

# **SPEED IN COGNITIVE TASKS AS AN INDICATOR OF SECOND/FOREIGN LANGUAGE READING AND WRITING SKILLS**

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**Abstract.** In a cross-sectional study 823 Finnish school children were tested to examine the relation between speed of performance in cognitive and linguistic tasks and second/foreign language reading and writing. Participants were Finnish-speakers with English as foreign language and Russian-speakers with Finnish as second language which made it possible to compare the results across these two language groups. The Finnish group was furthermore divided into three groups by age to see how speed develops with age and education. Groups were tested with a number of cognitive instruments that included measures of speed of performance. Overall, performance on the speed measures improved with age; often, the second language learners outperformed their foreign language peers of the same age. Regression analyses indicated that speed measures could predict from 20% to over 40% of performance in second/foreign language reading and writing tasks. Prediction was somewhat stronger for writing than reading. The best predictors were also somewhat different for the foreign and second language learners, as well as for the different age groups.\*

**Keywords:** processing speed, reading, writing, cognitive testing, L2, Finnish, English, Russian

## **1. Introduction**

Fluency in language skills can be seen as a combination of speed and accuracy (Grabe 2010, Segalowitz 2010). Speed and accuracy can either be seen as contrasting or complementary skills, and for example dyslexia is considered as a problem with either speed or accuracy. Usually dyslexics encounter problems in one of these skills, and only the most difficult cases have problems in both. In addition to reading problems, dyslexics often have problems with other kinds of automatic constructs, such

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as reciting weekdays, months or multiplication tables (Cronin, Carver 1998). Fluent reading requires fast and automatic knowledge of vocabulary. Automatization of language skills is thus an integral part of language learning. When language skills, and especially word retrieval, become automatic, more cognitive capacity becomes available for the higher processes such as holistic text comprehension (Segalowitz 2003). William Grabe (2010: 72) states that: “Effective L1 reading comprehension generally assumes reading fluency – a person reading at a reasonable reading rate, between 250–300 WPM, using very efficient and fast word recognition skills, and combining information from various sources while reading under fairly intense time constraints.” Automaticity and its development have been researched widely in first language (L1) environments, but in second language (L2) acquisition the studies are fewer. Also the role of L1 skills in L2 fluency is a question that has evoked discussion (cf. Van Gelderen et al. 2007). The purpose of the current study is to examine the development of automaticity of vocabulary in both L1 (Finnish or Russian) and L2 (English or Finnish), and their relation to second/foreign language reading and writing skills. This examination was conducted in a cross-sectional design using four different age groups with two different language backgrounds: cross-group comparisons were performed on the speed of performance on the similar cognitive and linguistic tasks in both of their languages.

The capacity of working memory is restricted, so the more automatic word retrieval is, the more capacity there is for the use of higher mental processes (Kirby et al. 2003). Overall, the efficient lower-level processes such as memory, attention and word-decoding skills are a prerequisite for the higher ones. Fluent reading and reading comprehension require fast word retrieval. Automatic access to, and retrieval of, word knowledge are required for reading words as wholes and they are essential for being able to get past grapheme-phoneme method of reading. Automatic processes in general are nonconscious, unintentional, involuntary and effortless. They are also more immune to interference from outside sources (Segalowitz 2003, 2010, Grabe 2010). For example, mother-tongue word recognition is involuntary and unavoidable as the so-called Stroop effect shows. In the Stroop test, when the name of a colour is printed in a colour not denoted by the name (e.g., the word ‘red’ printed in blue ink instead of red ink), naming the colour of the printed word takes longer and is more prone to errors than when the colour of the ink matches the name of the colour (Stroop 1935). As Maryanne Wolf and Patricia Greig Bowers (1999: 418) state, rapid naming can be seen as ‘a microcosm of reading’. Working memory is also responsible for the combination and manipulation of new information. If word retrieval is slow, the beginning of the sentence can disappear from memory and integration of information can be hindered. This might mean that there is a certain threshold level in reading speed that should be attained for adequate comprehension (Kirby et al. 2003). Control of attention and retrieval from long-term memory also rely on working memory capacity. Eye-tracking studies have revealed that good readers can control their attention to some extent and concentrate on the relevant parts of the text while skimming (Kaakinen 2004). Effective word retrieval thus has an effect on all levels of reading. In addition to requirements in L1, fluent reading in another language requires direct connections from concepts to L2 vocabulary, and L2 word recognition would be automatic only when direct connections from the print to meanings have been formed. Connections develop

slowly with exposure to language, and especially at the early stages of learning to read in L2 the L1 vocabulary also becomes activated (e.g. Kroll, Sunderman 2003; Segalowitz 2003; Hulstijn et al. 2009).

