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Running head: READING COMPREHENSION IN SHALLOW ORTHOGRAPHIES

**Reading Comprehension from Grade 1 to 6 in Two Shallow Orthographies: Comparison
of Estonian and Finnish Students**

Reading comprehension is a multifaceted and constructive process in which basic information processes and higher cognitive skills must be coordinated and self-regulated (Cain, Oakhill, and Bryant 2004). To understand the meaning of a text, the readers must recognize words, construct meanings and embed its information into previous knowledge (Kintsch 2013). It is a prerequisite for advancement in various academic domains (Cano, García, and Justicia 2014; Hakkarainen, Holopainen, and Savolainen 2013; Vista 2013) and thus, acquiring high proficiency in reading comprehension is important for every student. International surveys, like the Programme for International Student Assessment (PISA), have shown that students' mean levels and variance in reading proficiency vary greatly in different countries by the end of middle school (OECD 2016). Reasons for this variation may lie in orthographic transparency, educational systems, and teaching practices. Knowledge regarding the time point when differences in reading comprehension achievement, including levels of comprehension (literal or inferential), arise provides valuable information for curriculum development and teacher training.

According to our best knowledge, there are no studies that conducted cross-linguistic comparisons on reading comprehension development with longitudinal data, while considering different levels of comprehension. The present study intends to fill this gap. The study aims to examine the developmental changes in reading comprehension in shallow

orthographies—Estonian and Finnish—through the first six grades. The comparison of Estonian and Finnish students is informative on several accounts. First, the fact that the Estonian and Finnish languages are very similar provides an opportunity to exclude the linguistic and orthographic characteristics as the possible reasons for differences in children's reading development. Second, Finnish success in international comparison studies is well-known and the present study adds a developmental perspective to the existing knowledge.

Reading Comprehension

Most cognitive theories of reading comprehension state that reading comprehension is a multifaceted process of formation of a mental representation (see Kendeou et al. 2014). This mental representation (*situation model, mental model*) represents the information provided by the text which is integrated with background information from the reader's prior knowledge (Kendeou et al. 2014; Kintsch 2013). It is a semantic network meaning that the text elements (e.g., events and facts) are interconnected through semantic relations and form an integrated whole (Kendeou et al. 2014; van den Broek and Espin 2016).

The semantic relations are identified by the reader through several cognitive processes, falling roughly into two categories. Lower level processes involve translating the written code into meaningful language units. Higher level processes involve combining these units into a meaningful and coherent mental representation (Kendeou et al. 2014). With respect to lower level processes, the main factors influencing reading comprehension are considered to be word decoding, vocabulary (Cain, Oakhill and Bryant 2004; de Jong and van der Leij 2002), and grammar knowledge (Muter et al. 2004; Silva and Cain 2015). Several higher level processes, such as inference making (Cain, Oakhill and Bryant 2004; Silva and Cain 2015) and comprehension monitoring (Oakhill and Cain 2007), have been identified to be necessary for successful reading comprehension.

The mental representation that readers construct also depends on their interests and purposes for reading, as well as on their prior knowledge on text topic (Kintsch 2013). In addition, the use of reading strategies—defined as mental activities selected by the reader to acquire, organize, elaborate information, and further reflect on and guide one's text comprehension—plays an important role in reading comprehension (Andreassen and Bråten 2011).

Development of Reading Comprehension

Development of both lower and higher level processes of reading comprehension begins at a young age, well before formal reading instruction begins (Hogan et al. 2011; Kendeou et al. 2009). Lower level processes such as word recognition develop very fast during the first stages of reading instruction and typically become rather automatic during the first grades of elementary school (Landerl and Wimmer 2008; Verhoeven 2013). Several cross-linguistic studies (e.g., Aro and Wimmer 2003; Frith, Wimmer, and Landerl 2008; Seymour, Aro, and Erskine 2003) have found that children in shallow orthographies (e.g., Finnish, German, Italian) show faster rates of reading development and face less difficulties in accurate decoding than those using deeper orthographies (e.g., English). After one year of explicit reading instruction, children in shallow orthographies are typically accurate and rather fluent readers (Landerl and Wimmer 2008; Lerkkanen et al. 2004; Soodla et al. 2015; Verhoeven 2013). Automatization of word recognition and reading fluency avails more cognitive resources for higher level processes of reading comprehension (Perfetti, Landi, and Oakhill 2005).

Higher level processes are also evident already in young children. However, as compared to lower level processes, they become automated more slowly, going through considerable developmental changes from early childhood into adulthood (Luna, Garver, Urban, Lazar, & Sweeney, 2004). For example, children as young as four years of age can

make inferences during comprehension of aural and televised stories (Kendeou, Bohn-Gettler, White and van den Broek 2008) but when they become older, the inferences they generate change both quantitatively and qualitatively: children increasingly generate inferences that connect larger text units and infer abstract connections (see Kendeou, van den Broek, Helder, & Karlsson 2014; van den Broek, Helder, and Van Leijenhorst 2013).

