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Preliterate Phonological Awareness and Early Literacy Skills in Turkish

Keywords: phonological awareness; Turkish; reading; phonological STM; spelling.

Abstract

The role of preschool phonological awareness in early reading and spelling skills was investigated in the transparent orthography of Turkish. Fifty-six preschool children (mean age = 5.6 years) were followed into grade 2 (mean age = 7.6 years). Whilst preschool phonological awareness failed to make any reliable contribution to future reading skills, it was the strongest longitudinal correlate of spelling skills measured at the end of grades 1 and 2. Overall findings suggested that phonological awareness may be differentially related to reading and spelling and that spelling is a more sensitive index of phonological processing skills. In this study, verbal short-term memory emerged as the most powerful and consistent longitudinal correlate of reading speed. This finding raised important questions about the component processes of reading speed, and the role of memory and morpho-syntactic skills in an agglutinative and transparent orthography such as Turkish.

Preliterate Phonological Awareness and Early Literacy Skills in Turkish

A substantial body of research evidence from English indicates that there is a powerful relationship between preschool phonological awareness (broadly defined as the perception and analysis of speech sounds) and subsequent literacy achievement (Shankweiler & Fowler, 2004). However, the pattern of findings from research in transparent writing systems with simpler and more consistent letter-sound relationships than English tends to be inconsistent and sometimes contradictory. Some have reported findings more similar to those in English with a strong predictive effect of preschool phonological awareness on early literacy performance (Dufva, Niemi, & Voeten, 2001; Jimenez & Ortiz, 2000; Müller & Brady, 2001). Others have reported that preschool phonological awareness skills are either less important or irrelevant for future literacy attainment (de Jong & van der Leij, 1999; Holopainen, Ahonen, & Lyytinen, 2001; Wimmer, Landerl, Linortner, & Hummer, 1991)

Three main issues complicate a coherent evaluation of the research evidence in this area.

i) Lack of systematic control for other important predictors such as existing literacy skills and letter knowledge;

ii) The tendency to focus on a limited or single measure of phonological awareness skills when evidence suggests that different phonological awareness measures might be differentially related to literacy skills (e.g., Muter, Hulme, & Snowling, 1998).

iii) Differences in literacy outcome measures: phonological awareness tends to be more predictive of spelling rather than reading (Harris & Giannouli, 1999; van Bon & van Leeuwe, 2003; Wimmer & Mayringer, 2002), and reading accuracy rather than reading speed[1] (Barker, Torgesen, & Wagner, 1992; Lovett, 1987; Savage & Frederickson, 2005; Torgesen, Wagner, Rashotte, Burgess, & Hecht, 1997).

Although the issues of control measures and type of phonological awareness measure have been extensively discussed in the literature (Castles & Coltheart, 2004), the possible role of the type of literacy outcome measure has received less attention. The observed tendency of phonological awareness to be less predictive of reading speed relative to reading accuracy is particularly important when comparing the research evidence between transparent and opaque systems (Patel, Snowling, & de Jong, 2004). This is because studies on transparent systems tend to use reading speed as an index of reading skills, whereas reading accuracy is used when studying opaque systems. The primary reason for this is the relative simplicity of transparent systems, which appears to facilitate reading accuracy development; so much so, that the performance reaches ceiling levels within one year of instruction. Hence, reading speed rather than reading accuracy becomes a more reliable index of reading skills (Wimmer et al., 1991). However, given the research evidence that, in English, there is a tendency for phonological awareness to be less predictive of reading speed than reading accuracy (e.g., Lovett, 1987), it is not clear to what extent it is the orthographic transparency and/ or the use of reading speed measure that contributes to the observed weak or unreliable relationships between reading and phonological awareness in transparent systems. For these reasons, despite increasing research evidence from alphabetic writing systems with different degrees of transparency, there are still major gaps in understanding of the role of phonological awareness in a truly transparent orthography.

The present research was undertaken to investigate the role of preschool phonological awareness in early reading and spelling attainment in Turkish. Turkish orthography is simpler and more transparent than the widely researched German and Dutch writing systems. Furthermore, unlike German and Dutch, Turkish presents a symmetrical transparency in that it is

transparent for both reading and spelling. German and Dutch are transparent for reading but not for spelling (see Wimmer & Mayringer, 2002). Hence, Turkish provides an appropriate medium for investigating the role of phonological awareness as a function of orthographic transparency in both reading and spelling skills.

It is important to note that we use the term predict as a statistical term, which does not suggest causality. Even in a well- controlled longitudinal study, it is not possible to rule out the involvement of an unmeasured variable which might have contributed to the observed relationships (Bradley & Bryant, 1983; Castles & Coltheart, 2004). Hence, the reported predictive relationships in this paper should be considered to suggest longitudinal correlational relationships.

Evidence from English and Transparent Orthographies

There seems to be a consensus that preschool phonological awareness is one of the key predictors of future reading and spelling skills in English (Stainthorp, 2003). This strong effect of phonological awareness has been observed in studies with strict controls over prior reading skills, memory, and naming speed (e.g., Wagner et al., 1997). Wagner and colleagues (1997) followed 216 children from kindergarten into the 4th grade and found that phonological awareness consistently predicted individual differences in reading at each point of measurement.

In transparent alphabetic systems, studies that have systematically controlled for existing reading skills and letter knowledge have often reported less reliable or nonsignificant longitudinal relationships between phonological awareness and subsequent reading skills. For instance, de Jong and van der Leij (1999; 2003) conducted a series of studies and reported that naming speed rather than phonological awareness was the most reliable and persistent predictor of future reading skills in Dutch. Similar findings reporting a weaker or unreliable longitudinal

predictive role for preschool phonological awareness came from studies conducted in German (Wimmer & Mayringer, 2002), Greek (Harris & Giannouli, 1999) and Finnish (Holopainen et al., 2001).