In the *Jyväskylä Longitudinal Study of Dyslexia (JLD)*<sup>1</sup>, which started in 1993, the researchers have been following 200 children from birth and have tried to identify the best predictors for diagnosing learning difficulties as early as possible. The results show that phonological awareness and word recognition can, as early as the age of 3.5 years, predict possible reading problems at school age (Puolakanaho et al. 2007). The role of phonological processing as the best predictor for reading proficiency is supported by several other studies (e.g. Torgesen et al. 1997, Bowey et al. 2004). The effect of phonological processing is most notable in languages with very opaque orthography, such as English. In a more transparent language (e.g. Finnish, German or Italian) word recognition has been shown to be a stronger predictor of reading proficiency (Dufva, Voeten 1999, Di Filippo et al. 2005, Landerl, Wimmer 2008). In such languages, word decoding skills develop quickly, and accuracy seems to be close to a maximum level from a very early age. Thus, the ease of word retrieval seems to be an important differentiating factor. Also Grabe (2010: 76) concludes that L2 research, albeit its scarcity, generally supports the importance of fluency in reading comprehension.

The whole process of fluency development in L2 thus needs to be examined more closely. The current study concentrates on the development of fluency in second language (L2) reading and writing. The main interest in the study was to find out whether, in time-pressure tasks, speed as a reflection of a more or less automatic skill could be used to predict L2 reading and writing, which are higher-order skills. This was done by measuring the speed of performance in cognitive and linguistic tasks. These tasks were conducted in both the mother tongue and in the second or foreign language of the participants. This allowed us to compare the possible differences in the second and foreign language learners, as the second language learners live in an authentic language environment and the foreign language is only learned in the school classes. Also the rarer language combinations of Finnish/English and Russian/Finnish can give us new insights on the matter. The cognitive tasks were conducted orally, as Norman Segalowitz (2010), for example, points out that oral fluency is taken to reflect higher rather than lower-level processing, i.e. articulation. The scores from the speed of performance were then correlated with measures of reading and writing in L2 to see if the former could predict performance in the latter. The three different age groups were also compared to see differences in skill development. The design also allowed us to examine whether the speed of performance in L1 had any affect on the L2 skills, which is a much-debated question. The role of L1 for second and foreign language learners is basically different and the differences in the results of this study also reflect this aspect.

The research questions in this study were:

1. Does speed in cognitive tasks develop with age?
2. Can differences in fluency measures be found between second and foreign language learners?
3. Does the speed in time-pressure cognitive and linguistic tasks performed in L1 and L2 predict second/foreign language reading and writing skills?

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<sup>1</sup> See: [https://www.jyu.fi/ytk/laitokset/psykologia/huippututkimus/en/research/JLD\\_main/JLD](https://www.jyu.fi/ytk/laitokset/psykologia/huippututkimus/en/research/JLD_main/JLD) (21.12.2012).

## 2. Method

### 2.1. Participants

The data were gathered in the DIALUKI project (Diagnosing reading and writing in a second or foreign language<sup>2</sup>) in a cross-sectional setting in 2010–2011. Participants ( $n = 823$ ) were selected from 111 schools in Finland. The first group consisted of Finnish-speaking learners of English and was divided into sub-groups from three different grades. All these children had started learning English as a foreign language in the third grade. The second group consisted of primary school children with Russian as L1 and Finnish as L2 (see Table 1). Russian students were immigrants living in Finland, and their language skills varied widely in both languages. At the time of the study, they either participated in preparatory classes or were already integrated within mainstream education, depending on their language skills and length of residence. For some of them Finnish was even a stronger language than Russian. Agreements for participation in the study were collected from the county, schools, parents and children themselves.

