

The Relative Contributions to Foreign Language Reading
Comprehension of the Selected Individual-difference Variables

Thesis submitted to the
Institute for Graduate Studies in Social Sciences
in partial fulfillment of the requirements for the degree of

Master of Arts
in
English Language Education

by
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Boğaziçi University

2006

ACKNOWLEDGEMENTS

This thesis is a result of a long-lasting study which has required non-stop working. I owe special thanks to a number of people who have helped and encouraged me along the way.

First and foremost, I would like to express my heartfelt gratitude to my thesis advisor, Prof. Dr. Ayşe Akyel, whom I have been privileged to work with. I can never thank her enough for the tremendous time she devoted in providing profound advice, invaluable guidance, and constructive criticisms at all stages throughout the preparation of this study. Without her guidance, this thesis could not have been completed.

I am also greatly indebted to Assist. Prof. Dr. Gülcan Erçetin, who has been immensely helpful and encouraging throughout the course of this study. She has always been supportive and patient in answering my endless queries on statistical matters in spite of her intensive academic schedule. With her expert tutoring and constructive feedback, all those numbers in the statistical analysis made sense to me.

I am also grateful to Prof. Dr. Zülal Balpınar for the time she has devoted to reading and commenting on my thesis.

My extended gratitude also goes to my professors, Assist. Prof. Dr. Ayşe Gürel, Assist. Prof. Dr. Belma Haznedar, Prof. Dr. Cem Alptekin, Assist. Prof. Dr. Sumru Akcan, and Assist.

Prof. Dr. Yasemin Bayyurt, who have contributed greatly to my academic and professional development, and thereby built my background in the field.

I would also like to thank Prof. Dr. Eser Erguvanlı Taylan for letting me conduct the present study at the Boğaziçi University School of Foreign Languages, the students who participated in this study, and their teachers for their generosity with their time.

My sincere thanks also go to my colleagues and friends Filiz Çele, Yavuz Gösterişli, Emine Kunduz, and Deniz Ortaçtepe for their constant support and encouragement throughout the preparation of this thesis. In particular, I owe special thanks to my officemate Nazik Dinçtopal, who kindly helped me with the scoring of recall protocols despite her demanding academic schedule. Special thanks also go to Assist. Prof. Dr. Yeşim Özek and Zeynep Sunkar Koçoğlu, who proofread several parts of this thesis.

Above all, my love and deepest gratitude go to my mother and dearest friend Selma Aslan, for being most understanding, encouraging, and supportive when I had to stay up late at many nights, my sister Elif, and my brother Emrah, for bearing with me and for keeping my spirits up when I felt down, and my fiancé Gazi, for always being there to cheer me up and also for helping me with the proofreading of this thesis.

ABSTRACT

The Relative Contributions to Foreign Language Reading
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by

Neslihan Aslan

This thesis has two main goals. First, the relative contribution to foreign language reading comprehension of the following individual-difference variables is explored: the reader's prior knowledge on the text content, topic interest, linguistic proficiency in English, gender, motivation to read in English, and metacognitive awareness in English. Second, the relationship between the contribution to foreign language reading comprehension of these individual-difference variables and text difficulty is investigated.

66 students studying English for academic purposes at the Boğaziçi University School of Foreign Languages took part in the study. Data for the study were collected through topic interest and prior knowledge tests prepared for each text (one intermediate, one advanced-level text), a reading motivation questionnaire, and a metacognitive awareness questionnaire. The participants' level of reading comprehension was assessed through recall protocol. Data were analyzed through hierarchical multiple regression procedures.

Results indicated that the following individual-difference variables, in order of significance, accounted for 54% of the variability in the English reading comprehension of the

participants: linguistic proficiency in English, motivation to read in English, prior knowledge of the text content. Besides, it was found that the relative contribution to foreign language reading comprehension of individual-difference variables (i.e.: prior knowledge, topic interest, gender, motivation to read, and metacognitive awareness) was influenced by the difficulty level of the text.

KISA ÖZET

Seçilen Bireysel Farklılık Değişkenlerinin Yabancı Dilde
Okuduğunu Anlamaya Göreli Katkıları

Neslihan Aslan

Bu tezin iki amacı vardır. İlki, aşağıda belirtilen bireysel-farklılık değişkenlerinin yabancı dilde okuduğunu anlamaya göreli katkısının incelenmesidir: metnin içeriği hakkında sahip olunan önbilgi, konuya duyulan ilgi, İngilizce dilbilgisi yeterliliği, cinsiyet, İngilizce’de okuma güdüsü, ve biliş bilgisi farkındalığı. İkinci amaç ise, bu bireysel farklılıkların yabancı dilde okuduğunu anlamaya göreli katkısı ile metnin zorluk düzeyi arasındaki ilişkinin araştırılmasıdır.

Boğaziçi Üniversitesi Yabancı Diller Yüksek Okulu’nda, akademik amaçlı İngilizce öğrenmekte olan 66 öğrenci bu çalışmaya katılmıştır. Veriler, biri orta, diğeri ileri-düzye iki metin için hazırlanmış, metnin içeriği hakkında sahip olunan önbilgiyi ve konuya duyulan ilgiyi ölçen testler, İngilizce’de okuma güdüsü ve biliş bilgisi farkındalığı anketleri yoluyla toplanmıştır. Katılımcıların okuduğunu anlama düzeyleri hatırlama protokolü yöntemiyle ölçülmüştür. Veriler, hiyerarşik çoklu regresyon yordamıyla incelenmiştir.

Sonuçlar, katılımcıların İngilizce’de okuduğunu anlamasındaki varyasyonun %54’ünün, aşağıda belirtilen bireysel-farklılık değişkenleri tarafından açıklandığını göstermiştir: açıkladıkları varyasyonların önem sırasına göre

değişkenler; İngilizce dilbilgisi yeterliliği, İngilizce’de okuma güdüsü, ve metnin içeriği hakkında sahip olunan önbilgidir. Ayrıca, incelenen bireysel farklılıkların yabancı dilde okuduğunu anlamaya göreli katkısının metnin zorluk düzeyine göre farklılık gösterdiği saptanmıştır.

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CHAPTER 1- INTRODUCTION

Second language (L2) reading is a multifaceted, complex process in that it involves the interplay of a wide range of components. As a result, although most of the reviews on L2 reading research start with an attempt to answer the question 'What is reading?', nearly all of them go on to state that reading is such a complex concept that no definition of reading, which is clearly stated, empirically supported, and theoretically unassailable, has been offered to date (e.g. Aebbersold, & Field, 1997; Alderson, 2000; Bernhardt, 1991; Grabe & Stoller, 2002; Urquhart & Weir, 1998). In the most general terms, it can be stated that reading is a process that involves the reader, the text, and the interaction between the reader and the text (Rumelhart, 1977). The attempt to explain how the reader and the text components interact, and how this interaction results in reading comprehension has paved the way to the conceptualization of a number of reading models, each focusing on different aspects of reading.

The present study focuses on readers as individuals, and attempts to better understand the way individual differences contribute to foreign language reading comprehension. In more specific terms, the effect of the following individual-difference variables on foreign language reading comprehension is studied: prior knowledge, topic interest, linguistic proficiency, gender, motivation to read, and metacognitive awareness. In addition, the relationship between the

contribution to foreign language reading comprehension of these individual-difference variables and text difficulty is investigated.

In this respect, the theoretical background of the study originates from the following fields: L2 reading theory, and L2 reading research on individual differences.

Theoretical Background of the Study

L2 Reading Theory

Reading models are broadly classified into two categories: 1) Process models, and 2) Componential models. While the process models attempt to describe the actual process of reading as a cognitive activity operating in real time according to temporal sequence (Weir, C. & Yan, J., 2000), the componential models merely describe what components are thought to be involved in the reading process, with little or no attempt to say how they interact, or how the reading process actually develops in time (Urquhart & Weir, 1998). In the past two decades, three types of process models have emerged: 1) Bottom-up models, 2) Top-down models, and 3) Interactive models.

In bottom-up models (e.g., Gough 1972; La Berge & Samuels, 1974), reading is seen as a decoding process of reconstructing the author's intended meaning. It is argued that the reader constructs the text from the smallest textual units at the bottom (e.g., letters and words) to larger units at the top (e.g., phrases, clauses, sentences). Roles of general world

knowledge, contextual information or other higher order processing strategies have not received much attention in accounting for reading comprehension in this approach. Hence, the focus is on the language to be comprehended rather than the comprehender.

In contrast to bottom-up approach, the focus is on the reader component in top-down models (e.g., Goodman, 1973; Smith, 1971). It is argued that readers bring a great deal of knowledge, expectations, assumptions, and questions to the text. The reader is characterized as someone who has a set of expectations about text information and samples enough information from the text to confirm or reject these expectations (Grabe & Stoller, 2002). Top-down models are criticized on the grounds that they emphasize several higher-level skills, such as the prediction of meaning through context clues or certain kinds of background knowledge at the expense of several lower-level skills, such as the rapid and accurate identification of lexical and grammatical forms (Eskey, 1988).

Interactive models of reading, on the other hand, argue that both bottom-up and top-down processes are occurring, either alternately or at the same time, depending on the type of the text, the reader's background knowledge, language proficiency level, motivation, strategy use, and culturally shaped beliefs about reading (Aebbersold & Field, 1997). However, Grabe and Stoller (2002) argue that taking useful

ideas from a bottom-up perspective and combining them with key ideas from a top-down view would lead to a self-contradictory model since the key processing aspects of bottom-up approaches (e.g., automatic word recognition) are incompatible with strong top-down controls on reading comprehension.

As opposed to process models, componential models attempt to model the reading ability rather than the reading process, and to understand reading as a set of theoretically distinct and empirically separable constituents (Hoover and Tunmer, 1993). In other words, while componential models limit themselves to arguing that such and such a factor is actually present in the reading process, process models attempt to describe how the factor operates (Urquhart & Weir, 1998). Besides the distinctions, it should be noted that there are inescapable overlaps between these two classes of reading models since all models must make reference to both 'processes' and 'components' to a certain extent in explaining the reading process. However, each model emphasizes some aspect of reading. Hence, as Urquhart and Weir (1998) put it, both classes of reading models provide valuable insights in explaining the reading process.

The focus of the present study, on the other hand, is on componential models of reading. The objective of componential approach, as indicated by Carr and Levy (1990), is to identify specific individual differences influencing reading, exploring their functional interdependence, and in so doing, determining

their relative contributions to the overall reading ability. Hence, as Koda (2005) points out, the componential approach to reading is particularly well suited for examining individual differences in L2 reading

Individual Difference Research on L2 Reading

Individual difference research on L2 reading has been influenced by second language acquisition (SLA) research to a great extent. Although there are several studies in SLA (e.g., Altman, 1980; Ellis 1994; Larson-Freeman & Long, 1991; Lightbown & Spada 1999; Skehan, 1989) that include discussions of individual differences, these studies do not specifically examine the individual differences thought to contribute to variations in L2 reading comprehension.

Koda (2005) reports two traditions of individual difference research in reading: 1) Single-focus studies, and 2) Component-skills studies. In single-focus studies only one or two individual-differences are investigated. Although single-focus studies identify many factors directly associated with successful reading comprehension, most are primarily correlates of reading ability. Thus, they offer little direct explanation of reported performance variations. Component-skills studies, on the other hand, explore the interconnections between the components to determine their conjoint effect on successful reading performance. Therefore, it is argued that component-skills approach to individual differences has more explanatory power in providing insights

into reading comprehension. In this respect, Koda (2005) points out the needed work in this area.

Purpose of the Study

The present research is an exploratory study examining the way individual-difference variables contribute to foreign language reading comprehension. More specifically, this study has two main goals. First, the relative contributions to foreign language reading comprehension of the following individual-difference variables will be examined: prior knowledge, topic interest, linguistic proficiency, gender, motivation to read, and metacognitive awareness. Second, the relationship between the contribution to foreign language reading comprehension of these individual-difference variables and text difficulty will be investigated.

Specifically speaking, the following research questions are asked:

1. What are the relative contributions to foreign language reading comprehension of the following individual-difference variables when intermediate and advanced EFL learners read an intermediate text for general comprehension: prior knowledge, topic interest, linguistic proficiency, gender, motivation to read, and metacognitive awareness?

2. How does the contribution of these individual difference variables (i.e., prior knowledge, topic interest, linguistic proficiency, gender, motivation to read, and metacognitive awareness) relate to text difficulty?

Significance of the Study

As it was noted previously, although individual variations in SLA have been examined to some extent (e.g., Altman, 1980; Ellis 1994; Larson-Freeman & Long, 1991; Lightbown & Spada 1999; Skehan, 1989), there is still a need for research explaining the role of individual-differences in accounting for the variability in foreign language reading comprehension (Brantmeier, 2003; Koda, 2005).

In her very recent book "Insights into Second Language Reading", Koda (2005) devotes a whole chapter to explaining the needed work on individual differences in L2 reading. Koda indicates that studying individual-differences in L2 reading can provide useful information for both reading theory and practice. On theoretical grounds, such research can shed light on to what Koda calls "two fundamental puzzles" in reading research: 1) What constitutes successful reading, 2) What precisely distinguishes strong from weak readers. On pedagogical grounds, on the other hand, individual difference studies can increase instructional quality by providing L2 teachers with a clearer understanding of individual variations, and thereby encouraging them to adapt their instruction to the diverse needs of individual learners.

The present study holds a component-skills approach in examining individual differences influencing L2 reading since it aims at exploring the relative contributions to foreign language reading comprehension of several individual

differences (namely; prior knowledge, topic interest, linguistic proficiency, gender, motivation to read, and metacognitive awareness). As noted previously, a component-skills perspective is argued to be more suitable for examining individual differences in L2 reading rather than single-focus studies. In this respect, this study can be considered as an attempt to provide some insights into this research area, which 'has not been fully explored yet, despite its potential utility' (Koda, 2005, 195).

Overview of Methodology

Participants

A total of 66 students studying English for academic purposes at the Boğaziçi University School of Foreign Languages took part in the study. The level of the students' linguistic proficiency had been determined by the Boğaziçi University English Proficiency Test (BUEPT) at the beginning of the semester. While half of the participants were advanced-level students, the other half was composed of intermediate-level students. There were 31 female and 35 male students. The average age was 19 ranging from 17 to 24.

Data Collection

Data come from the results of the following instruments:

Topic Interest Questionnaire

The topic interest questionnaire (Appendix B.01 and B.02) was adapted from Schiefele, 1996. The test comprised two parts. In the first part, the participants were asked to

estimate the value of the text's topic to them personally while in the second part, they were asked to estimate how they expected to feel while reading the text in question. All the items in the questionnaire were rated on four-point rating scales, "4 - completely true" implying complete agreement with a specific feeling, and "1 - not at all true" implying complete disagreement with that feeling.

Prior Knowledge Test

Before the participants read the selected texts, a prior knowledge test developed by the researcher for each text was implemented (Appendix A.01 and A.02). The tests are composed of multiple choice items and true-false questions. While some of the questions in both tests are related to information contained in the text, some questions are asked for domain knowledge which is not directly addressed in the text.

Reading Motivation Questionnaire

The instrument used to assess reading motivation in this study was adapted from the Motivation for Reading Questionnaire (Wigfield & Guthrie, 1995) (Appendix F). MRQ is a 53-item questionnaire, which is designed to assess 11 possible dimensions of reading motivations including reading efficacy, several intrinsic and extrinsic motivations, social aspects of reading, and the desire to avoid reading.

Metacognitive Knowledge Questionnaire

A metacognitive knowledge questionnaire developed by Carrell (1989) was used in the present study (Appendix G). The

questionnaire included 36 items eliciting information from the participants as to their metacognitive conceptualizations or awareness judgments about their silent reading strategies in English as a foreign language.

Recall Protocol

After the participants read the given texts, they were asked to write down the text content as completely as possible in their native language. The first step in analyzing the recall protocols was dividing the original texts into idea units. Each idea unit produced by students was given '2' points when the idea was the complete copy or paraphrase of the original unit. '1' point was given if the idea unit in question was incomplete, and '0' point was given when the idea was wrong, new, or repetition of a previously stated idea. The comprehension scores were calculated by adding the points given to each idea unit.

Data Analysis

For each research question, a hierarchical multiple regression analysis was used to determine the relative influence of each independent variable on the dependent variable. More detailed information on the data analysis is provided in Chapter 3- Methods and Procedures.

Limitations

This study poses several limitations that suggest a need for caution concerning the results obtained. First, it should be noted that this study has examined only 66 students.

Further studies can include a larger group of participants to obtain more generalizable results.

Moreover, this study employed quantitative research methods to analyze the effects of selected individual differences on L2 reading comprehension. However, using qualitative research methods (e.g., interviews with students, classroom observations) besides quantitative instruments would provide more explanatory insights into the topic, and could aid at capturing several individual differences in a more detailed way.

In addition, the present study used recall protocol to measure students' comprehension of the texts. Future studies can support the results gained from recall protocol by other techniques measuring reading comprehension, such as multiple choice or short answer questions.

Operational Definitions

The definitions of some key terms as used in the present study are provided below.

Prior Knowledge

It refers to how much a reader knows about the topic of the text before reading it.

Topic Interest

It refers to one's feelings and value judgments towards a certain topic or domain of knowledge.

Reading motivation

Individuals' goals and beliefs regarding reading (Guthrie & Wigfield, 1999)

Metacognitive knowledge

In the context of this study, it refers to readers' conscious awareness of strategies while reading silently in English.

Recall protocol

It is a technique in measuring reading comprehension. There is a general agreement that recall protocol provides the most straightforward measure of comprehension since test questions do not intervene between the reader and the text (Anderson, 2000; Bernhardt, 1991; Koda, 2005). In this technique, students are asked to read a text and write down everything they can remember from the text in their native language. Then the recalls produced by students are scored according to a scoring template developed.

CHAPTER 2-REVIEW OF LITERATURE

Introduction

This chapter provides a review of literature on current theories of L2 reading and individual-difference research in L2 reading.

Current Theories of L2 Reading

According to Urquhart and Weir (1998) there are two classes of reading models: process models in which an attempt is made to model the actual process of reading as it is thought to take place in the human mind, and componential models which 'merely describe what components are thought to be involved in the reading process, with little or no attempt to say how they interact, or how the reading process actually develops in time' (Urquhart and Weir, 1998, 39). The bottom-up, top-down and interactive models fall into the former class of reading models. As opposed to process models, componential models attempt to model the reading ability rather than the reading process, and to understand reading as a set of theoretically distinct and empirically separable constituents (Hoover and Tunmer, 1993).

As Urquhart and Weir (1998) point out, while componential models limit themselves to arguing that such and such a factor is actually present in the process, process models attempt to describe how the factor operates. In other words, each class of models focuses on some aspect of reading. While componential models emphasize components without mentioning

the interaction between them in a detailed way, process models focus on the psychological aspects of reading.

The following is a brief review of reading models which have been frequently referred to in the literature. They are discussed under two main headings: process models and componential models.

Process Models

This section discusses three second language reading models, which can be classified as process models, and which are derived from theories of first language reading. These are bottom-up, top-down, and interactive models. However, greater emphasis will be on interactive models, which are currently considered to be more adequately characterizing the nature of the reading process.

Bottom-up Models

Reading research and pedagogy had been under the influence of generative-transformational theory of language until the emergence of psycholinguistic model and the schema theoretic views of reading (Grabe, 1991). Generative-transformational theory of language viewed comprehension as building meaning from the smallest, simplest sentence level features (Urquhart & Weir, 1998).

In this traditional view of reading, reading was seen as a decoding process of reconstructing the author's intended meaning via recognizing the printed letter and words, and building up a meaning from the smallest textual units at the

bottom (letters and words) to larger units at the top (phrases, clauses, sentences) (Barnett, 1986; Carrell, 1988; Hammadou, 1991). In other words, within this framework reading comprehension was conceived to be taking place in a linear fashion, in which lower units were analyzed, and then gradually added to higher units until the meaning was constructed. Comprehension was considered to take place after this series of operations were complete with little influence from general world knowledge, contextual information or higher order processing strategies (Grabe and Stoller, 2002; Rayner and Pollatsek, 1989). Thus, in this approach, the focus was on the language to be comprehended rather than the comprehender.

The early proponents of the models within this framework were Gough (1972), and La Berge and Samuels (1974). According to them, meaning was in the text with a separate, independent existence from the reader, and the failures in comprehension could be attributed to language specific deficits, such as a word not in the reader's vocabulary, or a rule of grammar misapplied (Carrell, 1984).

Bottom-up model of reading explained the role of decoding and encoding of print in the comprehension process. However, reading models within this framework were criticized on the grounds that they downgraded the reader contribution in the process of meaning construction (Goodman 1968), and that they failed to recognize that readers utilize their expectations

about the text based on their knowledge of language, and how it works (Eskey, 1973).

Top-down Models

This model views the act of meaning construction as being an ongoing, cyclical process of sampling from the input text, predicting, testing and confirming, or revising those predictions, and sampling further (Goodman, 1988). Such a view of reading is based almost totally on the psycholinguistic model of reading based on the theories of Goodman (1973). Urquhart and Weir (1998) state that Goodman, in fact, did not name his theory as a top-down model; however, several other reading researchers such as Anderson (1978) and Czikó (1978) characterized Goodman's theory as basically a concept-driven, top-down pattern in which higher level processes interact with, and direct the flow of information through lower level processes.

Goodman described reading as a psycholinguistic guessing game, in which the reader reconstructs meaning from written language by utilizing cues from the grapho-phonetic, syntactic, and semantic systems of the language to predict meaning, and then confirms those predictions by relating them to his/her past experiences and knowledge of the language (Goodman, 1971). According to Goodman, the reader, especially the efficient reader, is selective in the use of available textual cues and makes effort to minimize his/her dependence on visual details (Goodman, 1973). In other words, the better the reader

is able to make correct predictions depending on his/her background knowledge, the less confirmation from the text is necessary.

Likewise, in the field of L2 reading research, Smith (1971) conceptualizes reading as a meaning construction process, and indicates that readers need to predict during the reading comprehension process (Barnett, 1989). Smith points out that reading is purposeful and the interaction of the reader's prior knowledge and purpose in reading leads him/her to anticipate the content of the text.

This brief review of top-down processing models shows that reading, in this approach, is seen as a conceptual rather than a perceptual process. In other words, top-down models are particularly appealing to theorists who believe that derivation of meaning from a written text can be attained through a process, in which readers extract known words from a text, and use their knowledge of the world and language to predict, or conceptualize the meaning of the rest of the text (Samuels and Kamil, 1984).

