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FOREIGN LANGUAGE READING COMPREHENSION: TEXT REPRESENTATION AND THE EFFECTS OF TEXT EXPLICITNESS AND READING ABILITY

by

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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

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Abstract

The present study investigated text reconstruction performance of EFL university-level students reading a fairly long naturally-occurring popular magazine article taking two factors into consideration: degree of text content explicitness and EFL reading ability level. More specifically, it attempted to examine a deeper level of text representation, or what Kintsch and his associates label the *situation model* (Kintsch & van Dijk, 1978; van Dijk & Kintsch, 1983; Kintsch, 1974, 1988, 1992, 1994, 1998), by subjects of two reading ability levels in EFL [high and low]. Subjects performed an *immediate written reconstructive recall* after reading one of the two versions [*fully explicit and less explicit*] of a popular science article. This recall or text representation reflected (1) the comprehension or the reconstruction of the text as a whole, (2) the distribution of information in the text, i.e., in terms of its macro and microstructure, and (3) any correct inferences that may have been generated. In addition, the study considered the influence of text difficulty, topic interest, and topic familiarity in the reconstructive representation.

Ninety-two Brazilian university-level subjects participated in this study. Comprehension was measured quantitatively in terms of: (1) the number of *propositions* recalled from reading one of the two versions, (2) textbase recall, and (3) inferential recall. In both text versions, six hierarchical levels of information were considered.

There were four main findings of the present study:

(1) Text version had an impact on the reconstructive process. Readers benefited from reading a less explicit version of the text regardless of their reading

ability level, although high reading ability level readers outperformed low reading ability ones.

(2) The fully explicit version had an advantage over the less explicit version only with respect to the construction of the textbase representation.

(3) Results respected the *Hierarchy Principle*, that is, higher-level propositions were better and more frequently recalled than lower-level ones.

(4) Text difficulty and topic familiarity were not determining factors in the reconstructive representation. Topic interest, however, was shown to be a significant factor in the construction of the textbase as well as in the reconstructive process as a whole of low reading ability subjects.

The findings of the present study are broadly consistent with those reported in earlier cognitive research in the area of text representation, particularly with those which examined text comprehension in the context of the Kintsch & van Dijk (Kintsch & van Dijk, 1978; van Dijk & Kintsch, 1983; Kintsch, 1974, 1988, 1992, 1994, 1998) model of reading comprehension.

To the memory of my parents

Stefano and *Alcina*

Acknowledgements

I would like to take this opportunity to express my deep gratitude to those whose contributions were crucial to the completion of my Ph.D studies.

I am deeply indebted to my supervisor, *Professor Philip C. Hauptman*, for his consistent and valuable guidance throughout my program, and in the development of this thesis, in particular. His academic talent, unique enthusiasm, great sense of humor, extraordinary patience, and constant encouragement significantly contributed to make my work a rewarding academic and personal experience. I thank him for the confidence he showed in me without which I would have not completed my program.

My gratitude is extended to *Professor Henry Edwards* of the School of Psychology at the University of Ottawa, who generously devoted so much of his busy schedule to help me with the statistics involved in this thesis. In every step of the process, his unfailing advice was essential to the outcome of this project.

Very special thanks go to my husband, *Glaucio Roloff*, who dedicated hour upon hour to help me run and interpret the statistical data. His clear guidance, and understanding of my knowledge limitations in statistics were greatly appreciated.

Sincere thanks to the members of my committee Professors *Eta Schneiderman*, *P. G. Patel*, *Hedy McGarrell*, and *Henry Edwards* for their comments on the final draft of this thesis.

My appreciation to *Yolande Thériault* and *Lise Picard*, secretaries of the Department of Linguistics, for their friendly and prompt assistance throughout the course of my studies at the University of Ottawa.

Because the Ph.D journey is not an easy one, encouragement from fellow students has been greatly appreciated. *Elisabete Malvar* has enhanced my experience immeasurably

through her friendship, and constant support. She far exceeded what is typically expected from a colleague and friend. A warm thank you also goes to *Dawn Harvey*, *Michele Foley*, *Margaret Ling*, *James Walker*, *Louise Jasmin*, *Ahmad Moinzadeh*, *Reza Ghafarsamar*, and to all the others who reminded me that research is not the only priority in life.

I would like to extend my appreciation to my colleagues *José Erasmo Gruginski*, *Maria Ascensión Jimenez*, *Eva Dal Molin*, *Cecília Mendes Silva*, *Cristiane Busato*, *Michael Watkins*, and *Joana D'Arc Pupo* in the Departamento de Letras Estrangeiras Modernas (DELEM) at Universidade Federal do Paraná, in Curitiba, Brazil, who allowed me to use their regular class time to collect the data for this study, and to their EFL students for their willingness to participate in the present study. A special thanks to my colleagues *José Erasmo Gruginski* and *Eliana Bettega* for their assistance with university-related matters during my absence from the Department.

Most important of all is the support I received from my family. I must thank my husband, *Glaucio*, once again, and my children, *Bruno* and *Silvia*. I have no doubt that I could not have reached this point without their omnipresent love and support. I also thank them for their patience with me during these last few years. I know that you three share my joy in this accomplishment. Many, many thanks go to my brother, *Wilson*, and my sister-in-law, *Marisa*, for having so kindly taken care of our finances and family commitments in Curitiba during our absence.

Funding for my graduate program in Linguistics was provided by *CAPES* (Fundação Coordenação de Aperfeiçoamento de Pessoal de Nível Superior), Brasília, Brazil.

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CHAPTER I

Introduction

1.1. Reading Comprehension

Reading plays a crucial role in educational settings as well as outside these realms. For foreign language learners in academic contexts, reading is the essential prerequisite for school achievement, as well as a virtual springboard for personal and eventual professional success.

Defining precisely what reading comprehension entails has been the goal of reading researchers for many years. This concern has yielded many insights from interdisciplinary research along with a considerably large body of data resulting from the complex nature of the reading process, regardless of whether it is accomplished in the reader's native (L1) or second/foreign language (L2/FL). Reading is a dynamic activity which involves a number of perceptual, linguistic, and cognitive processes related to both text and reader variables. Skilled processing of written discourse is an individual cognitive activity that involves the construction of meaning through interactions with the printed text, more specifically, with the distribution of information in the text, and the reader's integration of this information with his/her own knowledge. Comprehension is assumed to be the result of a balanced interplay between information supplied by the reader, i.e., his/her prior knowledge, and the information printed on a page (Rumelhart, 1977; Stanovich, 1980; Perfetti, 1985; Just & Carpenter, 1987).

This view of reading as an interactive process has further led first language (L1) cognitive research to suggest that readers "construct" the meaning

of texts. In the process of constructing the meaning from text, readers build a representation or a *model* that is analogous in structure to the situation(s) described by the text. Theories of reading comprehension that involve the representation of situations described by the text have been known as mental model theories (Sanford & Garrod, 1981; Johnson-Laird, 1983; van Dijk & Kintsch, 1983).

One of the most influential cognitive models which provides an account of this process is the *Construction-Integration* (CI) model of text representation proposed by Kintsch and his associates (Kintsch, 1974, 1988, 1992, 1994,1998; Kintsch and van Dijk, 1978; van Dijk and Kintsch, 1983). This model postulates that the constructed mental representation by the reader reflects at least two different processing levels: the *textbase* and the *situational model*. The *textbase*, or surface level of representation, constitutes the representation of the meaning and the structure of the text itself. The *situation model*, or deeper level of representation, on the other hand, is more sophisticated. It results from the explicit and implicit information provided by the text which is elaborated and integrated with the reader's prior knowledge. Research has demonstrated a close relationship between the formation of a coherent situation model and learning from text (Mannes and Kintsch, 1987; Britton & Gulgoz, 1991; Moravcsik & Kintsch, 1993; Kintsch, 1994; McNamara, et al., 1996).

The present study was designed to investigate text reconstruction performance of university level- readers of English as a Foreign Language (EFL) of two reading ability levels as they perform an immediate reconstructive recall after having read one of the two versions of a fairly long popular science

magazine article. Text reconstruction performance is defined following the CI model view of text representation, i.e., comprehension was measured in terms of the recall of a number of text-based propositions and inference-based propositions from a text that together would reflect the comprehension of the text as a whole. Text-based recall refers to the number of propositions in a given hierarchy which ideally corresponds to the propositional organization of the target text in terms of its macro and micro structures. Inference-based recall refers to the number of correct inferences made about the situation(s) posed by the text.

This study sought to investigate the effect of reading ability level[1] and degree of text explicitness in the reconstructive performance. In addition, the influence of text difficulty, topic interest, and content familiarity in the reconstructive process is considered.

1.2. Justification for the Present Study

A review of the literature which has been conducted under the CI model assumptions and involving text reconstruction performance by adults has revealed that most studies have been developed in L1 contexts. Virtually no study has emerged with such an aim in a non-native context, and, consequently, the impact of reading ability in the foreign language has received little attention. This study is a replication of what one would expect L1 readers' performance to be.

In addition, the majority of studies which have targeted this performance have assessed it by having the subjects read and recall short passages or, in many

[1] The concept of reading ability in a foreign language used here incorporates both notions of language proficiency and reading skill.

cases, specially-prepared texts [laboratory texts]. Texts averaging one thousand or more words have not been used.

In sum, a review of the literature has not yielded any study which has investigated adult reading performance in a foreign language in light of the CI model assumptions as a result of the processing of long naturally-occurring texts.

1.3. Pilot Study

The present investigation replicates, in part, a pilot study that was designed to fulfill the requirements of my second doctoral comprehensive exam[2]. The main goal of that study was to examine the nature of the text representations constructed by L2 readers as a result of their reading one of two versions of one text. In particular, the effects of three variables — text version, propositional structure, and language proficiency level — were investigated on the construction of two text representations, the *textbase* and the *situation model*, as proposed by the models of text comprehension of Kintsch and his associates (Kintsch, 1974, 1988, 1992, 1994; Kintsch & van Dijk, 1978; van Dijk and Kintsch, 1983) within the context of second language reading. These representations are associated with levels of comprehension — superficial and deep or, in the CI model terminology, the *textbase* and the *situation model* — as reflected in the *reproductive* and the *reconstructive* aspects of the reader's recall. In this study the reproductive portion of the recall was measured by the number and types of propositions recalled directly from the target text, while the reconstructive portion of the recall was examined in terms of the correct inferences or elaborations generated in the

[2] *Text representation in L2 reading comprehension: A pilot study*. University of Ottawa, 1997.

recall task. In addition, the role of degrees of text content explicitness in comprehension was examined. Finally, the effect of language proficiency on text recall was investigated.

Two versions [the original, fully explicit and a modified, less explicit version] of a fairly long popular science article (**'Peering through the smoke screen'**, by Ian Mundell, published in the periodical *New Scientist*, October 9, 1993) were recalled by two groups of subjects: an *L1* and an *L2* group. The first consisted of four Canadian university-level anglophones who served as a ceiling for the expectations of the L2 group's performance. This, in turn, consisted of ten Brazilian university-level native-speakers of Portuguese who were temporarily residing in the Ottawa-Carleton area while either pursuing doctoral degrees and post-doctoral research at different institutions or attending ESL courses at the University of Ottawa's Second Language Institute. The participants were assigned to one of the two test conditions (i.e., original and modified text groups). The modifications made to the original text can be found in Section 3.4. of this thesis.

The recalls were analyzed in terms of *reproductive* and *reconstructive* representations; the former reflected textual information retrieval whereas the latter was a result of inference generation processes which were activated by unavailability of information in the text and the readers' prior knowledge.

The results summarized below suggest that the three variables considered (text version, propositional structure, and language proficiency level) have an effect.

1. ***Text version.*** The study suggests that a less explicit, but still coherent, version of a text does seem to enhance both immediate reproductive and

reconstructive recall produced by L2 readers. In the case of reproductive recall — the formation of the textbase representation — the unavailability of key information segments in a text seems to force them to read more carefully, and thus recall the text better than they would if they had read the original version. Interest may have played a part in the process of text reconstruction, but this is mere speculation at this point. It appears that the processing of the modified text version seems to have required more effort from the reader than that which was accomplished by reading a more explanatory text, and that appears to have a positive effect on recall. L1 studies have found that people remember information that they themselves have generated better than supplied information (McNamara et al., 1996; Kintsch, 1994; Mannes and Kintsch, 1987). The pilot-study results obtained for L2 readers generally pointed in a similar direction.

With respect to reconstructive recall — the development of the situation model representation — the benefits from reading a less explicit text were clearer. The findings of the present study suggest that the modified version enabled the readers to attempt to compensate for the missing information by not only engaging in active inferencing, but also generating correct inferences. It is believed that appropriate inferences were possible to be drawn as a result of text coherence. The retrieval of the macropropositions is a significant example of the positive effect of coherence in text. Readers could thus establish more links between the content of the text and their knowledge, resulting in a new information network that reflected a deeper level of comprehension (the situation model in the Kintch and van Dijk model). Again, the contribution on the part of

the reader with information that was unstated in the text is particularly valuable in contexts where learning from text is at stake. Studies have found that people remember information that they themselves have generated better than supplied information (McNamara et al., 1996; Voss and Silfies, 1996; Moravscik and Kintsch, 1993; Kintsch, 1994; Kintsch, 1988).

2. ***Propositional structure.*** The findings of this study with respect to the effect of propositional structure on recall indicate that there was a general trend to recall higher–level propositions better than lower-level ones for both text versions. It appears that the results obtained in this study provide further support to the *Levels Effect Principle*. These results corroborate those reported in many studies of the *Levels Effect Principle* (Kintsch & Keenan, 1973; Kintsch, 1974; Rumelhart, 1977; Kintsch, Mandel & Kozminsky, 1977; van Dijk & Kintsch, 1983; Hauptman, 1996; Zerhouni, 1996). With regard to the situation model representation, the fact that L2 readers could reinstate the macropropositional information by reading the modified version was certainly noteworthy.

3. ***Language proficiency.*** The findings of this study regarding the impact of language proficiency upon recall are nonconclusive for the textbase representation for at least two reasons. First, this might have been due to the small number of subjects participating in the study. Second, it may be the case that language proficiency does not play such a major role as predicted, but, rather, it is reading skill that is a determining factor in L2 comprehension (Hudson, 1982; Sarig, 1987).

As far as the situation model construction, the fact that high-proficiency level subjects performed significantly better in overall recall as well as in the

reinstatement of the macropropositions from the modified text is far from surprising. Most of the high-level subjects consisted of doctoral candidates whose reading experience is fairly well established.

In summary, the findings of this study indicate that (1) the modified version (less explicit) yielded superior performance both for reproductive and reconstructive recalls, (2) the propositional structure indicated general support for the *Hierarchy Principle*, and (3) higher proficiency level was a determining factor only for reconstructive recall.

The following sections of this thesis consist of: Chapter II: *Review of the Related Literature*, Chapter III: *Methodology*, Chapter IV: *Results*, Chapter V: *Discussion*, and Chapter VI: *Conclusions*

CHAPTER II

Review of the Related Literature

2.1. Introduction

Current theories and models of the reading process espouse the view of reading as a multifaceted, complex, interactive process which involves a number of reader and text variables. Under a cognitive/interactional perspective, reading is viewed as an *active* interplay between the *reader* and the *text*, with comprehension varying as a function of *text features* and *reader characteristics* (Swaffar, 1988; Barnett, 1989; Bernhardt, 1991; Swaffar, Arens & Byrnes, 1991). Text includes features of discourse structure, while reader characteristics comprise prior knowledge, and language proficiency. A substantial body of L1 reading research has adopted models of comprehension based on the interaction of prior knowledge and text features, e.g., the Kintsch & van Dijk (1978) model. A close look at the L1 and L2/FL reading research focusing on the interplay between text and reader has revealed a strong tendency towards the theoretical principles of *Schema Theory* (c.f. Rumelhart & Ortony, 1977; Rumelhart, 1980; Carrell & Eisterhold, 1983; Anderson & Pearson, 1984; Carrell, 1988; Barnett, 1989; Bernhardt, 1991; Hauptman, 1996; Zerhouni, 1996).

2.2. Reading as an Interactive Process: the Role of Schemata

According to Schallert (1982), *schemata* "are abstract structures that one holds to be generally true about the world (p. 20)". As far as reading comprehension is concerned, these knowledge structures are cognitive systems

which are involved in the interpretation of messages (Rumelhart, 1980; Anderson & Pearson, 1984; Carrell & Eisterhold, 1983; Carrell, 1988). For Schallert (1982), meaning emerges as a result of the powerful interaction between these structures and the clues made accessible by the author (p. 27). According to Schema theory, reading for meaning involves the activation of knowledge networks of world-based and rhetorically-based information for the purpose of processing a text. Readers are assumed to possess and activate three types of schemata: *content*, *textual* or *formal*, and *linguistic*. When readers process a text on the basis of content, textual, or linguistic schemata they are attempting to generate textual meaning by means of a *top-down* approach, also referred to as 'conceptually-driven' processing. If, on the other hand, readers choose to focus only on the text itself to get its meaning, then they are processing it in a *bottom-up* mode or 'data-driven' processing (Bobrow & Collins, 1975, cited in Rumelhart & Ortony, 1977:128). It has been suggested that successful readers rely on both types of processing, alternating them according to the difficulties posed by the text (c.f. the 'interactive-compensatory model' of reading comprehension proposed by Stanovich, 1980)

2.3. Content, Textual/Formal, and Linguistic schemata

Content schemata are related to factual knowledge and cultural conventions which readers are thought to possess, and actively use when confronting the topic or/and content of a text. Despite the fact that text processing requires a large set of processing strategies, from perceptual to discourse level, it is undeniable that activation of content knowledge in the domain of the text is

crucial to comprehension (Weaver & Kintsch, 1996). According to Haberlandt (1988), readers do not construct the meaning of a text in a vacuum. Rather, they do so against a background of relevant facts as well as linguistic and pragmatic information which text writers clearly assume when producing a text. The more readily the reader can associate text content with the appropriate knowledge sources, the faster comprehension will take place. This is possible when the text topic/content is familiar to the reader. Studies have attested that readers who are *familiar* with the content of a text, whether written in their first or second language, comprehend and recall more than those who are not as familiar with text topic/content (Johnson, 1982).

Zuck & Zuck (1984) conducted a study in which six native and nonnative English speaking biologists and ten native and nonnative English speaking ESL teachers were given texts about biology or botany to read. They sought to investigate the effect of perception of both specialists and nonspecialists through a variety of tasks (e.g., perception of text difficulty, key words and phrases that are required to the understanding of the text, and comprehension questions). They concluded that there may be a systematic variation between the two groups, in particular with regard to implicit versus explicit information, and recognition of certainty of claim.

In a similar vein, Alderson & Urquhart (1988) conducted a study in which comprehension by ESL subjects was assessed in terms of performance in the subjects' areas of specialization versus areas of nonspecialization. They found that subjects performed better in their own fields of study than outside their fields.

In another study on the impact of content schemata, Lee (1986) tested the effect of three components of prior knowledge, namely, context, transparency, and familiarity. Results indicated that all three components of prior knowledge had an effect, although their interaction was found to be rather complex.

Studies on the impact of familiar and unfamiliar culturally-defined aspects on comprehension have indicated that familiar cultural content allows readers to recall more and make more correct inferences (Steffensen et al., 1979; Johnson, 1981).

With respect to *textual* or *formal schemata*, i.e., schemata related to the rhetorical organization of different genres, research in both first and second language reading indicates that readers who generally recognize and utilize discourse structure to aid their comprehension show superior performance when compared with those who do not (Meyer, 1975, 1977; Meyer, Brandt & Bluth, 1980; Meyer & Freedle, 1984; Carrell, 1984a, 1984b, 1988, 1989; Connor, 1984; Horowitz, 1985; Slater, Graves & Piché, 1985; Barnitz, 1986). Schema-based research on second language reading comprehension have provided ample evidence that reading comprehension is a function of the interaction of discourse structure with the reader's formal schemata (Carrell, 1983, 1984a 1984b; Urquhart, 1984; Carrell, Pharis & Liberto, 1989; Zerhouni, 1995, 1996). Readers who make use of text organization generally provide text recalls whose organizational structure resembles that of the studied text (Richgels, McGee, Lomax & Sheard, 1987). Moreover, explicit training in recognizing and analyzing rhetorical organization of texts can facilitate second language students'

reading comprehension, as measured by quantity and quality of information recalled (Carrell, 1985; Davis, Lange & Samuels, 1988; Raymond, 1993).

