The relationship between syntactic knowledge and reading comprehension in EFL learners

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Abstract

Via a variety of measurements, 64 Hungarian native speakers in the 12th grade 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 foreign language reading comprehension. The test instruments involved a standardized reading comprehension test in English, and a test of syntactic knowledge in both Hungarian and English, in addition to a background questionnaire in Hungarian. Power correlations and regression analyses rendered results that showed syntactic knowledge to be a statistically significant estimator for foreign language reading comprehension. The study provides evidence that the ability to process complex syntactic structures in a foreign language does contribute to one's efficient reading comprehension in that language.

Keywords: syntactic knowledge, nonnative reading comprehension

Despite the existence of numerous studies on nonnative or foreign language (hereafter L2) reading comprehension,[1] 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

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[1] While participants in the study are EFL learners, the term L2, as opposed to *foreign language*, is used to refer to their nonnative language reading comprehension in order to follow common practice in the reading literature.

(hereafter L1) reading studies. Also, researchers in L2 routinely adopted L1 conceptual frameworks for conducting research in L2 (e.g., Clarke, 1979; Cziko, 1978).

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 outcomes. 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 proficiency. In fact, while L2 vocabulary knowledge is intuitively and obviously taken to be relevant to successful L2 reading comprehension, the function of syntax is taken to be 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 find out 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. The present study examined this possible interdependence in learners of English as a foreign language (EFL) 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, the study provided 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.

L1 Reading and Syntax

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 respectively, 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 and 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. On the other hand, Nation and Snowling (2000) found a strong correlation between syntactic awareness skills and reading comprehension. These and other L1 studies (Cox, 1976; Ehri & Wilce, 1980; Forrest-Pressley & Waller, 1984; Morais, Cary, Alegria, & Bertelson, 1979; Rego & Bryant, 1993) indicate that the relationship between syntactic abilities and reading comprehension is still controversial.

Normally developing readers – since the discussion of various reading disabilities is beyond the scope of this paper – go through stages leading to the achievement of 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 which do not involve reading (Liberman & Shankweiler, 1985; Vellutino, 1979). 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.

In recent years, two competing hypotheses have attempted to explain the differences between poor and good comprehenders, each offering a fundamentally different view of what reading requires 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, pp. 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, Deutsch, & Liberman, 1990; Demont & Gombert, 1996; Waltzman & Cairns, 2000).

L2 Reading and Syntax

While most reading research in a foreign language has investigated vocabulary knowledge, also the ability to process structures has an important facilitative effect on reading comprehension (Barnett, 1986; Berman, 1984).

Among recent studies on children's L2 reading development and syntactic abilities, Martohardjono, Otheguy, Gabriele, and Troseth (2005) focused on struc-

tures 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. Their second question concerned the degree to which a strong syntactic base in L2 contributes to listening comprehension in L2, and if this is 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. Kindergartners were tested on a syntax measure using various coordinate and subordinate structures in Spanish and English through an act-out task. Martohardjono et al. (2005) found that performance on the coordinate structures exceeded the performance on subordination, which reflects 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. The participants were then tested on the pre-reading level of the Gates-MacGinitie Standardized Reading Test (MacGinitie, MacGinitie, Maria, Dreyer, & Hughes, 2000) which has components known to be precursors of reading ability.[2] 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 those 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 L1 and L2.

Some recent investigations have also focused on the syntactic knowledge that L2 readers bring to the reading process and how such knowledge influences comprehension. Bernhardt (2003), for example, hypothesized that syntax would be a key variable in predicting L2 reading comprehension. She claimed 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

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[2] These four components were literacy concepts, oral language concepts, letter-sound correspondences, and listening comprehension.

for comprehension, but must understand the signaling relationships between and among words. Odlin (2003) 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.

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 in the prediction of reading comprehension performance. They pointed 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., Brisbois, 1995; Ulijn and Strother, 1990) attached a greater importance to vocabulary knowledge in foreign language reading, Shiotsu and Weir (2007) offered support for the relative superiority of syntactic knowledge over vocabulary knowledge in predicting performance on a reading comprehension test. They further claimed 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) would shed more light on the question.

Research Questions

Based on the above discussion, the following research questions were investigated:

1. To what extent does syntactic knowledge contribute to reading comprehension?
2. What are the effects of L1 (Hungarian) syntactic knowledge on L2 (English) reading comprehension?
3. What are the effects of L2 (English) syntactic knowledge on L2 (English) reading comprehension?