Although the top-down model had a profound impact on the field of second language reading, it was criticized for several reasons. According to Eskey (1988), for example, top-down models tend to emphasize several higher-level skills such as the prediction of meaning through context clues or certain kinds of background knowledge at the expense of several lower-level skills such as the rapid and accurate identification of

lexical and grammatical forms. In other words, for Eskey, these models deemphasize the perceptual and decoding dimensions of the reading process. However, there are also studies pointing out the significance of the perceptual and decoding dimensions of the reading process. To illustrate, Urquhart and Weir (1998) indicate that good readers' ability to decode rapidly and accurately distinguishes them from poor readers, and Stanovich's 1991 study shows that good readers are less dependent on context than poor readers. Top-down models were also criticized on the grounds that they provided an account of only the skillful, fluent reader, for whom perception and decoding have become automatic, but not for the less proficient, developing readers who have not gained well-developed linguistic skills yet (Eskey, 1988; Grabe, 1991).

The inadequacy of bottom-up and top-down models in explaining the reading process paved the way to the introduction of interactive approaches, which encompass the attributes of both bottom-up and top-down processing, while at the same time taking into consideration the attributes and characteristics of the individual reader.

Interactive Models

Following the top-down approach, a more balanced approach has come about. In this approach, reading has been viewed as a kind of dialogue between the text and reader (Grabe, 1988). In other words, reading has been considered as a process of

combining textual information with the information a reader brings to a text.

Grabe (1991) notes that the term 'interactive' refers to the interaction between the reader and the text - the reader reconstructing the text information based in part on the knowledge drawn from text and in part from the prior knowledge available to the reader - and also the interaction between lower-level rapid, automatic identification skills and higher level comprehension/interpretation skills. Along the same lines, Eskey (1986) states that 'interactive' refers to the interaction of the reader's several kinds of knowledge in the process of reading, and the interaction of the reader with his/her individual characteristics and the text.

Considering the meaning of 'interactive' in this respect, bottom-up and top-down reading models have a series of 'non-interactive' processing stages, and tend to operate in a linear fashion. Moreover, as Rumelhart (1977) points out linear models which pass information along in one direction only, and which do not permit the information contained in a higher stage to influence the processing of a lower stage contain a serious deficiency.

Unlike bottom-up models, models which are interactive in nature do not consider reading simply a matter of extracting knowledge from the text. They are also different from top-down models in that they do not presuppose the primacy of top-down processing skills but rather posit a constant interaction

between the bottom-up and top-down processing in reading, each source of information contributing to a comprehensive reconstruction of the meaning of the text (Eskey, 1988).

Grabe (1988:60) states that there is no single interactive model; rather, interactive models include any model that minimally tries to account for more than serial processing.

Rumelhart (1977) was one of the first reading researchers who proposed an interactive model of reading which argued that lower-level and higher-level processes worked together interactively as part of the reading process. In Rumelhart's model, when the reader looks at the words and spelling that are registered in a visual information store, the feature extraction device pulls out the critical features of these words and passes them to the pattern synthesizer where all the information from syntactic, semantic, lexical, and orthographic sources come together (Barnett, 1989). According to the model, all these operations take place simultaneously and contribute to the reader's comprehension of a text.

Later, Rumelhart and McClelland (1986) elaborated on the original interactive model offered by Rumelhart (1977), and proposed the parallel distributed processing models which attempted to explain how the human mind processed information. Rumelhart and McClelland apply these models to information processing in general. In their opinion, the concept is appealing in terms of second language reading because it takes into account the myriad of functions necessary for

understanding meaning through a foreign language (Barnett, 1989).

Like Rumelhart's model, the interactive-compensatory model of Stanovich (1981) proposes that reading involves an array of processes, and comprehension occurs as a result of constant flow of information from various sources. The model offered by Stanovich attempts to account for the individual differences in reading fluency. Stanovich argues that the degree of interaction among components in the reading process depends on the knowledge deficits in individual components (Alderson, 2000). Thus, readers who are weak in word recognition skills, for example, can lean on other strategies, such as making use of topic knowledge, to compensate for their weakness. The model is best described by Stanovich (1981) himself:

A compensatory-interactive model of processing hypothesizes that a pattern is synthesized based on information provided simultaneously from all knowledge sources and that a process at any level can compensate for deficiencies at any other level (p. 262).

As Rayner and Pollatsek (1989) point out the main weakness of the compensatory-interactive models is that although they are good at explaining the parts causing difficulties, they are not good at predicting them in advance.

The Just and Carpenter model (1980) provides an account of comprehension processes basing its arguments upon studies of reader eye movements. Just and Carpenter recorded and analyzed

what a reader's eye does as it scans the text. Their analysis showed that the amount of time an eye fixated on a word was a direct index of the amount of processing time that word required. In the light of their studies, they identified five processes occurring during reading. Any of these stages can influence the processing of the other. The following are the processes identified by Just and Carpenter:

- 1) seeing the next word and extracting its physical features
- 2) seeing the word as a word and comparing it to the mental lexicon
- 3) assigning a case (e. g., nominative, dative) to the word
- 4) relating the word to the rest of the words
- 5) wrapping up the sentence when complete

According to Barnett (1989), the serial nature of word recognition and comprehension in this model may help explain the word-for-word reading styles of some second language readers.

The interactive view of reading process has also been widely acknowledged in second language reading research. Coady (1979) proposed one of the earliest models in second language reading. Coady's psycholinguistic model postulates that comprehension results from the interaction of conceptual abilities, background knowledge and process strategies. The

following list is the seven individual process strategies proposed in the model:

- 1) Phoneme-grapheme correspondences
- 2) Grapheme-morpheme correspondences
- 3) Syllable-morpheme information
- 4) Syntactic information
- 5) Lexical and contextual meaning
- 6) Cognitive strategies
- 7) Affective mobilizers

According to the model, the beginning second language reader progresses from reliance on concrete processing strategies such as the application of grapheme-morpheme correspondence rules to more abstract ones such as making use of contextual clues. Mature readers, however, are more flexible, and may resort to a variety of strategies if a problem arises. Emphasizing the individual nature of the reading process, Coady states that each reader uses process strategies, but not necessarily in the same manner or to the same degree. He suggests that a reader shifts processing strategies to match different types of text or to accomplish different reading goals.

Another interactive model in second language reading was offered by Bernhardt (1986). Bernhardt's constructivist model classifies the processes involved in second language reading comprehension into two categories; text-driven, and reader-

driven. The text-driven operations refer to bottom-up processes while the latter refer to top-down processes.

Text-driven processes comprise:

- 1) word recognition
- 2) phonemic/graphemic decoding
- 3) syntactic feature recognition

Reader-driven processes comprise:

- 1) intratextual perception, i.e., word recognition and perception of syntactic features
- 2) prior knowledge
- 3) metacognition

The way the text-driven, and reader-driven forces of L2 reading comprehension in Bernhardt's model are called into play is unique to each L2 reader.

Bernhardt (1986) describes the model as conceptualizing the interactive and multidimensional nature of the components. As she states, it is impossible to determine at which point in the reconstruction one component influences another one, i.e., prior knowledge can influence word recognition, and in return word recognition can activate prior knowledge for example. In other words, it is impossible to determine where the cycle begins. The model assumes that it will begin in different ways for different readers with different texts. Thus, it is circular and interactive with one or a combination of components influencing one or a combination of other components.

The model also suggests that, text-driven and reader driven operations work separately at early stages of linguistic competence while they start to interact as the linguistic proficiency increases.

In the revised version of the model, Bernhardt (1991: 32-33) includes three variables to consider in a definition of reading. These are:

- 1) Language: linguistic variables consisting of the seen elements in a text such as word structure, word meaning, syntax, and morphology
- 2) Literacy: intrapersonal variables such as purpose for reading, intention, and preferred level of understanding, as well as goal setting and comprehension monitoring
- 3) World knowledge: the background knowledge that a reader already possesses and may or may not use in order to fill in the gaps in the explicit linguistic elements in a text

The model, also suggests that with the development of the reader's literacy, reading becomes a purposeful strategic process involving the use of various cognitive and metacognitive strategies. Literacy, combined with the use of appropriate background knowledge helps determine how to approach a text most efficiently, and how to monitor the process of reading in order to achieve the purposes of reading.

This brief review of interactive models of reading shows that reading, in this approach, is seen as a conceptualization process in which meaning results from the interaction of the reader, the writer, and the text, as well as the interaction of the reader's several kinds of knowledge.

Interactive models allow for all sorts of communications between top-down and bottom-up processes and hence, seem to be a satisfying compromise between bottom-up and top-down approaches. In this respect, proponents of interactive models claim that these models are very good in explaining the reading process. However, other researchers criticize the interactive models for the very same reason. In the opinion of Rayner and Pollatsek (1989), for example, these models are unconstrained and hence, can not predict what the outcome of any particular experiment might be. They further go on to state that while process models account for lower level processes (such as word recognition, lexical access) accurately, they are quite vague about higher-order processes.

In a similar way, Grabe and Stoller (2002) argue that taking useful ideas from a bottom-up perspective and combining them with key ideas from a top-down view would lead to a self-contradictory model since the key processing aspects of bottom-up approaches (e.g., automatic word recognition) are incompatible with strong top-down controls on reading comprehension. They explain their argument by stating that the automatic processing aspects of comprehension need to be able

to operate without a lot of interference from moment-to-moment information gained from background knowledge. Therefore, they assert that more accurate ways to understand reading comprehension require 'modified interactive models' that highlight the number of processes, especially automatic processes, being carried out primarily in a bottom-up manner with little interference from other processing levels or knowledge sources. They further state that this kind of an approach can better account for various purposes for reading, such as reading to skim quickly, or reading for general comprehension.

Componential Models

The process models attempt to describe the actual process of reading as a cognitive activity operating in real time. So, they explain the psychological process of reading according to temporal sequence (Weir et al., 2000). The componential models, on the other hand, do not even attempt to model the process. They only describe areas of skills or knowledge thought to be involved in the process (Urquhart and Weir, 1998).

The following is a brief review of the reading models which refer to the components involved in the reading process, and which are more explicit about higher-order processes.

Hoover and Tunmer (1993) refer to their model as 'the simple view'. The simple view holds that reading can be decomposed into two components:

- 1) decoding (or 'word recognition' in their terms): the ability to rapidly derive a representation from printed input that allows access to the appropriate entry in the mental lexicon (ibid, 6)
- 2) linguistic comprehension: the ability to take lexical information and derive sentence and discourse interpretations (ibid, 8)

According to the model, both of the components are of equal importance. Hoover and Tunmer (1993) argue that when a decoding-skill measure and comprehension-skill measure are multiplied, the resulting score is an accurate measure of reading comprehension. They also make a differentiation between linguistic comprehension and reading comprehension. As stated above, according to the simple view, linguistic comprehension is the ability to take lexical information and derive sentence and discourse interpretations. In this model, reading comprehension involves the same ability, but one that relies on printed information arriving through the eye (ibid, 8). Hence, this model holds that reading and listening are not very different from each other, and comprehension is a centrally controlled linguistic skill rather than a reading skill.

However, Urquhart and Weir (1998) point out that the application of this model to second language readers can be problematic. As stated above, Hoover and Tunmer assume that language knowledge can be tapped by an oral comprehension

test. However, Urquhart and Weir argue that this assumption may not hold true for L2 learners who may perform better on a reading test than on an equivalent oral test.

In a similar way, Carr and Levy (1990) refer to the role of componential skills approach in reading. Like Hoover and Tunmer (1993), they argue that reading is a decomposable information processing system and consists of specialized processing mechanisms, each of which are responsible for one particular kind of mental operation in the process of reading. The analysis of reading process should identify these mental operations, their organization, control and coordination, and the flow of information among them in order to explain individual and developmental differences.

Grabe and Stoller's taxonomic views of reading comprehension are also componential in terms of their approach to reading. Grabe and Stoller (2002) state that reading comprehension abilities are quite complex and involve a variety of processes. According to them, fluent reading is rapid (the reader needs to maintain the flow of information at a sufficient rate), efficient (the various processes involved in comprehension must be coordinated, and certain processes need to be carried out automatically), interactive (the interaction between the reader's background knowledge and the text, and the interaction between many skills working together simultaneously in the process), strategic (the reader needs to recognize processing difficulties, and make decisions for

monitoring comprehension and shifting goals for reading), flexible (the reader employs a range of strategies to read efficiently), evaluative (the reader must decide if the information being read is coherent and matches the purpose for reading), purposeful (the reader has a purpose for reading), comprehending (the reader expects to understand what s/he is reading), learning (the reader reads to learn), and a fundamentally linguistic (rather than a reasoning process) process.

Thus, Grabe and Stoller (ibid) argue that being such a complex process, the fluent reading can be better understood if analyzed into a set of component skills. Then, they divide the components involved in reading into two main categories. These are:

1) Lower-level processes

- lexical access (the calling up of the meaning of a word as it is recognized)
- syntactic parsing (the ability to take in and store words together so that basic grammatical information can be extracted to support clause level meaning)
- semantic proposition formation (the process of combining word meanings and structural information into basic clause level meaning units)

- working memory activation (the network of information and related processes that are being used at a given moment)

2) Higher-level processes

- text model of comprehension (the coordination of ideas from a text that represent the main points and supporting ideas to form a meaning representation of the text)
- situation model of reader interpretation (the interpretation of the information gained from the text in terms of the reader's own goals, feelings, and background)
- background knowledge use and inferencing
- executive control processes (a monitor controlling the text model of comprehension and the situation model of reader interpretation)

While lower-level processes represent the more automatic linguistic processes, the higher-level processes represent comprehension processes that make much more use of the reader's background knowledge and inferencing skills. In addition, Grabe and Stoller (ibid) point out that lower-level processes are not assumed to be easier than higher-level processes in any way.

Kintsch and Van Dijk (1978), in their model of text comprehension and production, offer an explanation on how

semantic structures or propositions (the meaning elements of a text, underlying semantic structures) are processed for comprehension. They classify the semantic structure of discourse into two components:

- 1) a microstructure consisting of micropropositions
working at a local level
- 2) a macrostructure consisting of macropropositions
working at a more global level

Macrorules are the semantic mapping rules that organize the propositions into appropriate levels. The reader relies on his/her schemata in applying the macrorules (i.e. deleting, generalizing, and constructing) while processing the text, and arrives at meaning through classifying the propositions as relevant or irrelevant based on his/her schema. So, according to this model, schema has a key role in text comprehension.

Kintsch and his colleagues emphasize comprehension to the exclusion of word identification, though they assume the latter must exist (Barnett, 1989). The model assumes the following:

- 1) multiple micro-processing of the elements or
propositions in a text,
- 2) a drive toward text reduction (i.e.; finding the gist
of the text, sometimes involving the use of inference),
- 3) the use of memory and reader schemata (what the reader
knows of the text structure and expects to find there)

to generate a new text built from the processed propositions

The model does not include a grammar parser since the reader is assumed to have the knowledge of grammar.

Lastly, although classified as interactive models by several reading researchers (e. g., Barnett, 1989) Coady's (1979) and Bernhardt's (1991) models are apparently componential in their approach to reading. While Coady considers the process of reading as an interaction of the reader's conceptual abilities, process strategies, and background knowledge, Bernhardt suggests three variables to consider, language, literacy and world knowledge. Since both Coady and Bernhardt identify three components, Urquhart and Weir (1998) and Weir et al. (2000) name these models three-component models.

Componential models have gained much attention from EFL researchers. Grabe (1991) remarks on the usefulness of a componential approach by stating that:

A reading components perspective is an appropriate research direction to the extent that such an approach leads to important insights into the reading process. In this respect, it is evident that a component skills approach is indeed a useful approach (p. 382).

Hoover and Tunmer (1993) explain the use of componential models as to understand reading as a set of theoretically distinct and empirically isolable constituents and, thereby,

to account for different reading performance in terms of variation in one of the components. According to them, the advantage of the componential approach is that it allows explaining the components involved in reading step by step and in various ways.

Similarly, Koda (2005) indicates that the componential approach to reading is more suitable for examining individual differences in L2 reading since the objective of the approach is to identify specific individual differences influencing reading, exploring their functional interdependence, and in so doing determining their relative contributions to the overall reading ability. Moreover, Koda points out to the following advantages of the approach in analyzing L2 reading ability:

- 1) The complexity inherent in reading ability stems from the multiplicity of components and their functional interconnections. The componential approach can help dissecting closely interwoven competency elements (p. 194).
- 2) The componential approach can illuminate the place of L2 knowledge in L2 reading comprehension by determining the complex connection patterns between the two multidimensional constructs: linguistic knowledge and reading ability (p. 195).
- 3) Component dissection can also explain the impact of another competence dimension associated with L2 reading ability: "restricted L2 sophistication". In Koda's words

"by comparing and contrasting ways in which component skills contribute to reading performance in L1 and L2 within individual readers, we should be able to pinpoint specific deficiencies attributable to limited L2 linguistic sophistication. Furthermore, similar comparisons of individuals across proficiency levels could also allow us to determine, with increased proficiency, which deficiencies are most easily overcome" (p. 195).

As indicated previously, the componential approach to reading is particularly well suited for examining individual differences in L2 reading (Koda, 2005). Therefore, the present study holds a componential approach in exploring the relative contributions to foreign language reading comprehension of the following individual differences: prior knowledge, topic interest, linguistic proficiency, gender, motivation to read, and metacognitive awareness.

Due to its particular significance in this study, a brief review of individual difference research on L2 reading is presented in the next section.

Individual Difference Research

Individual difference research on L2 reading has been largely influenced by SLA research in the same area. Therefore, before expanding on individual-difference research in L2 reading, a brief overview of individual-difference studies in SLA is provided.

Individual Difference Research in SLA

Ellis (1994) points out that there is still no comprehensive theory of individual differences in SLA research. According to him, a comprehensive theory will need to do the following: 1) to identify those individual differences that are important for successful learning, 2) to specify how they interrelate, and 3) to indicate the relative contribution of particular individual differences to learning. However, research on individual differences has revealed little about the relative influence of different learner factors or how they interrelate (Ellis, 1994).

Although there are several studies of second language acquisition that include discussions of individual differences, these studies do not specifically examine the individual differences thought to contribute to variations in L2 reading comprehension. Moreover, as seen in Table 2.1, the research on individual differences has not been consistent in attempt to identify which variables to examine. These inconsistencies in classifications raise difficulties in synthesizing the results of different studies.

Table 2.1 Classifications of individual differences in SLA literature

Altman (1980)	Skehan (1989)	Larson-Freeman, D. & Long, M. (1991)	Ellis (1994)	Lightbown, P. & Spada, N. (1999)
Age	Language aptitude	Age	Learner beliefs	Intelligence
Sex	Motivation	Socio-psychological	Affective states	Aptitude
Previous experience	Strategies	factors (motivation, aptitude)	e.g. anxiety	Personality
Proficiency in L1	Cognitive and	Personality (self esteem,	Age	Motivation and attitudes
Personality factors	affective factors (extraversion /	extraversion, risk taking, anxiety,	Aptitude	Learner preferences
Language aptitude	intaversion, risk taking,	sensitivity to rejection, empathy,	Learning style	Learner beliefs
Attitudes and motivation	intelligence, field independence, anxiety)	inhibition, tolerance of ambiguity)	Motivation	Age of acquisition
IQ			Personality	
Sense modality preference				
Sociological preference				
Cognitive styles		Cognitive style		
Strategies		Hemisphere specialization		
		Strategies		
		Other factors e.g. memory, gender		

Individual-Difference Research in L2 Reading

Koda (2005) emphasizes the importance of individual differences in L2 reading by indicating that research on this area can yield useful information for both reading theory and practice (p. 181). On theoretical grounds, separation of basic component skills can determine their specific contributions to reading capability, and, hence, can illuminate what constitutes successful reading and what precisely distinguishes strong from weak readers. On pedagogical grounds, on the other hand, individual difference studies can provide critical information necessary for instructional quality. Koda goes on to explain that for instruction to be efficient, intervention must target skills that are causally related to reading performance. Practitioners can identify which skills to emphasize with greater accuracy once they have a clearer understanding of variations in competencies and their direct effect on reading performance.

Koda (ibid.) indicates that there are two traditions of individual difference research in reading: single-focus studies and component-skills studies. In single-focus studies only one or two individual-differences are investigated. Despite clarifying capabilities in successful reading performance, single focus studies are insufficient since they rarely address interconnections among component competencies. The insufficiency of single-focus studies lies in the fact that some abilities necessary for comprehension functionally

depend on other component skills and, therefore, their true influences cannot be determined in isolation. In addition, a number of additional capabilities are linked with reading performance, but only indirectly through their respective mediating variables. Without incorporating these intermediary factors, correlational data can not explain the possible causal relationships. Therefore Koda (ibid.) suggests that individual difference research should go beyond examinations of single skills separately. The alternative for single-focus studies is component skills approach, which attempts to separate the interwoven components, explore their functional interdependence, and in turn, to determine their relative contributions to overall reading ability (p. 190).

As pointed out earlier, because the objectives of componential approach to reading and those of present study are in parallel with each other, the present study holds a componential approach to L2 reading in exploring the role of individual differences in L2 reading comprehension.

Individual Variables Influencing Foreign Language Reading Comprehension

For the purposes of this study, in this section, a review of literature on the following individual-difference variables, and how they influence foreign language reading comprehension is provided: prior knowledge, topic interest, linguistic proficiency, gender, motivation to read, and metacognitive awareness.

Prior Knowledge

Having prior knowledge, i.e. readers' existing knowledge of the topic (Bernhardt, 1991), regarding the text to be read is one of the individual differences that influence reading comprehension. The relationship between prior knowledge (also referred to in the literature as background knowledge or world knowledge) and reading comprehension has long been recognized. The research on the relationship between prior knowledge and reading comprehension was inspired by a theory of knowledge, known as schema theory, applied to the reading process. Schema theory forms the theoretical base for the interactive model of reading process proposed by Rumelhart (1977). As Anderson and Pearson (1984) point out, it is schema theory that helps us see how old knowledge interacts with new knowledge in the process of comprehension. This interaction is comprehension.

Grabe and Stoller (2002) emphasize the importance of prior knowledge in their taxonomic views of reading comprehension. As stated previously, they argue that fluent reading can be better understood if analyzed into a set of component skills. Then, they divide the components involved in reading into two main categories: 1) lower level processes, and 2) higher level processes. In the higher-level processes, which represent comprehension processes that make much more use of the reader's background knowledge and inferencing skills, Grabe and Stoller (2002) list background knowledge use as one factor explaining L2 reading.

Coady considers the process of reading as an interaction of the reader's background knowledge, conceptual abilities, and process strategies. Coady emphasizes the role of prior knowledge while explaining the background knowledge component. Similarly, Bernhardt suggests three variables to consider in explaining L2 reading: language, literacy, and world knowledge. In the world knowledge component (also called background knowledge) Bernhardt points out the role of prior knowledge.