A transparent orthography with simple letter-sound relationships facilitates the development of both reading accuracy and phonological awareness skills (Durgunoglu & Öney, 1999). Even children with low phonological awareness skills seem to be able to compensate for any deficit after exposure to systematic literacy instruction in a simple orthography (Landerl & Wimmer, 2000). Conversely, in opaque systems such as English, the achievement of phoneme level of awareness skill appears to take longer, and is sometimes never fully achieved, resulting in persistent phonological awareness deficits as well as problems with word reading accuracy (Bruck, 1992). Hence, phonological awareness remains as a major limiting factor for the development of accurate reading skills in opaque systems such as English, but not in transparent systems (Aro & Wimmer, 2003).

The differentiation between reading and spelling becomes important in view of the several isolated findings from transparent systems such as German, Greek and Dutch, which reported that although preschool phonological awareness failed to predict later reading skills, it was a reliable predictor of spelling skills (Harris & Giannouli, 1999; van Bon & van Leeuwe, 2003; Wimmer & Mayringer, 2002). In a comprehensive longitudinal study, Wimmer and Mayringer (2002) found that preschool phonological awareness was the best index of future spelling performance in German. They attributed this to the lower transparency of German for spelling.

Finnish has a relatively transparent orthography for spelling. In a recent study, Leppanen, Niemi, Aunola, and Nurmi (2006) reported that when existing reading and spelling skills were

controlled at early preschool, the effect of phonological awareness on later preschool measures of reading and spelling became unreliable. This finding is clearly in line with Wimmer and Mayringer's proposition, which would predict that in a transparent spelling system the role of phonological awareness would be redundant.

Research evidence from Turkish is highly limited. At the time of writing, there was only one published longitudinal study in Turkish by Öney and Durgunoğlu (1997). They tested 30 children during grade 1 and reported that the phonological awareness measures obtained in October explained reliable unique variance in reading accuracy in February. However, the lack of control of existing reading skills complicates evaluation of these findings. Unfortunately, spelling was not assessed in February, which impeded an analysis of its longitudinal relationship with phonological awareness. Clearly, more research is needed to understand the role of preschool phonological awareness in early reading and spelling skills in highly transparent writing systems.

Current Study and Rationale

The primary aim of the current study is to investigate whether phonological awareness prior to formal literacy instruction would make a reliable contribution to later reading and spelling achievement in Turkish. The data were collected in Northern Cyprus where Turkish is the only official language. The Turkish spoken in Northern Cyprus is regarded as an extension of Anatolian Turkish and referred to as Cypriot Turkish. It shows some variations from the standard Turkish (see Demir & Johanson, 2006). The formal written Turkish and reading instruction in Northern Cyprus is based on the standard Turkish (see also Vanci-Osam, 2006). Most of the teaching materials and books including those used for reading instruction are publications of the Ministry of National Education in Turkey.

In Northern Cyprus, formal literacy instruction starts at grade 1 when children are about 6 years of age and teachers as well as parents are strongly discouraged from teaching any reading skills or letters before then. The method of reading instruction is eclectic with a mixture of whole word and phonics elements and is based on the formal national curriculum implemented in Turkey[2]. Children are expected to read accurately within a few months after the start of formal reading instruction. Those who are successful are presented with a certificate in a formal ceremony called 'okuma bayrami' (the reading festival) organised often in the autumn term.

Method

Participants

Fifty-six children from two public preschools acted as participants. Children came from families where Turkish was the only spoken language. Fifteen of these children had one or both parents from Turkey, the remaining children came from families of Turkish Cypriot origin. Hence, the spoken Turkish of the sample was a mixture of standard and Cypriot Turkish dialects. The children were followed from preschool to grade 2 and tested on three occasions. The consent for testing was obtained from school authorities, parents as well as children. None of the children had any reported visual or auditory problems. During the course of the study, a total of eight participants were lost from the study. Seven moved out of the country and one was in hospital at the time of testing. The numbers and mean ages at each testing time are given in Table 1. The overlap in the age ranges is caused by the admission procedure, which is based on a single intake

Table 1 about here

Materials and Procedures

The testing was conducted at the end of each grade level. The children were tested individually in a quiet classroom in their schools. A fixed order of presentation was used. There were two testing sessions for all children at each wave of data collection. The duration of these sessions varied across the age groups. At Time 1, each session lasted for about 15 minutes, at Time 2, 30 minutes, and at Time 3, 45 minutes. All testing was carried out by the first author who is a Turkish Cypriot and native speaker of Turkish (i.e., cultured in both standard and Cypriot Turkish dialects).

The socioeconomical status (SES) of the parents was a composite measure of both the educational level and occupational background of the mother and the father. The occupational status was scored on a scale of 1-7 ranging from unemployed/housewife to professional. The educational level was rated from 1-6 ranging from no schooling to postgraduate level of education.

At Time 1, a series of standardised and experimental measures was implemented. The standardised measures were the vocabulary and digit span forwards subtests from the Turkish version of the Wechsler Intelligence Scale for Children-Revised (WISC-R, Savasir & Sahin, 1995) and Raven's Coloured Progressive Matrices (Raven, Raven, & Court, 1998) as a measure of nonverbal IQ. As there are no norms for Northern Cyprus, only raw scores were used in the analyses.

A word -span task was developed as a second measure of phonological STM. The test format and procedure for this task was exactly the same as the digit span forwards subtest except that words rather than digits were used. This task was adapted from Case, Kurland, and Goldberg

(1982). Nine one-syllable concrete words were used. These were sal, beş, top, kül, kol, göz, mum, çöp (raft, five, ball, ash, arm, eye, candle, rubbish, respectively).

Six phonological awareness tasks were developed for this study: syllable tapping, syllable deletion, rime awareness, onset awareness, initial phoneme deletion, and final phoneme deletion (see Appendix A). In all tasks children received four practice trials with feedback. No feedback was provided for the test trials.