Recent efforts to investigate the interaction of textual and content schemata and their impact on comprehension have attested their important role in both first and second language reading comprehension (Meyer, 1987; Carrell, 1987; Olhausen & Roller, 1988; Roller, 1990; McKeown, Beck, Sinatra & Loxterman, 1992; Moravcsik & Kintsch, 1993).

Studies on the impact of *linguistic schemata* have generally indicated that language proficiency affects the level of comprehension of second and foreign language readers (Cziko, 1978; Ulijn, 1980; Clarke, 1980; Hudson, 1982; Barnett, 1986; Devine, 1987; Eskey, 1988; Carrell, 1991; Zerhouni, 1996). A close investigation of these studies reveals conflicting findings with respect to whether language proficiency determines reading skill in a second language (Cziko, 1978; Clarke, 1980; Devine, 1987) or first language skills transfer into second language reading especially in the case of advanced second language readers (Hudson, 1982; Sarig, 1987). More recently, Carrell (1991) found that the two factors, linguistic proficiency and reading ability, taken individually, play an important role in second language reading comprehension. No combined effects of these variables were reported in her study.

2.4. Reading and Affective Factors

Although affective factors, such as attitude, motivation and interest, have been shown to be of significant interest to teachers involved with reading pedagogy (Dillon et al., 1992, cited in Mathewson, 1994), they have not

stimulated researchers to investigate their influence in reading (Bernhardt, 1991; Mathewson, 1994). Research on how readers evaluate text, and how these evaluations relate to comprehension, recall, content, formal, and linguistic schemata is still fairly limited.

Relevant to the present study is the effect interest may have on FL reading comprehension. *Interest* has been defined as "a favorable attitude with a strong action orientation (Mathewson, 1994, p. 1143)". An examination of the literature on this factor shows that there has not been much research on the concept of interest. According to Mathewson (1994), research on interest has been limited to experiments which have related interest in short text segments to recall (e.g., Shirey & Reynolds, 1988, cited in Matthewson, 1994).

Very few studies in L2/FL reading have focused on the impact of affective variables on recall. Fransson (1984, cited in Bernhardt, 1991) addressed the impact of level of anxiety and level of intrinsic motivation on reading comprehension by university students. This study found positive affect to have a facilitative effect on reading comprehension. Zerhouni (1996)[3] also pointed to a positive effect of interest in the reading topic in the performance of L2 and FL university-level readers.

2.5. Text representation theory

2.5.1. The construction of a text representation

When readers comprehend a text, they integrate information from different sentences as well as relevant information (schemata) activated from long-term

[3] Although affective factors were not the primary focus of this study, a number of interesting results concerning the influence of interest on recall are reported for L2 and FL reading.

memory (prior knowledge) into a coherent mental representation of the events, actions and states present in the written text. In cognitive psychology, these mental representations are known as *situation models* (Kintsch, 1988, 1992, 1994, 1998; van Dijk and Kintsch, 1983) or mental models (Johnson-Laird, 1980,1983). Successful text comprehension has been equated with the construction of a coherent situation model (van Dijk & Kintsch, 1983).

Various factors influence the construction of a coherent situation model. Among these are reader-related factors, such as reading skill, fluency in the language of the text, motivation, and goals, and text-related factors, such as text structure, vocabulary, genre.

Evidence for the construction reality of this representation has been reported in a number of studies, all of which were conducted in L1 contexts (Schmalhofer & Glavanov, 1986; Mannes & Kintsch, 1987; Fletcher & Chrysler, 1990; Sanford & Garrod, 1994; Kintsch & Franzke, 1995; McNamara et al., 1996; Voss & Silfies, 1996).

2.5.2. The role of inferences in the construction of a text representation

Inference generation can be defined as the cognitive process in which a reader engages in order to obtain the implicit meaning of a written text on the basis of explicitly stated information and his/her prior knowledge.

Inferential activities have been claimed to be central to reading comprehension (Farr, Carey & Tone, 1986; Chikalanga, 1992; van den Broek, Fletcher & Risden, 1993). In fact, it has been suggested that a theory of text comprehension would not be complete if an explanatory account of inferential processes were not provided (Graesser, Bertus & Magliano, 1995). An increasing

number of studies in the fields of cognitive psychology and discourse processing have been devoted to investigating these phenomena (Graesser & Bower, 1990; McKoon & Ratcliff, 1992; Graesser & Kreuz, 1993; Kintsch, 1993). Despite these extensive research efforts, substantial differences in the type of inferences investigated and in the methodologies used have generally prevented the emergence of a larger and clearer picture concerning these processes, thus making it very difficult to interpret and integrate the findings. In response to these difficulties, van den Broek, Fletcher & Risden (1993) have suggested a tetrahedral model of studies on inference generation which attempts to identify clusters of variables commonly explored in inference experiments, and which accounts for the interactions between these clusters. Four clusters are distinguished: materials, subjects, orienting tasks, and criterial tasks. In discussing the main effects of these clusters, some of the conclusions seem relevant to the present study. With respect to materials, it was pointed out that length of text may influence the amount of inferential processes. Brief, artificial texts are less conducive to inference generation than long, naturally-occurring texts (Potts, Keenan & Golding, 1988). As far as subjects are concerned, research has indicated that reading skills may also influence inferential activities. Skilled readers have been shown to engage in inferential processing to a greater extent than less skilled readers (Long & Golding, 1993). Concerning criterial tasks, it has been found that the amount of inferential activity observed is a function of the task used in the experiment. Tasks such as recall, are more sensitive to inferential activities that may have occurred after some interval of time than other tasks, e.g., naming and lexical decision, (Magliano et al., 1993). Finally, experimental procedure decisions may also affect

inferential activities. These are less likely to occur when subjects are given a limited amount of time to read the text. Absence of time constraints has been shown to increase the likelihood of inference generation (Kintsch, 1998).

2.5.3. Text representation systems

One of the problems reading researchers face when investigating relations between readers and texts is what approach to use in order to determine the distribution of information in a given text and the reader's knowledge of that distribution from a semantic perspective. Several models of text analysis are available including those developed by Johnson (1970), Fredericksen (1975), Meyer (1975), Halliday & Hasan (1976), Kintsch & van Dijk (Kintsch & van Dijk, 1978; Kintsch, 1988; van Dijk & Kintsch, 1983) each one being better suited for particular purposes, and each displaying limitations regarding their scope and applications to both first and second language reading research.

The systems developed by Meyer (1975) and Kintsch & van Dijk (Kintsch & van Dijk, 1978; Kintsch, 1988; van Dijk & Kintsch, 1983) are among those most frequently used for describing text structure or hierarchies of information in expository texts. Both systems are propositional (cf. Fillmore, 1968), i.e., they adopt the idea unit or *proposition* as the minimal unit of meaning, yet these two systems do not share the same definition of proposition. For Meyer, propositions are text-based, i.e., they represent the actual text language or the author's point of view (Raymond, 1993). For Kintsch & van Dijk, they are reader-based, i.e., they result from the reader's interpretation of the surface structure of the text as well as the inferences generated from the interaction of his/her background knowledge and the text itself. The main difference between the two systems is that Meyer's

assumes the propositional structure to be the result of one text only, that is, that written by the author, while the system proposed by Kintsch & van Dijk assumes that the propositional structure is a result of an *interaction* between textual input and the reader's knowledge base. The reader is, in fact, forging another text, one that will reflect the author's version to varying degrees. It is this particular aspect of the Kintsch & van Dijk model that motivated the present study. Therefore, more attention will be devoted to this model in the subsequent sections of this proposal. The Meyer model will only be summarized.

2.5.3.1. *The Meyer model*

The Meyer (1975) prose analysis system parses texts into linguistic units at the same time that it establishes the structural importance of these hierarchically arranged units. The analysis maps the organization of information in the text, with information located at the top levels of this structure corresponding to the main idea or the gist of the passage, and information at low levels in the structure corresponding to details. Meyer (1975, 1977; Meyer & Rice, 1984; Meyer & Freedle, 1984) has identified five rhetorical organization patterns or top-level structures. They are description, collection, causation, response or problem/solution, and comparison. Not all of these rhetorical patterns have the same capacity to hold together the content of the texts to which they apply. The highest degree of integration is achieved by the causation pattern, the lowest by description (Meyer & Freedle, 1984).

Research conducted with the Meyer (1975) system of text analysis has generally shown that information located at the top levels of a text is recalled and retained better than information at the lower levels of a passage. This effect has

been confirmed across various types of materials, recall tasks, and subjects ranging from elementary school children to graduate students (Meyer, 1975; Meyer, Brandt & Bluth, 1980; Meyer & Rice, 1984; Raymond, 1993; Zerhouni, 1995, 1996).

However, Piché & Slater (1983) have reported difficulties with the Meyer system. In a study comparing Meyer's system with that of Johnson's (1970) (see section 2.5.3.3 for a description of Jonhson's system) for the recall of university students, Piché & Slater (1983) reported that the Meyer system was not a consistent predictor of text recall. They noted that while the higher level textual segments were better recalled than lower level ones, as determined by the Johnson's system, the opposite could be observed with Meyer's system. In this case, lower level segments were better recalled than those higher in the hierarchy.

2.5.3.2. *The Kintsch & van Dijk model*

a. Overview

The Kintsch and van Dijk model of text representation (Kintsch, 1988, 1992, 1994, 1998), known as the *Construction-Integration model of text comprehension (CI model)*, is a psychological model of text processing which aims at explaining memory and comprehension of text as well as knowledge acquisition from text. It is an interactive, reader-driven model which assumes that meaning is constructed by the reader as he/she integrates textual information and his/her prior knowledge. The basic framework of that model was laid out in Kintsch & van Dijk (1978), and included the concepts of propositional representation, cyclical processing, and the micro and macrostructure of text. Later, Kintsch & van Dijk (1983) introduced the dimension of the situation

model which marked a major shift in the emphasis from a text-driven to a schema-based reader-driven model. In Kintsch (1988) the CI model is proposed as a redefined and expanded version of earlier proposals. Kintsch (1998) not only elaborates the 1988 version, but introduces an alternative representation to the propositional analysis which permeated his theory, and that is Latent Semantic Analysis (LSA). According to Kintsch (1998), the first results from the application of this framework look promising.

An investigation of the literature on the empirical application of the Kintsch & van Dijk model has revealed a number of studies conducted in L1 contexts (Schmalhofer & Glavanov, 1986; Mannes & Kintsch, 1987; Fletcher & Chrysler, 1990; Tardieu, Ehrlich & Gyselinck, 1992; Sanford & Garrod, 1994; Kintsch & Franzke, 1995; Voss & Silfies, 1996; McNamara et al., 1996; McNamara & Kintsch, 1996), yet virtually no attempts have been made to address it in L2/FL contexts.

b. Text structure: the microstructure and the macrostructure

The Kintsch & van Dijk model is fundamentally a propositional theory of mental representation. The proposition is a relational structure consisting of one predicate and one or more arguments which stands as a description of what is expressed in a text. Meaning of a text can be represented as a list or network of propositions. It should be noted that the model does not assume that readers understand a text just by turning it into a list of propositions.

There are two basic forms of structural relation into which the propositions enter which readers must grasp before they understand a text. These are the *microstructrure* and the *macrostructure* of the text. The microstructure constitutes

the lowest, and, at the same time, the most detailed representation level, i.e., it consists of propositions which capture the meaning of the text in all its details. At this level, the meaning is abstracted by the reader through the detection of argument overlap, or repetition. This process is argued to be constrained by the limits of working memory. A reader can hold up to four propositions in working memory at one time; if the argument in one of these propositions is the same as the argument in one being read, the two propositions become linked. Failing to detect such overlap forces the reader to search through the text, or through his/her long-term memory of it.

The *macrostructure* constitutes a higher, more general level of textual meaning, reflected by the macropropositions. Macropropositions are units which represent the meaning of a text in a reduced or summarized form, i.e., the overall point, or gist, of a text. The macrostructure of a text is derived from the microstructure by the application of operations, called *macrorules.* These include *generalization*, *deletion*, and *integration* (van Dijk, 1977; Kintsch & van Dijk, 1978). These rules act upon micropropositions and map them into macropropositions for the production of a "meaningful whole, characterized in terms of a discourse topic" (Kintsch & van Dijk, 1978:366). The application of these rules is constrained by the reader's world knowledge, and his/her need to infer the point or gist of the text.

Kintsch (1998) highlights the importance of this level for longer texts:

> The macrostructure of a text — intuitively, its gist — plays a major role in memory and comprehension, especially of longer texts.Texts differ in the extent to which this structure is made explicit [...] macrostructures are formed automatically even in the absence of task demands [...] the macrostructure of a text may dominate the comprehension process to such

> an extent that material contradictory to what the reader takes to be the text's macrostructure is simply ignored (p. 213-214)

A number of predictions concerning the effect of text structure on comprehension have been made by the theory. The model suggests that how well a text is understood depends largely on how well the macrostructure is represented in memory. The macrostructure will be adequately built if the textual propositions are logically connected. Certain propositions may be more difficult to process than others. For example, where there is absence of argument overlap, the reader must search either the text itself or his/her long-term memory until a link for the new proposition can be found. This process is called a *reinstatement search* (Kintsch, 1979). The model assumes that texts in which argument overlap abounds should be easier to understand than those which require a lot of reinstatement searches, or, in other words, a lot of inferences. Thus, a text which requires a lot of inferences will be more difficult to understand than those which call for fewer.

Another important prediction made by the model, related to text structure, concerns the *Levels Effect* or *Hierarchy Principle*. According to this principle, when readers process information represented at various levels of textual organization, higher-level propositions are more readily recalled than lower-level ones. A number of studies, both in L1 contexts (Kintsch & Keenan, 1973; Kintsch, 1974; Kintsch, Mandel & Kozminsky, 1977; van Dijk & Kintsch, 1983) and in L2/FL (Hauptman, 1996; Zerhouni, 1996) have generally provided support for that principle.

c. Levels of text representation: *textbases* and *situation models*

As mentioned previously, readers comprehend a text when they construct a mental representation for it. The result of comprehension constitutes a mental representation of the text. Within this mental representation, two levels of comprehension may be distinguished. One, called the *textbase*, can be traced directly to the text. The *textbase* represents the semantic content of the text as a result of a network of propositions. It also represents the memory for the text itself. It encompasses all content and structure-preserving paraphrases of a text, and results from processes that derive the meaning of the text itself, without any integration with prior knowledge. It accounts for the reader's superficial understanding of a text. The other level, known as the *situation model*, is derived from the reader's knowledge of the situation posed by the text. It basically results from processes which integrate textual information with the reader's prior knowledge. It is a reflection of the reader's understanding and interpretation of textual information, or the outcome of a deeper level of understanding. The contribution of the reader is so significant at this level that Weaver & Kintsch (1996) have suggested that at this deeper level, "the text has lost its identity" (p. 238). It has been claimed that the situation model constructed by an individual mirrors what that individual has learned from text (Mannes and Kintsch, 1987; Kintsch, 1994; McNamara et al., 1996, Voss and Silfies, 1996). In fact, Kintsch (1994) makes an important distinction between textbases and situation models as he discusses how people learn from text. Readers may be able to reproduce a text quite accurately, i.e., provide a good textbase for it, but they may be unable to use

that information in other situations or for other purposes, i.e., demonstrate that they have *learned* from that text. The construction of situation models allows readers to integrate information from text with related information drawn from prior knowledge. Such integration, as it has been pointed out earlier, provides the reader with a deeper understanding of what he/she has read; the more complete and elaborate the integration is, the stronger the situation model will be (Kintsch, 1994, p. 295), and, consequently, the better the conditions for learning will be. This process is particularly significant to reading instruction using expository texts, and, as such, it has drawn attention from research, particularly through the work of Rothkopf (1982)[4]. Nonetheless, recent research has pointed to the fact that although much is currently known about how readers construct textbases, very little is known as to how they go about using textual information to learn from text (Weaver & Kintsch, 1996).

d. The role of inferences in the model

Reading involves the skill of identifying information in the text and the skill of integrating it with knowledge found in the reader's mind. Not all the information that the reader may need to fully comprehend a text will be found explicitly stated in that text.

[4] Ernst Rothkopf has published extensively on the subject of learning from text. His research effort extends for over 30 years. The 1982 publication summarizes the main issues of his theory. Rothkopf's theory for learning from text assumes that reading is an interactive and purposeful enterprise, i.e., the reader constructs textual meaning with a goal in mind, and based on information coming from the text and from knowledge the reader brings to the text (Rumelhart, 1977). Rothkopf stipulates four conditions that are necessary for the attainment of this interaction. Two are related to text and two are related to the reader (from Singer, 1982, p. 140). *Text Conditions*: (1) The text must contain information that the reader needs; (2) It is helpful if the text is well organized and well written. *Reader conditions*: (1) Readers must read the portions of the text that contain the information that they need; (2) Readers must deal with the relevant text portions in a manner sufficient to get out of them what they need.

Generating information that is implicit in a text may be required, that is accomplished through inferencing processes. Inferences are cognitive operations which result from active processing, i.e., actions carried out by the reader in his/her attempt to capture the meaning of textual information not readily available during reading. The reader, starting out from the explicitly conveyed textual information and taking into account the particular context, constructs a new meaning representation. The explicitly conveyed information as well as the information inferred by the reader become the representation of that text. Studies have shown that readers remember textual information they have been required to generate better than textual information that has been explicitly supplied to them (Chi & Bassok, 1989; Bereiter & Scardamalia, 1989; Kintsch, 1994; McNamara et al., 1996). Kintsch & van Dijk (1978) have suggested that inferences serve a particular function in comprehension. They have argued that inferences perform the role of filling coherence gaps in the text.

Based on work by Guthke (1991, cited in Kintsch, 1993,1998), Kintsch distinguishes two types of what is generally treated in the literature as inferences: inference generation and knowledge retrieval processes[5] Both may be either automatic (i.e., unconscious) or controlled (i.e., conscious and strategic). *Retrieval processes* may be a rapid, automatic access to the reader's knowledge whereby he/she uses information stored in long-term memory so as to bridge a gap in coherence in the text. An example of an automatic retrieval process would be the activation of *with a hammer* in the sentence *John nailed down the board* (1998:189-190). Retrieval processes may also be controlled. In cases in which an

[5] See *Appendix A* for *A Classification system for inferences in text comprehension*, from Kintsch (1998)

automatic process is not helpful in the course of restoring relevant information, it is claimed that the reader engages in a resource-demanding search to yield the targeted information. This is the case when propositions at the textbase level are not interrelated and, therefore, do not constitute a coherent whole.

In *generation processes* new information is constructed from information found in the text and associated background information [schemata] in long-term memory. This process can also be either automatic or controlled. Automatic generation processes are those which are immediately available to the reader. Their prompt availability to the reader is assumed to be the result of a *mental image* of the statement provided in the text that enables the reader to readily access this image in all of its dimensions. Unlike automatic retrieval operations, automatic generation processes originate during the comprehension process. These operations yield *new information* on the basis of the information provided by text and the information found in the reader's long-term memory (prior knowledge). Controlled generation processes, on the other hand, occur when automatic processes fail to provide the necessary links between textual information and relevant information found in short-term memory. An extended and demanding long-term memory search is activated to supply the required information.

More recently, Kintsch (1998) has recognized that propositional networks may fail to capture the prominent features of the mental images associated with automatic generation processes. He argues that this shortcoming in the theory may be overcome by ensuring that this imagery is somehow adequately represented in the propositional network (p. 192). Despite criticism by advocates of mental

models (Johnson-Laird, 1980,1983; Garnham, 1984), Kintsch has forcefully argued that the situation model, the most elaborated representation of a text content, fulfills that need (van Dijk & Kintsch, 1983; Kintsch, 1998).

Inferencing processes, when successful, allow for the formation of more links between textual information and information in the prior-knowledge base (Mannes & Kintsch, 1987) which potentially leads to a well-structured mental representation the text. The CI model suggests that the formation of appropriate situation models depend on the activation of the reader's inference processing and prior knowledge. Hence, inference generation is an important aspect of deeper levels of text comprehension.

e. The application of the model to reading research

Research on the reading of expository texts conducted under the Kintsch & van Dijk model is largely confined to first language research. These studies have been experiments in which recall was assessed by means of short, artificial descriptive and narrative texts to determine (1) the psychological reality of the textbase and situation models, and (2) the effect of a number of factors related to the construction of these two levels. Among these factors, prior knowledge, coherence [text explicitness], and reading ability have received considerable attention.