Likewise, Alderson (2000) divides factors that affect reading into two components: 1) reader variables, and 2) text variables. In the discussion on reader variables, he includes the knowledge of topic as one variable influencing L2 reading comprehension and states that readers find it easier to read texts in areas they are familiar with than those which they are not.

Extensive research in the past thirty years using varied materials, subjects, and methods of providing prior knowledge demonstrates the importance and specific effects of prior knowledge in both L1 and L2 reading comprehension.

Studies on the influence of prior knowledge on L1 reading.

Bransford and Johnson (1972) used the following passage in a research study:

The procedure is quite simple. First, you arrange things into different groups. Of course, one pile may be sufficient depending on how much there is to do. If

you have to go somewhere else due to a lack of facilities, that is the next step. Otherwise, you are pretty well set. It is important not to overdo things (p. 722).

It was found that high school students who could read and understand all the words in the passage were unable to understand or recall it without the title "Washing Clothes" which supplied the necessary background knowledge. Other studies using ambiguous passages showed that subjects with different perspectives (Anderson, R. C.; Spiro, R. J., & Monatague, W. E., 1977) or with different background knowledge (Brown, A. L., Smiley, S. S., Day, J., Townsend, M., & Lawton, S. C., 1977) remembered only the information in the text that was important to their point of view. Pearson, Hansen, and Gordon (1979) found that children with knowledge of a text's topic were better at answering questions about it than were children with little knowledge of the topic.

Studies on the influence of prior knowledge on L2 reading.

A considerable number of research studies in L2 reading have revealed the importance of prior knowledge in the comprehension process.

To illustrate, Alderson and Urquhart (1988), Johnson (1982), Mohammed and Swales (1984), Nunan (1985), and Olah (1984) all found that having topic familiarity with the text to be read facilitated reading comprehension, and predicted comprehension ability better than text based linguistic

factors, such as syntactic ease or explicit vocabulary knowledge.

Adams (1982), Carell (1983), Hudson (1982), and Omaggio (1979), on the other hand, tested the influence of background knowledge on L2 reading by manipulating pictorial support to provide background knowledge before reading the text. While Adams and Omaggio found that the presence of picture facilitated comprehension in a second language, Hudson found differentiated impact of such support. His study demonstrated that cueing readers about an upcoming topic with a picture aids comprehension more than teaching vocabulary, and it is particularly useful for lower proficiency students.

Hammadou (1991) conducted two parallel studies in French and Italian as a foreign language (FL) to examine the influence of prior knowledge on L2 reading comprehension across proficiency levels. More specifically, she asked the following questions: 1) Do non-native readers comprehend familiar topics significantly better than they do unfamiliar ones? 2) Does the influence of topic familiarity change across linguistic proficiency levels? 3) What are the qualitative differences in L2 readers' inferencing according to topic familiarity and language proficiency? The participants were 89 students of French; 41 in the beginning level, 48 in the more advanced level, and 77 students of Italian; 43 in the beginning level, 34 in the more advanced level. All were native speaker of English.

All students read three different texts that were identified as French or Italian newspaper articles. Before reading the texts, the participants were asked to rate their familiarity with the topics by assigning a number to each of the three topics. After reading the texts, the subjects were asked to write whatever they can remember in English. The results revealed that the topic judged to be the most familiar was the passage least well recalled. The researcher attributed the contradictions between topic familiarity ratings and actual recall performance to the fact that prior knowledge ratings were based on self report. In addition, in contrast to current language theories which imply that more proficient readers rely less on prior knowledge of topic and rely more on linguistic elements, no significant difference was found between the effects of topic familiarity regarding the beginner and advanced levels.

Topic Interest

Topic interest is also one of the individual variables of which influence on reading comprehension has been studied extensively. A review of the available literature on the influence of interest on reading (Asher, 1980; Hidi 2001; Kintsch, 1980; Krapp, Hidi & Renninger, 1992; Schiefele, 1996; Schraw G., Bruning, R., & Svoboda, C., 1995; Tobias, 1994) reveals a distinction drawn between text-based interest (situational), and topic interest (individual). While text-based interest is an emotional state aroused by specific text

features, topic interest is conceived of as a relatively enduring evaluative orientation towards certain topics (Schiefele, 1996).

The importance of the reader component as a variable influencing L2 reading comprehension has already been noted in many of the componential models reviewed above (Bernardt, 1991; Coady, 1979; Grabe and Stoller, 2002). The L2 reader as an individual brings many characteristics to the text, and topic interest is one of the reader characteristics that affect the nature of reading (Alderson, 2000).

Studies on the influence of topic interest on L1 and L2 reading. Research conducted over the last 20 years in L1 and L2 (Alexander, Kulikowich, & Schulze 1994; Asher, 1980; Hidi 2001; Kintsch, 1980; Krapp, Hidi & Renninger, 1992; Schiefele, 1996; Schraw et al., 1995; Tobias, 1994) has indicated that there is a positive relationship between interest and reading, and that all types of interest facilitate readers' comprehension and text recall. However, compared to the number of studies in L1, there is little research in foreign/second language investigating the role of topic interest in reading comprehension.

Beside the quantitative increases in comprehension due to interest, some researchers suggested that interest may also influence the type of learning that takes place. To illustrate, Krapp (1999), Schiefele (1996), and Schiefele and Krapp (1996) found that interest did not simply enhance the

amount of information recalled, but had a strong influence on the quality of learning. Specifically, interest was found to be related to deep comprehension questions, recall of main ideas, and to a higher degree of cognitive organization in college students' knowledge structures. Ryan et al. (1990) also indicated that interest leads to more elaborate and deeper processing of expository texts.

Studies on the influence of prior knowledge and topic interest on L1 reading. More recent studies in both L1 and L2 explore the influence of prior knowledge and topic interest and the relationship between these two variables. These studies suggest that both topic interest and prior knowledge affect reading comprehension such that readers may have better comprehension when they read materials on topics in which they are interested or when they read materials on topics for which they have appropriate prior knowledge.

Tobias (1994) states that it is almost a truism that people know more about topics related to their interests than they do about others. While some researchers attempt to distinguish between the effects of interest and prior knowledge (Baldwin et. al., 1985; Carrell & Wise, 1998), others acknowledge the relationship in their definitions of interest. To illustrate, Renninger (1992) defines interest as being composed of value and knowledge, and Hammadou (1991) confounds topic interest and prior knowledge under the name of "topic familiarity". However, confounding the influences of

topic interest and prior knowledge leaves the problem of whether results ascribed to topic interest can in fact be accounted by prior knowledge or whether results ascribed to prior knowledge can in fact be accounted by topic interest unanswered.

Kintsch (1980) argued that interest should be low with little or no relevant knowledge. According to him, interest increases as enough is known about a topic to relate it to different schemata, but it diminishes again as knowledge increases to the point where nothing new can be learnt.

This formulation was supported by Garner and Gillingham (1992) who tested the argument that everything else being equal, cognitive interest in a descriptive text is determined by how much a reader knows about the topic of the text. They found that the recall of information from a text was related to level of topic interest. Their results suggested that rather than low or high topic knowledge level, moderate topic knowledge was associated with high cognitive interest, and that high interest, in turn, appeared to be associated with high recall of information. These findings are also consistent with schema theory. If topic is completely unfamiliar, the new knowledge cannot be related to already existing information structures, and in turn no interest is generated. On the other hand, if a text unit conforms wholly to expectations, interest is lacking again.

Schiefele conducted a series of studies regarding the relationship between interest and prior knowledge. In one of these studies (1990), a short summary of the text selection was rated for interest. The total interest score consisted of the sum of two sub-scales designed to measure feeling-related and value-related reactions. Prior knowledge was assessed by a word association test and five open ended questions dealing with domain knowledge of basic aspects of the text. After reading a five-page passage dealing with the "Psychology of Emotion", 53 computer science students received 12 open-ended questions. The results showed a main effect for interest only for questions tapping deeper comprehension. Besides, there were no prior knowledge differences between high and low interest groups.

In a similar study, Schiefele and Krapp (1991) used a text on communication and interest rating scales described in the preceding study while examining the effects of interest on a variety of comprehension measures. Prior topic knowledge was assessed by multiple choice and open ended questions. It was found that interest, prior knowledge, and intelligence were not significantly related. However, Schiefele and Krapp stated that these relationships may have been attenuated by the fact that most subjects were not familiar with the topic of the experimental text and had only very limited amounts of topical knowledge. The results also showed that interest affected recall of total idea units, total main ideas, and coherence of

recall, while prior knowledge was related only to recall of total idea units.

In a more recent study, Schiefele (1996) investigated the relationships between topic interest, prior knowledge and intelligence, variables of the reading process, and free recall of expository text. 80 male university students were presented with a text on which they had presumably low levels of prior knowledge and a large variety of interest levels. Before reading the text, the prior knowledge was assessed through 13 multiple choice items that were related to the information contained in the text and 3 open ended questions asked for information that was not directly addressed in the text. Topic interest was assessed through an inventory with items asking for the subjects' value and feeling related judgments. All the items in the test were rated on a four point scale. Next, the subjects were asked to write down the text content as completely as possible (intercoder coefficient .89). The results revealed that while topic interest was significantly related to the total amount of recalled idea units, the relation between prior knowledge and the total number of recalled idea units was only marginally significant. In addition, it was suggested that the relations between interest and recall were independent of prior knowledge and intelligence. These findings were consistent with Schiefele's previous studies.

Studies on the influence of prior knowledge and topic interest on L2 reading.

Although compared to L1 studies limited in number, there are also studies investigating the relationship between prior knowledge and topic interest in L2. To illustrate, Carrell and Wise (1998) investigated the relationship between prior knowledge and topic interest in reading in English as a second language. They also investigated how this relationship was affected by English proficiency level and gender. 104 students learning English for academic purposes at an American university took part in the study. After taking a prior knowledge test and a topic interest inventory, each student read passages on topics for which they had all possible combinations of high and low topic interest, and high and low prior knowledge. The level of comprehension was assessed through multiple choice tests.

The results showed that there was a very low correlation between students' prior knowledge of the topics and topic interest for the topics used in the study. Carrell and Wise stated that their results conflicted with the common-sense notion that prior knowledge and topic interest should be highly correlated. They explained this finding by the fact that in academic settings students might be forced to study things whether they were interested in them or not. Therefore, it was indicated that their participants, who were college students, could express low interest in topics in which they had a lot of knowledge, and conversely, that they could

indicate high interest in topics about which they knew very little. Thus, they suggested that topic interest and prior knowledge might not be necessarily correlated for any group of learners in any settings.

Regarding the influence of topic interest and prior knowledge on reading comprehension, it was found that when either topic interest or prior knowledge was high, reading comprehension was slightly facilitated. Yet, neither topic interest, nor prior knowledge alone was found to have a statistically significant effect on comprehension. On the other hand, reading comprehension suffered most when both prior knowledge and topic interest were low.

English proficiency level was found to have a significant main effect on reading comprehension, with significant distinctions between the high-beginner and high-intermediate groups, and high-beginner and advanced groups. In addition, there was a significant interaction between interest and gender, with males more influenced by high topic interest than females.

Gender

Gender is one of the variables that have been included in classifications of individual differences influencing SLA by several researchers (Altman, 1980; Larson-Freeman & Long, 1991).

As stated previously, the purpose of componential models of reading is to conceptualize reading as a set of

theoretically distinct and empirically separable constituents, and hence, to account for different reading performance in terms of variation in one of the components. The significance of the reader component as a variable influencing L2 reading comprehension has been highlighted in many of the componential models reviewed above (Bernardt, 1991; Coady, 1979; Grabe and Stoller, 2002). The L2 reader as an individual brings many characteristics to the text, and as stated by Alderson (2000), gender is one of the stable reader characteristics that affect the nature of reading.

Studies on the influence of gender on L1 reading. The role of gender on reading comprehension has been extensively investigated in both L1 and L2. Studies conducted by Hyde and Linn (1988), and Doolittle and Welch (1989) provide examples to the research findings in the field of L1 reading. Hyde and Linn state that the lower scores of women in the United States on the language part of the American Scholastic Aptitude Test (SAT) are mainly attributed to changes in the content of the readings of the test. Likewise, Doolittle and Welch, in a study on gender differences in achievement test performance at the college level, report notable gender differences for items associated with specific passages. They found that females scored higher than males with humanities-oriented reading passages, but lower than males with science-oriented passages.

Studies on the influence of gender on L2 reading. The influence of gender has also been widely investigated in the

field of L2 reading. To illustrate, Bügel and Buunk (1996) carried out a study investigating the relationships among prior knowledge, interest, gender, and the influence of these variables on foreign language text comprehension. On a national foreign language exam in the Netherlands, Bügel and Buunk found that males scored significantly better on the multiple choice comprehension items for essays about laser thermometers, volcanoes, cars, and football players while females achieved significantly higher scores on the comprehension tests for essays on text topics such as midwives, a sad story, and a housewife's dilemma. This situation prompted Bügel and Buunk to test the hypothesis that gender differences in prior knowledge and interest lead to differences on test performance on different topics, and in turn make text topic an important factor. The results supported the assumption that there were differences in prior knowledge and interests between male and female students and that these differences contributed to sex differences in foreign language text comprehension.

Brantmeier conducted a series of studies on the role of readers' gender and passage content on L2 reading comprehension. In one study, Brantmeier (2003) reported significant interactions between readers' gender and gender-oriented passage content with comprehension among intermediate second language learners of Spanish at the university level. The two passages utilized in the study were authentic

narratives about a boxing match and a frustrated housewife. Findings revealed that there were significant interactions between readers' gender, topic familiarity, and L2 reading comprehension measured by both written recall and multiple-choice questions. The results of the study provided evidence that topic familiarity had a facilitating effect on L2 reading comprehension by gender at the intermediate level of Spanish language instruction.

However, Brantmeier (2002) found no significant interaction between these variables with advanced level Spanish learners. She found that significant differences in topic familiarity were maintained across instruction levels whereas the effects of passage content on L2 reading comprehension by gender were not maintained when the intermediate level text is read by more advanced learners. While at the intermediate level, male and female readers got better reading scores on familiar topics, at more advanced levels male and female performance on L2 reading comprehension tasks was no longer affected by gender-oriented passage content.

The above L2 reading studies examined whether a reader's gender accounts for differences in reading comprehension. Although there are differences in the research design methods of each study, in all of the studies gender appears to have a role in reading comprehension.

Linguistic Proficiency

The critical role of linguistic proficiency in L2 reading comprehension has in fact already been mentioned briefly in Bernhardt's model (1991) discussed above. The model suggests that while text-driven and reader-driven factors are separate concepts at early stages of linguistic competence, they start to interact as the linguistic proficiency increases. More specifically, while beginning L2 readers focus on lower-level processing strategies such as identification of lexical and grammatical forms, readers with more developed L2 language proficiency shift attention to more global and abstract conceptual abilities such as the prediction of meaning through context clues, and make better use of background knowledge. This argument points out to a relationship between reading comprehension performance and L2 proficiency.

Similarly, in the three-component model of Coady (1979), the significance of L2 proficiency is emphasized in the process strategies component, which includes both the knowledge of a language system and the ability to use this knowledge.

The Interdependence Hypothesis and the Threshold Hypothesis. Cummins (1981) stated his views regarding the relationship between L1 reading ability and L2 linguistic proficiency in the form of two hypotheses: the Interdependence Hypothesis and the Threshold Hypothesis. According to the Interdependence Hypothesis, if a reader has adequate

motivation and exposure to the target language, it is possible for him/her to transfer literacy skills from the native language. The Threshold Hypothesis, on the other hand, asserts that transfer of literacy skills can only take place after a minimal threshold level of linguistic proficiency in the target language has been reached.

The threshold hypothesis was criticized on that there is not a single set of linguistic knowledge that can be defined as presenting the necessary foundation (Grabe & Stoller, 2002). Koda (2005), also, indicates that little is known about what might constitute sensible linguistic thresholds although empirical data generally support the need for proposing minimum proficiency requirements for L2 text comprehension. Along the same lines, Alderson (2000) points out that the linguistic threshold is not absolute but varies by task difficulty. That is, the more demanding the task gets, the higher the linguistic threshold gets.

The short circuit hypothesis. Clarke's short circuit hypothesis (1980) is a combination of Cummin's Interdependence Hypothesis and Threshold Hypothesis. According to Clarke, L2 readers skilled in L1 reading but lacking proficiency in L2 will abandon the effective strategies they employ when reading in L1, and approach L2 reading with a bottom-up mode of processing. However, once these readers acquire a minimal proficiency in the foreign language, they will adopt a more

holistic, interactive bottom-up and top-down mode of processing.

Alderson (1984) proposes a similar argument. He asserts that there is a minimum proficiency level L2 readers must attain in order to read competently in L2, and that once this level has been attained, it is possible to transfer L1 reading strategies to L2. In other words, once a good L1 reader attains an adequate threshold competence ceiling in L2, he/she will transfer L1 reading strategies to L2. However, a reader with poor L1 reading skills may achieve a satisfactory threshold competence ceiling in L2 but will exhibit poor L2 reading comprehension because he/she is a poor L1 reader and has no good strategies to transfer. In other words, once the students have passed through the linguistic threshold, they can free up their cognitive resources, which were previously used to figure out language structures and vocabulary, to read more strategically and to transfer L1 strategic reading practices to the L2 setting (Grabe & Stoller, 2002, p. 51).

Studies on the influence of linguistic proficiency on L2 reading comprehension. There are several experimental studies supporting the existence of a linguistic threshold level. To illustrate, Clarke's 1988 study on native Spanish and ESL reading indicates that L2 proficiency may limit the transference of good L1 reading skills to L2 reading. Carrell reports similar results in her 1991 study. However, there is also research which indicates that efficient reader-based

processing can compensate for lower proficiency levels in language (Hudson, 1982).

Recent empirical findings, in addition, further demonstrate that L2 knowledge explains 30% to 40% of L2 reading variance (e.g. Bernhardt and Kamil, 1995; Bossers, 1991; Carrell, 1991). Hence, these findings suggest that limited L2 knowledge inhibits learners from using their previously acquired L1 skills.

Alderson's argument (2000) that the linguistic threshold is not absolute but must vary by task demands is supported by Taillefer's 1996 study, which tested the relative importance of L1 reading ability and L2 proficiency for reading tasks of varying cognitive complexity. In this study, Taillefer, also, sought to determine whether or not the relative importance of L1 reading ability changes in a recognizable way as L2 proficiency increases once an L2 language threshold has been reached. The findings indicated that both of the variables, namely; L1 reading ability and L2 proficiency, showed significant effects on L2 reading comprehension. More specifically, the results suggested that L1 reading skills may transfer in simple tasks, but the importance of the role played by these skills decreases as the complexity of the tasks increases. While the importance of the role played by L1 reading skills decreases with more demanding tasks, L2 proficiency gains importance in tasks with higher complexity.

The above discussion indicates that L2 proficiency plays an important role in successful reading comprehension. Moreover, the studies summarized in this section point out that, the linguistic threshold does not rely on lexical or grammatical knowledge only, but also on the amount of background knowledge the readers bring with them and the types of the texts.

Motivation to Read

Guthrie and Wigfield (1999) defined reading motivation as "the individual's goals and beliefs regarding reading" (p.199). Reading motivation is included as a component influencing L2 reading in Grabe and Stoller's componential model of reading discussed earlier. As stated previously, Grabe and Stoller (2002) divide the components involved in reading into two main categories: lower-level processes and higher-level processes. One component of higher-level processes is situation model of reader interpretation, which emphasizes the reader's interpretation of the information gained from the text in terms of the reader's own goals, feelings, background and motivation to read. Hence, Grabe and Stoller suggest reader motivation is among many of the reader variables (such as background knowledge, inferences, and reader goals) that influence L2 reading comprehension.

Studies on the influence of motivation to read on L1 reading. Much of the research investigating the nature and the role of motivation to read in L1 has been inspired by Wigfield

and Guthrie (1995). They tried to conceptualize the nature of motivation specifically for reading arguing that motivation to learn can be domain specific. That is, students may be, for example, motivated to listen or speak, but not to read in English.

To assess specific dimensions of reading, Wigfield and Guthrie (1995) developed a set of possible dimensions that could comprise reading motivations. They proposed three major learner factors that affect reading comprehension: 1) Individual's beliefs that they are competent and efficacious at reading, 2) achievement values and goals, 3) social reasons for reading. These factors and their sub-components are summarized in the following table:

Table 2.2

Aspects of Reading Motivation

Aspects of Reading Motivation
1) Competence and Efficacy Beliefs
Reading efficacy
Reading challenge
Reading work avoidance
2) Achievement Values and Goals
Intrinsic motivation:
Curiosity
Reading involvement
Importance
Extrinsic motivation:
Competition
Recognition
Grades
3) Social Aspects
Social reasons for reading
Reading compliance

The first category concerns an individual's sense of efficacy and beliefs about their reading ability, and consists of reading efficacy, reading challenge and reading work avoidance. Within the field of motivation, self-efficacy has been widely researched. Bandura (1986: 391) defined it as "people's judgment of their capabilities to organize and execute courses of action required to attain designated types of performances". While the notion of reading challenge refers to the satisfaction of understanding complicated ideas in a text, reading work avoidance refers to what people do not like about reading.

The second category is based on the work intrinsic and extrinsic motivation. Intrinsic motivation refers to being motivated and curious enough to be engaged in an activity for its own sake (Harter, 1981). Increased intrinsic motivation has been related to greater interest in the reading material, higher reading performance (Wigfield & Guthrie, 1997) and higher achievement in text comprehension tasks (Gottfried, 1990). The dimensions based on intrinsic motivation are reading curiosity, reading involvement and importance of reading. Reading curiosity refers to the desire to learn about a particular topic of interest (Schiefele, 1996). Reading involvement is the enjoyment of experiencing different kinds of literary or informal texts. Importance of reading is the individual's valuing of different tasks or activities.

Different dimensions of extrinsic motivation are also highlighted. Extrinsic motivation refers to efforts directed toward obtaining external recognition, rewards, or incentives (Deci, Vallerand, Pelletier, & Ryan, 1991). The dimensions based on extrinsic motivation are reading recognition, reading for grades and reading competition. Reading recognition is the gratification in receiving a tangible form of recognition for success in reading. Reading for grades is the desire to be favorably evaluated by the teacher. Reading competition is the desire to outperform others in reading.

The last category is social aspects of reading. Reading is often a social activity and often takes place in social settings. The first of these aspects is social reasons for reading. It refers to the process of sharing what is gained from reading with friends or family members. Reading compliance, on the other hand, refers to the kind of reading required by the teacher.