The syllable tapping task was adapted from Liberman, Shankweiler, Fischer, and Carter (1974). All stimuli were simple, concrete, 2-4 syllable words.

The syllable deletion task was based on the word analysis test of Bruce (1964). Words were spoken orally and the task was to say the remaining word after deleting a target syllable articulated by the experimenter. Half of the test trials involved word-initial and the other half word-final deletions. All the items were 2-syllable concrete words.

The phoneme deletion tasks were also developed from Bruce (1964). The procedure was the same, except this time the task was to say the remainder of the word after deleting the target phoneme. There were two forms of this task; one involved word-initial phoneme deletion and the other word-final phoneme deletion. All items were simple words with a consonant-vowel-consonant (CVC) syllable structure.

The sound oddity task consisted of two parts**:** rime and onset awareness. These tasks were based on the sound categorization paradigm of Bradley and Bryant (1983). For each trial, three words were presented with a 1-second interstimulus interval. Only monosyllabic words were used. The children were told they should pay attention to the sounds that they heard rather than the meaning. The onset awareness task included only CVC words and the task was to state

the odd word that differed in its initial sound. In the rime awareness task both CVC and CVCC words were used.

In order to assess letter knowledge, all 29 letters of the Turkish alphabet were randomly presented on an A4 size card. In Turkish, vowel letter names and sounds are the same. For this reason, any answer in the form of either a correct letter name or letter sound received one mark. There were two trials, one with lower case letters and one with upper case letters. The score for the letter knowledge was the mean score of these two trials.

At the time of testing, there were no standardised tests of literacy in Turkish. Hence, experimental literacy outcome measures were developed for this study. At Time 1, children were screened for rudimentary reading and spelling skills by three measures: 1-minute word reading, preschool reading and spelling. At Times 2 and 3, four literacy skills measures were implemented. These were 1-minute word reading, 1- minute nonword reading, text reading, and spelling (see Appendix A). All the reading tasks were timed with a chronometer and tape-recorded for further analyses and cross-validation.

The preschool reading test was a list of 15 common words selected from the early years curriculum in order that they would be well within the vocabulary of preschool children. All the words were concrete nouns with simple VC, and CVC syllable structures.

For the 1-minute word reading task a list of 100 words with graded difficulty were presented. The difficulty level of the words was manipulated in terms of syllable complexity, syllable length and frequency. As frequency data were not available in Turkish at the time of testing (see Tekcan & Goz, 2005), the literacy books of primary and secondary grades were analysed in order to select words with different levels of difficulty. The words were presented randomly in serial form with five or six words on each line. The children were asked to read the

list of words accurately and as quickly as possible. The scores reflected the number of correctly read words in 1 minute.

For the 1-minute pseudoword reading task, a list of 90 graded pseudowords was constructed by changing the several graphemes of real words in line with the phonotactic and phonographic rules of the Turkish language [3]. The difficulty of the pseudowords was manipulated in terms of syllable complexity and length. The procedure for this task was the same as for the 1-minute word reading task.

Text reading ability was measured using a 70-word narrative text based on the story of "Tim and the biscuit tin" by Oakhill (1984) . The children were asked to read the text accurately and as fast as possible. The words were simple and within the vocabulary of children at grades 1 and 2. The reading speed was measured in terms of the number of correctly read words per minute. The accuracy score reflected the total number of accurately read words.

Spelling skills were assessed through oral presentation of six real words and thirteen pseudowords. Common real words taken from the reading vocabulary of the children in their first year of primary school were used to in order to make the task easier and increase the variability of the scores. All the pseudowords were constructed in line with the phonotactic and phonographic rules of Turkish. Each item was read aloud twice in quick succession after which the child was asked to write each item as correctly as possible. The children were told when the pseudowords began.

Finally, the arithmetic subtest from the WISC-R (Turkish version) was administered at Times 2 and 3 in order to investigate to what extent any observed relationships were specific to literacy skills.

Results

Initial Analyses

Descriptive statistics for each measure at Times 1, 2, and 3 are given in Table 2.

Table 2 about here

Only one child was able to decode five words on the reading tasks at Time 1. She reported that she had been taught to read at home. In order to maintain consistency of the sample characteristics, her data were excluded from subsequent analyses. The initial and final phoneme deletion tasks proved to be too difficult for the children at Time 1. For these reasons, the reading, spelling, and phoneme deletion measures are not presented in Table 2.

The internal reliability (Chronbach's alpha coefficient) of all the measures was at or above the criterion of .7. Only the rime and onset components of the sound oddity tasks failed to reach this criterion and for both measures the alpha coefficient was .4, possibly due to restricted variability on these two measures (see Table 2). Further analysis of these two measures revealed that they were highly correlated ($r = .42$, $p \leq .001$), hence it was considered appropriate to combine the scores on these two measures in order to increase variability in the distribution of the scores. When this was done, the internal reliability of the sound oddity measure increased to .6 and the distribution of the scores also improved and became normal (mean score = 7.88 , *SD* =

2.97, range of scores = 1-17). For this reason, all the analyses were based on the sound oddity task as a measure of both rime and onset awareness skills.

Overall children's letter knowledge was very low. Only two children were able to name at least 27 letters of the alphabet, and 46% of the children could name a maximum of 5 letters. It should be noted that the mean error rates in the 1-minute reading tasks were very low (range= 2.06 - 2.87) at both testing times. Hence, it was decided to drop these error rate measures from the subsequent analyses and that is why they are not presented in Table 2.

Correlation Analyses

Table 3 presents a summary of the intercorrelations among the variables at Time 1 (after Bonferroni correction, the p was adjusted to .01).

Table 3 about here

The two phonological STM measures shared large variance r (55) = .58, $p \leq .001$. SES was moderately related to the vocabulary and sound oddity measures, r's *(55)* = .37 and .44, $p \leq .01$, respectively. Sound oddity and letter knowledge also shared moderate variance, r (55) = .36, $p \leq .01$. The rest of the measures were not related to each other.

