

THE PROCESSING OF COMPLEX SYNTAX AND ITS RELATION TO NON-NATIVE  
READING COMPREHENSION

by

GABRIELLA MORVAY

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This manuscript has been read and accepted for the Graduate Faculty in Linguistics in satisfaction of the dissertation requirements for the degree of Doctor of Philosophy

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Date

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Prof. Elaine Klein, Chair of Examining Committee

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Date

---

Prof. Gita Martohardjono, Executive Officer

---

Prof. Gita Martohardjono

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Distinguished Prof. Loraine Obler

Supervisory Committee

## **Abstract**

The Processing of Complex Syntax and Its Relation to Non-native Reading Comprehension

by

Gabriella Morvay

Adviser: Professor Elaine Klein

It is commonly recognized that vocabulary knowledge contributes to non-native reading ability. This dissertation, however, examines the important question of whether the knowledge of late-emerging complex syntactic structures also plays a significant role in L2 reading, and if so, which structures contribute to it the most.

Via a variety of measurements, 64 Hungarian speaking 12<sup>th</sup> graders learning English as a foreign language in Slovakia were tested in a cross-sectional correlational study in order to determine the relationship between the ability to process complex syntax and L2 reading comprehension across two levels of language proficiency. The test instruments involved a standardized reading comprehension test in English, a standardized reading comprehension test in Hungarian, a test of syntactic comprehension in both Hungarian and English, a listening component of a standardized English language proficiency test, and a standardized non-verbal intelligence test in addition to a background questionnaire in Hungarian that reported on

participants' language learning history and reading habits. Using power correlations and regression analyses, results showed syntactic comprehension to be a statistically significant estimator for L2 reading comprehension.

Furthermore, it was found that the ability to process complex syntactic structures is an equal contributing factor in both at the lower and at the higher levels of English proficiency. An analysis and comparison of different syntactic structures also revealed that temporal adverbial clauses contributed more to reading comprehension than did other structures, such as passives, and relative clauses. Moreover, native language syntactic abilities also had an effect on participants' L2 reading comprehension.

While vocabulary knowledge is considered to be the most important determinant of effective non-native reading comprehension, this study provides evidence that the ability to process complex syntactic structures in L2 does contribute to one's efficient reading comprehension in that language. The results of this study have both theoretical and pedagogical implications in the field of L2 reading, especially in the context of teaching English as a foreign language.

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## **Chapter 1**

### **Introduction**

#### **1.0. General introduction**

What contributes to effective non-native language (hereafter L2) reading comprehension has been in the center of researchers' attention for many years. Despite the existence of numerous studies on L2 reading comprehension, the precise factors involved in L2 reading have not been researched to the extent one would expect. This might be due to the fact that much of L2 reading research has been a replication of native language (hereafter L1) reading studies. Also, researchers in L2 routinely adopted L1 conceptual frameworks for conducting research in L2 (e.g., Clarke, 1979; Cziko, 1978; McLeod & McLaughlin, 1986 and others).

There is clearly a need for studies that investigate distinct skills that contribute to L2 reading comprehension. The gap in L2 reading research is obvious when it comes to investigating adults whose L1 reading skills are high, and who are relatively proficient in their L2 as well, for most substantial research has focused on L2 learners who are either children or adults with special needs or whose L1 literacy skills are low. Relatively little study has been undertaken concerning the processes involved when skilled L1 readers attempt to become fluent in L2 reading and achieve variable success. For such individuals, one might hypothesize that higher-level linguistic processes, such as those associated with syntax, might plausibly be related to individual differences in L2 reading success. In fact, while L2 vocabulary knowledge is

intuitively obvious to successful L2 reading comprehension, the function of syntax is less so. This unclear role of syntax in L2 reading comprehension can be observed in some studies which demonstrate conflicting findings about the importance of syntactic knowledge (e.g., Barnett, 1986; Brisbois, 1995; Shiotsu & Weir, 2007).

Consequently, this study was motivated by the need to understand whether knowledge of syntax plays a significant role in L2 reading comprehension. The fact that certain syntactic structures are acquired later and, thus, are considered to be more difficult than others suggests that reading comprehension might be affected by these differences in structural complexity. We examined this in learners of English as a foreign language, whose native language is Hungarian, and who study English in a classroom setting as opposed to a more natural second language environment. Given that the two languages are fundamentally different from each other, it gave us a good opportunity to observe how students utilize their knowledge of syntax in both Hungarian and English. The study is a correlational one; therefore, it establishes various relationships between syntactic knowledge and reading comprehension; it does not claim, however, that the lack of the first one causes a deficit in the second. In this chapter we will give a brief overview of the basic concepts involved in reading, as well as the organization of the dissertation.

### **1.1. Skills, strategies and processes**

Before we start our investigation of reading, it is necessary to clarify some of the fundamental concepts involved in it. Many times the terms “reading skills,” “reading processes”

and “reading strategies” are used interchangeably, as well as “reading ability” and “reading competence”. They all seem to denote the act of reading, but skills are often seen as part of the generalized reading process and have been a major area of reading research.

Let us first discuss the differences between skills and strategies. Many researchers (e.g., Olshavsky, 1977; Sarig, 1987) view reading as a “problem-solving process,” and distinguish strategies from skills as ways of getting around difficulties while reading. Olshavsky (1977) claims that a strategy is a “purposeful means of comprehending the author’s message” (p. 656), while Pritchard (1990) defines it as “a deliberate action that readers take voluntarily to develop an understanding of what they read” (p. 275). Cohen (1998) points out that the element of consciousness is what distinguishes strategies from skills. Strategies represent conscious decisions taken by the reader, while skills are deployed unconsciously. Also, while strategies are reader-oriented, skills are text-oriented (Urquhart & Weir, 1998). The overall distinction was most eloquently formulated by Williams & Moran (1989): “A skill is an ability which has been automatized and operates largely subconsciously, whereas a strategy is a conscious procedure carried out in order to solve a problem” (p.223).

The distinction between the terms “skills” and “processes” is a more problematic one. Skills might be viewed as the tools that are needed in order to carry out the processes involved in reading. Processes, on the other hand, can be viewed as the descriptions of what is happening while one is reading. According to Urquhart & Weir (1998) a reading skill can be described roughly “as a cognitive ability which a person is able to use when interacting with written texts” (p.88). There have been various attempts to investigate the psychological reality (or separateness) of different skills such as literal comprehension, drawing inferences, skimming,

automatic recognition skills, accessing word meaning etc. Following common practice, the concepts “skills” and “processes” will be used interchangeably throughout this study.

After these somewhat overlapping explanations, we can turn our attention to the many definitions of reading. Each definition agrees that reading is a highly complex cognitive activity, which has physical manifestations, such as eye movements and subvocalizations as well. As early as the turn of the previous century, Huey (1908) wrote that to analyze reading would be to describe “very many of the most intricate workings of the human mind” (p.6). Seventy years later, Venezky (1976) refers to reading as a “complex process involving perceptual, linguistic and cognitive skills which themselves are not well understood” (p. 5). According to Baddeley et al. (1985), “reading is one of the most important and complex cognitive skills within Western culture” (p. 119). As we can see, the concept of reading as defined by respected reading authorities has become so broad that it includes, besides “comprehension,” practically all of the human intellectual, emotional, and social responses that people can make in conjunction with their interaction with written form.

Objections, however, have often been made to such comprehensive definitions.

In counterpoint to the notion of reading as a highly complex activity, the Simple View (Gough, 1972; Hoover & Tunmer, 1993) claims that while reading certainly does involve many of the higher mental processes, it nevertheless can be divided into two parts: decoding and linguistic comprehension, also known as lower level and higher level processes respectively.

### 1.1.1. Lower level processes

There is substantial evidence suggesting that decoding and linguistic comprehension are separate components of reading skill. A number of investigators have shown (e.g., Curtis, 1980; Stanovich et al., 1984) that pseudoword reading and listening comprehension make independent contributions to silent reading comprehension. The most evident examples are the two types of reading disabilities, namely dyslexia, in which adequate or even superior linguistic comprehension can exist in the absence of decoding skills; and hyperlexia, a syndrome characterized by superior decoding skills and inferior comprehension. In addition, numerous studies have found that only decoding and linguistic comprehension made consistent, significant contribution to reading comprehension (e.g., Curtis, 1980; Singer & Crouse, 1981; MacLeod et al., 1985; Stanovich et al., 1986).

Some reading experts equate decoding skills with “context free word recognition”, but Gough & Tunmer (1986) contend that while the two are related (for word recognition skills depend on the knowledge of letter-sound correspondence rules), they are not exactly the same. They argue that these letter-sound correspondence rules (the cipher) are not sufficient in English to read irregular words like *pint*, or *yacht*, or even orthographically ambiguous words such as *bread* and *bead*. Lesgold & Resnick (1982) found that a child’s speed of word recognition in first grade was an excellent predictor of reading comprehension in second grade. Efficient, automatic word recognition appears to lead to better comprehension and vocabulary growth as

well as reading volume. This leads, according to Stanovich (1986:381), to a cumulative advantage for the good readers: “The very children who are reading well and who have good vocabularies will read more, learn more word meanings, and hence read even better.” On the other hand, sometimes the terms “word identification” and “lexical access” are used interchangeably. Perfetti (1985) clarifies the two as the former being the recognition of a letter string as a particular word, while the latter being the recognition that a letter string represents a real word. Therefore, Perfetti further explains lexical access as a process of finding a written word in long-term memory.

In order to narrow the focus of our investigation, we have to clarify that lower- or word-level processes, also known as the mechanics of the reading process, will not be examined in the learners of English who have participated in our study. We also have to emphasize that as text demands increase, the importance of the above mentioned essential decoding skills, such as word recognition and recoding (letter-by-letter decoding) does not lessen, though Stanovich (1991) remarked that the proportion of variance in reading ability accounted for by these skills decreases over the years, but believed that “a sizeable relationship” still pertains in adulthood (p. 419). Nevertheless, these lower level processes must be executed rapidly, and without little effort, in order to attain the ultimate goal of reading, comprehension.

### **1.1.2. Higher level processes**

In the Simple View of reading described above (Gough, 1972; Hoover & Tunmer, 1993), linguistic comprehension is the “ability to take lexical information (i.e., semantic information at

the word level) and derive sentence and discourse interpretations” (Wesley et al., 1990:129). Reading comprehension involves the same ability, but one that relies on graphic-based information arriving through the eye. Therefore, when people read with comprehension they generate meaning for written language. To construct meaning for a text involves a set of complex psychological processes. These psychological processes, along with linguistic, neurological, and contextual variables influence the meanings people construct as they read.

We do not know if reading comprehension consists of a distinctive set or of a great variety of psychological processes. Kintsch & Kozminsky (1977) found that reading comprehension shared a common core of psychological processes with listening comprehension. LaBerge & Samuels (1974), on the other hand, believe that the process of reading comprehension might be as complicated as thinking itself. According to Perfetti (1985), there are two major components to comprehension: local processing and text modeling.

By local processing, Perfetti means “those processes that construct elementary meaning units from the text over a relatively brief period” (p. 33). These include the semantic encoding of words and the assembling of propositions. While encoding the meaning of a single word is a lower level process, the meaning of a word is encoded in a way that is appropriate for its context. This, however, is comprehension, a higher level process. The encoding of individual words enables the encoding of elementary text units, or propositions, which are abstract, elementary meaning units that comprise the meaning of a sentence. The central element in a proposition is the predicate. The major theory of text representation based on the assumption of propositions is described in Kintsch (1974) and Kintsch & van Dijk (1978). As readers are assembling the propositions of a text, their processing capacity (the amount of information the working memory can handle) is limited. Kintsch & van Dijk (1978) assume that readers can only hold a few

propositions in working memory at any one time. Therefore, to circumvent this problem, readers have to quickly integrate the assembled propositions into a representation. Thus, reading as a local process is a matter of assembling and integrating propositions for long term memory (Perfetti, 1985). Processes that integrate text materials are called integrative processes. Therefore, local integrative processes are those that occur by linking recently formed representations with new propositions as they are encoded. Many times local integration is a process that depends on linguistic signals that trigger attachments in memory, and so have a vital importance in our study since syntax is part of such signals. However, the accessibility of linking propositions in memory depends not only on local processing, but also on the reader's text model.

By text modeling, Perfetti (1985) means encoding propositions in the context of knowledge about concepts, knowledge about inferences, and knowledge about the everyday world, which we often refer to as "background knowledge." Some experts also refer to it as schema, which is a "conceptual abstraction containing slots to be instantiated in various ways" (Perfetti, 1985: 41). As we realize that the reader's knowledge about the world is important in comprehension, any theory of reading must take account of such knowledge. While exactly how schemata facilitate comprehension is not very clear, Anderson et al. (1978) claim that a schema serves as a scaffolding on which to construct the meaning of the text.

Finally, another relevant type of knowledge in text comprehension is the kind of text being read, in other words, the discourse type. This is because comprehension interacts actively with the text being read, and it is influenced by many of the characteristics of the reader as well as of the text.

### 1.1.3. The importance of syntax in text comprehension

Our main concern is the quick integration of the assembled propositions into a representation. We might claim that word recognition and lexical access correspond to one's vocabulary and word knowledge, and the integration of the assembled propositions corresponds to one's syntactic (as well as semantic) knowledge. In addition to words being recognized, the significance of the relationships between them (i.e., syntax) needs to be extracted by the reader. One might think that reading researchers would be well informed on the issue of how syntax operates in reading. This is not the case, however. Syntactic knowledge has not been given adequate attention in the reading literature. In fact, Bernhardt (2005) calls for more research particularly in L2 reading to investigate the importance of syntax in text processing and the interplay of syntax and vocabulary. She poses questions, such as "Can strategic knowledge compensate for weaknesses in syntax and can these elements be overwhelmed by vocabulary knowledge" (p. 142)?

We are hypothesizing the position that syntactic knowledge of some kind is necessary in order to impose meaning on the words being recognized. However, as we will see in Chapter 2, our position has been disputed as well as supported by some studies, and so the issue remains controversial. Some experts believe vocabulary knowledge is much more important in non-native reading comprehension than syntactic knowledge is, and so in our study we wanted to investigate the effects of one's ability to process complex syntax in the context of non-native

language reading. There has virtually been no research done in this area. We will try to determine which component (vocabulary or syntax) contributes more to non-native reading comprehension, and investigate whether there is a substantial syntactic contribution from either the native and/or the non-native language.

## **1.2. Purpose and organization of the study**

This research was designed to examine the direct and indirect relationship that syntactic knowledge might have with L2 reading comprehension. Given that there is contradictory evidence regarding the effect of syntactic knowledge on L2 reading comprehension, the principal goal is to determine what role syntactic knowledge plays in L2 reading comprehension, in addition to other skills. Consequently, the following objectives were pursued:

a/ To determine the extent to which L1 syntactic knowledge contributes to L2 reading comprehension;

b/ To determine the extent to which L2 syntactic knowledge contributes to L2 reading comprehension;

c/ To find out if there is a relationship between L1 and L2 reading comprehension in adults whose L1 literacy skills are high;

d/ To compare the difference (or lack thereof) of syntactic contribution across lower and higher levels of language proficiency;

e/ To compare and contrast certain syntactic structures in two typologically different languages to determine their effects on L2 reading comprehension;

f/ To investigate if factors other than vocabulary and syntax (i.e., non-verbal IQ, reading habits, L1 reading skills, and knowledge of other languages) have an effect on L2 reading comprehension.

g/ To propose theoretical and pedagogical implications based on the results of the study.

This work is organized into 7 chapters. The next chapter reviews reading studies that investigate the relationship between syntax and reading comprehension in both L1 and L2. Chapter 3 provides theoretical background to the issue of syntactic complexity and its relation to readability formulas, as well as a description of the various structures in English and Hungarian that are involved in the study, their potential “transfer” from L1 to L2, and the potential relationship of these linguistic and acquisition facts to reading comprehension. Chapter 4 contains the design of the study together with the research questions and their respective hypotheses, while Chapter 5 provides the statistical results. Chapter 6 deals with the general discussion/interpretation of the results, and puts them into perspective as they relate to previous studies and findings. Finally, Chapter 7 recapitulates the principal findings of the study and discusses its significance as well as its limitations together with its implications and applications, ending with suggestions for further research.

## **Chapter 2**

### **Review of Literature**

#### **2.0. Introduction**

This Chapter is divided into three main sections where we will discuss the relevant research regarding the relationship between syntactic knowledge and L2 reading, and thus motivate our study. In the first section, L1 reading comprehension research with both children and adults is reviewed with regard to two hypotheses that have attempted to shed light on the reasons for various reading deficits. In the second section, the relationship between L1 and L2 reading is discussed and how reading ability in L1 affects comprehension in L2. In the third part of the chapter, studies investigating L2 reading comprehension and its relationship to syntax are examined and related to our current study. Within this section, studies with children and adults are discussed and their relevance to our research is pointed out.

#### **2.1. L1 reading comprehension research**

Numerous research studies have attempted to answer the question of what contributes to individual reading comprehension differences both in children and adults. Are variations in decoding ability primarily responsible for these differences, or can we attribute these differences to higher level processes as well? Since we have determined in Chapter 1 that deficiencies in

lower level processes can disrupt comprehension at any stage of reading, our concern here is whether higher level skills – or lack thereof – can also cause individual differences among readers whose lower level skills are not deficient.

Because the single most important goal of reading is comprehension, any complete theory of reading should account for individual differences in comprehension, and not only in terms of lower-level processes. Unfortunately, it seems to be a “chicken and egg” dilemma: Do lower level skills determine higher level comprehension abilities, or do the cognitive and linguistic abilities that are required for skilled comprehension determine lower level, i.e., decoding skills? According to Perfetti (1988), if comprehension is the target of reading, then “the description of reading ability may be non-distinct from the description of language comprehension ability” (p.113). By contrast, there have been some attempts to keep comprehension out of the scope of reading (e.g., Crowder, 1982), and other attempts to keep comprehension differences out of explanations of individual differences in reading ability (e.g., Carr, 1981).

Perfetti (1988), however, gives three reasons why it is necessary to include comprehension in the definition of reading: The first argument is theoretical-empirical; the comprehension of written language follows from the comprehension of spoken language, as noted above. In fact, reading and listening tap so many of the same linguistic abilities, it is easy to overlook the fact that reading may pose more difficulties than listening for some of the language apparatus. The second argument has to do with the theory of reading ability, in which the goal of reading is not decoding of individual words, but comprehending connected text quickly and accurately. Finally, there is a practical reason for including comprehension in a definition of reading ability: Individual differences in reading comprehension emerge early and

dramatically, even after students have completed reading instruction. Therefore, a theory of reading ability that does not address comprehension will have limited application to individual differences beyond the first two years of schooling.

As mentioned previously, since the focus of our research is skilled readers' comprehension abilities in a foreign language, our attention will be on the use of higher-level processes that are necessary for skilled reading comprehension and have been discussed in Chapter 1. Some of these skills and processes include word knowledge (Davis, 1968; Thorndike, 1973), integration processes (Daneman & Carpenter, 1980; Lorch, Lorch, & Morgan 1987), efficient working memory (Baddeley et al., 1985), and background knowledge (Sternberg & Powell, 1983). One of the higher-level processes/skills that is much less understood and has not sufficiently been investigated is how one's grammatical knowledge, — more precisely, the knowledge and processing of syntax — contributes to efficient reading comprehension.

Although there is a general consensus that a link between syntactic skills and reading comprehension exists, researchers are less in agreement when it comes to determining the specific relations between syntax and each of the two major aspects of reading, namely decoding and comprehension. Some researchers have demonstrated a link between syntactic abilities and decoding and L1 reading comprehension, but have pointed out that there was a stronger relationship between syntactic abilities and the former than there was with the latter. For example, Willows & Ryan (1986) found that syntactic tasks of repetition, localization, correction and cloze tasks correlated more strongly with decoding than with reading comprehension. Bowey (1986) obtained the same results when she experimented with children in fourth and fifth grades. Moreover, Tunmer (1989) revealed no direct link between syntactic awareness and comprehension but simply an indirect one. On the other hand, Nation & Snowling (2000) found

a strong correlation between syntactic awareness skills and reading comprehension. These and other L1 studies will be discussed in more detail below, but they appear to indicate that the relationship between syntactic abilities and reading comprehension is still controversial.

For normally developing readers – since the discussion of various reading disabilities is beyond the scope of this dissertation – there are stages that one has to go through in order to achieve skilled, fluent reading (Chall, 1983; Ehri, 1991). There is no doubt that those children who struggle to learn to read often fail to perform well on various verbal tasks not involving reading (Vellutino, 1979; Liberman & Shankweiler, 1985). These problems are often so subtle that they may not be detected in everyday communication, and only sophisticated testing might shed light on them. Moreover, poor readers do not perform as well as competent readers in understanding oral puns and jokes (Hirsch-Pasek, Gleitman & Gleitman, 1978), and cannot detect, correct, or explain semantically and syntactically anomalous sentences (Ryan & Ledger, 1984). There has been much speculation about whether these deficiencies are due to impoverished verbal short-term memory, deficient speech perception and production, or lack of syntactic awareness (Clark & Andersen, 1979; Smith & Tager-Flusberg, 1982).

In recent years, two competing hypotheses attempt to explain the differences between poor and good comprehenders, each offering a fundamentally different view of what reading demands and how language acquisition is related to it. While one view, the processing limitation theory, claims a deficiency in processing and locates the problem in the “subsidiary mechanisms that are used in language processing” (Crain & Shankweiler, 1988, 168-169), the other view, the structural lag hypothesis, blames poor reading comprehension on a deficiency in linguistic knowledge, more precisely on insufficient syntactic abilities (e.g., Bentin, Deutch, Liberman,

1990; Demont & Gombert, 1996; Waltzman & Cairns, 2000). These two hypotheses are discussed in the sections that follow.

### **2.1.1. The Processing Limitation Hypothesis**

This view (PLH) assigns an essential role to linguistic memory and presupposes that most of the elements of the primary linguistic apparatus have already been acquired by the time children begin to learn to read. While in speech processing the routines such as word identification, syntactic parsing, and semantic composition of word meanings are all highly automatic, reading requires the mastery of accurate and rapid routines in the orthographic system. Until these are mastered, higher-level processes such as syntactic parsing and semantic composition might be inhibited.

There is evidence that suggests a link between phonological processing and verbal working memory demonstrating that short-term memory for verbal materials depends on phonological coding or pronunciation (Crowder, 1982). In other words, a phonetic code is important for maintaining language material in short-term memory, for phonological processing is verbatim and highly transient. In fact, phonological processes are understood as a system for accumulating and holding segments of speech in memory as they arrive during continuous listening to speech or during reading. From this it follows that poor readers must be lacking the necessary verbal memory or phonological processing abilities necessary for efficient reading comprehension. In other words, poor readers' language-related difficulties derive from a limitation in phonological processing. According to Smith et al., (1989) "poor readers'

performance deficits at higher levels of language processing are symptoms of an underlying phonological deficit” (p. 430). This has been demonstrated by poor readers’ impaired memory for nonsense syllables (Liberman, Mann, Shankweiler, & Werfelman, 1982), unrelated words (Mann, Liberman & Shankweiler, 1980; Smith, Mann, & Shankweiler, 1986), and sentences (Roit, 1980; Mann et al., 1984; Shankweiler, Smith, & Mann, 1984), while their nonverbal memory is unimpaired.

The PLH also supposes that “because information in language is conveyed sequentially, phonological coding in verbal working memory is needed to retain linguistic information temporarily in verbatim phonological form while syntactic and semantic relations are determined” (Smith, Macaruso, Shankweiler, & Crain, 1989:431). This view, therefore, attributes symptoms of reading problems to underlying difficulties in phonological processing, and predicts that poor readers will be unable to fully take advantage of their syntactic knowledge, and will have difficulties with those sentences that exceed the resources of their working memory. By contrast, simple sentences that put less demand on their memory will not pose a difficulty for these readers.

Numerous studies seem to support this hypothesis (e.g., Glass & Perna, 1986 ; Fowler, 1988; Macaruso, Bar-Shalom, Crain & Shankweiler, 1989; Smith, Macaruso, Shankweiler, & Crain, 1989). Fowler (1988), for example, experimented with second graders’ grammaticality judgment and correction abilities and their performance on these sentence-level tasks was examined in relation to their reading scores, memory span, and meta-phonological skills. According to her findings, Fowler suggested that performance on the judgment task was not associated with reading ability or meta-phonological skills and was minimally affected by short-term memory factors. On the other hand, performance on the correction task was strongly

associated with reading ability and meta-phonological skill and was greatly affected by short-term memory factors. Fowler interpreted her results to suggest that reading disability does not reflect problems in basic syntactic knowledge, but rather in phonological limitations.

In order to demonstrate that poor readers' comprehension deficits are not due to deficient syntactic comprehension, Glass and Perna (1986) examined fourth grader good and poor readers on syntactic competence, vocabulary and auditory and reading comprehension. Even though the poor readers performed significantly worse on a syntactic test, when vocabulary level was controlled for, there was no correlation between syntactic competence and either reading or aural comprehension for good or poor readers. The reading scores of poor readers were best predicted by their vocabulary scores, and the researchers hypothesized that syntactic development might depend on a sufficiently large vocabulary.

As seen in the above studies, the evidence to support the PLH is compelling. However, other researchers have investigated another account to explain differences in individual reading achievement, namely, the Syntactic Deficit Hypothesis.

### **2.1.2. The Syntactic Deficit Hypothesis**

The Syntactic Deficit Hypothesis (SDH), based on research in language acquisition that suggests that complex syntactic structures are late to develop, posits that reading requires more syntactic competence than beginning readers have at their disposal, and that some aspects of syntax that are necessary for reading are not yet mastered by beginner readers. Moreover, it claims that language acquisition proceeds in the order of complexity of structures; in other words, in a step-wise fashion. On this view it follows that a given structure is considered less complex than another one if children are able to comprehend and speak the first before the second. For example, relative clauses are considered to be acquired later than coordinate sentences and hence are more complex. In Chapter 3 we provide a more comprehensive discussion of syntactic complexity.

Under this hypothesis, the ability to manipulate the syntactic structure of spoken language, as a child's syntactic abilities gradually develop, is generally considered to correspond to the development of reading comprehension and thereby reading development in general (e.g., Bowey, 1986; Demont & Gombert, 1996). Some evidence suggests that syntactic awareness may also facilitate reading development via a more direct contribution to word recognition (Tunmer, Nesdale, & Wright, 1987; Tunmer & Hoover, 1992). For example, Tunmer (1989) found that first grade syntactic awareness skills predicted second grade word recognition, even when the effects of phonological awareness and general ability were controlled for.

We now examine some important L1 (English) studies that directly investigate the relation between syntax and reading to report the existing evidence for and against the Structural Deficit Hypothesis in English.

## **2.2. L1 reading and syntax**

Studies that involve an examination of the relationship between syntax and reading deal with various aspects of syntax and use different terminology: Some investigate syntactic awareness (e.g., Tunmer, Nesdale & Wright, 1987; Bowey, 1986, a,b; Demont & Gombert, 1996; Nation & Snowling, 2000;), some address the issue of syntactic competence (e.g., Bentin, Deutsch & Liberman, 1990), yet others deal with syntactic processing (e.g., King & Just, 1991). In the following subsections we will discuss separately the studies involving children and adults.

### **2.2.1. L1 studies with children**

Studies in the field of reading often involve experiments comparing groups of poor or disabled and skilled readers. Tunmer et al., (1987) attempted to establish a causal relationship between syntactic awareness and reading achievement in an experiment that involved good, younger readers matched with less-skilled, older readers on several measures of reading ability, such as real word recognition, pseudo-word naming, reading fluency and reading comprehension. The researchers also examined participants' verbal intelligence. Children's syntactic awareness

was assessed by their performance on an oral correction task and an oral cloze task. Their findings suggest that the older, less-skilled readers were developmentally delayed in syntactic awareness and this delay might have retarded their reading development. Tunmer et al. (1987) further suggest that while phonological awareness can be improved through training, similar studies on training in syntactic awareness have not been reported.

Bowey (1986) examined the relationship of syntactic awareness to reading comprehension monitoring fourth- and fifth graders with various levels of decoding abilities. She assessed syntactic awareness orally through an error imitation and an error correction task, and then used correlational analyses to examine the relationship between the syntactic awareness and reading measures. Her finding was an important one: skilled and less skilled readers (as defined by word decoding skill) differed significantly on grammatical awareness, thus suggesting that the difference between skilled and less skilled decoders may represent a substantial delay in the development of syntactic awareness. She also poses an alternative explanation, that literacy itself promotes the development of syntactic awareness. This would be in line with similar arguments that have been made regarding the contribution of literacy to phonemic awareness (e.g., Morais, Cary, Alegria & Bertelson, 1979; Ehri & Wilce, 1980).

Nation & Snowling (2000) looked at factors influencing syntactic awareness skills and how these related to reading comprehension. They assessed syntactic awareness skills using a word order correction paradigm in children with good and poor reading comprehension, matched for age, decoding skill, and nonverbal ability. Their findings – poor comprehenders performed less well than normal readers on syntactic skills tasks – support the view that poor comprehenders have language processing deficits encompassing grammatical as well as semantic weaknesses, although their phonological skills are normal. Furthermore, performance on the

word order correction task depended on whether the sentence belonged to an easy, medium or to a difficult category. Easy sentences all maintained subject-verb-object order and were in the past tense. Sentences of medium difficulty included the imperfect tense of past progressive and nonfinite clauses, while difficult sentences included relative clauses, subordinate clauses and passives. The results indicated that syntactic complexity accounted for a significantly larger percentage of the variance than did semantic ambiguity (the number of alternative ways a sentence could be interpreted) and sentence length both of which accounted for a non-significant portion of the variance. The non-significance of sentence length suggests that while always included in readability formulas, it did not contribute to difficulty in this case. In Chapter 3 we will further discuss readability issues.

Relations between the two metalinguistic abilities (phonological and syntactic awareness) and two components of reading (decoding and comprehension) were investigated in a longitudinal study by Demont & Gombert (1996). Making a test of recoding and a test of comprehension their dependent variables, and the non-reading variables such as non-verbal intelligence, and vocabulary level their independent variables, the researchers tested metalinguistic performances at different stages of learning to read. Using fixed-order stepwise regressions, first the researchers were able to determine how well phonological and syntactic awareness predict the different components of reading, independent of general abilities of non-verbal intelligence, IQ and vocabulary. In the second step, stepwise regressions were used to determine the best predictors of reading among all the predictive measures. In their findings, Demont & Gombert determined that children's phonological awareness predicts later recoding abilities, while syntactic awareness predicts later reading comprehension (after effects of non-reading variables have been ruled out). It should also be noted that the contribution of the

phonemic measures to recoding skills was stronger than the contribution of syntactic measures to comprehension. This suggests that other processes, not measured by their study, might contribute to the variance of comprehension skills.

Studies of children in the intermediate grades indicate that there are differences in the language processing of skilled and less skilled readers. Researchers have shown that skilled readers are more sensitive than less skilled readers to the syntactic and semantic information contained in a text (Isakson & Miller, 1976; Willows & Ryan, 1981). Moreover, this difference in sensitivity to linguistic information is also evident in the processing of orally presented material (Bowey, 1983; Forrest-Pressley & Waller, 1984).

Willows and Ryan (1986), for example, tested children across three grades to assess the role of grammatical sensitivity in the development of reading skill. With a cross-sectional design, they attempted to trace the development of grammatical ability across grades 1-3 on a variety of oral language tasks and to relate this development to the acquisition of reading skill. They also took into account measures of short-term memory, non-verbal intelligence, and receptive vocabulary. In their findings, it was clear — because of consistent increases across the first three grades of school on all of the measures of grammatical sensitivity — that maturational and/or experiential influences in these early grades contribute to the development of the above mentioned aspects of language processing.