Research shows that lower level processes such as decoding and higher level processes such as inference making and other language skills develop in relative independence, both contributing on child's reading comprehension (e.g., Kendeou, van den Broek, White, and Lynch 2009; Verhoeven and van Leeuwe 2008). However, with an increase of age, reading comprehension becomes less closely related to decoding skill, and more strongly related to higher level processes and skills (Catts, Adlof, and Weismer 2006, Gough, Hoover, and Peterson 1996). These relationships between reading comprehension and lower- and higher level processes change particularly early in languages with transparent orthographies (Florit & Cain, 2011). For example, in Finnish, the direct effect of decoding (reading fluency) on reading comprehension disappears already after first grade, whereas the effect of listening comprehension remains significant for a longer time (Torppa, Georgiou, Lerkkanen, Niemi, Poikkeus, and Nurmi 2016).

As text comprehension depends on numerous underlying processes and skills, becoming a proficient reader is not an easy task. On one hand, difficulties in reading comprehension may be caused by insufficient functioning of lower level processes, leading to inaccurate or incomplete input to the higher level processes. On the other hand, readers with weaknesses predominantly in higher level processes suffer because they have difficulties in identifying semantic connections between text units and between the text and their prior knowledge, identifying the main ideas in a text, and monitoring their comprehension (Kendeou et al. 2014). In addition, many elementary school students do not spontaneously use

reading strategies, especially when confronting texts that are challenging to comprehend (Pressley and Allington 1999). However, there is substantial evidence that children can learn to comprehend effectively if reading strategies are explicitly taught in classrooms (see meta-analyses by Berkeley, Scruggs, and Mastropieri 2010; Gersten et al. 2001; Melby-Lervåg and Lervåg 2014). In addition to explicit reading instruction, current educational approaches emphasize the importance of supporting students' autonomous motivation and satisfying their needs for relatedness, competence, and autonomy (Deci and Ryan 2000). In relation to development of reading comprehension, it means giving choices in reading material according to a student's skill level and interests, providing both instructional and emotional feedback (cf. Hamre and Pianta 2010). Research has generally documented positive effects of child-centered (see a review by Cornelius-White 2007; Lerkkanen et al. 2016) but also combined child-centered and teacher-directed (Kikas et al. 2016; Tang et al. 2017) teaching practices on children's reading skills and motivation. However, using child-dominated teaching practices, characterized by giving too much freedom to children and too little guidance and support, tends to undermine children's reading and motivational development (Kikas et al. 2016; Tang et al. 2017).

Educational Systems and Reading Instruction in Estonia and Finland

International comparative education study of achievement such as PISA (OECD 2016) among 15 year olds, have shown that Estonia and Finland have high-quality educational systems and high performance outcomes across the school years, especially in reading. In both countries, compulsory formal education consists of nine years of comprehensive school, beginning in the year the child turns seven and continuing with the same class teacher for the main subjects. In addition, the academic demands in primary school are similar in both national core curricula (National Board of Education 2014; Vabariigi Valitsus 2011/2014). However, there are also some important differences between the countries. For example, the

countries' different histories (Estonia was a part of the Soviet Union from 1941 to 1991) are reflected in teachers' values, beliefs, and practices. In Finland, child-centered practices, modification of instruction according to the students' skills, and individualized support for learning are highly valued and evident in teaching practices (Kiuru et al. 2015; Nurmi et al. 2013). Meanwhile, a variety of child-rearing values (Tulviste and Kikas 2010) and practices (Palu and Kikas 2007; Tang et al. 2017) are found among Estonian teachers. For example, alongside with child-centered and combined child-centered and teacher-directed, remarkable amount of Estonian elementary school teachers (but only a few Finnish teachers) use predominantly child-dominated practices in classroom (Tang et al. 2017).

Finnish and Estonian languages share much in common with each other in terms of phonology, syntax, morphology, and lexicon (see Dasinger 1997). Both languages have shallow orthographies meaning that grapheme–phoneme correspondences are systematic (see Viise, Richards, and Pandis 2011, for Estonian; Aro and Wimmer 2003, for Finnish). Thus, reading instruction is based on grapheme–phoneme correspondence (phonics) in both countries. However, there is a specific difference between Estonia and Finland. Besides promotion of oral language skills (e.g., vocabulary, storytelling, and listening comprehension), the formal teaching of reading begins in kindergarten (one year before school) in Estonia and children are expected to decode before school entry while in Finnish kindergarten children still focus on play-centered activites with letters and sounds during their kindergarten year and more systematic reading instrcutin begins at first grade. Although in Estonia, the reading instruction at the first grade still emphasizes decoding during the first weeks of school, most students have already acquired these basic skills and can go further in practicing reading fluency and comprehension rather quickly. In Finland, the first semester focuses on decoding. However, since word-level decoding reaches a high level of accuracy for most first grade students after only a few months of school (Lerkkanen et al. 2004),

students' commitment and motivation for reading to improve their fluency and comprehension is strongly supported already in first grade. Student gains and engagement in reading are encouraged, for example, through the availability of high-interest texts on multiple difficulty levels and by giving students the freedom to choose reading materials (Lerkkanen 2007; Lerkkanen et al. 2016).