Based on their 11 theoretical aspects of reading motivation, Wigfield and Guthrie (1995) developed the Motivation for Reading Questionnaire (MRQ). The instrument used to assess second language reading motivation in the present study largely drew upon Wigfield and Guthrie's Motivation for Reading Questionnaire.

Tercanlioğlu (2001) also used MRQ to explore the nature of Turkish students' motivation to read in partially English-medium high-schools. She investigated the relationship between

the students' reading motivations and their reading frequencies. However, Tercanlioğlu indicated that she focused on students' motivation to read in general, that is, not specifically on their motivation to read in L1 or L2. The results of her study revealed that the students' reading motivations were closely related to their reading frequencies.

Studies on the influence of motivation to read on L2 reading. There has been a great deal of research on the role of attitudes and motivation in second language learning. The overall findings show that positive attitudes and motivation are related to success in second language learning (Gardner, 1985). However, little work can be found on motivation to read in a second/foreign language. Day and Bamford (1998) are the only ones who have attempted to create a theoretical model of motivation to read in a second language. Their model includes expectancy and value components. While the expectancy component is concerned with materials and reading ability, value component is concerned with attitudes and socio-cultural environment. However, as indicated by Mori (2002) this model lacks empirical evidence.

Takase (2003) investigated Japanese high school students' motivation and demotivation to read in English extensively through questionnaires and interviews. The findings showed that materials and attitudes toward extensive reading in L2 were likely to play the most important roles in motivating L2 learners to read. In particular, providing an abundance of

extremely easy reading materials of interest were found to be needed for the less motivated students.

Metacognitive Awareness

Strategies are deliberate, cognitive steps that learners can take to assist in acquiring, storing, and retrieving new information (Anderson, 1991). Research in second language reading suggests that learners use a variety of strategies to assist them with the acquisition, storage, and retrieval of information (Rigney, 1978). Skimming, scanning, contextual guessing, reading for meaning, utilizing background knowledge and recognizing text structure are all examples to strategies that second language readers may adopt during reading. While previous research has focused on strategy use, researchers now are examining readers' awareness of strategies during the reading process, that is, their metacognitive awareness.

As noted in the componential models of reading section, Coady (1979) explains the significance of strategic reading in the processing strategies component of his three-component model of reading. On the other hand, the role of metacognitive awareness in L2 reading is clarified in the literacy component of Bernhardt's model (1991). Literacy, in this model, refers to the intrapersonal variables such as purpose for reading, intention, and preferred level of understanding, as well as goal setting and comprehension monitoring. In addition, Grabe and Stoller (2002) emphasize the role of metacognitive awareness in L2 reading while explaining the role of executive

control processor in higher-level processes component of their model. The executive control processor refers to a monitor that assesses our understanding of a text and evaluates our success. It is also noted that the reader's evaluation of how well they comprehend the text depends on executive control processing.

Studies on the influence of metacognitive awareness on L1 reading. Baker & Brown (1984) subdivide metacognitive knowledge or awareness into three distinct factors: 1) knowledge about ourselves, 2) the tasks we face, and 3) the strategies we employ. Knowledge about ourselves may include knowledge about how well we perform on certain types of tasks or our proficiency levels. Knowledge about tasks may include knowledge about task difficulty level. To illustrate, one may know that familiar-topic content is easier to understand than unfamiliar topic content. The concept of strategy variable is further refined by Paris, Lipson, and Wixson (1983). They suggested that metacognitive knowledge about strategies is of three types: declarative (knowledge about strategies), procedural (knowledge about how strategies can be employed), and conditional (knowledge about when it is appropriate to apply a certain strategy).

Metacognitive awareness also involves the awareness of whether or not comprehension is occurring, and the conscious application of one or more strategies to correct comprehension (Baumann, Jones, & Seifert-Kessel, 1993). First language

reading researchers, most notably Baker and Brown (1984) have investigated several different aspects of the relationship between metacognitive ability and effective reading. Two dimensions of metacognitive ability have been recognized: 1) knowledge of cognition or metacognitive awareness; and 2) regulation of cognition which as stated includes the reader's knowledge about his or her own cognitive resources, and the compatibility between the reader and the reading situation. For example, if a reader is aware of what is needed to perform effectively, then it is possible to take steps to meet the demands of a reading situation more effectively. If, however, the reader is not aware of his or her own limitations as a reader or of the complexity of the task, then the reader can hardly be expected to take actions to anticipate or recover from difficulties (Carrell, 1989).

Studies on the influence of metacognitive awareness on L2 reading. In second language reading, some studies have shown that better readers are also better strategy users. Carrell (1989) for example, conducted a study to investigate the metacognitive awareness of second language readers about reading strategies in both their first and second language, and the relationship between their metacognitive awareness and comprehension in both first and second language reading. Two groups of subjects of varying proficiency levels including forty-five native speakers of Spanish enrolled at an ESL intensive program at a university, and seventy-five native

speakers of English studying Spanish were involved in the study. A metacognitive questionnaire was developed to elicit relevant information from subjects to tap their metacognitive awareness and judgments about silent reading in their first and second language. Subjects were also tested in both their first and second languages by reading a text in each language and then answering comprehension questions pertaining to the text. The results for reading in the L1 showed that local reading strategies such as focusing on grammatical structures, sound-letter, word meaning and, text details tended to be negatively correlated with reading performance. For reading in the L2, there were some differences between the Spanish L1 and the English L1 groups. The ESL group, of more advanced proficiency levels, tended to be more global (used background knowledge, text gist, and textual organization) or top-down in their perceptions of effective and difficulty-causing reading strategies, while the Spanish-as-a-foreign language group, at lower proficiency levels tended to be more local or bottom-up, perhaps because they may have been more dependent on bottom-up decoding skills. Carrell (1989) cautions these results are to be taken as suggestive as further research in this area is needed.

In another study involving 278 French language students, Barnett (1988) investigated the relationships among reading strategies and perceived strategy use on reading comprehension. The initial part of the study required students

to read an unfamiliar passage and write in English what they remembered. The second part of the study asked the students to answer a series of background knowledge questions before reading a text, and the third part of the study required students to continue the ending of a text. The final part required the subjects to answer a seventeen-item questionnaire in English about the types of reading strategies they thought best described the way they read. "Background knowledge scores", "comprehension scores" and "strategy-use scores" were used for analysis which revealed that students who effectively consider and remember context as they read, (i.e. strategy use) understand more of what they read than students who employ this strategy less or less well. Moreover, students who think they use those strategies considered most productive (i.e. perceived strategy use) actually do read through context better and understand more than do those who do not think they use such strategies" (p. 156).

Given the above discussion, there appears to be a strong relationship between reading strategies used by readers, metacognitive awareness, and reading proficiency. Better readers also have an enhanced metacognitive awareness of their own use of strategies and what they know, which in turn leads to greater reading ability and proficiency (Baker & Brown, 1984; Garner, 1987; Pressley & Afflerbach, 1995). Researchers in this area have found that in general, more proficient readers exhibit the following types of reading behaviors:

Overview text before reading, employ context clues such as titles, subheading, and diagrams, look for important information while reading and pay greater attention to it than other information, attempt to relate important points in text to one another in order to understand the text as a whole, activate and use prior knowledge to interpret text, reconsider and revise hypotheses about the meaning of text based on text content, attempt to infer information from the text, attempt to determine the meaning of words not understood or recognized, monitor text comprehension, identify or infer main ideas, use strategies to remember text (paraphrasing, repetition, making notes, summarizing, self-questioning, etc), understand relationships between parts of text, recognize text structure, change reading strategies when comprehension is perceived not be proceeding smoothly; evaluate the qualities of text, reflect on and process additionally after a part has been read, and anticipate or plan for the use of knowledge gained from the reading (Aebbersold & Field, 1997; Pressley & Afflerbach, 1995).

Summary

This chapter has attempted to provide an overview of literature on models of L2 reading and individual difference research on L2 reading.

The review of literature on models of L2 reading has suggested that componential approach to reading, which aims to identify specific individual differences influencing reading,

to explore their functional interdependence, and hence, to determine their relative contributions to the overall reading ability, is more suitable for the objectives of the present study, which can be briefly stated as:

- 1) to examine the relative contributions to foreign language reading comprehension of the following individual differences: prior knowledge, topic interest, linguistic proficiency, gender, motivation to read, and metacognitive awareness,
- 2) to examine the relationship between the contribution to foreign language reading comprehension of these individual-difference variables (i.e., prior knowledge, topic interest, linguistic proficiency, gender, motivation to read, and metacognitive awareness) and text difficulty.

As revealed in the objectives, the role of individual differences on L2 reading is the main focus of this study. Therefore, in addition to the review of literature on models of L2 reading, an overview of individual difference research on L2 reading has also been provided.

The next chapter discusses the research questions in a more detailed way, and describes the methods and procedures used in the present study.

CHAPTER 3-METHODS AND PROCEDURES

Introduction

This chapter explains the methods and procedures that are employed in the study. The chapter will first list the research questions and provide the operational definitions of the variables to be investigated. Next, the population and the instruments used in the data collection procedure will be described. Finally, detailed information on the procedures that are followed for data collection and data analysis will be presented.

Research Questions

The present study examines the way individual difference variables interact and contribute to foreign language reading comprehension. The individual difference variables that are selected to be investigated in this study are as follows: 1) prior knowledge, 2) topic interest, 3) linguistic proficiency, 4) gender, 5) motivation to read, and 6) metacognitive awareness. The researcher will also examine the relationship between the contribution to foreign language reading comprehension of these individual-difference variables and text difficulty.

The research questions drawn from these issues are stated below:

1. What are the relative contributions to foreign language reading comprehension of the following individual-difference variables when intermediate and advanced EFL

learners read an intermediate text for general comprehension: prior knowledge, topic interest, linguistic proficiency, gender, motivation to read, and metacognitive awareness?

2. How does the contribution of these individual difference variables (i.e.: prior knowledge, topic interest, linguistic proficiency, gender, motivation to read, and metacognitive awareness) to foreign language reading comprehension relate to text difficulty?

Definitions and Measurements of Variables

Independent Variables

The independent variables analyzed in the present study are prior knowledge, topic interest, linguistic proficiency, gender, motivation to read, and metacognitive awareness.

Prior Knowledge

Prior knowledge refers to how much a reader knows about the topic of the text to be read. It is a continuous variable measured through a prior knowledge test designed by the researcher, and administered before the participants read the selected texts.

Topic Interest

Topic interest refers to one's orientation towards a certain topic or domain of knowledge. It is a continuous variable measured through a test based on the participants' ratings on the text topic's usefulness, meaningfulness, importance and worthiness.

Linguistic Proficiency

Linguistic proficiency refers to the participants' level of English as determined by the Boğaziçi University English Proficiency Test. It is a categorical variable with two levels: a) intermediate level, b) advanced level.

Gender

Gender is a categorical variable with two levels: a) female, b) male.

Motivation to Read

This is a continuous variable measured through a questionnaire designed to assess the level of students' motivation for reading. The questionnaire used in the present study is an adapted form of The Motivations for Reading Questionnaire (Wigfield and Guthrie, 1995).

Metacognitive Knowledge

Metacognitive knowledge, referring to one's ability to monitor and plan his/her reading, is a continuous variable measured through a questionnaire developed by Carrell (1989) to elicit relevant information from subjects as to their metacognitive conceptualizations or awareness judgments about their silent reading strategies in English.

Dependent Variables

L2 reading comprehension of intermediate and advanced students on two different linguistic proficiency-level texts (i.e.: intermediate and advanced) is analyzed as the dependent variable for this study.

L2 Reading Comprehension

L2 reading comprehension is a continuous variable measured through the scoring of the free written recalls produced by the participants after reading the texts.

For the first research question, the L2 reading comprehension of both the intermediate and advanced-level students on the intermediate-level text is analyzed as the dependent variable.

For the second research question, three separate multiple regression analyses are run. In the first analysis, the L2 reading comprehension of the intermediate-level students on the intermediate-level text is examined as the dependent variable. In the second analysis, the L2 reading comprehension of the advanced-level students on the advanced level-text is analyzed as the dependent variable. In the final analysis, on the other hand, L2 reading comprehension of the advanced-level students on the advanced level-text is analyzed as the dependent variable. Then, the results of these three analyses are examined to see the relationship between the contribution to foreign language reading comprehension of these individual-difference variables and text difficulty.

Participants

The research was conducted at the Boğaziçi University School of Foreign Languages in the first half of October, 2003. A total of 66 students studying English for academic purposes took part in the study. The students had different majors;

however, they were required to prove to be at a specific level of English language proficiency before they could start their programs. The level of the students' English language proficiency had been determined by the Boğaziçi University English Proficiency Test (BUEPT) at the beginning of the semester, and they had been placed into classes according to their linguistic proficiency levels. While half of the participants were advanced-level students, the other half was composed of intermediate-level students.

There were 31 female and 35 male students. The average age was 19 ranging from 17 to 24. The following table shows the distribution of the female and male students in the two classes.

Table 3.1

The distribution of the female and male students at two linguistic proficiency levels

	Female	Male
Intermediate-level students	13	20
Advanced-level students	18	15
Total	31	35

Data Collection

Topic Interest Test

The topic interest questionnaire (Appendix B.01 and B.02) was adapted from Schiefele, 1996. The test comprised two parts. In the first part, the participants were asked to estimate the value of the text's topic to them personally by using the terms: ("To me, reading a text on stress/brain is ...") "meaningful", "unimportant", "useful", "worthless". In the second part, the participants were asked to estimate how they expected to feel while reading the text in question by using the following adjectives: ("While reading the text on 'stress/brain' I expect to feel ...") "bored", "stimulated", "interested", "indifferent", "involved", "engaged". All the items in the questionnaire were rated on four-point rating scales, "4 - completely true" implying complete agreement with a specific feeling, and "1 - not at all true" implying complete disagreement with that feeling. The internal reliability of the topic interest test was calculated to be .874 (Cronbach's alpha: .874).

Prior Knowledge Test

Before the participants read the selected texts, a prior knowledge test developed by the researcher for each text (Appendix A.01 and A.02) was implemented. Two experts examined and provided feedback regarding the content of the tests.

The prior knowledge test on the intermediate level text ("Stress") is composed of 5 multiple choice, and 7 true/false

questions. The prior knowledge test on the advanced level text ("Split Brain"), on the other hand, is composed of 7 multiple choice, and 12 true/false questions. While some of the questions in both tests are related to information contained in the text, some questions are asked for domain knowledge which is not directly addressed in the text.

Both of the tests met the requirements for internal reliability. The mean inter-item correlation for the prior knowledge test on the intermediate level text ("Stress") was calculated to be .481¹. The split half reliability of the prior knowledge test on the advanced level text ("Split Brain") was found to be .801 (Spearman-Brown coefficient: .801).

Reading Passages

An intermediate and an advanced level text developed by the Curriculum Committee of the Boğaziçi University School of Foreign Languages constituted the reading materials used in this study (Appendix C and D). The selected texts were a part

¹ Cronbach's coefficient alpha is largely influenced by scale length. The mean inter-item correlation differs from a reliability estimate in that it is not influenced by scale length. Therefore, reporting the mean inter-item correlation for scales with few items provides a clearer measure of internal reliability (Briggs and Cheek, 1986). The prior knowledge test on the intermediate level text in the present study is composed of 12 items; therefore the mean inter-item correlation of the test is reported. Briggs and Cheek indicate that the optimal level of the mean inter-item correlation is in the .2 to .4 range (p. 114-115).

of the regular curriculum followed by the instructors of both the intermediate and the advanced level classes.

While the intermediate level text was read by both the intermediate and advanced level students, the advanced level text was only read by the advanced level students.

Both of the texts were four pages long. One was related to the nature of stress and its influences on people's lives, and the other one was a text on the structure of human brain and split brain studies.

Recall Protocol

After the participants read the given texts, they were asked to write down the text content as completely as possible in their native language. The first step in analysing the recall protocols was dividing the original texts into idea units. As stated by Anderson (2000: 230), 'an idea unit is somewhat difficult to define, and rarely addressed in the literature'. Schiefele (1996) defines it as a meaningful information complex that corresponds to a proposition. The identification of idea units in this study does not include the structural or meaning relationships between text units, in contrast to a complete propositional analysis which includes the hierarchical nature of relationships between the idea units (Meyer, 1975). To be more specific, an idea unit, in this study corresponds to a simple sentence, a sentence including an adverbial clause, adjective clause, noun clause, or a verb phrase.

To illustrate how idea units in the texts used in the present study were identified, the parsing of the first paragraph of one of the texts into idea units is given as an example (for further information see Appendix D and E.02).

The first paragraph in the text:

Everyone has two minds. Most people feel that way occasionally, but only recently have scientists learned how accurately this subjective impression mirrors physical reality. There are two brains. Perched on top of the brain stem inside the human skull are two large bulges - the left and right cerebral hemispheres. Normally the two are interconnected so that they work together, sharing the work of the brain, and each can, if necessary, take over many of the functions of the brain as a whole. Yet the two brains are not alike, and a number of crucial responsibilities are divided between them. They have quite different roles in behaviour. The left brain, highly literate and analytical, tends to dominate personality. It specializes in language skills such as speech and writing, as well as in mathematics and reasoning. The right brain, endowed with special powers of intuition and spatial perception, is particularly important creativity, music, art and athletics.

The idea units identified:

1. Everyone has two minds.
2. Most people feel that way sometimes.
3. Recently scientists have learnt that this feeling reflects physical reality.

4. There are two brains.
5. The left hemisphere is placed on top of the brain stem.
6. The right hemisphere is placed on top of the brain stem.
7. The brain stem is inside the human skull.
8. The two hemispheres are interconnected.
9. The two brains work together.
10. The two brains share the work of the brain.
11. Each brain can take over many of the functions of the
 mind as a whole.
12. The two brains are not alike.
13. The two brains share a number of important
 responsibilities.
14. The have quite different roles in behavior.
15. The left brain is highly literate.
16. The left brain is highly analytical.
17. The left brain dominates personality.
18. The left brain specializes in language skills.
19. Speech is an example to language skills.
20. Writing is an example to language skills.
21. The left brain specializes in mathematics.
22. The left brain specializes in reasoning.
23. The right brain is endowed with intuition.
24. The right brain is endowed with spatial perception.
25. The right brain is particularly important to
 creativity.
26. The right brain is particularly important music.

27. The right brain is particularly important art.

28. The right brain is particularly important athletics.

The parsing of the original texts into idea units was done by two independent raters, and then checked by two other experts. Disagreements were resolved through discussion. Each idea unit was given '2' points when the idea was the complete copy or paraphrase of the original unit. '1' point was given if the idea unit in question was incomplete, and '0' point was given when the idea was wrong, new, or repetition of a previously stated idea. The comprehension scores were calculated by adding the points given to each idea unit. Two independent raters scored the recalled texts produced by the participants, and an inter-rater reliability of .986 was found.

Reading Motivation Questionnaire

The instrument used to assess reading motivation in this study was adapted from the Motivation for Reading Questionnaire (Wigfield and Guthrie, 1995) (Appendix F). Since Wigfield and Guthrie's motivational scales were specifically developed for primary school students learning to read their L1, some items appearing in the MRQ were not considered directly applicable to university students learning English as a foreign language. Thus, some items in the original questionnaire were eliminated and some were slightly changed so that the questionnaire would be more relevant to the participants and the context in which this study was carried out. Two experts; a specialist in foreign language testing,

and a specialist in foreign language reading, contributed to the adaptation of the questionnaire. The items that were eliminated and changed are shown in Appendix H.

The MRQ assesses 11 possible dimensions of reading motivation which are categorized under three major learner factors that affect reading comprehension: 1) Competence and Efficacy, 2) Achievement Values and Goals, 3) Social Reasons for Reading.

The adapted version of the MRQ used in the present study comprises 54 items in total: 4 items in the "reading efficacy" part, 6 items in the "challenge" part, 7 items in the "curiosity" part, 6 items in the "reading involvement" part, 2 items in the "importance" part, 2 items in the "recognition" part, 6 items in the "grades" part, 2 items in the "social" part, 4 items in the "competition" part, 7 items in the "compliance" part, and finally 8 items in the "reading avoidance" part. The items are scored on a 1 to 5 likert scale (1 = strongly disagree, 5 = strongly agree). The internal reliability of the questionnaire is .791 (Cronbach's alpha: .791).

Metacognitive Knowledge Questionnaire

A metacognitive questionnaire developed by Carrell (1989) was used in the present study (Appendix G). The questionnaire included 36 items eliciting information from the participants as to their metacognitive conceptualizations or awareness judgments about their silent reading strategies in English as

a foreign language. Six of the items were about the participants' abilities in reading in English and provided a measure of students' confidence in English. Five of the statements were pertaining to what the students do when they do not understand something in the text. The following seventeen statements were about the participants' perception of effective reading strategies, and the last eight items were asked to learn about the participants' perception of things that may cause difficulty in reading in English. All of the items are rated on a 1-5 Likert Scale (1 = strongly disagree, 5 = strongly agree). The internal reliability of the questionnaire was found to be .819 (Cronbach's alpha: .819).

Data Collection Procedures

The study was conducted in the Boğaziçi University School of Foreign Languages at two different linguistic proficiency levels; intermediate and advanced classes. The data were collected in four weeks starting from the second week of October, 2003.

In the advanced class, the data collection was completed in four sessions, all of which took place in concurrent weeks. In the first session, following the implementation of the topic interest questionnaire, the prior knowledge test was administered. Next, the students read the intermediate level text "Stress". After all the participants read the text given, they were asked to write down the text content as completely

as possible in their native language. The total amount of time the first session took was 2 hours.

The intermediate level students went through the very same procedure as the advanced class in the same week.

The following week, the same session was repeated in the advanced class with a different text this time (the advanced text "Split Brain").

In the third week of the data collection procedure, the reading motivation questionnaire was implemented in both of the classes in 20 minutes.

In the fourth week, the students at both levels took the metacognitive awareness questionnaire in 20 minutes.

The students, in all of the sessions, were asked to verbalize out-loud everything that came to mind as they worked through the questions and decided on their answers.

All of the sessions took place in the normal class hours with the permission and the co-operation of the classroom teachers.

The following is a summary of the data collection procedure that took place in the advanced and the intermediate level classes.