While this pattern of findings clearly indicates a link between language development and reading acquisition, various interpretations were offered by Willows and Ryan. The first possibility is that reading experience contributes to grammatical sensitivity. That is, by virtue of being a good reader and reading a lot, the child might gain grammatical sensitivity. Another

possibility is that the relationship is a reciprocal one (Ehri, 1979). Grammatical sensitivity may contribute to reading development and, in turn, reading experience facilitates the development of grammatical sensitivity. A third possibility, supported by Willows and Ryan's data is that oral language processing and reading performance both reflect some underlying neurologically based language processing efficiency that is subject to maturational change with age and to genetically determined individual differences.

The examination of grammatical knowledge in relation to reading achievement was the primary goal of Waltzman and Cairns' (2000) study involving 63 third graders. Their secondary goal was to answer questions about children's syntactic development: more precisely, the principles of control<sup>1</sup> and binding<sup>2</sup> and whether poor readers differ from good readers in their understanding of these two grammatical phenomena. In addition to measuring their decoding skills, phonological memory, and language function to ensure membership in the normal range, children were given a sentence-picture matching task to see how they interpret the grammatical structures involving binding and control. In order to avoid the problem of short-term memory, the researchers designed their study so there was almost no strain on short-term memory, allowing repetitions of sentences and keeping pictures in front of the children. The researchers found that the scores of the good readers differed significantly from those of the poor readers in that the good readers demonstrated more adult-like interpretations of the grammatical structures than the poor readers did.

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<sup>1</sup> The Principle of Control assigns a referent to the pronominal element PRO (a silent linguistic element that serves as the subject of a verb that has no tense marker) based on the structure of the sentence in which it appears. *E.g., Mother tells Nancy PRO to pick up the clothes.*

<sup>2</sup> Principles A, B, and C govern the reference assignments of reflexive pronouns and personal pronouns within sentences. *E.g., A: The little sister is patting herself. (herself=sister) B: Grandmother is kissing her.(grandmother≠her) C: She tells Horse that Cow is cooking dinner.(she≠horse≠cow).*

The researchers also suggest that grammatical and semantic weaknesses impact reading development in at least two ways: first, they prevent facilitating text integration and comprehension monitoring (processes that are crucial to successful comprehension); second, they constrain the development of successful word recognition by influencing the ease with which children learn to read words they could not read through simple decoding. This is also demonstrated by Rego and Bryant (1993) who provided longitudinal evidence that phonological and syntactic skills both play a part in learning to read, but these skills make entirely different contributions to the process. The researchers administered a variety of phonological and syntactic/semantic tasks to children in their first grade of school. They predicted that phonological abilities would contribute more to performance on an invented spelling test and syntactic/semantic abilities would contribute more to a context facilitation test later in their reading development. The authors found a strong and consistent longitudinal relationship between children's early semantic and syntactic skills and their ability to use context clues in reading later on.

As can be seen, the link between reading acquisition and syntactic knowledge is definitely present; the extent of this relationship, however, is still unclear. Speculations concerning whether phonological and/or syntactic processes are responsible for one's successful reading comprehension (or lack thereof) leave us with a number of unanswered questions, out of which the most important one might not even be which of the two processes contributes more or less. Rather, acknowledging the importance of both in the stages of learning to read among children, we will proceed to shed light on the extent (if any) to which syntactic knowledge can predict reading comprehension in adults.

### **2.2.2. L1 studies with older children and adults**

As the previous section has suggested, there are numerous studies relating children's developing syntax to their literacy skills (see references in 2.2.1.). On the other hand, research investigating adults' syntactic abilities in relation to their reading comprehension is relatively scarce. The reason for this discrepancy is because the syntactic skills of monolingual adults are rarely tested, for syntax is supposed to be mastered by everybody by a very early age. In fact, however, terms such as "adult grammar" or "adult speech" refer to language forms used by adult native speakers as opposed to less sophisticated language forms used by children. Before examining adult readers, we begin by describing grammatical skills in the older child.

Most studies relate the development of literacy skills to child language development, though it is often assumed that children are linguistically mature by the time they start to learn to read (McNeill, 1970). Their phonological system is developed, and they can say and understand the sentences that the grammar of their language allows, except for rare and complicated sentence structures. Later developments in grammar and vocabulary might be the results and consequences of literacy development (e.g., Gibson & Levin, 1975). In other words, complex syntactic structures and complex vocabulary are acquired from reading, as suggested above. Therefore, the assumption is that given the lexical and syntactic knowledge children possess by the time they start to learn to read, reading is merely a task of decoding, listening, and interpreting. This theory, however, just like the widely-held belief of linguistic maturity being complete by the age of six, is an oversimplification. In fact, there is evidence that there are areas of structural knowledge which still need to be acquired by the older child (e.g., C. Chomsky, 1969).

Gibson & Levin (1975) claim that more complex grammatical structures will be mastered only by older children and, in fact, that some structures may be so complicated that many adults do not understand them. According to these researchers "...the grammar constructed from children's spontaneous verbalizations may underestimate the nature of the rule system that they use to construct and to understand language. To get at the more complex aspects of grammar, it may be futile to wait for the spontaneous occurrence of the structure. The child will have to be confronted with these kinds of sentences and the degree of his comprehension observed." (p. 139).

Even though there is a widely-held belief that children attain adult syntax at about the age of 5, C. Chomsky (1969) noted that while differences between a 5-year-old's and an adult's grammar might not be apparent in a conversation, direct testing can reveal differences. Her investigation supporting this claim involved 40 elementary school children between the ages of 5 and 10. In this study, the researcher elicited information about children's knowledge of sentence subject assignment to infinitival complement verbs and found that 3 out of 14 children who failed to show mastery of this subject were over 9 years of age. This suggests, according to C. Chomsky, that "active syntactic acquisition is taking place up to the age of 9 and perhaps even beyond" (p. 121).

In an attempt to verify whether certain syntactic structures are, in fact, part of the ordinary adult grammar, Sanders (1971) tested a group of adults who were believed to be sufficiently linguistically competent. Participants were supposed to respond to semantically simple sentences involving structures with the verbs "ask" and "tell." She employed these verbs in four different syntactic constructions in the following way: In the first, the construction

followed the minimal distance principle since the subject of the complement verb was the noun phrase that most closely preceded it.

*(1) John asked/told Bill to leave.*

In the second type the sentence included an interrogative pronoun and a subject in the complement clause.

*(2) Tell/ask me what color this is.*

The third type included a noun phrase as the subject of the complement clause, but the interrogative pronoun and the verb have been omitted from the complement clause:

*(3) Ask/tell me the color of this book.*

The fourth sentence type included an interrogative pronoun and an infinitival verb in the complement clause, but omitted the subject of the complement clause:

*(4) Ask/tell me what to build with the blocks.*

Even though only 5% of the answers given by the 40 adults were inaccurate, 80% of the errors resulted from the 4<sup>th</sup> type of construction containing the verb “ask”. Surprisingly,

about half of the 40 participants gave at least one incorrect response to questions that required knowledge of language forms thought to be commonly known to adult native speakers of English. Sanders, therefore, proposed that there might be other syntactic structures that are not understood by some adults. She also implied that there might not be an adequate basis for the evaluation of children’s language development given that it is unknown which syntactic forms are part of ordinary adult comprehension.

In another study involving adults, Cox (1976) designed an experiment – prompted by the unavailability of adequate readability formulas that take into consideration syntactic structure (also see Chapter 3) – that concentrated on the ability of adults to read syntactically complex materials. She compared monolingual English Adult Basic Education (ABE) readers with college juniors and seniors. Cox’s main hypothesis was that the mastery of syntactic complexity in ABE readers is not as advanced as that of the college readers. Furthermore, based on previous research she hypothesized that relative clauses belong to the most difficult constructions, particularly when the relative clause interrupted the Subject-Verb sequence of the independent clause. (These are the so called “centrally embedded” relatives that will be further discussed in Chapter 3.) Cox constructed a test that included the active and passive voices, complex questions, negatives, and passive negative sentence types. The purpose for testing these constructions was to determine whether or not an order of difficulty of these types existed for ABE readers as it does for children.

In Cox’s results, the ABE readers made four times as many errors on the test as the college group did. Complex questions were the most difficult constructions for both groups, though the ABE readers missed 22% of these test questions, while the college group missed only 5%. The average time to complete the test for the ABE group was 42 minutes, while the college group averaged 17.

Even though Cox controlled for vocabulary knowledge, she found that even those readers who were 100% familiar with the words still made errors, indicating that syntax played a role in their failure to carry out the task. She also found that the order of acquisition and difficulty for adults is not the same as for children. The implications of the study are that ABE readers may need explicit instruction in syntax. This is an important finding given that the present study also

investigates L2 readers' syntactic knowledge and their reading comprehension level. It is plausible to assume that L2 readers might need explicit syntactic training in order to familiarize them with the more complex sentence structures used in written language. These issues will be addressed in Chapter 6, while in the next section we begin discussion of our focus, non-native reading comprehension.

### **2.3. The relationship between L1 and L2 reading**

In this section we will look at various overlapping processes that are involved when reading in a non-native language. Just as in the discussion of native or first language reading, we can divide these processes into lower level and higher level skills. Lower level skills involve phonological and orthographic processes in the context of language transfer from L1 to L2 during reading tasks, as will be discussed below. While the theoretical models of the reading process in L2 are greatly informed by our understanding of the basic cognitive and linguistic processes involved in L1 reading, there are dimensions to L2 reading that are unique.

Koda (1994) identified three conditions that distinguish L2 reading from L1 reading: a) the influence of prior literacy; b) limited linguistic knowledge, and c) cross-linguistic effects of lower level processes. In this section we will begin our discussion with this last condition, i.e. cross-linguistic effects because we will better understand higher level processes if we briefly elaborate on lower level processes, as their importance for successful L2 reading comprehension is crucial.

### **2.3.1. Cross-linguistic effects of L1 on L2: orthographic and phonological**

#### **influences**

Accurate and fast word recognition is essential to successful reading comprehension, and so one may hypothesize that the nature of the L1 orthography influences the way L2 learners attend to L2 orthographic units. First language effects on phonological processing in L2 reading had received very little attention in reading research until recently. Wade-Woolley (1999) attempted to fill this void by comparing two groups of adult low-intermediate English as a Second Language (ESL) learners who differed on the basis of their L1 phonological and orthographic units (Japanese and Russian). While Japanese uses a combination of pictograms, Russian is an alphabetic language using the Cyrillic alphabet. The two groups were equal in their L2 reading comprehension and vocabulary measures, and were equally adept at recognizing real words and assigning pronunciations to pseudo-words. In terms of specific phonological and orthographic processes, however, they were significantly different: the Russians were better at manipulating sublexical phonological segments, while the Japanese were more accurate at recognizing legitimate spelling patterns in English. In fact, the Japanese speakers were consistently faster and more accurate than the Russian speakers at making decisions about spelling patterns. This indicates that L2 readers “arrive at their respective performance levels through qualitatively different approaches” (p. 463), presumably showing the effects of L1 orthographic influences. Similarly, because Russian is alphabetic, phonological coding in English is likely to aid in assigning speech equivalents to new words. Nevertheless, despite the

degree to which the L2 groups rely on different strategies, there is evidence that both groups have the ability to integrate phonological and orthographic knowledge for L2 reading. This is consistent with findings in L1 research which show that both phonological and orthographic skills are utilized in reading (e.g., Berninger, Yates, & Lester, 1991; Cunningham & Stanovich, 1990), while some Japanese word reading studies show phonological activation in both orthographic types, i.e., kanji, which requires grapho-phonemic and kana which requires grapho-morphemic processing (Wydell et al., 1993; Leong & Tamaoka, 1995).

In a somewhat similar experiment to that of Wade-Woolley, Koda (1990) was interested in the effects of L1 orthographic representation on the cognitive strategies used in L2 reading. Three groups of native speakers of languages with different orthographies (Spanish, Arabic, and Japanese), learning English, and an English control group were used under two conditions. Importantly, speakers of Spanish, Arabic and English use phonological information when reading words, while readers of Japanese use both phonological and orthographic information. In this experiment, therefore, one condition used nonsense English words (i.e. kamit), where phonological information was accessible, and one with Sanskrit character (i.e. रपबीलमम) where phonological information was inaccessible and readers would have to rely solely on orthographic clues. Koda's results indicated that the groups relying on L1 phonological information (i.e., Arabic, Spanish, English) were seriously handicapped when such information was inaccessible; i.e., words when reading under the Sanskrit symbol condition. On the other hand, the Japanese group was not affected by this lack of phonological information and spent even less time reading the passage with the symbol condition than the English nonsense word condition, presumably because their L1 reading strategy enabled them to make use of orthographic information alone. Therefore, this study provided strong empirical evidence of L1 orthographic influence on

cognitive strategies used in L2 reading, and demonstrates that cognitive transfer does occur in the L2 reading process.

The primary objective of the study of Geva et al., (1997) was to compare developmental trajectories associated with accuracy and speed, in other words, efficiency of reading letters, isolated words, and text in L1 and L2. In a longitudinal study, the researchers measured the development of bilingual (English-Hebrew) children's reading speed and accuracy, and compared them in Grade 1 and Grade 2 on parallel L1 and L2 tasks. Results indicated a high correlation between the two languages despite differences in orthography. However, in their L1 (English), children were more efficient (faster and more accurate) in reading text than isolated words. Also, in their L2 (Hebrew), accuracy distinguished between poor and good readers, but speed did not. Geva et al., concluded that steps associated with the development of L1 reading efficiency are applicable to the development of word recognition skills in the non-native language, but they do not emerge concurrently in both languages.

A study that investigated the role of both higher-level (syntactic and semantic) processes as well as the lower-level (word recognition and graphophonic processes) was carried out by Nassaji (2003). In particular, he wanted to examine the extent to which these processes can distinguish skilled readers from less skilled readers in a sample of fairly advanced Farsi speaker ESL readers. Measurements in reading comprehension, syntactic, semantic, phonological, and orthographic processes in addition to word recognition were used. Nassaji demonstrated that the differences in the efficiency with which ESL readers process information contribute reliably and significantly to the discrimination between skilled and less-skilled readers. There was a strong relationship between semantic processing skill and reading comprehension, and similarly, the efficiency of lower-level processing skills also distinguished skilled from less-skilled readers.

His study extended into L2 reading the findings based on L1 reading research, that efficient lower-level word recognition and grapho-phonetic skills are not only important factors in beginning reading but are integral components of fluent and skilled reading as well and so their roles must not be disregarded even in advanced L2 reading.

There is an interesting interaction, however, between the importance of lower-level and higher-level processes and L2 language competence. While in the previous experiment the L2 readers were fairly advanced, in Horiba's (1996) study, the groups were divided into intermediate and advanced readers in addition to their differences in L1 (English or Japanese). One of Horiba's research questions was how language competence affects the allocation of cognitive resources during text processing. The participants processed and recalled two passages that varied in degree of causal coherence. It was found that L1 readers of both English and Japanese used much of their attention for higher level processes such as the generation of inferences and general knowledge associations. Furthermore, they processed the high- and low-coherence texts differently, generating more elaborations for low-coherence texts than for high-coherence ones. By contrast, L2 readers paid more attention to lower level processes and did not process the high- and low-coherence texts differently. L2 advanced readers generated both backward and forward inferences during reading, while L2 intermediate readers generated neither type of inference. Although this study has some limitations in terms of sample size, the findings do provide important information about processes of L2 text comprehension and the relationship between higher and lower level processes. Therefore, it indicates that many features of the processing operations observed in the verbal reports of readers may also be rather common among silent readers who have similar competence in the language.

Now that we have established the importance of lower-level processes in L2 reading, we can return to Koda's (1994) first two factors that distinguish L1 reading from L2 reading: the reader's prior L1 literacy experience and potentially limited L2 linguistic knowledge. In other words, higher-level processes will be examined in light of Alderson's (1984) widely quoted question of whether difficulty in L2 reading is a reading problem or a language problem.

### **2.3.2. L2 reading research debate: A reading problem or a language problem?**

This question is related to Koda's first two differences between L1 and L2 reading: the influence of prior literacy and the language learner's L2 proficiency. It is basically asking (Alderson, 1984) whether native language literacy level or L2 proficiency would be a better predictor of L2 reading performance. In other words, how much L1 literacy does a reader need in order to read successfully in the L2? Similarly, how much L2 proficiency does one need in order to transfer L1 literacy skills and read successfully in the L2? Two hypotheses were formulated regarding this issue, both by Cummins (1978, 1979, 1981, 1984).

### *The Linguistic Threshold Hypothesis*

The Linguistic Threshold Hypothesis initially was also called the “short circuit” hypothesis, meaning that a lack of L2 linguistic knowledge ultimately “short-circuits” L1 reading knowledge. Therefore, a certain level of L2 linguistic ability must be obtained before L1 reading skills can be effectively transferred and aid L2 reading comprehension.

Within this hypothesis is the assumption that language is the key factor in reading/literacy activities. In other words, one has to know enough of the language in order to read it. To extend this hypothesis more broadly, it also assumes that

“...those aspects of bilingualism that might positively influence cognitive growth are unlikely to come into effect until children have attained a certain minimum or threshold level of proficiency in the second language. Similarly, if bilingual children attain only a very low level of proficiency in one or both of their languages, their interaction with their environment through these languages both in terms of input and output, is likely to be impoverished” (Cummins, 1981, p. 38.).

This suggests that there are at least two benefits from a sufficient level of L2 knowledge; the first as it relates to reading in particular and the second, more broadly, in regard to cognitive advantages. The latter interpretation, in fact, has become more generally associated with the Linguistic Threshold Hypothesis, while the Linguistic Interdependence Hypothesis has become more closely linked to reading skills.

### *The Linguistic Interdependence Hypothesis*

Reading in a L2 is not a monolingual event; L2 readers have access to their L1 as they read, and as we have seen in our previous section, they can use their L1 as a strategy to help comprehend a text. It was Cummins (1979) who first claimed that academic skills, such as reading, can easily be transferred from one language to another, and he makes a strong case for the transfer of literacy skills across languages. He states that an underlying cognitive/academic proficiency exists common to all written languages. Eslin & Downing (1986) suggested the possibility that literacy transfer could happen across languages. They argue that reading is a skill that can be developed in any language, and that there exists a universal pattern of skill development. Once readers have acquired such skills (most of the time in their L1), they just have to transfer them to similar tasks in L2. Therefore, the transfer of such skills must result in a very positive correlation between L1 and L2 reading. The studies reported in section 2.3.1. showing crosslinguistic effects of skills between L1 and L2 (e.g., Geva et al., 1997, Koda, 1990; Wade-Woolley, 1999) are evidence that particular aspects of reading, or the sub-skills underlying the reading process, have the potential of carrying over from one language to a subsequent one.

From the contribution of the L1 to L2 reading, we turn now to the potential contribution of syntax to L2 reading as reported in the literature to date.

## 2.4. L2 reading and syntax

Fluent L2 reading is also dependent on the acquisition of grammatical processing strategies according to Bernhardt (1986) and Koda (1987). Knowing a language means knowing its grammatical rules, which often translates to “syntactic knowledge.” While reading comprehension research in a foreign language draws on existing information in L1 reading, which is logical, unfortunately, most L2 studies combine the investigation of vocabulary knowledge and grammatical competence for an obvious reason: even for the most complex structures, one needs to know the words if one wants to make sense of a sentence. Therefore, the investigation of grammatical knowledge has somehow been secondary in reading research both in L1 and L2. Nevertheless, according to the previously mentioned studies in the field of L1 reading research, there is some compelling evidence – albeit controversial – that suggests a correlation between knowledge of syntax and reading comprehension (Perfetti, 1985; Tannenhaus, 1988).

In L2 reading research, vocabulary knowledge is given much greater importance than grammatical/syntactic competence. This may be because vocabulary knowledge seems so obviously critical for L2 reading. On a less obvious level, the knowledge of structures also has an important facilitative effect on reading comprehension of course (Berman, 1984; Barnett, 1986).

Bernhardt (2003) noted that this critical feature of text, namely, syntax, is never even mentioned in the National Reading Panel Report (2004). This may well be because there is scant

research that addresses the impact of either morphology or word order on text comprehension, or other aspects of syntax and morpho-syntax.

Some recent investigation, however, has focused on the syntactic knowledge that L2 readers bring to the reading process and how such knowledge or skill influences comprehension. In the following section, we will review relatively recent studies that have been carried out in L2 reading with children and adults.

#### **2.4.1. L2 studies with children**

Among recent studies on children's L2 reading development and syntactic abilities, Martohardjono et al., (2005) focused on structures that are considered to be milestones in the development of monolingual children, specifically coordination and subordination. The team investigated whether bilingual children with a strong knowledge base in their L1 (Spanish) acquire reading comprehension in L2 (English), better than those with weaker L1 syntax. The theoretical reason to investigate this came from Cummins' (1979, 1982) previously discussed Linguistic Interdependence Hypothesis. Their second question investigated the degree to which a strong syntactic base in the L2 contributes to listening comprehension in the L2, and if this was a "more significant factor than the corresponding base in the L1" (p. 4).

The tasks and stimuli were based on the literature on complex sentence development. (A detailed discussion on the emergence and development of complex sentences will follow in Chapter 3.) Kindergartners were tested on a syntax measure (coordination and subordination) in Spanish and English through an act out task. Within coordinate structures, three types were used:

subject coordination, as in (5); object coordination, as in (6); and IP (sentence) coordination as in (7).

(5) *The cat and the monkey sleep.*

(6) *The monkey touches the bear and the cat.*

(7) *The cat jumps and the bear runs.*

In addition, four types of subordinate structures were tested: temporal adverbials using *before* clauses where the order of events matches the order of mention using both transitive and intransitive verbs, as shown in (8) and (9), and two types of relative clauses as illustrated in (10) and (11):

(8) *The dog punches the bear before touching the box.*

(9) *The monkey pushes the dog before dancing.*

(10) *The bear hugs the cat who pushes the box.*

(11) *The monkey hugs the dog who jumps.*

Martohardjono et al., (2005) found that performance on the coordinate structures (shown in 5-7) exceeded the performance on subordination (shown in 8-11), which is the developmental order for monolingual children. In addition, performance on L1 (Spanish) coordination was better than on English (L2) coordination. On the other hand, although performance on the subordinate structures was also somewhat better in Spanish, the difference was not statistically significant. Finally, the combined performance on both coordination and subordination was

significantly better in Spanish. In further analysis among the various types of coordinate structures, the researchers also found subject coordination (as in (5) ) to be easier than object coordination and IP coordination (as in (6) and (7) respectively).

Participants were then tested on the Pre-Reading level of the Gates-MacGinitie Standardized Reading Test, which has components known to be precursors of reading ability.<sup>3</sup> Correlations between the syntax measure and the precursors to reading indicated that there were more significant correlations between the Spanish syntax scores and English pre-reading than between the English syntax scores and English pre-reading. Correlations between Spanish syntax and English listening also appear to be stronger than between English syntax and English listening. Based on these results, Martohardjono et al., concluded that there is indeed a strong relationship between syntactic skills in L1 and listening comprehension (as precursor to reading) in L2 in young ESL learners, and this relationship is particularly strong between the knowledge of subordination and listening comprehension in both the L1 and L2.

Another recent study by Lesaux et al., (2006) investigated the influence of cognitive and linguistic skills on the reading comprehension performance of a group of children from diverse linguistic backgrounds; the study also compared the reading comprehension performance of grade 4 children who entered kindergarten with little or no experience with English (the ESL group) to that of a group of native English speakers matched in age. Their participants included 480 children, of whom 395 were native English speakers and 85 ESL children. Since Lesaux et al. were interested in the reading comprehension skills and the related cognitive skills of different subgroups of poor comprehenders, the researchers distinguished between two groups:

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<sup>3</sup> These four components were Literacy Concepts, Oral Language Concepts, Letter-Sound Correspondences, and Listening Comprehension.

Students with poor word reading and poor comprehension skills were in the first group and students with adequate word reading skills but poor reading comprehension skills were in the second group. A third group was classified as good comprehenders. The measures administered to the children were organized into four categories: reading, memory, phonological processing, and syntactic awareness.

In their findings the researchers concluded that syntactic awareness, phonological awareness, and working memory skills, as measured in kindergarten and fourth grade, had a significant effect on fourth grade reading comprehension performance. Their results also indicate that limited early exposure to English and lack of proficiency in English upon entering school do not necessarily result in subsequent low comprehension scores. They suggest the need for more research with ESL learners in order to examine the nature of their syntactic awareness difficulties, focusing on whether these children are dealing with an area of deficit or a developmental lag. It would also be interesting to learn whether there are differential patterns of performance according to specific L1 backgrounds. In the studies with adults described below, both of these issues are investigated.

#### **2.4.2. L2 studies with adults**

A review of L2 reading literature with adults reveals that the investigation of syntactic competence in relation to reading comprehension is somewhat like a stepchild of L2 reading research. As noted earlier, this is probably because — just as in L1 reading research— it is assumed that syntactic structures are mastered by the time an individual reaches adulthood. In

reading, as in auditory comprehension, syntactic decoding does not occur in isolation from semantics and lexical understanding; nevertheless, in order to correctly perceive a text's grammatical and rhetorical interrelations, one needs to be fairly familiar with the L2's syntax. However, as mentioned earlier, the interdependence of lexical knowledge and syntactic knowledge is the confounding factor in most L2 reading comprehension research.

In an early study, Haarman (1988) attempted to assess the relative weight of some presumed components of reading comprehension, including grammar, a term often used to represent syntax. A battery of tests was administered to 112 first and second year students at an Italian university who had studied English for periods ranging from one to eight years. The results showed an erratic pattern of mean scores on grammar with respect to the reading comprehension scores, and Haarman took this as confirmation that grammar, as traditionally taught and tested, is not tapped in reading comprehension tasks. This, however, might be due to subjects' differences in their English language competence, for such differences were not measured in this study.

In a contrasting early study conducted with adults, Guarino & Perkins (1986) tested the relationship between awareness of morpho-syntactic knowledge and reading comprehension. Their participants consisted of 35 ESL students of various native languages, out of whom 10 were of intermediate proficiency and 25 of advanced proficiency. The researchers used De Lancey's (1962) Recognition of Linguistic Structures to assess participants' awareness of form class. This test consisted of nonsense words that could be recognized according to structural clues, such as prefixes and suffixes and word order placement. An example is shown in (12), where respondents must select the correct word (form) out of four possibilities:

(12) *We were vadable bons, and femish lars were dirful vols.*

*I nopped the \_\_\_\_\_, and they fodded me.*

*a. vadable    b. femish    c. lars    d. dirful*

It might be noted that this task involves a relatively high degree of meta-linguistic skills, i.e., explicit awareness of morpho-syntactic features. A multiple-choice reading measure was also administered and results correlated with a form class awareness test. Furthermore, the authors compared the reading comprehension scores of those subjects who scored above the mean on the form class awareness test, and this also resulted in a significant group difference. In short, the authors provide evidence suggesting that for intensive ESL students, awareness of form class, i.e., an element of morpho-syntax, correlates with reading ability. While this study provides support for the relationship between syntax and reading, in contrast to that of Haarman (1988), Guarino & Perkins might have also analyzed their data in relation to the language proficiency of the participants (intermediate vs. advanced). It is possible that relationships between reading comprehension and syntax differ according to L2 proficiency.

Berman (1984) claims that efficient foreign language readers must rely (at least, partially) on syntactic devices to get at text meaning. Furthermore, she claims that in order for readers to understand the basic propositional content of a sentence, they must be able to manipulate some interrelated components of sentence structure. Recognizing basic elements of a sentence (such as main and subordinate clauses, their predicates, word order) is crucial in language perception. For example, the L2 reader might experience more difficulties in passive constructions, where

the SVO word order is not followed, as shown in example (13) or where subordinate clauses precede rather than follow the main clause, as shown in example (14):

(13) Nuclei contributing to the zygote are transferred between two cells without the formation of obviously specialized gametes.

(14) That the note of fear in his parents' voice is uncontrollable is not understood by the child.

In a pilot study conducted with 20 Hebrew-speaking college students divided into two groups according to L2 English proficiency levels, Berman (1984) gave a syntactically simplified version of a passage (with vocabulary intact) to an experimental group, and the original version to a control group. A set of 30 questions followed the reading. The group that read the syntactically simplified version did consistently better than the other group. At the same time, more errors were made by readers of the original, syntactically complex text on questions of "specific" information than on the "global" or "general" content. Berman concludes that syntax might not be important for getting the "gist" of an entire text. However, if the aim is to acquire specific and detailed information accurately, then exact understanding of syntactic components of each sentence is important. Thus, Berman summarizes: "Intrasentential syntactic complexity might be more of an impediment to grasping specific details than to overall ideas" (p.146). The problem, however, is to determine what one understands under "gist" of a text and which components of reading relate to "overall ideas."

These findings suggest that there is potentially a link between syntactic competence and reading comprehension in L2, and the greater the syntactic knowledge as revealed in grammatical processing, the more precise the comprehension, i.e. particularly of details. On the

other hand, Ulijn & Strother (1990) suggest that while a complete conceptual and lexical analysis may be necessary for reading comprehension, a thorough syntactic analysis is not. They base this conclusion on their study of both native English speakers and Dutch computer science majors whose L2 is English. The authors found that the groups did not have significant differences in their understanding of authentic (unadapted) versus syntactically simplified computer science texts. Furthermore, there was no difference in the time taken to read the texts. While this finding appears to contradict those that show a relationship between syntax and reading comprehension, it might have to do with the fact that scientific texts often contain nominalizations, passives, participles, and infinitives – often considered complex syntax (see Chapter 3) – with greater frequency than regular texts, and science majors might have greater experience in reading these complex texts.

In a more recent paper Bernhardt (2003) hypothesized that syntax would be a key variable in predicting L2 reading comprehension. She claims that evidence within L2 contexts predicts that the impact on the comprehension process of readers moving between predictable and unpredictable word order is significant. Languages such as German, Russian, or French exhibit degrees of flexibility in word order and, consequently, readers cannot merely rely on word meaning for comprehension, but must understand the signaling relationships between and among words (Kern, 2000). Odlin (1989) also noted that L2 learners from flexible word order languages have higher numbers of oral production error rates when learning rigid word order languages (e.g. English). Odlin further hypothesized that learners from rigid word order languages have higher error rates in the receptive language skills, namely reading and listening, when learning flexible word order languages. This hypothesis relates to the study presented in Chapters 4 and 5, which examines speakers of Hungarian who are learning English.

Other studies on the relative contribution of syntactic knowledge and vocabulary in relation to language proficiency were conducted by Barnett (1986), Brisbois (1995), van Gelderen et al., (2004), and Shiotsu & Weir (2007).

Barnett (1986) found that both vocabulary and syntactic knowledge have comparable importance for reading comprehension at intermediate levels of general L2 proficiency; that is, syntax plays a major role when vocabulary is relatively strong and vice versa. However, weak syntax will critically affect reading comprehension even when the lexicon is strong and, alternatively, a weak lexicon will severely affect reading comprehension even when the syntax is strong.

In her study with native English speaking university students studying French, Barnett used recall protocols in the participants' native language. First, the students read two stories that were approximately 600-650 words long each. Then, Barnett administered a multiple choice deletion cloze test, where 50 deletions were used, and for each deletion, there were three choices. The correct choice for half of the blanks depended on knowledge of syntax, and the other half depended on knowledge of vocabulary. The tests were scored in terms of number correct in each of the two categories, syntax and vocabulary. In the following step, the students read the same previously administered stories, this time, however, with an additional 300 words, in order to present students with new material. Finally, a timed English recall protocol was given to assess participants' comprehension.<sup>4</sup> To determine the interaction between syntactic and vocabulary skills in relation to recall, Barnett ran a two-way ANOVA. She found that recall increases according to level of L2 syntactic proficiency, and also according to level of L2 vocabulary.