There have been several attempts to experimentally separate the two levels of representation proposed by Kintsch & van Dijk. Schmalhofer & Glavanov (1986) and Fletcher & Chrysler (1990), using recognition tests containing different types of distractors, have presented evidence that indicates that recognition memory consists of separate representations.

Investigations on the effects of the reader's background knowledge (in terms of general and specific-domain) and text coherence in comprehension have demonstrated that they facilitate and enhance comprehension and learning of high and low reading ability levels in different ways. Moravcsik & Kintsch (1993) conducted a study involving the factors of domain knowledge (high vs. low), writing quality of texts (organized vs. disorganized), and reading ability (high vs. low). In their study, they observed that skilled readers who lacked satisfactory background knowledge on the topic of the text they were reading were able to recall the text (i.e., build a good textbase), but failed to construct an adequate situation model of the text (i.e., achieve a deeper level of understanding), even when the text is well written and coherent. It was shown that writing quality may facilitate the construction of a superficial representation of a text, but it does not contribute directly to a deeper understanding of the text. In this study, domain knowledge was a key factor in the successful construction of a situation model. The fact that high-knowledge readers, who were successful at building an adequate situation model of the text, outperformed low-knowledge readers in inference and integrative summary tasks indicates that low knowledge readers can only be expected to understand information that is made explicit in a text. Implicit information requires knowledge to be generated.

McNamara et al. (1996) obtained similar results to those of Moravcsik & Kintsch (1993) with respect to the performance of high- vs. low-knowledge subjects reading two versions of a text (revised, fully coherent vs. original, less coherent), with an additional interesting fact. High-knowledge readers performed better when reading the original, less coherent version while the low-knowledge

readers benefited from the revised, fully coherent [explicit] version. Given this picture, McNamara et al., (1996) argue that high-knowledge readers should be allowed to read more challenging texts, such as those that require extra processing (i.e., more inferencing), whereas low-knowledge readers should be given easier, fully coherent texts. These findings have important pedagogical implications, in particular with respect to learning from text. They suggest that the level of explicitness of the text should be adjusted to the student's knowledge level "so that reading becomes challenging enough to stimulate active processing but not so difficult to break down comprehension (p. 36)". Similar conclusions are reached by McNamara & Kintsch (1996) and Voss & Silfies (1996).

As mentioned previously, a common ingredient across the studies which have used the Kintsch & van Dijk model is their use of short, experiment-generated texts instead of naturally-occurring texts. This is not without a reason. According to Kintsch (1998), naturalistic texts, usually longer than one paragraph, are problematic because their length prevents their recall to be fully predicted by the model for a number of reasons.

First, long texts are normally reconstructed rather than reproduced carefully from memory. In the reconstructive process only the macrostructure of the text remains, in summarized form; the microstructure is usually deleted or reconstructed (p. 265). Thus, full access to the textbase properties, that is access to the text macro and microstructure, may not be possible, and, as a result, the writer's plan (i.e., choice of words, sentence relations, etc) may not be recovered. A solution to this difficulty is to consider only the macrostructure, and, in this case, the model is claimed to yield better prediction (Kintch & van Dijk, 1978).

Second, the model assumes an ideal reader, i.e., one who will process the text and provide a mental representation of it without errors or interferences. It is argued that the longer the text, the more likely that misunderstandings may occur, thus resulting in an inadequate and unpredictable mental representation of the text.

Third, long naturalistic texts are very difficult to simulate by means of the propositional analysis proposed by the model. In fact, Kintsch admits that it would be very difficult, or "cumbersome" (Kintsch, 1994:300-301), if not impossible, to generate the propositional structure for such texts according to the principles specified by the model. More recently, however, Kintsch & Franzke (1995) reported an experiment in which a 892-word magazine article was used. For this experiment, the text was analyzed into propositional schemata (van Dijk & Kintsch, 1983). Propositional schemata are "more global units" than atomic propositions (Kintsch & Franzke, 1995:324).

2.5.3.3. *Alternative systems*

The restrictions of the model application to long texts coupled with the fact that using naturally-occurring texts with adult ESL/FL learners should be emphasized if reading fluency is to be achieved (Dubin, Eskey & Grabe, 1986), an alternative to Kintsch & van Dijk's propositional analysis seems warranted.

Johnson (1970) suggests a weighted system whereby a text is divided into pause units or propositions by a group of fluent readers. The readers are asked to read the text once carefully, then go over the text again placing a slash at the end of every stretch that contains a main idea or where the reader might pause for meaning. The final decision as to which sequences constitute idea units or pausal

units is determined by intersubject percentage of agreement: every linguistic stretch marked by 50% or more of the readers, becomes an idea unit. The next step consists of grouping these units into hierarchically arranged levels. Another group of readers will perform that task. Again, these readers will read the text twice; during the second reading they will place a number 1 before 25% of the units considered the least important. Next they will proceed to place a number 2 before another 25% of units which are considered the next least important. This procedure will be repeated for 25% additional units which will receive a 3, and the final 25% which will receive a 4.

The lowest level (level 1) would contain the least important propositions in the text, the next level up (level 2) would accommodate the following least important level, and so forth, culminating with the highest-level propositions (level 4), i.e., those containing the main ideas of the text. Linguistic units assigned to a level 4 would represent the main points of the text, or its macrostructure (in Kintsch and van Dijk's terms), while units labeled 3, 2, and 1 would correspond to subordinate information and details, or the microstructure of the text.

As it was previously mentioned, a study by Piché & Slater, (1983) comparing Johnson's (1970) approach to Meyer's (1975), found that the system proposed by Johnson was a better predictor of text recall by university students. Bernhardt (1991) found that the Johnson system correlates highly with Meyer's system, with the advantage of being a much simpler and less-time consuming alternative. More recently, similar procedures to those proposed by Johnson (1970) were adopted in L2/FL studies by Hauptman (1996) and Zerhouni (1996).

It appears that the application of the principles guiding the Kintsch & van Dijk model has revealed its strength in a number of studies conducted in L1 contexts. It remains to be assessed in L2/FL contexts, in particular regarding the extent to which second/foreign language learners reconstruct text, or, in the model's terminology, build the situation model.

The present study was designed to investigate precisely that. It examines text reconstruction performance of a group of Brazilian EFL university-level students at beginner and advanced levels of reading proficiency who read a fairly long naturally-occurring popular magazine article. In particular, it assesses the effect of text explicitness and reading ability on that performance.

CHAPTER III

Methodology

3.1. Objective of the Study

Generally, this study aimed at examining text reconstruction performance, i.e, the *situation model* (cf. Kintsch & van Dijk model) of a group of Brazilian university-level subjects reading one of two possible versions of a popular science article. Immediate recall protocols were used as a measure of reading comprehension based on the assumption that there is a direct relationship between what readers comprehend in a text and what they are able to recall; those who comprehend better will also recall it better.

More specifically, this study aimed at investigating the impact of text explicitness on comprehension as measured by the number and levels of textbase and inferential propositions recalled by means of an immediate reconstructive recall. In addition, the study examined the effect of reading ability in English as a Foreign language on both textbase and inferential propositional recall. Finally, the study sought to investigate the role that text difficulty, familiarity with text content, and interest in the text content may have on the amount and levels of textbase and inferential recall.

3.2. Research Questions

The present study attempted to address the following research questions:

1. What is the effect of *text version* on textbase, inferential, and reconstructive recall, as measured by an immediate recall protocol?

2. What is the effect of *reading ability level* on textbase, inferential, and reconstructive recall, as measured by an immediate recall protocol?

3. What is the effect of *text version* and *reading ability level* on propositional recall?

4. What types of recall patterns at the propositional levels do the textbase and inferential representations yield?

5. What is the impact of *text difficulty*, *topic familiarity*, and *topic interest* on recall?

3.3. Subjects

The subjects in this study (N=92) consisted of undergraduate students majoring in EFL ("Curso de Letras/Inglês") and graduate students[6] (MA candidates in EFL) from Universidade Federal do Paraná (UFPr), in Curitiba, State of Paraná, southern Brazil. 71 females and 21 males with the mean age of 24 years volunteered to participate in this study. The undergraduate subjects were

[6] The graduate students participating in this study are former undergraduate students in EFL at UFPr.

attending one of the four levels of the reading/writing training component of their program or an English Literature class in which case they had already completed the reading/writing program requirements. This group of subjects constituted a fair representation of the whole population in terms of gender breakdown and age average.

3.4. Materials

3.4.1. Text selection

A popular science article entitled **'Peering through the smoke screen'**, written by Ian Mundell, and published in the periodical *New Scientist* (October 9, 1993) was selected for this study for mainly two reasons. First, for text accessibility; this genre of writing allows readers without specialized domain knowledge to understand scientific problems through the use of explicit linguistic signals that indicate the cohesive relations in a text, or to permit them to be inferred (Myers, 1991). Moreover, it is assumed that the general topic – *smoking* – would be familiar to the target subjects, so it could be reasonably anticipated that familiarity with the subject can also help compensate for language deficiencies which could be experienced by low proficiency level subjects in reading the text (Hauptman, 1995; Steffensen at al., 1979). However, the facet of smoking which is explored by the author in the text may not be altogether familiar to that reader who does not keep updated with the latest news on the topic. Second, for affective reasons: a favourable attitude towards content has been shown not only to correlate with intention to read or to continue reading, but also

to facilitate the reading process (Matthewson, 1994). The unusual facet of the information on smoking which is explored in the selected text is assumed to be generally perceived as interesting by the subjects and might, therefore, raise their motivation in reading the selection. The article discusses a little known aspect of nicotine research — one that focuses on the *benefits* of nicotine — and the problems (e.g., prejudice and bias) researchers and funding bodies face as they attempt to advance studies in that area.

The participants were randomly assigned to read one of the two versions of the article. Both were fairly long texts: the original version (see *Appendix B*) has 1,856 words whereas the modified version (see *Appendix C*) consists of 1,228 words. The modifications to the original article include: (1) removing every explicit mention of the beneficial aspects of nicotine/smoking, (2) removing the middle section of the article (five paragraphs) where the writer presents testimony of various researchers on the reasons for prejudice against nicotine.

The issue of text coherence was carefully considered when the sections mentioned above were removed since it has been shown to play a major role in comprehension (McNamara et al, 1996; van Dijk & Kintsch, 1983; Kintsch & Vipond, 1979). Overall text coherence was not disturbed in any way as it was assumed that only a well organized, and well written text would allow high-knowledge as well as low-knowledge readers to generate what was not made explicit in the text (Kintsch, 1994; Moravcsik & Kintsch, 1993). The aim for using a modified version from the original was to try to determine whether the

information removed — mainly that related to the beneficial aspects of nicotine/smoking which is the main thrust of the target article — could be retrieved by the readers in part or, ideally, in full through inferential processes.

3.4.2. Propositional Analysis and Determination of Hierarchical Levels

Each version of the text was analyzed in terms of its propositional structure following the guidelines of the approach used in Zerhouni (1996) (See *Appendix D* for the propositional structure and the hierarchical levels identified in both versions). One analysis was done by me and another by my thesis supervisor. We compared our analyses, and the final accepted propositional structure for both versions was the result of agreement between the two of us. Six hierarchical levels were assigned to both text versions: a *Macropropositional level* [MP] — the highest in the hierarchy — comprising the topic of the text; *primary* propositions [PIs] representing the main ideas; *secondary* propositions [PIIs] corresponding to ideas of comparable importance which clarify and/or expand main ideas; *tertiary* propositions [PIIIs] representing ideas of less importance which provide further detail to secondary propositions; quarternary propositions [PIVs] comprising details in the text related to names of places and institutions, substances, as well as to other minor details which provided clarification for tertiary propositions; fifth level propositions [PVs] representing names of people, e.g., scientists and researchers, and institutions. Table 1 displays the number and level of propositions in the two versions of the text:

TABLE 1. Level and Number of Propositions for the Original and Modified text versions

	Text O	Text M	Text O – Text M = difference
No. of words	1,856	1,228	628
No. of MPs	2	1	1
No. of PIs	13	9	4
No. of PIIs	29	22	7
No. of PIIIs	105	74	31
No. of PIVs	54	29	25
No. of PVs	61	25	36
Total no. of propositions	264	160	104

3.4.3. Assessment of Reading Ability Levels

A self-assessment instrument was used in which the subjects assessed their reading ability in English (see *Appendix E*, Subjects' booklet, Part 5 with accompanying English translation). The instrument design follows the trend suggested in the self-assessment literature according to which instruments should be planned according to the areas of concern or local needs of the institution and learners involved (Cohen, 1994). Hence, this instrument reflects the skill areas in which the students are trained throughout the reading component of the current curriculum for the undergraduate degree in EFL at Universidade Federal do Paraná[7].

[7] The reading skills training component lasts five or more semesters depending on student's progress.

The instrument consists of twelve statements to which the subjects were asked to respond using a five-point graded scale. These statements globally reflect skills ranging from basic to more advanced levels. They are: (1) recognizing words and phrases of similar and opposing meaning, (2) using reading strategies to identify or locate information in short and long texts, (3) reading to extract the main idea or gist of a text, (4) identifying the macrostructure of a text, (4) summarizing, (5) discriminating of different elements or features that characterize different rhetorical functions within and beyond the paragraph level, (6) inferring, (7) distinguishing facts from opinions, (8) identifying the target audience of a text, (9) identifying features pertaining to various text genres (e.g., a newpaper editorial, a weekly magazine article, a scientific article, a textbook chapter) (10) editing: reading and improving a text (e.g., orthography, text organization, style).

3.5. Experimental Design

In this study, each subject read and recalled one of the two text versions of a popular science article. The independent variables were (1) two text versions of an article, (2) two levels of reading ability. The dependent variables were (1) subjects' scores on recall protocols — both in terms of total number of propositions recalled and number of propositions recalled per hierarchical level within the text version, (2) subjects' scores on correct inference generation. Finally, the control variables were subjective indices of text difficulty, topic interest, and topic familiarity which were used as covariates in the statistical analysis.

3.6. Procedure

The experiment was conducted in a two-hour session on the university premises, and in the presence of the researcher. The booklet containing the data collection materials (See *Appendix E*) was disassembled so that subjects were handed each of the five sections separately. As they individually finished reading and/or completing each of the sections, the next one was handed out, and so forth. At the end, the sections were reassembled, stapled, and placed in a yellow envelope.

The experiment itself started with the researcher reading the instructions aloud in Portuguese while the students read them silently. Following that, the subjects received one of the two versions of the text and blank sheets where they wrote their recall protocol. They were asked to read the text, take notes if they wished, and, write everything they could remember using their own words or those of the author, without consulting the text or their notes. They were also instructed that they would be able to write their recall protocol in Portuguese — their native language — or in English, or in both languages, whichever they found easier to use. When they completed the recall task, they were instructed to put it in the yellow envelope. Next they performed the text assessment in terms of difficulty, topic interest, and content familiarity. Finally, they completed the personal data and educational background profile, and performed the reading ability self-assessment.

3.7. Scoring of Recall Protocols

The written recall protocols were scored for (1) number and types of textbase propositions recalled, and (2) for the number of inferences[8] drawn. In both cases, six propositional levels were assumed, i.e., a macropropositonal level (MP) — the highest — followed by propositionnal level I (PI), then propositional level II (PII), propositional level III (PIII), propositional level IV (PIV), and finally, propositional level V (PV) — the lowest (See *Appendix F* for an example [translated into English] of a scored recall protocol). Scoring of propositions was conducted considering the weighted values in Table 2 below:

Table 2. Scoring of Textbase and Inferential Propositions for Subjects' Reconstructive Recall

Propositional level	*Textbase propositions*	*Inferential propositions*
MP	16	32
PI	8	16
PII	4	8
PIII	2	4
PIV	1	2
PV	0.5	1

Table 3 displays the maximum possible scores for the two versions at the propositional level as well as for the total textbase recall:

[8] The term *inference* here, and throughout this study, refers to what Kintsch (1993, 1998) labels as *knowledge retrieval processes* (see *Appendix A*).

Table 3. Maximum Possible Scores By Text Version for Each Propositional Level at Textbase Recall

	Original Version		Modified Version	
Prop. Level	*Number of Propositions*	*Number of propositions X Weighted Values*	*Number of Propositions*	*Number of propositions X Weighted Values*
MP	2	32	1	16
PI	13	104	9	72
PII	29	116	22	88
PII	105	210	74	148
PIV	54	54	29	29
PV	61	30.5	25	12.5
Total	264	546.5	160	365.5

3.8. Treatment of the Data and Statistical Analyses[8]

Before making any decisions as to which statistical tests would be conducted on the collected recall data, the data were submitted to the Kolmogorov-Smirnov Normality Test (significance level of 0.05). The data for the total textbase recall and the total reconstructive recall did not differ significantly from normal distribution, while the data for each of the six propositional levels and the total inferential recall did. Transformations (e.g., square root and arc sin) also failed to make these data normally distributed. Given these outcomes, three types of statistical analyses, one parametric and two non-parametric, were chosen. First, the data that displayed normality, i.e., the total textbase and the total reconstructive recall, were submitted to a Two-Way Analysis of Covariance (ANCOVA) with text version and reading ability as the main factors, and text difficulty, topic familiarity, and topic interest as covariates.

[8] All statistical analyses were run on *SYSTAT*®Version 7.0 for Windows (Standard Version)

Second, the data that lacked normality, i.e., the total inferential recall and propositional recall, required a Kruskal-Wallis One-Way Analysis of Variance. Finally, A Wilcoxon Matched-Pair Signed-Rank Test was performed on the propositional levels both for textbase and inferential recalls in order to determine whether significant differences existed between the propositional levels for each type of recall.

In order to facilitate the various comparisons of scores, the raw recall protocol data were converted into standard scores, more specifically, *T* scores. The *T*-score or standard score "is from a distribution designed to have a mean of 50 and a standard deviation of 10. A *T*-score is equal to ten times the respective *z*-score, plus 50 (Henning, 1987, p. 198)". The formula to calculate a *T* score[9] is therefore

$$T = 10z + 50$$

For the purposes of comparing the recall of the various propositional levels, proportional weighted scores (P) were used. The formula to calculate a proportional weighted score is

$$P = \frac{Propositional\ Level\ Score\ for\ Subject_x}{Highest\ Possible\ Propositional\ Level\ Score}$$

[9] In J.D. Brown (1988) *Understanding Research in Second Language Learning*, New York, NY: Cambridge University Press, p. 87.

CHAPTER IV

Results

4.1. Introduction

The present study investigated the influence of text explicitness and reading ability level on the performance of Brazilian university students reading English as a Foreign Language. The subjects' performance was examined vis-à-vis the results yielded by the reconstructive recall protocols, and the reader assessment measures of text difficulty, topic familiarity, and topic interest. Each subject's recall protocol was analyzed at the textbase and at the inferential levels for information recalled at the various propositional levels within the full text.

The independent measures included text version and reading ability level, while the dependent measure comprised the subjects' recalls at the textbase, inferential, and reconstructive levels, each examined in their totality, and at the propositional level. The subjects' assessment of text difficulty, topic familiarity, and topic interest by means of three Likert scales were used as covariates in the main analysis because they were not independently determined.

4.2. Total Textbase Recall

The *T* score mean for the total recall of the Original version was higher (58.58) than for the Modified version (47.41) (c.f. Table 4). High reading ability subjects recalled more propositions (54.60) of the text they read than low reading ability ones (45.39) (c.f. Table 4).

Table 4. Means and Standard Deviations for Total Textbase Recall by Text Version and Reading Ability [*T* scores].

Text Version				Reading Ability			
Original (N=46)		Modified (N=46)		High (N=46)		Low (N=46)	
Mean	*S.D.*	*Mean*	*S.D.*	*Mean*	*S.D.*	*Mean*	*S.D.*
52.58	10.44	47.41	8.92	54.60	9.67	45.39	8.07

From Table 4, it appears that the subjects who read the Original version and those of high reading ability yielded a better recall at the textbase level.

In order to understand the relationship and contribution of text version and reading ability to total textbase recall, the results obtained in Table 4 were submitted to a Two-Way Analysis of Covariance (ANCOVA) with measures of text difficulty, topic familiarity, and topic interest as covariates. Table 5 displays the results of this analysis.

Table 5. Effect of Text Version and Reading Ability Level on Total Textbase with Text Difficulty, Topic Familiarity, and Topic Interest as Covariates.