By the end of third grade, both Estonian and Finnish children are expected to read fluently and comprehend different types of texts (National Board of Education 2014; Vabariigi Valitsus 2011/2014). Although some reading strategies (e.g., predicting, dividing text into meaningful passages, making a plan, a scheme or a map according to the text) should be taught already in Estonian early elementary grades, their conscious usage is supported since fourth grade (Vabariigi Valitsus 2011/2014). In Finland the special task of reading instruction at grades 3 to 6 is to guide the students towards more fluent reading skills, usage of reading strategies as well as observing and assessing their own reading (i.e. comprehension monitoring) in expanded selection of text genres.

In both countries, special education support is provided for students with reading disabilities. In Estonia, class teachers' reports on students' reading skills and special education teachers' self-designed tools are used when determining the need for additional support in reading skills. The most common approach to supporting children with problems in reading and/or writing is part-time special education in the form of extra lessons, outside general education classroom in groups of up to six children (Riigikogu 2014). The amount of the extra lessons is determined based on the child's individual needs (Haridus- ja teadusminister 2014) but mostly, it is 1–2 extra lessons per week. In Finland in the case of reading difficulties the forms of support are remedial teaching during or after school by class teacher, part-time special education given by special education teacher individually or in a small group during school days, or co-teaching by class teacher and special education teacher

during normal literacy lessons (Lerkkanen 2007). These forms of support do not require any formal diagnosis of a reading difficulty (Björn et al. 2016).

Reading Skills among Estonian and Finnish Students

Due to beginning reading instruction a year earlier in Estonian schools, Soodla et al. (2015) found that reading accuracy and fluency were significantly better among Estonian students than their Finnish peers at the beginning of first grade. However, the study also showed that Finnish children caught up with their Estonian peers already by the end of the first school year. This finding shows that in shallow orthographies, such as Finnish, children can acquire decoding skills very quickly with the help of systematic phoneme-based teaching provided in the first grade. In addition, students' reading comprehension was also at a similar level by the end of first grade.

The other existing studies that include both Estonian and Finnish students have been conducted with older students. The earliest study (Must 1997) was based on an international survey carried out among 32 countries in 1990–1991 by the International Association for the Evaluation of Educational Achievement (IEA). The study involved 9-year-old (3rd grade) and 14-year-old (8th grade) Estonian students whose comprehension of different types of texts was investigated. The findings showed that Estonian students' reading comprehension outcomes were near the international mean, yet significantly lower than their Finnish peers' results. In the recent PISA surveys where both Estonia and Finland have participated, results have shown that in both countries, 15-year-old students' reading performance is relatively high as compared to the OECD average (OECD 2014, 2016). Although Estonian students' results have shown an average yearly improvement and Finnish counterparts a decline during the recent years (OECD 2016), Estonians' performance has still stayed significantly lower than that of their Finnish peers. Further, Finland has had significantly larger percentages of students performing at the highest proficiency levels in reading comprehension, characterized

by a full and detailed understanding of a text with unfamiliar content and form, and an ability to make multiple inferences during reading (OECD 2014, 2016).

Present Study

Previous international comparisons conducted among elementary (Mullis et al. 2012) and middle school students (OECD 2016) have shown that there are substantial differences among countries in reading comprehension. However, as these studies have been cross-sectional, it is unknown when and for which levels of comprehension (literal or inferential) the differences between countries arise. The present study examined students' reading comprehension from the end of first grade until the end of sixth grade in two countries with shallow orthographies—Estonia and Finland.

This study examined the following research questions and hypotheses.

1. Do Estonian and Finnish students differ in their reading comprehension? At what grade do these differences emerge? First, we expected that the average performance level of reading comprehension of Estonian and Finnish children would be similar at the end of first grade (Soodla et al. 2015) but that Finnish students' will develop faster after the first grade. The rationale for the latter part of the hypothesis is that the international surveys have shown that Finnish students show better reading comprehension than Estonians (Must 1997; OECD 2014, 2016). We also relied on an observational study (Tang et al. 2017) showing that child-centered and combined child- and teacher-centered practices, which have been found to be beneficial for students' reading comprehension development, are used to a greater extent in Finland. Second, we expected that the percentages of good performers in reading comprehension were higher among Finnish than Estonian students. So far, this tendency has been shown in 15-year-olds (OECD 2014, 2016). However, we expected this tendency to emerge already in elementary school because previous research has shown that child-centered

and combined teaching practices are more common in Finnish lower elementary classrooms than in Estonia (Tang et al. 2017).