Bivariate relationships between Time 1 measures and subsequent measures of reading and spelling are shown in Tables 4 and 5.

Tables 4 and 5 about here

Similar patterns of results were observed across the two testing periods. None of the preschool measures were related to text reading accuracy; possibly due to high ceiling effect on this measure. The STM measures and in particular digit span forwards, were the strongest correlates of reading speed at both testing periods. The correlates of spelling at Time 2 were letter knowledge, digit span forwards and phonological awareness measures. Similar patterns of correlations were observed for the spelling at Time 3, except that syllable deletion was no longer related to spelling and this time, word span also shared moderate variance with spelling.

Hierarchical Multivariate Regression Analyses

As word and digit span measures were highly correlated, it was appropriate to standardise the scores on these measures and combine them into a single composite STM measure. This was done to simplify the subsequent hierarchical regression analyses. Age and SES did not correlate with any of the literacy measures, and likewise text reading accuracy did not share any reliable variance with any of the preschool measures. Therefore, they were excluded from the subsequent analyses.

Prior to the multiple regression analysis, a series of diagnostic tests were conducted and appropriate data transformations were carried out (see Tabachnick & Fidell, 1989). The analysis was conducted with both transformed and untransformed scores. The results were essentially the same in each case. Therefore, the results based on the untransformed scores are presented in Tables 6 and 7.

Tables 6 and 7 about here

Similar patterns of results were observed across the two testing periods (i.e., from Time 1 to Time 2 and from Time 1 to Time 3). After accounting for nonverbal IQ, vocabulary, STM and letter knowledge, none of the phonological awareness measures explained statistically reliable variance in the reading measures at Times 2 and 3. The most powerful and consistent longitudinal correlate of the reading skills at both testing occasions was the STM, which irrespective of its point of entry into the regression equation explained moderate to large unique variances. In contrast, phonological awareness measures emerged as the most powerful longitudinal correlate of spelling skills at both testing occasions (see Tables 6 and 7, Model A).

When entered last (5th step) into the regression equation, the sound oddity task explained 11%, syllable tapping 8% and syllable deletion 10% of unique variances in spelling at Time 2 (see Table 6, Model A). However, at Time 3, only sound oddity measure made a unique contribution to spelling skills explaining a moderate unique variance of 11% (see Table 7, Model A).

In this study, nonverbal IQ and vocabulary were not predictive of later reading and spelling skills. Re-analysis of the data after excluding these measures yielded essentially the same results (see Tables 6 and 7, Models D and E). After controlling for STM and letter knowledge, phonological awareness measures predicted only the spelling skills (see Tables 6 and 7, Model D).

When phonological awareness measures were entered before the STM, it was possible to see some moderate to small longitudinal relationships with reading measures at Time 2. Sound oddity explained 11% and 8% unique variances in 1-minute word and pseudoword reading, respectively. Likewise, syllable tapping explained 13% in 1- minute word reading and 10% in

pseudoword reading (see Table 6, Models B and C). Syllable deletion was not related to any reading measures even when entered first into the regression analysis (see Tables 6 and 7, Model C).

Letter knowledge explained small and marginally significant unique variances for reading and spelling measures (7%-8%) when entered on the third step after controls of vocabulary and nonverbal IQ (see Tables 6 and 7, Model B). However, the effect of letter knowledge on later literacy skills was almost completely mediated by phonological awareness measures and STM (see Tables 6 and 7, Models A, D and E).

Overall the predictive effect of preschool measures was higher for Time 2 literacy outcome measures than Time 3. At Time 2, the model with nonverbal IQ, vocabulary, STM, letter knowledge and phonological awareness measures explained 45% variance in 1- minute word reading, 42% in 1- minute pseudoword reading, 32% in text reading, 37% in spelling. At Time 3, the model explained 27% variance in 1- minute word reading, 25% in 1- minute pseudoword reading, 21 % in text reading, 39% in spelling.

Finally, after controls for the nonverbal IQ, neither phonological awareness nor STM explained any reliable variance in the arithmetic scores suggesting that the observed longitudinal relationships were specific to literacy skills (see Tables 6 and 7, Model A) .

Discussion

While phonological awareness measures, and in particular the sound oddity measure, emerged as the strongest and consistent predictor of spelling skills at both testing times, STM was clearly the most powerful predictor of reading speed performance. Such a strong and exclusive effect of STM was unexpected. There was evidence for a moderate to small effect of

phonological awareness on reading at Time 2 but this effect was completely mediated by the STM measure.

Overall, performance on the onset and rime awareness tasks was lower than that reported in English, Dutch and German (Bradley & Bryant, 1983; de Jong & van der Leij, 1999; Wimmer, Landerl, & Schneider, 1994). The children's performance on the initial and final phoneme deletion tasks was at floor level. This can be attributed to a number of possible factors including sample characteristics, item selection, as well as differences in literacy practices such as no teaching of the alphabet in preschools in Northern Cyprus. Further studies among the current population of children will be necessary to confirm these results.

Text reading accuracy was at ceiling level at the end of grade 1 (mean accuracy = 94%). This is in line with the existing studies in Turkish, reporting that with one year's reading instruction, reading accuracy reaches ceiling levels (Öney & Durgunoglu, 1997).

Despite the simplicity of spelling in Turkish, the spelling task reported here proved to be more demanding than reading. Children's spelling accuracy did not reach ceiling levels even by the end of grade 2, which is at variance with their much higher reading accuracy rate. However, it is important to note that these findings should be considered as suggestive, because the current study was not designed to compare reading with spelling skills. Ideally, the relative difficulty of reading and spelling should be analysed through the use of carefully matched items and task paradigms.