Advanced Level Class

Session 1 (the second week of October, 2003)

Implementation of the topic interest questionnaire on the nature of stress

Implementation of the prior knowledge test

Reading the intermediate level text "Stress"

Free recall

Session 2 (the third week of October, 2003)

Implementation of the topic interest questionnaire on the
structure of human brain

Implementation of the prior knowledge test

Reading the advanced level text "Split Brain"

Free recall

Session 3 (the fourth week of October, 2003)

Implementation of the reading motivation questionnaire

Session 4 (the first week of November, 2003)

Implementation of the metacognitive awareness questionnaire

Intermediate Level Class

Session 1 (the second week of October, 2003)

Implementation of the topic interest questionnaire on the
nature of stress (10 minutes)

Implementation of the prior knowledge test (20 minutes)

Reading the intermediate level text "Stress" (45 minutes)

Free recall (45 minutes)

Session 2 (the fourth week of October, 2003)

Implementation of the reading motivation questionnaire (20
minutes)

Session 3 (the first week of November, 2003)

Implementation of the metacognitive awareness questionnaire
(20 minutes)

Data Analysis

Research Question #1

What are the relative contributions to foreign language reading comprehension of the following individual-difference variables when intermediate and advanced EFL learners read an intermediate text for general comprehension: prior knowledge, topic interest, linguistic proficiency, gender, motivation to read, and metacognitive awareness?

Dependent variable:

- Reading comprehension of both the intermediate and advanced level students on the intermediate level text 'Stress' (assessed by the scoring of the recall protocols)

Independent variables:

- Prior knowledge
- Topic interest
- Linguistic proficiency
- Gender
- Motivation to read
- Metacognitive awareness

For this research question, a hierarchical multiple regression analysis was used to determine the relative

influence of each independent variable on the dependent variable.

Research Question #2

The second research question is how the contribution of these individual difference variables (i.e.: prior knowledge, topic interest, linguistic proficiency, gender, motivation to read, and metacognitive awareness) to foreign language reading comprehension relates to text difficulty.

Three separate multiple regression analyses are run to answer this question.

Dependent variable:

- Analysis 1: Reading comprehension of the intermediate-level students on the intermediate-level text 'Stress' (assessed by the scoring of the recall protocols)
- Analysis 2: Reading comprehension of the advanced-level students on the intermediate-level text 'Stress' (assessed by the scoring of the recall protocols)
- Analysis 3: Reading comprehension of the advanced-level students on the advanced-level text 'Split Brain' (assessed by the scoring of the recall protocols)

Independent variables:

- Prior knowledge
- Topic interest
- Gender
- Motivation to read
- Metacognitive awareness

In analysis 1, the relative influence of the independent variables on the reading comprehension of the intermediate - level students on the intermediate text was examined. In analysis 2, the relative influence of the independent variables on the reading comprehension of the advanced-level students on the intermediate text was examined. In analysis 3, the relative influence of the independent variables on the reading comprehension of the advanced-level students on the advanced text was examined. Then, the results obtained from each analysis were examined to see the relationship between the contribution to foreign language reading comprehension of these individual-difference variables and text difficulty.

Summary

The research questions, data collection procedures, and data analyses are summarized in the following table.

Table 3.4

Overview of Research Questions and Related Procedures

Research Questions	Instruments	Data Analysis
1. What are the relative contributions to foreign language reading comprehension of the following individual-difference variables when intermediate and advanced EFL learners read an intermediate text for general comprehension: prior knowledge, topic interest, linguistic proficiency, gender, reading motivation, and metacognitive knowledge?	Topic interest test on the intermediate level text ("Stress") Prior knowledge test on the intermediate level text ("Stress") The intermediate level text ("Stress") Reading motivation questionnaire Metacognitive awareness questionnaire Recall protocol	Hierarchical multiple regression analysis
2. How does the contribution of these individual difference variables (i.e.: prior knowledge, topic interest, linguistic proficiency, gender, motivation to read, and metacognitive awareness) to foreign language reading comprehension relates to text difficulty?	In addition to the instruments used in Research question 1: Topic interest test on the advanced level text ("Split Brain") Prior knowledge test on the advanced level text ("Split Brain") The advanced level text ("Split Brain")	Hierarchical multiple regression analyses

CHAPTER 4-RESULTS and DISCUSSION

Introduction

The present chapter presents and discusses the results of the analyses conducted based on the procedures specified in the methodology chapter. Results are organized by research questions so that the findings can be presented in a more coherent manner.

The Relative Contribution to Foreign Language Reading Comprehension of Prior Knowledge, Topic Interest, Linguistic Proficiency, Gender, Motivation to Read, and Metacognitive Awareness

A hierarchical multiple regression analysis was used to answer the first research question: What are the relative contributions to foreign language reading comprehension of the following individual-difference variables when intermediate and advanced EFL learners read an intermediate text for general comprehension: prior knowledge, topic interest, linguistic proficiency, gender, motivation to read, and metacognitive awareness?

The dependent variable for the first research question was the reading comprehension of both the intermediate and advanced-level students on the intermediate-level text 'Stress'. The independent variables were prior knowledge, topic interest, linguistic proficiency, gender, motivation to read, and metacognitive awareness. First, the correlation coefficients between the dependent variable and independent

variables were checked. Table 4.1 shows the intercorrelations among the variables.

Table 4.1

Intercorrelations among Variables for the Advanced and Intermediate Groups Reading the Intermediate Text

	2	3	4	5	6	7
1. Reading comprehension	.37*	.596**	.385**	.084	.05	.375**
2. Gender	--	-.129	-.205	.013	.39**	-.163
3. Linguistic proficiency		--	.230*	-.145	.125	.168
4. Prior knowledge			--	.015	-.096	.016
5. Topic interest				--	-.078	.213
6. Metacognitive awareness					--	.123
7. Motivation to read						--

* $p < .05$. ** $p < .01$

As seen in Table 4.1, all the independent variables except for topic interest and metacognitive awareness are significantly correlated with the dependent variable.

In light of the correlations between the independent variables and reading comprehension, a hierarchical multiple regression analysis was conducted. The decision regarding which variables would enter the equation was made after examining the relationships among the independent variables and reading comprehension. The independent variables with

insignificant relationships with the dependent variable (i.e., reading comprehension) did not enter the multiple regression analysis. Thus, the independent variables that entered the equation were linguistic proficiency, prior knowledge, motivation to read, and gender. The assumptions of multicollinearity for the predictor variables, normality, linearity, and uncorrelated residual terms were checked, and it was found that none of these assumptions were violated for this analysis. Table 4.2 shows the results of the regression analysis.

Table 4.2

Beta Weights Obtained in Multiple Regression Analysis
Explaining the Variability in Reading Comprehension of both
the Intermediate and Advanced Level Students on the
Intermediate Level Text 'Stress'

Independent Variable	Step 1		Step 2		Step 3		Step 4	
	Beta	T	Beta	T	Beta	T	Beta	T
Linguistic proficiency	.622	5.61***	.551	5.05***	.481	4.61***	.475	4.63***
Prior knowledge	--	--	.274	2.52*	.283	2.8*	.249	2.42*
Motivation to read	--	--	--	--	.303	3.03*	.292	2.94*
Gender	--	--	--	--	--	--	.144	1.43

p<.05. **p<.01, ***p<.0001

Note. N=52

Note. Beta weights are standardized multiple regression coefficients.

At the first step of the analysis, linguistic proficiency entered the equation and accounted for 39 % of the variability ($R^2 = 0.39$, Adj. $R^2 = 0.38$) in reading comprehension, $F(1, 51) = 31.51$, $p < .0001$. At the second step in the regression analysis, prior knowledge entered the model, adding an incremental R^2 change of 7 % to the model, $F(2, 51) = 20.6$, $p < .05$. At the third step, motivation to read entered the model and added another 9 % to the R^2 , $F(3, 51) = 19.06$, $p < .05$. Then, gender entered the equation, and added an R^2 change of 2 % to the model. However, the unique contribution of this variable to the model was not significant. Therefore, this variable was taken out of the model.

As a result, it was found that the variables that significantly explained the variability in the reading comprehension of both the intermediate and advanced level students on the intermediate-level text were linguistic proficiency, motivation to read, and prior knowledge. While linguistic proficiency, alone, explained 39 % of the variability, motivation to read explained 9 %, and prior knowledge accounted for 7 % of the variability. Thus, it was revealed that these three variables, together, explained 54 % of the variability ($R^2 = 0.54$, Adj. $R^2 = 0.52$) in reading comprehension, $F(3, 48) = 19.06$, $p < .001$.

However, metacognitive awareness, topic interest, and gender were not found to have any significant contributions to

the foreign language reading comprehension of the participants. This might be related to the number of participants involved in the study. Had there been a larger group of participants, the unique contributions of these variables might have yielded significant results.

The Relative Contribution to Foreign Language Reading Comprehension of Prior Knowledge, Topic Interest, Gender, Motivation to Read, and Metacognitive Awareness according to Text Difficulty

The next research question was "How does the contribution of these individual difference variables (i.e.: prior knowledge, topic interest, linguistic proficiency, gender, motivation to read, and metacognitive awareness) to foreign language reading comprehension relate to text difficulty?"

To answer this question, the intermediate learners were asked to read an intermediate-level text. The advanced learners were also asked to read the same intermediate-level text read by the intermediate group, in addition to an advanced text. Then, three separate multiple regression analyses were run to see the relationship between the contribution to foreign language reading comprehension of these individual-difference variables and text difficulty. The results of the multiple regression analyses are reported below.

The Relative Contribution of Prior Knowledge, Topic Interest, Gender, Motivation to Read, and Metacognitive Awareness to the Foreign Language Reading Comprehension of Intermediate Learners Reading an Intermediate Text

The first hierarchical multiple regression analysis for the second question was run to determine the relative contributions of the independent variables on the reading comprehension of the intermediate-level students on the intermediate text. The dependent variable for this analysis was the reading comprehension of the intermediate-level students on the intermediate-level text 'Stress'. The independent variables were prior knowledge, topic interest, gender, motivation to read, and metacognitive awareness. First, the correlation coefficients between the dependent variable and independent variables were checked to determine which variables would enter the equation. Table 4.3 shows the intercorrelations among the variables.

Table 4.3

Intercorrelations among the Variables for the Intermediate
Group Reading the Intermediate Text

	2	3	4	5	6
1. Reading comprehension score	-.25	.23	-.04	-.08	.25
2. Gender	--	-.44	.16	-.36	-.12
3. Prior knowledge		--	-.09	-.11	-.08
4. Topic interest			--	.17	.23
5. Metacognitive awareness				--	.34
6. Motivation to read					--

The variables with low or insignificant relationships cannot enter the multiple regression analysis. As revealed in the table, none of the relationships among the independent variables and reading comprehension proves to be significant. Therefore, it was concluded that none of the independent variables significantly accounted for the variability in the reading comprehension scores of the intermediate level students on the intermediate-level text.

The Relative Contributions of Prior Knowledge, Topic Interest, Gender, Motivation to Read, and Metacognitive Awareness to the Foreign Language Reading Comprehension of Advanced Learners Reading an Intermediate Text

The next hierarchical multiple regression analysis was run to determine the relative influence of the independent variables on the reading comprehension of the advanced-level students on the intermediate text.

The dependent variable for this analysis was the reading comprehension of the advanced-level students on the intermediate-level text 'Stress'. The independent variables were prior knowledge, topic interest, gender, motivation to read, and metacognitive awareness. First, the correlation coefficients between the dependent variable and independent variables were checked. Table 4.4 shows the intercorrelations among the variables.

Table 4.4

Intercorrelations among the Variables for the Advanced Group
Reading the Intermediate Text

	2	3	4	5	6
1. Reading comprehension	-.461*	.393*	.345	-.002	.434*
2. Gender	--	.111	-.129	-.399*	-.17
3. Prior knowledge		--	.158	-.147	.039
4. Topic interest			--	-.183	.26
5. Metacognitive awareness				--	-.077
6. Motivation to read					--

* $p < .05$

In light of the correlations between the independent variables and reading comprehension, a hierarchical multiple regression analysis was conducted. After examining the relationships among the independent variables and reading comprehension results, which variables would enter the equation was determined. The independent variables with low and negligible relationships with the dependent variable (i.e., reading comprehension) did not enter the multiple regression analysis. As a result, the independent variables that entered the equation were prior knowledge, motivation to read, and gender. The assumptions of multicollinearity for the predictor variables, normality, linearity, and uncorrelated residual terms were checked, and it was found that none of

these assumptions were violated for this analysis. Table 4.5 shows the results of the multiple regression analysis.

Table 4.5

Beta Weights Obtained in Multiple Regression Analysis
Explaining the Variability in Reading Comprehension of the
Advanced Level Students on the Intermediate Level Text
'Stress'.

Independent Variable	Step 1		Step 2		Step 3	
	Beta	T	Beta	T	Beta	T
Prior knowledge	.41	2.25*	.40	2.46*	.39	2.49*
Motivation to read	--	--	.42	2.54*	.40	2.58*
Gender	--	--	--	--	-.29	-1.89

* $p < .05$

Note. $N=27$

Note. Beta weights are standardized multiple regression coefficients.

At the first step of the analysis, prior knowledge entered the equation and accounted for 17 % of the variability ($R^2 = 0.17$, $\text{Adj. } R^2 = 0.14$) in reading comprehension, $F(1, 25) = 5.08$, $p < .05$. At the second step in the regression analysis, motivation to read entered the model, adding an incremental R^2 change of 18 % to the model, $F(2, 24) = 6.34$, $p < .05$. At the third step, gender entered the model and another 8 % to the R^2 . However, the unique contribution of this variable to the model was not significant. Therefore, this variable was taken out of the model.

Hence, it was concluded that the variables that significantly explained the variability in the reading comprehension of the advanced-level students on the intermediate text were motivation to read and prior knowledge. While motivation to read, alone, explained 18 % of the variability, the unique contribution of prior knowledge to the variability in reading comprehension was 17%. As a result, 35% of the variability ($R^2 = 0.35$, Adj. $R^2 = 0.30$) in the reading comprehension of the advanced-level students on the intermediate text was found to be explained by the conjoint contributions of motivation to read and prior knowledge, $F(2, 24) = 6.34$, $p < .05$. However, as in the findings of the first research question, metacognitive awareness, topic interest, and gender were not found to have any significant contributions to the foreign language reading comprehension of the advanced group. As indicated earlier, this finding might be attributed to the limited number of participants involved in the study.

The Relative Contribution of Prior Knowledge, Topic Interest, Gender, Motivation to Read, and Metacognitive Awareness to the Foreign Language Reading Comprehension of Advanced Learners Reading an Advanced Text

The dependent variable for the next analysis was the reading comprehension of the advanced-level students on the advanced level text, 'Split Brain'. The independent variables

were prior knowledge, topic interest, gender, motivation to read, and metacognitive awareness.

First, the correlation coefficients between the dependent variable and the independent variables were checked to determine which variables would enter the regression analysis. Table 4.6 shows the intercorrelations among the variables.

Table 4.6

Intercorrelations among the Variables for the Advanced Group
Reading the Advanced Text

	2	3	4	5	6
1. Reading comprehension	-.067	.042	.388*	.159	-.022
2. Gender	--	.154	-.017	-.373	-.138
3. Prior knowledge	--	--	.135	-.296	-.068
4. Topic interest	--	--	--	-.200	.152
5. Metacognitive awareness	--	--	--	--	-.111
6. Motivation to read	--	--	--	--	--

* $p < .05$, ** $p < .01$

As revealed in the table, none of the regressors except for topic interest is significantly correlated with the dependent variable. Therefore, topic interest was the only independent variable that entered the regression analysis. However, the contribution of this variable to foreign language reading comprehension was found to be insignificant. Thus, it was concluded that none of the variables significantly accounted for the variability in the reading comprehension

scores of the advanced level students on the advanced-level text.

As a consequence, the three analyses conducted to answer the second research question highlighted the relationship between the difficulty level of the text and the relative contributions to foreign language reading comprehension of the selected individual-difference variables (i.e., prior knowledge, topic interest, gender, motivation to read, and metacognitive awareness). The analyses revealed that when both the intermediate and advanced-level participants read a text supposed to be at their own level of linguistic proficiency, none of the above noted individual-difference variables made a significant contribution to their foreign language reading comprehension. However, the situation was different for the advanced EFL learners reading the intermediate text. The analyses indicated that motivation to read and prior knowledge became significant predictors of the variability when the advanced EFL learners read the intermediate text.

The results gained from these analyses can be better interpreted in light of the Threshold Hypothesis (Cummins, 1981). According to the Threshold Hypothesis, students must have reached a minimal threshold level of linguistic proficiency in the target language to make effective use of skills and strategies that are part of their L1 reading comprehension abilities. However, it is also pointed out that

linguistic threshold is not absolute, but varies by the demands of the task (Alderson, 2000). In relation to that, Grabe and Stoller (2002: 51) state that readers generally cross the threshold whenever they encounter L2 texts in which they know almost all of the words and can process the text fluently. Grabe and Stoller (2002) go on to state that because L2 readers are all different in their L2 knowledge, prior knowledge about the text content, and other reading experiences, there is no level of linguistic proficiency that counts as the threshold for all readers or for all texts. The threshold varies depending on the reader, the text and the topic. In light of these explanations provided by Grabe and Stoller (2002), it can be argued that, the intermediate and advanced-level participants in the present study did not cross the threshold when they were reading the texts supposed to be at their own level of linguistic proficiency. They were probably so busy with figuring out the language of the L2 text they were trying to read that they were left with few cognitive resources needed for fluent reading comprehension. For Grabe and Stoller (2002), once students have passed through the linguistic threshold, they free up cognitive resources, which were previously used to figure out language structures and vocabulary, to read more strategically. This suggestion supports the findings for the advanced-level students reading the intermediate text (the easier text) in the present study. As indicated earlier, while none of the

individual-difference variables selected to be investigated in the present study was found to make a significant contribution to the reading comprehension of advanced-level students when they were reading the advanced-level text, motivation to read and prior knowledge became significant predictors of the variability in the reading comprehension of the advanced level students reading the intermediate text.

Summary

This chapter has presented and discussed the results of the analyses conducted to answer the research questions posed in the previous chapter.

The analyses revealed that linguistic proficiency, motivation to read, and prior knowledge had significant contributions to the variability in the foreign language reading comprehension of the participants. It was found that %54 of the variability in the foreign language reading comprehension of the participants was explained by these three variables.

Moreover, the findings pointed out that text difficulty influenced the way the selected individual-difference variables (i.e., prior knowledge, topic interest, linguistic proficiency, gender, motivation to read, and metacognitive awareness) contributed to foreign language reading comprehension.

CHAPTER 5- CONCLUSION and IMPLICATIONS

This study explored the relative contribution to foreign language reading comprehension of the following individual differences: prior knowledge of the text content, topic interest, linguistic proficiency in English, gender, motivation to read, and metacognitive awareness. In doing so, the present study also investigated the relationship between the contribution to foreign language reading comprehension of these individual-difference variables and text difficulty.

Findings of the study indicated that the following individual-difference variables, in order of significance, accounted for variability in the English reading comprehension of the participants: linguistic proficiency, motivation to read, prior knowledge.

The finding of this study that L2 proficiency has a vital role in explaining the variability in foreign language reading comprehension (39% of the variability in the reading comprehension of the participants) concurs with the results of the previous empirical studies (Bernhardt & Kamil, 1995; Bossers, 1991; Carrell, 1991) which demonstrate that L2 proficiency explains 30% to 40% of the variability in foreign language reading comprehension. This finding, also, provides further evidence to the L2 reading models which identify linguistic proficiency as a major component of reading comprehension process, such as the componential models

proposed by Bernhardt (1991), Coady (1979), and Grabe and Stoller (2002).

The finding of the present study that motivation to read is a statistically significant factor explaining the variability in foreign language reading comprehension provides evidence for arguments that reader motivation is among many of the reader variables that influence L2 reading comprehension (Alderson, 2000; Grabe and Stoller, 2002). However, contrasted with the abundance of literature on motivation to interact/communicate in L2, or motivation to read in L1, little research can be found on motivation to read in second/foreign language reading (Day & Bamford, 1998; Mori, 2002; Takase, 2003, Tercanlioğlu, 2001). Furthermore, to the best knowledge of the researcher, these studies do not attempt to determine the relative contribution of this particular individual-difference variable to overall L2 reading comprehension. Therefore, it is not possible to compare the finding of the present study regarding the relative contribution to foreign language reading comprehension of motivation to read to the findings of the previous studies.

As for the role of prior knowledge in explaining the variability in foreign language reading comprehension, the findings of the present study concur with the results of a number of previous studies (e.g.: Adams, 1982; Anderson and Urquhart, 1983; 1988; Johnson, 1982; Hudson, 1982; Mohammed and Swales, 1984; Nunan, 1985; Olah, 1984; Omaggio,

1979). In addition, the findings provide further support for various reading models, which include prior knowledge as a component of L2 reading comprehension process (e.g.: Bernhardt, 1991; Coady, 1979; Grabe and Stoller, 2002).

Besides, the results of the present study indicate that the relative contribution to foreign language reading comprehension of individual-difference variables (i.e.: prior knowledge, topic interest, gender, motivation to read, and metacognitive awareness) is influenced by difficulty level of the text. This finding concurs with the findings in Taillefer's study (1996), which tested the relative importance of L1 reading ability and L2 proficiency for reading tasks of varying cognitive complexity. Taillefer's study (1996) indicated that the contribution of the individual difference variables varied depending on the complexity of the reading task. This finding is very similar to those reported in the present study since the results of the present study also made it explicit that the contribution to foreign language reading comprehension of the selected individual differences varied depending on text difficulty.

To sum up, the present study cast light on the significance of L2 proficiency, motivation to read, and prior knowledge as powerful predictors of foreign language reading comprehension, and highlighted the role of text difficulty as a factor influencing the way individual differences are called into play in foreign language reading comprehension.

The findings of the study offer several implications for foreign language teaching contexts. First of all, the results shed light on the importance of L2 proficiency, as the most significant individual-difference variable, in accounting for the variability in foreign language reading comprehension. Text difficulty was also found to be a significant variable influencing the relative contributions to foreign language reading comprehension of the selected individual variables for the advanced-level students. These findings, in line with the suggestions previously made (Grabe and Stoller, 2002), imply that EFL teachers should provide students with texts which are not linguistically too difficult to comprehend, and focus on fluent reading. In addition, to facilitate students' L2 reading, L2 teachers should support the students with activities that would help them deal with the structural difficulties of the text.

Regarding the findings on the role of prior knowledge and motivation to read, one implication of this study is that L2 teachers should provide students with necessary background knowledge about the text content through various activities before the students read the text. They should also try to increase students' motivation to read through appealing to their individual needs and interests.

Consequently, revealing the importance of individual differences in accounting for the variability in L2 reading comprehension, the findings of the present study suggest that

L2 teachers need to be aware of the role of individual differences in L2 reading comprehension, and that they should adapt their instruction to the diverse needs of individual learners in order to achieve greater instructional quality.

Although some interesting and important findings were obtained in the present study, they should be taken as suggestive rather than definitive because of the following limitations.