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<sup>4</sup> The native language (i.e. English) was used in order to eliminate possible interference effects of students' productive L2 skills, particularly when such skills were weak.

Barnett points out that while both proficiencies (syntactic and semantic) affect reading comprehension, inferencing skills or vocabulary-building exercises might not help those students who lack adequate syntactic knowledge. While Barnett's (1986) study among intermediate-level L2 readers supports the relationship between L2 syntax and reading, further research is clearly needed to tell us the degree to which syntax plays a role in reading comprehension at various levels of L2 proficiency, when the lexicon is held constant. In addition, we still do not know which syntactic structures or which types of syntactic complexity are correlated with L2 reading comprehension among adult learners. And, finally, the use of a cloze test as measurement for assessing syntactic abilities relies on productive knowledge, which Klein and Martohardjono (1999) have argued is not as reliable a measure as a comprehension task. The latter, they argue, is not as confounded with the processing difficulties that production often entails.

In contrast to Barnett's experiment is the study by Brisbois (1995), which according to Alderson (1995) and Bernhardt (1999) is the only linguistic threshold study to separate grammar, i.e. syntax, and vocabulary as independent predictor variables. In Brisbois's results, vocabulary correlated more strongly with a reading comprehension measure than did her grammar measure. Shiotsu and Weir (2007), however, are critical of such results, pointing out that the timing of Brisbois's data collection makes the interpretation of her findings misleading. That is, while the grammar knowledge data were collected two months prior to the reading comprehension data collection, the vocabulary test was taken only two weeks before the reading comprehension test. Furthermore, it appears that Brisbois's procedures for assessing vocabulary versus grammar

provided an advantage for the former over the latter, again with a problematic production task measuring syntax.<sup>5</sup>

A very recent study dealing with the issue of syntactic knowledge and reading comprehension in L2 was conducted by Shiotsu and Weir (2007) who investigated the relative significance of syntactic knowledge and vocabulary breadth in the prediction of reading comprehension performance. They point out that even though a number of contributing factors to reading ability have been empirically validated, the relative contribution of these factors to the explanation of performance in a foreign language reading test is limited. While previous studies (i.e., Ulijn and Strother, 1990; Brisbois, 1995) had demonstrated a greater importance of vocabulary knowledge in foreign language reading, Shiotsu and Weir (2007) offer support for the relative superiority of syntactic knowledge over vocabulary knowledge in predicting performance on a reading comprehension test. They further claim that the literature on the relative contribution of grammar and vocabulary knowledge to reading comprehension is too limited to offer convincing evidence for supporting either of the two predictors, and a more sophisticated statistical approach (i.e., Structural Equation Modeling, or SEM) would shed more light on the question.

To carry out their investigation, Shiotsu and Weir (2007) conducted three studies, of which two were pilot studies using participants of various L1 backgrounds, whereas the third (the main) tested a homogeneous Japanese speaking undergraduate population studying in the United Kingdom. The main study involved a larger homogenous Japanese speaking undergraduate population than the one in the pilots. The test instruments were a text reading

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<sup>5</sup> For the grammar test Brisbois adopted a test consisting of “multiple-choice and cloze items” (p. 572), and for the vocabulary test she selected 50 words from test passages taken from the reading comprehension measure, but not yet studied in the curriculum.

comprehension measure, along with measures of knowledge of vocabulary and knowledge of syntax. The text reading comprehension measure consisted of six separately timed sub-texts based on a total of four academic passages ranging from 600 to 1000 words in length. The test employed short answer, true-false with justification, and a table/flowchart or sentence completion task. The knowledge of vocabulary test drew on another part of the reading test battery that targeted understanding of contextualized meaning of academic words through a task requiring respondents to find words from a given word bank that appropriately filled blanks embedded in two different academic passages. Finally, in the test of syntactic knowledge each item was presented as a sentence with one part replaced by a blank (a grammatical production task that also depends on reading ability). There were four response options which had similar semantic content but only one satisfied the syntactic constraints imposed by the structure of the rest of the sentence. An example of an item requiring syntactic knowledge is shown in (15):

(15) There are very few areas in the world \_\_\_\_\_ be grown successfully.

- |                       |                       |
|-----------------------|-----------------------|
| A. where apricots can | C. apricots can       |
| B. apricots that can  | D. where can apricots |

Between the two predictors, syntax appeared to contribute slightly more to the text reading performance than did vocabulary, even though the grammar task could be argued to be quite difficult.

Shiotsu and Weir (2007) further did a subgroup analysis in which they analyzed the data according to lower and higher achieving participants. This analysis showed that the relative

significance of the syntactic variable was not a phenomenon limited to readers of lower ability alone, but extended to those with higher ability as well. As for further research, Shiotsu & Weir suggest identifying proficiency levels in terms of standard scales, so that researchers can provide reference concerning where on the proficiency continuum the significance of syntactic knowledge is most evident and where it begins to vanish in significance (if it does).

The most challenging task for future research in this area would be to develop a rigorous research study to precisely test the relationship between syntax and reading in adult L2 readers, controlling for lexicon, and examining learners at different proficiency levels. Unfortunately, existing syntactic measurements do not accurately capture learners' knowledge and ability to process complex structures. Thus it is necessary to use a comprehension task rather than the type of production task that has been used in prior research in this area. Such an assessment tool should test relatively complex as well as simple structures to measure differences in syntactic comprehension. More specifically, it should isolate syntactic features that might affect L2 reading comprehension and test learners acquiring a language with a very different syntax from their L1, for example Hungarian learners of English, to see whether cross-linguistic influences are apparent. Finally, it is important to evaluate the L1 reading skills of the learners under investigation and include only relatively skilled readers in the study, but still within a range of L1 abilities. This is for two reasons: 1) examine any correlations between L1 and L2 reading skills to further support prior research findings; and 2) to ensure that evidence of low and high L2 reading skills can be correlated with (or not correlated with) correspondingly low or high syntactic skills, the independent variable of primary interest, without the confound of low reading skills in the native language.

## 2.5. Summary

As has been empirically illustrated in the studies described above, there are unique features that characterize L2 reading comprehension. These specific features have to do with the interaction of L1 literacy and L2 proficiency, among other factors including lexical and syntactic skill in the L2 especially. While syntactic skill as it relates to L2 reading comprehension is more researched in the context of child bilingualism, studies with adults also demonstrate some evidence as to the contribution of syntactic knowledge to L2 reading comprehension. One reason for the not-so-clear evidence for the role of grammatical knowledge in L2 reading might originate from the fact that researchers use different terms and different research designs that might make the comparison of results difficult. In fact, the definition of syntactic knowledge, skills, processes or abilities can mean different things according to different researchers. In the following chapter, we will formalize the construct of syntactic knowledge as it will be interpreted in this thesis.

Finally, in the subsequent chapter we begin formulating the framework for the present study by discussing syntactic complexity, describing syntactic development with focus on the acquisition of complex structures that have been correlated with reading comprehension (as reported above), and elaborating on the contrasts between these specific constructions in Hungarian and English, the two languages of this study.

## **Chapter 3**

### **Syntactic Complexity and its Relation to Reading Comprehension**

#### **3.0. Introduction**

In the previous chapter we discussed the various lines of research that concentrate on the relation between L1 and L2 reading and syntactic skills. In order to further investigate the importance of syntactic comprehension in reading –both in L1 and L2- we will take a closer look at both syntactic development and syntactic complexity and how they relate to reading comprehension and readability formulas that measure text difficulty. We will also discuss the complex structures that emerge later in language acquisition and thus are considered problematic for beginner readers. The chapter will also examine the specific late-emerging structures that are used in the study as stimuli in both English and Hungarian. Finally, we will discuss the issue of transfer from L1 to L2 in reference to the development of L2 complex structures in order to determine whether L1 syntactic processing abilities fundamentally influence those in L2.

#### **3.1. Syntax and reading revisited**

The basic unit with which a grammar is concerned is the sentence. Syntax - as the study of those properties of language that are involved in the construction of grammatical utterances - consequently is a very important component of the language apparatus. Since reading is a

language-based skill, we can reasonably hypothesize a positive relationship between the individual's knowledge and processing of syntax and his or her comprehension of oral or written input.

Furthermore, there is no reason to conjecture that while L1 reading utilizes syntactic knowledge in text comprehension as was discussed in Chapter 2, L2 reading would not. In fact, in his recent book Alderson (2000) refers to "the importance of knowledge of particular syntactic structures, or the ability to process them, to some aspects of second language reading" (p. 37) and states that "the ability to parse sentences into their correct syntactic structure appears to be an important element in understanding text" (p. 37). However, as noted in Chapter 2, the contribution of syntax to L1 reading is not uncontroversial. As also mentioned in Chapter 2, this leads us to some of the crucial questions involved in L2 reading research: First, the question whether the extent to which difficulty in L2 reading is a reading problem or a language problem is still unanswered; that is, is a particular poor L2 reader hampered by low reading skills in general (regardless of language), or by low levels of proficiency in the L2? In addition, if syntactic skills are necessary for reading comprehension, is this relationship more closely tied to the processing of one's L1 syntax, as was found among child bilinguals (Martohardjono et al., 2005), or is it more dependent on the knowledge and processing of L2 syntax? Also, how do these relationships differ among older L2 readers who are highly literate in their L1?

There are usually two main questions associated with the study of syntactic abilities. The first one is commonly referred to as the logical problem of language acquisition, or the learnability issue, and it tries to explain how speakers come to know more than is present in the language input. In other words, what makes it possible for language speakers (and foreign

language learners as well) to build mental grammars that enable them to develop a level of syntactic understanding that goes beyond the limited speech or writing samples they encounter?

The second, and for our purposes the more important question, is the so called developmental problem, which tries to explain how knowledge of syntax develops over time. It also attempts to answer why some properties of syntax are acquired earlier than others and why some structures remain difficult even for advanced speakers. This brings us to the related issue of syntactic complexity and its entailments, particularly in the realm of reading comprehension.

Although these two lines of investigation are closely related to each other, their approaches are different. In the following section, we will tackle the developmental question first by explaining the terminology involved in labeling syntactic skills.

### **3.2. Terminological preliminaries**

English uses numerous terms to describe the syntactic processes that fall between the visual perception of letter strings (or in spoken form, speech perception) and sentence comprehension. In the literature we have encountered the following terms, just to name a few: explicit and implicit syntactic knowledge, syntactic competence and capability, syntactic skills, syntactic awareness, syntactic parsing and processing. Sometimes these terms are not explained adequately, let alone teased apart in research testing. While the various processes are not independent of each other, for our purposes we will treat them as if they were autonomous.

Reading is not a single mental activity, but an interaction of various component processes at the word, sentence and text level. Sentence level processes include syntactic parsing processes, among others. A great deal of empirical research suggests that readers perform an on-line structural analysis of text, constructing a grammatical representation of sentences as they read (Rayner & Sereno, 1994). Eye movement research in laboratories (e.g., Frazier & Rayner, 1982; Tanenhaus, Carlson, & Trueswell 1989; Ferreira & Henderson, 1990) has revealed some facts about the initial stages of sentence comprehension, and Rayner & Sereno (1994) identified three issues that have emerged from this research: the first is the nature of principles underlying structural analysis; the second is the proper measure of syntactic complexity, and the third are the parameters of semantic or pragmatic information in initial syntactic analysis. The first two have the most relevance for our research, since various strategies have been proposed to describe how readers determine the proper structural analysis of a sentence. Frazier (1987), for example, argued that the reader builds an initial analysis of a sentence on the basis of syntactic knowledge. This implies, therefore, that syntactic knowledge (implicit or explicit) precedes the ability to process or parse (where the words of the sentence are assigned to phrasal constituents whose organization is determined). Thus, syntactic processing entails syntactic knowledge, while syntactic knowledge does not necessarily lead to parsing or processing, the latter of which is necessary for sentence comprehension. In the study to follow we will therefore use the terms “syntactic processing” and “syntactic comprehension” in our discussion of the syntax-reading relationship. The reason for this is the hardships associated with tapping into one’s syntactic knowledge and testing it empirically.

While syntactic processing and parsing research deals mostly with sentence ambiguity, and how the parser handles it, a major issue that has recently captured the attention of linguists

and psycholinguists concerns the effects of syntactic complexity in the absence of ambiguity. This is an issue that is relevant to our research, for we did not use ambiguous sentences in our stimuli, only those that are considered to be syntactically complex. We can ask the question: What makes a sentence more complex and thus harder to process and longer to comprehend? It is still an unsettled question that has motivated many cognitive scientists to formulate theories that are discussed below.

### **3.3. Syntactic complexity**

Three interrelated perspectives will be considered in our discussion of syntactic complexity: (1) developmental; (2) structural; and (3) computational. It is difficult to discuss language acquisition/development without an overview of linguistic complexity, within which we are most interested in syntactic or sentential complexity. While there is no universal definition among linguists of what syntactic complexity means, it is well established that certain syntactic structures are harder to process and take longer to comprehend than others (Goldsmith, 1977). Children find subject-extracted relative clauses such as (1) easier to understand than object-extracted relative clauses such as (2) (Menyuk, 1984).

- (1) The cat that chased the dog ran away
- (2) The cat that the dog chased ran away.

According to C. Chomsky (1968), “there is a natural assumption that children acquire later those structures which are more complex” (p. 6), contrasting the familiar pair shown in (3) and (4):

(3) John is eager to see.

(4) John is easy to see.

The fact that (3) is less problematic for children to understand is due to its simple S-V-O word order. In (4), however, this order is not maintained. She therefore hypothesized that the interpretation of (3) will be learned earlier than that of (4).<sup>6</sup>

The fact that children have more difficulty with constructions in which word order differs from the standard has been noted by many researchers (e.g., Maratsos & Abramovitch, 1975). The passive construction, “*The girl was kissed by the boy,*” for example, has been observed to be understood as active — “*The girl kissed the boy*”— by children (e.g., Whitehurst, Ironsmith & Goldfein, 1974). Similar difficulty has been observed with centrally embedded relative clauses (e.g., “*The man that was wearing blue pants left the room.*”) and the adverbial structures containing *before* and *after* (Amidon & Carey, 1972), as in “*Before we had lunch, we went to the museum.*” On the other hand, because the theory of Universal Grammar maintains that the language module develops much faster than any other cognitive module used for such skills as arithmetic or knot-tying, (Hamburger & Crain, 1984) according to Crain & Shankweiler (1988) it

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<sup>6</sup> C. Chomsky paraphrases (4) as “*to see John is easy*” and although John appears to be the subject of both sentences in (4), it is the surface subject only (N. Chomsky, 1968). The deep structure of (4), by contrast, suggests that *someone (else)* is the underlying subject, while in (3) *John* is the subject at both the deep and surface levels. C. Chomsky (1968) therefore claims that to interpret (4) correctly is a more complex task and requires more extensive syntactic knowledge. Later syntactic analyses suggest other reasons for the complexity of (4) vs. (3), but these will not be presented here.

makes little sense to compare structures according to their difficulty, for each structure simply develops in its own time, “according to a predetermined schedule, regardless of its specific properties” (p. 173).

The rapidity of syntactic acquisition has an implication for theoretical issues in linguistics, namely, the question C. Chomsky (1968) was investigating: *At what age is syntax complete?*

In the 1960s there were attempts made to relate the complexity of a sentence to its derivation in generative grammar, the Standard Theory by N. Chomsky (1965). This became known as the Derivational Theory of Complexity (DTC), which hypothesizes that “insofar as sentential complexity is a function of syntactic variables, the complexity of a sentence is measured by the number of grammatical rules employed in its derivation” (Fodor & Garrett, 1967:289). In other words, the complexity of a sentence is due to the length of its derivational history. This theory was, however, abandoned after research showed it was untenable, and it failed to relate linguistic complexity to psycholinguistics (e.g., Givon, 1985; Smith, 1985; Gibson, 1998).

According to Givon (1985:1021), “all other things being equal, structural complexity tends to accompany functional complexity in syntax.” He identifies three coding devices that make up syntactic structure: word order, morphology, and intonation, the first two of which are of interest here. He claims also that this principle is easiest to demonstrate from grammatical morphology, and gives the example of four major parameters of the simple/neutral clause: main, declarative, affirmative, and active. Therefore, it is in general likely that:

- (a) embedded/subordinate clauses will have extra morphemes over the main clause;
- (b) non-declarative clauses will have added morphology over the declarative;

- (c) negatives tend to have an added morpheme over the affirmative;
- (d) passive clauses tend to have extra morphology over the active.

Thus, he concludes, that “extra morphology” adds to structural complexity. For word order and intonation in simple clauses, however, he acknowledges that one must resort to a notion of relative, rather than an absolute measure of complexity.

Smith (1985) is most concerned with the relation between linguistic complexity and performance. She suggests that linguistic complexity is a property of individual sentences, and is a result of several factors in combination, such as systematic complexity, surface syntactic complexity, interpretive complexity, and phonological complexity. According to this theory, for a given sentence, a complexity profile can be created, such that it indicates complexity at each level. A sentence may have high complexity of one type and low complexity of another.

More recently, a theory of the relationship between the sentence processing mechanism and the available computational resources was proposed by Gibson (1998), who claims that the process of comprehending a sentence involves structuring a sequence of words syntactically and semantically to arrive at a representation of the sentence’s meaning. Because these processes consume computational as well as memory resources to maintain syntactic and conceptual structures activated in memory during the processing of a sentence, an important part of understanding how humans process sentences involves understanding the relationship between the sentence processing mechanism and the available resources.

One well-established complexity phenomenon to be explained by the theory of the relationship between sentence processing mechanisms and the available computational resources is the higher complexity of an object-extracted relative clause (RC) compared with a subject-

extracted RC as shown previously in (2) vs. (1), respectively, and now illustrated in (6) vs. (5) in an S-V-O language like English. In (5) the relative pronoun ‘who’ is extracted from the subject position of the RC, while the same pronoun is extracted from the object position in (6):

(5) [The reporter [who<sub>i</sub> [ t<sub>i</sub> attacked the senator]] admitted the error].

(6) [The reporter [who<sub>i</sub> [the senator attacked t<sub>i</sub> ]] admitted the error].

Object extraction is more complex by a number of measures including on-line lexical decision, reading times, and response-accuracy to probe questions (Holmes & O’Regan, 1981; Ford, 1983; Waters et al., 1987; King & Just, 1991). Furthermore, the volume of blood flow in the brain is greater in language areas for subject-object (SO) sentences in which the subject of the main clause plays the role of the object in the relative clause, as in (2) and (6), than for subject-subject (SS sentences) shown in (1) and (5) (Just et al. 1996; Stromswold, et al., 1996), where the head in both clauses plays the role of the subject, as in (1) and (5) above. Also, aphasic stroke patients cannot reliably answer comprehension questions about SO relative clauses, but they perform well on SS RCs (Grodzinsky, 1989; Hickok et al., 1993). The differences between relative clause types are further discussed in the sections to follow.

The source of this complexity difference between RC types cannot relate to lexical or plausibility differences, for both SS and SO structures involve the same lexical items in equally plausible relationships. Moreover, the complexity difference is not caused by a local ambiguity or a “garden-path” effect as in (9) below. Although there is a brief local ambiguity at the word ‘who,’ in both (5) and (6), there is no reanalysis effect. That is, theories of ambiguity resolution (Frazier, 1987, MacDonald et al., 1994; Mitchell, 1994; Trueswell, et al., 1994) make no

predictions in the examples of (5) and (6) (or generally in any construction that lacks ambiguity). Consequently, according to Gibson (1998), the only remaining plausible cause of the complexity difference is in the quantity of computational resources that the two constructions require to process. Furthermore, this processing theory on sentential complexity – unlike many other theories – is compatible with a wide range of phrase structure theories, including lexical functional grammar (Bresnan, 1982), dependency grammars (Hudson, 1984, 1990), categorical grammars (Ades & Steedman, 1982), Head-Driven Phrase Structure Grammar (Pollard & Sag, 1994), and the Minimalist Program (Chomsky, 1995).<sup>7</sup>

Another class of complexity effects to be accounted for by a theory of computational resources is the high complexity of nested or center embedded structures, such as (7), which contains a singly-nested embedded RC (as well as a sentence-final RC), and (8), which contains a doubly-nested RC structure:

(7) The intern [who the nurse supervised] had bothered the administrator [who lost the medical reports].

(8) The administrator [[who the intern [who the nurse supervised] had bothered]] lost the medical reports. (Gibson, 1998, p. 3.)

Increasing the number of nestings makes sentences unprocessable (Yngve, 1960). Again, the two sentences contain the same lexical items, and have the same meaning, so the complexity difference is not due to plausibility differences; also, there is no local ambiguity in (8), so the processing difficulty associated with this sentence is not related to ambiguity confusions. This type of sentence processing breakdown is often referred to as a processing overload effect.

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<sup>7</sup> See corresponding references for details of each theory, which are too extensive to describe here.

Gibson (1998) also notes that this effect is different from processing breakdown caused by the “garden-path” effect as in (9):

(9) The dog walked to the park was chasing a squirrel.

While these types of “garden-path” sentences are relatively problematic, the correct interpretation can be obtained and the sentence can be eventually processed without difficulty. On the other hand, it is not possible to arrive at a correct interpretation of sentences like (8) using a normal sentence processing mechanism.

Sentences such as (8) are complex cross-structurally and cross-linguistically.

Unfortunately, there is currently little agreement as to what properties of complex constructions make them hard to understand, including those properties cited above. One of the theories currently available in the field is the previously mentioned theory of Yngve’s (1960), stacking incompletely parsed phrase-structure rules according to which complexity is indexed by the number of phrase structure rules that the parser has to hold in memory on a stack at a particular parse state.

Another theory is the one of self-embedding (Gibson & Thomas, 1996) which states that the parser has additional parsing difficulty with self-embedded structures such as (8), and part of the difficulty understanding it is due to the fact that the most embedded clause itself is self-embedded within the second clause, which itself is self-embedded in the matrix clause.

Yet another hypothesis is the perspective-shift theory (MacWhinney & Pléh, 1988), according to which processing resources are required to shift the perspective of a clause, where the perspective is taken from the subject of the clause. Consequently, processing an object-extracted RC requires two perspective shifts: one from the perspective of the matrix subject to

the subject of the RC, and the second from the perspective of the subject of the RC back to the matrix subject, after the RC is processed. Processing a doubly-nested RC structure like (8) requires multiple perspective shifts, and so it is more difficult than the processing of a subject-extracted RC, which requires no perspective shift since the matrix subject is also the subject of the RC, and thus comes from the same perspective. Nevertheless, there are some doubly-nested structures that are processible, such as:

(10) The reporter [who everyone [that I met trusts]] said the president won't resign yet.

(Bever, 1974)

(11) A book [that some Italian [I've never heard of]] wrote will be published soon by

MIT Press. (Frank, 1992)

While Bever (1970, 1974) was the first to note that examples like these were acceptable, Kac (1981) noticed first that these structures all contained personal pronouns in the most embedded position, and so this indexical pronoun makes the structure processible. The previously discussed Gibson's (1998) distance-based dependency locality theory accounts for the contrast between (8) and (10), by claiming that building new discourse structure requires more resources than accessing previously constructed discourse structure. Warren & Gibson (2002) demonstrated support experimentally that there is a cost associated with identifying a referent for an NP, consistent with earlier research (Garrod & Sanford, 1982; Murphy, 1984). Furthermore, experiments using questionnaires of intuitive complexity (Warren & Gibson, 2002) provided evidence that the location and amount of processing cost are dependent on sentence structure.

These findings mean that syntactic complexity — however determined — must bear on reading time and reading comprehension. Therefore, in our quest to uncover the relationship between syntactic abilities and reading comprehension, we will give a brief overview of readability formulas, the most widely used methods to identify difficulty of a text by assigning to it a numerical estimate of “readability.”

### **3.4. Readability formulas**

According to Adams (1993), readability or text difficulty is not a unary dimension. A text can be more or less difficult at the level of words, syntax or concepts, but identifying the features that make a text easy or difficult is a challenge to current reading theories. Because they are intended as quick and convenient measurements, typical readability formulas take into account only easily measurable aspects of a text. Consequently, the problem is that they do not measure all of the factors that influence the comprehensibility of a text. Some readability formulas produce estimates that represent grade levels; others range over a 100 point scale where higher numbers indicate greater readability. According to Bruce & Rubin (1988), because most of the formulas include only sentence length and word difficulty as factors, they can account only indirectly for factors that may make a text difficult, such as syntactic complexity or rhetorical structure. Furthermore, Bruce & Rubin (1988) also state that because the formulas are text-based measurements isolated from the context of use, they cannot reflect such reader-specific factors as motivation, interest, or purpose. Anderson & Davison (1988) are also critical of the use of readability formulas, for they measure features that are correlated with difficulty,

but do not cause it. While the first readability formulas were constructed in the 1920s (Vogel & Washburne, 1928) and have undergone some development since then, the general conception has remained the same.

While the research in readability has uncovered over one hundred factors related to difficulty, (e.g., vocabulary, sentences, ideas, concepts, organization, content, abstractness, appeal, format, and illustrations), the two found consistently to be most strongly associated with comprehensibility are vocabulary difficulty and sentence length, as noted above. The stronger factor of the two is vocabulary difficulty, which is measured – for English – either by a count of unfamiliar words, words of low frequency, words of three or more syllables, or words of seven letters or more. Once a vocabulary factor is used in a formula, another factor adds little to the prediction. Average sentence length, measured by the number of words in a sentence, is the second strongest and second most widely used measure of difficulty in readability formulas. It is apparently very highly related to other measures of syntactic difficulty and in order to avoid confounding effects, only one sentence factor is usually used in a formula.

To summarize, vocabulary difficulty and sentence length together predict the comprehension difficulty of written text to a high degree of accuracy, although there is disagreement as to the value of such predictions, as described above. Still, most current readability formulas are based on two factors: vocabulary (measured by word frequency) and syntax (measured by average sentence length). While vocabulary/word frequency as a factor is used by all of them, not all formulas use syntax/sentence length as a variable. These two variables contribute to the formulas in different weights: sentence length seems to be somewhat more important in primary grade materials, while word difficulty is more important in middle-grade materials (Harris & Sipay, 1980).

The problem that has a relevance to our research, however, is that while the number of words in a sentence may be correlated with syntactic complexity, it is not its cause. To illustrate, let us consider the following groups of sentences, (12) – (14), provided by Adams (1993):

(12) The dog chased the cat. The cat killed the rat. The rat ate the malt.

(13) This is the dog that chased the cat that killed the rat that ate the malt.

(14) This is the malt the rat the cat the dog chased killed ate.

Clearly, complexity increases from (12) to (14); however, it can be seen that the key to syntactic ease or complexity cannot really be measured by just the number of words or ideas in a sentence. (14) has fewer words than (13), yet it is harder to comprehend because of a processing overload effect of multiply-nested structures.

Despite the efforts in the early 70s to use theories of transformational grammar to improve the measurement of syntactic complexity of the readability formulas, the more empirical and “theoretically weaker” average sentence length measure was used instead because empirical tests found it to be more predictive of comprehension difficulty (Bormuth, 1969; MacGinitie & Tretiak, 1971). However, this means, again, that a longer, coordinative sentence structure might get a higher score than a shorter, but more complex subordinative sentence. In fact, to illustrate the discrepancy between sentence length and difficulty, Charrow & Charrow (1979) compared revisions of jury instructions. For example, (15a) and (15b) are almost the same length and the vocabulary in both sentences is difficult, but (15b) produced significantly higher comprehension of the subjects.

(15a) An essential factor in contributory negligence is that it contributes as proximate cause of the injury (Charrow & Charrow, p. 1354)

(15b) If the plaintiff was contributorily negligent, he actually helped cause his own injury, through his own negligence. (Charrow & Charrow, p. 1355).

This, therefore, indicates that in some cases comprehension of a sentence is made difficult by some features of the sentence structure itself, i.e. not just its length, along with the composition of its lexical items. Anderson & Davison (1988), however, argue that difficulty of comprehension is not linked in a simple way to complex features of sentence syntax. In other words, there is no general causal relation between how long a sentence is and how easy it is to understand. This is not to say that sentence structure has no effect on how well a sentence can be understood. What is not easy to characterize is some general definition of sentential complexity because it is not an absolute value. Sentence features do not always make processing difficult; sentence features interact with other sentence features, and the characteristics of readers as well.

In a study by Irwin & Pulver (1984) it was demonstrated that participants at the 3<sup>rd</sup>, 5<sup>th</sup>, 8<sup>th</sup> grades and college level comprehended the following two sentences differently:

(16) Because Mexico allowed slavery, many Americans and their slaves moved to Mexico during that time.

(17) Many Americans and their slaves moved to Mexico during that time because Mexico allowed slavery.

The prediction was that (16) would always be easier because of the general cause-before-effect

ordering, i.e. *because* followed by the main clause. While this was the case for the older and more skilled readers, younger and less skilled readers did not use the cause-effect ordering. The version with the pre-posed adverbial clause (16) was more difficult for the participants in the 3<sup>rd</sup> and 5<sup>th</sup> grades. Yngve (1960) attempted to answer the puzzle associated with the question of why a pre-posed clause should be more complex for less-skilled readers than a similar clause that follows the main verb and its objects, i.e. main clause followed by *because*, as in (17). He proposed that because pre-posed adverbial clauses are left branches, and as such they always require more memory capacity to produce and understand than right branches, large phrases must be held in memory until the main clause constituents are found (Bever and Townshend, 1979).

Kemper (1988a) investigated this with elderly adults who have less working memory capacity than younger adults do, and she compared their ability to recall or paraphrase sentences with left branching and right branching structures. She found that the elderly had more trouble paraphrasing sentences with left-branching structures than the right-branching ones. Therefore, left-branching structures appear to be more complex than right-branching ones for readers with memory limitations as predicted by Bever & Townshend (1979).

There have been some objections to this view, mainly by Frazier (1984), who claimed that sentences such as (18), which is right-branching, were not read any differently than (19), which is left-branching, according to eye-movement studies by Frazier, Rayner & Carlson (cited in Frazier, 1984).

(18) That the traffic in this town is unregulated bothers me.

(19) It bothers me that the traffic in this town is unregulated.

However, if there is a pronoun in the pre-posed embedded clause, sentences of the type in (20)

were read slower than those like (21):

(20) That people look at him strangely bothers Mary.

(21) It bothers Mary that people look at him strangely.

Researchers (e.g., Chall, 1984; Klare, 1984) are aware of the shortcomings of these readability formulas and how they fail to capture factors such as readers' background knowledge, writing style, and text organization. At the same time, they are also aware of the impossibility of reducing text properties to formula variables. Nevertheless, both Chall and Klare interpret available evidence as demonstrating that vocabulary and sentence length/complexity account for a large proportion of the variance in the understanding of texts, despite the uncertainty and disagreements among researchers.

As we demonstrated in the previous section on sentential complexity, length and difficulty — while in most sentences go hand-in-hand— do not correlate in some structures. We have also shown that evidence of sentence complexity — aside from readability — has been determined by psycholinguistic phenomena (language development), along with criteria (albeit controversial) related to structural elements of the sentences themselves. We now consider both of these factors — psycholinguistic and linguistic — in our discussion, below, where we turn our attention to some of the structures in question, the ones that have been found to cause difficulty for readers across languages. We will begin our discussion with a description of Hungarian, given that it is the native language of our participants, followed by English, and a comparison and contrast between the two.

### 3.5. Syntactic development in Hungarian

Hungarian is typologically very different from Indo-European languages, such as English. It is spoken in Hungary by approximately 10 million people and in the neighboring Central European countries where Hungarian minorities reside. In addition, there is a sizeable population of Hungarians in North America, Israel, and Australia as well as in Western Europe. Being a member of the Ugric branch of Finno-Ugric languages, Hungarian, unlike English, appears to be free with respect to word order, without affecting the grammaticality of the sentence. Subjects, objects, and most adverbials seemingly appear in almost any combination and sequence. The sentence “*Kati hit Anna at school*” can legitimately have the following word orders.