The research questions investigate whether there is a different contributing effect of L1 and L2 syntax respectively on 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, our hypothesis predicts the opposite for the young adult population that was studied, for the following reason: Since the participants' mean age was over 18 years, their L1 syntactic skills had

been finalized. The strong correlation between L1 syntax and L2 listening comprehension in Martohardjono et al.'s study is due to the fact that children's syntactic abilities at kindergarten age have not been developed fully.

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 schoolchildren between the ages of 5 and 10. In that 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 syntactic feature 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). This claim 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 were not in the developing stages, but rather were mature, it was predicted that their L1 syntactic comprehension would have no effect on their L2 reading comprehension. Instead, it was predicted that L2 syntax would have a significant effect on L2 reading comprehension given that these adolescents were 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 (Baddeley, Logie, & Nimmo-Smith, 1985; Danks & End, 1987; Duker, 1965; Dymock, 1993; Sinatra & Royer, 1993).

Method

Participants

Experimental group. Participants in the experimental group were 64 (26 males, 38 females) 12th 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). They were recruited via the help of the school principal and local English teachers. The language of instruction in the school was Hungarian, which is the native language of all the participants. The participants' background information was collected via a written questionnaire in Hungarian. In addition, all the participants were foreign language learners of English, all of whom have been learning the language in a class-

room 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 the participants were literate in Slovak, but did not speak it at home. Furthermore, all the participants in the study signed the required consent forms. Execution of the study was in compliance with Institutional Review Board protocol of the City University of New York.

  Control group. These participants were 15 native English speakers between the ages of 18 and 24 (mean age 22.5). This group only took the English version of the Test of Syntactic Comprehension in order to ensure the reliability of the drawings used in the study, and to provide a confirmation that, in fact, native speakers do not have difficulties with the types of complex sentences used in the test.

Materials

The measures used in the study were one standardized proficiency test 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 to ensure as much homogeneity of the participants as possible, and to identify the possible differences between the participants which might affect their reading performance such as gender, reading habits, knowledge of other languages, and so forth.

Gates-MacGinitie Reading Test Level 6. The Gates-MacGinitie Reading Test (MacGinitie et al., 2000), which is a standardized reading test, was designed to provide a general assessment of reading achievement of native English speakers in sixth grade. However, an earlier pilot study, carried out in December 2005 in order to find the most appropriate level for the grades tested, revealed that Level 4 was much too easy for 11h graders learning EFL. Therefore, it was speculated that Level 5 would be an adequate match for 11th graders, and Level 6 for 12th graders, that is, the population in this study. The test consists of a vocabulary and a comprehension section, including 45 and 48 items respectively. The time for completing the sections is 20 min for the vocabulary one, and 25 min for the comprehension one.

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. The comprehension section measures readers' abilities to read and understand different types of prose. According to the publishers of this standardized test, all of the passages are taken from published books and periodicals. Some are fiction, and some are nonfiction, 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.

   Test of Syntactic Knowledge in Hungarian. This test was developed on the basis of previous research by Martohardjono et al. (2005),[3] and consisted of sets of three drawings, out of which one accurately reflected 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.

Example 1
A nagymama bántotta az orvost a kórházban.
the grandmother hurt the doctor the hospital [in]
'The grandmother hurt the doctor in the hospital.'

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

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[3] The format of our stimuli was carefully chosen to reflect as closely as possible the ability to comprehend sentences, as opposed to producing 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 and Martohardjono (1999).

Of the three drawings, one was always semantically anomalous (i.e., it used a wrong picture for one of the vocabulary items in the sentence; e.g., a nurse, instead of a doctor), while the other two illustrated the contrasts tested. Thus, in Example 1, which tested the participants' understanding of the active voice, C is the semantic distracter, while A and B present the contrast which is tested. At the same time, the participants had answer sheets on which to circle the letter that corresponds to the drawing that matches the sentence at the top of a Power Point slide. In the set illustrated in Example 1, drawing B matches the meaning of the sentence presented, so for the right response the letter B should be circled in the answer sheet.

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

Test of Syntactic Knowledge 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 structures used in Hungarian were used in the English version as well. In addition, six passive sentences were added to the test items (see the description of the test items below). Therefore, the English version of the test was slightly longer, amounting to 36 items as opposed to the 30 items in the Hungarian version. Example 2 shows a set of drawings that tested the passive voice. Here, A and B reflect the contrast which is tested, while C is the semantic distracter.

