Morphological awareness and early and advanced word recognition and spelling in Dutch

Rispens, J.E.; McBride-Chang, C.; Reitsma, P.

DOI
10.1007/s11145-007-9077-7

Publication date
2008

Document Version
Final published version

Published in
Reading & Writing

Read Writ (2008) 21:587–607
DOI 10.1007/s11145-007-9077-7

Morphological awareness and early and advanced word recognition and spelling in Dutch

Judith E. Rispens · Catherine McBride-Chang · Pieter Reitsma

Published online: 20 June 2007

Abstract This study investigated the relations of three aspects of morphological awareness to word recognition and spelling skills of Dutch speaking children. Tasks of inflectional and derivational morphology and lexical compounding, as well as measures of phonological awareness, vocabulary and mathematics were administered to 104 first graders (mean age 6 years, 11 months) and 112 sixth graders (mean age 12 years, 1 month). For the first grade children, awareness of noun morphology uniquely contributed to word reading, and none of the morphological tasks were uniquely associated with spelling. In grade 6, derivational morphology contributed both to reading and spelling achievement, whereas awareness of verb inflection uniquely explained spelling only. Lexical compounding did not uniquely contribute to literacy skills in either grade. These findings suggest that awareness of both inflectional and derivational morphology may be independently useful for learning to read and spell Dutch.

Keywords Morphological awareness · Reading acquisition · Spelling acquisition · Word recognition

Introduction

The purpose of this paper was to determine what aspects of morphological awareness, including inflectional and derivational morphology as well as lexical

J. E. Rispens (✉)
PI Research, Rijksstraatweg 145, Duivendrecht 1115 AP, Netherlands
e-mail: judith_rispens@yahoo.co.uk

C. McBride-Chang
Department of Psychology, Chinese University of Hong Kong, Shatin, New Territories, Hong Kong

P. Reitsma
Vrije Universiteit, Amsterdam, The Netherlands

compounding, are related to word recognition and spelling in native Dutch speakers in first and sixth grades. Despite the obvious importance of phonological awareness for reading achievement in alphabetic orthographies (for overviews see Bryant & Bradley, 1985; Castles & Coltheart, 2004; Goswami & Bryant, 1990; Vellutino, Fletcher, Snowling, & Scanlon, 2004), there is evidence that morphological awareness also promotes literacy development in both early reading development (e.g., Casalis & Louis-Alexandre, 2000) and in later literacy development (Carlisle, 2000). However, although it is clear from these studies that morphological awareness is important for understanding alphabetic literacy acquisition for at least some children of various ages, the precise mechanisms by which morphological awareness and literacy skills interact remain largely unexplored. For example, although there are studies of the ways in which morphological awareness interacts with word recognition, its relationship with spelling skills has been studied relatively little. In addition, the issue of whether morphological awareness represents a single construct or whether the different aspects of morphological awareness such as inflectional or derivational awareness uniquely explain literacy acquisition has yet to be investigated. Below, we review evidence on morphological awareness in relation to both reading and spelling and highlight the potential relevance of different aspects of morphological awareness for literacy acquisition in children.

Morphological awareness

Morphological awareness refers to the ability to recognize and manipulate the morphemic structure of words (Carlisle, 1995). The present paper will focus on awareness of inflectional morphology, derivational morphology, and lexical compounding. Inflectional morphology refers to a process in which word forms are varied by the combination of the word stem plus grammatical suffixes (inflectional morphemes) to express grammatical notions such as case, agreement between the subject and the verb, tense, person, and gender. The morphemes 's' and 'ed' are, for example, English markers of agreement (I walk, he walks) and past tense (I walked). Derivational morphology refers to the formation of new words through the combination of a word stem and a suffix. With this process a new word is formed that is from a different grammatical category than its base word. For instance, the noun 'dirt' can be changed into the adjective 'dirty' with the addition of the suffix −y, and the noun 'teacher' is derived by adding the suffix 'er' to the verb 'teach'. The derivational process is not always transparent, in the sense that the base word is phonologically or orthographically different from the result of the derivation (base word + affix). For instance, the formation of dirty (dirt' + 'y') is a transparent one, but 'operation' ('operate' + 'ion') and 'admission' ('admit' + 'ion') are less transparent examples. Given the complexity of derivational morphology, the acquisition of this linguistic feature takes several years to complete and even continues after primary school (Nagy, Diabkidoy, & Anderson, 1993). This is in contrast to inflectional morphology whose principles are in general acquired around the time that children are learning to read (Casalis, & Louis-Alexandre, 2000). Another morphological process is lexical compounding: combining lexical