First of all, this study employed quantitative research methods to investigate the effects of selected individual differences on L2 reading comprehension. However, using qualitative research methods such as interviews with students or classroom observations, in addition to quantitative instruments could aid at capturing each individual difference in a more detailed way, and also would provide more explanatory insights into the interaction between the variables. Hence, more reliable results could be obtained.

In addition, the present study used one single measure of reading comprehension, recall protocol, to assess the students' comprehension of the texts. Although, there is a general agreement that recall protocol provides the most straightforward measure of comprehension since test questions do not intervene between the reader and the text, it is argued that, it does not inform the test giver about what is not recalled, and hence makes it difficult to determine whether the omission of certain text elements is attributable to lack

of understanding, retention difficulty, or other factors (Bernhardt, 1991; Anderson, 2000; Koda, 2005). So, further studies can support the results gained from recall protocol by other techniques for measuring reading comprehension, such as multiple choice or short answer questions.

Finally, as indicated earlier, the individual differences investigated in the present study accounted for %54 of the variability in the foreign language reading comprehension of the participants, leaving %46 of the variability unexplained. This suggests that, there are factors other than the ones studied in the present study, which can account for the variability in the foreign language reading comprehension of the participants. Future research can take into account more individual-difference variables such as reading styles, self-esteem, cognitive styles, vocabulary knowledge, text-structure knowledge, or L1 reading abilities, which were not examined in this study. However, increasing the number of individual differences to be investigated necessitates a much larger group of participants. The present study included a limited number of participants. Therefore, it should be replicated, with necessary modifications, with a larger population of participants to obtain more reliable and generalizable results. Such research would also contribute to construction of a theory of individual differences in L2 reading research.

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APPENDIX A- Prior Knowledge Test on the Intermediate-level Text “Stress”¹

Name:

Age:

Gender:

Department:

Please circle the correct answer to each of the following questions.

1. A stressor is _____.
 - a. a person who gets stresses frequently
 - b. any event that may produce stress
 - c. a person who causes others to feel stressed
 - d. a psychological problem that makes people stressed
2. A physical illness caused by psychological factors is an example of a _____.
 - a. psychopathologic disorder
 - b. psychopharmacologic disorder
 - c. psychosomatic disorder
 - d. psychopathic disorder
3. “Acute stress” is a kind of stress caused by _____ problems.
 - a. short-term
 - b. serious health
 - c. emotional
 - d. uncontrollable
4. _____ is an example of cognitive symptoms of stress.
 - a. anxiousness
 - b. nervous laughter
 - c. sleep disturbances
 - d. reduced creativity
5. The complex network of interacting cells that protects body from foreign substances is called _____.
 - a. immune system
 - b. nervous system
 - c. fight or flight system
 - d. general adaptation system

¹ The underlined items are the correct answers.

6. Please circle **true** or **false** for the following statements. If you circle false, correct the statement.

<u>True</u>	False	A certain amount of stress is a healthy and necessary part of one's life.
True	<u>False</u>	Men and women are equally open to stress-related illnesses.
<u>True</u>	False	Psychological stress influences the immune system.
<u>True</u>	False	Long-term relationship problems are an example of chronic stress.
True	<u>False</u>	Stress is accepted as one of the causes of cancer.
True	<u>False</u>	Learning how to manage stress can cure medical problems.
<u>True</u>	False	As people get older, it becomes more difficult for them to relax after a stressful event.

APPENDIX A.02- Prior Knowledge Test on the Advanced-level Text “Split Brain”¹

Name:

Age:

Gender:

Department:

Please circle the correct answer to each of the following questions.

1. Right and left brains have different functions in _____.
 - a. all living creatures
 - b. only human beings
 - c. human beings and birds
 - d. human beings and chimpanzees

2. _____ refers to either of the two halves of brain.
 - a. cerebrum
 - b. cerebral cortex
 - c. cerebellum
 - d. cerebral hemisphere

3. Which of the following statements is true for *handedness* and *specialization of certain brain parts*?
 - a. Right handed people use their left brain for physical work whereas most left handed people use their right brains.
 - b. While right handed people use their right brain for physical work, left handed people use their left brains.
 - c. Scientific studies show that there is no relationship between handedness and specialization of certain brain parts.
 - d. Scientists cannot explain the relation between handedness and specialization of certain brain parts although they don't deny it.

4. Which one of the following terms in the alternatives is defined in the following sentence?
 “It connects the brain's left and right hemispheres.”
 - a. corpus callosum
 - b. nervous system
 - c. cerebral retractor
 - d. nerve cell

5. When the connection between right and left brain is lost,
 - a. the left brain can function as it did before but the right brain loses its function.
 - b. each brain can think, learn, and remember on its own.
 - c. the brain loses its all functions and cannot work as before.
 - d. the right brain can function as it did before but the left brain loses its function.

¹ The underlined items are the correct answers.

6. A *split brain patient* is a patient whose_____.

- a. cerebellum is impaired
- b. right and left brains are not connected
- c. left brain is removed
- d. cerebellum is taken out by an operation

7. Until recently scientists called the left brain as the _____ brain.

- a. silent
- b. holistic
- c. mild
- d. major

8. Please check the correct areas in which the right or left brain hemisphere specializes in the following table.

Specialization areas	<i>Right hemisphere</i>	<i>Left hemisphere</i>
Music	X	
Analytical thinking		X
Language skills		X
Creativity	X	
Athletics	X	
Mathematics		X
Intuition	X	
Reasoning		X

9. Please circle **true** or **false** for the following statements. If you circle false, correct the statement.

<u>True</u>	False	The right hemisphere processes information from the left side, whereas the left hemisphere processes information from the right side.
True	<u>False</u>	The less wrinkled is the brain, the more efficient it is.
<u>True</u>	False	The brain is made of three main parts: the forebrain, midbrain, and hindbrain.
True	<u>False</u>	The cortex is the smallest part of the human brain.

APPENDIX B.01- Topic Interest Test on the Intermediate-level Text “Stress”

Name:

Gender:

Age:

Department:

To me, reading a text on the ***nature of stress*** (sources of stress, kinds of stress, the way stress influences people’s lives) is:

	1 (not all true)	2 (slightly true)	3 (True)	4 (completely true)
meaningful				
unimportant				
useful				
worthless				

While reading the text on the ***nature of stress*** (sources of stress, kinds of stress, the way stress influences people’s lives), I expect to feel:

	1 (not all true)	2 (slightly true)	3 (True)	4 (completely true)
bored				
stimulated				
interested				
indifferent				
involved				
engaged				

APPENDIX B.02- Topic Interest Test on the Advanced-level Text “Split Brain”

Name:

Gender:

Age:

Department:

To me, reading a text on *the way human brain functions, and the different roles of the right and left brain* is:

	1 (not all true)	2 (slightly true)	3 (True)	4 (completely true)
meaningful				
unimportant				
useful				
worthless				

While reading the text on *the way human brain functions, and the different roles of the right and left brain*, I expect to feel:

	1 (not all true)	2 (slightly true)	3 (True)	4 (completely true)
bored				
stimulated				
interested				
indifferent				
involved				
engaged				

APPENDIX C- The Intermediate-level Text “Stress”

APPENDIX D- The Advanced-level Text “Split Brain”

APPENDIX E.01 - The Idea Units Identified in the Intermediate-level Text “Stress”

STRESS (Idea Units)

Paragraph #1

1. Throughout history everyone has experienced stress.
2. Throughout history few people can define stress.
3. Members of an institute of medicine panel have reviewed stress research.
4. They reviewed 35 years of stress research.
5. The proposed definitions of stress haven't satisfied even a majority of stress researchers.
6. It has been very difficult to agree on the definition of stress.

Paragraph #2

Alarms and adaptation: The physiology of stress

1. Hans Selye is Canadian.
2. Hans Selye is a physician.
3. Hans Selye wrote The Stress of Life.
4. Hans Selye wrote The Stress of Life in 1956.
5. Hans Selye popularized the idea of stress.
6. Hans Selye advanced the study of stress.
7. Selye said many environmental factors throw the body out of equilibrium.
8. One example of environmental factors is heat.
9. One example of environmental factors is cold.
10. One example of environmental factors is pain.
11. One example of environmental factors is toxins.
12. One example of environmental factors is viruses.
13. Environmental factors require the body to respond.
14. These environmental factors are called stressors.
15. A stressor includes anything that requires the body to mobilize its sources.
16. The body responds to a stressor with an orchestrated set of physical changes.
17. The body responds to a stressor with an orchestrated set of chemical changes.
18. The orchestrated set of physical and chemical changes prepares one to fight.
19. The orchestrated set of physical and chemical changes prepares one to flee.
20. To Selye, stress consisted of a package of reactions.
21. This set of reactions is called the General Adaptation Syndrome.
22. The General Adaptation Syndrome has a memorable acronym: GAS.
23. Usually, the body will be challenged by environment.
24. Usually, the body will adapt to stress.

Paragraph #3

1. To Selye, GAS consists of three phases.
2. The first is the alarm phase.
3. In the alarm phase the organism mobilizes to meet the threat.
4. The second is the phase of resistance.
5. In the second phase, the organism attempts to resist the threat.
6. In the second phase the organism attempts to cope with the threat.
7. The stressor may overwhelm the body's resources, if it persists.
8. The body runs out of energy.
9. It enters the phase of exhaustion.

10. In the phase of exhaustion, the body becomes open to fatigue.
11. In the phase of exhaustion, the body becomes open to symptoms.
12. In the phase of exhaustion, the body becomes open to illness.
13. The reactions that let body to resist to short term stressors are unhealthy.
14. The reactions that let body to resist to short term stressors are long range responses.
15. Boosting energy is one of the reactions that let body to react short term stressors.
16. Shutting out signs of pain is one of the reactions that let body to react short term stressors.
17. Closing off digestion is one of the reactions that let body to react short term stressors.
18. Raising blood pressure is one of the reactions that let body to react short term stressors.
19. Increased blood pressure can become chronic hypertension.
20. Closing of digestion can lead to digestive disorders.

Paragraph #4

1. Stress is a nuisance of modern civilization.
2. Because our physiological alarm mechanism is triggered too often now.
3. Human beings had to cope with simpler stressors (e.g. wooly mammoths) in past.
4. Then, the fight-or-flight system was working.
5. Today human beings are faced with different kinds of stressors such as traffic jam.
6. The fight-or-flight system does not work with today's stressors.

Paragraph #5

1. Selye says that psychological and physical stressors are equally important.
2. Psychological factors cause stress.
3. One example of psychological stressors is conflict.
4. One example of psychological stressors is grief.
5. Physical factors cause stress.
6. One example of physical stressors is heat.
7. One example of physical stressors is toxic chemicals.
8. One example of physical stressors is noise.
9. Selye also observed that some factors influence the impact of stressors.
10. A warm climate can soften the impact of pollution.
11. A nutritious diet can soften the impact of pollution.
12. Pollution is an environmental stressor.
13. A harsh climate can make environmental stressors worse.
14. A poor diet can make environmental stressors worse.
15. Selye focused on the biological responses.
16. Biological responses result from a person's attempt to adapt to environmental demands.
17. To Selye any event that produces the stress (or the GAS) is a stressor.

Paragraph #6

1. Later studies have found that stress is not a purely biological condition.
2. Later studies have found that stress does not lead directly to illness.
3. The individual's evaluation of the event is between the stressor and the stress.
4. Something stressful for one person may be challenging for others.
5. Something stressful for one person may be boring for others.
6. Becoming pregnant is stressful to some people.
7. Becoming pregnant is not stressful to some other people.

8. Losing a job is stressful to some people.
9. Losing a job is not stressful to other people.
10. Traveling to China is stressful to some people.
11. Traveling to China is not stressful to some other people.
12. Between the stressor and its consequences is the way the individual copes with stress.
13. Not all people under stress behave the same way.
14. Not all people under stress get ill.

Paragraph #7

1. It's been difficult for psychologists to define stress.
2. Because people differ in how they interpret events.
3. Because people differ in how they respond to events.
4. To many people the definition of stress takes into account aspects of the environment
5. To many people the definition of stress takes into account aspects of the individual.
6. To many people the definition of stress takes into account how the environmental and individual aspects intersect.
7. Psychological stress is the result of a relationship between the person and the environment.
8. Psychologically stressed people believe that the situation strains or overwhelms their resources.
9. Psychologically stressed people believe that the situation is endangering their well-being.

Paragraph #8

Illness and immunology: The psychology of stress

1. Psychosomatic medicine brought a different approach to the origins of illness.
2. Psychosomatic medicine developed within psychiatry at the turn of the century.
3. Psyche means mind.
4. Soma means body.
5. Psychosomatic describes the interaction between mind and body.
6. Freud was one of the main contributors to this field.
7. Freud said that physical symptoms were often the result of unconscious conflicts.
8. Other psychodynamic theorists thought that neurotic personality patterns cause certain disorders.
9. Other psychodynamic theorists thought that neurotic needs cause certain disorders.
10. One example of these disorders is rheumatoid arthritis.
11. One example of these disorders is asthma.
12. One example of these disorders is ulcers.
13. One example of these disorders is migraine headaches.
14. One example of these disorders is hypertension.

Paragraph #9

1. Some researchers are studying the effects of physical stress on the immune system.
2. Some researchers are studying the effects of psychological factors on the immune system.
3. These researchers borrowed ideas from Selye.
4. These researchers borrowed ideas from psychosomatic medicine.
5. The immune system is designed to do two things.
6. One is to recognize foreign substances (antigens).
7. The other is to destroy them.

8. The other is to deactivate them.
9. One example to antigens is flu viruses.
10. One example to antigens is bacteria.
11. One example to antigens is tumor cells.
12. There are basically two types of white blood cells in the immune system.
13. One type of white blood cells is lymphocytes.
14. One type of white blood cells is phagocytes.
15. Lymphocytes' job is to recognize foreign cells.
16. Lymphocytes' job is to destroy foreign cells.
17. Phagocytes' job is to ingest foreign cells.
18. Phagocytes' job is to eliminate foreign cells.
19. Phago means eating.

Paragraph #10

1. The immune system deploys different weapons (cells) to defend the body against foreign invaders (foreign substances).
2. Depending on the nature of the enemy, the immune system uses these weapons sometimes together sometimes alone.
3. Prolonged stress can suppress these weapons.
4. Severe stress can suppress these weapons.
5. Prolonged stress can suppress other cells that normally fight disease or infection.
6. Severe stress can suppress other cells that normally fight disease or infection.

Paragraph #11

Some sources of stress

1. There are the stressors that might affect the immune system.
2. There are the stressors that might lead to stress.
3. Some psychologists study events that take an emotional charge.
4. One example of an emotional charge is the death of a spouse.
5. One example of an emotional charge is the death of a child.
6. Some other psychologists study small problems that cause stress ("small straws that break the camel's back").
7. And some other psychologists study people who are under stress for no apparent reason.

Paragraph #12

Major events

1. Two decades ago, Thomas Holmes and Richard Rahe identified some events.
2. These events seemed to be especially stressful.
3. They tested thousands of people.
4. They ranked a series of "life-change events".
5. They ranked a series of "life-change events" in order of their disruptive impact.
6. They assigned each event a corresponding number of "life-change units"(LCUs).
7. At the top of the list was death of a spouse.
8. The death of a spouse is 100 LCU.
9. Death of a spouse was followed by divorce.
10. Divorce is 73 LCU.
11. Divorce was followed by death of a close family member.
12. The death of a close family member is 63 LCU.
13. Divorce was followed by imprisonment.

14. Imprisonment is 63 LCU.
15. Not all the events in the list were unpleasant.
16. Marriage was also in the list.
17. Marriage is 50 LCU.
18. Pregnancy was also in the list.
19. Pregnancy is 40 LCU.
20. Buying a house was also in the list.
21. Buying a house is 31 LCU.
22. Christmas was also in the list.
23. Christmas is 12 LCU.
24. Most of the people who became ill had 300 LCUs or more.
25. Most of the people who became ill had 300 LCUs or more in a single year.

Paragraph #13

1. Death of a spouse is at the top of the life-change events list.
2. Divorce is at the top of the life-change events list.
3. Researchers found that these events are followed by a decline in health.
4. Grieving widows are more open to illness.
5. Grieving widowers are more open to illness.
6. Grieving widows are more open to physical ailments.
7. Grieving widowers are more open to physical ailments.
8. One example of such illness and physical ailments is pneumonia.
9. One example of such illness and physical ailments is diabetes.
10. One example of such illness and physical ailments is ulcers.
11. One example of such illness and physical ailments is rheumatoid arthritis.
12. Mortality rate in grieving widows and widowers are higher than expected.
13. Divorce takes a long-term health charge.
14. Divorced adults are more open to emotional disturbance than adults who are not divorced.
15. Divorced adults are more open to heart disease than adults who are not divorced (Jacobson, Weiss).
16. Divorced adults are more open to pneumonia and other diseases than adults who are not divorced.
17. There are some other changes in divorced people's lives.
18. There are some other changes in bereaved people's lives.
19. One example to such changes is insomnia
20. One example to such changes is poor diets.
21. One example to such changes is increased smoking.
22. One example to such changes is increased drinking.
23. One example to such changes is increased drug consumption.
24. This sort of changes can make these people open to illness.
25. Animal and human studies indicate that separation causes changes in the cardiovascular system.
26. Animal and human studies indicate that separation causes a lower white blood cell count.
27. Animal and human studies indicate that separation causes abnormal responses in the immune system.

Paragraph #14

1. Other researchers criticized the idea that all major life events are stressful.

2. Other researchers criticized the idea that all major life events lead to illness.
3. 29 of the 43 items in the scale may be the result of psychological problems.
4. 29 of the 43 items in the scale may not be the cause of illness.
5. Problems at work may be a result of psychological problems.
6. Problems at work may be a result of illness.
7. Major changes in the sleeping habits may be a result of psychological problems.
8. Major changes in the sleeping habits may be a result of illness.
9. Once a person already is ill or depressed, some events become more stressful.
10. The Holmes-Rahe scale assumes that every event has the same stress impact on everyone.
11. Many of the changes in the list are not stressful for most people.
12. Retirement is not especially stressful for most people.
13. Having children leave home is not especially stressful for most people.
14. Positive events are not related to illness.
15. Positive events are not related to poor health.

Paragraph #15

1. Newer measures of stress try to correct these problems.
2. Newer measures of stress assess one's perception of how stressful an event is.
3. Newer measures of stress assess one's perception of how stressful an accumulation of events is.
4. Being too busy is not stressful.
5. If you don't feel overwhelmed by the things you have to do.

Paragraph #16

Daily hassles

1. Some psychologists say that one can cope with the big problems of life quite well.
2. It is small daily problems that get us stressed.
3. Irritations of everyday routines are called hassles.
4. Frustrations of everyday routines are called hassles.
5. Traffic jam is an example to hassles.
6. Bad weather is an example to hassles.
7. An annoying argument is an example to hassles.
8. Broken plumbing is an example to hassles.
9. A lost key is an example to hassles.
10. A sick cat is an example to hassles.
11. Some research indicates that hassles predict psychological and physical symptoms better.
12. Some research indicates that major life events predict psychological and physical symptoms less than hassles.

Paragraph #17

1. A major event can increase the number of hassles one copes with.
2. Divorce is an example to those major events.
3. Divorce can create problems like new financial pressures.
4. Divorce can create problems like custody questions.
5. Divorce can create problems like moving.
6. Having fought in a war can make one more intolerant of hassles.
7. Most people say that hassles and life events are independent.
8. In a study, 210 police officers were asked about stressful things they experienced.

9. The most stressful things reported were not dramatic dangers seen on TV.
10. The most stressful things reported were not arrests seen on TV.
11. One of the most stressful things reported was daily paperwork.
12. One of the most stressful things reported was distorted news in press.
13. One of the most stressful things reported was slowness of judicial system.

Paragraph #18

1. People call something a hassle based on their feeling about the activity.
2. The activity itself may be neutral.
3. A young mother can say cooking every day is a hassle.
4. The young mother actually reveals her feelings about the activity.
5. Cooking every day can feel very stressful.
6. Because she might have so many other things to do.
7. It's possible that her husband likes cooking.
8. It may reduce the husband's tension.
9. One can find commuting a hassle if s/he is in a hurry.
10. One can welcome the commuting time to read novels.

Paragraph #19

Continuing problems

1. Stressors differ in their duration.
2. Stressors differ in their intensity.
3. Some stressors are brief.
4. Some stressors are one shot events.
5. Awaiting surgery is an example to brief stressors.
6. Awaiting news about admission to graduate school is an example to brief stressors.
7. Some stressors are continuous.
8. Some stressors recur frequently.
9. Living with an abusive or tyrannical parent is an example to continuous stressors.
10. Working in certain situations can cause continuous stress.
11. Being discriminated due to your color is an example to continuous stressors.
12. Being discriminated due to your religion is an example to continuous stressors.
13. Being discriminated due to your gender is an example to continuous stressors.
14. Being discriminated due to your age is an example to continuous stressors.
15. Feeling trapped in a relationship is an example to continuous stressors.

Paragraph #20

1. Many stress researchers believe that people can stand acute stress.
2. Acute stress is short term stress.
3. The stress researchers say that the real problem is interminable stress.
4. Prolonged or repeated stress is related with heart disease.
5. Prolonged or repeated stress is related with hypertension.
6. Prolonged or repeated stress is related with arthritis.
7. Prolonged or repeated stress is related with immune related deficiencies.
8. Occupations such as air traffic control cause prolonged stress.
9. Occupations such as air traffic control cause repeated stress.
10. Black men in America who live in stressful neighborhoods are more open to hypertension and related diseases.
11. Stressful neighborhoods in America are characterized by poverty.
12. Stressful neighborhoods in America are characterized by high divorce.

13. Stressful neighborhoods in America are characterized by unemployment rates.
14. Stressful neighborhoods in America are characterized by crime.
15. Stressful neighborhoods in America are characterized by drug use.
16. Female clerical workers who have no support from their bosses are most open to heart disease.
17. Female clerical workers who are stuck at a low-paying job with no hope of promotion are most open to heart disease.
18. Female clerical workers who have financial problems at home are most open to heart disease.

Paragraph #21

1. The most debilitating thing is the feeling of powerlessness.
2. The most debilitating thing is the feeling of having no control over what happens to you.
3. People can cope with long-term difficulty if they feel they can control events.
4. People can cope with long-term difficulty if they feel they can predict events.
5. Being able to control events and being able to predict them are not always the same thing.
6. Taking a test is a stressful experience.
7. One may not be able to avoid taking a test.
8. One can predict tests.
9. One can and prepare for tests.
10. One can take steps to reduce stress when s/he knows s/he will go through something stressful.