Example 2
The mother was kissed by the father in the theater.
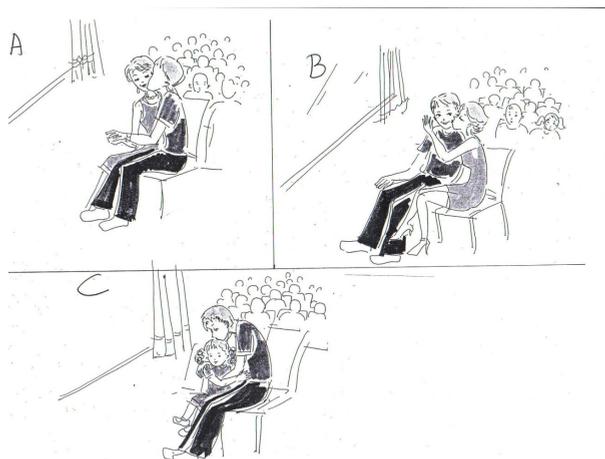
Stimuli used in the Tests of Syntactic Knowledge. Lexical items used in the English sentences were controlled for frequency, in the following manner: Thorndike and Lorge's (1944) *The Teacher's Word Book of 30,000 Words* was used to select vocabulary items that occur at least 100 times per million words, 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 the ones in Example 2, 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.

The following Hungarian structures were tested:

1. Relative clauses (N = 12) within which only subject headed sentences of two types were tested:
   a) 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 Example 3:

   Example 3
   A nővér [*aki az orvost látta*] *magas volt.*
   the nurse who the doctorACC saw tall was
   'The nurse that saw the doctor was tall.'

   b) 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 Example 4:

   Example 4
   A nővér [*akit látott az orvos*] *magas volt.*
   the nurse whom saw the doctor tall was
   'The nurse that the doctor saw was tall.'

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, this particular word order was tested. In addition,

this is one of the two most common word orders as verified by three native Hungarian speakers independently. For each sentence that appeared in one condition, (e.g., SS relative) a matched sentence, that is, using the same lexical items, appeared in the other condition (e.g., SO relative), as shown in Examples 3 and 4. What follows are the other Hungarian structures that were tested:

2. Subordinate clauses containing the temporal terms *mielőtt* 'before' and *miután* 'after' (*N* = 12).

   The sentences containing *mielőtt* (*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. One set (*n* = 3) contained the subordinate clause sentence-initially, as in Example 5, and the other set (*n* = 3) contained the subordinate clause after the main clause, that is, in sentence-final position, as in Example 6.

   Example 5
   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.'

   Example 6
   A fiú befejezte a házi feladatát mielőtt megvacsorázott.
   the boy finished the home work-POSS before had dinner
   'The boy finished his homework before he had dinner.'

   The sentences containing *miután* (*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 Example 7, and the other set (*n* = 3) contained the subordinate clause in sentence-final position, as in Example 8.

   Example 7
   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.'

   Example 8
   A férfi megebédelt miután meglátogatta az anyját.
   the man lunched after visited the mother-POSS
   'The man had lunch after he visited his mother.'

3. Simple active sentences (*n* = 6). In these sentences the subject noun, verb and object appear in SVO word order as shown in Example 9:

    Example 9
    A lány megrúgta a fiút a játszótéren.
    the girl kicked the boyACC the playground [PREP]
    'The girl kicked the boy in the playground.'

The total number of sentences used for the Hungarian stimuli (*N* = 30)[4] thus included 12 relative clauses, 12 'before'/'after' clauses and six active ones.

The following English structures used as stimuli matched those of the Hungarian test, except for the passive voice:

1. Relative clauses (*N* = 12) within which centrally embedded subject headed sentences were tested.
    a) Six of them were SS relative clauses, as shown in Example 10:

        Example 10
        The nurse [*that saw the doctor*] *was tall.*

    b) The other six were SO relative clauses, as illustrated in Example 11:

        Example 11
        The nurse [*that the doctor saw*] *was tall.*

2. Subordinate clauses containing the temporal terms *before* and *after* (*N* = 12) Again, depending on the position of the *before* and *after* clauses, the sentences were divided into two types. In six of the sentences the temporal clauses with *before* and *after* occurred sentence-initially, as in Examples 12 and 14, and in the other six they occurred in the sentence-final position, as in Examples 13 and 15.

    Example 12
    Before the man visited his mother, he had lunch.

