	A. By the middle of the nineteenth century this practice appeared to be placing colleges in [ever greater] financial trouble.	3.
IV	5	a. ever greater	4.
II	2	B. As commercial growth agitated a country in the midst of rapid industrial expansion,	5.
II	2	C. the country's young men sought business success and	6.
III	1	1. shunned both the ministry and teaching.	7.
II	2	D. With declining enrollments, colleges faced three alternatives:	8.
III	1	1. they could go bankrupt,	9.
III	1	2. they could open their doors to women,	10.
III	1	3. or they could revise their curricula to cater to the needs of youth	11.

Proposition Examples from Text E:
Evolution: Two Different Views (78 propositions; 895 words)

LEVEL	POINT	PROPOSITIONS	PROP #
I	4	II. but he finally surmised that there was some "force of life" that caused an organism to generate new structures or organs to meet its biological needs.	8
II	2	A. Once formed, such structures continued to develop through use.	9
II	2	B. and their development in the parents was inherited by the offspring.	10
III	1	1. In this way, he said, the structure became perfected in succeeding generations.	11
II	2	C. Lamarck's most famous example of such change was his theory of how the giraffe developed a long neck.	12
II	2	D. He maintained that the long neck evolved as each generation of giraffes stretched their necks in an effort to reach the topmost branches of trees.	13
III	1	1. He argued that this effort altered the animals heredity materials	14
III	1	2. so that a longer neck was passed along to the offspring.	15
II	2	E. This example did not bring him great respect.	16
IV	.5	a. In fact, it brought guffaws of derision	17
IV	.5	b. and even today	18
III	1	1. it is cited as a classic case of scientific error.	19
II	2	F. Whereas Lamarck's arguments did little to persuade his lecture audiences,	20
III	1	1. he did create some lively discussions in intellectual circles.	21
III	1	2. Society at large, however, held to the firm conviction	22
III	1	3. that each form of life had arisen through special creation.	23

Proposition Examples from Text M:
Black Macho and the Myth of the Superwoman (78 propositions; 674 words)

LEVEL	POINT	PROPOSITIONS	PROP#
I	4	II. Whether slavery would continue seemed in doubt during the Revolutionary War and immediately afterward.	10.
II	2	A. The truth is that the Revolutionary forces had enlistment problems.	11.
III	1	1. When the British offered blacks freedom if they fought with them.	12.
III	1	2. the Revolutionaries had no choice but to enlist blacks too.	13.
II	2	B. Five thousand blacks fought in the Revolutionary War.	14.
IV	5	a. in integrated and all-blacks regiments.	15.
II	2	C. They did so because they believed it would win them their freedom.	16.
III	1	1. The Rights of Man, they had reason to assume, would be extended to them.	17.
II	2	D. After the war, ...[when many masters did not make good their promises], ...many blacks escaped to Canada and to other territories.	18.
III	1	1. when many masters did not make good their promises.	19.
II	2	E. Others sued for their freedom in the American courts and won.	20.

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