TOTAL TEXTBASE RECALL (N = 92)					
Source	**SS**	**df**	**MS**	**F-ratio**	*Significance*
• **Text version**	612.68	1	612.68	9.45	**
• **Reading Ability**	1116.57	1	1116.57	17.22	***
• **Text version** *vs* **Reading Ability**	29.15	1	29.15	0.45	ns
• *Text Difficulty*	51.75	1	51.75	0.79	ns
• *Topic Familiarity*	156.22	1	156.22	2.41	ns
• *Topic Interest*	664.64	1	664.64	10.25	**
Error	5508.73	85	64.80		

** $p \leq 0.01$
*** $p \leq 0.001$

Strong, significant main effects were obtained for text version (F=9.45, df=1/85, p<0.003), and reading ability level (F=17.22, df=1/85, p<0.001). There was also a significant effect for topic interest (F=10.25, df=1/85, p<0.002). It is important to note that this analysis clearly showed that there was no correlation between text version and reading ability (F=0.45, df=1/85, p<0.504).

4.3. Total Inferential Recall

Subjects who read the Modified version generated more inferences (55.19) than subjects who read the Original version (41.80) (c.f. Table 6). Again, high reading ability subjects yielded more inferences (50.73) than low reading ability ones (44.48) (c.f. Table 7)

Table 6. Median and Percentiles for Total Inferential Recall by Text Version [*T* scores]

Text version					
Original (N=46)			**Modified** (N=46)		
Median	*25%*	*75%*	*Median*	*25%*	*75%*
41.80	40.91	46.27	55.19	48.05	58.02

Table 7. Median and Percentiles for Total Inferential Recall by Reading Ability [*T* scores]

Reading Ability					
High (N=46)			**Low** (N=46)		
Median	*25%*	*75%*	*Median*	*25%*	*75%*
50.73	44.48	59.65	44.48	40.91	50.73

In order to examine the effect of text version and reading ability on total inferential recall, the data on Tables 6 and 7[10] were submitted to two Kruskal-Wallis One-Way Analysis of Variance tests. Table 8 and 9 present the results of these analyses.

Table 8. Effect of Text Version on Total Inferential Recall [*T* scores]

	Reading Ability	
Text Version	**High** (N=46)	**Low** (N=46)
ORIGINAL	326	405
MODIFIED	755	706
Significance	***	**

** $p \leq 0.01$
*** $p \leq 0.001$

[10] Due to the nature of these data, where no considerations about their distribution normality were made, a non-parametric statistical test was used.

Table 9. Effect of Reading Ability on Total Inferential Recall [*T* scores]

	Text Version	
Reading Ability	**Original** (N=46)	**Modified** (N=46)
HIGH	597	704
LOW	484	378
Significance	ns	***

*** $p \leq 0.001$

Significant main effects were found for text version on total inferential recall within both levels of reading ability (Table 8). The Modified text yielded significantly more inferences than the Original text for both high reading ability subjects ($p<0.001$), and low reading ability ones ($p<0.01$). With regard to the effect of reading ability on total inferential recall, there was a strong main effect within the Modified version (Table 9). High reading ability subjects yielded significantly more inferences than low reading ability ones ($p<0.001$). Reading ability was not a significant factor with respect to inference generation within the Original version.

4.4. Total Reconstructive Recall

Subjects who read the Modified version yielded a better (52.13) reconstructive recall than those who read the Original version (47.68) (c.f. Table 7). High reading ability subjects produced a superior (55.02) overall recall than low reading ability ones (44.97) (c.f. Table 10).

Table 10. Means and Standard Deviations for Total Reconstructive Recall by Text Version and Reading Ability [*T* scores]

Text Version				Reading Ability			
Original (N=46)		Modified (N=46)		High (N=46)		Low (N=46)	
Mean	*S.D*	*Mean*	*S.D.*	*Mean*	*S.D.*	*Mean*	*S.D.*
47.68	7.93	52.13	11.32	55.02	9.62	44.97	7.61

In order to examine the relationship and contribution of text version and reading ability to total reconstructive recall, the results obtained in Table 10 were submitted to a Two-Way Analysis of Covariance (ANCOVA) with measures of text difficulty, topic familiarity, and topic interest as covariates. Table 11 displays the results of this analysis.

Table 11. Effect of Text Version and Reading Ability Level on Total Reconstructive Recall with Text Difficulty, Topic Familiarity, and Topic Interest as Covariates [*T* scores].

TOTAL RECONSTRUCTIVE RECALL (N = 92)					
Source	**SS**	**df**	**MS**	**F-ratio**	*Significance*
• **Text version**	425.99	1	425.99	6.93	**
• **Reading ability**	1830.68	1	1830.68	29.80	***
• **Text version *vs* Reading Ability**	134.28	1	134.28	2.18	ns
• *Text Difficulty*	21.11	1	21.11	0.34	ns
• *Topic Familiarity*	27.57	1	27.57	0.50	ns
• *Topic Interest*	901.15	1	901.15	14.67	***
Error	5221.34	85	61.42		

* $p \leq 0.05$ ** $p \leq 0.01$ *** $p \leq 0.001$

Strong, significant main effects were obtained for text version (F=6.93, df=1/85, p<0.01), and reading ability level (F=29.80, df=1/85, p<.001). This implies that the text version they read and the subjects' reading ability level made a difference as they attempted to reconstruct the text. There was also a significant effect for topic interest (F=14.67, df=1/85, p<0.001). No interaction between text version and reading ability (F=2.18, df=1/85, p<0.143) was found.

4.5. Propositional Level Recall for Textbase Recall

Tables 12 and 13 display the median and percentiles of propositional level recall for textbase recall by text version and reading ability level.

Table 12. Median and Percentiles for Textbase Recall by Text Version and Propositional Level [*T* scores]

	Text version					
	Original (N=46)			**Modified** (N=46)		
Prop. L.	*Median*	*25%*	*75%*	*Median*	*25%*	*75%*
MP	53.82	53.82	66.41	41.24	41.24	41.24
PI	51.36	42.97	59.76	51.36	42.97	55.56
PII	47.43	43.67	51.18	47.43	43.67	54.93
PIII	48.21	41.45	51.59	50.75	44.83	58.36
PIV	48.22	43.68	57.30	43.68	43.68	48.22
PV	45.38	45.38	59.07	45.38	45.38	45.38

Table 13. Median and Percentiles for Textbase Recall by Reading Ability Level and Propositional Level [*T* scores]

	Reading Ability Level					
	High (N=46)			**Low** (N=46)		
Prop. L.	*Median*	*25%*	*75%*	*Median*	*25%*	*75%*
MP	41.24	41.24	66.41	47.53	41.24	53.82
PI	51.36	42.97	59.76	47.17	38.77	51.36
PII	51.18	43.67	62.44	43.67	39.92	51.18
PIII	51.59	46.52	61.74	44.83	39.76	49.90
PIV	48.22	43.68	57.30	48.22	43.68	52.76
PV	45.38	45.38	45.38	45.38	45.38	45.38

In order to examine the effect of text version and reading ability on propositional recall at the textbase level, two Kruskal-Wallis One-Way Analysis of Variance tests were run on the data presented in Tables 12 and 13. Results of these analyses are displayed in Tables 14 and 15.

Table 14. Effect of Text Version on Propositional Recall at the Textbase Level [*T* scores]

		TEXT VERSION		
Reading Ability	*Prop. Level*	**ORIGINAL** (N=46)	**MODIFIED** (N=46)	*Significance*
High (N = 23)	MP	794	288	***
	PI	579	502	ns
	PII	483	599	ns
	PIII	472	610	ns
	PIV	587	495	ns
	PV	563	518	ns
Low (N = 23)	MP	764	317	***
	PI	510	572	ns
	PII	572	510	ns
	PIII	493	588	ns
	PIV	575	506	ns
	PV	557	524	ns

*** $p \leq 0.001$

Table 15. Effect of Reading Ability Level on Propositional Recall at Textbase Level [*T* scores]

		READING ABILITY LEVEL		
Text version	*Prop. Level*	**HIGH** (N=46)	**LOW** (N=46)	*Significance*
Original (N = 23)	MP	644	437	**
	PI	655	427	**
	PII	607	475	ns
	PIII	643	438	*
	PIV	579	503	ns
	PV	514	567	ns
Modified (N = 23)	MP	518	564	ns
	PI	601	481	ns
	PII	691	390	***
	PIII	683	398	**
	PIV	562	519	ns
	PV	507	574	ns

* $p \leq 0.05$
** $p \leq 0.01$
*** $p \leq 0.001$

The Original version showed a significant superiority of recall at the macropropositional level (MP) over the Modified version for both high and low ability level readers ($p<0.001$) (c.f. Table 14). For the other propositional levels, text version did not exert any significant effect.

As to the effect of reading ability on propositional recall (c.f. Table 15), high reading ability subjects who read the Original version yielded a significantly

superior recall over low ability subjects at the macroprositional level (MP) ($p<0.01$), at the primary propositional level (PI) ($p<0.01$), and at the tertiary propositional level (PIII) ($p<0.02$). Similarly, high reading ability subjects who read the Modified version showed a significantly greater recall over low ability ones at the secondary propositional level (PII) ($p<0.001$), and at the tertiary propositional level (PIII) ($p<0.002$)

4.6. Propositional Level Recall for Inferential Recall

Tables 16 and 17 display the median and percentiles of propositional level recall for textbase recall by text version and reading ability level.

Table 16. Median and Percentiles for Inferential Recall by Text Version and Propositional Level [*T* scores]

	Text version					
	Original (N=46)			**Modified** (N=46)		
Prop. L.	*Median*	*25%*	*75%*	*Median*	*25%*	*75%*
MP	42.59	42.59	42.59	54.54	42.59	66.50
PI	42.78	42.78	50.78	50.78	42.78	58.78
PII	45.35	45.35	45.35	45.35	45.35	54.25
PIII	46.05	46.05	46.05	46.05	46.05	53.61
PIV	48.01	48.01	48.01	48.01	48.01	48.01
PV	0.00	0.00	0.00	0.00	0.00	0.00

Table 17. Median and Percentiles for Inferential Recall by Reading Ability Level and Propositional Level [*T* scores].

	Reading Ability					
	High (N=46)			**Low** (N=46)		
Prop. L.	*Median*	*25%*	*75%*	*Median*	*25%*	*75%*
MP	54.54	42.59	66.50	42.59	42.59	42.59
PI	50.78	42.78	58.78	42.78	42.78	50.78
PII	45.35	45.35	54.25	45.35	45.35	54.25
PIII	46.05	46.05	53.61	46.05	46.05	46.05
PIV	48.01	48.01	48.01	48.01	48.01	48.01
PV	0.00	0.00	0.00	0.00	0.00	0.00

The effect of text version and reading ability level on propositional recall at the inferential level was examined by running two Kruskal-Wallis Analysis of Variance tests on the data displayed in Tables 16 and 17. The results of these analyses are displayed in Tables 18 and 19.

Table 18. Effect of Text Version on Propositional Recall at Inferential Level [*T* scores]

		TEXT VERSION		
Reading Ability	*Prop. Level*	**ORIGINAL** (N=46)	**MODIFIED** (N=46)	*Significance*
High (N = 23)	MP	311	771	***
	PI	422	659	**
	PII	530	552	ns
	PIII	512	570	ns
	PIV	519	563	ns
	PV	0	0	-
Low (N = 23)	MP	435	646	**
	PI	453	628	*
	PII	522	559	ns
	PIII	512	570	ns
	PIV	541	541	ns
	PV	0	0	-

*$p \leq 0.05$
** $p \leq 0.01$
*** $p \leq 0.001$

Text version exerted a significant effect on inferential recall at the macropositional and primary propositional level (c.f. Table 18). The Modified version provided a significant predominance of recall at the MP level over the Original version for both high reading ability subjects ($p<0.001$) and low ability ones ($p<0.002$), and at the PI level for high ability ($p<0.006$) and low ability

($p<0.03$). Text version did not yield a significant effect on inferential recall at the other propositional levels.

Table 19. Effect of Reading Ability Level on Propositional Recall at Inferential Level [*T* scores]

		READING ABILITY LEVEL		
Text version	*Prop. Level*	**HIGH** (N=46)	**LOW** (N=46)	*Significance*
Original (N = 23)	MP	564	517	ns
	PI	567	515	ns
	PII	555	527	ns
	PIII	572	509	ns
	PIV	552	529	ns
	PV	0	0	-
Modified (N = 23)	MP	699	383	***
	PI	608	474	ns
	PII	551	531	ns
	PIII	575	506	ns
	PIV	575	506	ns
	PV	0	0	-

*$p \leq 0.5$
** $p \leq 0.01$
*** $p \leq 0.001$

With regard to the effect of reading ability on inferential recall at the propositional level, it yielded a strong, significant effect only for the recall of macropropositions (MP) (c.f. Table 19). High reading ability subjects recalled significantly more at the MP level than did low reading ability ones ($p<0.001$).

4.7. Propositional Structure

Results of propositional recall for the two types of recall (textbase and inferential) revealed a general tendency among subjects to recall superordinate propositions better than subordinate ones. To test whether there were differences between propositional recall levels, a Wilcoxon Matched-Pair Signed Ranks Test was performed on the proposition recall data both at the textbase and inferential levels[11]. Results for the textbase and inferential recall levels for the four groups (O_H=Original version/high reading ability; O_L=Original version/low reading ability; M_H=Modified version/high reading ability; M_L=Modified version/low reading ability) are presented in Figure 1.

[11] For the purposes of this analysis, proportional weighted scores were used for textbase and inferential propositions. For textbase propositions, a ceiling was assumed which was the total possible number of propositions from the original and the modified versions (see Table 3). For inferential propositions, in the absence of a true ceiling for this type of recall — given the assumption that no true ceiling can be established for inferences drawn from a text — an artificial ceiling was used, and that was the highest possible overall recall obtained among the subjects.

Figure 1. Comparison of Propositional Level Recall for Groups Combined by Text Version and Reading Ability Level for Textbase and Inferential Recall Levels

	O_H (N=23)		O_L (N=23)		M_H (N=23)		M_L (N=23)	
Prop. levels	**Textb**	**Infer.**	**Textb**	**Infer.**	**Textb**	**Infer.**	**Textb**	**Infer.**
MP vs. PI		ns		ns				°
MP vs. PII		ns		°				
MP vs. PIII		ns		ns				
MP vs. PIV		ns		ns				
MP vs. PV		-		-	ns	-	ns	-
PI vs. PII		ns		ns		ns		ns
PI vs. PIII		ns		ns				
PI vs. PIV		ns				°		
PI vs. PV		-		-		-		-
PII vs. PIII	ns	ns	ns	ns	ns	ns	ns	
PII vs. PIV		ns				ns		
PII vs. PV		-		-		-		-
PIII vs. PIV		ns		ns		ns		
PIII vs. PV		-		-		-		-
PIV vs. PV		-		-		-		-

Higher-Level Props > Lower-Level Props	
-	statistical analysis not done: PV score=0
°	$p \leq 0.1$
	$p \leq 0.05$
	$p \leq 0.01$
	$p \leq 0.001$

Results for textbase recall yielded a similar pattern across the four groups (c.f. Figure 1). Performance of the four groups indicated a respect for the hierarchical structure of the two versions, that is, higher-level propositions were better recalled that lower-level propositions. For both text versions and reading ability levels, MPs were significantly better recalled than PIs, PIIs, PIIs, PIVs , and PVs. A similar significant pattern was found for PIs in relation to PIIs, PIIIs, PIVs, and PVs, and for PIIs in relation to PIVs and PVs. There was no significant

difference between the recall of PIIs over PIIIs across the four groups. Finally, significant differences were found between the recall of PIIIs and PIVs and PIIIs and PVs, and between PIVs and PVs.

Results for inferential recall yielded different recall patterns for the two text versions (c.f. Figure 1). Performance of the Original text groups (O_H and O_L) showed significant differences between PIs and PIVs, and PIIs and PIVs, and the marginal significance ($p<0.07$) found in the recall of MPs in relation to PIIs among low reading ability subjects (O_L). Performance of the Modified text groups (M_H and M_L) (c.f. Figure 1), however, was more consistent. For the M_H group, a solid pattern of strong, significant differences between the recall of MPs and PIs, MPs and PIIs, MPs and PIIIs, and MPs over PIVs was found. Equally significant differences were found between the recall of PIs and PIIIs, and a marginal difference between PIs and PIVs. With respect to the M_L group, significant differences were found between the recall of MPs and PIIs, MPs and PIIIs, and MPs and PIVs. In addition to these, there were significant differences between PIs and PIIIs, PIs and PIVs, PIIs and PIIIs, PIIs and PIVs, and PIIIs over PIVs.

4.8. Subject Assessment of Text difficulty, Topic Familiarity, and Topic Interest

Tables 20 and 21 present the means and standard deviations for each of the three Likert scale items through which subjects of both reading ability levels assessed text difficulty, topic familiarity, and topic interest for the two text versions. Each scale ranged from 1 (very difficult/not at all familiar/totally uninteresting) to 5 (easy/totally familiar/very interesting).

Table 20. **Means and Standard Deviations of Likert Scales for Text Difficulty, Topic Familiarity, and Topic Interest by Text Version**

	Text Version (N=92)			
	Original (N=46)		**Modified** (N=46)	
	Mean	*S.D.*	*Mean*	*S.D.*
Text Difficulty	3.30	1.00	3.65	.87
Topic Familiarity	2.23	.97	2.67	.76
Topic Interest	3.17	1.18	3.39	.97

Table 21. **Means and Standard Deviations of Likert Scales for Text Difficulty, Topic Familiarity, and Topic Interest by Reading Ability Level**

	Reading Ability (N=92)			
	High (N=46)		**Low** (N=46)	
	Mean	*S.D.*	*Mean*	*S.D.*
Text Difficulty	3.82	.90	3.13	.88
Topic Familiarity	2.30	.89	2.60	.88
Topic Interest	3.30	1.09	3.26	1.08

Table 20 reveals that, in general, the sample said that the text they read was of average difficulty, reasonably familiar, and quite interesting. The Modified version was easier (3.65) to read than the Original version (3.30). The content of the Modified version was also more familiar (2.67) than that of the Original

version (2.30), and it was considered more interesting (3.39) than the Original version (3.30).

Table 21 shows that, in general, high reading ability subjects felt that the text they read was easier (3.82) to read than did the low reading ability ones (3.13). On the other hand, the low reading ability sample felt they were more familiar with the content of the text (2.60) they read than did the high ability subjects (2.30). With regard to content interest, high reading ability subjects considered the text they read more interesting (3.30) than low reading ability subjects (3.26).

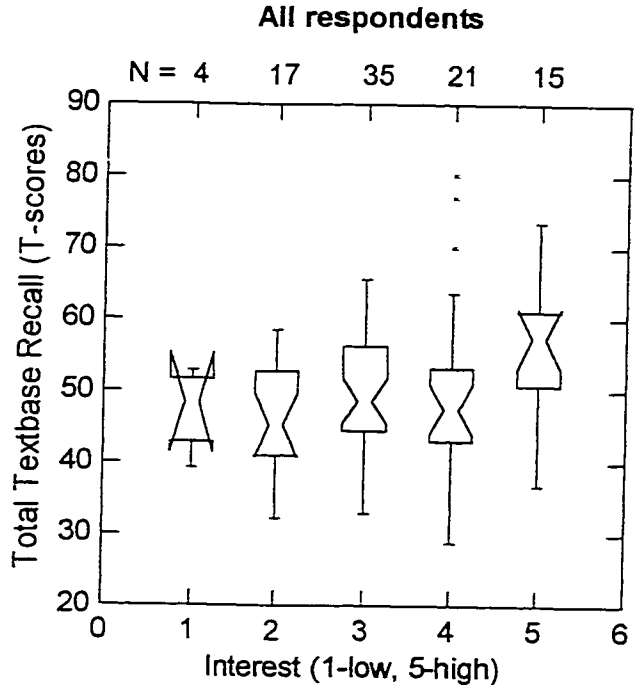
Results from the ANCOVA analysis on the effect of text version and reading ability level on total textbase recall (c.f. Table 5) and total reconstructive recall (c.f. Table 11) revealed a significant effect of interest on both total textbase recall ($F=10.25$, $df=1/85$, $p<0.002$) and total reconstructive recall ($F=14.67$, $df=1/85$, $p<0.001$). This suggests that interest in the topic of the text made a difference as subjects proceeded to reproduce the content of the text and establish its situation model.

Visual analysis of notch overlap was used to elicit the effect of topic interest on each type of recall. In a notched box-plot, the notch width corresponds to the confidence interval of the median represented by the notch apex. The objective of this analysis is similar to a post-hoc test used to determine significant differences among means in parametric statistics.