(22) Kati    megütötte    Annát                    az                    iskolában.

          Kati    hit                    Anna (ACC)            the                    school (at).

(23) Kati    Annát                    megütötte            az                    iskolában.

          Kati    Anna (ACC.) hit                    the                    school (at).

(24) Az    iskolában            Kati                    megütötte            Annát.

The school (at) Kati hit Anna (ACC.).

(25) Kati az iskolában megütötte Annát.

Kati the school (at) hit Anna (ACC.).

(26) Az iskolában megütötte Annát Kati.

The school (at) hit Anna (ACC.) Kati.

(27) Megütötte Annát Kati az iskolában.

Hit Anna (ACC.) Kati the school (at).

(28) Annát az iskolában megütötte Kati.

Anna (ACC.) the school(at) hit Kati.

(29) Kati Annát ütötte meg az iskolában.

Kati Anna (ACC.) hit the school(at).

In the above examples we can observe that while English marks the subject and the object of sentences by strict word order, Hungarian does so with the accusative suffix *-t* (along with vowel lengthening). Thus, Anna appears as *Annát* in various positions in the sentences above. Different word order patterns, however, receive characteristic stress and intonation and semantic interpretation. While the structure of the VP is regarded as non-configurational (or flat), focusing, quantification and topic are all sensitive to word order.<sup>8</sup>

Therefore, in contrast to languages like English, the order of major constituents is independent of their syntactic functions and is subject to great variation in Hungarian sentences. The position of a constituent is determined by an interplay of such factors as its communicative role or discourse function, describable with terms like Topic and Focus, its logico-semantic category, and its logical scope (Kiss, 1987). Thematic roles and syntactic functions, rather than being encoded in terms of constituent structure, are expressed by morphological devices, primarily by attaching case suffixes or postpositions to Determiner Phrases (DPs). According to Kiss (2002), the functions associated with different structural positions are logical functions, e.g. verb, noun, instead of grammatical functions i.e. subject, object, etc. Therefore, the factors that constrain word order in the two languages are very different in nature: in English they mostly concern grammatical functions (and other strictly grammatical properties); in Hungarian they exclusively concern discursive or logical functions. The claim in most recent work on Hungarian is that Hungarian is in fact not a “free word order language” – though a particular proposition can be expressed in a wide variety of ways (more so than in English) – as shown in the examples above. However, for each particular word order there is a particular set of felicity conditions that makes it appropriate only in a specific context (den Dikken, personal

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<sup>8</sup> These syntactic properties are not related to the issues in the dissertation and so will not be detailed here. See Kiss (2002) for extensive discussion.

communication, June 2008). Free word order languages can, in principle, either be “discourse configurational” (i.e., having its word order constrained by discursive/logical functions, like topic and focus) or completely unconstrained (“non-configurational”). Whether the latter type of language is actually instantiated is a question. But at least in principle, there is no logical connection between being a free word order language and being a structural focus language, which also encompasses structural topic as well; in a discourse-configurational language, *all* discursive/logical functions are structurally encoded, giving rise to specific word orders.

In fact, the literature on Hungarian generally refers to the language as a language with a structural focus or syntactic focus position (e.g., Kiss, 1981; Horvath, 1986). A “structural focus language” means a language in which main focused constituents appear only in a given syntactic position, as opposed to languages, like English, where focus can be realized as a main stress occurring on any constituent, in any structural position in the sentence. If, for example, we look at example (29) above, the exact translation would be “*It was Anna that Kati hit at school.*” In Hungarian this meaning is manifested in a slight change of the verb preceding the particle (*ütötte meg* as opposed to *megütötte*).

Hungarian children learn their language in much the same way that English children do. According to MacWhinney (1985), however, because Hungarian is an agglutinative language and because the word order is so variable, the acquisition of individual words assumes a particularly central role in the child’s development of communicative competence. In fact, MacWhinney (1985) claims that the clearest indicator of the level of development of a Hungarian child is not so much the length of sentences he or she can produce, but the morphological complexity of the words contained in those sentences. Hungarian children enter

the two-word period at around age 1.6. The most important suffixes emerge between 1.8 and 2.8. MacWhinney (1985) also claims that Hungarian provides an interesting case for theories like that of Brown (1973), which attempt to predict the order of acquisition of grammatical morphemes on the basis of semantic complexity. In Hungarian the formal complexity of various grammatical markers is held constant by the fact that nearly all of the major markers are suffixes. Moreover, all of these suffixes are subject to the same basic set of phonological rules (i.e. of vowel harmony) and many are subject to rules of linking-vowel insertion. This situation contrasts sharply with the one in English where some grammatical markers are free morphemes, such as articles and auxiliaries, and some are suffixes (e.g. *-ed*) and discontinuous morphemes (e.g. *have+ -en*).

Another area of grammatical function that deserves study in Hungarian syntactic development is the contrast between the definite and indefinite (objective and subjective) forms of the verb. This contrast between the two forms involves a rather complex set of interactions between semantic and syntactic patterns. For example, intransitive verbs are always indefinite, as are verbs whose objects are indefinite, as in, “*látok egy macskát*” vs. “*látom a macskát*” (*I see a cat* versus *I see the cat*). The suffixes differ according to this in/definiteness: *-k* versus *-m*, in first person singular.

Despite these complexities, Hungarian children make few errors in their choice of inflection after the age of approximately 3.6 (MacWhinney, 1985), but exactly how they learn to control the verb system is a question that has not been yet investigated adequately. Errors made in verbal morphology are very prevalent, however, in foreigners’ speech, which signifies the difficulty of this aspect of Hungarian.

### 3.6. Late-emerging structures in English and Hungarian

Since reading comprehension may be dependent on knowledge and processing of syntactic structures, and especially on the ones that emerge relatively late in the course of language acquisition, they are of special interest for us, since they are also the very structures that might cause one to be less effective in his/her reading comprehension. In fact, several studies have shown children in the early school grades with poor reading comprehension have comprehension problems in spoken language as well (e.g., Byrne, 1981; Stein, Cairns, Zurif, 1984). Such findings provide evidence for the Structural Deficit Hypothesis, which has been discussed in detail in Chapter 2. In the following section we will give an overview of the structures that are considered to be not only milestones in children's syntactic development, but also among the most difficult ones cross-linguistically.

Based on research in English and other languages, the first syntactic category that appears in children's language is nouns (e.g., Gentner, 1981; Clark, 1983). The second most common word class is something that Gentner (1982) calls the "predicate" category, consisting of words that name a property of nouns, and it later divides into verbs and adjectives. Word-combination begins with two-word utterances. While it is possible that the first phrases produced by children are memorized units, the rapid increase in the number of multiword utterances suggests that productive rules must play a role at some early point.

"One of the most interesting and important aspects of language acquisition is the child's development of an ability to produce and understand complex sentences of various kinds"

(Limber, 1973, p.169). The production of relatively complex English sentences begins around the age of 3, when the mean length of utterances (MLU) is close to 4.0 (H. Cairns, 1996), and the first complex structures in children's speech are object complements or complex nominals.

Some examples of these include the following:

(30) I want John to go.

(31) I'll show how to do it.

(32) I don't remember if I was there. (Limber, 1972: 174).

As communication requires more sophisticated structures with maturation, children's language must have a way to mark the grammatical roles of the various phrases that can occur in the sentence. For example, in a sentence "*The child fed the cat,*" there must be a way to indicate that the first NP functions as the subject, and the second NP as direct object. Two of the most common ways to convey this sort of information in languages are through linear position (word order), and affixation (case) (O'Grady, 1997), as is the case with Hungarian. Since English is a language with very strict word order, the few constructions in which the canonical or standard word order is violated are very difficult for children. One such construction is the passive. In fact, English-speaking children produce very few passive sentences until late stages in their language development, especially the full passive (see discussion in 3.6.1.).

When a child produces a yes/no question, it is very significant, for this structure requires movement of the auxiliary to a complementizer position. Similarly, the production of *wh* questions with inverted auxiliaries demonstrates movement from a lower to a higher clause. It was mentioned in section 3.3., that relative clauses are among the most difficult structures for children to comprehend. One of the reasons for this is that the structure of relative clauses is

closely related to that of *wh*-questions, since in both involve a somewhat similar moved element (see section 3.6. 2).

Previously it was thought that by the time children begin school, they have acquired most of the morphological and syntactic rules of their language. However, most recent studies of English indicate that developmental changes in knowledge of syntactic and morphological rules continue to occur after age five, and throughout the school years. Therefore, according to Menyuk (1984) it is not the case that that on entrance to school the child has a fully mature grammar of the language, which might then be available for processing all types of written material presented. In more recent studies Snow et al., (2005) also confirmed this hypothesis.

There are obviously, then, areas of structural knowledge which remain to be acquired. Furthermore, as has been mentioned, it is assumed by most researchers that syntactically complex structures are those learned later, at the same time or even after the child has begun to read. Since reading is a language-dependent skill, we can hypothesize that structures acquired late would negatively affect reading comprehension until they are eventually learned. In the following sections we will discuss three late-emerging structures that Martohardjono et al., (2005) and others (e.g., Kieffer et al., 2007) have claimed are just those related to reading comprehension in English: the passive, centrally embedded relative clauses, and subordinate adverbial clauses containing the temporal relations *before* and *after*. These structures will be described as they occur in both English and Hungarian, which leads to the final discussion of this chapter: implications for the acquisition of these structures by Hungarian learners of English, laying the groundwork for potential syntactic effects on NNL reading comprehension.

### 3.6.1. Passives

Many languages in the world utilize different *voices* to put syntactic constituents in various positions. According to O'Grady (1997), passivization has the effect of reorganizing the relationship between thematic roles and grammatical relations found in active English sentences such as (33), where the agent *the cat* serves as subject and the theme *the cake* as direct object.

(33) The cat ate the cake.

Therefore, the goal of thematic passivization is to vary the focus of the sentence by taking advantage of a shift involving NP movement of the object to structural subject position. After passivization (34), the theme (i.e., “cake”) functions as subject while the preposition *by* is used to mark the now optional agent (i.e., “cat”):

(34) The cake was eaten (by the cat).

We can note that the agent is absorbed by the passive morphology of the verb. Furthermore, since *cake* bears the theta-role of theme, it will have to originate in object position. Since it occurs in subject position in passive, it will have moved from object position to subject position.

There are some effects of passivization: First, it affects the morphology of the verb. In (34) the verb *eat* is in its participial form and is accompanied by the auxiliary *be*. Also, in the passive sentence the AGENT of the activity is not expressed by an NP in an A-position. If we want to refer to the AGENT of the action, we need to use an adjunct PP headed by the preposition *by*. This agent plays the same thematic role as the subject of the corresponding active sentence, shown in (33).

There are two types of passive in English: one is the verbal, as in (34), and the other is the adjectival pattern, as in (35):

(35) He was shocked.

This is primarily a semantic distinction. In addition, passives have been classified into agentive, quasi-agentive and agentless in terms of whether they can or cannot occur with an agent. An example of an agentless passive, i.e., without a by-phrase, is shown in (36):

(36) The letter was sent yesterday.

The passive construction has a considerably long history of investigation in child English language development studies (e.g., Bever, 1970; DeVilliers & DeVilliers, 1973). In fact, it is one of the most widely studied structures in child language. This interest probably originates from the structure's early importance in constructing the theory of transformational linguistics by Chomsky (1965), and also from the fact that children seem to have difficulty comprehending the structure accurately (e.g., Bever, 1970; Whitehurst, Ironsmith & Goldfein, 1974). Children have a strong tendency to interpret the passive as an active because of the resemblance of passives to the NP-VP-NP meaning *agent-action-object*, pattern of active sentences

Other research has focused on the reversible and nonreversible active and passive sentences (e.g., Turner & Rommetveit, 1967). A sentence is considered reversible if its agent and theme arguments can be switched without making the sentence implausible. For example, sentence (33) is non-reversible, for *The cake ate the cat* is not plausible, while *The girl kissed the boy* and *The boy kissed the girl* are equally plausible.<sup>9</sup> The most common error observed with

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<sup>9</sup> Therefore children easily misinterpret "*The boy was kissed by the girl*" as "*The boy kissed the girl*," while misinterpretation of "*The cake was eaten by the cat*" is not likely (*\*The cake ate the cat*).

comprehending passive constructions is reversal as has been mentioned previously. Thus, children treat the theme subject as if it were the agent and the agent as if it were the theme.

Although linguists speak of a universal characterization of the passive (e.g., Perlmutter and Postal, 1977; O'Grady, 1981; Dryer, 1982), there is no doubt that the passive is not a language universal, for irrespective of how it has been defined, it has not been attested in numerous languages of the Australian continent, Polynesian languages such as Tongan and Samoan, and many Native American languages, just to name a few (e.g., Siewierska, 1984). While the passive construction is not restricted to Indo-European languages, it is mostly associated with accusative, subject prominent, reference dominated languages, which are the characteristics of the Indo-European group. It is difficult to determine the actual distribution of the passive because of the lack of consensus of what passive is.

Whether or not the passive exists in Hungarian is somewhat controversial, although most linguists agree that it does not. For sure, Hungarian does not have a “garden-variety” passive of the English type.

The agentless passive in Hungarian, as shown in the English example (36) above, does not exist in the form that it does in Indo-European languages. In (37), for example, when the predicative adverbial participle phrase accompanies a finite copula, the copula and the participial head form a complex predicate, sharing all operator projections, including AspP:

(37) [TopP A kérdőív [AspP ki van<sub>i</sub> [VP t<sub>i</sub> töltve ]]]

The form in is filled.

The form is filled in.

(Kiss, 2002, p. 225).

If the copula is in an unstressed position following a focus or a negative particle, then the main verb will surface in front of the participle it belongs to:

(38) [FP A KÉRDŐÍV van<sub>i</sub> [ kitöltve ]]

The form is filled in

It is the form that is filled in.

(39) [ A kapu [ NegP nincs befestve.]]

The gate isn't VM painted.

The gate isn't painted.

Some argue that in a construction like that of (40), the copula+adverbial phrase complex functions as a kind of passive construction, as regular passive verb morphology is extinct in present-day Hungarian (Alberti, 1998). The imperfective and perfective variants of the copula

result in aspectually different interpretations, corresponding to the English passive constructions derived by the auxiliary *be* and *get/become*, respectively:

(40) a. A kapu be van festve

The gate is/has been (painting) painted.

(40) b. A kapu be lett festve.

The gate became (painting) painted.

According to Kiss (2002), the distribution of this construction in Hungarian is markedly different from that of the English passive. On the one hand, it is narrower; it can only be used if its subject is an affected theme undergoing a change of state:

(41) \*Mari meg van látva.

Mary has been (seeing) seen.

(42) Mari meg van hatva.

Mary has been (moving) moved (emotionally).

At the same time, the distribution of this passive-like construction is also wider than that of the English-type passive: intransitive verbs with an affected theme can also be “passivized” in this way, and they allow only the imperfective copula:

(43) A virág el van hervadva.

The flower is wilted.

(44) A ruha ki volt fakulva.

The dress was faded.

These kinds of agentless “passives” could be called the stative constructions. When derived from a transitive verb, they are very similar to a real passive construction both in syntax and morphology, but they have a function which is analogous to that of the English adjectival passives. They may be used for asserting that their subject is/was/will be in the state brought about by the event denoted in the input verb. Except for some set phrases, a stative construction can only be formed from perfective complex predicates or predicate complexes denoting a change of the patient/theme argument.

Another construction (even though, non-standard), which could be called “perfective dynamic passive” (45)-(46) differs from the above mentioned stative construction only in a small detail: the verb *lesz* (become) is used in place of the copula. Since this construction is always perfective, it has only two tenses: past and future. Perfective dynamic passives can only be formed from transitive verbs. As for their meaning, they are translational equivalents of simple past and future tense forms of English agentless passive.

- (45) A levél holnapra meg lesz írva.  
 The letter tomorrow-ONTO PREV will be written  
 By tomorrow, the letter will have been written.

- (46) Péter nagyon meg lett verve.  
 Peter very PREV became beaten  
 Peter was very much beaten up.

(Komlósy, 1994)

Alberti (1997, 1998) claims that passivization can be interpreted as agent suppression or patient preferring, or both. Hungarian opts for interpreting passivization as patient preferring, which also licenses passivization in the case of unaccusative verbs with an affected subject. Choosing this type of ‘passive’ instead of the active verb form – (47 a. b.) – has primarily aspectual consequences:

- (47) a. A ruha ki volt fakulva.  
 The dress was faded.  
 (47) b. A ruha kifakult/ Kifakult a ruha.

The dress faded. Faded the dress.

Preferring the patient in the case of (47a) means that the affectedness of the patient is focused on.

A further argument against syntactic passivization in Hungarian can be built on the properties of phrases headed by archaic active adverbial participles, such as in (48).

(48)	New York-ba	érkeztén	mindjárt	hazatelefonáltam.
	New York (into)	arrive-PART	soon	hometelephoned I.

When arriving in New York, I phoned home immediately.

According to Komlósy (1994), these are the only participles that seem to have a subject relation which needs not be controlled and even may be filled by a lexical expression. He also calls attention to the fact that the best conditions for syntactic passivization are found in this kind of participial phrase.

In summary, Hungarian differs from English in that passive does not exist in the form that is does in English. It has, however, passive-like structures that superficially look like the English passive, but in fact, they are underlyingly quite different. This lack of similarity in structure has potential effects on the acquisition of the passive by Hungarian learners of English, as will be discussed in section 3.7. The degree to which such syntactic effects impact the English reading comprehension of these learners is the primary subject of this dissertation. Thus, it is important to learn about each syntactic structure potentially having such an effect.

### 3.6.2. Relative Clauses

We have already introduced relative clauses in previous sections, where we discussed sentence complexity and readability. Such clauses are very frequent in written material, as well as oral language, and are therefore a critical structure for acquisition. The acquisition of relative clauses has been studied extensively in the past thirty years. The majority of these investigations are concerned with children's comprehension of relative clauses in English (e.g., Brown, 1971; Sheldon, 1974; Smith, 1974; Tavakolian, 1977, 1981; Hamburger & Crain, 1982; Tager-Flusberg, 1982; Schuele & Nicholls, 2000; McKee & McDaniel, 2001; Kidd & Bavin, 2002). In English, relative clauses are embedded clauses that modify noun phrases in the clause above them. For example, in

(49) [I found the book [that<sub>i</sub> [you lost t<sub>i</sub>]]].

the relative clause (RC) “*that you lost*” modifies the noun “*book*” in the subject NP “*the book.*”

Diessel & Tomasello (2000) showed that children's early relative clauses are attached either to an isolated head noun or, more frequently, to the predicate nominal of a copular clause. Some typical examples are given in (a)-(c):

- (a) The girl that came with us.
- (b) This is the sugar that goes in there.
- (c) Here's a tiger that's gonna scare him.

(Diessel & Tomasello, 2005, p.2).

The same constructions seem to be characteristic of children's early relative clauses in many other languages, including French, (Hudelot, 1980; Jisa & Kern, 1998), German (Brandt, 2005), Hebrew (Dasinger & Toupin, 1994), and Indonesian (Cole et al. 2003).

In an attempt to determine the universal properties of RCs by comparing their syntactic form in a large number of languages, Keenan & Comrie (1972) proposed the Noun Phrase Accessibility Hypothesis (NPAH). After examining 50 languages they stated that "languages vary with respect to which NP positions can be relativized, and that the variation is not random" (Keenan & Comrie, 1977, p. 66). The range of accessibility goes from relativizing the subject to the object of comparison. The relativizability of certain positions is dependent on that of others, and these dependencies are universal. Keenan & Comrie (1977) thus formulated the Hierarchy Constraints (HCs) as follows:

1. A language must be able to relativize subjects.
2. Any RC-forming strategy must apply to a continuous segment of the Accessibility Hierarchy.
3. Strategies that apply at one point of the AH may in principle cease to apply at any lower point.

Empirical testing, however, revealed that the NPAH is not a viable hypothesis, for it cannot be applied to languages such as Cantonese, Korean, or Japanese.

Universally, relative clauses – just like passives – have been widely studied and recent research in psycholinguistics has proposed many theories in order to explain differences in processing difficulties of these structures. The question is what influences the comprehension of

nested structures, in particular, sentences containing relative clauses that modify head nouns in subject position. In English, there are four basic types depending on what the role of the head in the main and in the relative clause is. If the head in both clauses plays the role of the subject, we get a centrally-embedded, subject-subject (SS) structure, as briefly discussed in section 3.3 and now shown in (50):

(50) *The boy [that likes the girl] chases the cat.*

If the subject of the main clause plays the role of the object in the relative clause, we have a centrally-embedded subject-object (SO) structure, as shown in example (51):

(51) *The boy [that the girl likes] chases the cat.*

Furthermore, if the head is the object of both the main and the relative clauses, then we get an object-object (OO) structure, such as in (52):

(52) *The boy likes the girl [that the cat chases].*

Finally, if the head plays the role of object in the main clause, and the subject of the relative clause, then we talk about an object-subject (OS) structure, like

(53) *The boy likes the girl [that chases the cat].*

The two major structural variables, then, are embeddedness, namely the role of the complex NP in the sentence, and focus, or the role of the head noun within the complex NP. Because of the rigid word-order of English, the role of head noun in the main clause is inseparable from the fact whether the relative clause interrupts the main clause or not. This means that in English one cannot really investigate the two factors independently, for subject-headed relative clauses are always centrally embedded. This is not the case in Hungarian, where

due to its flexible word- order all varieties can be centrally embedded. In fact, in Hungarian one can create minimally 144 different relative clauses based on the examples of (50)-(53).

Many early researchers investigated only one structural variable, e.g. embeddedness, without controlling for the second. However, even among those researchers who carefully controlled for embeddedness and focus, there is no consensus about the relative difficulty among the four sentence types. According to Diessel & Tomasello (2000) "...as children grow older, they begin to use relative clauses that are attached to an element in a full-fledged main clause" (p. 2). In contrast to the main-clause object, however, the main-clause subject is only rarely modified by a relative clause; in fact, in Diessel & Tomasello's (2004) data there was only one child who produced a few SS and SO relatives before the age of 5.

Sheldon (1974), for example, theorized that SS and OO sentence types would be more easily understood than SO and OS, since in those the head noun has the same function in the complex NP as in the matrix sentence. Tavakolian (1977),<sup>10</sup> however, argued against the parallel function claim. She proposed the same order of difficulty (SS<OO< SO<OS) but with a different explanation: SS sentences were easily understood because of a conjoined-clause analysis; in other words, they are treated as coordinates rather than embeddings. OS sentences are, on the other hand, poorly understood because they are analyzed as SS sentences.

DeVilliers et al., (1979) conducted a study similar to Sheldon's and Tavakolian's, using the same sentence types and act-out procedures, with a larger sample of participants. Their data suggest a different order of difficulty, primarily in that OS was no more difficult than SS. The order of difficulty of their participants was OS=SS< OO< SO. Yet in another theory, Kuno (1974)

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<sup>10</sup> While Tavakolian revised aspects of the conjoined-clause hypothesis (e.g., Goodluck & Tavakolian, 1981), it is still one of the most frequently discussed hypotheses in the literature on the acquisition of relative clauses.

hypothesized that OS and OO relative clauses would be easier to acquire than SS and SO types. He reasoned that when the embedded relative clauses interrupted the sentence by coming directly after the subject of the main clause, — the phenomenon previously described as central embeddedness —, they would be more difficult to process than those relative clauses that modified the object of the main sentence and thus came at the end of the sentence.

In most recent research, (as discussed in section 3.3.) within centrally embedded relative clauses, the ones that are subject-extracted, i.e. SS, are easier to process than object-extracted, i.e. SO, relative clauses for a number of reasons that are discussed below.

First, the structure-based accounts that follow a generative approach claim a universal preference for subject relative clauses. Second, the working-memory-based approaches rely on functional factors such as cognitive resources and integration constraints. According to this latter theory, object relatives are harder because there is a “larger number of temporally incomplete dependencies in the processing of object extractions” (Real & Christiansen, 2007:2). More specifically, the previously discussed dependency locality theory (Gibson, 1998; Gibson, 2000; Warren & Gibson, 2002) is based on the principle that “dependencies between lexical items are constrained by both storage and integration resources.” (Real et al., 2007, p. 2). Finally, according to experience-based accounts, the observed difference may be explained, at least in part, by differences in exposure to statistical regularities of the language (MacDonald & Christiansen, 2002; Tabor et al., 1997).

Previous research has shed light on the distributional regularities of the use of relative clauses in English. For example, Fox and Thompson (1990) examined transcripts of naturally occurring conversations, exploring distributional characteristics of 414 relative clauses. They

found that the distribution of object and subject relative clauses varied according to the properties of the head noun phrase of the main clause. For example, if the head noun phrase was an inanimate subject, such as in (54), object relatives were more frequent than subject relatives, while if the head noun phrase was an animate object, such as in (55) then subject relatives were more frequent than object relatives. King and Just (1991) also found that fixation times on the final word of the relative clause were longer for object relatives than for subject relatives.

(54) The car that the man bought was red. (SO)

(55) The student that liked the professor failed the exam. (SS)

Several other studies support the conclusion that an important difficulty in processing object relative clauses involves the assignment of patient role. Baird and Koslik (1974) found that recall of the action-patient relations was poorer in object relatives than in subject relatives. Fraunfelder, Segui, and Mehler (1980) found that phoneme-monitoring times for targets immediately after a relative clause were longer for object relative clauses than for subject relative clauses.

In sum, there is a wealth of evidence to show that in English, at least, centrally-embedded relative clauses with extracted objects are more difficult than those with extracted subjects.

In Hungarian, comprehension is aided by relative pronouns that indicate whether the sentence is object headed or subject headed. This contrast is possible because of the existence of two paradigms of verbal conjugation: the objective (when the object is definite) and subjective (when the object is indefinite) conjugation. In relative clauses, the contrast serves a different

purpose. If the head noun plays the role of the object in the relative clause, the verb is obligatorily indefinite even though the head of a relative is usually thought of as semantically definite (Kuno, 1986), and this definiteness is even marked morphologically on the relative pronoun, as shown in examples (56) and (58) below. If the head noun is the subject of the relative clause, the conjugation varies according to the definiteness of the object in the relative clause; if the verb of the relative clause is intransitive, it will also appear in the indefinite. Therefore, the combination of the *-t* accusative marker on the relative pronoun (56)-(57) and the indefinite conjugation on the verb serves as a double marking of an object-extracting relative clause. Similarly, the combination of an unmarked nominative relative pronoun and the definite conjugation on the verb serves as a double marking of a subject-extracting relative clause in (56)-(58).

(56) SS:

A fiú aki szereti a lányt kergeti a macskát.

The boy-NOM who likes-DEF the girl-ACC chases-DEF the cat-ACC.

(57) SO:

A fiú akit a lány szeret kergeti a macskát.

The boy-NOM whom(ACC) the girl-NOM likes-INDEF chases the cat-ACC.

(58) OS:

A fiú szereti a lányt aki, kergeti a macskát.

The boy-NOM likes-DEF the girl-ACC who chases-DEF the cat-ACC.

(59) OO:

A fiú szereti a lányt akit a macska kerget.

The boy-NOM likes-DEF the girl-ACC whom(ACC) the cat-NOM chases- INDEF.

The role of the head in the relative clause is doubly marked: first, by case marking on the relative pronoun ( $\emptyset$  on nominative and  $-t$  on accusative) and second, by inflectional markings on the verb ( $\emptyset$  on indefinite and  $-i$  on definitive forms). According to Keenan and Comrie (1977) this means that the RC-forming strategy in Hungarian is case coding, for it unambiguously marks the roles of all nouns in both the main clause and the relative clause.

While English has the option to choose between *that* and *who* in case of animate nouns, Hungarian has separate pronouns for inanimate (*ami, amely*), and animate nouns (*aki*), as shown in (56) and their usage is obligatory.

Hungarian, unlike English, does not allow the zero form in object position. Therefore, a sentence such as “*The man the woman loved was tall*” is not possible in Hungarian. We might hypothesize that these types of relative clauses would pose an extra difficulty for Hungarians learning English although this will not be tested in our study.

To summarize the similarities and contrasts between Hungarian and English relative clauses, we note that in Hungarian all six orders of subject, object, and verb (SOV, OSV, SVO, OVS, VSO, VOS) are grammatical, but the SVO and OSV are the default, such that when the object is modified by an article, then the order is SVO, and when the object is indefinite and has no article then it is SOV. The implications of these contrasts will be discussed in section 3.7. We

now turn to the final complex structure in our investigation of syntactic complexity and its potential effects on L2 reading comprehension.

### 3.6.3. Adverbial clauses containing the temporal relations of *before* and *after*

Some subordinate clauses have adverbial functions, giving additional information that modifies a verb or a main clause. The (adverbial) subordinator, introducing the dependent clause, indicates the kind of relevance its clause has to the main clause. For example, the subordinators *before* and *after* indicate that it is the time aspect of the subordinate clause that is relevant.

Examples of these are shown in (60) and (61) respectively:

(60) The teacher took attendance before he gave a quiz.

(61) After the teacher took attendance, he gave a quiz.

Temporal subordinators have been investigated extensively by researchers, and studies have shown that children in the early school grades with poor reading ability also have problems comprehending these complex sentences. Not only are these sentences difficult in English; Ferreiro and Sinclair (1971), for example, found that sentences containing temporal order terms are difficult also for French-speaking children up to and even beyond the ages of 8 and 9. As mentioned previously in Chapter 2, some researchers have interpreted this association to mean that poor readers are delayed in acquisition of certain aspects of syntax (e.g., Byrne, 1981; Stein, H. Cairns, and Zurif, 1984).

There have been two explanations offered to account for children's difficulties with temporal terms. Most of the explanations (e.g., Clark, 1970, 1971; Amidon and Carey, 1972) presuppose the existence of distinct stages in language acquisition. Developmentally it means that some more complex structures emerge later than others and that preschool children initially lack the knowledge to comprehend the late-emerging structures. Within a theory of different stages of acquisition of these structures, however, there are two explanations: one attributes the difficulty to semantic reasons and the other one to syntactic factors. The semantic explanation is that children fail to understand the meaning of specific connectives. This explanation is supported by Clark's (1971) investigation of preschoolers' comprehension of sentences with "before" and "after". She proposed a semantic feature model in which words are learned one feature at a time, with superordinate features learned first and positive features learned before negative features. Therefore, *before* is acquired earlier than *after*, for it is +Time, -Simultaneous and +Prior, while *after* is +Time, -Simultaneous, -Prior (Clark, 1971).

Research within the alternative explanation attributes this difficulty to syntactic features, and the most important finding in this regard is that children under the age of 6 have difficulty comprehending sentences containing temporal terms, especially when the conceptual order of events and the order in which events are mentioned present a semantic conflict, such as in (62):

(62) Before the bear pushed the horse, he pushed the dog.

In this sentence, the action of pushing the dog occurred first, yet it is mentioned last.

On the other hand are sentences containing temporal terms in which there is a correspondence between the conceptual order and the order of mention, such as in (63): (63) After the bear pushed the horse, he pushed the dog.

Sentences like (63) are hypothesized to be easier than the ones like (62) because the actions are mentioned in the order of happening. A sentence like (63) does not put an unnecessary burden on the verbal memory, and for the – especially beginner – reader it is easier to process.

Furthermore, there is additional evidence to support this theory, namely, that sentences such as (64) do not pose the same problem as those like (60) do.

(64) Push the horse last and push the dog first.

Note that (64) uses coordination instead of subordination, which means easier processing (Martohardjono, et al., 2005).