morphemes to express a new concept. For instance 'shoelace' consists of the morphemes 'shoe' and 'lace'. The difference between lexical compounding and derivational and inflectional morphology is that lexical compounding combines two free lexical morphomes to form a new word that is from the same grammatical class as its two morphemes (door + bell → doorbell). As described above, derivational morphology refers to the union of a lexical morpheme with a morpheme that cannot stand on its own, and the combination of the two morphemes is from another grammatical category than the original free morpheme (wood + en → wooden). This is the same for inflectional morphology, in which a bound suffix is attached to a verb stem. The three kinds of morphological processes are universal features of languages, but the frequency with which these processes occur is language dependent. The present study investigates the role of morphological awareness in beginning and advanced reading and spelling of Dutch.

Dutch is relatively transparent at the level of morphological compounding, at least more so than English (Monz & de Rijke, 2001), and derivations frequently occur. Its morphosyntactic inflectional system is fairly restricted, even though it is relatively rich compared with English. In Dutch, nouns are pluralised by adding an 's' or 'en' to the stem (*bloem* → *bloemen* flower → flowers); *meisje* → *meisjes* girl → girls). Verbs are inflected for person and number in the present tense by adding a 't' for second and third person singular and 'en' for plural (*hij bakt, wij bakken* he bakes, we bake), and 'de (n)' or 'te (n)', in case of a voiceless stem, to inflect a regular verb for past tense (*hij rende, wij renden* he ran, we ran; *hij bakte, wij bakten* he baked, we baked).

The role of morphological awareness in learning to read

Morphological sensitivity can be expected to be important for the reading process because the mental lexicon is morphologically organized and processing written information entails access to the mental lexicon. Even though there are controversies on how words are stored in the mental lexicon, there is evidence that during processing, transparent morphologically complex words are decomposed into different morphemes or are assembled via the morphemes they consist of (e.g., Clahsen & Felser, 2006). As we discussed above, in the Dutch language all three processes of derivational, inflectional morphology, and lexical compounding occur. We will therefore discuss how awareness of morphology may play a role in reading Dutch. Schreuder and Baayen (1995) describe a parallel route model for mental lexicon access in which a representation is accessed either via a direct or via a parsing route. In the former route a full form representation is accessed which activates the semantic representation. However, via the parsing route the meaning of a word is accessed via segmentation and composition of the constituents of the morphologically complex word. In case the meaning of a word is transparent, that is, if the meaning of a word can be obtained via union of the constitutional elements, the parsing route has an advantage over the direct route. Thus, it can be envisaged that the ability to recognize the different morphemes of a word will facilitate word recognition. In addition, the role of morphological structure in word recognition has also been demonstrated through the effect of frequency: the more frequent a word,

the faster word recognition. De Jong, Schreuder, and Baayen (2000) review the idea that, for both Dutch and English, the speed of processing is determined by the family size of a given morpheme rather than its base frequency: the more family members a morpheme has, the faster recognition. For example, the morpheme 'calculate' has eight family members (calculable, calculation, calculator, calculus, incalculable, incalculably, miscalculate, miscalculation) and this word will be recognized faster than a word with a smaller family size. Awareness of the different morphemes within a constituent may therefore be assumed to facilitate word recognition as the family size will be larger if there are more representations stored, leading to faster processing. In addition, decoding a word via grapheme–phoneme correspondence instead of direct recognition is much slower and more prone to errors than the parsing or direct access route. Recognition of the morphological make-up of a word can furthermore help a reader to discover the meaning of an unknown word. For instance, in English, the meanings of *botanophobia*, *aviatophobia*, and *ornithophobia* may be easier to derive if you already know that 'botany' is the study of plants, and 'aviator' is one who flies, 'ornithology' is the study of birds, and 'phobia' is a fear. Knowledge of these various words, comprised of morphemes, can indicate that *botanophobia* is the fear of plants, *aviatophobia* is the fear of flying, and *ornithophobia* is the fear of birds.