2. Do Estonian and Finnish students differ in the level of literal and inferential reading comprehension in Grades 1 to 6? At what grade do these differences emerge? We expected the differences between Estonian and Finnish students to exist particularly in inferential comprehension requiring higher level reading processes to be involved in reading as compared to literal comprehension. This hypothesis was based on findings of PISA surveys (OECD 2014, 2016) showing that typically the students achieving the highest levels of reading comprehension are also able to make multiple inferences during reading (OECD 2014).

Method

Participants

Estonian sample. The total sample of Estonian students ($N = 619$) consisted of two cohorts (see Figure 1). The data of the first cohort (the same as in Authors XXXX) were collected in 2012–2014 involving 357 children (50% boys) whose reading comprehension was assessed twice: at the end of first and second grade. The data were gathered from 22 classrooms from three municipalities in different parts of Estonia, with a mean group size of 22.32 students ($SD = 2.88$) in the first grade. At the beginning of the study, the children's mean age was 88.07 months ($SD = 3.90$). The majority (98%) of children came from families with Estonian as the language spoken at home. Students' socioeconomic status was measured using parents' education. The measure of the highest educational level in the family was used in the analyses. A total of 4% (general population 10%) of the families had a low education level (nine years of formal education, grades 1–9), 47% (general population 52%) were high school graduates (grades 10–12, or vocational education granting secondary education), and 49% (general population 37%) had a college degree (at least three years of education at a

university or professional higher education institution of applied sciences). The parents in our sample showed a somewhat higher educational level than the general Estonian population (see Eurostat 2013).

The second cohort consisted of children who were assessed three times in 2008–2013: at the end of second, third, and sixth grade. The students participated in a large-scale longitudinal study (Authors XXXX) following children from kindergarten until ninth grade. In second grade, only 82 children's (from 10 classrooms) reading comprehension was measured using the same assessment instrument as in the first cohort, but in the third and sixth grades, 180 students (from 13 classrooms) were added to the sample. Thus, the total sample in the second cohort of third and sixth graders consisted of 262 students (49% boys). The students came from 23 classrooms in the third grade and 26 classrooms in the sixth grade, across rural and urban areas (the same as in the first cohort). The mean group size in second grade (where all 357 children from the first cohort and 82 children from the second cohort were included) was 22.94 ($SD = 3.38$). In third and sixth grades, the mean group sizes were 20.09 ($SD = 3.06$) and 19.85 students ($SD = 3.99$), respectively. Like in the first cohort, a large majority (99%) of children in the second cohort had Estonian as their home language. Their parents were also somewhat more highly educated than the general Estonian population (Eurostat, 2013): the low education level was present for 4% of the families, high school education level for 53% families, and higher education level for 43% families.

The first cohort ($n = 357$) and the subsample of the second cohort who participated in the second, third, and sixth grades ($n = 82$) were similar for background variables, i.e., children's gender [$\chi^2(1) = 1.48, p = .22$], parents' educational levels [$\chi^2(2) = 2.30, p = .32$], home language [$\chi^2(1) = 0.03, p = .87$], and classroom sizes [$t(30) = 1.42, p = .17, d = 0.53$]. In addition, their reading comprehension in second grade was at a similar level [$M = 7.88 (SD = 2.39)$ and $M = 8.01 (SD = 2.29)$, respectively, $t(437) = -0.46, p = .65, d = 0.06$]. The

subsamples in the second cohort [$n = 82$ and $n = 180$, respectively] were also similar for children's gender [$\chi^2(1) = 1.82, p = .18$], parents' educational levels [$\chi^2(2) = 0.52, p = .77$], and home language [$\chi^2(1) = 0.25, p = .62$]. Classrooms involved somewhat less students in the first subsample ($M = 18.85, SD = 1.99$) than in the second subsample ($M = 21.70, SD = 3.53$) [$t(21) = -2.46, p = .02, d = 0.99$]. Reading comprehension in the subsamples of the second cohort slightly differed in third grade [$M = 8.84 (SD = 2.00)$ and $M = 8.20 (SD = 1.92)$, $t(260) = 2.48, p = .01, d = 0.33$] but were similar in sixth grade [$M = 6.55 (SD = 2.23)$ and $M = 6.52 (SD = 2.55)$, $t(260) = 0.10, p = .92, d = 0.01$].

Finnish sample. The Finnish sample was a subsample from an extensive follow-up study of 1,880 children (Authors XXXX) assessed in 2007–2012. The Finnish participants for the present study were 292 children (52% boys), coming from a single municipality of Finland. Their reading comprehension was assessed four times (i.e., at the end of first, second, third, and sixth grade). The students belonged to 24 classrooms with the mean size of 21.29 students ($SD = 3.78$) in first grade and 21.63 students ($SD = 3.40$) in second grade, 25 classrooms with the mean size of 21.44 students ($SD = 3.78$) in third grade, and 28 classrooms with the mean size of 22.18 students ($SD = 3.43$) in sixth grade. At the beginning of the study, the mean age of children was 86.51 months ($SD = 3.77$). The large majority (99.6%) of the children came from Finnish-speaking families. A total of 2% of the Finnish families had a low education (general population 12%), 47% had a high school education (general population 46%), and 51% (general population 42%) had a higher education. Again, the parents in this study showed a somewhat higher educational level than the general population (Eurostat 2013).