For total textbase recall (Figure 2), the notch corresponding to Likert scale 5 ('very interesting') is clearly above and not overlapping the notches corresponding to Likert scales 2 to 4 ('somewhat interesting' to 'quite

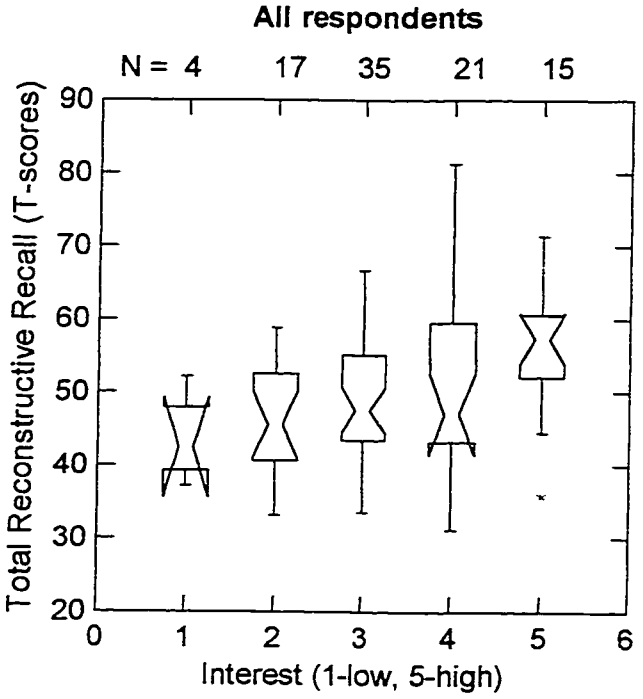
interesting'). This indicates that the median total textbase recall corresponding to scale 5 has about a 95% probability of being significantly higher than scales 2 to 4 (c.f. SYSTAT® 7.0, *Graphics*, p. 112). Even though Likert scale 5 ('very interesting') and 1 ('totally uninteresting') overlap, results from 1 are less reliable because of the limited number of respondents (N=4) at this level.

Figure 2. Effect of Topic Interest on Total Textbase Recall for All Subjects



Similarly, the median total reconstructive recall (Figure 3) for Likert scale 5 ('very interesting') respondents is significantly higher than all other levels. For both the textbase and the total reconstructive recall, the medians for levels 1 to 4 are not different from each other.

Figure 3. Effect of Topic Interest on Total Reconstructive Recall for All Subjects.



To further elicit whether topic interest was related to reading ability, the notched-box plots (Figure 4) show the positive effect interest had for the total textbase recall of low reading ability subjects who considered the text 'very interesting'(i.e., 5 in the Likert scale). The median total textbase recall for Likert scale 5 respondents is significantly higher than all other levels. This indicates that these subjects had a significantly higher total textbase recall score than the ones who considered it 'quite interesting' (i.e., 4 in the Likert scale) and 'a little interesting'(i.e., 2 in the Likert scale).

Figure 4. Effect of Topic Interest on Total Textbase Recall for Low Reading Ability Subjects.

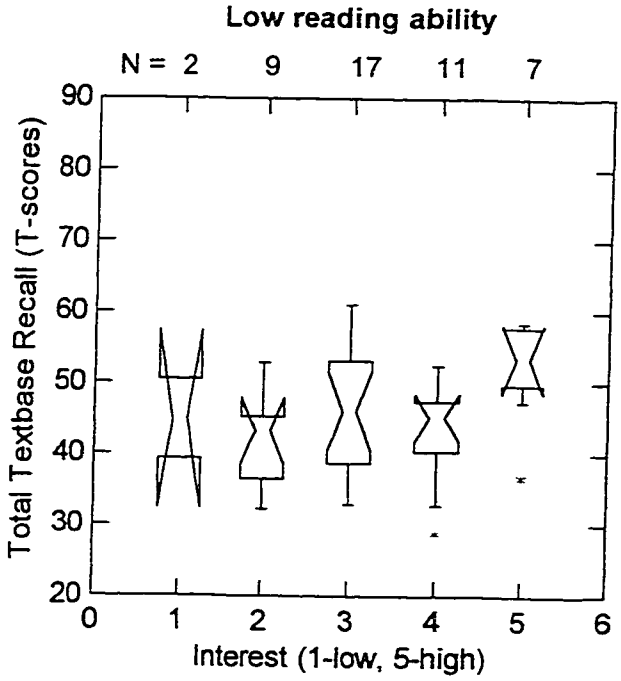
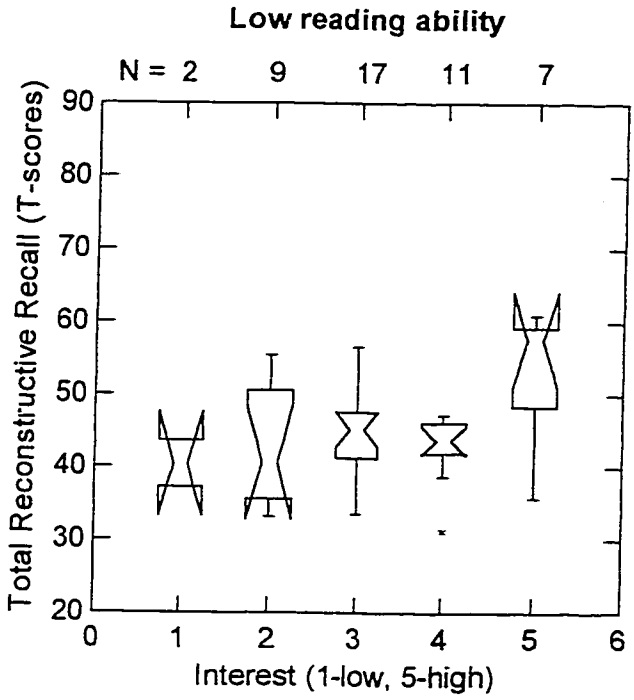


Figure 5 reveals an even stronger effect of interest for total reconstructive recall of low ability readers who felt the text they read was 'very interesting' over those who considered it less interesting.

With regard to text difficulty and content familiarity, no significant differences were found.

Figure 5. Effect of Topic Interest on Total Reconstructive Recall for Low Reading Ability Subjects.



CHAPTER V

Discussion

5.1. Introduction

The present study investigated the effects of text explicitness on the reconstructive recall of two versions of a text by university subjects of two reading ability levels in English as a Foreign Language.

This chapter will discuss the findings reported in Chapter IV in light of the research questions posed in Chapter III.

5.2. Research Question #1

- *What was the effect of text version on textbase, inferential, and reconstructive recall, as measured by an immediate recall protocol?*

As discussed in Chapter II, when readers process a text, they construct a mental representation for it. According to the Kintsch and van Dijk model of text comprehension (Kintsch & van Dijk, 1978; van Dijk & Kintsch, 1983; Kintsch, 1974, 1988, 1992, 1994, 1998) and Johnson-Laird's (1983) mental models, two levels of text representation may be distinguished. A superficial representation, referred to as the *textbase*, and a deeper representation, labeled the *situation model*. The *textbase* representation comprises the propositional structure which represents the semantic content of the text. The *situation model*, on the other hand, is derived from the reader's knowledge of the situation posed by the text, and from processes which integrate textual information with the reader's prior

knowledge. It constitutes a direct reflection of the reader's understanding and interpretation of textual information whose outcome is the emergence of a deeper level of understanding. It is through the activation of this knowledge that readers are able to infer the information that is left implicit in the text. It is argued that the more complete and elaborate this integration is, the stronger the situation model will be (Kintsch, 1994).

The present study investigated the impact of a fully explicit versus a less explicit version of a fairly long text on the construction of the *textbase* and the *situation model*. As predicted by the Kintsch & van Dijk (1978) model for long texts, subjects retrieved the macrostructure of the text, i.e., the text's global organization into main points and subordinate points or its gist. The results obtained indicated that subjects yielded a stronger textbase representation, that is, a representation which reflected the reproduction of text content, when they processed the fully explicit, Original version. In contrast, a superior *situation model* emerged when they read the less explicit version of the text. In other words, subjects reconstructed a text more appropriately when they had to generate information that was not explicit in the text. These results parallel those reported in Chi & Bassok (1989), Bereiter & Scardamalia (1989), Kintsch (1994), McNamara et al. (1996), McNamara & Kintsch (1996), Voss & Silfies (1996), and Roloff (1997) whereby readers remembered textual information they had been required to generate better than textual information that was explicitly supplied to them. Readers, therefore, seem to benefit from more challenging texts, that is, those that require an extra processing effort on the part of the reader.

Results from total inferential recall indicated that it was the Modified version which significantly allowed subjects to generate the highest amount of inferences. It enabled the readers to attempt to compensate for the missing information by engaging in more inference generation processing, and hence establishing more links between the content of the text and their knowledge. The positive outcome yielded by the less explicit version seems, to a large extent, to be due to writing quality. As it was mentioned in Chapter III, the issue of text coherence was carefully considered when the modifications to the original version were made. Overall coherence was not disturbed in any way as it was assumed that only a well organized, and well written text would allow high-knowledge as well as low-knowledge readers to generate what was left implicit in the text (Moravcsik & Kintsch, 1993; Kintsch, 1994).

5.3. Research Question # 2

- *What was the effect of reading ability level in EFL on textbase, inferential, and reconstructive recall, as measured by an immediate recall protocol?*

As discussed in Chapter II, reading ability in a second or foreign language, that is, language proficiency and reading skill, have been shown to affect the level of comprehension of second and foreign language readers (c.f. Cziko, 1978; Ulijn, 1980; Clarke, 1980; Hudson, 1982; Barnett, 1986 Devine, 1987; Eskey, 1988; Carrell, 1991; Zerhouni, 1996).

The present study investigated the impact of reading ability level in EFL on textbase, inferential, and reconstructive levels of representation. The results reported in Chapter IV indicated that reading ability was a significant factor across the three levels of representation. Comparisons between the two reading ability levels — high and low — revealed that high reading ability subjects produced a superior overall textbase, overall inferential, and overall reconstructive representations. Far from surprising, these results support the assumption that reading ability level influences the type and amount of information recalled, as it has been extensively demonstrated in previous research.

5.4. Research Question # 3

- *What was the effect of text version and reading ability level on propositional recall?*

Results for the effect of text version on propositional recall at the textbase level showed a significant superiority of the Original version over the Modified version only for the macropropositions. Text version did nor exert any influence on the recall of the other propositional levels. At the inferential recall level, on the other hand, it was the Modified version which provided a significant predominance of recall not only at the macropropositional level, but also at the primary propositional level. Again, version was not a factor in relation to the recall of the micropropositional levels. In sum, the better propositional recall in

both the textbase and the inferential recall levels was primarily a consequence of the better recall of the macropropositions.

It is not surprising that the Original, fully explicit version yielded a more adequate textbase recall than the Modified version, while the latter yielded a superior performance on inference generation. By definition, textbase recall is a measure of memory for the text itself, a reflection of a superficial understanding of the text (McNamara et al., 1996). The superior propositional recall performance at the textbase level by subjects who read the Original text can be attributed to (1) the full and consistent availability of all the macro and micro information that he/she needed to form a more adequate memory of the text, and, consequently, a more accurate reproduction of it, and (2) the nature of the task. It has been shown that subjects who read-to-recall show a superior recall than subjects who read to perform another task (Mills et al.,1995). Moreover, immediate recall may significantly increase the number of propositions recalled at the textbase level when compared to delayed recall (Mannes & Kintsch, 1987).

With respect to propositional recall at the inferential level, as it was noted before, text version produced a significant effect for the macropropositional and primary propositional levels. The less explicit version led readers to infer significantly more at these propositional levels, an outcome that was generally expected.

5.5. Research Question #4

- *What types of recall patterns at the propositional levels did the textbase and inferential representations yield?*

This research question attempted to tap the Hierarchy Principle effect on textbase and inferential recall levels. According to this principle, higher-level propositions, i.e., those that are essential to the message of the text, are recovered more promptly than lower-level ones. A number of studies L1 have attested to its effect (Kintsch & Keenan, 1973; Kintsch, 1974; Kintsch, Mandel & Kozminsky, 1977; van Dijk & Kintsch, 1983) and in L2/FL (Hauptman, 1996; Zerhouni, 1996).

Results for the propositional recall for the textbase and the inferential representations revealed a general tendency among subjects to recall superordinate propositions better than subordinate ones.

For the textbase recall, a pattern of significant higher recall of higher-level propositions over lower–level ones was observed in the performance of the four groups (O_H, O_L, M_H, M_L). It should be noted that the only case where results showed no significant differences between a higher level proposition and a lower level one was between PII and PIII. This outcome was interesting because it occurred across the textbase recall of the four groups. This may be explained by the number of PII and PIII propositions that each of the two text versions contained, which affected the total possible score. Even though the recall of PIIs received a higher score (4 points) versus 2 points for PIIIs, the fact that the total

amount of PIIIs far exceeded that of PIIs in both versions (see Table 3 in Chapter III) may have contributed to the absence of significance.

Another interesting, yet not surprising or significant, pattern was that observed with regard to the superior recall of PVs over PIVs by low reading ability level readers (c.f. Table 15). One possible explanation for this violation of the Hierarchy Principle may be what Wade et al. (1993) and Wade et al. (1995) have referred to as the *seductive details effect*. According to this effect, certain unimportant details, yet interesting in the view of the reader, seem to attract his/her attention more than other more important ideas.

For the inferential recall, the Original version showed a different recall pattern when compared to the Modified version. The Original/fully explicit version showed a fairly consistent pattern of no significance between higher-level propositions and lower-level ones. This was observed in the propositional recall of high and low reading ability level subjects, with the exception of a result of MP versus PIs, which approached significance, and MP and PIVs, both for low ability subjects. The Modified/less explicit version, on the other hand, yielded a stronger picture of higher-level propositions over lower-level ones, respecting, therefore, the Hierarchy Principle, as it was expected. While the subjects in the fully explicit version condition were not expected to provide an impressive inferential recall, and, in fact, they did not, the subjects in the less explicit version condition were. If they had not inferred higher-level propositions better than lower-level ones, their reconstruction of the text (i.e., their *situation model*) would have suffered seriously.

5.6. Research Question #5

- *What was the impact of text difficulty, topic familiarity, and topic interest on recall?*

As discussed in Chapter IV, the population investigated in the present study in general, found that the text they had read of average difficulty, reasonably familiar, and quite interesting. Text difficulty and topic familiarity did not significantly affect either textbase recall or reconstructive recall. Presumably, the level of syntactic and semantic complexity posed by both versions did not constitute an obstacle to both levels of reading ability, at the same time as they were able to utilize discourse structure effectively to aid the processing of the two versions. Similarly, the topic of the text they read was sufficiently familiar not to cause an adverse effect on their recall. Subjects were, therefore, able to extract information from both versions, and actively interact with their content (c.f. Rumelhart, 1980; Anderson & Pearson, 1984; Carrell, 1987; Zerhouni, 1996)

With regard to interest in the topic of the text, although not much research has focused on this affective variable, a relationship between affect and recall has been verified empirically (c.f. Fransson, 1984, cited in Bernhardt, 1991). The present study investigated the influence that interest of a topic might have on textbase and reconstructive recalls. Results showed that interest had a positive effect, one which was particularly strong on the total textbase and total reconstructive recalls of low reading ability level subjects. One could conclude that if compared with text difficulty and topic familiarity, interest in the topic of

the reading material was a more crucial factor in determining the quality of textbase and reconstructive recall of low reading ability subjects.

CHAPTER VI

Conclusions

6.1. Findings of the Study

The present study attempted to investigate the effects of text explicitness on the reconstructive recall of two versions of a popular science text by a group of university students of two reading ability levels in English as a Foreign Language.

Investigation of the impact of text version, more specifically levels of textual explicitness, on recall yielded results that are consistent with findings of earlier research (Chi & Bassok,1989; Bereiter & Scardamalia, 1989; Kintsch 1994; McNamara et al., 1996: McNamara & Kintsch, 1996; Voss & Silfies, 1996; Roloff, 1997) which demonstrated the benefits of less explicit texts in the reconstructive process of texts, and on inferential processing by itself. Readers remembered textual information they had been required to generate better than textual information that had been explicitly supplied to them. Less explicit, that is, challenging texts have been shown to require active processing on the part of the reader or an intense activation of long term-memory which may translate into a more adequate reconstructive representation of the text, or in the Kintsch & van Dijk's model terminology, a better *situation model*.

The fully explicit version had an advantage over the less explicit version only with regard to the construction of the textbase representation. This finding parallels those of earlier studies (Kintsch, 1994; McNamara et al., 1996) which indicated that a complete and adequate reproduction of textual content (i.e.,

memory of textual information) seems to be more closely associated with the full availability of information to the reader than with its absence. However, the formation of a good textbase representation does not ensure a high quality situation model. While fully explicit texts facilitate text memory, constructing a situation model requires the integration of the textbase information with that of prior knowledge. This integration has been shown to be crucial for learning from text (McNamara & Kintsch, 1996). If this link between text and prior knowledge fails to occur, learning will not take place. Understanding how this integration takes place seems to be no easy task since it is difficult to clearly draw the boundaries between the textbase representation and the situation model.

The findings of the present study with regard to the impact of reading ability level on recall indicated that this was a significant factor for the retrieval of information in the entire process of reconstructing the text as well as in the building of the textbase representation, and in generating inferences from textual content. Performance across these various processes indicated that high reading ability subjects outperformed the low reading ability subjects.

The findings of the present study with respect to recall at the propositional level indicated that subjects tended to recall the macrostructure of the text, that is, the propositions that accounted for the gist of the text. Even low reading ability subjects displayed that tendency. In addition, the findings of this study provided support for the *Hierarchy Principle* which postulates that information held in higher-level propositions are better and more frequently recalled than information found in lower-level propositions.

Finally, investigation of text difficulty, familiarity with and interest in the topic of the text indicated that difficulty with the text and familiarity with the topic were not determining factors in the recall of these subjects. The absence of significance of these two factors seem to indicate that the two text versions were fairly adequate for the subjects' linguistic, formal schemata, and content schemata. The findings of the study with respect to interest in the topic indicated that this affective covariable had a significant impact on the textbase representation as well as on the reconstructive representation of low reading ability subjects. This seems to indicate that reader interest can positively influence low ability readers to retrieve more of the text.

The findings of the present study provide support for a number of predictions advanced by the Kintsch & van Dijk model (Kintsch & van Dijk, 1978; van Dijk & Kintsch, 1983; Kintsch, 1974, 1988, 1992, 1994, 1998). First, the distinction between textbase representations and situational representations proposed by the model clearly emerged in the present study. This distinction was found to be due to the text version that the participants read. Levels of explicitness of relevant textual information seemed to influence the type of representation that the reader developed. The participants who read the fully explicit version seemed to be able to elicit better textbase representations while those who read the less explicit version seemed to be able to derive a more adequate overall situational representation, a direct result of more active processing on the part of the reader. The model, therefore, seems to have been able to successfully account for how texts are represented and remembered.

Second, the model predicts that readers will construct a macrostructure of the text in case they are reading a long, yet well-organized and coherent, text to perform a recall task. A key feature of the textbase-situation model representation that readers form then they read a text is the its macrostructure, that is, a global representation of the main points and relevant subordinate points. Coherence is of major importance in this process in that it allows for the preservation of the hierarchical structure of the text. Because the theory argues that in reading a text, a student/reader is supposed to acquire knowledge from it, the model suggests that effective macrostructures will, in the end, be those that result, not from a passive processing brought about by an easy text, but from texts that stimulate active processing. Not all readers will benefit from the same texts. In other words, not all readers will learn from the same texts. Background knowledge and reading skills are important considerations in this frame. High knowledge/high-reading skill readers may be expected to generate knowledge and gap-filling links which will improve their retrieval of a text. Low-knowledge/low-reading skill readers, on the other hand, may benefit more from a fully explicit text, one which will not demand or assume a great deal of knowledge, one with which they feel comfortable to process (Kintsch, 1994). According to the theory, matching reader characteristics with text characteristics constitutes a solid base for successful learning.

Finally, the findings of the present study seem to be generally compatible with those of the Pilot Study summarized in Chapter I. In both studies, text version and reading ability level exerted a significant difference in recall, and propositional recall indicated a general support for the Hierarchy Principle.

However, while the Pilot Study revealed a significant superior performance by those who read the less explicit version in textbase and in overall reconstructive recall, the findings of the present study showed that the fully explicit version yielded a better textbase recall while the less explicit version accounted for a more adequate reconstructive recall (i.e., *situation model*). In addition, the Pilot Study indicated that high reading ability was a determining factor only for reconstructive recall. The present study, nonetheless, concluded that high reading ability was a decisive factor in textbase, and overall reconstructive text representations, and was an equally powerful influence on inference generation.