The Role of Phonological Awareness

The observed weaker and unreliable predictive role of phonological awareness in early reading skills is in line with previous studies in German, Finnish and Dutch (de Jong & van der Leij, 1999; Leppanen et al., 2006; Wagner et al., 1997; Wimmer et al., 1991). In Turkish, so long

as mappings of the 29 letters of the alphabet with their corresponding sounds are learnt, a child can decode any word. This extreme simplicity of the orthography might have left no room for speech analysis skills to make any meaningful impact on reading accuracy by the end of grade 1.

However, it is suggested that analysis skills at the phoneme level are more predictive of reading skills (Muter, Hulme, Snowling, & Stevenson, 2004). Unfortunately, it was not possible to obtain any meaningful scores on any of the explicit phoneme awareness tasks in this study. This might be another possible reason for the observed nonsignificant results. This issue can only be clarified by implementing a wider range of phonological awareness measures and ideally using tasks supported by pictures which could help to avoid floor effects among preliterate samples (e.g., see Stuart, 1990; Wood & Terrell, 1998).

Given the tendency of phonological awareness to be more closely related to reading accuracy, it is essential to assess reading accuracy before performance reaches ceiling. In view of the rapid development of reading accuracy, testing reading skills every month from September going up to December would have enabled a finer analysis of the development of reading accuracy skills. Hence, a microgenetic study might be a better design for capturing the rapid developmental changes in reading processes in highly transparent systems like Turkish (see Siegler & Crowley, 1991). Likewise, a recent Finnish study reported that a developmental profile of preschool phonological awareness skills rather than just a single measure of performance is more likely to reveal the true role of phonological awareness in literacy skills (Lyytinen et al., 2006).

In sum, two factors were identified as possible reasons for the observed weaker and unreliable role of phonological awareness in reading in this study. These are:

i) The extreme transparency of the Turkish orthography that renders the role of phonological awareness redundant in reading;

ii) Methodological factors including research paradigm and task-related factors such as the restricted variance on the explicit phoneme awareness and reading accuracy measures.

With respect to spelling, the findings revealed a special close relationship of preschool phonological awareness measures with subsequent spelling performance. These results are in line with the Greek, German and Dutch studies that also reported a more specific and closer relationship between preschool phonological awareness and early spelling skills (Harris & Giannouli, 1999; van Bon & van Leeuwe, 2003; Wimmer & Mayringer, 2002).

The observed effect of phonological awareness on later spelling provides support for Wimmer and Mayringer's proposition and takes it a step further to suggest that it is possible to see a positively biased relationship between spelling and phonological awareness even in a transparent spelling system during the very early stages of literacy development. In other words it seems that irrespective of orthographic transparency, spelling is a more sensitive index of phonological analysis skills. This explanation also fits well with the reports that despite high rates of reading accuracy, children with dyslexia perform lower than control groups on nonword spelling tasks in transparent orthographies such as Czech (see Caravolas, 2005) and Finnish (Lehtola & Lehto, 2000).

However, it is still necessary to explain why there was no reliable relationship between preschool phonological awareness and spelling in the Finnish study (Leppanen et al., 2006). Sample differences are likely to be the primary reason for this discrepant finding. In the Finnish study, preschool children were able to read and spell, whereas, in this study, children were

preliterate and had little alphabet knowledge. In a previous Turkish study, it was found that when existing spelling skills were controlled, phonological awareness at grade 1 failed to predict spelling skills measured at the end of grade 2 (Babayigit, 2006). This is in line with Leppanen et al.'s (2006) findings and suggests that in highly transparent spelling systems, possibly due to the rapid development of fine-grained phonological representations among the normally developing populations, orthographic knowledge assumes a central role in later spelling performance. Any effect of phonological awareness is subsumed in its relationship with the existing spelling skills. This is in contrast with findings from English where phonological awareness continues to make a unique contribution to later spelling performance over and above the existing spelling skills during the similar period of literacy development (Caravolas, Hulme, & Snowling, 2001).

There are three main issues that need to be considered in order to understand the observed closer relationship between spelling and phonological awareness in this study.

i) Spelling is a more sensitive index of quality of phonological representations than reading (see Bosman & van Orden, 1997; Perfetti, 1997).

ii) Differences in literacy practices. The lack of teaching of letters and sounds before grade 1 and the eclectic mode of instruction with little or no phonics in early literacy instruction.

iii) It is important to acknowledge that spelling in Turkish is transparent to the extent that spoken Turkish is based on the standard written Turkish. During rapid speech, the salience of an individual phoneme may vary depending on its phonological context and processes such as assimilation (the articulation of two consecutive sounds become more similar to each other, e.g., pronunciation of /t/ is more similar to /p/ in <football>) that can complicate spelling are also observed in Turkish (Demircan, 2001; Lewis, 1967).This means that spelling is inherently less

transparent than reading even in a highly transparent spelling system (see Treiman & Kessler, 2005).

It is not clear whether the Cypriot Turkish dialect might have played any role in these results. In this study, the sample included children who spoke both standard and Cypriot Turkish dialects. The use of a spelling to dictation task with mainly pseudowords is likely to have limited the ways in which dialect might have impacted on spelling in this study. Nevertheless, the question of language specific phonological features and/or dialect in early literacy acquisition clearly has very important pedagogical implications, given that the importance and role of phonological processing skills are not emphasised in the current national literacy curriculum or teacher training in both Northern Cyprus and Turkey (see Demircan, 2001).

The Case of Phonological STM

Without doubt phonological STM is the most powerful predictor of reading speed in this study. There is a general agreement that STM is important for literacy skills (see Aaron, 1989). However, a review of longitudinal studies shows an inconsistent pattern of results. Some attribute a central role to memory skills in explaining individual differences in reading skills (Wimmer, Mayringer, & Landerl, 1998). Others fail to find any longitudinal predictive effect of preschool memory skills on reading (de Jong & van der Leij, 1999; Wimmer & Mayringer, 2002). As far as the authors are aware such an exclusive and powerful effect of phonological STM on early literacy development over and above phonological awareness skills has not been reported before.