    Example 13
    The man had lunch before he visited his mother.

    Example 14
    After the man played football, he called his wife.

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[4] Appendix B lists all the 30 sentences used for this task.

Example 15
The man called his wife after he played football.

3. Simple active sentences (*n* = 6) such as Example 16:

Example 16
The child fed the mother in the hospital.

4. Passive sentences (*n* = 6)
Since the passive in Hungarian does not exist in the exact form in which it does in English, it was speculated that in English this structure might pose potential difficulty to Hungarian speakers. An example of the stimuli in this set is shown in Example 17:

Example 17
The mother was fed by the child in the hospital.

As the numbers show, the English version of the test was longer by the six additional passive items, thus making the total number of the English sentences 36.[5] This included 12 relative clauses, 12 *before/after* clauses, six active and six passive sentences.

Procedures

Data were gathered over a 3-day period. All the participants attended a session where the purpose of the study was explained in Hungarian, and the Informed Consent forms were distributed to be either signed by them, or by their parents if they were minors. The background questionnaire was also distributed, and the participants were asked to return the completed forms the following day.

The first task to be administered was the Test of Syntactic Knowledge in English, which did not require an additional timing device, for the PowerPoint automatically projected the slides at 15-s intervals. The entire test took about 20 min to complete.

The next day the participants started with the Gates-MacGinitie Reading Test, which took 60 min, including instructions. After the session, they were given a 30-min break. Then, the students went on to the last task, the Hungarian Test of Syntactic Knowledge, which took approximately 17 min. On the

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[5] Appendix A lists all the 36 sentences used in this task.

final day of testing, the participants who had missed either the first or the second session were tested separately in smaller rooms.

Results

Descriptive Statistics

The control group of native English speakers (n = 15) scored at ceiling (100%) on the test of English syntactic comprehension; what is presented below are the results of the experimental group. Table 1 includes descriptive statistics concerning the number and age of the participants.

Table 1 Description of participants

Participants	Number	Mean age	SD	Minimum	Maximum
Male	26	18.4	.702		
Female	38	18.2	.714		
Total	64	18.3	.709	17.6	19.6

Table 2 shows descriptive statistics for all participants on each test taken. The four measurements that were used yielded the following mean scores, standard deviations and raw numbers for minimum, maximum and item totals.

Table 2 Descriptive results of the variables

Variable	N	% of correct responses	M	SD	Minimum	Maximum	Total no. of items
English reading comprehension	64	44%	19.85	11.27	0	44	45
English vocabulary	64	52%	21.29	6.05	8	35	40
English syntactic knowledge	64	93%	33.57	3.06	25	36	36
Hungarian syntactic knowledge	64	98%	29.35	1.46	23	30	30

One of the most striking results is the ceiling performance on the Hungarian Syntactic Knowledge. This result is obviously highly skewed by the ease of the test. The English Syntactic Knowledge yielded a near-ceiling result at 93%. 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 test also produced a relatively wide range of scores with most participants scoring in the mid-range.

Relationships Between L2 Reading Comprehension and 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, a correlational analysis was performed and its results are shown in Table 3.

Table 3 Correlations between the variables

	English reading comprehension	English vocabulary	English syntax	Hungarian syntax
English reading comprehension	1.000			
English vocabulary	.543**	1.000		
English syntax	.475**	.552**	1.000	
Hungarian syntax	.292*	.143	.225	1.000

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

Table 3 reveals that all the variables significantly correlated with English reading comprehension. L2 vocabulary correlated most highly with L2 reading comprehension (r = .543). The second most highly correlated variable indicates that L2 syntactic ability has a very powerful weight in reading comprehension (r = .4754), supporting the main hypothesis of this study.

Looking at other correlations among the independent variables it can be noticed that English vocabulary knowledge correlated most highly with English syntax (r = .552) but did not correlate with Hungarian syntactic knowledge. The correlation between English and Hungarian syntax (r = .225) did not reach significance. The intercorrelation of variables is usually a problem in 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, it was attempted to reduce the level of "contamination" of these skills. For example, words used in the syntactic test were pretaught and the sentences were read aloud by the researcher in addition to the participants reading the sentences to themselves. The following sections discuss the regression analyses and the results with respect to the research questions.

The research questions of this study concern the degree of contribution of syntactic skills to reading comprehension in L2. In order to answer them, the two variables of syntax (English and Hungarian) that did not correlate with each other were regressed to shed light on their independent effects. The results are shown in Table 4.