Paragraph #22

Stress-prone personalities

1. Some people look stressed for no apparent reason.
2. These people have stress-prone personalities.
3. Even if they are at a tranquil beach far from civilization, they worry about home.
4. When you go to their office with two tickets to the World Series, they accuse you of interrupting them.
5. The difference between easy-going and tense people is their frequency of feeling negative emotions.
6. Tense people feel negative emotions more often than easy-going people.
7. Two psychologists identified a personality dimension called negative affectivity (NA).
8. NA is a person's tendency to feel negative emotions.
9. Anger is an example to negative emotions.
10. Scorn is an example to negative emotions.
11. Revulsion is an example to negative emotions.
12. Guilt is an example to negative emotions.
13. Rejection is an example to negative emotions.
14. Sadness is an example to negative emotions.
15. High NA people feel worried for no apparent reason.
16. High NA people feel tense for no apparent reason
17. High NA people have low-self esteem.
18. High NA people have negative moods.
19. High NA people continuously think about their mistakes.
20. High NA people continuously think about their disappointments.
21. High NA people continuously exaggerate their mistakes.

- 22. High NA people continuously exaggerate their disappointments.
- 23. High NA people are sensitive to hassles.
- 24. High NA people are sensitive to frustrations.
- 25. Compared to low NAs, high NA people are more distressed for a longer time.

APPENDIX E.02- The Idea Units Identified in the Advanced-level Text “Split Brain”

THE SPLIT BRAIN (Idea Units)

Paragraph #1

1. Everyone has two minds.
2. Most people feel that way sometimes.
3. Recently scientists have learnt that this feeling reflects physical reality.
4. There are two brains.
5. The left hemisphere is placed on top of the brain stem.
6. The right hemisphere is placed on top of the brain stem.
7. The brain stem is inside the human skull.
8. The two hemispheres are interconnected.
9. The two brains work together.
10. The two brains share the work of the brain.
11. Each brain can take over many of the functions of the mind as a whole.
12. The two brains are not alike.
13. The two brains share a number of important responsibilities.
14. They have quite different roles in behavior.
15. The left brain is highly literate.
16. The left brain is highly analytical.
17. The left brain dominates personality.
18. The left brain specializes in language skills.
19. Speech is an example of language skills.
20. Writing is an example of language skills.
21. The left brain specializes in mathematics.
22. The left brain specializes in reasoning.
23. The right brain is endowed with intuition.
24. The right brain is endowed with spatial perception.
25. The right brain is particularly important to creativity.
26. The right brain is particularly important to music.
27. The right brain is particularly important to art.
28. The right brain is particularly important to athletics.

Paragraph #2

1. The intellectual talents are located in the left brain.
2. This was found out over several centuries.
3. People who had lost the ability to speak through illness went through autopsy examinations.
4. People who had lost the ability to speak through head injury went through autopsy examinations.
5. People who had lost the ability to calculate through illness went through autopsy examinations.
6. People who had lost the ability to calculate through head injury went through autopsy examinations.
7. Autopsy examinations showed damage to the left brain in these people.
8. Only recently the abilities of the right brain have been worked out.
9. Only recently the distinctions between the left and right brains have been worked out.

10. Some patients' corpus callosum was severed for medical purposes.
11. The studies on these patients provided knowledge about brain.
12. Corpus callosum provides the main connections between the two brains.
13. Corpus callosum is a bundle of nerve fibers.
14. Corpus callosum is 6 millimeters thick.
15. Corpus callosum is 89 millimeters long.
16. Corpus callosum conveys information from one hemisphere to the other.
17. When corpus callosum is cut the two brains become autonomous.
18. Certain split brain experiments show that the impact on behavior is astonishing.
19. Ordinary behavior is hardly affected by this separation.
20. Each brain can think on its own.
21. Each brain can learn on its own.
22. Each brain can remember on its own.
23. Under the impact of strong emotions, the two minds sometimes compete with each other.
24. The two brains sometimes act as if they were different selves.

Paragraph #3

1. The division of responsibilities is unique to the human brain.
2. All vertebrates have twin hemispheres in their brains.
3. The two brains in vertebrates are real twins.
4. The two brains in vertebrates carry out the same functions.
5. An animal that damages one side of its brain loses some general capacity.
6. An animal that damages one side of its brain does not lose any particular mental skill.
7. It is not the case for human beings.
8. Hemispheres in human brain are specialists in many respects.
9. Damage to one side of human brain may cause the loss of certain capabilities.
10. The blood clots of stroke can damage the human brain.
11. Sometimes the lost capacity can be relearned by the unharmed hemisphere.
12. The unharmed hemisphere can relearn a lost skill only laboriously.

Paragraph #4

1. Handedness is the most familiar example of cerebral speciality.
2. 92 per cent of all people use only their right hands.
3. 92 per cent of all people use only their right hands for the most delicate physical tasks.
4. Writing is a delicate physical task.
5. 92 per cent of all people favor their right hand when strength is required.
6. Left hands and arms in 92 per cent of all people are clumsier.
7. Left hands and arms in 92 per cent of all people are weaker.
8. The nerve circuits connect most muscles to the brain.
9. The nerve circuits cross over before entering the brain.
10. The left hemisphere controls the movements of the right side of the body.
11. Right-handed people use their left brains for most physical work.
12. Most left-handed people use their right brains for most physical work.

Paragraph #5

1. People favor one hand rather than the other.
2. The favoring of one hand rather than the other makes good sense.
3. It is not clear why the right is preferred predominantly.
4. Evolution emphasized the advantage of manual dexterity to the early man.

5. Evolution emphasized the advantage of the ability to hold an object with one hand.
6. Evolution emphasized the advantage of the ability to work on it with the other hand.
7. The division of labor between the hemispheres helped human beings to use this ability more efficiently.
8. The development of control precision goes with favoring of one hand.
9. As the child grows up, the control precision develops.
10. A child learns to hold a toy with one hand.
11. A child learns to manipulate it with the other nearly at the age of one.

Paragraph #6

1. Language is a unique gift to the human beings.
2. The brain's management of language is very specialized.
3. The ability to write is almost always one hemisphere's speciality.
4. The ability to speak is almost always one hemisphere's speciality.
5. In 97 per cent of all people the ability to write resides in the left brain.
6. In 97 per cent of all people the ability to speak resides in the left brain.
7. Left handed people use their right brains to control the physical movements of writing.
8. Even left handed people use their left brains to determine what they write.

Paragraph #7

1. Language is the brain's highest function.
2. Language is the most distinctive feature of human behavior.
3. Language skills reside in the left brain.
4. Scientists focus their studies on the left brain until recently.
5. Scientists called the left brain the major hemisphere.
6. The non-speaking right brain was considered to have a lesser role.
7. The right brain was called the minor hemisphere.
8. The right brain was called the mute hemisphere.
9. It is wrong to underestimate the right brain.
10. The wrongness of underestimating the right brain has just been understood.

Paragraph #8

1. The right brain had special powers.
2. The right brain had valuable powers.
3. There had been evidence for that for a long time.
4. Few scientists had paid much attention to the powers of the right brain.
5. One clue about the power of the right brain appeared in 1745.
6. There was a patient with a severely damaged left brain by a stroke.
7. The patient could not say anything except 'yes'.
8. The patient had to communicate by making signs with his hands.
9. The patient could sing certain hymns.
10. The patient learnt these hymns before the illness.
11. The patient could sing these hymns clearly as a healthy person.
12. The patient could sing these hymns distinctly as a healthy person.
13. This observation indicates that musical abilities are a right-brain function.

Paragraph #9

1. These extraordinary findings were unnoticed and untested for almost a century.
2. It was believed that man had one brain.
3. It was believed that the talkative left hemisphere ruled the whole brain.

4. Then the time came for a decade of experiments.
5. These experiments ranked among the most remarkable in the history of brain research.
6. The split-brain studies started in the USA at the University of Chicago.
7. The split-brain studies continued at the California Institute of Technology.
8. These studies showed that the right brain was not a minor hemisphere.
9. These studies showed that the right brain influenced significant aspects of behavior.
10. These studies showed clearly that each person had two minds.

Paragraph #10

1. The tests quickly showed the subtle dichotomy of the split brain.
2. The tests confirmed the specialization of the left brain in language skills.
3. In one test the subject was asked to fix his eyes at the center of a board.
4. The lights were flashed on the left and right visual fields.
5. Right lights were seen by the left brain.
6. Right lights were easily reported.
7. The reason is that the left hemisphere controls the speech.
8. The subject was like half blind when the lights were flashed into the left visual field.
9. The right brain saw the lights.
10. The right brain lacks speech.
11. The right brain remained mute.
12. The subject was asked to point to where the lights had been.
13. The subject was successful in indicating the position of the lights.
14. The right brain can control physical movement.

Paragraph #11

1. A printed instruction told a split brain subject to move his left hand.
2. The printed instruction was flashed into his visual field.
3. There was no response.
4. The right brain received the message.
5. The right brain could not understand the message.
6. The right brain was not able to order the left hand to move.
7. The subject could not name common objects in his left hand if he could not see them.
8. The subject could not describe common objects in his left hand if he could not see them.
9. The sensations of touch had gone to his mute right brain.
10. It was as if the scientists had handed the object to a person in one room.
11. It was as if the scientists asked a second person in another room to identify the object.
12. The patient was asked about the activities of his left hand.
13. The patient's responses were bizarre.
14. Both his brains could hear.
15. Only the talking left brain could answer.
16. The left brain received no information of the left hand's activities.
17. The left brain did not remember anything.
18. In test after test neither hand knew what the other was doing.
19. In test after test neither brain knew what the other was doing.

Paragraph #12

1. The right brain proved greatly inferior to the left brain linguistically.
2. The right brain did not turn out to be totally illiterate.
3. The right brain's capacity showed varied from one patient to another.

4. Some split brain patients understood simple words flashed to the right brain.

Paragraph #13

1. The right brain comprehended spoken words.
2. Touch does not communicate with both hemispheres.
3. Hearing communicates with both hemispheres.
4. Subjects were asked to take out objects from a hidden bag.
5. Subjects were asked to take out objects with their left hands.
6. They could pick out the right object –a watch, spoon, or comb.
7. They could pick out the right object when it was described.
8. They could not pick out the right object when it was named.
9. The subjects were asked to “retrieve the fruit monkeys like best”.
10. The left hand pulled out a banana from a hidden bag of plastic fruit.
11. The subjects could identify the banana by shape.
12. The subjects were unable to give the banana a name.

Paragraph #14

1. At certain tasks the right brain was better than the left brain on the left.
2. The right brain controlled the spatial skills.
3. Arranging blocks to match a pictured design is an example to spatial skills.
4. Drawing a cube in three dimensions is an example to spatial skills.
5. The right brain could not copy a written word.
6. The right hand retained the ability to write.
7. The right hand could not cope with certain spatial tasks.
8. One subject failed in copying a simple square with his right hand.
9. He was able to draw the four corners.
10. He failed in linking the corners with four lines.

Paragraph #15

1. Each brain proved to have a will of its own.
2. Each brain proved to have emotions of its own.
3. In most of the test situations the body language spoke louder than words.
4. Sometimes gestures contradict what is said.
5. Sometimes facial expressions contradict what is said.
6. Sometimes gestures reveal true feelings.
7. Sometimes facial expressions reveal true feelings.
8. There were situations where only the right brain knew what the left hand was doing.
9. In such situations the left brain made wild guesses.
10. The right brain attempt to correct the left brain’s guesses in such situations.
11. The right brain made the face frown.
12. The right brain made the face wince.
13. The right brain shook the head negatively to correct the left brain’s guesses.

Paragraph #16

1. The split-brain emotional responses of a young house wife were tested.
2. A picture of a nude woman was flashed.
3. The picture was flashed to the subject’s left hemisphere.
4. The subject laughed.
5. The subject was able to identify the picture.
6. Then the picture was flashed only to the right hemisphere.

7. The subject failed to identify the object.
8. The subject blushed.
9. The subject squirmed.
10. The right brain could not describe the picture.
11. The right brain could react to the picture emotionally.
12. Then the subject grinned.
13. Then the subject chuckled.
14. The subject was asked for an explanation for her response.
15. She said "I don't know... nothing. That funny machine."

Paragraph #17

1. There is a great potential for conflict between the hemispheres of the split brain.
2. Sometimes they are at war with themselves.
3. Sometimes the left hand acts as if it does not know what the right hand is doing.
4. The conflict between the hemispheres was dramatically observed in one split-brain subject.
5. This subject was a war veteran.
6. This subject's brain had been injured by bomb fragments.
7. He had above average intelligence.
8. He had a good sense of humor.
9. For a short time after surgery, he could not control the movements of his hands.
10. One hand was trying to pull up his pants.
11. The other hand was pulling them down.

Paragraph #18

1. The new appreciation of right brain is surprising.
2. This appreciation is the result of split-brain studies.
3. Language is the weakest aptitude of the right brain.
4. The right brain shows unexpected potential in language skills.
5. The muteness of the right brain is not assigned by evolution.
6. The muteness of the right brain develops in the late childhood.
7. An 11-year-old boy was born without any corpus callosum.
8. The case of this child confirms the language potential of the right brain.
9. The tests showed that each of the brains had developed fully.
10. The tests showed that each of the brains had developed for language.
11. A small part of this ability survives in adults.
12. Split brain experiments indicate this fact.
13. Several instances from medical history indicate this fact.
14. A man's left brain was surgically removed.
15. A man's left brain was removed because of a tumor.
16. He was 47.
17. The man kept language ability.
18. The man woke up from the operation cursing.
19. The man was soon able to communicate his thoughts in short phrases.
20. The man was soon able to communicate his thoughts in hesitant phrases.
21. The man learnt to print words with his left hand.

Paragraph #19

1. The split brain research has intriguing philosophical implications.
2. The results provide a physiological answer for an old and familiar human behavior.

3. There are two different ways of thinking.
4. Verbal thinking is one way of thinking.
5. Analytical thinking is one way of thinking.
6. Non-verbal thinking is one way of thinking.
7. Intuitive thinking is one way of thinking.
8. These two ways of thinking match neatly with the concept of two brains.
9. The left hemisphere is analytical.
10. The right hemisphere is intuitive.

Paragraph #20

1. In Western societies, the emphasis on rational thought began in the Renaissance.
2. The rational thought favored the left brain.
3. The rational thought did not favor the right brain.
4. Right brain is irrational.
5. Man's highest achievements are a result of integration of left brain intellect and right brain intuition.
6. The primary emphasis in science is on rational thinking.
7. The primary emphasis in science is on linear thinking.
8. At least in the development of a scientific idea the primary emphasis is on rational thinking.
9. At least in the development of a scientific idea the primary emphasis is on linear thinking.

Paragraph #21

1. Almost all discoveries in every field involve a sudden right brain inspiration.
2. At an idle moment intuition makes a sudden intellectual leap.
3. In a dream intuition makes a sudden intellectual leap.
4. Sensing a solution to a long standing problem is an example to the intuition's intellectual leaps.
5. Arriving at a fresh understanding is an example to the intuition's intellectual leaps.
6. Reaching a new level of appreciation is an example to the intuition's intellectual leaps.
7. The left brain intellect works out the details of this intuition step by step.
8. The left brain pays attention to details patiently.
9. Without left brain's attention to the details, the right brain's intuition may remain fantasy.
10. Albert Einstein is one of the most brilliant thinkers of modern times.
11. Einstein said that most of the times a new idea occurs to him by intuition.
12. Einstein said that sometimes a new idea occurs to him in visual images.
13. Einstein said "The real valuable thing is intuition, a thought comes and I may try to express it in words afterwards."

Paragraph #22

1. Both brains have a crucial role in the creative process.
2. Einstein's words sum up this role.
3. Without the right brain there would be no idea.
4. Without the left brain the idea could not be explained.
5. Split brain research has given scientists an unprecedented opportunity.
6. With the help of split brain research scientists can explore statements like the one made by Einstein.

APPENDIX F- Reading Motivation Questionnaire

Name:

Gender:

Age:

Department:

The following statements are about your reading motivation in *English*. Please indicate the level of your agreement or disagreement with each statement by circling the appropriate number: 1 indicates strong disagreement, 5 indicates strong agreement.

	STRONGLY DISAGREE 1	DISAGREE 2	NEUTRAL 3	AGREE 4	STRONGLY AGREE 5
1. I am a good reader.	1	2	3	4	5
2. I don't know why I sometimes get low grades in reading.	1	2	3	4	5
3. I know how well I am doing before I get my paper back.	1	2	3	4	5
4. I know how to get good grades in reading if I want to.	1	2	3	4	5
5. I like hard, challenging books.	1	2	3	4	5
6. I like to look up words I don't know.	1	2	3	4	5
7. I like it when there are questions that make me think about what I read in the text.	1	2	3	4	5
8. I don't like reading difficult texts.	1	2	3	4	5
9. I usually learn difficult things by reading.	1	2	3	4	5
10. If a topic is interesting I don't care how hard the text is.	1	2	3	4	5
11. If the teacher discusses something interesting, I might read more about it.	1	2	3	4	5
12. I have favourite subjects that I like to read about.	1	2	3	4	5
13. I like to learn new information about topics that interest me.	1	2	3	4	5
14. If I am reading about an interesting topic, I sometimes lose track of time.	1	2	3	4	5
15. I read about my hobbies to learn more about them.	1	2	3	4	5
16. I like to read about new things.	1	2	3	4	5
17. I enjoy reading about people in different countries.	1	2	3	4	5
18. I like to read about fantasy and imagine.	1	2	3	4	5
19. I like mysteries.	1	2	3	4	5
20. I like stories with interesting characters.	1	2	3	4	5
21. I make pictures in my mind when I read.	1	2	3	4	5
22. I read a lot of adventure stories.	1	2	3	4	5
23. I enjoy a long, involved story or fiction book.	1	2	3	4	5
24. It is very important for me to be a good reader.	1	2	3	4	5

25. In comparison to other activities I do, it is very important to me to be a good reader.	1	2	3	4	5
26. My friends sometimes tell me that I am a good reader.	1	2	3	4	5
27. I like to get compliments for my reading.	1	2	3	4	5
28. Grades are a good way to see how well you are doing on reading.	1	2	3	4	5
29. Getting graded in reading makes me nervous.	1	2	3	4	5
30. I like to get good grades in reading.	1	2	3	4	5
31. Getting a high grade in reading makes me proud.	1	2	3	4	5
32. I look forward to finding out my reading grade.	1	2	3	4	5
33. I read to improve my grades.	1	2	3	4	5
34. My friends and I like to trade things to read.	1	2	3	4	5
35. I talk to my friends about what I am reading.	1	2	3	4	5
36. I like being the best at reading.	1	2	3	4	5
37. I like to finish my reading before other students.	1	2	3	4	5
38. I like being the only one who knows an answer in something we read.	1	2	3	4	5
39. I am willing to work hard to read better.	1	2	3	4	5
40. I read as little as possible for my schoolwork.	1	2	3	4	5
41. I read because I have to.	1	2	3	4	5
42. It is important for me to do my reading work carefully.	1	2	3	4	5
43. I read things that are not assigned.	1	2	3	4	5
44. I always do my reading work as the teacher wants it.	1	2	3	4	5
45. Finishing every reading assignment is very important to me.	1	2	3	4	5
46. I always try to finish my reading on time.	1	2	3	4	5
47. I don't like to read loud out in class.	1	2	3	4	5
48. I think worksheets are boring.	1	2	3	4	5
49. I don't like vocabulary questions.	1	2	3	4	5
50. Complicated stories are no fun to read.	1	2	3	4	5
51. I don't like having to write about what I read.	1	2	3	4	5
52. I don't like reading stories that are too short.	1	2	3	4	5
53. I don't like reading something when the words are too difficult.	1	2	3	4	5
54. I don't like it when there are too many people in the story.	1	2	3	4	5

APPENDIX G- Metacognitive Knowledge Questionnaire

Name:

Gender:

Age:

Department:

The following statements are about **your silent reading in English**. Please indicate the level of your agreement or disagreement with each statement by circling the appropriate number: 1 indicates strong disagreement, 5 indicates strong agreement.

	STRONGLY DISAGREE 1	DISAGREE 2	NEUTRAL 3	AGREE 4	STRONGLY AGREE 5
1. When reading silently in English, I am able to anticipate what will come next in the text.	1	2	3	4	5
2. When reading silently in English, I am able to recognize the differences between main points and supporting details.	1	2	3	4	5
3. When reading silently in English, I am able to relate information which comes next in the text to previous information in the text.	1	2	3	4	5
4. When reading silently in English, I am able to question the significance or truthfulness of what the author says.	1	2	3	4	5
5. When reading silently in English, I am able to use my prior knowledge and experience to understand the content of the text I am reading.	1	2	3	4	5
6. When reading silently in English, I have good sense of when I understand something and when I do not.	1	2	3	4	5
When reading silently in English, if I don't understand something,	STRONGLY DISAGREE 1	DISAGREE 2	NEUTRAL 3	AGREE 4	STRONGLY AGREE 5
7. I keep on reading and hope for clarification further on.	1	2	3	4	5
8. I reread the problematic part.	1	2	3	4	5
9. I go back to a point before the problematic part and reread from there	1	2	3	4	5
10. I look up unknown words in a dictionary	1	2	3	4	5
11. I give up and stop reading	1	2	3	4	5

When reading silently in English, the things I do to read effectively are to focus on	STRONGLY DISAGREE 1	DISAGREE 2	NEUTRAL 3	AGREE 4	STRONGLY AGREE 5
12. mentally sounding out parts of the words	1	2	3	4	5
13. understanding the meaning of each word	1	2	3	4	5
14. getting the overall meaning of the text	1	2	3	4	5
15. being able to pronounce each whole word	1	2	3	4	5
16. the grammatical structures	1	2	3	4	5
17. relating the text to what i already know about the topic	1	2	3	4	5
18. looking up words in the dictionary	1	2	3	4	5
19. the details of the content	1	2	3	4	5
20. the organization of the text	1	2	3	4	5

When reading silently in English, things that make the reading difficult are	STRONGLY DISAGREE 1	DISAGREE 2	NEUTRAL 3	AGREE 4	STRONGLY AGREE 5
21. the sounds of the individual words	1	2	3	4	5
22. pronunciation of the words	1	2	3	4	5
23. recognizing the words	1	2	3	4	5
24. the grammatical structures	1	2	3	4	5
25. the alphabet	1	2	3	4	5
26. relating the text to what i already know about the topic	1	2	3	4	5
27. getting the overall meaning of the text	1	2	3	4	5
28. the organization of the text	1	2	3	4	5

The best reader I know in English is a good reader because of his/her ability to	STRONGLY DISAGREE 1	DISAGREE 2	NEUTRAL 3	AGREE 4	STRONGLY AGREE 5
29. recognize words	1	2	3	4	5
30. sound out words	1	2	3	4	5
31. understand the overall meaning of a text	1	2	3	4	5
32. use a dictionary	1	2	3	4	5
33. guess at word meanings	1	2	3	4	5
34. integrate the information in the text to what s/he already knows	1	2	3	4	5
35. focus on the details of the content	1	2	3	4	5
36. grasp the organization of the text	1	2	3	4	5

**APPENDIX H - The Items Eliminated from, and Changed in the Original Version of MRQ
(Motivation for Reading Questionnaire)**

Eliminated Items
Reading efficacy 1. I know that I will do well in reading next year. 2. Sometimes I don't feel as smart as others in reading. 3. To do well in reading I have to get the teacher to like me. 4. I learn more from reading than most students in the class.
Challenge 1. I need my parents to help me with my reading homework. 2. If the project is interesting, I can read difficult material.
Curiosity 1. I don't like to read books about living things.
Reading involvement 1. I feel like I make friends with people in good books.
Importance -----
Recognition 1. I like having the teacher say I read well. 2. It is important for me to get good comments on my reading papers. 3. My parents give me gifts when I do well in reading.