**Table 1.** Participants of the study

Mother tongue	Grade / age	Foreign / second language	
		English	Finnish
Finnish	4th grade / 9–10 years	210	
	8th grade / 13–14 years	208	–
	Gymnasium / 17–18 years	219	
Russian	3rd–6th grades (mean age 10.9 years)	–	186
Total		637	186

### 2.2. Procedure

Tests were administered in the school during school hours. There were two parts in the test battery: reading and writing tasks and the speed-measuring linguistic tasks were performed in groups in the classroom; the individual cognitive tasks were computer-assisted and administered by trained assistants.

### 2.3. Speed-measuring linguistic tasks

*Word segmentation task.* The children were given a short text written without spaces between the words and without punctuation. The task was to segment the text by drawing a pencil stroke on word boundaries (i.e. between the words). The task was performed in both L1 and L2, but the texts were different for the different age groups. The time the children took to complete the task was recorded (to the nearest 30 seconds); also, the number of correctly separated words was counted.

*Spelling error detection task.* In the spelling error detection task, the children were given a paper with a list of 100 Finnish words each containing a spelling error. The spelling errors were of several different types; either there was a letter missing or extra in the word (*lauvantai* instead of *lauantai*), or there was a wrong letter (*heunäkuu* – *heinäkuu*), or incorrect inflections (*aurinkonkukka* – *auringonkukka*). Children were instructed to mark all the spelling errors they could detect but not to correct them. They were given 3.5 minutes to mark as many as they could. The maximum score was 100 points and the number of correct answers was counted. The task was designed for youths and adults, so only the eighth graders and gymnasium students took this task (Holopainen et al. 2004). The task was conducted only in Finnish.

## 2.4. Cognitive tasks

Students performed the cognitive tasks with the *Cognitive Workshop* computer program developed in the *Jyväskylä Longitudinal Study of Dyslexia*. The test battery consisted of eight different tasks in total, and three of these measured performance speed. These tasks were *Rapidly Presented Words*, *Reading Aloud Word List*, and *Rapid Alternating Stimulus*. The original tasks had been developed and validated in the JLD project; the Russian and English versions of these tasks were developed by the DIALUKI project. Each task is described in more detail below.

*Rapidly Presented Words* (RPW). The task measured reading (and perceiving) a word as a whole. The words appeared one at a time on the computer screen for 80 milliseconds and the child had to read them aloud. There were 14 words in L1 and 8 or 12 words in L2, depending on students' age. All the words were simple, everyday words but in the task they became progressively longer, from two-letter words up to a nine-letter word. A star first flashed on the screen as a prompt, after which the target word appeared. After 80 milliseconds it was replaced by a mask (e.g., B/W#Q?) to erase the visual image from the working memory. The next stimulus was given only after the child had answered or confirmed not having perceived the word. Correct answers were counted and converted to percentages to enable the comparisons of performances on tasks consisting of a different number of stimuli reported later in this article.

*Reading Aloud Word List.* The children were given a list consisting of 105 words. They were instructed to read the list as fast and as accurately as they could in one minute. The test was conducted in both L1 and L2. The Finnish word list was from the Lukilasse test battery developed for diagnosing reading in L1 Finnish in primary school (Häyrinen et al. 1999). The English and Russian word lists were designed by sampling from frequency lists for these two languages.<sup>3</sup> Time was measured with a stopwatch and the last word read by the child was marked. Afterwards, the words were divided into syllables, which makes the word lists across languages more (although not completely) comparable. This was necessary as the words in both Finnish and Russian typically consist of several syllables and, thus, take longer to pronounce, whereas many frequent English words are rather short.

*Rapid Alternating Stimulus* (RAS) and *Rapid Automatic Naming* (RAN) are considered to be very good tests for measuring the automaticity of language skills

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<sup>3</sup> See: [http://ucrel.lancs.ac.uk/bncfreq/lists/1\\_2\\_all\\_freq.txt](http://ucrel.lancs.ac.uk/bncfreq/lists/1_2_all_freq.txt) (15.10.2010), <http://corpus.leeds.ac.uk/serge/frqlist/rnc-modern.num.html> (15.10.2010).

(e.g. Cronin, Carver 1998). It is a matrix consisting of letters, numbers, colours or simple objects or a combination of these. The matrix used in this study was a mixed one with numbers, colours and letters or pictures. This made the test more difficult and therefore more prone to mistakes compared with a task consisting of only numbers, for example. The basic matrix consisted of 50 units. For primary school participants it was shorter in L2 (30 units) and letters were replaced by pictures of easily identifiable objects (i.e., pen, car and house). Children were told to read the entire matrix aloud as fast and as accurately as they could. The completion time for the test was measured by a stopwatch. To make comparisons across the 30 and 50-unit versions of the task possible, the overall completion times were converted to time-per-unit values.