Table 4 The contribution of L1 and L2 syntactic knowledge to L2 reading com-
prehension

English reading comprehension	Coefficient	SE	t	p > | t |
English syntax	1.5874	.4154	3.82*	0.000
Hungarian syntax	1.5074	.8705	1.73	0.088

$N = 64$
$F(2, 61) = 10.84$
$R^2 = .2623$
Adjusted $R^2 = .2381$
% of variance = 24%

Table 4 shows 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 ($t = 1.73$).[6]

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. We can state that while L1 syntactic abilities have some effect, syntactic abilities in L2 have a much stronger effect on L2 reading comprehension.

Table 5 Contribution of L2 syntactic knowledge to L2 reading comprehension

English reading comprehension	Coefficient	SE	t	p > | t |
English syntax	1.7498	.4111	4.26*	0.000

$N = 64$
$F(1, 62) = 18.11$
$R^2 = .2260$
Adjusted $R^2 = .2136$
% of variance = 21.36%

Discussion

Let us begin with reiterating some of the characteristics of our partici-pants and their results on the various tests. Given the participants' mean age (18.3) and the fact that at the time of testing they had been studying EFL for 7-

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[6] Due to the fact that L1 syntactic processing was so highly skewed by its ceiling effect, far-reaching conclusions concerning its contribution (which was 7%) cannot be reached.

8 years on average, the findings indicate that the study involved a relatively highly-skilled cohort that possessed relatively high L2 proficiency. Participants performed above 90% on the syntactic test in both languages, although there was a range of significant differences among the structures tested. L2 reading comprehension and L2 vocabulary performance, however, were in the lower range of 44 and 52% respectively.

To start the discussion, one might want to rephrase the major research question that was the focus of this study: What is the role of the ability to process complex syntactic structures in efficient L2 reading? By looking at the data, it can be noted that all the independent measures correlated with L2 reading comprehension either at the .05 or at the .01 probability level. In other words, the following ranking of correlations emerged: The measure most highly correlated with L2 reading comprehension was L2 vocabulary, followed by L2 syntactic ability. These measures correlated at the .01 level, while L1 syntax correlated at the .05 level. The fact that L2 vocabulary knowledge had the strongest correlation of all the measurements had been 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, Beck, Omanson, & Perfetti, 1983), and in L2 this strong relationship has also been demonstrated (e.g., Koda, 1993). 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). Since the 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 that the study is based on correlational analysis and therefore gives no evidence of causality.

In the present study L2 syntax had the second highest correlation (right after L2 vocabulary) with L2 reading comprehension ($r = .475$). 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 would 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 prereading skills than between their L2 syntax measure and L2 prereading skills. The researchers mostly emphasized the subskill of listening as the most significant predictor of L2 reading comprehension. Nevertheless, significant correlations were determined also between other prereading skills (i.e., litera-

cy 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. This study differed from Martohardjono et al.'s (2005) in that the goal was to link the syntactic abilities of highly literate young adults to their L2 reading comprehension. The relationship between syntactic skills and reading comprehension in older L2 learners is still a controversial one. This study contributes to the ever growing field of L2 reading research in that (a) it examines a typologically different language (Hungarian), (b) 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 (c) it includes participants who have learned their English skills in a foreign language classroom setting. It can thus be claimed that the findings confirm that strong syntactic abilities are necessary for efficient L2 reading comprehension among highly skilled older L2 learners.

Conclusions and Suggestions for Future Research

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 Martohardjono et al.'s (2005) study with children, and makes further contributions in that it sheds light on reading comprehension of 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 taps learners' syntactic knowledge as closely as possible (Klein & Martohardjono, 1999), as opposed to other studies that used mostly production tasks. Moreover, it points out the shortcomings of the current readability formulas that leave out syntactic factors from their calculations of text difficulty.

The implications of the study for classroom reading/foreign language 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. Whether it is useful or not to point out the similarities/differences between Hungarian and English structures is not for this paper to determine, but incorporating them into various skills of EFL, such as listening and, predominantly, reading, is a necessary element of instruction and practice at every level of EFL. The more highly skilled in English syntax these learners become, the greater their chances to become skilled English readers as well.

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

Since all the participants were also L2 speakers of Slovak (the official language of Slovakia), 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), and determine its effects on English reading comprehension of Hungarian speakers in Slovakia. As a follow-up study one 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 nonnative language.