6.2. Limitations of the study

This present study was limited to ninety-two Brazilian university level students of English as Foreign Language, all native speakers of Portuguese, who volunteered to participate in the experiment at Universidade Federal do Paraná, in Curitiba, State of Paraná, Brazil, under the supervision of the researcher. The results obtained may apply only to those subjects who were EFL majors or EFL graduates, and had had some formal training (low reading ability subjects) or extensive formal training (high reading ability subjects) in reading comprehension.

6.3. Implications for Future Research

Further studies are necessary to confirm the general findings reported in the present study.

In particular, future research could explore the following issues. First, future studies could consider more than two levels of text explicitness within naturally-occurring texts. It seems that by considering more levels of explicitness, one may move closer to what Kintsch (1994) refers to as "content overlap between text and knowledge (p. 302)" which he sees as an essential condition to learning from text. According to this view, suitability of texts for learning are determined by a certain (not total) amount of overlap that exists between the content of the texts and what readers already know. The determination of the different amounts of overlap presumably translates into a clearer understanding of how one should go about manipulating texts to best adapt them to his/her target readers. Foreign Language learners need reading materials that not only generate interest in them, but also materials to which they can respond to the best of their abilities. In other words, the question to be answered by future studies could be "*Which text version would potentially be the best balance of information supplied / information removed for various foreign language reading ability levels?*" The answer to this question would be particularly useful to educational contexts where reading English is a prime requirement — at universities and secondary schools in Brazil, for example. It could also provide better grounds for more informed decisions on the part of foreign language instructors regarding the issue of text simplification, the use of naturally-occurring texts — long or short as they apply to instructional texts. In this way, reading research would be contributing directly to the broad and challenging area of learning from text, a step that would have a far-reaching positive contribution to other fields of study.

Second, future studies could conduct similar experiments using university students from other fields of study, who have not had serious training in reading in English. In addition, the number of participants could be increased to satisfy the requirements of studies which might attempt to answer the question posed above.

Finally, while in the present study each subject read and recalled one of the two text versions, future research could conduct experiments whereby each subject would read two versions of two propositionally equivalent texts. Propositional equivalence could be used as a measure to control text difficulty (Hauptman, 1996; Zerhouni, 1996). By having the same subject read two versions of two equivalent texts, one might move a step further into the understanding and better characterization of what text and what version constitute the most adequate reading source for a certain type of reader.

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APPENDIX A

A classification system for inferences in text comprehension.
After Kintsch, (1993, 1998)

	Retrieval	**Generation**
	A	**C**
Automatic Processes	Bridging inferences, associative elaborations	Transitive inferences in a familiar domain
	B	**D**
Controlled Processes	Search for bridging knowledge	Logical inferences

APPENDIX B

Original, fully explicit version of the text

Note: Text that was removed in order to prepare the *modified version* appears in **bold**.

Peering through the smoke screen

Cigarette smoking appears to protect against a number of diseases, but researchers have been reluctant to ask why

Ian Mundell

YOU would have to be stupid not to have realised by now that smoking kills. The evidence is overwhelming and the death toll huge. According to government figures, in 1991 smoking helped to kill more than 68 000 Britons from two diseases alone — heart disease and lung cancer.

But **there is another, less well-known side to this story which suggests that cigarettes can protect against disease.** A number of epidemiological studies have reported that smokers suffer fewer cases than nonsmokers of the progressive brain disorder, Parkinson's disease. The same has been found for Alzheimer's disease, **the common form of dementia,** and **the inflammatory gut disease** ulcerative colitis. **Smoking also appears to protect against** rheumatoid arthritis, some cancers and other conditions.

Many scientists believe these studies open important avenues for research that could reveal the mechanisms of these diseases and new treatments. But strong evidence also exists that, because of the stigma attached to smoking, researchers, funding bodies and drugs companies have failed to follow up these leads.

Epidemiologists began to find apparently beneficial effects of smoking in the late 1960s, **when** a study showed that American military veterans with Parkinson's disease were less likely to be smokers. Although other studies produced contrary or equivocal findings, the weight of evidence suggests that smokers are 50 per cent less likely to develop Parkinson's disease than those who never smoked.

In the mid-1980s a similar effect was spotted for Alzheimer's disease although, **again, later studies have produced** varying results. Some found that smokers are 70 per cent less likely to develop the disease than abstainers; in others, smokers had no advantage. The most consistent finding of a reduced risk in smokers has been found in inherited Alzheimer's disease.

Findings such as these usually send epidemiologists, molecular biologists and neurologists scuttling for theories to explain them. **And, sure enough, ideas have emerged to show how smoking can endow protection. One theory suggests that Parkinson's disease is triggered by environmental toxins. Caroline Tanner of the California Parkinson's Foundation in San José, speculates that something in cigarette smoke protects against these toxins.**

In Alzheimer's, interest has focused on the ability of nicotine to improve attention and the brain's ability to process information, **although this is unlikely to explain a protective effect.**

"The epidemiological evidence suggests that there is something in the cigarette smoke, in the nicotine, that directly relates to the manner in which brain cells die," says Peter Whitehouse, director of the Alzheimer's Centre, University Hospitals of Cleveland, Ohio. **"It's not just supporting the cells that are still there ... but preventing the cells from dying in the first place."**

One theory that could explain this **preventive** effect stems from a tie-up between nicotine and acetylcholine, one of the vital chemicals that relay impulses from one brain cell to the next. Acetylcholine stimulates two different types of "receptors" on these cells, one that can be artificially stimulated by a substance called muscarine, the other by nicotine.

Nicotine has the added effect of increasing the nicotinic receptors on brain cells. When researchers found that Alzheimer's patients had depleted numbers of acetylcholine receptors in their brains, they questioned whether nicotine's actions might stop brain function deteriorating.

Lukewarm response

While these theories exist, some say the research effort put into investigating them has not been as intensive as it could have been. "There is no question that development in these areas has been slow," says Jeffrey Gray, professor of psychiatry at the Institute of Psychiatry in London. "If the same information was available about any other compound it would have been headline news a decade ago."

But why should medical researchers be so reluctant to study the apparent positive effects of smoking? One reason given is that the epidemiological results are not all they appear to be. "Many workers in the field are lukewarm to the notion that smoking cigarettes protects against Parkinson's disease," says Niall Quinn of the Institute of Neurology in London, who counts himself among them. "Other explanations are possible."

For example, not smoking could be an early symptom of Parkinson's, says Quinn. Similarly

people who develop Parkinson's may have a genetic predisposition to the disease that also makes them less likely to smoke. Yet another theory is that a larger than normal proportion of smokers die young from diseases induced by cigarettes, so it may not be surprising that a smaller than normal proportion of elderly smokers develop Parkinson's and Alzheimer's.

There is no doubt that in some cases the epidemiological evidence conflicts, **and it may be that research showing smoking as beneficial is just wrong.** Richard Doll, the eminent epidemiologist who first discovered the link between smoking and lung cancer, has turned his attention to smoking and Alzheimer's and says his preliminary results show no link between the two at all.

This work emphasises the need for more research, not less. But, as Grays says, medical researchers have been slow to grasp the bull by the horns. He and others see another effect at work, that of anti-smoking bias, which has also tarnished the reputation of nicotine.

"When the first results appeared everybody bent over backwards to find reasons it couldn't be true," says Gray. He likens the efforts of medical researchers to disprove the benefits of smoking with attempts by the tobacco industry to destroy the link between smoking and heart disease.

Other researchers have also come up against this resistance. "There is a glaring lack of a desire to investigate these anomalies, because people do not want to promote smoking in any way," says Graham Cope, a researcher at the Wolfson Research Laboratories in Birmingham who has worked on ulcerative colitis.

Karl Olov Fagerström, a nicotine researcher and consultant to the Swedish drugs company Kabi Pharmacia, has seen a similar effect. "When I speak to neurologists handling Parkinson's patients about nicotine they cannot believe it. They cannot imagine prescribing what to them is such a dirty drug," he says.

One senior academic researcher singled out Doll and Richard Peto of the Imperial Cancer Research Fund's Cancer Studies Unit in Oxford, saying that their public campaigning on the fatal effects of smoking discouraged funding bodies and young scientists from pursuing research into the potential benefits of smoking. Doll describes this as nonsense: "I am not aware of [the epidemiology] being played down or not given the attention it deserves."

Others say bias certainly made an impact on the bodies that set the research agenda. Ian Hindmarch, professor of psycho-pharmacology at the University of Surrey, says that in the 1970s approval to study smoking's apparent advantages was as hard to come by as permission to research into cannabis. "The ethical committees wouldn't let us do it," he says.

Researchers who have had grant applications turned down by funding bodies also mutter about prejudice. Organisations such as the Medical Research Council and Wellcome Trust claim impartiality on the matter but it is impossible to be sure this is so, because neither gives reasons for turning work down.

"One can be suspicious, but then you lapse into paranoia," says David Warburton of the University of Reading. Until receiving a recent grant from the Wellcome Trust, all Warburton's nicotine research was funded "either by the makers of nicotine products or savings from drug research grants on other cognitive enhancers."

But a perception of bias can be as damaging as the real thing. Anticipating prejudice within funding bodies, some scientists have not bothered even to apply for research grants. The Wellcome Trust says it sees no conflict in funding work where a positive effect of smoking is implied, but notes it has not had many such proposals.

Drugs companies have also been slow to follow up the epidemiological evidence, says Elaine Perry of the MRC Neurochemical Pathology Unit at Newcastle General Hospital. One reason is because nicotine is an unattractive drug for companies. "The whole subject of smoking and what nicotine does to the brain goes into the realms of drug abuse," she says. "Drug companies tend to steer clear of what could be regarded as abusable drugs."

Perry's interest is in the actions of acetylcholine in the brain. She says drugs companies have been "rather slow" to explore the value of nicotinic receptors in Alzheimer's disease. In contrast, they rushed in to study muscarinic receptors, and develop drugs to stimulate them. "These were all tested in a remarkably short space of time, with little effect," she says. Companies have many nicotine analogues on their shelves which were developed years ago to paralyse muscles in general anaesthesia. But, says Perry, they have little interest in letting researchers investigate their activity in the brain.

Nicotine patches may improve the reputation of the drug, but support for research is unlikely to come from the companies that make them. Both Marion Merrell Dow and Ciba-Geigy say they have no research interests in the area. Kabi Pharmacia funds some work on ulcerative colitis but says that, for the most part, the areas where nicotine appears to be useful are too distant from their core interests.

Over the years, the tobacco industry has spent large sums of money on research into smoking and nicotine. **A look at the scientific literature shows cigarette company funding often acknowledged after epidemiological studies and research on possible mechanisms.**

But **Fagerström feels that** tobacco companies' research efforts have never been wholehearted because they fear it would confirm the "dependence-producing potential" of nicotine. **"They don't want to deal with nicotine, they are selling tobacco. They would rather feel that tobacco is good for**

Parkinson's," he says. Regardless of their motives, however, recession has hit their research budgets. "There isn't a deep pool of money around any more. And the funding of blue skies research is diminishing," says Jeff Idle, professor of pharmacogenetics at the University of Newcastle upon Tyne and a former adviser to the industry-sponsored US Council for Tobacco Research.

If nicotine's value has been besmirched by tobacco, it is now having something of a renaissance. The impetus has come not, however, through attempts to explain the epidemiological effects, but from basic neurological findings. **"What has turned everybody back on again is the nicotinic receptor playing a role in neuroprotection,"** says Perry. If you administer nicotine to a damaged animal brain, it recovers much faster. **"This backs up the notion that nicotine prevents the degeneration in Alzheimer's disease,"** she says.

This work and Doll's epidemiological research may reveal once and for all whether nicotine — and hence smoking — has a beneficial effect. But the question remains: should this research have been carried out sooner, and what about all the other diseases smoking apparently protects against? Whitehead feels the moral is clear: the "legitimate scientific clues" that point to a smoking's preventive effect need to be dealt with separately from its harmful consequences. Government and industry, he says, need to play a part in that investigation.

Ian Mundell *is a freelance science writer.*

APPENDIX C

Modified, less explicit version of the text

Peering through the smoke screen

Ian Mundell

Many questions are still to be answered about cigarette smoking

YOU would have to be stupid not to have realised by now that smoking kills. The evidence is overwhelming and the death toll huge. According to government figures, in 1991 smoking helped to kill more than 68 000 Britons from two diseases alone — heart disease and lung cancer.

However, a number of epidemiological studies have reported that smokers suffer fewer cases than nonsmokers of the progressive brain disorder, Parkinson's disease. The same has been found for Alzheimer's disease, ulcerative colitis, rheumatoid arthritis, some cancers, and other conditions.

Many scientists believe these studies open important avenues for research that could reveal the mechanisms of these diseases and new treatments. But strong evidence also exists that, because of the stigma attached to smoking, researchers, funding bodies and drugs companies have failed to follow up these leads.

In the late 1960s, a study showed that American military veterans with Parkinson's disease were less likely to be smokers. Although other studies produced contrary or equivocal findings, the weight of evidence suggests that smokers are 50 per cent less likely to develop Parkinson's disease than those who have never smoked.

In the mid-1980s a similar effect was spotted for Alzheimer's disease, although with varying results. Some found that smokers are 70 per cent less likely to develop the disease than abstainers; in others, smokers had no advantage. The most consistent finding of a reduced risk in smokers has been found in inherited Alzheimer's disease.

Findings such as these usually send epidemiologists, molecular biologists and neurologists scuttling for theories to explain them. In Alzheimer's, interest has focused on the ability of nicotine to improve attention and the brain's ability to process information. "The epidemiological evidence suggests that there is something in the cigarette smoke, in the nicotine, that directly relates to the manner in which brain cells die," says Peter Whitehouse, director of the Alzheimer's Centre, University Hospitals of Cleveland, Ohio.

One theory that could explain this effect stems from a tie-up between nicotine and acetylcholine, one of the vital chemicals that relay impulses from one brain cell to the next. Acetylcholine stimulates two different types of "receptors" on these cells, one that can be artificially stimulated by a substance called muscarine, the other by nicotine.

Nicotine has the added effect of increasing the nicotinic receptors on brain cells. When researchers found that Alzheimer's patients had depleted numbers of the acetylcholine receptors in their brains, they questioned whether nicotine's actions might stop brain function deteriorating.

Lukewarm response

While these theories exist, some say the research effort put into investigating them has not been as intensive as it could have been. "There is no question that development in these areas has been slow," says Jeffrey Gray, professor of psychiatry at the Institute of Psychiatry in London. "If the same information had been available about any other compound it would have been headline news a decade ago."

One reason given for the lack of enthusiam is the epidemiological results are not all they appear to be. Other explanations are possible.

For example, not smoking could be an early symptom of Parkinson's. Similarly, people who develop Parkinson's may have a genetic predisposition to the disease that also makes them less likely to smoke. Yet another

theory is that a larger than normal proportion of smokers die young from diseases induced by cigarettes, so it may not be surprising that a smaller than normal proportion of elderly smokers develop Parkinson's and Alzheimer's.

There is no doubt that in some cases the epidemiological evidence conflicts. Richard Doll, the eminent epidemiologist who first discovered the link between smoking and lung cancer, has turned his attention to smoking and Alzheimer's and says his preliminary results show no link between the two at all.

This work emphasises the need for more research, not less. But, as Gray says, medical researchers have been slow to grasp the bull by the horns. He and others see another effect at work, that of anti-smoking bias, which has also tarnished the reputation of nicotine.

"When the first results appeared, everybody bent over backwards to find reasons it couldn't be true," says Gray. He likens the efforts of medical researchers to disprove the benefits of smoking with attempts by the tobacco industry to destroy the link between smoking and heart disease.

Other researchers have also come up against this resistance. "There is a glaring lack of a desire to investigate these anomalies, because people do not want to be seen to promote smoking in any way," says Graham Cope, a researcher at the Wolfson Research laboratories in Birmingham who has worked on ulcerative colitis.

But a perception of bias can be as damaging as the real thing. Anticipating prejudice within funding bodies, some scientists have not bothered even to apply for research grants.

Drugs companies have also been slow to follow up epidemiological evidence, says Elaine Perry of the MRC Neurochemical Pathology Unit at Newcastle General Hospital. One reason is because nicotine is an unattractive drug for companies. The whole subject of smoking and what nicotine does to the brain goes into the realms of drug abuse," she says. "Drug companies tend to steer clear of what could be regarded as abusable drugs."

Perry's interest is in the actions of acetylcholine in the brain. She says drugs companies have been "rather slow" to explore the value of nicotinic receptors in Alzheimer's disease. In contrast, they rushed in to study muscarinic receptors, and develop drugs to stimulate them. "These were all tested in a remarkably short space of time, with little effect," she says. Companies have many nicotine analogues on their shelves which were developed years ago to paralyse muscles in general anaesthesia. But, says Perry, they have little interest in letting researchers investigate their activity in the brain.

Over the years, the tobacco industry has spent large sums of money on research into smoking and nicotine. But tobacco companies' research efforts have never been wholehearted because they fear it would confirm the "dependence-producing potential" of nicotine.

Regardless of their motives, however, recession has hit their research budgets. "There isn't a deep pool of money around any more. And the funding of blue skies research is diminishing," says Jeff Idle, professor of pharmacogenetics at the University of Newcastle upon Tyne and a former adviser to the industry-sponsored US Council for Tobacco Research.

If nicotine's value has been besmirched by tobacco, it is now having something of a renaissance. The impetus has come not, however, through attempts to explain the epidemiological effects, but from basic neurological findings. If you administer nicotine to a damaged animal brain, it recovers much faster.

This work and Doll's epidemiological research may reveal once and for all whether nicotine — and hence smoking — is significant. But the question remains: should this research have been carried out sooner, and what about all the other effects of smoking? Whitehead feels the moral is clear: all these effects of smoking need to be dealt with separately. Government and industry, he says, need to play a part in that investigation.