However, another line of research demonstrates that kindergartners' frequent errors with comprehending *before* and *after* sentences are not random, and they do not depend on conceptual order versus order of mention, but often involve the failure to carry out the command in the subordinate clause. This error pattern has been observed in many studies (e.g., De Villiers et al., 1979; Hamburger & Crain, 1982; Hsu et al., 1985) and it is in accordance with the claim of Smith & McMahon (1970) that information in main clauses is more easily interpreted than information in subordinate clauses. In fact, this is the case even in adulthood. In Smith and McMahon's experiment, adults were presented with sentences containing *before* and *after*, followed by the question "*what happened first?*" or "*what happened second?*" Although main clauses were more easily remembered than subordinate clauses, and first events were more easily remembered than second events, there was no indication that the order in which events were mentioned, affected comprehension. The order-of-mention hypothesis is orthogonal to the proposition that any sentence with *before* is easier to comprehend than any sentence with *after*.

Temporal adverbial clauses in Hungarian follow the same pattern as in English, with the only difference being that Hungarian, as a PRO-drop language,<sup>11</sup> does not require the personal pronoun in the second clause. Therefore, the word order in Hungarian can be exactly the same as it is in English:

(65) Mielőtt a lány hazament, fölhívta az apját.

Before the girl went home, (she) called her father.

(66) A lány fölhívta az apját mielőtt hazament.

The girl called her father before (she) went home.

(67) Miután a lány fölhívta az apját, hazament.

After the girl called her father, (she) went home.

(68) A lány hazament miután fölhívta az apját.

The girl went home after (she) called her father.

There are two principles interacting in these sentences: one is the correspondence of the order of mention and the order of events, according to which in the case of *before* and *after*, (66) should be easier than (65). The second principle is the relative difficulty of the order of adverbial clause-main clause versus the main clause- adverbial clause. According to this principle, (66) and (68) should be easier than (65) and (67). In other words, to aid processing, the

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<sup>11</sup> A PRO-drop language is one that allows the pronoun in subject position to be dropped. In Hungarian the verb carries the necessary information regarding person, number, etc.

main clause should come first, while the canonical order requests that the order of events correspond to the order of mention. Thus, the optimal case is when the main clause precedes the adverbial clause while the event that came first also is the main clause. If there were no interactions between the two principles, then (66) should be the easiest to process. However, there is an interaction according to which *after/miután* is considered easier for semantic reasons.

Pléh (1998) pointed out that even when the sentences are coordinative using the conjunction word *and*, we still inject logical timing into them as shown in (69). Thus (70) sounds bizarre since the timing does not match the order of the two clauses.

(69) Vera entered the bathroom, and she brushed her teeth. (Pléh, 1998:136)

(70) Vera brushed her teeth, and she entered the bathroom. (Pléh, 1998:136).

To summarize the contrast between Hungarian and English in temporal adverbial clauses, we find that the two languages operate the same way, and so the implications for L2 will be different from the previously discussed two structures, namely the passive and the relative clauses. We will now discuss the implications of these linguistic and native language acquisition facts for the development of syntactic processing in the non-native language, in preparation for our investigation of the effects of syntactic skills on reading comprehension in the non-native language. Therefore, the following section will examine how the above discussion relates to speakers who are in the process of learning a foreign/second language.

### 3.7. Syntactic issues in Second Language Acquisition

One of the central issues in the study of Second Language Acquisition (SLA) is the role the learner's L1 plays in the process. It is assumed that the L1 will have some influence on both the process and the final product of the SLA. The most frequent label for this phenomenon is transfer, defined by Odlin (1989) as "The influence resulting from similarities and differences between the target language and any other language that has been previously (and perhaps imperfectly) acquired" (p. 27). It is also referred to as cross-linguistic influence, which is often qualified by being either positive or negative. This labeling has been criticized by researchers primarily concerned with the processes underlying transfer (e.g., Faerch & Kasper, 1987; Sajavaara & Lehtonen, 1989), who claim that the distinction between positive and negative is relevant "at the product level only, not the process level" (Ringbom, 2007, p. 30). Transfer plays a part in the areas of syntax, morphology, phonology, semantics, pragmatics and the lexicon. For our research, the most important implication of transfer or lack of it is with regard to syntax and reading comprehension.

Researchers' interest mostly concentrates on negative transfer (interference) which is described as "absence of concrete (positive) transfer, leading to subsequent wrong assumptions about cross-linguistic similarities between L1 and L2" (Ringbom, 2007, p. 31), or as an inappropriate influence of an L1 structure or rule on L2 use (Saville-Troike, 2006). Positive transfer, could then be described as "the application of at least partially correct perceptions or assumptions of cross-linguistic similarity" (Ringbom, 2007, p. 31). Saville-Troike (2006) gave a

more direct definition by stating that “positive transfer is an appropriate incorporation of an L1 structure or rule in L2 structure” (p. 192). The ultimate question is to what extent prior linguistic knowledge has a facilitative or hindering effect on SLA and what counts as evidence for either positive or negative transfer. Clearly, for our participants – native Hungarian speakers having knowledge of Slovak and learning English as a foreign language – native language, foreign language input, and other psychological and biological factors, such as age, attitude and motivation, cognitive style and personality traits also played a role in their language attainment. However, since our investigation’s focus was on the role of syntax in non-native reading comprehension, we are only discussing some issues concerning cross-linguistic influence.

One of the observations that drive theories of SLA is that there are limits on the effect of a learner’s first language on L2 (VanPatten & Williams, 2007). In other words, there are constraints on transfer. Odlin (2003) explains the notion of constraint as follows: “it could be anything that prevents a learner from either noticing a similarity in the first place or from deciding that the similarity is a real and a helpful one” (p. 454). Two of the most interesting attempts to explain constraints have looked at interactions between linguistic and general cognitive capacities. The Transfer to Somewhere Principle (Andersen, 1983) focuses on the conditions that will induce learners to make interlingual identifications, while the Transfer to Nowhere (Kellerman, 1995) position considers how cross-linguistic influence can occur even when there might seem to be no basis for interlingual identification. Andersen (1983) restricts his discussion of transfer to syntactic transfer. He says that one of the two conditions for transfer to occur is that the learner must perceive similarity between an element in the L2 and a corresponding element in L1: there must be transfer to somewhere. Kellerman (1995) states that if cross-linguistic similarity is reason for transfer, then where there is no perceived similarity,

there should be no transfer. This, however, does not directly follow from Andersen's argument. Kellerman (1995) proposes a refinement of his principle to complement Andersen: there can be transfer "which is not licensed by similarity to the L2" (p. 137). Schachter (1983) also makes a point that one's L1 knowledge has as much influence on the learning of an unrelated L2 as on the learning of a related one. The somewhere/nowhere debate illustrates the possibility of looking at transfer from two points of view, both of them perfectly justifiable. The differences between them can be explained by researchers focusing on different types and aspects of transfer.

One of the basic questions in transfer is what is transferred. Cruttenden (1981) first made the distinction between item learning and system learning, relating it to L1 acquisition. This distinction can be applied to SLA as well. Some learning takes place on an item-by-item basis in all areas of language: phonological, lexical, morphological, and syntactic. When the learner perceives a similarity of forms between the two languages, and assumes a similarity of meaning, there is a basis for establishing a simplified one-to-one relationship between an L1 item and an L2 item, which Arabski (1979) calls "primary counterparts."

Cross-linguistic similarity is one of the issues Ringbom (2007) notes and he states that even though learners expect the vocabulary of a L2 to be different, they assume that the system of grammar will work more or less the same way as their L1 does. Assumptions can be and are often based on previous perception. There are three different relations that two languages can be in: similarity, difference, and zero relation. Perceived and assumed similarities are often difficult to distinguish from one another for comprehension and production work in interaction. Some studies, (Bergh, 1986; Kolers, 1966) for example, have found that there is more interdependence between L1 and L2 in comprehension than in production. The consequence of this is that there is more transfer, more use of cross-linguistic similarities in L2 comprehension than in L2

production. This has relevance in our study, since we only tested for comprehension, not production as it is described in Chapter 4. On the other hand, it is remarkable that researchers who downplayed the role of transfer, tended to restrict their discussion to syntactic errors in learner production. As an example, we mention the absence of the passive form as it is represented in English. Would that mean that Hungarian learners have extreme difficulties comprehending and properly interpreting this structure? These kinds of questions will be answered in Chapter 6, in the discussion of the results.

Another important issue in the study of SLA is the concept of natural order (or universal sequence) in the grammatical development of L2. If there is a predictable order in L2 acquisition for speakers of different languages, then transfer from L1 might be less important. This predictable order is the basis for an earlier theory in SLA, The Natural Order Hypothesis, which claims that the order of acquisition is independent of instructional sequences and the L1. Some advocates (e.g., Larsen-Freeman, 1975) of this hypothesis claim even that these natural orders develop for both child and adult learners regardless of the complexity of the structures. Brown (1973) reported the L1 acquisition sequence of English morphemes and Dulay & Burt (1974) replicated it with Spanish and Chinese speaker children learning English as L2. Even though the order of L2 morpheme acquisition was not identical to the L1 sequence, it was similar, and virtually the same for the two languages. The morpheme acquisition studies were followed by other research in areas of syntax, and it indicated that there is also a predictable sequence of acquisition of negation, question formation and relative clauses. These findings form part of continued speculation that innate mechanisms for language acquisition may not be limited to early childhood. Bearing these findings in mind, let us examine the structures that were tested, and based on our discussion of transfer and the Natural Order Hypothesis, let us try to predict

some possible scenarios regarding Hungarian speakers' acquisition of English late-emerging syntactic structures.

Since two languages can be in three different relations (see above discussion), the case of passive can be regarded as that of a zero relation, for this structure as it exists in English is non-existent in Hungarian (albeit controversially so). In other words, there is nothing to be transferred either negatively or positively. Ellis (1995:311) claims that "the absence of a structural feature in the L1 may have as much impact on the L2 as the presence of a different feature." The procedural transfer that learners use in production can be of two kinds: intrusive and inhibitive (Hammerly, 1991). While intrusive transfer leads to inappropriate use of L1-based items and structures, inhibitive transfer prevents or inhibits learning to use new words and structures appropriately (Ringbom, 2007). In the case of Hungarian speakers learning the English passive, the lack of Hungarian passive would mean an inhibitive transfer, and most likely manifest in underuse or avoidance in production of the English passive. Avoidance may imply that a particular structure, e.g. passive, is known (i.e. can be recognized and comprehended) by learners, but not freely used by them (Levenston, 1971).

The relation that Hungarian has with English regarding temporal adverbials is that of similarity. Our prediction would therefore be that there is a positive transfer from L1 to L2, and Hungarian learners would not have difficulties with sentences containing *before* and *after*. This is orthogonal to the statement that difficulties would arise due to the inherent complexity of this structure in both languages. In other words, we would have to examine if our participants made significantly more errors on temporal adverbials in their L1 than with the active sentences in L1.

Relative clauses – due to the flexible word order of Hungarian – can either be in the relation of similarity or difference depending on word order. Since we used the most common word order in our experiment, our prediction is that positive transfer is most likely when interpreting English relative clauses. Nevertheless, the fact that Hungarian allows a relatively free word order due to numerous case markings and inflections, differences in the difficulty of the various relative clause types (SS versus SO) might occur.

We will return to our discussion of transfer in light of data analyses that follow in Chapter 5, where we will try to explain based on the participants' errors whether their interpretation of certain structures is due to transfer (negative or positive), cross-linguistic similarity, or a feature of their interlanguage.

### **3.8. Summary**

While Hungarian is typologically a very different language from English, as far as language development is concerned, the path of acquisition is more or less the same. The difficulties associated with some late-emerging complex structures are problematic for speakers of both languages. Syntactic processes that enable students to understand complex/late emerging structures can be labeled with numerous terms, depending on whether they take place at the initial, mid- or final stages of the process. Furthermore, the outside factor, how complex a text is for the reader, is measured by various formulas that do not take into account sentential complexity, for the simple reason that there is no consensus about what constitutes complexity. Finally, discussing our participants' reading achievements and results on the syntactic tests in the

following chapters, we might wonder whether certain errors are caused by the absence of the structure in their L1 (passive), or simply by virtue of a natural order of development while developing their interlanguage. How learners of a relatively free word order language (Hungarian) comprehend the late-emerging structures (passives, relative clauses and temporal adverbials) in English in their high-intermediate stages of language development, and how it relates to their English reading comprehension are therefore the foci of our study. In Chapter 4, the descriptive details of the study are given together with the research questions and their respective hypotheses.

## **Chapter 4**

### **The Study**

#### **4.0. Introduction**

This chapter presents the rationale for the study, the research questions, and a detailed description of the participants, materials, and procedures carried out to answer the main research questions investigated in this thesis. The results will be presented in the subsequent chapter.

#### **4.1. Objectives of the study**

As discussed in Chapter 2, studies investigating adults' syntactic knowledge in relation to their reading comprehension are not very numerous. The number is even scarcer in the field of non-native reading investigation. Therefore, our study looks into what contributes to successful non-native reading, in particular foreign language reading comprehension, besides vocabulary knowledge. In this respect it makes a significant contribution to the field of non-native reading research.

The main purpose of the research is to determine what role syntactic knowledge (in both the native and foreign language) plays in foreign language reading comprehension. It also investigates the relative contributions of first language reading ability, and other factors that

were assessed by a questionnaire, such as reading habits in native and non-native language, and knowledge of other foreign languages besides English. We also investigate whether syntactic abilities contribute variably to reading comprehension at different proficiency levels. In the following sections we present our research questions and the rationale for their respective hypotheses.

#### **4.2. Motivation for the research questions**

The role of syntax in L2 reading has been supported in a study of bilingual children (Martohardjono et al., 2005), and it was found that there is a stronger relation between bilingual children's L1 syntax scores and their predicted L2 reading comprehension than there is with their L2 syntax scores and L2 reading comprehension. In order to further investigate this finding, our study targeted a different population in a different language environment: adolescents/young adults in an EFL (English as a Foreign Language) setting, who speak Hungarian in contrast to Spanish, the native language spoken in the child study. Therefore, the age native language and language learning experience of our participants differed from those of the Martohardjono et al. study. Consequently, our first research question asks if there is a contribution of L1 syntax (Hungarian) to L2 reading comprehension (English) among an older population of non-native learners of English. Furthermore, we also ask if there is a stronger contribution of L2 syntax to L2 reading comprehension in this population, in contrast to the child study.

Our second research question is motivated by Barnett's (1986) study in which she found that L2 reading comprehension (measured by recall) increases according to both vocabulary and

syntactic proficiency, but is related differently to each of these two proficiencies at the medium and higher levels but not at lower levels. On the other hand, according to Brisbois (1995) — who divided her participants into lower and upper level groups — grammatical skills do not contribute significantly to one's L2 reading comprehension. There is a controversy between these studies and our research question attempts to find out if syntactic skills contribute — assuming they do — differently to lower level L2 proficiency students' L2 reading comprehension from those whose L2 proficiency is higher.

Our third research question inquires about the complexity differences among syntactic structures and how they affect L2 reading comprehension. In Chapter 2 we discussed two hypotheses — the Processing Deficit and the Structural Deficit Hypotheses — regarding children's difficulties comprehending complex structures in written discourse.

Our study is loosely based on the Structural Deficit Hypothesis that claims that syntactic development gradually progresses from inherently simpler to more complex structures, and it is the more complex structures that weak or disabled readers struggle with. As discussed in Chapter 3, one of the criteria of complexity— and by extension difficulty – of structures is determined by the order children can comprehend and produce such structures. Therefore, knowledge of simple structures is not considered to correlate with reading comprehension in L1, only complex structures are. Our research question attempts to find out whether different complex structures have variable effects on L2 reading comprehension.

There is another reason for asking the extent to which various syntactic structures contribute to L2 reading comprehension: The non-existence of certain structures in L1 that could

negatively affect comprehension of these structures in L2, and thus, have an indirect impact on L2 reading comprehension.

Our last motivation for establishing a “complexity-rank” for the various syntactic structures comes from readability formulas which do not acknowledge syntactic complexity as a factor in classifying texts according to difficulty. This problem was discussed in Chapter 3.

The rationale behind our fourth research question comes from the L2 reading literature according to which reading comprehension— being a highly complex cognitive activity — might depend on numerous other factors besides L1 reading ability, L2 vocabulary and L2 grammar knowledge. Our research question asks whether there are other contributing factors to L2 reading comprehension.

#### **4.2.1. Research Questions**

1. To what extent does syntactic knowledge contribute to reading comprehension as

follows:

a/ The effects of syntactic processing ability in native language (Hungarian) on reading comprehension in the non-native language (English)

b/ The effects of syntactic processing ability in the non-native language (English) on reading comprehension in the non-native language (English)

2. What is the relationship between syntactic processing abilities and reading comprehension across different levels of non-native language proficiency?
3. To what extent do certain syntactic structures correlate more with non-native reading comprehension than others and why?
4. What other factors contribute to effective non-native reading comprehension (e.g. L1 reading proficiency, L1 reading habits, knowledge of another language, non-verbal IQ)?

#### **4.2.2. Hypotheses**

In order to formulate viable hypotheses, we need to consider previous research. Our first research question investigates whether there is a different contributing effect of L1 and L2 syntax to L2 reading comprehension, and if so, which one? While Martohardjono et al., (2005) found a stronger relationship between bilingual children's L1 syntax and L2 listening than between their L2 syntax and L2 listening comprehension – a precursor to reading comprehension – our hypothesis predicts the opposite for the young adult population we are studying. This is for the following reasons: first, our participants' L1 syntactic skills have been finalized; and second, their reading comprehension skills equal their listening comprehension skills. The strong correlation between L1 syntax and L2 listening comprehension in Martohardjono et al.'s study is probably due to the fact that children's syntactic abilities at kindergarten age might not have

been developed fully (C. Chomsky, 1969). This is especially true for the less dominant language in the case of bilingual children. Studies of oral language development have challenged the notion that children know most structures by the age of five or six. Certain syntactic structures have not emerged in the syntactic development process as yet, and so this gap must have affected the relationship between the two skills. Since our participants' L1 syntactic abilities are not in the developing stages, but rather are mature, we predict that their L1 syntactic comprehension will have no effect on their L2 reading comprehension. Instead, L2 syntax will have a significant effect on L2 reading comprehension given that these adolescents are still in the process of acquiring complex structures in the L2.

Furthermore, while aural comprehension has strong predictive value in the early stages of reading acquisition, in adults this predictive value fades, and listening and reading comprehension rates level out. Therefore, for the first research question we predict no correlation between L1 syntax and L2 reading comprehension.

For our second research question we hypothesize that syntax will have the biggest effect in the relatively lower levels of L2 proficiency and will have considerably less effect in the higher levels of L2 proficiency. This seemingly controversial prediction comes from our acknowledgment that vocabulary knowledge contributes the most to L2 reading comprehension, and so the largest part of linguistic knowledge consists of knowledge of lexis. Those who lack this knowledge will utilize their other source of knowledge, that of morpho-syntax (e.g., Guarino & Perkins, 1986) and syntax. If this knowledge is low, their reading comprehension would be correspondingly low; however, if this knowledge is relatively high, it logically could aid their reading comprehension. Those with higher levels of linguistic knowledge will have an adequate range of vocabulary and so syntactic analysis will not be crucial for their text comprehension.

Based on our discussion of positive and negative transfer in 3.7., we make predictions about correlations between L2 reading comprehension and the various syntactic structures tested. Our hypothesis predicts a stronger correlation between L2 reading and syntactic ability for those structures that are dissimilar in the two languages, namely relative clauses and passives. The structures that are similar or identical in the two languages will not show a strong correlation. Transfer effects will manifest themselves in the following manner according to our discussion in 3.7: if we perceive the “non-existence” of a structure as being on one end of the different-similar continuum, and “exactly the same” as being on the other end, the strongest correlation with L2 reading comprehension will most likely be observed in passive structures (i.e., which are non-existent in Hungarian), a moderately significant correlation with relative clauses, and a somewhat significant correlation with the temporal adverbials.

Our hypothesis for the fourth research question comes from research that indicates the contribution of other factors to L2 reading comprehension. Most important of these is the claim that reading skills in two languages within the same orthography are transferrable. It considers the relative contribution of L1 reading ability. Given that our participants were highly skilled readers in their L1, we posit that their reading comprehension difficulties in L2 will not originate from L1 literacy deficiencies, but rather from inadequate L2 knowledge, whether vocabulary or syntax. We hypothesize that L1 reading comprehension will contribute significantly to L2 reading comprehension among skilled L1 readers. We also predict that reading habits in L1 will not contribute to L2 reading comprehension. While a non-verbal IQ test was given to our participants to screen and exclude those with below average non-verbal IQ, we hypothesize no correlation between non-verbal IQ and reading comprehension for the obvious reasons that

reading is a highly verbal activity. Our hypotheses relating in particular to Hungarian readers of English are reiterated as follows:

1. Syntactic processing ability will contribute to reading comprehension as follows:
  - a. Syntactic ability in the native language will not contribute significantly to non-native reading comprehension.
  - b. Syntactic ability in the non-native language will contribute significantly to non-native reading comprehension.
2. Syntactic ability will contribute most at the lower levels of non-native language proficiency, and it will contribute less at the higher levels of proficiency.
3. Knowledge of certain syntactic structures will correlate differently to non-native reading comprehension, such that:
  - a. Relative clauses, subordinate clauses containing temporal adverbials, and passives will correlate more than active structures.
  - b. There will be effects of the native language such that those structures that differ from the non-native language (e.g. the passive) will show the strongest correlation, while native and non-native language structures that are similar (e.g. temporal adverbials) will show weaker correlation to non-native reading comprehension.
4. First language reading comprehension will contribute significantly, while native language reading habits, knowledge of another language and non-native language

reading habits, and non-verbal IQ will not contribute significantly to non-native reading comprehension.

### **4.3. Participants**

#### **4.3.1. Experimental group**

Participants in the experimental group were 65 twelfth graders attending a high school in Galanta, Slovakia. Their ages ranged from 17 to 19, with a mean age of 18.3 years (SD .71). Participants were administered a non-verbal IQ test to ensure that each has normal intelligence. One participant was eliminated due to lower than average non-verbal IQ score and uncooperative behavior. Thus, analyses were conducted on 64 students (26 males, and 38 females). They were recruited via the help of the school principal and local English teachers. The language of instruction in the school is Hungarian, which is the native language of all the participants. Participants' background information was collected via a written questionnaire in Hungarian. In addition, all participants were foreign language learners of English, all of whom have been learning the language in a classroom setting since the approximate age of 11, ensuring relative equality among participants in their language learning experiences. The average number of years the participants had studied English was 8. All participants were literate in Slovak, but did not speak it at home. Furthermore, all participants in the study signed the required consent forms. Execution of the experiments was in compliance with IRB protocol of the City University of New York.

### **4.3.2. Control Group**

These participants were native English speakers between the ages of 18 and 24 (mean age 22.5) studying at the Borough of Manhattan Community College in New York. They were recruited through flyers that were distributed by professors of the English Department. Each participant also signed the informed consent form according to IRB requirements of BMCC CUNY. This group only took the English version of the Test of Syntactic Comprehension in order to ensure the reliability of drawings, and to have baseline confirmation that, in fact, native speakers do not have difficulties with these types of complex sentences presented in the test. Fifteen students participated in the testing, all of whom performed at ceiling.

### **4.4. Materials and procedures**

In the study, the following six separate measures were used: four standardized proficiency tests and two experimental tasks specifically designed for the study. All of the tests and tasks were group-administered. In addition, a written background questionnaire was administered. The tests and tasks are now described.

### *I. Background Questionnaire*

The purpose of the questionnaire was a) to ensure as much homogeneity of the participants as possible; and b) to investigate differences participants might have in matters that could affect their reading performance, such as gender, reading habits, knowledge of other languages etc. The entire questionnaire (20 questions) in Hungarian along with its English translation can be found in Appendix A.

### *II. Michigan Listening Comprehension Test*

The University of Michigan English Language Institute Listening Comprehension Test is a standardized proficiency measure designed to assess knowledge of English grammar through listening and writing responses to 45 multiple-choice questions. This measurement was used to determine the proficiency levels of participants in order to answer Research Question (RQ) 2, namely what relationship, if any, can we find between L2 language proficiency and L2 reading comprehension. The test questions were pre-recorded by a native English speaker and were administered via a laptop computer. The participants listened to either a one-sentence question as in (1), or to a one-sentence statement as in (2), and then checked the appropriate response from a three-choice written list (A., B., C.) on an answer sheet, as shown in examples (1) and (2) below.

(1) Do you know if Grandfather is coming for dinner on Thursday?

A/ Yes, we are.

B/ Yes, he is.

C/ Yes, they are.

(2) I've never seen snow here.

A/ There has been no snow in the past.

B/ There has been less snow in the past.

C/ There has been more snow in the past.

### *III. Gates-MacGinitie Reading Test (GMRT) Level 6*

This standardized reading test is designed to provide a general assessment of reading achievement of native English speakers in grade 6. While it is designed for native speakers in the 6<sup>th</sup> grade, an earlier pilot study revealed that Level 4 was much too easy for 11<sup>th</sup> graders learning English as a foreign language. Therefore, we speculated that Level 5 would be an adequate match for 11<sup>th</sup> graders, and Level 6 for 12<sup>th</sup> graders, our population in the research. The test consists of a Vocabulary and a Comprehension section, with 45 and 48 items respectively. The time for the two sections is 20 minutes for the vocabulary, and 25 minutes for the comprehension.

The vocabulary test measures reading vocabulary; the words are presented in a brief context intended to suggest which part of speech the word belongs to, but not to provide clues to

meaning. Participants are expected to select the word or phrase out of five possible choices that is closest in meaning to the test word, which is underlined. An example is shown in (3), where choice A) would be the correct response:

(3) -a big garage

A/ place for cars

B/ machine

C/ sidewalk

D/ covered porch

E/ cloth sack

The comprehension section measures readers' abilities to read and understand different types of prose. All of the passages are taken from published books and periodicals. Some are fiction, and some are non-fiction, from various content areas, and written in a variety of styles. The content is selected to reflect the type of materials that students at a particular grade level are required to read for schoolwork and choose to read for recreation. Some questions require participants to construct an interpretation based on a literal understanding of the passage; others require them to make inferences or draw conclusions. The comprehension section also measures the ability to determine the meaning of words in an authentic context. Example (4) illustrates a literal question from a non-fiction context, where D. Is the correct response:

(4)

*Sometimes – not very often – we get two full moons in one month. That second full moon is called a “blue moon”. No one knows why. Now we say “once in a blue moon” to mean “once in a long time”.*

To be a “blue moon,” the moon must be.....

A/ dark

B/ long

C/ blue

D/ full

#### *IV. Hungarian National Reading Competency Measure (OKM)*

The reason for administering a native language reading test was to ensure that no participant had reading disabilities, i.e. that each scores within the 'normal' range. The Hungarian Reading Competency Measure was selected as it is the standardized reading test of the Hungarian Ministry of Education that is administered every year to each 4<sup>th</sup>, 6<sup>th</sup>, and 10<sup>th</sup> grader. Since the highest level of this measurement is at the 10<sup>th</sup> grade, we had no choice but to use it even though our participants were in the 12<sup>th</sup> grade. Also, this test measures only comprehension of different styles of prose, some of which are extensive in length. The participants select their answers on a multiple-choice questionnaire. While in English, reading tests always contain a separate vocabulary section, the Hungarian test almost exclusively concentrates on inference making, tone of prose and other aspects of comprehension.

### *V. Naglieri Nonverbal Ability Test (NNAT)*

As noted above, we administered a non-verbal IQ test to ensure that our participants were all within the normal range of cognitive ability. The NNAT is a 38-item test of non-verbal reasoning, such as reasoning by analogy, serial reasoning, and spatial visualization, which are said to be independent of language proficiency or educational background. The test also claims that its scores are predictive of academic success, and has a variety of educational applications. It has separate test levels from Kindergarten through Grade 12. Level G is designed for grades 10-12, and thus was used in our study. Test questions include items that ask for reasoning by analogy, serial reasoning and spatial visualization. Reasoning by analogy items require the students to recognize the logical relationship between several geometric shapes. Serial reasoning items require students to recognize a sequence of shapes and changes in the sequence. Spatial visualization items are among the most difficult ones, for they require students to recognize rotations or shapes that intersect.

### *VI. Test of Syntactic Processing in Hungarian*

As indicated in the theoretical background in Chapter 2 and Chapter 3, certain syntactic structures are believed to be harder to process and understand than others. For a detailed description of each syntactic structure, please refer to Chapter 3. (See below section 4.4.1. for details regarding the number of test items per structure). In order to ensure that participants are competent in their abilities to process complex syntactic structures in their L1, a test was

developed that was based on previous research by Martohardjono et al. (2005).<sup>12</sup> This task involved a set of line drawings, out of which one accurately reflects the meaning of the syntactic structures involved. The sentences were read aloud by the experimenter as they appeared on the screen. The example below illustrates the procedures that were followed.

(5) A            nagymama      bántotta    az    orvost      a            kórházban.

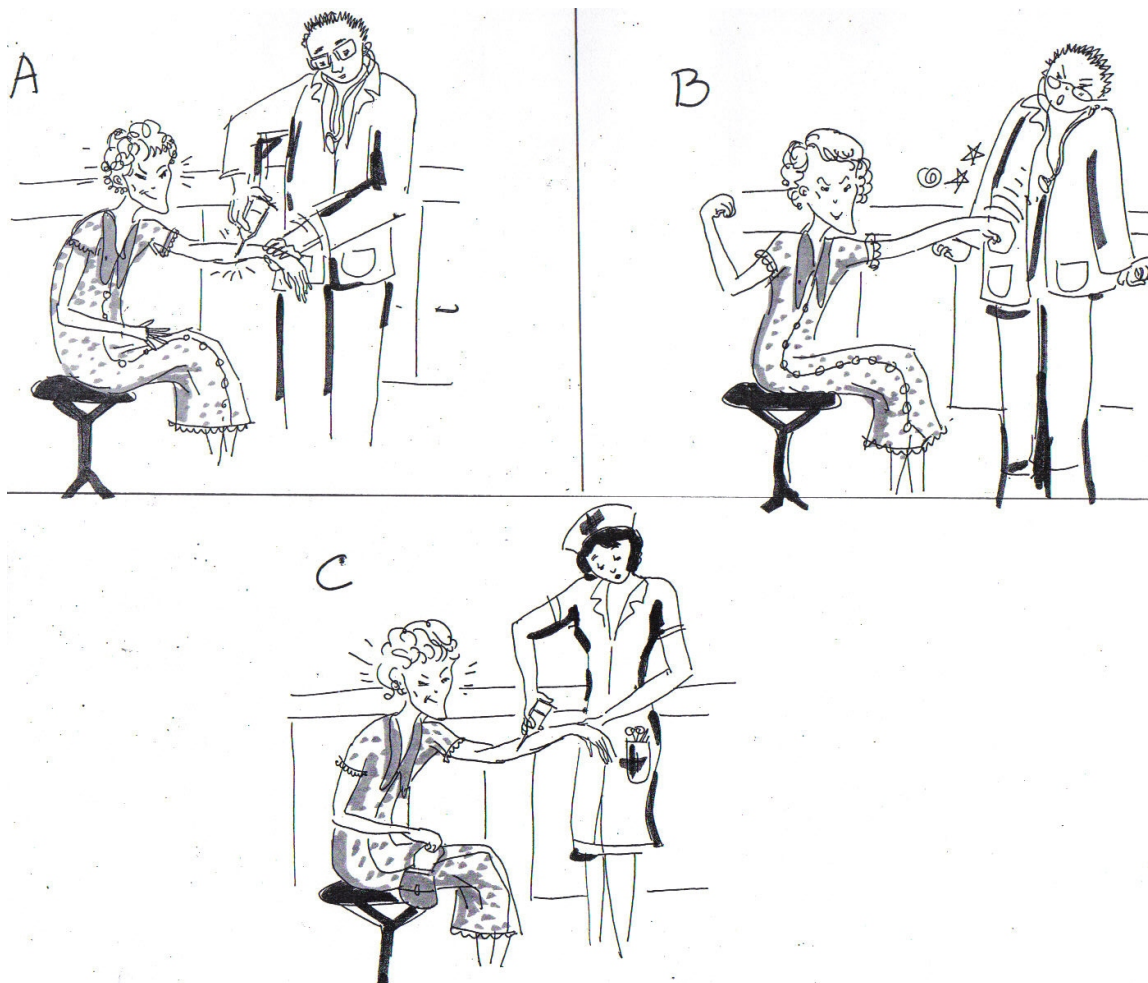
The        grandmother    hurt        the    doctor      the        hospital [in].