## 2.5. Reading and writing measures

The second/foreign language reading and writing tasks that were in the study were standardised and age-appropriate.

*Reading tasks.* In the primary school, reading comprehension tasks in English as a foreign language were three tasks from the Pearson Young Learners test. The older students had four tasks from the Pearson Test of English General test. The Finnish L2 reading comprehension tasks were three tasks from the YKI test (National Certificate for Language Proficiency) and ten tasks from DIALANG. All reading tasks were paper-and-pencil tests, except DIALANG, which is an online diagnostic system, designed to assess proficiency in fourteen different European languages. The reading test scores were analysed with Rasch software (Winsteps)<sup>4</sup>, and reading ability values were used as dependent variables in the analyses focusing on reading.

*Writing tasks.* The writing tasks were paper-and-pencil tasks. The English L2 writing tasks were a letter or e-mail to a friend, a short story and an opinion; there was one task for the fourth graders and three for the older groups. Finnish L2 tasks included a letter to a friend and a short story. The tasks were taken from the above-mentioned Pearson tests and the Topling research project. Two professional raters evaluated the learners' performances against the Common European Framework of Reference (CEFR) 6-point scale<sup>5</sup>. The ratings were analysed with the multi-faceted Rasch programme Facets<sup>4</sup>, and the ability values that take into account both the raters' leniency/severity and the task difficulty were later used as the dependent variables in the regression analyses reported below.

## 3. Results

### 3.1. Analysis of variance

First the speed of performance in the cognitive tasks was compared across the age groups (fourth graders, eighth graders, and gymnasium students). The second and foreign language learners (i.e. the Russian-speaking learners of Finnish and Finnish-speaking learners of English) were also compared to see the possible differences

<sup>4</sup> See: <http://www.winsteps.com> (21.12.2012).

<sup>5</sup> See (21.12.2012): YKI test [http://www.oph.fi/english/mobility/testing\\_language\\_skills](http://www.oph.fi/english/mobility/testing_language_skills); DIALANG <http://www.lancs.ac.uk/researchenterprise/dialang/about>; Topling. Paths in Second Language Acquisition <https://www.jyu.fi/hum/laitokset/kielet/topling/en>.

between these groups. For these, one-way analysis of variance (ANOVA, see Hatch, Farhady 1982) was used.

The results concerning the *Rapidly Presented Words* (RPW) task are presented for L1 and L2, respectively. Tables 1 and 2 present the means (M) and standard deviations (SD) of the percentages of correct words in each group. The results show that automatic recognition of vocabulary increased with age. The RPW task was able to distinguish between different age groups: a particularly clear distinction was found between the primary school and the older children both in the L1 and L2 condition (for L1 Finnish/Russian  $F = 75.38$ ,  $p < 0.0001$ ,  $df = 3$ , and for L2 English/Finnish  $F = 145.03$ ,  $p < .0001$ ,  $df = 3$ . The effect size  $\eta^2$  for L1 was 0.235 and for L2 0.364). The task was quite easy for the two oldest age groups and a ceiling effect was in fact found for them; thus, the RPW tasks used in the study could not differentiate between the eighth graders and the gymnasium students. Interestingly, in the L1 task, both the Finnish and Russian-speaking children performed equally well (assuming that the different language versions of the task are comparable; see Table 2), whereas in the L2 task, the Russian-speakers outperformed their same age Finnish-speaking peers although they fell far behind the older Finnish-speaking learners (Table 3).