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APPENDIX A

List of sentences in the Test of Syntactic Knowledge (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.	SS relative
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.	SO relative
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.	Temporal adverbial (difficult)
9.	The cat that the dog killed was black.	SO relative
10.	After the boy visited his mother, he had lunch.	Temporal adverbial (easy)
11.	The woman that the man pushed was blond.	SO relative
12.	The girl hit the boy in the playground.	Active
13.	Before the boy finished his homework, he had dinner.	Temporal adverbial (difficult)
14.	The mother fed the child in the hospital.	Active
15.	The doctor that saw the nurse was tall.	SS relative
16.	After the girl talked to her brother, she bought ice cream.	Temporal adverbial (difficult)
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.	SO relative
21.	The girl read the newspaper after she cleaned her room.	Temporal adverbial (difficult)
22.	The cat that killed the dog was black.	SS relative
23.	The mother kissed the father in the theatre.	Active
24.	The dog that found the child was fat.	SS relative
25.	The boy that the girl kicked was short.	SO relative
26.	Before the girl went to the museum, she fed the dog.	Temporal adverbial (difficult)
27.	The woman that pushed the man was blond.	SS relative
28.	The bear was killed by the crocodile in the river.	Passive
29.	The boy visited his mother after he had lunch.	Temporal adverbial (difficult)
30.	The mother was kissed by the father in the theatre.	Passive
31.	The doctor that the nurse saw was tall.	SO relative
32.	The boy finished his homework before he had dinner.	Temporal adverbial (easy)
33.	The tiger was eaten by the lion in the jungle.	Passive
34.	The boy that kicked the girl was short.	SS relative
35.	The mother was fed by the child in the hospital.	Passive
36.	The girl talked to her brother after she had ice cream.	Temporal adverbial (difficult)

APPENDIX B

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

PRACTICE SENTENCES
P1. A magas férfi egy csésze kávét 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.	SS relative
2.	A nagymamam bántotta az orvost a kórházban.	Active
3.	A lány elment a múzeumba mielőtt megetette a kutyát.	Temporal adverbial (easy)
4.	A tigris széttépte az oroszlánt a dzsungelben.	Active
5.	A kutya, amelyet talált a gyerek, kövér volt.	SO relative
6.	Miután a lány elolvasta az újságot, kitakaritotta a szobáját.	Temporal adverbial (easy)
7.	Mielőtt a férfi focizott, fölhivta a feleségét.	Temporal adverbial (difficult)
8.	A macska, amelyet elkapott a kutya, fekete volt.	SO relative
9.	Miután a fiú meglátogatta az anyját, megebédelt.	Temporal adverbial (easy)
10.	A nő, akit meglökött a férfi, szőke volt.	SO relative
11.	A lány megütötte a fiút a játszótéren.	Active
12.	Mielőtt a fiú elkészitette a házi feladatát, megvacsorázott.	Temporal adverbial (difficult)
13.	Az anya megetette a gyereket a kórházban.	Active
14.	Az orvos, aki látta a nővért, magas volt.	SS relative
15.	Miután a lány beszélt az öccsével, fagylaltot vett.	Temporal adverbial (easy)
16.	A medve megölte a krokodilt a folyóban.	Active
17.	A férfi focizott mielőtt fölhivta a feleségét.	Temporal adverbial (easy)
18.	A tolvaj, akit megfogott a férfi, piszkos volt.	SO relative
19.	A lány elolvasta az újségot miután kitakaritotta a szobáját.	Temporal adverbial (difficult)
20.	A macska, amely elkapta a kutyát, fekete volt.	SS relative
21.	Az anya megcsókolta az apát a szinházban.	Active
22.	A kutya amely megtalálta a gyereket, kövér volt.	SS relative
23.	A fiú, akit megrúgott a lány, alacsony volt.	SO relative
24.	Mielőtt a lány elment a múzeumba, megetette a kutyát.	Temporal adverbial (difficult)
25.	A nő, aki meglökte a férfit, szőke volt.	SS relative
26.	A fiú meglátogatta az anyját miután megebédelt.	Temporal adverbial (difficult)
27.	Az orvos, akit látott a nővér, magas volt.	SO relative
28.	A fiú befejezte a házi feladatát mielőtt megvacsorázott.	Temporal adverbial (easy)
29.	A fiú, aki megrúgta a lányt, alacsony volt.	SS relative
30.	A lány beszélt az öccsével miután fagylaltot vett.	Temporal adverbial (difficult)