Absence of any comparable study means that a replication of these findings is essential before one can speculate on the possible meaning of this unexpected finding. However, it is still possible to outline several methodological issues as well as some speculative explanations.

Differences in operationalisation of phonological STM skills could be one possible explanation for the observed discrepant results between this study and the German and Dutch studies. Wimmer and Mayringer (2002) used a pseudoword repetition task as a measure of STM and de Jong and van der Leij (1999) used pictures and tested recognition memory rather than verbal production with their word span test. Moreover, closer analysis of our results revealed that word span was not as powerful and consistent a predictor as digit span forwards (see Tables 4 and 5). Clearly, this speculation about the differential effect of different phonological STM measures on reading development needs to be addressed by examining the relationship of a wider range of phonological STM measures with both reading accuracy and reading speed (see Berninger et al., 2006).

It is also possible that phonological STM may play a more important role in early literacy development in agglutinative languages characterised by long words with a string of suffixes. Most importantly, the observed puzzling relationship between STM and reading speed has highlighted an important gap in knowledge: that is, the component processes of reading speed. Theories of reading explain that fast reading in the absence of an accuracy problem is related to rapid activation, retrieval and processing of orthographic representations or higher order phonological representations [4] (Coltheart, Curtis, Atkins, & Haller, 1993; Ehri, 1992). It is the higher order representations beyond the phoneme levels that determine the success on speeded reading tasks. Many studies in transparent systems often report that poor readers are characterised as using a syllable-by-syllable or even letter-by-letter phonological recoding strategy. Given sufficient time, they can even read pseudowords very accurately but make more errors in time limited conditions (Leinonen et al., 2001; Yap & van der Leij, 1993). That is why individual differences in reading are better captured by the speeded reading tasks. There seems to

be some consensus that inability to establish orthographic representations underlies the observed poor reading speed in transparent systems (Wimmer & Mayringer, 2002). However, the issue is complicated by the fact that there is ongoing debate about the nature of these orthographic representations and how they are established (Burt, 2006; Cunningham, 2006), and it is far from clear how orthographic processing takes shape when reading the polysyllabic and polymorphemic words that characterise agglutinative writing systems.

Working memory and STM have long been associated with general language skills such as syntactic processing (e.g., see Perfetti & Lesgold, 1977). In keeping with this, it is conceivable that the observed close relationship between STM and reading might reflect the role of morpho-syntactic processing skills in agglutinative systems. It is notable that a substantial amount of variance in reading and spelling was left unaccounted for in this study (about 55- 79% variance). This suggests that in order to understand the precursors of literacy skills, it is important to look beyond the basic cognitive and phonological awareness skills in Turkish.

Conclusions

Orthographic transparency clearly shapes the observed relationship between phonological awareness and literacy skills. The unreliable relationships between phonological awareness and reading observed in this study should be evaluated in the light of methodological limitations that did not allow us to obtain reliable measures of explicit phoneme awareness and reading accuracy skills. Clearly, the strong relationship between phonological STM and reading speed needs to be replicated by further research. Nevertheless, this unexpected result has raised some important questions about the component processes of reading speed and morpho-syntactic skills in agglutinative writing systems.

The findings also highlight that for a coherent analysis of the role of phonological awareness in early literacy development, it is essential to take a more comprehensive approach in assessment of literacy skills, as phonological awareness may be differentially related to different literacy measures. In this study, preschool phonological awareness emerged as the most powerful and consistent predictor of future spelling attainment. This is in sharp contrast with its much poorer relationships with reading.

Overall findings should be evaluated against the backdrop of the ongoing debate about the role of phonological awareness in English and the proposition that there is no clear evidence as yet to suggest that phonological awareness is causally related to reading and spelling independent of letter knowledge and/or reading instruction (Castles & Coltheart, 2004). The general consensus states that literacy skills are built upon speech processing skills (Liberman, 1992; Snowling & Hulme, 2005). Phonological awareness, clearly, reflects only one aspect of speech processing skills and the way forward in this area of research entails understanding the precursors of phonological awareness skills and taking a more comprehensive approach to analysis of speech processing skills in literacy development (Hulme, Snowling, Caravolas, & Carroll, 2005; Wade-Wooley & Wood, 2006).

Finally, in view of the close relationship between phonological awareness and spelling observed in this study, as well as the general consensus that phonics is an important element of an effective reading instruction programme (Snow & Juel, 2005), it is important that research and educational policies examine more closely the role of phonological awareness and its systematic training in literacy instruction in Turkish. It is also not clear what impact the 'reading ceremonies' might have on children's literacy development, motivation and self-esteem.

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Footnotes

[1] In this paper, the term reading speed is used as a generic term meaning any reading measure with a latency component (see Kuhn & Stahl, 2003).

2 This has recently changed. The Turkish Cypriot government introduced different books and some changes into to the literacy curriculum.

[3] In Turkish, 'the principle of vowel harmony' (see Lewis, 1967, p. 15) dictates which vowel sounds can follow each other in a given word. However, it is possible to find the violations of this principle in some common native words such as <elma> (apple),<anne> (mother), certain suffixes, and nonnative words (Lewis, 1967), and are relatively common in children's spoken and reading vocabulary. In this study, only 1- minute reading, text reading and syllable awareness measures included some words that did not conform to the principle of vowel harmony. The possible effect of vowel harmony on literacy development clearly needs to be addressed by further research.

[4] Although the terms orthographic and higher order phonological representations are used interchangeably in this paper, it is acknowledged that they might mean different kinds of representations according to some theorists (e.g., Jackson & Coltheart, 2001).