The Finnish sample was selected to match the Estonian sample in terms of children's individual backgrounds and classroom sizes, allowing us to control for these variables. Finnish children were on average 1.6 months younger than the Estonian children, $t(647) =$

$4.95, p < .001, d = 0.41$. For all other individual background variables, the Estonian and Finnish samples did not differ significantly: the Finnish sample was similar in comparison to both Estonian cohorts for children's gender [$\chi^2(1) = .33, p = .57$, and $\chi^2(1) = .69, p = .41$, respectively], parents' educational levels [$\chi^2(2) = 1.32, p = .52$, and $\chi^2(2) = 4.29, p = .12$, respectively], and home language [$\chi^2(1) = .88, p = .17$, and $\chi^2(1) = .43, p = .51$, respectively]. The samples were also compared for classroom sizes. In first grade, the Estonian classrooms included more children than those in Finland, $t(44) = 2.60, p = .01, d = 0.82$. In second and third grades, the classroom sizes were similar [$t(54) = 1.44, p = .16, d = 0.39$, and $t(46) = -1.36, p = .18, d = 0.39$, respectively]. In sixth grade, classrooms were smaller in Estonia than in Finland, $t(52) = -2.31, p = .03, d = 0.63$. Note, however, that despite statistical significance, the actual classroom size between the countries differed little, by only one child in Grades 1–3 and by two children in Grade 6.

Procedure

In both countries, principals and teachers of the schools were first contacted in order to inform them of the project and invite them to participate. Parents were then asked to give written informed consent for their child's participation. Information on background variables (i.e., parental education, child's gender, age, and home language) was gathered from parents.

Students' reading comprehension was assessed at four time points: during the final semester of first, second, third, and sixth grades (April–May). The assessment was conducted by trained examiners, in a group setting during regularly scheduled lessons.

Measures

At all time points, students' reading comprehension was assessed using tests from Finnish standardized test battery for first to sixth grades (ALLU; Lindeman 1998). In each grade level, the test consisted of an expository text and 12 comprehension tasks. The texts in first and third grades had descriptive structures, in second grade sequential structure, and in

sixth grade mixed structure (description/comparison). The lengths of the Estonian and Finnish texts were 150 and 144 words in first grade, 115 and 114 words in second grade, 147 and 139 words in third grade, and 586 and 558 words in sixth grade. With each grade, the lexical difficulty (average length of words) and syntactic complexity (average length of sentences in words) increased, being the lowest in first and highest in sixth grade. In first, second, and third grades, the tasks included 11 multiple choice questions with 4 answer choices and one task requiring the students to order information units according to the text. In sixth grade, the tasks included only multiple choice questions with 4 answer choices.

All tests involved questions assessing both literal and inferential reading comprehension. Literal comprehension questions examined students' understanding of information stated explicitly in the text [e.g., *Judo is (a) martial arts, (b) bodybuilding, (c) gymnastics, (d) winter sports*]; inferential comprehension questions assessed an ability to make inferences and draw conclusions about information that was stated in the text [e.g., *Style of the text is (a) emotional, (b) objective, (c) disparaging, (d) angry*]. The total number of literal and inferential comprehension questions varied in different time points: the respective numbers were 6 and 6 in first grade, 3 and 9 in second and third grades, and 2 and 10 in sixth grade.

The Estonian versions of the reading comprehension tests were translations of the original Finnish tests. The translated Estonian versions were also back-translated to Finnish. The original and back-translated texts and tasks were highly similar in terms of length (i.e., number of words, characters, and sentences), lexical difficulty, and syntactic complexity. For the first grade, the Estonian version of the test was also adapted culturally: in two sentences and one respective test item, information about Finland was replaced with the same information about Estonia.

Scoring of the tests was based upon the total number of correct responses (maximum score in each grade = 12). Lindeman (1998) reported the Kuder–Richardson reliability coefficients to be .85 in first grade, .80 in second grade, and .75 in third grade. In the current study, Cronbach's alphas in first, second, third, and sixth grades were .86, .86, .77, and .72 in Estonian sample, and .79, .88, .88, and .81 in Finnish sample, respectively.

Results

First, we examined whether Estonian and Finnish students' reading comprehension differed at the end of first, second, third, and sixth grades by comparing mean differences (see Table 1). While in first grade, Estonian and Finnish children's test results did not differ significantly [$t(647) = -1.35, p = .18, d = 0.11$], Finnish students showed a higher level of overall reading comprehension in second [$t(729) = -6.41, p < .001, d = 0.49$], third [$t(552) = -8.07, p < .001, d = 0.69$], and sixth grade [$t(552) = -5.67, p < .001, d = 0.48$]. As there was a slight age difference of about one month between the Finnish and Estonian children, we conducted also ANCOVAs with reading comprehension score as the dependent variable, sample (Estonian or Finnish) as the categorical variable, and age as the covariate. The results did not change.