As indicated above, this study examined the influence of three types of morphological awareness on reading and spelling: inflectional and derivational morphology and compounding. We predicted that all three types of morphological awareness would facilitate word recognition based on the psycholinguistic models of Schreuder and Baayen (1995) and de Jong et al. (2000).

Empirical evidence of previous studies indicates that there seems to be indeed an independent contribution of morphological awareness to reading skills (Carlisle, 2000; Casalis & Louis-Alexandre, 2000; McBride-Chang, Cho, Liu, Wagner, Shu, Zhou, Cheuk, & Muse, 2005; Singson, Mahony, & Mann, 2000; Nagy, Berninger, Abbott, Vaughan, & Vermeulen, 2003). For instance, Casalis and Louis-Alexandre (2000) conducted a longitudinal investigation in which they followed French speaking kindergartners with respect to their development of phonological and morphological awareness in relation to their reading ability. Regression analyses showed that awareness of inflectional morphology measured in kindergarten explained unique variance in decoding, apart from phonology, in first grade. Kindergarten measures of derivational morphology accounted for second grade decoding ability while inflectional morphological analysis explained significant variance in reading comprehension. Derivational morphology thus seems to develop increasingly during at least the first two years of reading. Along the same lines are the results of the study of Singson et al. (2000) who showed that awareness of derivational morphology made an independent contribution to decoding which increased from grade 3 to grade 6. McBride-Chang, Cho, et al. (2005) also tested whether morphological awareness tasks such as lexical compounding and inflectional morphology explained word recognition in second grade readers of Chinese, Korean, and English. They demonstrated that morphological awareness in the form of lexical compounding was uniquely associated with word recognition in Chinese and Korean, but not in English. However, items that tested inflectional morphology

and lexical compounding were not tested separately in the English part of the study but were mixed and presented together in one task making interpretation of the result somewhat difficult. Few, if any, studies have tested the influence of morphological awareness on reading in Dutch. The aim of the current study, therefore, was to test the three features of morphological awareness in their relation to word recognition and spelling skills in grade 1 and grade 6.

Spelling

Although there are a number of studies that suggest a role of morphological awareness in developing reading skills, fewer have focused on how morphological awareness might influence spelling knowledge. Spelling an alphabetic language initially relies on phonological skills such as phonological awareness and the ability to link phonemes to graphemes. However, as Caravolas (2004) rightly points out, this does not suffice for competent spelling, as in many languages, spelling is also based on morphemes and on orthographic patterns that express word pronunciations which cannot be predicted by phoneme–grapheme conversion. Even though Dutch is a fairly transparent language in which children are initially taught to spell by phoneme–grapheme conversion, there are also cases in which words are not spelled using phonological principles, but by morphological principles. For instance, singular nouns of which the stem ends orthographically with a 'd' are phonologically devoiced and are pronounced with a 't'. However, they are spelled with a 'd' due to the morphological principle that the plural form has a 'd' (for example, /mant/ is spelled as *maand*, plural form *maanden*; month, months). This phenomenon also occurs for bound morphemes such as /hɛit/ which is orthographically represented by 'heid' rather than 'heit'. Spelling based on phoneme–grapheme conversion will in this example not result in the target. Thus, spelling may be facilitated by morphological awareness because spelling often is transparent with respect to the morphological structure of words (Caravolas, 2004; Green, McCutchen, Schwiebert, Quinlan, Eva-Wood, & Juelis, 2003; Landerl & Reitsma, 2005; Levin, Ravid, & Rapaport, 2001). Spelling of inflected verbs is also partly dependent on awareness of the inflectional system. In Dutch regular singular verbs inflected for the present tense consist of the verb stem + 't' in the case of the second and third person, except when a verb stem ends with a 't'. If a verb stem ends with a 'd', the inflectional morpheme 't' is silent but in spelling the 't' is visible (e.g., *ik antwoord*, *hij antwoordt*; I answer; he answers). Thus again, correct spelling of inflected verb forms cannot always be derived from mapping graphemes-to-phonemes but may rely on awareness of the inflectional system. A recent study by Gillis and Ravid (2006) illustrates this phenomenon. They investigated how Dutch and Hebrew speaking children from grade 1 to grade 6 use morphological cues in learning to spell homophonous segments. The children were asked to spell words in four conditions, one of which was a 'morphological' one. Children were asked to spell verb forms in which one only hears one 't' but in which in half of the cases a double 't' is required for correct spelling due to a morphological principle. For instance, in verbs that are used as adjectives, 't' is spelled with a single 't' (*verplichte*; required), but past tense verb forms that have a stem that ends with 't'