Appendix A

Extracts from the Phonological Awareness and Literacy Outcome Measures

Syllable Deletion		*Initial Phoneme Deletion*		*Final Phoneme Deletion*	
Silgi	gi	Bal	b	Top	p
Fare	fa	Kuş	k	Diş	ş
Bebek	bek	Gül	g	Bal	l

Sound oddity task

Rime awareness

1. fil zil <u>top</u>
2. yol <u>saz</u> kol
3. <u>taş</u> yüz düz

Onset awareness

1. diz dal <u>mor</u>
2. baş <u>tel</u> bir
3. <u>top</u> kaş kül

Syllable Tapping: kedi; gözlük; şeker; arı

Preschool Reading: al el baş at saç

Spelling: Words: saç, kuzu. Pseudowords: füt, tamar .

1-Minute Word Reading: ay pilot kamyon dört bahçe

1-Minute Pseudoword Reading: uk tolak pütürdez kanyı

Text Reading: Hüda annesinin alışverişe gitmesini bekledi. Ev sessizdi.

Table 1

Sample Characteristics and Timetable

	Time 1 Preschool (April-May 2002)	Time 2 Grade 1 (April-May 2003)	Time 3 Grade 2 (March-April 2004)
Number of students	56	54	48
(Female: Male)	(26: 30)	(25: 29)	(23: 25)
Mean age in months (*SD*)	67.45 (3.64)	79.11 (3.55)	90.61 (3.36)
Age range in months	64-76	76-88	87-99

Table 2

Measures, Occasions of Administration and Descriptive Statistics

Measure/ Maximum possible score	Time 1 (N = 55)		Time 2 (N = 53)		Time 3 (N = 47)	
	Mean (*SD*)	Range	Mean (*SD*)	Range	Mean (*SD*)	Range
1. Raven's Coloured Progressive Matrices / 36	13.70 (3.40)	8-25				
2. Vocabulary/ 68	9.22 (4.69)	2-28				
3. Letter knowledge/ 29	7.63 (6.81)	0-27.5				
4. Digit span forwards/ 14	2.54 (1.08)	0-5				
5. Word span/ 14	2.02 (1.15)	0-5				
6. Rime awareness/12	5.29 (1.95)	1-9				
7. Onset awareness/ 9	2.69 (1.54)	0-8				
8. Syllable tapping/ 12	10.48 (2.54)	2-12				
9. Syllable deletion/ 8	4.15 (1.96)	0-8				
10. Text reading accuracy/70			65.76 (5.35)	42-70	67.96 (2.04)	61-70
11. Text reading speed (accurate words/ min)			27.96 (11.13)	7-55	47.68 (14.90)	25-82

Measure/ Maximum possible score	Time 1 (N = 55)		Time 2 (N = 53)		Time 3 (N = 47)	
	Mean (*SD*)	Range	Mean (*SD*)	Range	Mean (*SD*)	Range
12. 1-minute word reading/ 100			13.33 (6.99)	0-29	25.56 (8.18)	9-43
13. 1-minute pseudoword reading/ 90			12.85 (6.52)	0-31	20.88 (6.06)	7-35
14. Spelling / 19			7.75 (3.67)	0-14	13.04 (2.78)	6-18
15. Arithmetic/ 18			6.53 (1.65)	2-11	8.44 (1.49)	5-11

Table 3

Intercorrelations between the Measures at Time 1 (N = 55)

Variables at Time 1	1	2	3	4	5	6	7	8	9	10
1. Raven's Coloured Progressive Matrices	-									
2. Vocabulary	.17	-								
3. Letter knowledge	.22	.28	-							
4. Digit span forwards	.24	.20	.30	-						
5. Word span	. 13	. 29	.15	.58**	-					
6. Sound oddity	. 27	.11	. 36*	.19	.13	-				
7. Syllable tapping	.07	.16	.25	.21	. 19	.23	-			
8. Syllable deletion	.09	.13	.19	.03	.13	.23	.19	-		
9. Age	.31	.03	.29	-.04	.08	-.21	-.12	.13		
10. Socio-economical Status	.20	.37*	.11	.14	.04	.44**	.10	.08	-.05	-

*$p \leq .01$. **$p \leq .001$, two-tailed.

Table 4

Intercorrelations between Measures at Time 1 and Literacy Outcome Measures at Time 2 (N= 53)

Time 1	Time 2				
	1-minute word reading	1-minute pseudoword reading	Text reading accuracy	Text reading speed	Spelling
Raven's Coloured Progressive Matrices	.22	.15	.14	.13	.26
Vocabulary	.13	.03	.00	.15	.13
Letter knowledge	.32*	.27	.21	.30	.35*
Digit span forwards	.61**	.56**	.21	.50**	.36*
Word span	.39*	.38*	.16	.36**	.10
Sound oddity	.33*	.29	.25	.27	.47**
Syllable tapping	.30	.19	.00	.05	.32*
Syllable deletion	.21	.15	.24	.09	.35*

*$p \leq .01$. **$p \leq .001$, two-tailed.

Table 5

Intercorrelations between Measures at Time 1 and Literacy Outcome Measures at Time 3 (N= 47)

Time 1	Time 3				
	1-minute word reading	1-minute pseudoword reading	Text reading accuracy	Text reading speed	Spelling
Raven's Coloured Progressive Matrices	.08	.05	-.28	.04	.15
Vocabulary	.21	.05	.06	.09	.22
Letter knowledge	.38*	.26	.06	.35*	.43**
Digit span forwards	.49**	.46**	.15	-.47**	.41*
Word span	.34*	.39*	.24	.21	.37*
Sound oddity	.11	.13	.05	.01	.45**
Syllable tapping	.07	.08	.08	.00	.32*
Syllable deletion	.05	.06	.04	-.10	.15

*$p \leq .01$. **$p \leq .001$, two-tailed.