*The grandmother hurt the doctor in the hospital.*

---

<sup>12</sup> The format of our stimuli was carefully chosen to reflect as closely as possible the ability to comprehend sentences, as opposed to produce them. Many of the previous studies used poorly controlled production tasks (e.g., cloze test) to measure comprehension. For more discussion on the importance of comprehension tasks in L2 studies, see Klein & Martohardjono (1999).

Below the sentence, the following three drawings appeared, marked with A, B and C:



Of the three drawings, one was always semantically anomalous, while the other two were the contrasts being tested. Thus, in Example (5) – which tests the participant's understanding of the active voice – C is the semantic distracter, while A and B present the contrast being tested. At the same time, the participant has an answer sheet on which to circle the letter that best corresponds to the drawing that matches the sentence at the top of the slide. In the set illustrated in (5), drawing B matches the meaning of the sentence presented so the participant must circle the letter B on his/her answer sheet.

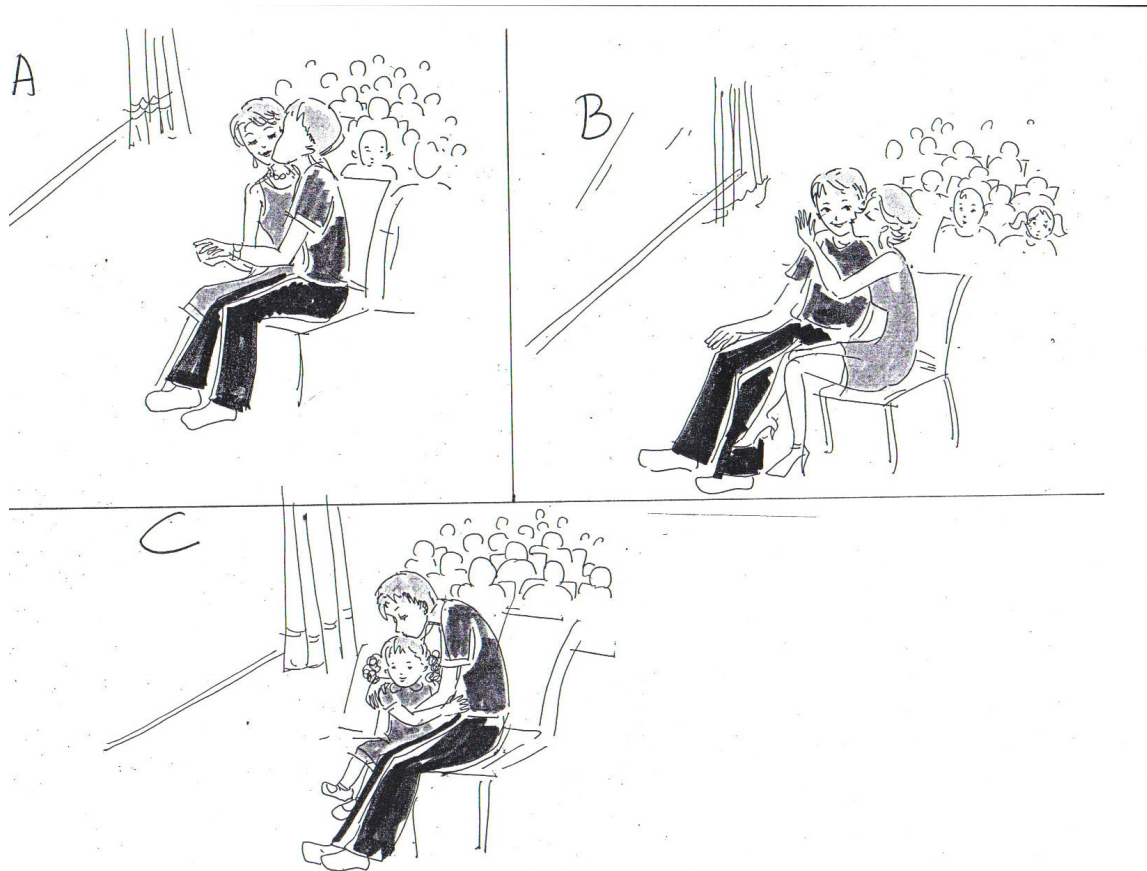
The drawings were scanned into a PowerPoint presentation, and were projected on a screen, thus ensuring adequate visibility of the pictures for all participants. Each slide disappeared automatically after 15 seconds, after which a blank slide followed for another 15 seconds before the presentation of the next slide. There were 30 items in this section. In addition, there were 5 practice items in the beginning of the session in order to establish the routine and ensure familiarity with the task.

Appendix D gives a complete list of the sentences, while Appendix E provides the actual test.

### *VII. Test of Syntactic Processing in English*

This test was identical to the Hungarian version, except that the sentences written at the top of the slides were in English and were read aloud by the experimenter in English instead of Hungarian. The same structures used in Hungarian were used in the English version as well. In addition, 6 passive sentences were added to the test items (see description of the test items below). Therefore, the English version of the test was slightly longer, making it a test of 36 items as opposed to 30 items in the Hungarian version. Example (6) shows a set of drawings that tests the passive voice. Here, A and B reflect the contrast being tested, while C is the semantic distracter.

(6) The mother was kissed by the father in the theater.



#### 4.4.1. Stimuli used in the Tests of Syntactic Processing

Lexical items used in the English sentences were controlled for frequency, in the following manner: Thorndike and Longe's (1947) *The Teacher's Word Book of 30,000 Words* was used to select vocabulary items that occur at least 100 times per million words, and at least

1,000 times in selected 120 juvenile books. Furthermore, verbs were all presented in the simple past tense; in the case of the passive voice, the past participle was used as required, with the past tense marked on the auxiliary *be*. Verb choice was balanced, so that regular (e.g., *kiss-kissed*, *visit-visited*, *push-pushed*), irregular (e.g. *catch-caught*, *see-saw*, *buy-bought*), and unchanged (e.g., *hurt*, *hit*) forms of the simple past tense (in the active, relative clauses and subordinates with temporal adverbials) and past participle (in the passive sentences) were used. Moreover, only animate nouns were used in order to make sentences reversible, and thus, plausible, such as in (6), in which both *mother* and *father* can function as the subject of the sentence. Finally, sentence length was controlled for, making the average sentence 11 syllables long. See below for more details of stimuli for each structure tested.

As previously discussed in Chapter 3, the following structures were tested:

*In Hungarian:*

**Relative clauses** (N=12 within which only subject headed sentences were tested of two types:

1. Subject-Subject (SS) (N=6) relative clauses, where the subject of the relative clause is identical with the subject of the main clause, as in the example (7):

(7)	A	nővér	[aki	az	orvost	látta]	magas	volt.
	The	nurse	who	the	doctorACC	saw	tall	was.

*The nurse that saw the doctor was tall.*

2. Subject-Object (SO) (N=6) relative clauses where the object of the relative clause is identical to the subject of the main clause, as shown in (8):

(8) A            nővér            [akit látott az orvos]            magas            volt.  
       The        nurse            whom saw        the        doctor            tall            was.

*The nurse that the doctor saw was tall.*

As mentioned in Chapter 3, due to word order flexibility in Hungarian, SS and SO relative clauses are not always centrally embedded (as they are in English). However, in order to make the structures comparable in difficulty with their English counterparts, we chose to test this particular word order. In addition, this is one of the two most common word orders as verified by 3 native Hungarian speakers independently.

For each sentence that appeared in one condition, (e.g., SS relative) a matched sentence, i.e. using the same lexical items, appeared in the other condition (e.g., SO relative), as shown in (7) and (8) above.

### **Subordinate clauses containing the temporal terms before and after (N=12)**

The sentences containing before (N=6) were divided into two categories, depending on the placement of the subordinate clause. This is because the location of the adverbial clause influences processing difficulty (as explained in Chapter 3). One set (N=3) contained the subordinate clause sentence-initially (N=3), as in (9) and the other contained the subordinate clause after the main clause, i.e. in sentence-final position (N=3), as in (10).

(9) Mielőtt a fiú megvacsorázott, befejezte a házi feladatát.

Before the boy had dinner, finished the home work-POSS

*Before the boy had dinner, he finished his homework.*

(10) A fiú befejezte a házi feladatát mielőtt megvacsorázott.

The boy finished the home work-POSS (poss.) before had dinner.

*The boy finished his homework before he had dinner.*

The sentences containing *after* (N=6), were also divided into two types for the same psycholinguistic reason: one set (N=3) contained the subordinate clause in sentence initial position as in (11), and the other (N=3) contained the subordinate clause in sentence-final position as in (12).

(11) Miután a férfi meglátogatta az anyját, megebédelt.

After the man visited the mother-POSS had lunched.

*After the man visited his mother, he had lunch.*

(12) A férfi megebédelt miután meglátogatta az anyját.

The man lunched after visited the mother-POSS

*The man had lunch after he visited his mother.*

**Simple Active Sentences** (N=6). In these sentences the subject noun, verb and object appear in SVO word order as shown in (13):

- (13) A lány megrúgta a fiút a játszótéren.  
 The girl kicked the boyACC the playground PREP.  
*The girl kicked the boy in the playground.*

Total sentences used for the Hungarian stimuli: 12 relative clauses

12 before/after

6 active

N=30

*In English:*

The English stimuli matched those of the Hungarian test, except for the passive voice (as indicated in Chapter 3). Specific examples of the English version are given below.

**Relative clauses** (N=12) within which centrally embedded subject headed sentences were tested, out of which six were SS relative clauses, as shown in example (14), and 6 were SO relative clauses, as illustrated in (15):

- (14) The nurse [that saw the doctor] was tall.

(15) The nurse [that the doctor saw] was tall.

**Subordinate clauses containing the temporal terms *before* and *after* (N=12)**

Again, the position of the *before* and *after* were divided into two types. Three of the sentences the temporal term *before* or *after* occurred sentence initially, as in (16) and (18), and in three they occurred post-sententially, as in (17), and (19).

(16) Before the man visited his mother, he had lunch.

(17) The man had lunch before he visited his mother.

(18) After the man played football, he called his wife.

(19) The man called his wife after he played football.

**Active simple sentences (N=6) such as in (20):**

(20) The child fed the mother in the hospital.

**Passive sentences (N=6)**

Since the passive in Hungarian does not exist in the exact form as it does in English, (see Chapter 3) we speculated that in English this structure might pose potential difficulty for Hungarian speakers. An example of this set of stimuli is shown in (21):

(21) The mother was fed by the child in the hospital.

As the numbers show, the English version of the test was longer by the 6 additional passive items, thus making the total number of the English sentences 36. (Appendix C).

Total number of sentences used for the English stimuli:

12 relative clauses

12 before/after

6 active

6 passive

N=36

#### **4.5. Procedures**

Data were gathered over a three-day period in April, 2006, in three separate sessions. In each session, participants performed at least three tasks. All participants attended a session where the purpose of the study was explained in Hungarian, and were distributed the Informed Consent form to be either signed by them, or by their parents in case they were minors. The background questionnaire was also distributed, and participants were asked to return the completed forms the following day.

The first testing session was conducted in a large auditorium of the Hungarian High School in Galanta. This room is routinely used for testing. The principal of the school briefly

talked to the students at the beginning of the testing session, and asked them to cooperate and take the tests seriously.

The first task administered was the Test of Syntactic Knowledge in English which did not require an additional timing device, for the PowerPoint automatically projected the slides in 15 second intervals. The entire test took about 20 minutes to complete. Without a break, the participants went on to the next task, which was the test of Hungarian Reading Competency. The participants were given brief instructions, and were reminded about the 30-minute time limit to complete the test. The end of the session was followed by a 20-minute break. When participants returned, the Naglieri Nonverbal Ability Test was distributed, for which participants also had 30 minutes. After this test, the participants were dismissed for the day, and were told that the testing would continue the next day.

The next day participants started with the Gates-MacGinitie Reading Test. This test was one of the most demanding and took 60 minutes, including instructions. After the session, participants were given a 30-minute break. The testing continued with the Michigan Listening test, which took 30 minutes, and without a break, students went on to the last task, the Hungarian Test of Syntactic Knowledge, which took approximately 17 minutes. On the final day of testing, participants who had missed either the first or the second session were tested separately in smaller rooms.

#### **4.6. Summary**

The standardized tests used in this research study were selected to determine participants' general abilities necessary for this research. The syntactic stimuli selected for the Hungarian and English tests of syntactic knowledge aimed at measuring participants' understanding of decontextualized sentences as accurately as possible. The procedures to carry out this investigation were carefully administered in order to comply with requirements commonly followed with human subjects, and to ensure validity and reliability of the research. Together the elements of the study were constructed and administered in order to determine the role syntactic processing plays in reading comprehension, the primary focus of this dissertation. In the following chapter we will first give a detailed description of the scoring methods for each test, along with a statistical analysis of the findings.

## **Chapter 5**

### **Results**

#### **5.0. Introduction**

The previous chapter described the design, the procedures and the materials for our study, while this chapter provides the findings, presenting the statistical results in relation to each research question. The data of the study are presented in 21 tables, which include descriptive statistics as well as correlational and regression analyses.

The primary goal of this study — as emphasized in previous chapters — is to determine the contribution of syntactic skills to L2 reading comprehension. We also present an analysis of the relative contribution of syntax to L2 reading comprehension across different language proficiency levels. Moreover, we compare and contrast various syntactic structures according to their degree of contribution to L2 reading comprehension. Finally, we investigate to what extent other factors, such as non-verbal IQ, reading habits and especially L1 reading comprehension, contribute to L2 reading comprehension.

#### **5.1. Descriptive statistics**

As we mentioned in Chapter 4, a control group of native English speakers (N=15) between the ages of 21 and 26 was used to ensure the validity of the syntax test. This group

scored at ceiling (100%) on the test of English syntactic comprehension, and so below we only present the results of our experimental group.

Table 1 Description of participants

Participants	Number	Mean age	Standard deviation	Min.	Max.
Male	26	18.4	.702		
Female	38	18.2	.714		
Total	64	18.3	.709	17.6	19.6

Table 1 gives the description of participants according to gender and age. Participants were 26 male and 38 female students whose mean age was 18 years and 3 months.

The following table (Table 2) shows the mean correct scores for all participants in each test taken.

The seven measurements that were used — and were described in detail in Chapter 4 — yielded the following means, standard deviations and raw numbers for minimum, maximum and item totals.

Table 2 Descriptive results of the variables

Variable	Number of participants	Mean correct	Std dev.	Minimum	Maximum	Total number of items
English reading comprehension	64	19.85/44%	11.27	0	44	45
English vocabulary	64	21.29/52%	6.05	8	35	40
English proficiency (Michigan)	64	31.10/69%	6.61	17	44	45
Hungarian reading comprehension	64	16.90/77%	3.08	10	22	22
English syntactic processing	64	33.57/93%	3.06	25	36	36
Hungarian syntactic processing	64	29.35/98%	1.46	23	30	30
Non-verbal IQ	64	28.88/76%	4.84	15	37	38

One of the most striking results is the ceiling performance on the Hungarian Syntactic Processing. This result is obviously highly skewed by the ease of the test. The English Syntactic Processing yielded a near-ceiling result at 93%. What this all means will be discussed in Chapter 6. The widest range (with SD of 11.27) was found with the English reading comprehension test, where the participants scored anywhere between ceiling and floor (0 minimum and 44 maximum out of the possible 45). The English vocabulary and the English proficiency tests also produced a

relatively wide range of scores, most participants scoring in the mid-range. Hungarian reading comprehension and the non-verbal IQ resulted in almost the same percent correct (77 and 76 respectively), with relatively small SDs. These results indicate our participants' high non-verbal intelligence and relatively high first language literacy level in addition to their relatively high L2 proficiency.

## **5.2. Relationships between L2 reading comprehension and the independent**

### **variables**

The data were analyzed using STATA 10.0 software. In order to find out how the various factors relate to L2 reading comprehension and to each other, we performed a correlational analysis which is shown in Table 3.

Table 3 Correlations between all the variables in the study

	English reading comp	English vocabulary	English syntax	Hungarian syntax	Hungarian reading comp.	English proficiency	IQ
English reading comp.	1.000						
English vocabulary	0.543**	1.000					
English syntax	0.475**	0.552**	1.000				
Hungarian syntax	0.292*	0.143	0.225	1.000			
Hungarian reading comp.	0.376**	0.396**	0.476**	-0.003	1.000		
English proficiency	0.399**	0.518**	0.558**	0.202	0.245	1.000	
Non-verbal IQ	0.282*	0.490**	0.416**	0.050	0.31*	0.252*	1.000

\*  $p \leq .05$ \*\* $p \leq .01$ 

Table 3 reveals that all the variables significantly correlated with English reading comprehension. L2 vocabulary correlates most highly with L2 reading comprehension (0.543), as reported in many studies previously discussed in Chapter 2. The second most highly

correlated variable indicates that L2 syntactic ability has a very powerful weight in reading comprehension (0.4754), supporting the main hypothesis in this study. Going down in rank we find the third highest correlation to be English proficiency as measured by the Michigan test (0.399). Hungarian reading comprehension is the next on our correlation rank (0.376). Finally, the non-verbal IQ's low, yet significant, correlation is not totally unexpected (0.282), and will be discussed in Chapter 6.

Let us look at other correlations among the independent variables. English vocabulary knowledge most highly correlates with English syntax (0.552) and English proficiency (0.518), while non-verbal IQ and Hungarian reading comprehension are also quite high, with correlation coefficients measuring 0.490 and 0.397 respectively. Both results are somewhat puzzling given that the Hungarian lexicon is not related in any way to that of English, and also that the non-verbal IQ test presumably taps into different abilities from the vocabulary test. English vocabulary did not correlate with Hungarian syntactic abilities. The correlation between English and Hungarian syntax (0.225) did not reach significance. Potential reasons for this result will be addressed in Chapter 6.

English syntax and English proficiency correlated the most highly of all the variables (0.558). The two tasks were somewhat similar in that both measured grammatical knowledge, though the Michigan listening test did not test any of the structures that we were focusing on in the syntax test. English syntax also highly correlated with Hungarian reading comprehension (0.476). Finally, English syntax and non-verbal IQ correlated with each other at the 0.416 level.

Furthermore, Hungarian reading comprehension and non-verbal IQ indicate a significant correlation (0.318), but not with English proficiency. Finally, English proficiency also correlated with non-verbal IQ (0.252), though the correlation was weaker than the others' (only at  $p \leq .05$ ).

The inter-correlation of variables is usually a problem for research, for it suggests that the variables are not totally independent from each other. The highly complex task of reading comprehension — and the measurement of it — involves skills that overlap: word knowledge, syntactic comprehension, and inferencing. When testing for syntactic comprehension, we tried to reduce the level of “contamination” of these skills. For example, words used in the syntactic test were pre-taught and the sentences were read aloud by the researcher in addition to the participants reading the sentences to themselves. Furthermore, the Michigan test of aural sentence comprehension did not involve structures that were tested by the test of syntax, as noted above.

The above described findings will be important in determining the level of contribution of some of the variables according to our research questions. The following sections discuss the regression analyses and the results for each research question.

### **5.3. Research Question (RQ) 1a/ and b/**

1. To what extent does syntactic knowledge contribute to reading comprehension as follows:
  - a/ The effects of syntactic processing ability in L1 (Hungarian) on reading comprehension in the L2 (English)?

b/ The effects of syntactic processing ability in the L2 (English) on reading comprehension in the L2 (English)?

Both questions ask the degree of contribution that syntactic skills have on reading comprehension in an L2. In order to answer them, we regressed the two variables of syntax (English and Hungarian) that do not correlate with each other to see their independent effects. The results are shown in Table 4.

Table 4 The contribution of native and non-native language syntactic processing ability to non-native (English) reading comprehension

English reading comp.	Coef.	Std. Error	t	P>  t
English syntax	1.5874	.4154	3.82*	0.000
Hun. syntax	1.5074	.8705	1.73	0.088

N = 64

F (2, 61) = 10.84

R-squared = 0.2623

Adjusted R-squared = 0.2381

Percent of variance = 24%

Table 4 shows us that 24% of variance in the dependent variable (English reading comprehension) is explained by the learners' knowledge of syntax, and that syntactic ability in

English is a statistically significant estimator for English reading comprehension ( $t=3.82$ ).

Hungarian syntax, on the other hand, has a much weaker effect ( $t=1.73$ ).<sup>13</sup>

If we take out Hungarian syntax from the regression, the results indicate that English syntax explains most of the variance (21.36%), showing its strong contribution to L2 reading comprehension. This is displayed in Table 5.

Table 5 Contribution of English syntactic processing to English reading comprehension

English reading comp.	Coef.	Std. Error	t	P>  t
English syntax	1.7498	.4111	4.26*	0.000

N = 64

F (1, 62) = 18.11

R-squared = 0.2260

Adjusted R-squared = 0.2136

Percent of variance = 21.36%

In answer to Research Question 1, then, we can say that while L1 syntactic abilities have some effect, syntactic abilities in L2 have a much stronger effect on L2 reading comprehension.

#### 5.4. Research Question 2

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<sup>13</sup> Due to the fact that L1 syntactic processing was so highly skewed by its ceiling effect, we cannot make far-reaching conclusions of its contribution (which was 7%), and so we will only briefly discuss it in Chapter 6.

1. What is the relationship between syntactic processing ability and L2 reading comprehension across different levels of L2 proficiency?

In order to answer this question, we tested our participants on the Michigan test, which is a standardized proficiency test used for placement purposes in many colleges. The part we utilized was the listening comprehension section that tests aural grammar comprehension by multiple choice responses to one sentence — either a question or a statement — prompts. We divided our participants' scores on the Michigan into two medians enabling us to have more robust numbers in each broad group. Thus, we had a bottom and a top proficiency group with 32 participants in each group. It is by chance that the median is also equal to half of our participants. In order to ensure that the two groups are in fact different, we performed a t-test. The group statistics are given in Table 6.

Table 6 Descriptive statistics for the low and high proficiency groups

Michigan Proficiency	Number	Mean	Standard deviation
Low	32	.5681	.0925
High	32	.8139	.0660

After a paired-samples t-test, we conclude that the two groups are statistically different  $t(31) = -12.32, p < 0.001$ , clearly representing two distinct proficiency levels.

Table 7 gives the contribution of Hungarian and English syntax to reading comprehension for each proficiency group, where the top two rows (the scores for English and Hungarian syntax)

indicate the upper range of proficiency scores, and the bottom two rows indicate the lower range of proficiency scores:

Table 7 The contribution of syntactic processing to English reading comprehension according to English proficiency (high versus low)

English reading comp.		Coef.	Std. Error	t	P>  t	Degrees of freedom F(2, 29)
<b>HIGH</b> <b>MICH.</b> <b>PROF.</b> <b>N=32</b>	English syntax	4.500	1.877	2.40*	0.023	F=5.97 R squared= 0.291 Adj.R squared=0.242 Percentage of variance=24.2%
	Hungarian syntax	3.744	2.063	1.81*	0.080	
<b>LOW</b> <b>MICH.</b>	English syntax	.085	.428	2.30*	0.029	F=3.19 R squared=0.1805 Adj R squared=0.124
	Hungarian					

<b>PROF.</b>	syntax	.618	.812	0.76	0.453	Percentage of variance=12.4%
<b>N=32</b>						

In order to find out the exact contribution of English syntactic abilities to English reading comprehension in the two different groups, we performed a stepwise regression. When Hungarian syntax is held constant, English syntactic processing contributes 12% of the variance in the high proficiency group, and only 3% in the low proficiency group. However, when English syntax is held constant, it explains 17.5% of the variance for the high proficiency group, and 13.6% for the low proficiency group.

We can conclude from Table 7 that at the higher level of English proficiency the combined effect of syntactic processing is similar ( $t=2.4$ ) to that of the lower level of English proficiency ( $t=2.3$ ). In other words, syntax seems to be an equally important contributor to L2 reading comprehension at least at the higher levels of L2 proficiency. We cannot confirm or disconfirm our hypothesis regarding L2 syntax's contribution to L2 reading at the lower level of L2 proficiency, for clearly, our participants' L2 proficiency was relatively high.

In answer to Research Question 2, then, our results show that syntactic skills contribute equally to English reading comprehension for learners at both higher and lower English proficiency levels, in contrast to our hypothesis, which posited benefits for the lower levels students only. While the reasons will be further discussed in Chapter 6, we might state here that our population's results indicated a rather high level English proficiency; in other words, our participants were not low enough in their proficiency to be able to yield any difference in syntactic contribution to L2 reading comprehension.

### 5.5. Research Question 3

3. To what extent do certain syntactic structures correlate more strongly with L2 reading comprehension than others and why?

Before we attempt to answer this question, let us look at the descriptive statistics of the mean correct on the English syntax measure. Table 8 gives the mean percentage correct of the different structures.

Table 8 Mean percent of correct answers to English structures

Sentence structure	Mean percent correct	Standard Deviation
Active	97.91	5.55
Passive	94.01	11.64
Relative clauses (SS & SO combined)	93.48	10.01
Temporal adverbials (before & after combined)	90.36	13.21

We can note that our participants performed quite well on all structures, but there were still statistical differences in performance between them: Participants performed best on the

active sentences (98% correct), and worst on the temporal adverbials (90% correct), while the passive and the relative clause structures yielded more or less the same percentage of correct answers (94% and 93% respectively). The difference between the performances on the active and passive sentences is significant ( $F(1, 63)=5.9, p<0.01$ ). The difference between the performances on the relative clauses and temporal adverbials is also significant ( $F(1, 63)=4.9, p<0.05$ ), though only at the 0.05 level. Let us now look at the results within the embedded relative clauses of two types: subject-subject (SS) relatives and subject-object (SO) relatives. Recall from our extended discussion of these structures in Chapter 3 that most other studies of English have shown SS relatives to be easier than SO relatives:  $SS>SO$ . Table 9 gives us the results for the SS and SO relative clauses in our study.

Table 9 Mean percent correct on the two types of English relative clauses

Relative clause structure	Mean percent correct	Standard Deviation
Subject-subject clause (SS)	91.2	13.74
Subject-object clause (SO)	95.3	10.05

We note that performance on the SO relatives (95% correct) exceeded performance on the SS relatives (91% correct), and this difference is significant ( $F(1, 63)=6.5, p=0.01$ ): thus, scores were in the unexpected direction:  $SO>SS$ . This finding will be discussed in Chapter 6, where effects of the native language, i.e., Hungarian, will be considered.

We next investigated the mean percent of correct answers in the two types of temporal adverbials (*before* and *after*), described in Chapter 3. Table 10 provides the results.

Table 10 Mean percent correct on the two types of temporal adverbials (before vs. after)

Temporal adverbial	Mean percent correct	Standard Deviation
BEFORE sentences	89.0	14.30
AFTER sentences	91.6	16.53

There was no significant difference between the two types. Because of the general difficulty readers have with these temporal adverbials, we wanted to examine the possible differences in these structures when they appear in “natural” order — where the order of presentation equals the order of time, e.g. *before* used in the first clause and *after* used in the second clause — as compared to the reverse order. As discussed in Chapter 3, the latter order is generally more difficult. Table 11 shows us the results with *before* and *after* adverbials combined in each category.

Table 11 Mean percent correct on the two types of temporal adverbials (natural vs. reverse order)

Temporal adverbial	Mean percent correct	Standard deviation
Natural order adverbials	88.5	16.50

Reverse order adverbials	92.1	15.42
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Although the natural order adverbials caused slightly more problems (88% correct) than the reverse order structures (92% correct), this difference is not significant.

Since performance on the Hungarian syntax measure reached ceiling (98% correct), we did not analyze it separately.

Why did our participants make more errors on temporal adverbials than on other structures? This question is an intriguing one, for this was the case in both L1 and L2. Possible explanations will follow in the subsequent chapter.

To reveal which of the structures tested correlate with reading comprehension, we now look at the correlations between L2 reading comprehension and the various structures. Table 12 shows these correlations.

Table 12 Correlation matrix of the English syntactic structures tested by the Test of Syntactic Processing in English

	English reading comprehension	Temporal adverbials	Relative clauses	Passive	Active
English reading comp.	1.0000				
Temporal adverbials	0.4236*	1.0000			

Relative clauses	0.3455*	0.5411*	1.0000		
Passive	0.3763*	0.5629*	0.5870*	1.0000	
Active	0.1261	0.1635	0.0297	0.0085	1.0000

\* $p < .05$

In Table 12 we note that the most highly correlated structure with English reading comprehension is the temporal adverbials, followed by the passives and the two types of relative clauses. Active sentences did not correlate with reading comprehension and this is in line with previous studies (e.g., Martohardjono et. al., 2005). Another feature of these results is that except for the active sentences, all other structures also correlate with each other besides correlating with reading comprehension. To analyze the relative contribution of the various structures for a more direct answer to our research question, we performed a step-wise regression on those variables that did not correlate with each other. Thus, each structure could be regressed with the active sentences as this was the only sentence type having no correlation with any other structure. Let us look at the contribution of the passive structures and of the relative clauses in Tables 13 and 14 respectively.

Table 13 The relative contribution of the active and passive sentences to English reading comprehension

English reading comp.	Coef.	Std. Error	t	P>   t
Passive	6.0598	1.898	3.19*	0.002

Active	4.1596	3.978	1.05	0.300
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N=64

$F(2, 61) = 5.67$

R-squared = 0.1567

Adjusted R squared = 0.1291

Percent of variance = 12.9%

The contribution of the passive sentences to English reading comprehension is a highly significant one ( $t=3.19$ ), explaining 12.9% of the variance.

Table 14 The relative contribution of the relative clauses (SS and SO combined) and the active sentences to English reading comprehension

English reading comp.	Coef.	Std. Error	t	P>   t
Relative clauses	3.211	1.119	2.87*	0.006
Active	3.923	4.035	0.97	0.335

N=64

$F(2, 61) = 4.67$

R-square= 0.132

Adjusted R square=0.1044

Percent of variance= 10.44%

The contribution of the relative clauses (combined) to English reading comprehension is also significant ( $t=2.87$ ), and the two independent variables together explain 10.44% of the variance.

We further analyzed the relative contribution of the two relative clause types, the SS and the SO clauses, and the results are given in Tables 15-16.

Table 15 The relative contribution of the S-S relative clauses and active sentences to English reading comprehension

English reading comp.	Coef.	Std. Error	t	P>   t
S-S relative clauses	4.9706	1.788	2.78*	0.007
Active	3.5577	4.0570	0.88	0.384

N=64

$F(2, 61) = 4.42$

R-square= 0.1265

Adjusted R square=0.0978

Percent of variance= 9.78%

The contribution of S-S relative clauses is highly significant ( $t=2.78$ ), and together with the active sentences explains 9.78% of the variance.

Table 16 The relative contribution of the S-O relative clauses and active sentences to English reading comprehension

English reading comp.	Coef.	Std. Error	t	P>   t
S-O relative clauses	4.9517	2.288	2.16*	0.034
Active	4.4447	4.142	1.07	0.288

N=64

F (2, 61) =2.87

R-square=0.086

Adjusted R square= 0.0551

Percent of variance=5.61%

The contribution of the S-O relative clauses is also significant (t=2.16), and together with the active sentences explains 5.61% of the variance.