For the purpose of next analyses, the students were divided into five proficiency levels according to reading comprehension test results across the samples: very poor performers (~the lowest 10% of students), poor performers (~11–25%), average performers (~26–75%), good performers (~76–89%), and very good performers (~90–100%). The categorical variable of these five comprehension proficiency levels of Estonian and Finnish students were compared separately at different grade levels by using frequency tables and adjusted standardized residuals (ASR). Frequencies, percentages, and ASRs of Estonian and Finnish students at different proficiency levels are presented in Table 2. The results showed that there were no differences between Estonian and Finnish students in first grade, $\chi^2(4) = 3.76, p =$

.44. In second grade, the Estonian and Finnish samples differed significantly, $\chi^2(4) = 36.59, p < .001$. In third grade, chi-square statistics also revealed significant difference between the samples, $\chi^2(4) = 56.92, p < .001$. Analysis of the ASRs for second and third grade revealed that in the Estonian sample, very poor and poor performers were overrepresented, whereas good and very good performers were underrepresented. For the Finnish children, very poor and poor performers were less common than expected, and good and very good performers were more frequent than expected. The samples differed also in sixth grade [$\chi^2(4) = 39.59, p < .001$], showing that very poor performers were more common than expected in the Estonian sample, whereas they were less common in the Finnish sample. Good and very good performers were underrepresented in the Estonian sample and overrepresented in the Finnish sample.

Finally, we examined the differences in literal and inferential reading comprehension between the Estonian and Finnish samples (see Table 1). In first and second grades, literal comprehension was at a similar level in the samples [$t(647) = 0.10, p = .92, d = 0.01$, and $t(729) = -1.73, p = .08, d = 0.13$, respectively]. Yet, the inferential comprehension was different, showing an advantage of Finnish children for both grades [$t(647) = -2.41, p = .02, d = 0.19$, and $t(729) = -7.27, p < .001, d = 0.55$, respectively]. In third grade, both literal and inferential comprehension were on average better among the Finnish students [$t(552) = -5.71, p < .001, d = 0.49$, and $t(552) = -7.48, p < .001, d = 0.64$, respectively]. Similarly, in sixth grade, both literal and inferential comprehension were on average better among the Finnish students [$t(552) = -2.56, p = .01, d = 0.21$, and $t(552) = -2.97, p = .003, d = 0.25$, respectively]. As there was a slight age difference of about one month between the Finnish and Estonian children, we conducted also ANCOVAs with literal or inferential reading comprehension score as the dependent variable, sample (Estonian or Finnish) as the categorical variable, and age as the covariate. The results did not change.

Discussion

The present study examined reading comprehension throughout elementary school in two languages with shallow orthographies, Estonian and Finnish. The Finnish students' success on different cross-national comparison reading studies is widely recognized, and the reasons behind the success have been of great interest. The contribution of the present study to this understanding lies in discovering the critical time points in reading development during elementary school. The results showed that reading comprehension of the Estonian and Finnish children was at a similar level at the end of first grade, but Finnish children started to make gains in second grade onward. The differences remained significant all the way to the end of sixth grade. Starting from the second grade, poor performers were overrepresented in Estonia, whereas they were underrepresented in Finland. Moreover, good performers were less common than expected in Estonia and more common in Finland. Comparisons of literal and inferential comprehension showed that country difference was significant in literal comprehension in third and sixth grades, whereas in inferential comprehension Finnish students showed better comprehension than Estonians at each time point.

The finding that reading comprehension was at a similar level in first grade was consistent with the finding in Soodla et al. (2015). This result indicates first that Finnish and Estonian children are able to comprehend a page-long continuous text already by the end of first grade. It is noteworthy that Finnish first graders read after seven to eight months of instruction at a similar level with their Estonian peers who have been systematically taught reading a year longer. This finding may point, first, to very efficient reading instruction during first grade in Finnish schools. The results may also reflect Finnish success in supporting listening comprehension and other oral language skills during kindergarten and first grade. The importance of oral language skills on reading comprehension alongside

decoding skills is evident (Adlof, Catts, and Little 2006; de Jong and van der Leij 2002; Ouellette 2006; Torppa et al. 2016) and in shallow orthographies, the impact of listening comprehension has greater influence on reading comprehension than decoding already in early grade levels (Florit and Cain 2011). In Finnish, for example, the direct impact of reading fluency on reading comprehension has been shown to fade away after first grade, while the effect of listening comprehension increases (Torppa et al. 2016). Therefore, at least in shallow orthographies, instruction to support the development of text comprehension ability should include both oral and written text from early stages of reading development, as also recommended by Florit and Cain (2011).