Table 6

Outcomes of Hierarchical Regression Analyses with Time 1 Predictor Measures and Time 2 Dependent Measures

Time 1 measures	1-Minute word reading	1-Minute pseudoword reading	Text reading speed	Spelling	Arithmetic
Order in equation	ΔR^2	ΔR^2	ΔR^2	ΔR^2	ΔR^2
Model A					
1. RCPM	.05	.02	.02	.07	.09*
2. Vocabulary	.01	.00	.02	.01	.01
3. STM	.27***	.30***	.22***	.03	.01
4. LK	.05, *p*=.07	.05, *p*=.07	.06, *p*=.07	.07, *p*=.06	.00
5. Sound oddity	.02	.01	.00	.11**	.06, *p*=.07
5. Syllable tapping	.04	.03	.01	.08*	.02
5. Syllable deletion	.05	.03	.01	.10*	.02
5. STM (After 1,2 4, & PA)	.22**	.25***	.20**	.02	.00
5. LK (After 1,2 3, & PA)	.01	.02	.04	.01	.00

Time 1 measures	1-Minute word reading	1-Minute pseudoword reading	Text reading speed	Spelling	Arithmetic
Order in equation	ΔR^2	ΔR^2	ΔR^2	ΔR^2	ΔR^2
Model B					
1. RCPM, 2. Vocabulary					
3. Sound oddity	.08*	.06, p =.08	.06, p =.11	.18**	.07, p =.05
3. Syllable tapping	.13**	.10*	.01	.13**	.03
3. Syllable deletion	.03	.02	.00	.11*	.02
3. LK	.07, p=.06	.07, p =.06	.08, p =.06	.08*	.00
Model C					
1. Sound oddity	.11*	.08, p=.06	.07, p =.06	.23***	.10*
1. Syllable tapping	.13**	.10*	.00	.13**	.01
1. Syllable deletion	.04	.02	.04	.12**	.02
1. LK	.11*	.07, p=.05	.09*	.12*	.01
1. STM	.32***	.28***	.23***	.06, p=.07	.02

Time 1 measures	1-Minute word reading	1-Minute pseudoword reading	Text reading speed	Spelling	Arithmetic
Order in equation	ΔR^2	ΔR^2	ΔR^2	ΔR^2	ΔR^2
Model D					
1. STM					
2. LK	.04, p =.07	.03	.03	.09*	.03
3. Sound oddity	.02	.02	.01	.11*	.02
3. Syllable tapping	.02	.00	.01	.04	.00
3. Syllable deletion	.04	.03	.01	.10**	.10*
Model E					
1. PA	.16*	.09*	.04	.30***	. 04
2. STM	.25***	.24***	.21***	.03	.00
2. LK	.02	.02	.06	.02	.00

Note. RCPM: Raven's Coloured Progressive Matrices; PA: Composite sum of the standardised scores of the three phonological awareness measures; LK: Letter knowledge; ΔR^2 = Change in explained variance. *$p \leq .05$. **$p \leq .01$. ***$p \leq .001$.

Table 7

Outcomes of Hierarchical Regression Analyses with Time 1 Predictor Measures and Time 3 Dependent Measures

Time 1 measures	1-Minute word reading	1-Minute pseudoword reading	Text reading speed	Spelling	Arithmetic
Order in equation	ΔR^2	ΔR^2	ΔR^2	ΔR^2	ΔR^2
Model A					
1. RCPM	.03	.01	.02	.04	.16**
2. Vocabulary	.04	.00	.01	.03	.02
3. STM	.15**	.21**	.10*	.08*	.01
4. LK	.06, p =.08	.03	.05, p =.13	.06 , p = .08	.08*, p =.05
5. Sound oddity	.00	.00	.02	.11**	.01
5. Syllable tapping	.00	.00	.02	.04	.02
5. Syllable deletion	.01	.01	.01	.02	.00
5. STM (After 1,2 4, & PA)	.13**	.19***	.10*	.05, p =.07	.00
5. LK (After 1,2 3, & PA)	.06, p = .08	.02	.07, p = .08	.01	.09*

Time 1 measures	1-Minute word reading	1-Minute pseudoword reading	Text reading speed	Spelling	Arithmetic
Order in equation	ΔR^2	ΔR^2	ΔR^2	ΔR^2	ΔR^2
Model B					
1. RCPM, 2. Vocabulary					
3. Sound oddity	.01	.02	.00	.20***	.00
3. Syllable tapping	.01	.02	.00	.09*	.00
3. Syllable deletion	.00	.00	.02	.01	.00
3. LK	.08, p =.06	.04	.06, p =.11	.07, p =.06	.08*, p =.05
Model C					
1. Sound oddity	.00	.00	.00	.20***	.00
1. Syllable tapping	.00	.01	.00	.10*	.00
1. Syllable deletion	.00	.00	.01	.02	.00
1. LK	.15**	.07, p =.08	.12*	.18**	.08*, p =.05
1. STM	.22***	.23***	.15**	.19**	.00

Time 1 measures	1-Minute word reading	1-Minute pseudoword reading	Text reading speed	Spelling	Arithmetic
Order in equation					
	ΔR^2	ΔR^2	ΔR^2	ΔR^2	ΔR^2
Model D					
1. STM					
2. LK	.07*, p =.04	.02	.07, p =.06	.10**	.08*, p =.05
3. Sound oddity	.01	.00	.03	.07*	.00
3. Syllable tapping	.01	.01	.03	.03	.00
3. Syllable deletion	.00	.01	.01	.02	.00
Model E					
1. PA	.03	.03	.02	.20**	.00
2. STM	.18**	.19**	.12*	.13**	.00
2. LK	.09, p =.05	.03	.08, p =.06	.08*	.08*, p =.05

Note. RCPM: Raven's Coloured Progressive Matrices; PA: Composite sum of the standardised scores of the three phonological awareness measures; LK: Letter knowledge; ΔR^2 = Change in explained variance. *$p \leq .05$. **$p \leq .01$. ***$p \leq .001$.