In both types of relative clauses (subject-subject and subject-object) the contribution is highly significant, but it is somewhat higher among the S-S relatives. Again, how this relates to our discussion of syntactic complexity in Chapter 3 and how these results compare to other studies will be discussed in Chapter 6.

Finally, Table 17 gives us the results for the temporal adverbial clauses that seemed to be the most problematic structures for our participants.

Table 17 The relative contribution of the temporal adverbial clauses and active sentences

English reading comp.	Coef.	Std. Error	t	P>   t
Temporal adverbials	2.914	.825	3.53*	0.001

Active	1.977	3.969	0.50	0.620
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N=64

$F(2, 61) = 6.82$

R-square=0.1828

Adjusted R square= 0.1560

Percent of variance=15.6%

The contribution of temporal adverbials is significant ( $t=3.53$ ) and, together with the active structures, they contribute 15.6% to L2 reading comprehension.

In answer to Research Question 3, we can conclude that temporal adverbials contributed the largest and relative clauses the smallest percentage to L2 reading comprehension. Based on these results, however, we cannot make the claim that one structure is more complex than another one.

#### **5.6. Research Question 4**

What other factors contribute to effective non-native reading comprehension? In particular, do the following factors make a contribution: L1 reading proficiency, non-verbal intelligence, L1 reading habits and knowledge of another language?

From Table 3 presented earlier, we can note that L1 reading comprehension and non-verbal IQ significantly correlated with L2 reading comprehension. First, we will take a closer look at L1 reading comprehension for it maintained its significance even at the .01 level. Recall

from Chapter 2 that Cummins' Interdependence Hypothesis (1977; 1980) posits that there is an underlying academic language proficiency such that L1 reading skills will support L2 cognitive skills, thus explaining the correlations we found. To further test this hypothesis, we regressed L1 reading comprehension with L2 reading comprehension with participants in the top and the bottom halves of the Michigan English proficiency test. This was also to examine whether there is a "threshold" such as that suggested by the early Threshold Hypothesis (Cummins, 1977, 1980, 1984), whereby a certain level of L2 linguistic ability must be obtained before L1 cognitive skills (e.g. reading) can be effectively transferred to L2 reading. The results are shown in Table 18.

Table 18 The relative contribution of L1 reading comprehension to L2 reading comprehension according to L2 language proficiency

English reading comp.	Coef.	Std. Error	t	P>  t	R-squared	Adj. R-squared
Hungarian reading Top half of Michigan N=32	1.7315	.7137	2.43*	0.021	0.1640	0.1361
Hungarian reading						

Bottom half of Michigan  N=32	.6287	.4785	1.31	0.199	0.054	0.022
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We used the previously determined two English proficiency (measured by the Michigan test) groups' Hungarian reading scores to calculate the contribution of L1 (Hungarian) reading comprehension to L2 (English) reading comprehension. We can note that L1 reading comprehension abilities only contribute significantly to L2 reading comprehension at the higher proficiency level; at the lower proficiency level it does not. This suggests that in order for L1 skills to be helpful, one needs to attain a certain threshold level of L2 proficiency in order for Linguistic Interdependence to play out. This will be further discussed in the following chapter.

In addition, we investigated the following variables from the information provided on participants' questionnaires: participants' reading habits in Hungarian and in English as well as participants' knowledge of another language. Our results show that none of these variables contributed to successful L2 reading. And, finally, as reported in Chapter 4, we also tested our participants' non-verbal IQ, primarily to ensure that their cognitive abilities were within the normal range. However we also included this measure in our correlations and, as can be seen on Table 3, non-verbal IQ had a significant correlation with every variable studied, except for Hungarian syntax, so some discussion of this finding will be offered in Chapter 6.

## 5.7. Summary

The statistical analyses of the data offer answers to our research questions, and provide us with numerical evidence to confirm or disconfirm our hypotheses. In answer to Research Question 1, we have demonstrated that L2 syntactic comprehension has a significant effect on L2 reading, while L1 syntactic comprehension plays a lesser role. On the other hand, Research Question 2 asked whether there were differential effects of syntax due to L2 proficiency levels and the answer is no, for our participants at least. Regarding Research Question 3, we found a difference between the effects of the various complex L2 syntactic structures, such that temporal adverbials had the largest effect, and passive structures had the smallest effect. Finally, Research Question 4 asked if among other factors, there is a differential contributing effect of L1 reading comprehension according to L2 language proficiency. Moreover, it also investigated the contribution of other factors, such as non-verbal IQ, the knowledge of other languages and reading habits in both L1 and L2. We found that in order for L1 reading skills to be transferred to L2 reading comprehension, one has to have sufficient L2 skills, lending support for hypotheses initially proposed by Cummins (1977, 1980, 1984), the Linguistic Threshold Hypothesis and the Linguistic Interdependence Hypothesis. In Chapter 6 we will interpret these results in the context of our hypotheses and recent research studies.

## **Chapter 6**

### **Discussion**

#### **6.0. Introduction**

The primary objective of the study was to test whether syntactic abilities in L2 contribute significantly to one's reading comprehension in L2. To accomplish this objective, we carried out a cross-sectional study with Hungarian speakers learning English by testing their ability to

process complex syntactic structures in both L1 and L2, and relating these to their reading performance in L2.

The previous chapter presented the statistical results, and so in this chapter we will discuss in detail what those results mean in the context of L2 reading theories. We will also pose other questions that have arisen in the analyses of the results. Answers to those questions will be considered as an attempt to further our understanding of the relationship not only between syntax and L2 reading comprehension, but also the interaction of linguistic knowledge and reading comprehension.

## **6.1. Discussion of findings**

### **6.1.0. General discussion**

Our study was motivated by some unsettled issues in three overlapping areas within L2 reading research: first, the relative contribution of syntactic skills (in both L1 and L2) to L2 reading comprehension; second, the differences in processing difficulty between various complex syntactic structures and the possible reasons (e.g., transfer and developmental) for them;

and third, the relative significance of L1 reading ability and L2 language proficiency in L2 reading comprehension as well as other contributing factors, such as non-verbal IQ and reading habits. We will examine our results taking into consideration these issues in light of our research questions, and keeping in mind Alderson's (1984:21) suggestion on research studies pertaining to the relationship among L2 proficiency, L1 reading and L2 reading:

“What is needed is at least information on reading ability in the first language, ideally where the sample of subjects contained both „good” and „poor” first-language readers; information of the reading ability in the foreign language; and information about the level and, importantly, the nature, of the foreign language proficiency of the same individual.”

We will see in our discussion below that our design partially followed Alderson's suggestion, despite the fact that our participants were considerably high level L1 readers. In other words, we did not have in our sample “poor” L1 readers, but there was still a range of differences within the group tested. While our participants' L2 reading comprehension was relatively low, their general language proficiency in L2, assessed by the Michigan Test of aural comprehension, was high.

Let us begin with reiterating some of the characteristics of our participants and their results on the various tests. Given our participants' mean age (18.3) and the fact that at the time of testing they had been studying English as a foreign language for 7-8 years on average, our findings indicate that we experimented with a relatively highly skilled cohort that possessed good L1 reading skills as well as relatively high L2 proficiency. Recall that our participants performed above 90% on the syntactic processing test in both languages, although there was a range of significant differences among the structures tested. Furthermore, their performance on the non-verbal IQ and L1 reading comprehension was close to 80%, and their L2 proficiency was

almost 70%. L2 reading comprehension and L2 vocabulary performance, however, were in the lower range of 44 and 52% respectively.

One might legitimately ask the question why choose such high level learners. Our rationale for selecting young adults with high level skills lies in Cummins's hypothesis (1984) according to which transfer of L1 reading (or other academic skills) to L2 will only occur if students have achieved a considerably high level of L1 skills. Furthermore, Clarke's (1980) "Linguistic Ceiling Hypothesis" also presupposes a certain level of L2 proficiency in order for students to benefit from high level L1 reading skills. The question then becomes whether learners who have high L1 skills necessarily use those skills to acquire L2 syntax, and further, whether newly acquired syntactic abilities necessarily contribute to L2 reading. In addition, high levels of L2 proficiency were important if we want to contribute to the growing literature on potential threshold effects in L2 reading, i.e. that L1 skills will only transfer to L2 reading if learners have reached relatively high levels of proficiency in the non-native language. We will see that this is exactly what our research has illuminated.

To start our discussion, we might want to pose some general questions, which are a rephrasing of the research questions that were the focus of this study: What are the skills that contribute most to fluent L2 reading comprehension among readers whose L1 literacy skills are adequately high? What is the role of the ability to process complex syntactic structures in efficient L2 reading? What is the significance of transfer — if there is any — of L1 structures in attaining efficient L2 reading comprehension? Are there any other contributing factors to L2 reading comprehension besides those presented above?

By looking at our data, we can note that all the independent measures correlate with L2 reading comprehension either at the .05 or at the .01 level. In other words, the order of correlations corresponded to the following order: The most highly correlated measure with L2 reading comprehension was L2 vocabulary, followed by L2 syntactic processing ability, followed by L2 proficiency, with the fourth most highly correlated measure being L1 reading comprehension. These measures correlated at the .01 level, while L1 syntax and non-verbal IQ correlated at the .05 level. The many correlations with L2 reading comprehension are not surprising given that reading is a highly complex cognitive activity involving an interaction of related skills. The fact that L2 vocabulary knowledge had the highest correlation of all the measurements is also expected, for one must know the words of the language one wants to read and understand. Both L1 and L2 studies indicate the crucial nature of this skill (e.g., Daneman, 1988). Some research studies have even shown a causal relationship between lexical knowledge and reading comprehension (e.g., McKeown et. al, 1983), and in L2 this strong relationship has also been demonstrated (e.g., Coady et al., 1993; Hawas, 1990; Koda, 1989). However, vocabulary knowledge alone is not enough, and while there is no research that would dismiss the importance of lexical knowledge, there are very few studies that strongly acknowledge the importance of syntax (e.g., Barnett, 1986; Shiotsu & Weir, 2007).

Consequently, our goal was to investigate the extent to which the ability to process complex syntax would contribute to L2 reading comprehension. It is appropriate to point out fact that our study is based on correlational analysis and therefore gives no evidence of causality. Let us see what our results mean by comparing them to previous studies in the area.

### 6.1.1. The relative contribution of syntactic skills to reading comprehension

Let us revisit some of the studies that have looked into the reading skills and syntactic abilities of both monolingual and bilingual children. We can recall from our discussion in Chapter 2 that several studies have demonstrated the importance of syntactic skills in early L1 reading development (e.g., Bowey, 1986; Demont & Gombert, 1996; Tunmer, 1989) giving credibility to the Syntactic Deficit Hypothesis according to which reading demands more linguistic competence than beginning readers possess; and even though learning to speak and learning to read are continuous processes, the hypothesis asserts that reading requires the ability to process more complex linguistic structures than does early speech development. Consequently, some assume that monolingual children's reading comprehension deficiencies can be attributed to a lag in syntactic development (Bentin, Deutch, & Liberman, 1990; Bowey, 1986a, 1986b; Stein, Cairns & Zurif, 1984). While it is hard to import this hypothesis to L2 reading among older learners – for the obvious reason that such learners are generally proficient in their L1 syntax before learning to read in L2, – the significance of adults' syntactic abilities in two languages is nonetheless worth examining, particularly in the developing L2. Recall that research focusing on the relationship of L2 syntax and L2 reading ability mostly involves children who possess low L1 literacy skills and relatively low L2 proficiency. Our study's primary goal was to investigate whether the ability to process sentences with complex syntactic structures is indeed an important component of non-native reading comprehension. The contradictory findings regarding this issue have been discussed at length in Chapter 2 where we mentioned that while earlier theories of reading comprehension in L2 – following a trend in L1 – revolved around concepts like schemata, and syntactic processes were considered largely

irrelevant, recent research argues that reading ability is largely a matter of narrow linguistic abilities.

To illustrate this point, while Cowan (1976) maintained that difficulty in reading a foreign language often results from frustrated expectations in sampling syntactic clues which do not correspond to structures in the readers' L1, Ulijn & Kempen (1976:499) claimed in this regard that "under normal conditions reading comprehension is little dependent on a syntactic analysis of the text's sentences." They further assert that usually the reader's conceptual knowledge will compensate for the lack of knowledge about linguistic contrasts between L1 and L2. Therefore, Cowan's parallel processing theory (i.e., that readers tend to process L2 syntax with the same strategies they adopt for the L1) was not confirmed by Ulijn and Kempen.

Cooper (1984) drew similar conclusions to Ulijn and Kempen's. The correlations between a test of reading comprehension and a series of lexical and syntactic tests lent support to the view that knowledge of word meanings is more important than knowledge of syntax for successful comprehension. Cooper's research showed a significantly higher correlation between a test of reading comprehension and a test of the meaning of grammatical and lexical cohesion (.85) than between the reading comprehension test and a test of syntactic meaning (.64). Berman (1984), however, indicated that participants reading a syntactically simplified version of a text did better on reading comprehension questions than did students reading the original version, especially as far as specific information was concerned. In a later study Haynes and Carr (1990) found that while reading comprehension performance in their study correlated more with vocabulary than grammar, the students' reading speed showed the reverse pattern. More recent research (Shiotsu & Weir, 2007) has also shown a very strong correlation between L2 syntax and L2 reading, suggesting that the issue is far from resolved.

The problems involving these and similar studies in general are in the differences of definition of terms and research designs. For example, Gaux and Gombert (1999) interchangeably use the terms syntactic knowledge, syntactic awareness, syntactic ability, and syntactic skills. Shiotsu and Weir (2007) only use the term syntactic knowledge, but the way they tested this knowledge was with a multiple choice cloze test — a major problem in itself according to Bernhardt (2000); in addition, this test inevitably involved reading, and additional confound. We credit ourselves with creating a purer syntax-measure where contamination of the results was minimized (see detailed description of the Test of Syntactic Processing in Chapter 4). Our study, therefore, attempted to support the few studies which have shown that the ability to process complex syntactic structures is indeed an important component of L2 reading comprehension.

Where do our results line up in the theories of L2 reading? Currently, most researchers subscribe to an interactive model of reading, both in L1 and L2 (e.g., McClelland & Rumelhart, 1981; Rumelhart, 1994; Carrell et al., 1988). That is, there are theories that characterize L2 reading comprehension mostly as the application of higher order L1 strategies and metalinguistic skills (e.g., Goodman, 1971). Other theories stress the importance of lower level skills and L2 linguistic knowledge (e.g., Alderson, 1984; Clarke, 1979; Cummins, 1979), and yet others, that emphasize the efficient and automatized processing of linguistic information (e.g., Favreau & Segalowitz, 1983; Koda, 1996; Segalowitz, 2000). An interactive model concedes that top-down, bottom-up and automatic processing are all important in the reading process, potentially including the learner's syntactic skills.

Considering the range of linguistic skills acknowledged in this interactive model of reading, let us turn our attention first to L2 syntax and examine its role in L2 reading comprehension, the

most important issue in our study. Our findings show that this variable had the second highest correlation (right after L2 vocabulary) with L2 reading comprehension, being .475. This demonstrates the highly significant role L2 syntax plays in L2 reading comprehension, contributing overall 21.3% to it. Our hypothesis predicted that L2 syntax will play a larger role in L2 reading than L1 syntax. This was an accurate prediction given that the contribution of L1 syntax to L2 reading comprehension was only 7%. Martohardjono et al.'s (2005) study with bilingual Spanish-English children found a stronger relationship between the children's L1 (Spanish) syntax and L2 pre-reading skills than between their L2 syntax measure and L2 pre-reading skills. The researchers mostly emphasized the sub-skill of listening, as the most significant predictor of L2 reading comprehension. Nevertheless, significant correlations were determined also between other pre-reading skills (i.e., literacy concepts, oral language concepts, and letter-sound correspondences) and the syntax measures. While both L1 and L2 syntactic skills correlated with these measures, L1 syntax indicated a more significant relationship than that of L2. Our study differed from Martohardjono et al.'s, for our goal was to link the syntactic abilities of highly literate young adults to their L2 reading comprehension. The relationships between syntactic skills and reading comprehension in older L2 learners is still a controversial one (and, to our knowledge, there are virtually no studies of this relationship in skilled L2 readers. In this, our study contributes to the ever growing field of L2 reading research in that 1/ it examines a typologically different language (Hungarian); 2/ it uses a syntax measure that more accurately taps into participants' syntactic processing and comprehension skills (as opposed to cloze tasks, enactment or grammaticality judgment tasks; and 3/ it utilizes participants who are highly literate in their L1 and learned their L2 skills in a foreign language classroom setting. We can thus claim that our findings confirm that strong syntactic abilities are necessary for efficient

L2 reading comprehension among highly skilled older L2 learners of a language very different from their L1.

Let us examine another important correlation: the one between L2 syntax and the Michigan proficiency test. Here we can note that the correlation yielded the highest value:  $r=0.558$ , meaning that understanding aurally presented sentences in an L2— as used in the Michigan test — is more related to syntactic processing ability in that language than reading comprehension is. This seems logical given that the aural sentence comprehension and the syntactic processing tests involved very similar skills, that of processing and correctly interpreting decontextualized sentences. The subtest of the Michigan test that we used to determine our participants' L2 levels measured receptive proficiency through aural sentence comprehension, but it did not use any of the structures that were tested in our syntax measure. Also, the Michigan test used question forms to which participants were supposed to choose the written correct answers from their questionnaire. Consequently, it involved at least some type of reading skill, although the questions were presented orally. In fact, this test has been used in many L2 studies as a measure of general L2 proficiency, when in fact it primarily measures grammatical accuracy through listening comprehension. It is also an important measure of the validity of our syntax test that is correlated so strongly with the Michigan Test.

There is little dispute in the field of L2 reading research that the two most important linguistic factors are vocabulary knowledge and syntax (e.g., Barnett, 1985; Brisbois, 1995; Shiotsu and Weir, 2007), though the interaction of semantic and syntactic factors is not well understood in L1 reading either. This overlapping nature of the two might be responsible for the strong correlation between L2 syntax and L2 vocabulary ( $r=0.552$ ). In general, most research studies (e.g., Bossers, 1992; Taillefer, 1996) have demonstrated that vocabulary makes a larger

contribution than syntax (or as they refer to it, “grammar”) does. For example, when calculating separate contributions of L2 proficiency (measured by vocabulary and grammar) and L1 reading skills, L2 vocabulary contributes about 27% and syntax contributes about 3%. In our study we did not calculate the separate contribution of vocabulary knowledge, only the one of syntactic processing ability in both the L1 and L2. Nevertheless, we also noted that the most strongly correlated measure with L2 reading comprehension was vocabulary ( $r=0.543$ ).

Let us now examine the correlations of L1 syntactic processing with other variables. Our results, as shown in Chapter 5, demonstrate that the mean percent correct on the Hungarian syntactic processing test was 98%, which means that our participants’ syntactic skills have reached a plateau on these measures.

The only variable that the processing of L1 syntax correlates with is L2 reading comprehension ( $r=.292$ ), and the significance barely holds at the .05 confidence level. In other words, it is almost non-significant. We had hypothesized that L1 syntactic abilities would not contribute at all to L2 reading comprehension because of the already finalized stage of young adults’ L1 syntax. This hypothesis originated from our expectation of having a ceiling effect in L1 syntax. In fact, what the results indicate (98% accuracy) is virtually ceiling, and the mistakes cannot be attributed to lack of knowledge of these structures, but rather to occasional slips of attention, fatigue or the like. To conclude, while L1 syntax’s contribution to L2 reading comprehension was only 7%, the contribution of L2 syntax to L2 reading comprehension was over 21%, suggesting a much stronger contribution of the latter as predicted.

In summary, our findings for the first issue in this discussion indicate the importance to L2 reading of the ability to process complex syntax in both L1 and L2; however, the importance

of L2 syntactic comprehension is much greater than that of L1 syntax. This finding points to an intricate relationship between L2 proficiency – that consists of vocabulary and syntactic knowledge – and reading. How the level of L2 proficiency plays an important role and how L1 reading skill comes to be an important factor will be looked at below.

### **6.1.2. The relationship between syntactic processing ability and L2 reading comprehension according to L2 proficiency levels**

In our second research question we investigated the relationship between syntactic abilities and L2 reading comprehension across two levels of L2 proficiency: High and low. Proficiency is not an easy construct to define, for it refers to many aspects of language competence, such as metalinguistic awareness, the ability to speak, read, write, and listen to the language accurately as well as fluently in a contextually appropriate way. In fact, proficiency is defined differently by different researchers and there is no clear agreement on how to represent constructs associated with knowledge of the language. For research purposes in studies of the relationship between L2 proficiency and other factors, the most commonly used language proficiency tests are the ones with proven validity and reliability, such as the one used in this study: The University of Michigan English Language Institute Listening Comprehension Test. (Other proficiency tests include the TOEFL, the Token Test, the Descriptive Test of Linguistic Skills, and the University of Cambridge First Certificate).

One of the theories about the relationship between L2 language proficiency and L2 reading comprehension is the notion of a threshold level of language proficiency (e.g., Cummins,

1979) or linguistic ceiling (Clarke, 1978, 1980). The concept of threshold in academic fields indicates a turning point on a continuum at which a major change will occur. In L2 reading, a threshold level has been closely associated with language proficiency, sometimes called a linguistic ceiling. The idea is that L2 learners will not be able to read effectively unless they develop some proficiency in the target language, no matter how good L1 readers they are. In other words, whether readers have or have not reached the linguistic threshold level can be a deciding factor in their success/failure in L2 reading. We might have rightfully assumed that our participants, being highly proficient in L2, passed the linguistic threshold at which point the effects of syntax can be investigated. We will further discuss the idea of threshold effects when we investigate the relationship between L1 and L2 reading. For now, we focus on whether L2 syntax affects the lower continuum of the relatively high L2 proficiency learners.

In our study we hypothesized that at relatively lower levels of L2 proficiency participants' syntactic ability will contribute more to their L2 reading comprehension than at relatively higher levels of L2 proficiency, for those who possess higher L2 proficiency will rely on their syntactic processing less than those whose L2 proficiency is not so high. We based our hypothesis on the existence of compensation strategies, which are known to be widely used in many tasks, such as reading or communication in a foreign language. They are defined by Oxford and Crookall (1989) as "behaviors used to compensate for missing knowledge of some kind, e.g., inferencing (guessing) while listening or reading, or using synonyms or circumlocution while speaking or writing" (p. 404). Furthermore, we based our hypothesis on Stanovich's (1980) interactive-compensatory model of reading, according to which less-skilled readers have to compensate for their weak word recognition skills by using contextual information. Further research demonstrated compensation between vocabulary and background knowledge (Stahl et al, 1989,

1991). In other words, stronger components of reading will try to make up for the weaker ones. Consequently, our assumption was that lower level students would compensate for their lack of vocabulary knowledge by relying on syntactic and morphological clues, such as word order and suffixes.

Our hypothesis, however, was not confirmed: After we split our sample around the median, into high and the lower level groups, we found that L2 syntactic skills contributed equally to L2 reading at both levels. In other words, there was no statistical significance between the degrees of contribution of the two levels, even though the groups were statistically two distinct ones. On the other hand, as we mentioned previously, the “low” group was not truly low (our participants’ mean percent correct on the proficiency test was at 69%). Therefore, both groups (low and high) possessed rather high skills in English. Had we had a wider range between the proficiencies, we might have had stronger results in terms of differences in the contributing factors of syntactic skills. On the other hand, the range on the L2 proficiency task (i.e., the Michigan test) was much wider than the one on the L2 syntax measure, which suggests that the syntactic test was made easier by the fact that it included a visual context. That is, recall that our syntactic processing tests involved correctly matching aurally and visually presented sentences with their corresponding pictures while the proficiency test as discussed in Chapter 4, utilized decontextualized sentences presented orally without any picture cues.

In conclusion, we can state that syntax is a very important contributing factor to L2 reading comprehension when L2 proficiency is relatively high. Further research will need to determine the extent to which this is also the case when L2 learners are at lower levels of L2 proficiency.

### 6.1.3. The individual contribution of complex syntactic structures

Our third research question concerned the relative contribution of various complex syntactic structures, and our hypothesis claimed that L2 structures that are dissimilar to the ones in L1 will contribute more to L2 reading comprehension than similar structures will. Our correlations indicate that each complex structure that was tested correlated with L2 reading comprehension. The one simple structure (active sentences in simple past tense) did not correlate with reading comprehension, as expected. The most highly correlated structure was temporal adverbials, followed by passives, and then relative clauses. The contributing effects of these structures were derived from regressions and they followed the same pattern: temporal adverbials contributed the most explaining 15.6% of the variance, followed by passives with 13%, and finally, relative clauses, with 10%. Our hypothesis, as noted above, was that structures that are missing from participants' L1 (e.g., the passive) will contribute the most to L2 reading comprehension and those which are identical (temporal adverbials) will contribute the least. This prediction originates from the previously discussed transfer-hypothesis under 3.7. However, this prediction was not supported. In fact, the opposite pattern can be observed: temporal adverbials were the most problematic, followed by passives and finally, relative clauses. This outcome, therefore, cannot be attributed to transfer effects, but rather to the inherent complexity of temporal adverbials, to be discussed below.

Let us first look at the distribution of errors within the structures. Analyzing the errors of the various syntactic structures reveals that despite the fact that participants performed correctly

at least 90% of the time on each structure, they made at least one error with each and every type of structure. In the following section we will compare the various structures and analyze the differences between them.

The majority of errors occurred with the temporal adverbial clauses, which left the mean percent correct for this structure at 90%. Why did our participants make more errors on temporal adverbials than on either passives or relative clauses? As discussed extensively in Chapter 3, there is no evidence that these structures are syntactically more complex than relative clauses or passives, and so we might only speculate on the answer. One plausible explanation might come from the semantic hypothesis according to which processing temporal expressions puts a burden on working memory. This burden might slow down comprehension and while the time we allotted for making a decision as to the meaning of a given sentence (15 seconds) might be sufficient for most complex structures, this allotment might not be sufficient for the processing of temporal adverbials, especially with the added illustrations they required (see below).

Furthermore, contradicting Clark's (1971) semantic feature principle according to which the positive aspect of a feature is learned before the negative aspect, and thus *before* sentences (e.g., Before the girl fed the dog, she went to the museum) would be easier than *after* sentences (e.g., After the girl fed the dog, she went to the museum), our study did not find significant differences between the two types. In fact, this principle has also been contradicted by other studies with children (e.g., Coker & Legum, 1975). There was also no significant difference between errors on sentences with natural order and those with reverse order. This means that contrary to children, who perform better on natural order sentences, especially those which have the main clause first, for young adults this is not a factor.

One explanation for this difference between young and older readers might be the cognitive advantages that adults have in processing decontextualized sentences. Olson's (1977) developmental hypothesis, for example, states that the ability to assign meanings to sentences *per se*, independent of their extralinguistic contexts, is achieved only in the middle school grades. In fact, the claim that the processing of decontextualized sentences is a most difficult task for young children is supported by several reviews of metalinguistic development (e.g., Hakes, 1981; Ryan, 1980 a, b). Furthermore, by manipulating the degree of contextual support, investigators have shown that young school-age children often rely on semantic strategies to interpret the meanings of structures such as passive sentences (Hutson, 1975; Powers & Gowie, 1977) and temporal adverbials (French & Brown, 1977). Emerson (1979, 1980) observed that without contextual support, even 8 and 10-year-olds do not demonstrate good comprehension of sentences with logical connectives. Young adults, as in our study, also appear to have problems with these connectives, but these difficulties are not associated with particular temporal features or order of clause presentation, both of which cause additional problems for younger readers of decontextualized sentences.

Another possibility for obtaining the highest percentage of errors on temporal adverbials is that illustrating these sentences required two pictures for each sentence, which altogether meant six pictures on the screen, instead of three required for other structures (see Chapter 4 for details of these illustrations). To comprehend, process, and match a sentence with its corresponding illustration might have been a demanding task to carry out in 15 seconds for even relatively high L2 learners. The likelihood of this explanation is further demonstrated by the high correlation between the non-verbal IQ scores and L2 syntactic processing ones in our study. The task in the non-verbal IQ measure required high levels of visual processing abilities that

closely resemble the ones used in the pictures of our syntactic task, especially with temporal adverbials where the sequencing of pictures was of crucial importance. Similar visual sequencing abilities are involved in successfully completing non-verbal IQ tests.

Relatedly, the culprit might also be a general time constraint as noted above. Favreau & Segalowitz (1983) and Segalowitz & Segalowitz (1993) have demonstrated that even fluent bilinguals read slower and fixate longer on individual words than monolinguals of the same reading level. Our participants were far from being fluent bilinguals, and so it is plausible that the time limit caused their low performance on temporal adverbials, though not on other structures where processing demands were not as great.

Our hypothesis regarding the positive effects of transfer was not confirmed. Recall that we predicted less contribution of (and consequently fewer errors on) temporal adverbials because these structures are identical in the two languages of our participants, Hungarian and English, and we hypothesized that these structures (after the active sentences) would be the least problematic ones; yet they were the most difficult for our participants. Importantly, in our L1 syntax test the most troublesome structures were also the ones involving temporal adverbials. This parallel finding tends to point to the explanation above: six pictures are hard to select from in any language.

If we turn our attention to the relative clauses and the passive structures, we can note that their success rate was at the same level (93.4% and 94% respectively). Let us first analyze the results of the relative clauses, for within them, there were two different types, namely the Subject-Subject (SS) and the Subject-Object (SO) ones, and there was a meaningful difference

between these two types in our study.<sup>14</sup> These are also referred to as “subject-modifying relatives” and are considered moderately difficult.<sup>15</sup> In our discussion of relative clauses in Chapter 3, we discussed the various theories accounting for the difficulty of SO types over the SS relatives. Our results, however, demonstrated unexpected superiority for the SO structures over the SS relatives. How can we account for this outcome given that SO relatives in most languages are believed to be more difficult?

One of our explanations refers back to the Noun Phrase Accessibility Hypothesis by Keenan and Comrie (1977) according to which subjects are more accessible than direct objects, and direct objects are more accessible than indirect ones. Based on this, Keenan and Comrie give two possible psychological reasons for the supposed advantage of subject relativization over object relativization. One focuses on the idea that there is a default processing strategy to take the head as the subject of the relative clause. The other is that subjects and heads share what they call the logical property of “independent reference.” This ease-determinant should make similar predictions for Hungarian relative clauses, since it specifically focuses on the roles of subject and object, rather than topic and comment.<sup>16</sup> Conceivably, however, the effect of this determinant might be weaker in Hungarian, since the subject role is not as prominent in Hungarian as it is in English.

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<sup>14</sup> Even though Object-Object (OO) and Object-Subject (OS) sentences are also often the target of psycholinguistic research, the only ones that are centrally embedded among the four restrictive relative clauses are SS and SO relative clauses, and so these were targeted in this study.

<sup>15</sup> As discussed in Chapter 3, there are three basic factors that seem to be the most important ones in determining the difficulty or ease of relative clauses: role of the head in the main clause, role of the head in the relative clause and the position of the relative clause in the sentence. Therefore, subject-modifying relatives in English should not be compared to object-modifying ones for the confounding nature of the above mentioned factors. In other words, if we compared them, we would not be able to tease apart whether the origin of any difficulty comes from central embeddedness or the role of the head in the relative clause.

<sup>16</sup> Topic-prominent languages, such as Hungarian (unlike subject-prominent languages such as English), have syntax that highlights the distinction between topic (theme) and comment (rheme/focus). In its simplistic form topic is what is being talked about, and comment is what is being said about the topic.