Ian Mundell *is a freelance science writer.*

APPENDIX D

Propositional structure and hierarchical levels identified in the Original and Modified versions

Peering through the smoke screen [original version]

by Ian Mundell *New Scientist*, 9 October 1993

Propositional Analysis

Prop #	PROPOSITIONS	Type	Points
1.	*Cigarette smoking appears to protect against a number of diseases,*	MP	16
2.	*but researchers have been reluctant to ask why*	MP	16
3.	**You would have to be stupid not to have realised by now that smoking kills.**	I	8
4.	**The evidence is overwhelming and**	II	4
5.	**the death toll huge.**	II	4
6.	According to government figures,	III	2
7.	in 1991 smoking helped to kill more than 68 000 Britons from two diseases alone	III	2
8.	– heart disease and lung cancer.	IV	1
9.	**But**	I	8
10.	**there is another, less-well known side to this story**	II	4
11.	which suggests that	III	2
12.	**cigarettes can protect against disease.**	I	4
13.	A number of epidemiological studies have reported that	III	2
14.	**smokers suffer fewer cases than nonsmokers of [the progressive brain disorder,] Parkinson's disease.**	II	4
15.	the progressive brain disorder,	IV	1
16.	**The same has been found for Alzheimer's disease,**	II	4
17.	the common form of dementia	IV	1
18.	**and the inflammatory gut disease**	II	4
19.	ulcerative colitis	IV	1
20.	**Smoking also appears to protect against**	II	4
21.	rheumatoid arthritis,	III	2
22.	some cancers, and other conditions.	III	2

23.	Many scientists believe	III	2
24.	**these studies open important avenues for research**	II	4
25.	that could reveal the mechanisms of these diseases	III	2
26.	and new treatments.	III	2
27.	But strong evidence also exists that,	III	2
28.	**because of the stigma attached to smoking,**	I	8
29.	researchers,	III	2
30.	funding bodies and	III	2
31.	drugs companies	III	2
32.	**have failed to follow up these leads.**	I	8
33.	**Epidemiologists began to find the apparently beneficial effects of smoking**	I	8
34.	in the late 1960s,	III	2
35.	when a study showed that	III	2
36.	[American military veterans] with Parkinson's disease were less likely to be smokers.	III	2
37.	American military veterans	IV	1
38.	Although other studies produced contrary or equivocal findings,	III	2
39.	the weight of evidence suggests that	III	2
40.	**Smokers are 50 per cent less likely to develop Parkinson's disease than those who have never smoked.**	II	4
41.	In the mid-1980s	III	2
42.	**a similar effect was spotted for Alzheimer's disease,**	II	4
43.	although, [again] later studies have produced varying results.	III	2
44.	again,	IV	1
45.	Some found that	III	2
46.	smokers are 70 per cent less likely to develop the disease than abstainers;	III	2
47.	in others, smokers had no advantage.	III	2
48.	**The most consistent finding of a reduced risk in smokers has been found in inherited Alzheimer's disease.**	II	4
49.	Findings such as these usually send [epidemiologists, molecular biologists and neurologists] scuttling for theories to explain them.	III	2
50.	epidemiologists,	V	.5
51.	molecular biologists and	V	.5

52.	Neurologists	V	.5
53.	And, sure enough,	IV	1
54.	ideas have emerged to show	III	2
55.	**how smoking can endow protection**	II	4
56.	One theory suggests that	III	2
57.	Parkinson's disease is triggered by environmental toxins.	III	2
58.	[Caroline Tanner, of the California Parkinson's Foundation in San José] speculates that	IV	1
59.	Caroline Tanner,	V	.5
60.	of the California Parkinson's Foundation	IV	1
61.	in San José,	V	.5
62.	**something in cigarette smoke protects against these toxins.**	I	8
63.	In Alzheimer's, interest has focused on the ability of nicotine to improve attention	III	2
64.	and the brain's ability to process information,	III	2
65.	although this is unlikely to explain a protective effect.	III	2
66.	"The epidemiological evidence suggests that	III	2
67.	there is something in the cigarette smoke,	III	2
68.	in the nicotine,	III	2
69.	that directly relates to the manner in which brain cells die,"	III	2
70.	says Peter Whitehouse,	V	.5
71.	director of the Alzheimer's Centre, University Hospitals.	IV	1
72.	of Cleveland, Ohio	V	.5
73.	"It's not just supporting the cells that are still there...	III	2
74.	but preventing them from dying in the first place."	III	2
75.	One theory that could explain this preventive effect	III	2
76.	stems from a tie-up between nicotine and [acetylcholine],	III	2
77.	Acetylcholine	IV	1
78.	one of the vital chemicals that relay impulses from one brain cell to the next.	IV	1
79.	[Acetylcholine] stimulates two different types of "receptors" on these cells,	III	2
80.	Acetylcholine	IV	1
81.	one that can be artificially stimulated by a substance called [muscarine],	III	2
82.	Muscarine	IV	1
83.	the other by nicotine.	III	2
84.	Nicotine has the added effect of increasing the nicotinic receptors on brain cells.	III	2

85.	When researchers found that Alzheimer's patients had depleted numbers of the acetylcholine receptors in their brains,	III	2
86.	they questioned	III	2
87.	whether nicotine's actions might stop brain function deteriorating.	III	2
88.	*Lukewarm response*	I	8
89.	**While these theories exist,**	II	4
90.	some say	V	.5
91.	**the research effort put into investigating them has not been as intensive as it could have been.**	II	4
92.	"There is no question that	III	2
93.	development in these areas has been slow,"	III	2
94.	says Jeffrey Gray,	V	.5
95.	professor of psychiatry at the Institute of Psychiatry	IV	1
96.	in London.	V	.5
97.	"If the same information had been available about any other compound it would have been headline news a decade ago."	III	2
98.	**But why should medical researchers be so reluctant to study the apparent positive effects of smoking?**	II	4
99.	One reason given is that	III	2
100.	the epidemiological results are not all they appear to be.	III	2
101.	**"Many workers in the field are lukewarm to the notion that smoking cigarettes protects against Parkinson's disease,"**	II	4
102.	says Niall Quinn	V	.5
103.	of the Institute of Neurology	IV	1
104.	in London	V	.5
105.	who counts himself among them.	III	2
106.	**"Other explanations are possible."**	II	4
107.	For example, not smoking could be an early symptom of Parkinson's,	III	2
108.	says Quinn.	V	.5
109.	Similarly, people who develop Parkinson's may have a genetic predisposition to the disease	III	2
110.	that also makes them less likely to smoke.	III	2
111.	Yet another theory is that	III	2
112.	a larger than normal proportion of smokers die young from diseases induced by cigarettes,	III	2

113.	so [it may not be surprising that] a smaller than normal proportion of elderly smokers develop Parkinson's and Alzheimer's.	III	2
114.	it may not be surprising that	III	2
115.	There is no doubt that	III	2
116.	in some cases the epidemiological evidence conflicts,	III	2
117.	**and [it may be that] research showing smoking as beneficial is just wrong.**	II	4
118.	it may be that	III	2
119.	Richard Doll,	V	.5
120.	the eminent epidemiologist who first discovered the link between smoking and lung cancer,	III	2
121.	has turned his attention to smoking and Alzheimer's	III	2
122.	and says	V	.5
123.	**his preliminary results show no link between the two at all.**	II	4
124.	This work emphasises	III	2
125.	the need for more research, not less.	III	2
126.	But, [as Gray says], medical researchers have been slow to grasp the bull by the horns.	III	2
127.	as Gray says	V	.5
128.	He and others see another effect at work,	III	2
129.	**that of anti-smoking bias,**	I	8
130.	**which has also tarnished the reputation of nicotine.**	II	4
131.	"When the first results appeared, everybody bent over backwards to find reasons it couldn't be true,"	III	2
132.	says Gray.	V	.5
133.	He likens the efforts of medical researchers to disprove the benefits of smoking	IV	1
134.	with attempts by the tobacco industry to destroy the link between smoking and heart disease.	IV	1
135.	Other researchers have also come up against this resistance.	III	2
136.	"There is a glaring lack of a desire to investigate these anomalies,	IV	1
137.	because people do not want to be seen to promote smoking in any way,"	IV	1
138.	says Graham Cope,	V	.5
139.	a researcher at the Wolfson Research laboratories	IV	1
140.	in Birmingham	V	.5
141.	who has worked on ulcerative colitis.	V	.5
142.	Karl Olov Fagerström,	V	.5
143.	a nicotine researcher	IV	1
144.	and consultant to	IV	1

145.	the Swedish drugs company	V	.5
146.	Kabi Pharmacia	V	.5
147.	has seen a similar effect	III	2
148.	"When I speak to neurologists handling Parkinson's patients about nicotine, they cannot believe it.	IV	1
149.	They cannot imagine prescribing [what to them] is such a dirty drug,"	IV	1
150.	what to them	V	.5
151.	he says	V	.5
152.	One senior academic researcher singled out	III	2
153.	Doll and	V	.5
154.	Richard Peto	V	.5
155.	of the Imperial Cancer Research Fund's Cancer Studies Unit	IV	1
156.	in Oxford	V	.5
157.	saying that	V	.5
158.	their public campaigning on the fatal effects of smoking	III	2
159.	discouraged [funding bodies and young scientists] from pursuing research into the potential benefits of smoking	III	2
160.	funding bodies and young scientists	V	.5
161.	Doll describes this as nonsense:	IV	1
162.	"I am not aware of [the epidemiology] being played down	V	.5
163.	or not given the attention it deserves."	V	.5
164.	Others say	V	.5
165.	**bias certainly made an impact on the bodies that set the research agenda**	II	4
166.	Ian Hindmarch	V	.5
167.	professor of psychopharmacology	IV	1
168.	at the University of Surrey	V	.5
169.	says that	V	.5
170.	in the 1970s	III	2
171.	approval to study smoking's apparent advantages was as hard as to come by as permission to research into cannabis	III	2
172.	"The ethical committees wouldn't let us do it,"	IV	1
173.	he says	V	.5
174.	Researchers [who have had grant applications turned down by funding bodies] also mutter about prejudice	III	2
175.	who have had grant applications turned down by funding bodies	IV	1
176.	Organizations [such as the Medical Research Council and the Wellcome Trust] claim impartiality on the matter.	III	2

177.	such as the Medical Research Council and	V	.5
178.	the Wellcome Trust	V	.5
179.	But it is impossible to be sure this is so,	IV	1
180.	because neither gives reasons for turning work down.	IV	1
181.	"One can be suspicious,	IV	1
182.	but then you lapse into paranoia."	IV	1
183.	says David Warburton	V	.5
184.	of the University of Reading	V	.5
185.	Until receiving a grant from [the Wellcome Trust]	III	2
186.	the Wellcome Trust,	V	.5
187.	all [Warburton's] nicotine research was funded	III	2
188.	Warburton's	V	.5
189.	"either by the makers of nicotine products	III	2
190.	or savings from drug research grants on other cognitive enhancers."	III	2
191.	**But a perception of bias can be as damaging as the real thing.**	II	4
192.	Anticipating prejudice within funding bodies,	III	2
193.	some scientists have not bothered even to apply for research grants.	III	2
194.	[The Wellcome Trust says] it sees no conflict in funding work where a positive effect of smoking is implied,	IV	1
195.	The Wellcome Trust says	V	.5
196.	but notes it has not had many such proposals.	IV	1
197.	**Drugs companies have also been slow to follow up epidemiological evidence,**	I	8
198.	says Elaine Perry	V	.5
199.	of the MRC Neurochemical Pathology Unit	IV	1
200.	at Newcastle General Hospital.	V	.5
201.	One reason is	III	2
202.	because nicotine is an unattractive drug for companies.	III	2
203.	The whole subject of smoking and what nicotine does to the brain goes into the realms of drug abuse,"	IV	1
204.	she says.	V	.5
205.	**"Drug companies tend to steer clear of what could be regarded as abusable drugs."**	II	4
206.	Perry's interest is in the actions of acetylcholine in the brain.	IV	1
207.	She says	V	.5
208.	drugs companies have been "rather slow" to explore the value of nicotinic receptors in Alzheimer's disease.	III	2

209.	In contrast, they rushed in to study muscarinic receptors,	IV	1
210.	and develop drugs to stimulate them.	IV	1
211.	"These were all tested in a remarkably short space of time, with little effect,".	IV	1
212.	she says	V	.5
213.	Companies have many nicotine analogues on their shelves	IV	1
214.	which were developed years ago to paralyse muscles in general anaesthesia.	IV	1
215.	But, [says Perry], they have little interest in letting researchers investigate their activity in the brain.	IV	1
216.	says Perry	V	.5
217.	Nicotine patches may improve the reputation of the drug,	III	2
218.	but support for research is unlikely to come from companies that make them	III	2
219.	Both [Marion Merrell Dow and Ciba-Geigy] say	V	.5
220.	they have no research interests in the area.	IV	1
221.	[Kabi Pharmacia] funds some work on ulcerative colitis	III	2
222.	Kabi Pharmacia	V	.5
223.	but says that,	V	.5
224.	for the most part,	V	.5
225.	the areas where nicotine appears to be useful are too distant from its core interests.	IV	1
226.	Over the years	III	2
227.	**the tobacco industry has spent large sums of money on research into smoking and nicotine.**	I	8
228.	A look at the scientific literature shows	III	2
229.	**cigarette company funding often acknowledged after epidemiological studies and research on possible mechanisms**	II	4
230.	But [Fagerstrom] feels that	III	2
231.	Fagerstrom	V	.5
232.	**tobacco companies' research efforts have never been wholehearted**	II	4
233.	because they fear it would confirm the "dependence-producing potential" of nicotine.	III	2
234.	"They don't want to deal with nicotine,	III	2
235.	they are selling tobacco	III	2
236.	They would rather feel that	III	2
237.	tobacco is good for Parkinson's,"	III	2

238.	he says.	V	.5
239.	Regardless of their motives,	III	2
240.	However, recession has hit their research budgets.	III	2
241.	"There isn't a deep pool of money around any more.	IV	1
242.	And the funding of blue skies research is diminishing,"	IV	1
243.	says Jeff Idle,	V	.5
244.	professor of pharmacogenetics	IV	1
245.	at the University of Newcastle upon Tyne and	V	.5
246.	a former adviser to the industry-sponsored US Council for Tobacco Research.	IV	1
247.	**If nicotine's value has been besmirched by tobacco, it is now having something of a renaissance.**	II	4
248.	The impetus has come not, however, through attempts to explain the epidemiological effects,	III	2
249.	But from basic neurological findings.	III	2
250.	"What has turned everybody back on again is the nicotinic receptor playing a role in neuroprotection,"	III	2
251.	says Perry.	IV	1
252.	If you administer nicotine to a damaged animal brain, it recovers much faster.	IV	1
253.	"This backs up the notion that nicotine prevents the degeneration in Alzheimer's disease,"	IV	1
254.	she says.	V	.5
255.	**This work and Doll's epidemiological research may reveal once and for all**	II	4
256.	**whether nicotine – and hence smoking – has a beneficial effect.**	I	8
257.	But the question remains:	III	2
258.	**should this research have been carried out sooner,**	II	4
259.	**and what about all the other diseases smoking apparently protects against?**	II	4
260.	Whitehead feels the moral is clear:	III	2
261.	the "legitimate scientific clues" that point to	III	2
262.	**a smoking's preventive effect need to be dealt with separately from its harmful consequences.**	II	4
263.	Government and industry, [he says], need to play a part in that investigation.	III	2
264.	he says	V	.5

Peering through the smoke screen [modified version]

by Ian Mundell *New Scientist*, 9 October 1993

Propositional Analysis

Prop #	PROPOSITIONS	Type	Points
1.	*Many questions are still to be answered about cigarette smoking.*	MP	16
2.	**You would have to be stupid not to have realised by now that smoking kills.**	I	8
3.	**The evidence is overwhelming and**	II	4
4.	**the death toll huge.**	II	4
5.	According to government figures,	III	2
6.	in 1991 smoking helped to kill more than 68 000 Britons from two diseases alone	III	2
7.	– heart disease and lung cancer.	IV	1
8.	**However,**	I	8
9.	a number of epidemiological studies have reported that	III	2
10.	**smokers suffer fewer cases than nonsmokers of [~~the progressive brain disorder,~~] Parkinson's disease.**	I	8
11.	the progressive brain disorder,	IV	1
12.	**The same has been found for Alzheimer's disease,**	I	8
13.	ulcerative colitis,	III	2
14.	rheumatoid arthritis,	III	2
15.	some cancers, and other conditions.	III	2
16.	Many scientists believe	III	2
17.	**these studies open important avenues for research**	II	4
18.	that could reveal the mechanisms of these diseases	III	2
19.	and new treatments.	III	2
20.	But strong evidence also exists that,	III	2
21.	**because of the stigma attached to smoking,**	II	4
22.	researchers,	III	2
23.	funding bodies and	III	2
24.	drugs companies	III	2

25.	**have failed to follow up these leads.**	II	4
26.	In the late 1960s,	III	2
27.	a study showed that	III	2
28.	[American military veterans] **with Parkinson's disease were less likely to be smokers.**	II	4
29.	American military veterans	IV	1
30.	Although other studies produced contrary or equivocal findings,	III	2
31.	the weight of evidence suggests that	III	2
32.	**smokers are 50 per cent less likely to develop Parkinson's disease than those who have never smoked.**	II	4
33.	In the mid-1980s	III	2
34.	**a similar effect was spotted for Alzheimer's disease,**	II	4
35.	**although with varying results.**	II	4
36.	Some found that	III	2
37.	smokers are 70 per cent less likely to develop the disease than abstainers;	III	2
38.	in others, smokers had no advantage.	III	2
39.	The most consistent finding of a reduced risk in smokers has been found in inherited Alzheimer's disease.	III	3
40.	Findings such as these usually send [epidemiologists, molecular biologists and neurologists] scuttling for theories to explain them.	III	2
41.	epidemiologists,	V	.5
42.	molecular biologists and	V	.5
43.	neurologists	V	.5
44.	In Alzheimer's, interest has focused on the ability of nicotine to improve attention	III	2
45.	and the brain's ability to process information,	III	2
46.	"The epidemiological evidence suggests that	III	2
47.	there is something in the cigarette smoke,	III	2
48.	in the nicotine,	III	2
49.	that directly relates to the manner in which brain cells die,"	III	2
50.	says Peter Whitehouse,	V	.5
51.	director of the Alzheimer's Centre, University Hospitals.	IV	1
52.	of Cleveland, Ohio	V	.5
53.	One theory that could explain this effect	III	2

54.	stems from a tie-up between nicotine and [acetylcholine],	III	2
55.	acetylcholine	IV	1
56.	one of the vital chemicals that relay impulses from one brain cell to the next.	IV	1
57.	[Acetylcholine] stimulates two different types of "receptors" on these cells,	III	2
58.	Acetylcholine	IV	1
59.	one that can be artificially stimulated by a substance called [muscarine],	III	2
60.	muscarine	IV	1
61.	the other by nicotine.	III	2
62.	Nicotine has the added effect of increasing the nicotinic receptors on brain cells.	III	2
63.	When researchers found that Alzheimer's patients had depleted numbers of the acetylcholine receptors in their brains,	III	2
64.	they questioned	III	2
65.	whether nicotine's actions might stop brain function deteriorating.	III	2
66.	**Lukewarm response**	I	8
67.	**While these theories exist,**	II	4
68.	some say	V	.5
69.	**the research effort put into investigating them has not been as intensive as it could have been.**	II	4
70.	"There is no question that development in these areas has been slow,"	III	2
71.	says Jeffrey Gray,	V	.5
72.	professor of psychiatry at the Institute of Psychiatry	IV	1
73.	in London.	V	.5
74.	"If the same information had been available about any other compound it would have been headline news a decade ago."	III	2
75.	One reason given for the lack of enthusiam is that	III	2
76.	the epidemiological results are not all they appear to be.	III	2
77.	**Other explanations are possible.**	II	4
78.	For example, not smoking could be an early symptom of Parkinson's,	III	2
79.	Similarly, people who develop Parkinson's may have a genetic predisposition to the disease	III	2

80.	that also makes them less likely to smoke.	III	2
81.	Yet another theory is that	III	2
82.	a larger than normal proportion of smokers die young from diseases induced by cigarettes,	III	2
83.	so [it may not be surprising] that a smaller than normal proportion of elderly smokers develop Parkinson's and Alzheimer's.	III	2
84.	it may not be surprising	III	2
85.	There is no doubt that	III	2
86.	in some cases the epidemiological evidence conflicts,	III	2
87.	Richard Doll,	V	.5
88.	the eminent epidemiologist who first discovered the link between smoking and lung cancer,	III	2
89.	has turned his attention to smoking and Alzheimer's	III	2
90.	and says	V	.5
91.	**his preliminary results show no link between the two at all.**	II	4
92.	This work emphasises	III	2
93.	the need for more research, not less.	III	2
94.	But, [as Gray says], medical researchers have been slow to grasp the bull by the horns.	III	2
95.	as Gray says	V	.5
96.	He and others see another effect at work,	III	2
97.	**that of anti-smoking bias,**	I	8
98.	**which has also tarnished the reputation of nicotine.**	II	4
99.	"When the first results appeared, everybody bent over backwards to find reasons it couldn't be true,"	III	2
100.	says Gray.	V	.5
101.	He likens the efforts of medical researchers to disprove the benefits of smoking	IV	1
102.	with attempts by the tobacco industry to destroy the link between smoking and heart disease.	IV	1
103.	Other researchers have also come up against this resistance.	III	2
104.	"There is a glaring lack of a desire to investigate these anomalies,	IV	1
105.	because people do not want to be seen to promote smoking in any way,"	IV	1
106.	says Graham Cope,	V	.5
107.	a researcher at the Wolfson Research laboratories	IV	1

108.	in Birmingham	V	.5
109.	who has worked on ulcerative colitis.	V	.5
110.	**But a perception of bias can be as damaging as the real thing.**	II	4
111.	Anticipating prejudice within funding bodies,	III	2
112.	some scientists have not bothered even to apply for research grants.	III	2
113.	[The Wellcome Trust says] it sees no conflict in funding work where a positive effect of smoking is implied.	IV	1
114.	The Wellcome Trust says	V	.5
115.	but notes it has not had many such proposals.	IV	1
116.	**Drugs companies have also been slow to follow up epidemiological evidence,**	I	8
117.	says Elaine Perry	V	.5
118.	of the MRC Neurochemical Pathology Unit	IV	1
119.	at Newcastle General Hospital.	V	.5
120.	One reason is	III	2
121.	because nicotine is an unattractive drug for companies.	III	2
122.	The whole subject of smoking and what nicotine does to the brain goes into the realms of drug abuse,"	IV	1
123.	she says.	V	.5
124.	**"Drug companies tend to steer clear of what could be regarded as abusable drugs."**	II	4
125.	Perry's interest is in the actions of acetylcholine in the brain.	IV	1
126.	She says	V	.5
127.	drugs companies have been "rather slow" to explore the value of nicotinic receptors in Alzheimer's disease.	III	2
128.	In contrast, they rushed in to study muscarinic receptors,	IV	1
129.	and develop drugs to stimulate them.	IV	1
130.	"These were all tested in a remarkably short space of time, with little effect,".	IV	1
131.	she says	V	.5
132.	Companies have many nicotine analogues on their shelves	IV	1
133.	which were developed years ago to paralyse muscles in general anaesthesia.	IV	1
134.	But, [says Perry], they have little interest in letting researchers investigate their activity in the brain.	IV	1
135.	says Perry	V	.5

136.	Over the years	III	2
137.	**the tobacco industry has spent large sums of money on research into smoking and nicotine.**	I	8
138.	**But tobacco companies' research efforts have never been wholehearted**	II	4
139.	because they fear it would confirm the "dependence-producing potential" of nicotine.	III	2
140.	Regardless of their motives,	III	2
141.	however, recession has hit their research budgets.	III	2
142.	"There isn't a deep pool of money around any more.	IV	1
143.	And the funding of blue skies research is diminishing,"	IV	1
144.	says Jeff Idle,	V	.5
145.	Professor of pharmacogenetics	IV	1
146.	at the University of Newcastle upon Tyne and	V	.5
147.	a former adviser to the industry-sponsored US Council for Tobacco Research.	IV	1
148.	**If nicotine's value has been bismirched by tobacco, it is now having something of a renaissance.**	II	4
149.	The impetus has come not, however, through attempts to explain the epidemiological effects,	III	2
150.	but from basic neurological findings.	III	2
151.	If you administer nicotine to a damaged animal brain, it recovers much faster.	III	2
152.	**This work and Doll's epidemiological research may reveal once and for all**	II	4
153.	**whether nicotine – and hence smoking –is significant.**	I	8
154.	But the question remains:	III	2
155.	**should this research have been carried out sooner,**	II	4
156.	**and what about all the other effects of smoking?**	II	4
157.	Whitehead feels the moral is clear:	III	2
158.	**all these effects of smoking need to be dealt with separately.**	II	4
159.	Government and industry, [he says], need to play a part in that investigation.	III	2
160.	he says	V	.5

APPENDIX E

Subjects' booklet

ESTUDO SOBRE LEITURA EM INGLÊS COMO LÍNGUA ESTRANGEIRA

Responsável: Profa. Vera Lúcia P. Roloff, DELEM-UFPr / University of Ottawa, Canada

I. Informações gerais sobre o estudo

Este estudo destina-se a investigar **como você lê em língua inglesa**. A investigação baseia-se no que você **lembra** e **aprende** a partir do texto lido. Você deverá **ler o texto cuidadosamente**, poderá, se quiser, **fazer anotações** no próprio texto, e, finalmente — **sem o auxílio do texto ou de suas anotações** — **ESCREVER TUDO** o que você lembrar e tiver aprendido com a leitura do mesmo.