Our expectation that the Finnish children's advantage in reading comprehension, as compared to their Estonian counterparts, emerges during elementary school was confirmed. The findings of country differences were in the same direction as previous findings in PISA surveys among older students (OECD 2014, 2016) that have shown the advantage of 15-year-old Finnish adolescents compared to Estonian students. However, our findings indicate that Finnish children outperformed their Estonian peers already in the second grade, suggesting that good comprehension skills among Finnish students have their roots already in early elementary school. There are several possible reasons for the advantage of Finnish children over their Estonian peers in reading comprehension since second grade. The first possibility is that strategy instruction, which is crucial for the development of reading comprehension (Berkeley, Scruggs and Mastropieri 2010; Gersten et al. 2001; Melby-Lervåg and Lervåg 2014), is more effectively implemented in Finnish elementary schools, both in literacy and content area subjects. To be effective in reading strategy instruction, teachers need to have good metacognitive knowledge of these strategies themselves. Recent research, carried out among Estonian teachers (Soodla, Jõgi, and Kikas 2016), shows that teachers vary considerably in their metacognitive knowledge of reading strategies. It is possible that the

level of reading-related metacognitive knowledge is lower among Estonian teachers, as compared to their Finnish colleagues. The second possible reason for the advantage of Finnish children may lie in more extensively used child-centered and combined teaching practices in Finland (Tang et al. 2017). Such practices have shown to be beneficial for children's development of reading skills as well as their motivation to read (Cornelius-White 2007). Moreover, Tang and his colleagues (2017) found that child-dominated teaching practices inhibiting children's skill and motivational development (Kikas et al. 2016) were present only in Estonian but not in Finnish first grades.

We also compared proportions of students at different proficiency levels in reading comprehension between the countries. Our expectation to find more advanced performers in Finland than in Estonia was confirmed: since the second grade, students at high and very high proficiency levels (whose reading comprehension test results belonged to 75–89 and 90–100 percentiles, respectively) were overrepresented in the Finnish sample, whereas they were underrepresented among the Estonians. This result is in line with PISA findings (OECD 2014, 2016) which have shown a significantly higher percent of 15-year-old students at the highest proficiency levels in Finland than in Estonia. Although on average, Estonian students have been performing relatively well in reading comprehension according to PISA assessments, the problem lies in having too few students at the highest proficiency levels when compared to OECD average (Tire et al. 2010). Our findings add to existing knowledge indicating that this tendency emerges already at the beginning of school. PISA findings, taken together with our results, give merit to Tire et al. (2010) suggestion that in Estonian schools too little attention is paid on more challenging tasks, which could enable students to attain the highest mastery of reading comprehension. Research has shown high efficiency of these kinds of tasks which promote higher level cognitive processes during reading, such as inference making (Bos et al. 2016) and comprehension monitoring (Berkeley and Riccomini 2013). For example,

inference-making skills might be supported by predictive reading and verifying the predictions made, distinguishing main issues from side issues, or using textual clues to understand what is implied (Bos et al. 2016; van Keer 2004). Students' comprehension monitoring and regulation of their understanding should be taught by rereading, adjusting reading speed, or tracing the meaning of unfamiliar words or expressions (van Keer 2004).

The present study revealed that percentages of children who scored poorly in reading comprehension tests were significantly higher in the Estonian than in the Finnish sample after first grade. This result points to the possibility that teachers tailor their instruction to the reading skills of each individual child in their classrooms (see Kiuru et al. 2015; Nurmi et al. 2013) to a greater extent than Estonian teachers do. That is, there might be a difference in the amount of individualization in reading instruction between Finnish and Estonian schools. Another possibility is that in Finnish schools, more effective special education support is provided for children with reading disability, such as the availability of remedial teaching or part-time special education teachers in the classroom, alongside adaptive computer games to practice basic reading skills, such as decoding and fluency (Saine et al. 2011). These latter approaches are not yet employed in Estonian schools. Although significant changes have taken place in education in Estonia during the past decades, the system for supporting children with learning difficulties or other special educational needs is not yet as multifaceted and flexible as in Finland.

Finally, we were interested whether the Estonian and Finnish children differed in literal and inferential comprehension. The expectation, based on PISA results (OECD 2014, 2016), was that the Finnish students outperformed their Estonian peers, particularly in inferential questions that require activation of higher level processes during reading. Our findings are in line with PISA results showing better performance in inferential comprehension among the Finnish children. However, it was highly surprising that their

advantage in inferential comprehension emerged as early as in the first grade. There are several possible reasons for this finding. First, as already mentioned above, we suspect that listening comprehension, which is an important prerequisite for reading comprehension, especially when inference making is necessary (Lerkkanen et al. 2004), is more strongly supported among Finnish children before school and during first grades (Lerkkanen 2007). Second, it is possible that supporting the higher level skills or reading strategy instruction, including training inference-making skills, is more common and/or modified to match the student's reading level in Finnish than in Estonian elementary schools.