Let us offer now a morphological explanation. In English there are two major cues to relative clause processing. One cue is the relative pronoun “who/which” and the relativizer “that.” The presence of the relativizer “*that*” after the noun is a highly reliable cue to the presence of a relative clause (MacWhinney et al., 1984). The second cue in English is a word order cue. Within the relative clause, the order of words is extremely strict. If there is a noun (subject) preceding the verb of the relative clause, the relative clause is an object relative, and if there is no noun (subject) preceding the verb of the relative clause, the relative clause is a subject relative. These cues to structure are always there, and so are completely reliable. According to MacWhinney & Pléh (1988), because the most valid cue in English is an order cue and not a morphological cue, – “that” can be deleted in object relatives – there has been an emphasis in the relative clause literature on the importance of configurational patterns.

In Hungarian, on the other hand, morphological marking is the most important determinant for sentence processing (MacWhinney et al. 1985). In fact, Hungarian case marking gives immediate and 100% reliable cues unambiguously to mark syntactic relationships. These cues with SO sentences happen earlier in the sentences (on the relative pronoun) than with SS sentences. Contrary to English, where the relative pronoun can be left out in object relatives, in Hungarian it is always there. To illustrate with two examples from our syntax measure, let us look at a SS and SO sentence in (1) and (2) respectively:

(1) A            tolvaj            aki    megfogta    a    ferfit            piszkos    volt.

The        thief            who    caught        the    man (ACC.)    dirty        was.

The thief that caught the man was dirty.

(2) A    tolvaj        akit    megfogott    a    ferfi        piszkos        volt.

The thief        whom caught        the    man        dirty        was.

The thief that the man caught was dirty.

We can note that in (2) the accusative case of the relative pronoun (*akit*) as well as the accusative inflection of the verb (*megfogott* as opposed to the nominative inflection *megfogta*) serve as double cues for interpreting the sentence correctly in Hungarian; of course neither cue is available in English. We might speculate that this existing duality in Hungarian might have influenced our participants towards SO rather than SS while they were processing the English relative clauses. This might be all the more plausible because we used the default “that” instead of “who.”

Another reason for the unexpected result of SS sentences being more difficult than SO ones may lie in the fact that after careful examination of the stimuli sentences we realized, that out of six SS sentences, four sentences used a semantically plausible but unlikely situation that might have been in conflict with participants’ expectations. To illustrate our point, sentences in column (A) are more plausible than sentences in column (B):

(A)

(B)

The thief that the man caught was dirty.

The thief that caught the man was dirty.

The dog that the child found was fat.

The dog that found the child was fat.

The cat that the dog killed was black.

The cat that killed the dog was black.

The woman that the man pushed was blond. The woman that pushed the man was blond.

It is possible that according to our participants' presuppositions, it is more likely that the thief is caught, and the dog is found, and the cat is killed, and the woman is pushed as opposed to the other way around in the sentences in Column B.

Going back to the individual items, we in fact, found that these very sentences, i.e., those in Column B, produced the most number of errors compared to the kinds that matched presuppositions. Future research should carefully control for semantic biases in such sentences.

Finally, passive structures did not pose the difficulty for our participants that we had anticipated. Since passive does not have syntactic equivalents in Hungarian, but has translational equivalents, we can state that our result is somewhat in line with the claim that the lack of a certain structure in L1 (whether at a surface level or underlyingly) only manifests inhibition or avoidance in production in L2, but not in comprehension in L2 (Levenston, 1971). Alternatively, we might claim that translation equivalents in the native language, though syntactically different from their corresponding L2 structures, are enough to facilitate syntactic learning of these structures in a new language. Our result with passive sentences is also evidence that while, children during their syntactic development, might interpret passives as actives, this is not the case with L2 adults, especially those who have advanced knowledge of English. However, another plausible theory might attribute the relative success our participants achieved on this structure to the positive influence of Slovak as a second language, which has the structural equivalent of the English passive. This is an interesting assumption that might be tested out with

participants who do not have a “facilitating” non-native language, which is structurally closer to English than their L1 is. The role of Slovak will be further discussed in Chapter 7.

Despite the fact that our hypotheses about each structure’s contribution based on transfer did not appear to be supported, we can state that the ability to process complex syntactic structures is a significant contributor to successful L2 reading. This finding regarding particular complex structures and their relationship to non-native reading is an important contribution to the current literature on L2 reading comprehension, which has not focused on such detailed analyses up to now.

In the end, let us return to the issue of readability formulas and their consistent disregard for factoring in syntactic complexity. As mentioned previously, readability formulas use certain language variables in a piece of writing in order to provide an index of its probable difficulty. Botel and Granowsky (1972a & b) have suggested that a difficulty measure for primary grade materials based upon syntactic complexity should parallel the usual readability formulas that emphasize vocabulary. They rated the complexity of various sentence structures on a 0-3 scale, based primarily on sentence length. There have been other attempts as well to factor in complexity, but most of these efforts were in the 1970s when a complexity hierarchy was measured by the now out-dated Transformational Theory (e.g., Brewer, 1972; Endicott, 1973). The purpose of using these formulas for only the early primary grades suggests the acknowledgement that adults are supposed to have mastered even the most complex structures. However, this may not be true for L2 learners. This section and the preceding one have presented strong evidence that L2 syntax and, in particular, specific complex structures contribute greatly to L2 reading. On that basis, we have established that there is a need to

develop new readability formulas to include consideration for syntactic complexity and test them on various texts for validity and reliability, not only for children, but also for adults.

#### **6.1.4. The relationship between L1 and L2 reading ability**

Our last research question investigated the interaction of L1 reading abilities and L2 language proficiency as well as the extent of contribution of factors such as non-verbal IQ and reading habits to L2 reading comprehension. We predicted that L1 reading comprehension would significantly contribute to L2 reading comprehension, while L1 and L2 reading habits and knowledge of another language would not contribute significantly.

Let us begin with the second part of our hypothesis, the one that predicts no significant contribution of certain variables. The main purpose of our questionnaire was to make sure that our participants are a homogenous cohort that does not differ too much in those factors that might influence their success as L2 readers, including the age at which they began learning the L2 (see Chapter 4 for details). These factors included language use and reading habits, experiences studying abroad, and fluency in another language. Our hypothesis was confirmed, for no variable on the questionnaire correlated significantly with L2 reading comprehension.

The issue of IQ represents a potentially important point, so we now discuss this separately. While the sole purpose of administering the Naglieri non-verbal IQ test was to ensure that our participants' intelligence fell within the normal range, we could not help but notice its significant correlation with L2 reading comprehension, and almost all the other variables (except for L1 syntax) as well.

The nature of the relationship between reading ability and performance on IQ tests has been for a long time controversial. Most of the studies investigating this relationship (e.g., Jensen, 1980, 1981a, b; Kaufman & Kaufman, 1983; Naglieri & Das, 1997; Siegel, 1988; Stanovich et al., 1984; White & Jacobs, 1979) have been carried out with children, and the results are usually related to one's beginning stages of reading and predictions of future reading comprehension ability. Some researchers go as far as to claim: "When elementary school children of the same age are matched on decoding skill, their rank on a test of reading comprehension is practically the same as on IQ" (Jensen, 1980:325). However, most researchers would caution that the explanation of reading ability by a global trait rather than a subskill or a group of skills is untenable, for it fails to reflect the complexity of the reading process.

We predicted a non-correlation between reading, which is a verbal skill, and non-verbal IQ. We based our hypothesis on Vellutino et al. (2000) and Rutter and Yule (1975) who questioned the validity of using IQ scores to estimate expected reading achievement. These researchers contend that measures of language and language-based skills are better predictors of reading ability than are IQ scores.

Stanovich et al., (1984) gives an overview of studies that correlate IQ with reading comprehension where the correlations of IQ and reading comprehension fall within the 0.3-0.7 values. Also, with increasing age, this correlation value increases as well. Therefore, with adults, the relationship between reading comprehension and IQ is a stronger one. This is an important fact, for relationships between decoding skills, comprehension and IQ may change as reading ability develops. The problem, however, is that most of these IQ tests are not strictly-speaking "non-verbal." In fact, traditional IQ tests contain subtests that are highly related to reading (e.g.,

vocabulary) and so correlations between such tests and reading achievement can be considered contaminated. In our study, however, a strictly nonverbal IQ still moderately correlated (at the .05 level) with both L1 and L2 reading comprehension. In response to Vellutino et al., (2000) Naglieri (2001) insists that evidence from large-scale investigations (e.g., Carver, 1990; Das & Naglieri, 1997; Kaufman and Kaufman, 1983; Naglieri and Ronning, 2000) indicates that both group- and individually administered tests of nonverbal ability are significantly and substantially correlated with reading achievement, suggesting that there is ongoing controversy about the relationship between non-verbal IQ and reading. Our results lend themselves to the debate — this time involving L2 reading — supporting Naglieri’s claim of a positive (albeit not particularly strong) relationship with non-verbal IQ. It is also conceivable that reading in a non-native language is more dependent on IQ than L1 reading is.

Let us finally turn our attention to L1 reading comprehension and its role in L2 reading. The issue of the relationship between L1 and L2 reading has been framed in several hypotheses of which two — the linguistic interdependence hypothesis and the linguistic threshold hypothesis— were discussed in Chapter 2. Another theory is Clarke’s (1980) “short circuit hypothesis” that argues that “limited control over the language ‘short circuits’ the good readers’ system, causing him/her to revert to poor reader strategies when confronted with a difficult or confusing task in the second language” (p. 206). Clarke refers to the good reader’s system as “using large chunks of text in attempting to fill cloze test blanks” compared to poor readers who “rely more on the semantic cues rather than syntactic cues” (p. 204). What he meant by this is that being an efficient reader in L2 is largely a function of linguistic proficiency in that language. This statement is in line with Perfetti’s (1990) claim that narrow linguistic abilities distinguish good readers from poor ones. Despite the fact that Perfetti made this claim referring to L1

readers, we can generalize it to L2 readers as well. Therefore, limited L2 proficiency prevents the transfer of higher-level skills in L1 to transfer to L2 reading.

Studies about the role of transfer have generally shown a moderate, but significant correlation between L1 and L2 reading comprehension measures. In our study there was a significant correlation between the two reading measures, providing further support that literacy skills transfer across languages within the same orthography (Bernhardt and Kamil, 1995; Bossers, 1991; Brisbois, 1995; Lee and Schallert, 1997; Perkins et al., 1989; Pichette, Segalowitz, & Connors, 2003; 1979; Taillefer, 1996; Yamashita, 1999, 2002), and giving credibility to the Linguistic Interdependence Hypothesis (discussed in Chapter 2). Most researchers, however, hypothesize a stronger relationship between L2 proficiency and L2 reading than between L1 reading and L2 reading. For example, Bernhardt and Kamil (1995) found after examining several studies that L1 reading accounts for between 10% to 16% of the variances in L2 reading, whereas L2 proficiency accounts for between 30% and 38%. In some studies L2 proficiency accounts for as much as 55% (e.g., Hacquebord, 1989) of L2 reading ability. Overall, more evidence supports the conclusion that the problem of L2 reading is more attributable to weakness in L2 proficiency than to L1 reading ability. An important finding that helps sort out the issue is that the relationship between L1 and L2 reading ability becomes stronger when the learners' L2 proficiency becomes higher. Lower-level L2 readers are either not able to transfer their L1 reading skills, or even if they do, the degree of transfer is smaller in comparison to higher-level learners (Brisbois, 1995; Lee and Shalleart, 1997).

Another useful notion to further our understanding of the relationship between L2 proficiency, L2 reading and L1 reading ability is that of compensation. In fact, Alderson (1984) raised some questions related to compensatory mechanisms that might play a role in L2 reading:

“Is it conceivable that good first-language readers will require a lower threshold before being in a position to utilize their good reading strategies? Will the attainment of a higher-level of competence compensate a good first-language reader?” (p. 21). What Alderson means is that it might be possible to compensate for somewhat deficient L2 proficiency by high L1 reading ability and vice versa.

Yamashita (2002) attempted to investigate whether high L1 reading ability compensates for low L2 proficiency and vice versa, i.e., whether high L2 proficiency compensates for low L1 reading ability. In her experiment with 241 Japanese learners of English she found that the answers to both of these questions were positive, but as has been repeatedly shown, the compensatory facilitation of L1 reading ability was much smaller than that of L2 proficiency. Yamashita confirmed that L2 proficiency is primarily responsible for high levels of L2 reading comprehension, suggesting that, as the linguistic threshold hypothesis proposes, without a firm basis of L2 proficiency, achieving high levels of L2 reading is difficult. Nevertheless, her results also indicated that readers with high L1 reading ability benefited from their L1 reading skills at least to some extent even if their L2 proficiency was low; this suggests that the transfer of L1 reading ability happens in spite of low L2 proficiency, thus supporting the linguistic interdependence hypothesis (see Chapter 2), but disputing the threshold hypothesis as it is usually formulated. In fact, Yamashita proposes a new model of the linguistic threshold. She hypothesizes that there are three levels of the linguistic threshold: the fundamental level, the minimum level, and the maximum level. Before readers reach the fundamental level, L2 proficiency is so low that it cannot contribute to explaining any of the variance of L2 reading. The contribution of L2 proficiency increases when readers' L2 proficiency becomes higher and approaches the minimum threshold. Consequently, when L2 proficiency reaches a very high

level, the maximum threshold is reached and the contribution of L1 reading ability will increase in its contribution. This is very much a theoretical scenario, for at this level L2 reading is virtually the same as L1 reading. This level suggests that readers are able to process L2 linguistic elements such as vocabulary and syntax as automatically as native speakers.

The results of our study differ from those of Yamashita, but are consistent with other previous findings, though in those studies (e.g., Bossers, 1992; Brisbois, 1995) language proficiency was always measured by grammar and vocabulary as opposed to an independent measure as in our study. Our results indicate that the degrees of correlation of L1 reading and L2 language proficiency to L2 reading comprehension are virtually equivalent (.376 and .399 respectively). Moreover, the percentage of L1's contribution to L2 reading shows an interesting and important distribution across L2 language proficiency. While the contribution in the top L2 proficiency group is significant, it is not the case with the lower level group. In other words, this indicates that students in our study at least need to attain a threshold level of L2 proficiency before their L1 reading skills can aid in their L2 reading comprehension. This is in line with Alderson's (1984) prediction that reading ability in an L2 is more likely to be influenced by proficiency in the L2 itself than by L1 reading ability alone.

It seems then that being a good reader in L1 only helps in L2 reading comprehension if one also has a high enough proficiency in L2. This is an important finding that demonstrates empirically the interdependence of L1 literacy skills and L2 linguistic skills in L2 reading comprehension, and more specifically, a relatively high threshold for the transfer of L1 reading skills. Further research is needed to help illuminate the conditions under which a high threshold (as in our study) vs. a lower threshold (as in Yamashita's 2002 study) is required for this transfer to occur.

## 6.2. Summary

In our findings, we contributed to our understanding of L2 reading comprehension and its components. Besides the knowledge of vocabulary, the ability to process complex syntax is a significant factor in L2 reading comprehension among learners whose L1 reading ability is sufficiently high. To summarize our findings of this study, we can claim that while L1 syntactic abilities indirectly contribute to L2 reading comprehension, the most significant contributing factor after vocabulary knowledge is the ability to process complex syntactic structures in L2.

We also demonstrated that the role L2 syntax plays in L2 reading comprehension is equally important at a relatively high level of L2 proficiency. Moreover, our results indicate some statistically significant differences between the degrees of contribution among different structures. The order of contribution among the various structures tested in this study is the following from most to least: temporal adverbials, relative clauses and passive structures. This finding only reflects the particular Hungarian speakers in this study and the measures used to test them. Further research will undoubtedly find different L2 developmental orders, but the important point is that several different complex syntactic structures all contribute very significantly to L2 reading comprehension. Finally, and very importantly, we empirically demonstrated that L1 reading ability can make a significant contribution to L2 reading comprehension at a high L2 proficiency level, strongly suggesting that there is an L2 threshold needed before L1 reading skills can transfer to the L2.

In the next chapter, we will explore the possibilities these findings hold for future research.

## **Chapter 7**

### **Conclusions**

#### **7.0. Summary of results**

To recapitulate the findings and the general conclusions of this study, we can claim that there is a significant relationship between L2 syntactic comprehension and L2 reading, supporting the major hypothesis of this study. We also found that L1 syntactic abilities relate to

L2 reading, but not as strongly, indicating differences between the young adults in this study and the children of Martohardjono et al.'s (2005) study, as expected.

The study also concludes that L2 syntax contributes to L2 reading comprehension at relatively high levels of L2 language proficiency. As far as the various late-emerging complex structures are concerned, significant correlations were found with temporal adverbials, relative clauses, and passives, but not with the simple active sentences, as expected. This supports our initial claim that not every structure will have a significant correlation with L2 reading comprehension, only late-emerging complex ones.

Finally, in an attempt to answer the question of what other variables contribute to L2 reading comprehension we can conclude that while non-verbal IQ's correlation is significant, it does not have a particularly strong relationship with L2 reading comprehension. However, L1 reading comprehension makes a very significant contribution but only when L2 language proficiency is in the upper range. Therefore, Alderson's question whether L2 reading difficulties represent a reading problem or a language problem cannot be answered straightforwardly, for it looks like L1 reading skills in proficient readers can only be transferred after one achieves a relatively high threshold level of linguistic proficiency in L2. Thus both L1 reading skills and L2 proficiency interact in interesting ways as they contribute to L2 reading.

### **7.1. Theoretical contributions of the study**

This study supports some not-so-well established previous claims regarding the contribution of syntactic abilities to reading comprehension. It takes a step further the findings

of the Martohardjono et al., (2005) study with children, and makes further contributions in that it sheds light on reading comprehension of the adult learners whose L1 reading level is high.

Furthermore, this study also illuminates some differences in difficulty of the various structures in a typologically contrasting language and points out the possible reasons for such difficulty. It also uses stimuli in a listening comprehension/syntax task that tap learners' syntactic knowledge as closely as possible (Klein and Martohardjono, 1999) as opposed to other studies that used mostly production tasks. Moreover, it points out the shortcomings of currently existing readability formulas that leave out syntactic factors from their calculations of text difficulty. Finally, and very importantly, it gives empirical credibility to the claim that L2 proficiency needs to reach a threshold level in order to make L1 reading ability helpful in L2 reading comprehension.

## **7.2. Pedagogical implications**

The implications of the study for classroom reading/L2 instruction in Slovakia are manifold. First, and most importantly, the study suggests that grammar instruction, within which complex structures are addressed, might be beneficial for Hungarian students in Slovakia. In other words, L2 vocabulary instruction cannot be taught in reading classes instead of teaching complex syntactic structures. Whether it is useful or not to point out the similarities/differences between Hungarian and English structures is not for us to determine, but incorporating them into various EFL skills, such as listening and mainly reading, is a necessary element for instruction

and practice at every level of EFL instruction. The more highly skilled in English syntax these learners become, the greater are their chances to become skilled English readers as well.

### **7.3. Limitations of the study**

No matter how much contribution a study makes to a field, there is always room for improvement. Some of the limitations of this study are addressed in this section.

As a cross-sectional, correlational study, it can only suggest relationships, while its predictive power is limited. Furthermore, the fact that our independent variables inter-correlate makes it very difficult to determine the exact amount of each measurement's contribution.

There are also ways our test materials could be improved. For example, the Hungarian reading measure was intended for 10<sup>th</sup> graders in Hungary, not 12<sup>th</sup> graders. Unfortunately, there was no available standardized reading measure for this grade, and so we were constrained to use this lower level version. The fact that the Hungarian reading test used substantially longer passages (in some occasions more than a page long), means that it is not quite comparable with the English reading comprehension measure.

Furthermore, it would have been useful to test more structures besides the ones we had tested. Also, besides the Subject-Subject (SS) and Subject-Object (SO) relative clause sentences, it would have been fruitful to test OO and OS sentences as well, given that the morphological explanation we presented in Chapter 3 of the order of difficulty predicts a fundamentally different order for Hungarian speakers than for English speakers.

Our study might also have benefited from the more current SEM statistical analysis, which more effectively deals with data where independent variables inter-correlate. Cronbach & Meehl (1955) pose two questions relevant to convergent and discriminant evidence as they relate to the evaluation of construct-validity: the first is whether the measures correlate with other measures they theoretically should correlate with. The second question is whether the measures that are supposed to be theoretically distinct correlate with each other. A well-designed study investigating the construct validity of measures of varieties of L2 reading comprehension should therefore include measures that are theoretically distinguishable as well as measures that are theoretically related. Our theoretically unrelated measure was only the non-verbal IQ, while all the other measures were theoretically related to L2 reading comprehension.

When a study has been completed and has answered the research questions adequately, it is usually the case that during the analysis more questions and ideas arise. Our study was not an exception from this rule. Besides the important findings, we have encountered many related issues worth investigating in the future. Let us discuss these below.

#### **7.4. Suggestions for further research**

The field of L2 reading provides vast opportunities for research, and this is especially true when it comes to the relationship between syntax and reading.

First, and most importantly, all our participants were also second language speakers of Slovak (the official language in Slovakia), and so in the future it will be useful to look at the same structures in Slovak (an Indo-European language that is syntactically closer to English than

Hungarian is), and determine its effects on English reading comprehension of Hungarian speakers in Slovakia. As a follow-up study we could also compare the results with those of monolingual participants from Hungary in order to measure the impact of another language when there is no intervening non-native language.

Also, to test the hypothesis from the transfer literature that claims that certain structures that are different/non-existent would be avoided in L2 production, we might want to design an L2 production study that would concentrate on the frequency of usage of these complex structures both in written and spoken form.

In order to more accurately test syntactic processing abilities in relation to reading, we might construct an eye-movement experiment that involves on-line processing of sentences. The data obtained this way would give a precise picture as to where in the sentence participants backtrack most frequently, indicating the problematic points within the sentence.

Moreover, in order to further investigate whether syntax plays a different role in L2 reading among low versus high and intermediate learners, we would want to investigate a range of learners whose proficiency is not yet advanced. As a measurement of syntactic abilities, it would also be desirable to include more than one type of task with various types of stimuli.

Finally, using the late-emerging structures we could also construct an input-modification experiment, where groups of equal reading ability and L2 proficiency would receive passages with variable degrees of complexity. The effect of simplification could then be examined in relation to participants' syntactic abilities.

## 7.5. Conclusions

The field of L2 reading research is growing rapidly. Investigating the role of syntax in this complex process, and particularly the role of late-emerging syntactic structures, brings us closer to an understanding of individual differences in students' L2 reading comprehension. The study provided evidence for the importance of L1 syntactic processing and, especially L2 syntactic processing, in L2 reading comprehension. It also provided further evidence of the threshold hypothesis in L2 reading comprehension.

## APPENDIX A

### QUESTIONNAIRE

Date: \_\_\_\_\_

Code: \_\_\_\_\_

1. Name: \_\_\_\_\_
2. Date of birth: \_\_\_\_\_
3. Place of birth: \_\_\_\_\_
4. At what age did you start learning English? \_\_\_\_\_
5. How many English lessons did you have at the elementary school? \_\_\_\_\_

6. Did you attend private English lessons? \_\_\_\_\_
7. If so, how often per week? \_\_\_\_\_
8. Have you ever been to an English speaking country? \_\_\_\_\_
9. If so, where and how long did you stay? \_\_\_\_\_
10. Have you ever attended an English language course abroad? \_\_\_\_\_
11. If so, where, and for how long? \_\_\_\_\_
12. Your parents' native language:

Mother's: \_\_\_\_\_

Father's: \_\_\_\_\_

13. What language do you use at home? \_\_\_\_\_
14. At what age did you start learning Slovak? \_\_\_\_\_
15. How would you rate your proficiency in Slovak(circle one)

excellent      good      satisfactory      not satisfactory

16. How would you rate your proficiency in English:(circle one)

excellent      good      satisfactory      not satisfactory

17. How many English lessons do you have weekly this year? \_\_\_\_\_
18. Do you attend private English lessons? \_\_\_\_\_
19. If so, how often and where? \_\_\_\_\_
20. Besides the Slovak and English languages, what other foreign languages do you study, and how often weekly? \_\_\_\_\_

**Kérdőív**

**Dátum:** \_\_\_\_\_

**Kód:** \_\_\_\_\_

1. Név: \_\_\_\_\_
2. Születési dátum: \_\_\_\_\_
3. Születési hely: \_\_\_\_\_
4. Hány éves korodban kezdtél angolul tanulni? \_\_\_\_\_
5. Hetente hány angolórát volt az alapiskolában? \_\_\_\_\_
6. Jártál külön angolórákra? \_\_\_\_\_
7. Ha igen, hetente hányszor? \_\_\_\_\_
8. Jártál valaha angol beszédnyelvű országban? \_\_\_\_\_
9. Ha igen, hol, és mennyi ideig tartózkodtál ott? \_\_\_\_\_

10. Jártál valaha angol nyelvtanfolyamra külföldön? \_\_\_\_\_

11. Ha igen, hol, és mennyi ideig? \_\_\_\_\_

12. Szüleid anyanyelve:

Anya: \_\_\_\_\_

Apa: \_\_\_\_\_

13. Milyen nyelven beszéltek otthon? \_\_\_\_\_

14. Hány éves korodban kezdtél szlovákul tanulni? \_\_\_\_\_

15. Hogyan értékelnéd a szlovák nyelvtudásodat? (keretezd be a megfelelőt)

kitűnő

jó

megfelelő

nem kielégítő

16. Hogyan értékelnéd az angol nyelvtudásodat? (keretezd be a megfelelőt)

kitűnő

jó

megfelelő

nem kielégítő

17. Hetente hány angolórád van ebben az évben? \_\_\_\_\_

18. Jársz külön angolórákra? \_\_\_\_\_

19. Ha igen, milyen gyakran és hová? \_\_\_\_\_

20. A szlovákon és az angolon kívül milyen idegen nyelvet tanulsz még és milyen heti gyakorisággal? \_\_\_\_\_

## **APPENDIX B**

List of sentences in the Test of Syntactic Processing (English version)

### **PRACTICE SENTENCES**

P1. The tall man drank a cup of coffee.

P2. The teacher went to the restaurant.

P3. The woman bought a pair of shoes.

P4. The boy is swimming outside.

P5. The girl put the book on the table.

- |   |                           |
|---|---------------------------|
| 1. The thief that caught the man was dirty.                     | S-S rel.                  |
| 2. The grandmother hurt the doctor in the hospital.             | Active                    |
| 3. The girl went to the museum before she fed the dog.          | Temporal adverbial (easy) |
| 4. The tiger ate the lion in the jungle.                        | Active                    |
| 5. The dog that the child found was fat.                        | S-O rel.                  |
| 6. After the girl read the newspaper, she cleaned her room.     | Temporal adverbial (easy) |
| 7. The girl was hit by the boy in the playground.               | Passive                   |
| 8. Before the man played football, he called his wife.          | Temp. adverbial (diff.)   |
| 9. The cat that the dog killed was black.                       | S-O rel.                  |
| 10. After the boy visited his mother, he had lunch.             | Temp. adverbial (easy)    |
| 11. The woman that the man pushed was blond.                    | S-O rel.                  |
| 12. The girl hit the boy in the playground.                     | Active                    |
| 13. Before the boy finished his homework, he had dinner.        | Temp. adverbial (diff.)   |
| 14. The mother fed the child in the hospital.                   | Active                    |
| 15. The doctor that saw the nurse was tall.                     | S-S rel.                  |
| 16. After the girl talked to her brother, she bought ice cream. | Temp. adverbial (diff.)   |
| 17. The bear killed the crocodile in the river.                 | Active                    |
| 18. The man played football before he called his wife.          | Temporal adverbial (easy) |
| 19. The grandmother was hurt by the doctor in the hospital.     | Passive                   |

- |   |                        |
|---|------------------------|
| 20. The thief that the man caught was dirty.                | S-O rel.               |
| 21. The girl read the newspaper after she cleaned her room. | Temp. adv. (diff.)     |
| 22. The cat that killed the dog was black.                  | S-S rel.               |
| 23. The mother kissed the father in the theatre.            | Active                 |
| 24. The dog that found the child was fat.                   | S-S rel.               |
| 25. The boy that the girl kicked was short.                 | S-O rel.               |
| 26. Before the girl went to the museum, she fed the dog.    | Temporal adv. (diff.)  |
| 27. The woman that pushed the man was blond.                | S-S rel.               |
| 28. The bear was killed by the crocodile in the river.      | Passive                |
| 29. The boy visited his mother after he had lunch.          | Temp. adv. (diff.)     |
| 30. The mother was kissed by the father in the theatre.     | Passive                |
| 31. The doctor that the nurse saw was tall.                 | S-O rel.               |
| 32. The boy finished his homework before he had dinner.     | Temp. adverbial (easy) |
| 33. The tiger was eaten by the lion in the jungle.          | Passive                |
| 34. The boy that kicked the girl was short.                 | S-S rel.               |
| 35. The mother was fed by the child in the hospital.        | Passive                |
| 36. The girl talked to her brother after she had ice cream. | Temp. adv. (diff.)     |

## **APPENDIX C**

List of sentences in the Test of Syntactic Processing (Hungarian version)

### **PRACTICE SENTENCES**

P1. A magas férfi egy csésze kávéét ivott.

P2. A tanér az étterembe ment.

P3. A hölgy egy pár cipőt vett.

P4. A lány az asztalra tette a könyvet.

1. A tolvaj, aki megfogta a férfit, piszkos volt. S-S rel.
2. A nagymamam bántotta az orvost a kórházban. Active
3. A lány elment a múzeumba mielőtt megetette a kutyát. Temp. adv. (easy)
4. A tigris széttépte az oroszlánt a dzsungelben. Active
5. A kutya, amelyet talált a gyerek, kövér volt. S-O rel.
6. Miután a lány elolvasta az újságot, kitakarította a szobáját. Temp. adv. (easy)
7. Mielőtt a férfi focizott, fölhevítte a feleségét. Temp. adv. (diff.)
8. A macska, amelyet elkapott a kutya, fekete volt. S-O rel.
9. Miután a fiú meglátogatta az anyját, megebédelt. Temp. adv. (easy)
10. A nő, akit meglökött a férfi, szőke volt. S-O rel.
11. A lány megütötte a fiút a játszótéren. Active
12. Mielőtt a fiú elkészítette a házi feladatát, megvacsorázott. Temp. adv. (diff.)
13. Az anya megetette a gyereket a kórházban. Active
14. Az orvos, aki látta a nővért, magas volt. S-S rel.
15. Miután a lány beszélt az öccsével, fagyalaltot vett. Temp. adv. (easy)
16. A medve megölte a krokodilt a folyóban. Active

17. A férfi focizott mielőtt fölhevítte a feleségét. Temp. adv. (easy)
18. A tolvaj, akit megfogott a férfi, piszkos volt. S-O rel.
19. A lány elolvasta az újségot miután kitakarította a szobáját. Temp. adv. (diff.)
20. A macska, amely elkapta a kutyát, fekete volt. S-S rel.
21. Az anya megcsókolta az apát a színházban. Active
22. A kutya amely megtalálta a gyereket, kövér volt. S-S rel.
23. A fiú, akit megrúgott a lány, alacsony volt. S-O rel.
24. Mielőtt a lány elment a múzeumba, megetette a kutyát. Temp. adv. (diff.)
25. A nő, aki meglökte a férfit, szőke volt. S-S rel.
26. A fiú meglátogatta az anyját miután megebédelt. Temp. adv. (diff.)
27. Az orvos, akit látott a nővér, magas volt. S-O rel.
28. A fiú befejezte a házi feladatát mielőtt megvacsorázott. Temp. adv. (easy)
29. A fiú, aki megrúgta a lányt, alacsony volt. S-S rel.
30. A lány beszélt az öccsével miután fagyaltot vett. Temp. adv. (diff.)

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