**Table 2.** Rapidly Presented Words in L1 (Finnish / Russian): percentage of correct words out of 14

Group	n	M	SD
4th grade	203	73.65	24.91
Russian primary	153	70.63	31.88
8th grade	194	93.37	6.32
Gymnasium	191	95.10	4.89

**Table 3.** Rapidly Presented Words in L2 (English / Finnish): percentage of correct words out of eight words for primary school groups and twelve words for older groups

Group	n	M	SD
4th grade	202	58.79	27.83
Russian primary	177	66.24	32.33
8th grade	192	93.45	11.06
Gymnasium	192	97.35	8.56

The results from the *Reading Aloud Word List* task are displayed as syllables read per second (see Tables 4 and 5). The results show that speed (syllables per second) increased with age and, presumably, with language skill development. Overall, the results are somewhat similar to those reported above for the *Rapidly Presented Words* task. On the whole, the groups are very clearly separated (for L1 Finnish/Russian  $F = 230.66$ ,  $p < 0.0001$ ,  $df = 3$ ; and for L2 English/Finnish  $F = 210.08$ ,  $p < 0.0001$ ,  $df = 3$ . The effect sizes are very large: 0.474 for L1 and 0.452 for L2). Again, the primary school age students performed less well than the older students but this time the Russian-speaking students' L2 Finnish performance was not only better than their same-age Finnish peers' L2 English performance but was at the same level as the eighth graders (Table 5). On this task, the oldest group (gymnasium) outperformed all younger groups statistically significantly, both in the L1 and L2 tasks.

**Table 4.** Reading Aloud Word List in L1 (Finnish / Russian): syllables per second

Group	n	M	SD
4th grade	205	2.76	0.76
Russian primary	182	2.60	1.20
8th grade	195	4.13	0.97
Gymnasium	189	4.86	1.01

**Table 5.** Reading Aloud Word List in L2 (English / Finnish): syllables per second

Group	n	M	SD
4th grade	204	1.32	0.42
Russian primary	182	2.30	0.85
8th grade	194	2.36	0.66
Gymnasium	190	2.95	0.66

In the *Rapid Alternating Stimulus* (RAS) task, the performance speed also increased with age (see Tables 6 and 7). The results of the RAS tasks were almost identical to those reported above for the *Reading Aloud Word List*: the two younger groups (Finnish-speaking and Russian-speaking primary students) performed the same on the L1 RAS task but the Russian-speakers outperformed the Finns on the second/foreign language version of the same task, and reached the same average speed as the eighth-grade Finns. Again, the gymnasium students did these tasks significantly faster than any of the younger groups. (Details of the ANOVA results are as follows: for L1  $F = 82.99$ ,  $p < 0.0001$ ,  $df = 3$ ; and for L2  $F = 120.55$ ,  $p < 0.0001$ ,  $df = 3$ . The effect sizes are also quite large: 0.246 for L1 and 0.321 for L2).

**Table 6.** Rapid Alternating Stimulus in L1 (Finnish/Russian): average time in seconds spent on each item (50 items)

Group	n	M	SD
4th grade	204	0.87	0.18
Russian primary	177	0.83	0.31
8th grade	195	0.68	0.16
Gymnasium	190	0.59	0.13

**Table 7.** Rapid Alternating Stimulus in L2 (English/Finnish): average time in seconds spent on each item (30 items in primary school and 50 items in 8th grade and gymnasium)

Group	n	M	SD
4th grade	205	1.20	0.41
Russian primary	180	0.89	0.22
8th grade	195	0.86	0.25
Gymnasium	190	0.68	0.15



### 3.2. Regression analyses

Stepwise multiple regression analyses were used to test to what extent the time-pressure cognitive and linguistic tasks explain reading and writing skills. The dependent variables were reading and writing in L2 (ability measures derived from the Rasch analyses of the reading scores and ratings of the writing scripts) and the independent variables (IV) were the time-pressure linguistic and cognitive tasks (see Table 8).

Overall, the speed-related measures predicted writing in L2 better than reading in L2: The amount of explained variance was at least 10%, sometimes even 20%, higher for writing. For reading, about 20% of the variance could be predicted from performance on the speed measures included in the study. For writing, the explained variance rose to about 30–40%. Interestingly, the prediction was somewhat better for the L2 (Russian-speakers) learners than it was for the foreign language learners (Finnish-speakers), in both reading and writing.

For the Finnish-speaking learners of English, the best predictor for the primary school group was shown to be L2 the *Rapidly Presented Words* (RPW) either in L1 or L2, and *Rapid Alternating Stimulus* (RAS) in L2 for other grades. However, several other measures of speed, including some linguistic speed tasks, also predicted reading and writing performance significantly among the Finnish-speaking learners. In comparison, the set of predictors of Finnish as a L2 reading and writing among the Russian-speaking learners looks somewhat different. *Reading Aloud Word List* in L2 Finnish dominates as the best predictor for both reading and writing. *Rapidly Presented Words* in L2 and (for writing) also *Reading Aloud Word List* in L1 Russian appear as significant predictors of L2 macro skills.