4. I am happy when someone recognizes my reading. 5. My parents often tell me what a good job I am doing in reading. 6. I don't care about getting rewards for being a good reader.
Grades 1. My parents ask me about my reading grade.
Social 1. I visit the library often with my family. 2. I often read to my brother or sister. 3. I sometimes read to my parents. 4. I like to help my friends about their schoolwork in reading. 5. I don't like reading with other students. 6. I like to tell my family about what I am reading.
Competition 1. I try to get more answers right than my friends. 2. I hate it when others read better than me. 3. My friends and I like to see who gets better comments on our papers. 4. It is important for me to see my name on a list of good readers.
Compliance 1. I do schoolwork so that the teacher can make sure that I am paying attention.
Reading work avoidance -----

Changed Items	
The Original MRQ	The Adapted Version of MRQ
Challenge 1. I like it when the questions in the book make me think. 2. If a book is interesting I don't care how hard it is to read.	Challenge 1. I like it when there are questions that make me think about what I read in the text. 2. If a topic is interesting I don't care how hard the text is.

STRESS

Throughout history, “stress” has been one of those things that everyone has¹ experienced but few can define. In a thorough review of 35 years of stress research, members of an Institute of Medicine panel wrote that “no one has formulated a definition of stress that satisfies even a majority of stress researchers”. Why has it been so difficult to agree on something all of us have felt?

Alarms and adaptation: The physiology of stress

In his 1956 book **The Stress of Life**, Canadian physician Hans Selye popularized the² idea of stress and advanced its study. Selye noted that many environmental factors throw the body out of equilibrium—heat, cold, pain, toxins, viruses, and so on—and require the body to respond. These factors, called stressors, include anything that requires the body to mobilize its resources. The body responds to a stressor with an orchestrated set of physical and chemical changes, which, prepare an individual to fight or flee. To Selye, “stress” consisted of this package of reactions, which he called the General Adaptation Syndrome (with the memorable acronym GAS). Usually, the body will meet the challenge of the environment and adapt to the stress.

According to Selye, the general adaptation syndrome consists of three phases.³ The first is the alarm phase, in which the organism mobilizes to meet the threat. The second is the phase of resistance, in which the organism attempts to resist or cope with the threat. If the stressor persists, however, it may overwhelm the body’s resources. Depleted of energy, the body enters the phase of exhaustion, becoming vulnerable to fatigue, symptoms, and, eventually, illness. The very reactions that allow the body to resist short-term stressors—boosting energy, shutting out signs of pain, closing off digestion, raising blood pressure—are unhealthy as long-range responses. Increased blood pressure can become chronic hypertension. Closing off digestion for too long can lead to digestive disorders.

Stress is a bane of modern civilization because our physiological alarm⁴ mechanism now chimes too often. When human beings had to contend with woolly mammoths, a dramatic fight-or-flight response was adaptive. Today, when the typical stressor is a mammoth traffic jam and not a mammoth mammal, the fight-or-flight response often gets revved up with nowhere to go.

Selye recognized that psychological stressors (such as emotional conflict or⁵ grief) can be as important as physical stressors (such as heat, toxic chemicals, or noise). He also observed that some factors mediate between the stressor and the stress. A warm climate or a nutritious diet, for example, can soften the impact of an environmental stressor such as pollution. Conversely, a harsh climate or a poor diet can make such stressors worse. But by and large, Selye concentrated on the biological responses that result from a person’s attempt to adapt to environmental demands. He defined a stressor as any event that produces the stress (that is, the General Adaptation Syndrome).

Later studies, however, have found that stress is not a purely biological⁶ condition that leads directly to illness. First, between the stressor and the stress is the

individual's evaluation of the event. For this reason, an event that is stressful for one person may be challenging for another and routinely boring for a third. Becoming pregnant, losing a job, traveling to China, are stressful to some people and not to others. Second, between the stress and its consequences is how the individual copes with the stress. Not all individuals who are under stress behave the same way. Not all get ill.

Psychologists have had a hard time defining stress precisely because people ⁷ differ in how they interpret events and in how they respond to them. Many now prefer a definition of stress that takes into account aspects of the environment, aspects of the individual, and how the two intersect. Psychological stress is the result of a relationship between the person and the environment, in which the person believes that the situation strains or overwhelms his or her resources and is endangering his or her well-being.

Illness and immunology: The psychology of stress

A different approach to the origins of illness came from the field of psychosomatic ⁸ medicine, which developed within psychiatry at the turn of the century. Psychosomatic describes the interaction of mind (psyche) and body (soma). Freud was one of the main contributors to this field, arguing that physical symptoms were often the result of unconscious conflicts. Other psychodynamic theorists maintained that certain disorders—notably rheumatoid arthritis, asthma, ulcers, migraine headaches, hypertension—are caused by neurotic personality patterns or needs.

Some researchers, borrowing ideas from Selye and from psychosomatic ⁹ medicine, are studying the effects of physical stress and psychological factors on the immune system. The immune system is designed to do two things: recognize foreign substances (antigens), such as flu viruses, bacteria, and tumor cells, and destroy or deactivate them. There are basically two types of white blood cells in the immune system: the lymphocytes whose job is primarily to recognize and destroy foreign cells, and the phagocytes whose job is to ingest and eliminate them (**phago** means “eating”).

To defend the body against foreign invaders, the immune system deploys ¹⁰ different weapons (cells), sometimes together and sometimes alone, depending on the nature of the enemy. Prolonged or severe stress can suppress these cells and others that normally fight disease and infection.

Some sources of stress

What are the stressors that might affect the immune system and thus lead to illness? ¹¹ Some psychologists study events, such as the death of a spouse or child, that take an emotional toll. Others count nuisances, the small straws that break the camel's back. Still others study people who seem to create their own stress for no apparent reason.

Major events. Two decades ago, Thomas Holmes and Richard Rahe identified ¹² 43 events that seemed to be especially stressful. By testing thousands of people, they were able to rank a series of “life-change events” in order of their disruptive impact. Holmes and Rahe then assigned each event a corresponding number of “life-change units” (LCUs). At the top was death of a spouse (100 LCUs), followed by divorce (73), imprisonment (63), and death of a close family member (63). Not all of the events

were unpleasant. Marriage (50) was on the list, as were pregnancy (40), buying a house (31), and Christmas (12). Among people who had become ill, the large majority had 300 LCUs or more in a single year.

Research has confirmed that the events at the top of the list, death of a spouse¹³ and divorce, are indeed powerful stressors that are linked to a subsequent decline in health. Grieving widows and widowers are more susceptible to illness and physical ailments—including pneumonia, diabetes, ulcers, and rheumatoid arthritis—and their mortality rate is higher than expected (Klenman & Izen.). Divorce also often takes a long-term health toll. Divorced adults have higher rates of emotional disturbance, heart disease, pneumonia, and other diseases than comparable adults who are not divorced (Jacobson, Weiss.). Bereaved and divorced people may be vulnerable to illness because of other changes in their lives, such as insomnia, poor diets, increased smoking, drinking, and drug consumption. But animal and human studies suggest that separation itself creates changes in the cardiovascular system, a lowered white blood cell count, and other abnormal responses of the immune system (Laudenslager & Reite, 1984).

Other studies, though, have found numerous flaws in the idea that all major life¹⁴ events are stressful and lead to illness:

- As many as 29 of the 43 items of the Holmes-Rahe Scale may be the result of psychological problems or illness, not their cause (such as “problems at work” and “major changes in sleeping habits”).
- Some events become more stressful once a person already is depressed or ill.
- The Holmes-Rahe scale assumes that every event has the same stress impact on everyone. But, many changes, such as retirement or having children leave home, are not especially stressful for most people.
- Happy, positive events are not related (thank goodness) to illness or poor health.

Newer measures of stress attempt to correct these problems. For example, they¹⁵ assess your perception of how stressful an event or accumulation of events is. Having 80 things to do in one week is not necessarily stressful unless you feel overwhelmed by them.

Daily hassles. Some psychologists argue that we handle most of the big¹⁶ problems of life quite well; it's the daily grind that can get us down. “Hassles” are the irritations and frustrations of everyday routines, such as traffic jams, bad weather, annoying arguments, broken plumbing, lost keys, and sick cats. Some research suggests that hassles are better predictors of psychological and physical symptoms than are major life events (DeLongis et al., 1982; Kanner et al., 1981).

Of course, a major event, such as divorce, can have a strong influence by¹⁷ increasing the number of hassles a person must contend with (new financial pressures, custody questions, moving). Also, a major event, such as having fought in a war, might make a person more intolerant of small hassles. By and large, though, people's reports of being hassled are independent of life events. In a study of 210 police officers, the most stressful things they reported were not the dramatic dangers and arrests you see on TV, but daily paperwork, annoyance with “distorted” accounts of the police in the press, and the snail-like slowness of the judicial system.

Notice, though, that when people report that something is a hassle, they are really reporting their feelings about the activity. The activity itself might be neutral. A young mother who says that making meals every day is a "hassle" is revealing her attitudes and emotions about this "chore." Perhaps because she has so many other things to do every day, preparing dinner feels to her like the last straw. Her husband might look forward to cooking as an enjoyable way to reduce tension. Similarly, one commuter finds taking the train a "hassle" because he is in a hurry to get to work, whereas another welcomes the commuting time to read novels.

Continuing problems. Stressors differ in their duration as well as in their intensity. Some are brief, one-shot events, such as awaiting surgery or news about admission to graduate school. Others are continuous or recur frequently: living with an abusive or tyrannical parent; working in a situation in which you are at a disadvantage because of your color, religion, gender, or age; feeling trapped in a relationship that you can't live with and can't live without.

Many stress researchers believe that people have a good ability to withstand acute (short-term) stress, even a massive blow. The real problem they say, occurs when stress becomes interminable. Prolonged or repeated stress (from occupations such as air traffic control) is associated with heart disease, hypertension, arthritis, and immune-related deficiencies (Taylor, 1986). Black men in America who live in stressful neighborhoods (characterized by poverty, high divorce and unemployment rates, crime, and drug use) are particularly vulnerable to hypertension and related diseases. Female clerical workers who feel they have no support from their bosses, who are stuck in low-paying jobs without hope of promotion, and who have financial problems at home, are the women most at risk of heart disease.

What seems to be most debilitating about these circumstances is the feeling of powerlessness, of having no control over what happens to you. People can tolerate years of difficulty if they feel they can control events or at least predict them. These are not necessarily the same thing. You may not be able to control the stressful experience of an exam, but you can usually predict and prepare for exams. When people know that they will be going through a stressful time or living in a stressful environment, they can take steps to reduce stress.

"Stress-prone personalities." Some people always seem to be in a state of stress for no apparent reason. Put them on a tranquil beach far from civilization, and they worry about what's happening at home. Show up at their offices with two tickets to the World Series, and they snap at you for interrupting them. A notable difference between easygoing people and tense worriers seems to be in the frequency with which the latter feel stressful negative emotions. Indeed, two psychologists have identified a dimension of personality they call negative affectivity (NA)—a person's tendency to feel negative emotions such as anger, scorn, revulsion, guilt, rejection, and sadness. High NA people frequently feel worried and tense, even in the absence of objective stress. Their low self-esteem and negative moods are linked to their tendency to brood about (and magnify) their mistakes and disappointments. They are particularly sensitive to hassles and frustrations, and report greater distress for a longer time than low NAs do.

The Split Brain

Everyone has two minds. Most people feel that way occasionally, but only recently have scientists learned how accurately this subjective impression mirrors physical reality. There are two brains. Perched on top of the brain stem inside the human skull are two large bulges—the left and right cerebral hemispheres. Normally the two are interconnected so that they work together, sharing the work of the brain, and each can, if necessary, take over many of the functions of the mind as a whole. Yet the two brains are not alike, and a number of crucial responsibilities are divided between them. They have quite different roles in behaviour. The left brain, highly literate and analytical, tends to dominate personality. It specializes in language skills such as speech and writing, as well as in mathematics and reasoning. The right brain, endowed with special powers of intuition and spatial perception, is particularly important to creativity, music, art and athletics.

The location of intellectual talents in the left brain was worked out over several centuries. Autopsy examinations revealed damage to the left side of the brain in people who, through illness or head injury, had lost the ability to speak or calculate. But only recently have the capabilities of the right brain—and many crucial distinctions between the right and left brains—come to light. This knowledge arises mainly from studies of patients who, for medical purposes, have undergone operations to sever the main connections between their two brains, the corpus callosum. This bundle of nerve fibres, six millimeters thick and 89 millimetres long, permits information received in one hemisphere to be perceived by the other also. When it is cut, the autonomy of the two brains becomes dramatically apparent. The impact on behaviour in certain experiments is astonishing, though ordinary behaviour is hardly affected. Each on its own can think, learn and remember. And each is capable of feeling such strong emotions that the two minds sometimes struggle for supremacy as if they were distinctly different selves.

The division of responsibilities is unique to the human brain. All vertebrates also have twin hemispheres in their brains, but the hemispheres are real twins, each capable of doing whatever the other does. An animal that damages one side of its brain loses some general capacity without losing any particular mental skill. Not so a man. Since his hemispheres are, in many crucial respects, specialists, damage to one—by the blood clots of stroke, for example—may eradicate an essential group of capabilities. In some cases the lost capacities can be relearned by the unharmed hemisphere, but only laboriously.

The most familiar example of a cerebral speciality is handedness. About 92 per cent of all people use only their right hands for the most delicate physical tasks, such as writing, and favour the right when strength is required. Their left hands and arms are clumsier and weaker. Because the nerve circuits that connect most muscles to the brain cross over before they enter the brain, the left hemisphere controls movements of the right side of the body. Consequently, right-handed people use their left brains for most physical work whereas most left-handed people use their right brains.

The favouring of one hand rather than the other makes good sense, though it is not clear why the right should be favoured so predominantly. Evolution emphasized manual dexterity, and the ability to hold an object in one hand while working on it with the other was clearly a great advantage to early man. They were able to use this ability more efficiently because of the division of labour between the brain's two hemispheres. The development of

the precision control that goes with the favouring of one hand can be seen taking place as a child progresses; it is only when he is about one year old that he learns to hold a toy with one hand and manipulate it with the other hand.

Even more specialized is the brain's management of man's unique gift: language. The ability to write and speak almost always resides in one hemisphere; in 97 per cent of the world's population it is the left hemisphere—even most people who use their left hands and right brains to control the physical movements of writing use their left brains to determine what they write.

Since language represents the brain's highest function and is the most distinctive feature of human behaviour, its localization in the left brain caused scientists until recently to focus their research on that hemisphere and to label it the major hemisphere. The non-speaking right brain, meanwhile, was assumed to have a lesser role, and was called the mute, or minor, hemisphere. How wrong it was to underestimate the right brain is only now being realized.

Evidence that the right brain possessed special—and valuable—powers had long existed, but few scientists had paid much attention to it. One clue appeared as early as 1745, when a physician described a patient whose left-brain language center was badly damaged by a stroke. He could not “say a single word except ‘yes’ and has to communicate by making signs with his hands.” But strangely, the writer noted, “He can sing certain hymns, which he had learned before he became ill, as clearly and distinctly as any healthy person.” This observation, it is now known, is one indication that singing and other musical abilities are a right-brain function.

These extraordinary findings went largely unheeded and untested for nearly a century. The accepted wisdom was that man had one brain, ruled by the talkative left hemisphere. But then came a decade of experiments that rank among the most remarkable in the history of brain research. Known as the split-brain studies, the work began in the United States at the University of Chicago and later moved to the California Institute of Technology. These investigations demonstrated that the right brain, far from being a minor hemisphere, influences significant aspects of behaviour. Moreover, they showed with bizarre clarity that each person does indeed have two minds.

The tests quickly showed the subtle dichotomy of the split brain—and confirmed beyond all question that the left brain specialized in language skills. In one test the subject was required to fix his eyes straight ahead at the center of a board while lights were quickly flashed left and right. Lights that flashed into the right half of his visual field, and thus were seen by his left brain, were easily reported by the subject—because his left brain is the hemisphere controlling speech. But when lights were flashed into the left visual field it was as if the subject were half blind. The right brain saw the lights but, lacking speech, remained mute. However, when the patient was asked to point to where the lights had been, he had no trouble indicating their position: the right brain can control physical movement.

* A split-brain patient, that is, a patient whose corpus callosum, the major carrier of nerve impulses between the brain's left and right hemispheres, is cut.

In another experiment, a printed instruction telling one of the split brain subjects to move his left hand was flashed into his visual field. There was no response. His right brain received the message but could not understand it and thus was unable to order the hand to follow instructions. Similarly, the subject could not name or describe common objects placed in his left hand if they were hidden from view behind a screen; the sensations of touch had gone to his mute right brain. He might call a pencil a tin opener or a cigarette lighter. It was as if the scientists had handed the object to a person in one room, then asked a second person in another room to identify it. When the patient was asked about the activities of his left hand, his responses were also bizarre. Both his brains could hear but only the talking left brain could answer. It had received no information of the left hand's activities, and therefore replied that it did not remember a thing. In test after test, neither hand—and neither brain—knew what the other was doing.

Though the right brain proved greatly inferior to the left brain linguistically, it did not turn out to be completely illiterate. Its capacity varied from one patient to the next. Some of the split-brain patients understood simple words that were flashed to the right brain.

The right brain also demonstrated the ability to comprehend words when they were spoken. Unlike touch, hearing communicates with both hemispheres. When test subjects were asked to retrieve objects from a hidden bag with their left hands, they could pick out the appropriate object—a watch, spoon or comb. They could also do this when the object they were supposed to select was not named but described. For example, if asked to “retrieve the fruit monkeys like best”, the left hand promptly pulled out a banana from a hidden bag of plastic fruit. But the subjects, though they could identify the banana by shape, were unable to give it a name.

At certain tasks the right brain proved to be superior to its literate counterpart on the left. It controlled the left hand in spatial skills such as arranging blocks to match a pictured design and drawing a cube in three dimensions—but could not copy a written word. The right hand, though retaining its ability to write, could not cope with certain spatial tasks. One subject was unable to copy a simple square with his right hand. He readily drew the four corners but could not link them together with four lines.

Most remarkably, each brain proved to have a will and emotions of its own. Often, the test situations resembled those occasions, familiar to everyone, when body language speaks louder than words—when gestures and facial expression contradict what is said and reveal true feelings. In situations where only the right brain knew what the left hand was doing, the left brain would make wild guesses. The right brain would then attempt to correct the guesses—by making the face frown or wince or even by shaking the head negatively.

In one of these experiments, the split-brain emotional responses of a young housewife were tested. A picture of a nude woman was flashed to her left hemisphere. She laughed and had no trouble identifying the picture. But when the picture was shown only to her right hemisphere, she could not say what it was. At first she blushed and began squirming. The right brain could not describe the picture, but it reacted emotionally nonetheless. Finally, she broke into a grin and began chuckling. Pressed for an explanation, she responded lamely, “I don't know... nothing ... oh—that funny machine.”

The potential for conflict between hemispheres of the split brain is great. There are times when they are at war with themselves, and then the left hand acts as if it does not know what the right hand is doing. This was dramatically illustrated in the problems of one split-brain subject, the war veteran whose brain had been injured by bomb fragments. He possessed above-average intelligence and a good sense of humour. Yet for a short time after surgery he had such quarrelsome hands that sometimes he would attempt to pull up his pants with one while pulling them down with the other.

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The new appreciation of the right brain is one of the most surprising results of split-brain research. Even in its weakest aptitude, language, the right brain shows unexpected potential. Apparently its muteness is not ordained by evolution but develops only relatively late in childhood. One striking confirmation of the right brain's language potential is the case of an 11-year-old boy who had been born without any corpus callosum at all. Tests showed that each of his brains had developed and retained full capacity for language. That a fragment of this ability survives in adults is indicated not only by the split-brain experiments but also by several instances from medical history. There is, for example, a case in which language ability survived in a 47-year-old man whose entire left hemisphere was surgically removed because of a tumour. The man woke up from the operation cursing and soon was able to communicate his thoughts in short, halting phrases. He even learned to print words with his left hand.

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The philosophical implications of the split-brain research are even more intriguing. The results provide a physiological explanation for an old and familiar observation of human behaviour. There have long appeared to be two different ways of thinking: some people are essentially verbal and analytical, while others are non-verbal and intuitive. These two ways of thinking coincide neatly with the concept of two brains, the analytical left hemisphere and the intuitive right hemisphere.

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In Western societies, the emphasis on rational thought that began in the Renaissance has for centuries favoured the left brain at the expense of the irrational right brain. And yet man's highest achievements seem to stem from the successful integration of both left-brain intellect and right-brain intuition. This is true even in science, where the primary emphasis—at least in the development of a scientific idea—is on rational, linear thinking.

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Nearly all discoveries in every field appear to involve a sudden right-brain inspiration. At an idle moment, maybe even in a dream, intuition makes an intellectual leap—sensing a solution to a long-standing problem, arriving at a fresh understanding, reaching a new level of appreciation—in one quick burst of illumination. Then the left-brain intellect laboriously works out the details of this hunch, step by step. Without the left brain's patient attention to detail, the right brain's hunch may remain fantasy. One of the most brilliant thinkers of modern times, Albert Einstein, once remarked that his first inkling of a new idea often came to him by intuition—sometimes in visual images. "The really valuable thing is intuition," Einstein said. "A thought comes and I may try to express it in words afterwards."

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Einstein's words sum up the crucial role of each brain in the creative process. Without the right brain, there would be no idea; without the left brain, the idea could not be explained. Now split-brain research has provided scientists with an unprecedented opportunity to explore the reality behind statements like the one made by Einstein.

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