Although we did not expect differences in literal comprehension between the countries, our results showed that in third and sixth grades, the Finnish children performed better than Estonians in literal comprehension as well. This finding suggests that during elementary school, Finnish children acquire better skills or strategies that enable the reader to retrieve information explicitly stated in the text. It is also worth noting that in the present study, only expository texts were used. Comprehension of expository text sets higher processing demands for the reader due to its unfamiliar content and structure (Diakidoy et al. 2005). Therefore, when reading expository text, previous knowledge and effective usage of reading strategies are even more important than during reading narrative text.

Limitations

The generalizability of these findings is first limited by the fact that the data from this study were collected using one reading comprehension measure in each grade and the numbers of items measuring literal and inferential comprehension were small. Multiple texts, more text types, and various comprehension tasks should be used in future studies to get more thorough information regarding children's skills in reading comprehension. Assessment of text reading comprehension, particularly among first grades, requires however, plenty of effort and time from the children. Therefore, the amount of items in any text reading

comprehension assessments is typically low. Second, no comparative data for reading fluency, listening comprehension, and motivation that all influence development of reading comprehension were included in the present study. Information about these underlying factors might have added value to the present findings. Third, the samples used in the study were not fully representative, showing a somewhat higher parental educational background than in the total populations of Estonia and Finland. However, the samples were similar to each other, both in terms of children's individual backgrounds and classroom sizes, allowing us to exclude these factors as the possible reasons for the country differences.

Conclusions

The results of the present study suggest that the rapid development of Finnish students' reading comprehension has its roots in the early grades of elementary school. The possible reasons for such development, such as teaching practices including instruction of reading strategies and individualized support focusing on children with varying reading skills, as well as support of students' motivation, should be examined in future studies. Well-developed reading comprehension skills are crucial in educational settings and beyond. Therefore, the best practices for supporting such skills in elementary school require further research efforts. In order to pinpoint what explains strong reading comprehension performance in Finland, among other successful PISA countries, we need longitudinal cross-country comparison studies on the daily practices in classrooms. Our study suggests that such research should focus on early stages, starting from kindergarten.

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Table 1. Descriptive statistics of reading comprehension in the Estonian and Finnish samples

		Total reading comprehension				Literal reading comprehension				Inferential reading comprehension					
		Estonia		Finland		Estonia		Finland		Estonia		Finland			
Grade	Range	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	Range	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	Range	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
1	0–12	5.85	2.86	6.16	2.84	0–6	2.63	1.69	2.64	1.71	0–6	3.23	1.56	3.52	1.48
2	0–12	7.90	2.37	9.04	2.30	0–3	1.85	0.81	1.96	0.85	0–9	6.06	1.94	7.08	1.76
3	0–12	8.40	1.96	9.72	1.87	0–3	1.83	0.68	2.17	0.70	0–9	6.57	1.60	7.55	1.48
6	0–12	6.53	2.45	7.72	2.50	0–2	1.36	0.74	1.51	0.69	0–10	5.83	2.32	6.39	2.13

Table 2. Cross-tabulation of the reading comprehension proficiency levels by the Estonian and Finnish samples

Estonia							Finland							
Grade		Very low	Low	Average	High	Very high	Total		Very low	Low	Average	High	Very high	Total
1	<i>n</i>	47	37	206	31	36	357		30	34	159	35	34	292
	%	(13.17)	(10.36)	(57.70)	(8.68)	(10.09)	(100.00)		(10.28)	(11.64)	(54.45)	(11.99)	(11.64)	(100.00)
	ASR	1.1	-0.5	0.8	-1.4	-0.6			-1.1	0.5	-0.8	1.4	0.6	
2	<i>n</i>	40	81	256	46	16	439		13	37	154	50	38	292
	%	(9.11)	(18.45)	(58.31)	(10.48)	(3.65)	(100.00)		(4.45)	(12.67)	(52.74)	(17.12)	(13.02)	(100.00)
	ASR	2.4*	2.1*	1.5	-2.6*	-4.7*			-2.4*	-2.1*	-1.5	2.6*	4.7*	
3	<i>n</i>	43	39	140	29	11	262		20	11	153	61	47	292
	%	(16.41)	(14.89)	(53.43)	(11.07)	(4.20)	(100.00)		(6.85)	(3.76)	(52.40)	(20.89)	(16.10)	(100.00)
	ASR	3.5*	4.6*	0.2	-3.1*	-4.6*			-3.5*	-4.6*	-0.2	3.1*	4.6*	
6	<i>n</i>	33	53	147	20	9	262		13	48	144	41	46	292
	%	(12.60)	(20.23)	(56.11)	(7.63)	(3.43)	(100.00)		(4.45)	(16.44)	(49.32)	(14.04)	(15.75)	(100.00)
	ASR	3.5*	1.2	1.6	-2.4*	-4.8*			-3.5*	-1.2	-1.6	2.4*	4.8*	

Note. ASR = adjusted standardized residuals. * $p < .05$

Figure 1. Description of the Estonian and Finnish samples at different measurement points