**Table 8.** Speed in the time-pressure cognitive tasks as a predictor of reading and writing in a second/foreign language

Age groups	Dependent variable	Adjusted R Squared	% variance	1st IV	2nd IV	3rd IV	4th IV
4th grade Finnish L1	Writing L2	0.272	<b>27.2%</b>	RPW L1	RAS L2		
	Reading L2	0.188	<b>18.8%</b>	RPW L2	RAS L2		
Primary Russian L1	Writing L2	0.459	<b>45.9%</b>	Word List L2	Word List L1	RPW L2	
	Reading L2	0.300	<b>30.0%</b>	Word List L2	RPW L2		
8th grade Finnish L1	Writing L2	0.422	<b>42.2%</b>	RAS L2	Segmentation L1	RPW L2	Segmentation L2
	Reading L2	0.218	<b>21.8%</b>	RAS L2	RPW L2		
Gymnasium Finnish L1	Writing L2	0.322	<b>32.2%</b>	RAS L2	Spelling errors L1	Word List L1	
	Reading L2	0.242	<b>24.2%</b>	RAS L2	Segmentation L1	Word List L1	

## 4. Discussion

The study shows that speed in the fluency tasks increases with age and education, at least among the learner groups studied here. Three different age groups were distinguished in most tasks. In both primary school groups, in which second or foreign language skills are only starting to develop, performance on the L1 versions of the tasks was always better than in the L2 tasks. When language skills become more fluent, the difference starts to diminish. In this study the difference was still mostly visible also in the older groups, which is in accord with Jan Hulstijn, Amos Van Gelderen and Rob Schoonen (2009), for example. Where no difference between L1 and L2 could be found, in particular in the *Rapidly Presented Words* task, this was mainly due to the task construction. The English version of the RPW task was clearly too easy for the older students and the results were influenced by a ceiling effect. In the *Word List* task the Finnish words used were much longer with complex inflections while the English and Russian versions contained easier basic words. For the comparability of the results they were analysed as syllable/second. Interestingly, the Finnish version of the list was also the language version that did have the most predictive value with reading and writing skills in the regression analysis, as both L1 and L2 task. It was quite a challenging task even for older children as the word-length came up to a 22 letter-word (e.g. *prosessikirjoittaminen* 'process writing').

The analyses revealed some differences between the two language groups. The primary school Russian speakers were closest to the corresponding Finnish age group in L1 tasks, but in L2 tasks they were markedly better and even indistinguishable from the eighth grader Finns. This might be caused by several factors. For some learners labelled as Russian-speakers, Finnish was in fact their stronger language. Their Russian skills were more varied, as we can see from the standard deviations on their L1 tasks. For the Finnish students English is a foreign language learned at school; the youngest group had only studied English for slightly over a year. For the Russian speakers, Finnish is a second language learned in an authentic environment. There is also a slight age difference in favour of Russian speakers. Positive effects that are often associated with bilingualism can also have some effect on the results (e.g. Bialystok 2001).

The time-pressure tasks studied here were found to predict the learners' reading and writing performance in L2 rather well. The regression analyses indicated that the speed measures predicted writing in L2 better than reading in L2, and that the prediction was somewhat better for the second language group than it was for the foreign language groups. The best predictor of reading and writing measures among the Finnish-speaking primary school group was the *Rapidly Presented Words*, which was also a significant predictor for the Russian-speaking primary school learners. The current versions of the RPW task, which made use of simple, very frequent words were too easy for the older students whose word recognition skills could be expected to be more automatic. It is possible that a more difficult version of the RPW could be useful in predicting L2 macro skills such as reading and writing but this remains to be studied in the future. Also, in line with earlier studies, *Rapid Alternating Stimulus* explained a significant amount of variance in L2 reading and especially writing, at least for the Finnish speakers. It can be argued to be a good predictor of automaticity in language as it combines different skills that

are required for fluent reading. Overall, the results are in accordance with previous research in that the lower level processes can predict more holistic processes, such as reading and writing also in a foreign language. In addition to the L2 tasks, the L1 tasks also had predictive power in the current study which has not been the case in all studies (cf. Van Gelderen et al. 2007). It would be reasonable to assume that L1 had influence only on the lower grades, when the L2 skills are still at quite a low level. This study shows the L1 effect on the L2 skills also in the older groups. For them it was especially the L1 linguistic tasks (i.e. *Segmentation* and *Spelling errors*) that showed up in the regression analysis.