O estudo consiste das seguintes seções:

a. Um texto seguido de folhas em branco onde você deverá escrever.
b. Uma avaliação do texto lido.
c. Dados pessoais do participante do estudo
d. Informações sobre a(s) disciplina(s) de Língua Inglesa Escrita.
e. Uma auto-avaliação de suas habilidades gerais como usuário de língua inglesa e específicas como leitor nessa mesma língua.

II. Instruções para as tarefas de *leitura* e *escrita*

A. Leitura

1. **Leia o texto cuidadosamente**. Você poderá fazer quaisquer anotações que desejar nas folhas onde o texto se encontra.

2. Ao acabar a leitura, anote no espaço indicado [*tempo de leitura*] quanto tempo você levou para concluir essa tarefa (incluindo suas anotações).

3. **Guarde o texto e suas anotações**.

B. Escrita

1. **Usando somente a sua memória**, [*sem o auxílio do texto e de suas anotações*] **ESCREVA TUDO o que você lembra e aprendeu** com essa leitura. Você deverá incluir o maior volume de informações possível, podendo usar suas próprias palavras ou utilizar as do autor. Essa tarefa poderá ser feita em Português ou em Inglês ou alternando as duas línguas, como preferir.

2. Ao acabar a tarefa de escrever, anote no espaço indicado [*tempo de escrita*] quanto tempo você levou para concluir essa tarefa.

Sugere-se que ambas as tarefas de leitura e escrita **não ultrapassem uma hora de duração**.

Nome _____ Número: _____

Tempo de leitura: _____

Tempo de escrita: _____

Escreva, em Português ou em Inglês, **TUDO** o que você ***lembra*** e ***aprendeu*** em relação ao texto que acabou de ler. *Lembre que você* ***não*** *poderá consultar o texto ou suas anotações nessa fase.*

Nome: _____ **Número:** _____

III. Avaliação do texto após a conclusão da tarefa escrita

Circule o número que melhor responde a pergunta. Circule somente ***um*** número.

1. Qual o seu grau de ***familiaridade*** com o conteúdo do texto que você acabou de ler?

nada conhecido	*pouco conhecido*	*razoavelmente conhecido*	*muito conhecido*	*totalmente conhecido*
1	2	3	4	5

2. Qual o grau de ***dificuldade*** do texto para sua **leitura e compreensão**?

muito difícil	*um tanto difícil*	*de dificuldade média*	*um pouco difícil*	*fácil*
1	2	3	4	5

3. Qual o grau de ***dificuldade*** do texto em relação à sua tarefa de **lembrar** do conteúdo?

muito difícil	*um tanto difícil*	*de dificuldade média*	*um pouco difícil*	*fácil*
1	2	3	4	5

4. Qual o grau de ***interesse*** que o texto despertou em você?

totalmente desinteressante	*um pouco interessante*	*interessante*	*bem interessante*	*muito interessante*
1	2	3	4	5

5. Qual o grau de ***clareza*** da linha principal de argumentação do texto?

nada claro	*um pouco claro*	*moderadamente claro*	*claro na maior parte*	*muito claro*
1	2	3	4	5

6. Qual o grau de ***organização*** do texto que você leu?

desorganizado	*um pouco organizado*	*moderadamente organizado*	*organizado na maior parte*	*muito organizado*
1	2	3	4	5

7. Você acha que as **informações** apresentadas no texto são **úteis**?

claro que não!	*talvez*	*não sei*	*sim*	*claro que sim!*
1	2	3	4	5

8. Você **recomendaria** a leitura desse texto a outro colega?

claro que não!	*talvez*	*não sei*	*sim*	*claro que sim!*
1	2	3	4	5

9. Você gostaria de ler **um outro texto** sobre o mesmo tópico?

claro que não!	*talvez*	*não sei*	*sim*	*claro que sim!*
1	2	3	4	5

10. Você estaria interessado(a) em **discutir esse texto** em sala de aula?

claro que não!	*talvez*	*não sei*	*sim*	*claro que sim!*
1	2	3	4	5

No espaço abaixo, escreva quaisquer **outros comentários ou impressões sobre o texto.**

Vera L. P. Roloff

ESTUDO SOBRE LEITURA EM INGLÊS COMO LÍNGUA ESTRANGEIRA

Parte 1: *DADOS PESSOAIS DO PARTICIPANTE*

DATA: / /

NOME: _____ **Número:** _____

IDADE:_____ **SEXO** _____

ENDEREÇO: _____

_____

TELEFONE: Res._____**Com.:** _____

Parte 2: *INFORMAÇÕES SOBRE LÍNGUA INGLESA ESCRITA*

DISCIPLINA DE LÍNGUA INGLESA ESCRITA QUE ESTÁ CURSANDO:
_____

PROFESSOR(A) DA REFERIDA DISCIPLINA: _____

Foi dispensado(a) de algum nível de Língua Escrita? Qual/Quais? _____

_____

Teve necessidade de cursar novamente **(repetir) algum nível de Língua Inglesa Escrita? Escreva no quadro abaixo** qual nível **e o** número de vezes **que foi cursado.**

Disciplina	***Número de repetições da disciplina***

Parte 3: *AUTO-AVALIAÇÃO GERAL DE SUA COMPETÊNCIA LINGUÍSTICA COMO USUÁRIO DE LÍNGUA INGLESA COMO LÍNGUA ESTRANGEIRA*

Assinale o perfil que mais se aproxima do seu caso [✓]:

	1. Usuário competente. Consigo me comunicar em Inglês sem quaisquer problemas. Na verdade, posso me expressar tão bem e me sinto tão a vontade quanto os falantes nativos dessa língua.
	2. Usuário muito bom. Quando eu falo Inglês, consigo expressar minhas idéias sem qualquer dificuldade. Não sou confundido com falantes nativos de Inglês, mas consigo me comunicar tão bem quanto eles.
	3. Usuário bom. Consigo me fazer entender na maioria das situações em Inglês. Apesar de cometer alguns erros, as pessoas não encontram dificuldades em entender o que eu quero dizer.
	4. Usuário razoável. Apesar de conseguir me comunicar de forma razoável em diferentes situações, as vezes cometo erros que levam a mal-entendidos.
	5. Usuário limitado. Em geral, eu consigo me expressar em Inglês. Apesar de cometer muitos erros, a maioria das pessoas consegue me entender.
	6. Usuário muito limitado. Eu sinto dificuldade em me expressar em Inglês, mas acredito que consigo me fazer entender em muitas situações.

Parte 4: *AUTO-AVALIAÇÃO GERAL DE PERFORMANCE NAS QUATRO HABILIDADES LINGUÍSTICAS EM LÍNGUA INGLESA*

Avalie a sua performance em língua inglesa com relação as habilidades de ler, falar, ouvir **e** escrever, **assinalando o quadro abaixo [✓]:**

	LER	FALAR	OUVIR	ESCREVER
Eu **não tenho** qualquer dificuldade				
Eu tenho **um pouco** de dificuldade				
As vezes tenho dificuldade				
Frequentemente tenho dificuldade				

Parte 5: *CIRCULE A OPÇÃO (**1, 2, 3, 4** ou **5**) QUE REFLETE O QUE VOCÊ CONSEGUE FAZER COM **FLUÊNCIA** E **SEGURANÇA** QUANDO **LÊ EM LÍNGUA INGLESA**. Siga o código abaixo.*

1 = *nunca*	2 = *raramente*	3 = *às vezes*	4 = *frequentemente*	5= *sempre*

1.	ler um texto curto e simples rapidamente para localizar determinadas informações nele contidas (i.e., datas, nomes, fatos importantes, etc).	**1 2 3 4 5**
2.	ler um texto curto sobre um assunto conhecido e extrair o tópico do mesmo.	**1 2 3 4 5**
3.	ler um texto de cerca de 5 parágrafos e segmentá-lo em tres partes: introdução, corpo e conclusão.	**1 2 3 4 5**
4.	ler um texto de aproximadamente uma página sobre um assunto conhecido e distinguir as idéias principais das subordinadas.	**1 2 3 4 5**
5.	ler um texto de uma página e meia sobre um assunto não especializado e fazer um resumo das idéias principais.	**1 2 3 4 5**
6.	ler um texto e determinar sua função retórica (i.e., se o autor está descrevendo algo, comparando, dando instruções, argumentando, classificando, narrando eventos no passado).	**1 2 3 4 5**
7.	inferir/deduzir informações que estejam implícitas em um texto sobre um tópico conhecido.	**1 2 3 4 5**
8.	ler um texto e distinguir fatos de opiniões.	**1 2 3 4 5**
9.	ler notícias provenientes de diferentes seções (internacional, esportes, horóscopo, moda, etc) de jornais de língua inglesa.	**1 2 3 4 5**
10.	ler um texto e determinar o público/leitor alvo (i.e., para quem ele foi escrito).	**1 2 3 4 5**
11.	ler textos de diferentes gêneros (i.e., um editorial, um artigo de revista semanal, um artigo científico, um capítulo de livro acadêmico, um documento legal) e raramente precisar usar um dicionário.	**1 2 3 4 5**
12.	ler um texto que necessite correções (grafia, organização, estilo) e fazê-las sem dificuldades.	**1 2 3 4 5**

Parte 5: *CIRCLE ONE OPTION (**1, 2, 3, 4** ou **5**) WHICH BEST REFLECTS WHAT YOU CAN DO WITH **FLUENCY** AND **COMFORT** WHEN YOU **READ IN ENGLISH**. Follow the code below.*

1 = *never*	2 = *rarely*	3 = *sometimes*	4 = *frequently*	5= *always*

1.	read a short simple text quickly to locate specific types of information (i.e., dates, names, important facts, etc).	**1 2 3 4 5**
2.	read a short text about a familiar topic, and extract its topic.	**1 2 3 4 5**
3.	read a text of about 5 paragraphs, and segment it into three parts: introduction, body and conclusion.	**1 2 3 4 5**
4.	read a one-page-long text on a familiar topic, and distinguish main ideas from subordinate ones.	**1 2 3 4 5**
5.	read a one-page-long text on a nonspecialized topic, and summarize the main ideas.	**1 2 3 4 5**
6.	read a text, and identify its rhetorical function (i.e., if the author is describing something, comparing, giving instructions, arguing a point, classifying, narrating an event in the past, etc).	**1 2 3 4 5**
7.	infer implicit information from a text on a familiar topic.	**1 2 3 4 5**
8.	read a text, and distinguish facts from opinions.	**1 2 3 4 5**
9.	read news from different sections (i.e., world news, sports, fashion, horoscope, etc) of newspapers published in English.	**1 2 3 4 5**
10.	read a text and determine its target audience.	**1 2 3 4 5**
11.	read texts of different genres (i.e., an editorial, a weekly magazine article, a scientific article, a chapter from a textbook, a legal document), and rarely need to consult a dictionary.	**1 2 3 4 5**
12.	read a text that requires editing (orthography, organization, style), and perform the editing without difficulties.	**1 2 3 4 5**

APPENDIX F

An example of a scored recall protocol

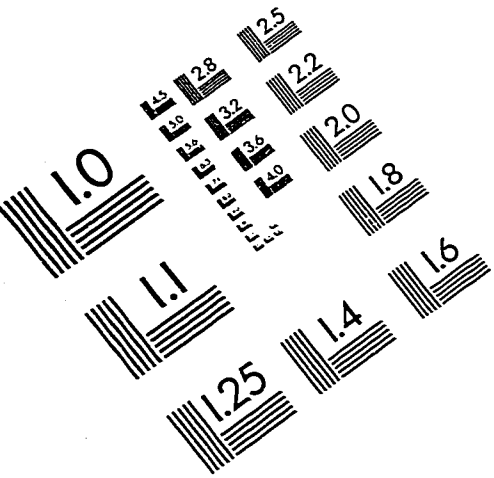
[translated into English]

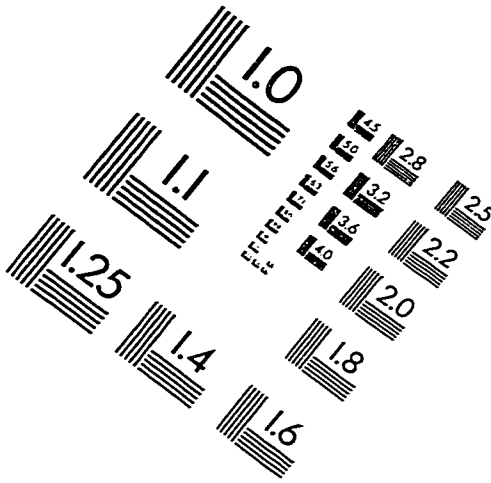
Version read: **ORIGINAL**

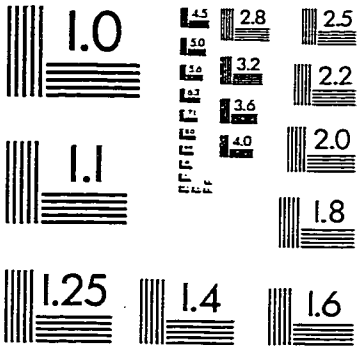
Prop #	Proposition	Prop. Level	Points
1.	The text discusses the merits of smoking.	MP	16
2.	After pointing out that	III	2
3.	smoking kills and	I	8
4.	is one of the major causes of heart disease and lung cancer,	IV	1
5.	the author makes the claim that	III	2
6.	smoking prevents Parkinson's,	I	8
7.	Alzheimer's,	I	8
8.	inflammatory gut disease	II	4
9.	among other things.	III	2
10.	There are different theories about	III	2
11.	why smoking does this.	I	8
12.	One theory is that	III	2
13.	it prevents brain cells from dying.	III	2
14.	There has been much resistance to accept such findings and	MP	16
15.	to promote research into the benefits of smoking.	II	4
16.	Because of the bad reputation given to smoking,	I	8
17.	not much funding is set aside for this type of research.	II	4
18.	Drug companies are not willing to do research into this field.	I	8
19.	Tobacco industries have not been willing to do studies in the area of smoking and disease,	I	8
20.	likely because it doesn't want to find results that support other studies that find smoking is addictive and causes disease	III	2
21.	They are also not interested in promoting nicotine,	III	2
22.	but rather	III	2
23.	want to promote tobacco.	III	2

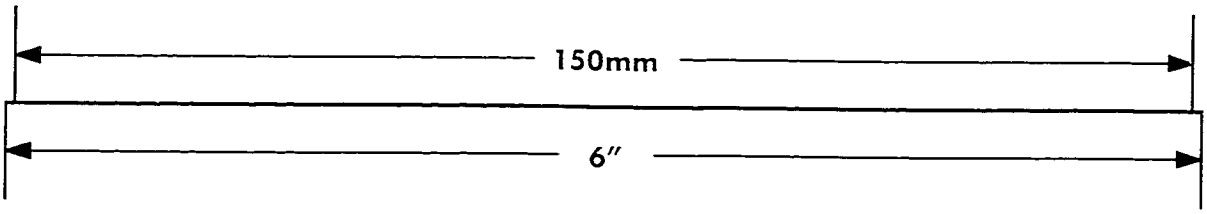
24.	There's a connection between nicotine and [acetylcholine].	III	2
25.	acetylcholine	IV	1
26.	[Acetylcholine] stimulates brain cells.	III	2
27.	Acetylcholine	IV	1
28.	Much of the research is inconclusive.	III	2
29.	Some studies have found	III	2
30.	a link between smoking and Alzheimer's and	I	8
31.	others have found no such correlation.	III	2
32.	People try to argue that	II	4
33.	since smokers die at an earlier age from smoking-related diseases than non-smokers that	III	2
34.	it's unlikely that	III	2
35.	one would see many older smokers with Alzheimer's or Parkinson's compared with non-smokers.	III	2
36.	Brain damaged animals who are given nicotine recover faster and better.	IV	1
37.	The recession means that	III	2
38.	there's even less funding for research into smoking and its benefits.	III	2
39.	Although, as mentioned, many companies shun this type of research,	II	4
40.	one company is willing to consider it,	III	2
41.	but stated that it doesn't get many requests for funding smoking and its benefits for disease.	IV	1
42.	More research needs to be done by government and industry	III	2

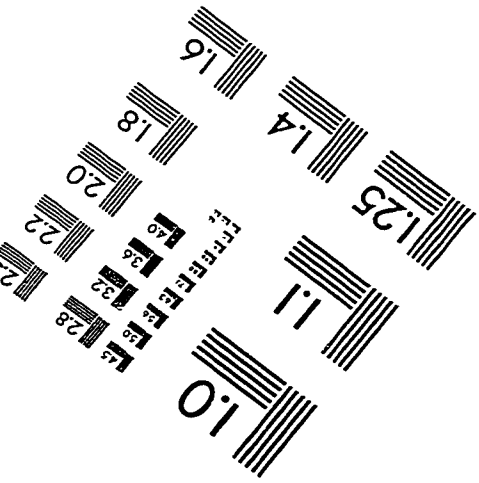
IMAGE EVALUATION TEST TARGET (QA-3)

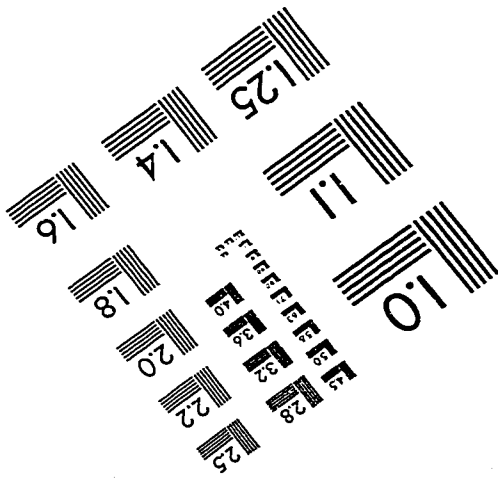












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