Hulstijn et al. (2009) conclude their analysis stating that processing speed may not be a very useful criteria for automaticity. Segalowitz (2010: 79) also proposes that for a skill to be regarded as automatized, speed cannot be the only criterion. This study has looked only at the speed component of fluency, and to examine the wider phenomenon of fluency, an analysis of accuracy of performance could bring a more balanced and informative view. From the data of this study it was evident that often the time to complete the task was only a part of the whole performance. The time-pressure in the tasks seemed to result in a trade-off of speed and accuracy, with quick performance sometimes revealing on a closer inspection to consist only of approximated responses. The combined effect of speed and accuracy should be therefore examined in the further analyses.

## 5. Conclusion

The main conclusion from the work presented here is that the speed in the time-pressure tasks in both L1 and L2 can be used in predicting L2 reading and especially writing skills. This applied also to the older students, even when some of the tasks used in this study were not very suitable for them. All in all, the tasks with the best predictive value differed somewhat for the different age groups and for the second or foreign language learners. For further study, an even more informative view could be attained by combining these speed of performance measures with accuracy measures from the same tasks.

### Abbreviations

L1	first language
L2	second or foreign language
M	mean
RAS	<i>Rapid Alternating Stimulus</i> test
RPW	<i>Rapidly Presented Words</i> test
SD	standard deviation

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# KOGNITIIVSETE ÜLESANNETE LAHENDAMISE KIIRUS KUI VÕORKEELE / TEISE KEELE LUGEMIS- JA KIRJUTAMISOSKUSE NÄITAJA

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Artikkel analüüsib võõrkeeleskuse automaatsuse arengut, mis on teise keele uurin-gutes veel väheksitletud valdkond. Käesolev läbilõikeuuring kasutas ajasurvega kognitiivseid ja keelelisi ülesandeid ning analüüsis, kuidas soorituskiirus vanusega ning õppimise käigus areneb. Andmed koguti aastatel 2010–2011 Soome koolide 823 õpilaselt. Soomekeelsed lapsed, kes õppisid põhikooli neljandas ja kahek-sandas klassis ning gümnaasiumi teises klassis, õppisid inglise keelt võõrkeelena. Venekeelsed lapsed olid algkooliõpilased ning õppisid soome keelt teise keelena. Hindamaks kiirust mõõtvate ülesannete võimet ennustada võõrkeele (teise keele) lugemis- ja kirjutamisoskust, kasutati regressioonanalüüsi.

Uuring näitas, et algkoolis, kui keeleskus alles hakkab arenema, oli sooritus emakeeles parem kui teises keeles või võõrkeeles. Kui keeleskus enam automa-tiseerus, hakkas see erinevus kaduma. Soorituskiirus üldiselt paranes vanusega, kuigi kohati ei olnud võimalik kahe vanema soomekeelse rühma tulemusi eristada. Venekeelsete algkooliõpilaste tulemused olid samas vanuses soomekeelse rühma omadest sageli paremad. Siiski ei olnud need enamasti vanemate soomekeelsete õpilaste tasemel. Parimateks võõrkeele lugemis- ja kirjutamisoskuste ennustajateks osutusid nooremate õpilaste puhul sõnade kiire esitamise ülesanne (*Rapidly Presented Words*) ja vanemate õpilaste puhul kiirelt vahelduv stiimul (*Rapid Alternating Stimulus*). Venekeelsete õpilaste puhul oli parimaks ennustajaks sõnaloendi valjult ettelugemise ülesanne (*Reading Aloud Word List*). Ka emakeelsed ülesan-ded suutsid teatud määral võõrkeele (teise keele) oskust ennustada. Kokkuvõttes ennustasid ajasurve ülesanded paremini kirjutamist kui lugemist.

**Võtmesõnad:** soorituskiirus, lugemine, kirjutamine, kognitiivne testimine, teine keel, soome keel, inglise keel, vene keel