are spelled with a geminate 'tt' (*hij verplichtte*; he required), due to the morphological suffix 'te' that is attached on the verb stem to express past tense. In another condition, children were able to recover the spelling with a phonological strategy, such as pluralizing a singular noun (*maand, maanden*; month, months). The results showed that spelling the words in the morphological rule condition was more difficult for the Dutch children compared with the phonological condition. The authors thus conclude that Dutch children are focused on grapheme–phoneme conversion rules which negatively interfere with the cases of homophonous morphologically motivated spelling in Dutch.

Despite the observation that spelling is partly morphologically based, experimental investigations into the connection between morphology and spelling are scarce. Treiman and Cassar (1996) found in a number of experiments that the morphological status of a word affected children's spelling. For instance, children generally omitted the first consonant of a word-final cluster rather than the second consonant (e.g., writing 'brad' for 'brand'). However, when spelling two morphemic words consisting of a stem and 'ed' the 'n' was often preserved (e.g., spelling 'tune' for 'tuned'). This observation may reflect the sensitivity of children to the morphological make-up of a word and the tendency to preserve the morphological status in spelling. Bryant, Nunes, and Bindman (2000), furthermore, found that performance on a morpho-syntactic awareness task predicted the ability to spell words in the genitive form with an apostrophe. In addition, Green et al. (2003) found written morphological accuracy (inflections and derivations) to predict spelling in grades 3 and 4. These results thus suggest that morphological awareness contributes to spelling. However, more data are needed to investigate what type of morphological awareness is important for facilitating spelling at what age and whether morphological awareness makes a unique contribution to spelling with phonological awareness statistically controlled.

The present study

Several studies suggest that morphological awareness plays a role in the acquisition of reading and spelling skills. However, these studies have varied in the types of morphological processes (inflectional, derivational morphology, and compounding) studied. It is not clear what aspects of morphological information are important for reading and/or spelling ability or at what ages: do all three features of morphological awareness play a role in learning to read and spell? The main aim of the present study was therefore to systematically investigate the influence of inflectional, derivational morphology, and lexical compounding on single word reading and spelling ability.

Results from English (Carlisle, 2000; Singson et al., 2000) and French (Casalis & Louis-Alexandre, 2000) studies showed that the contribution of morphology to reading ability changed over time: the role of morphological awareness was less clear in grade 1 compared to later grades. We therefore examined the relations between morphology and reading and spelling in two studies. Study 1 includes beginning readers and spellers (grade 1 children) whereas in Study 2 more proficient

readers and spellers (grade 6 children) participated. We expected a pattern similar to English and French: morphological awareness was expected to play a significant influence in the grade 6 children as the words that children encounter become morphologically more complex through their progression in school. In contrast, we expected that in the initial phase of learning to read and write the focus would be on phoneme–grapheme conversion due to the relatively transparent nature of the Dutch orthography.

Our main research question was: What are the different types of morphological awareness that are associated with basic literacy skills in children who represent beginning and older readers and spellers of Dutch?

We wanted to investigate the role of morphological awareness in reading and spelling separately from influences of phonology and vocabulary, especially because phonological abilities tend to be related to reading and spelling and morphological awareness tends to be strongly associated with phonological abilities and vocabulary (cf. Lyytinen & Lyytinen, 2004; McBride-Chang, Wagner, Muse, Chow, & Hua, 2005; Shankweiler et al., 1995; Wysocki & Jenkins, 1987). We therefore measured phonological skills and vocabulary to statistically control for these variables in order to investigate the contribution of morphological awareness independently from these skills. In addition, we included a mathematical test to statistically control for nonverbal learning skills which may be related to literacy skills in order to study the independent contribution of morphological awareness to reading and spelling.

Study 1

Study 1 was carried out to investigate whether morphological awareness makes an independent contribution next to phonological awareness to early reading and spelling skills in Dutch speaking grade 1 children.

Method

Subjects

Participants were 104 first graders (53 boys and 51 girls, average age 83 months old, range 76–96 months). Children came from four different primary schools that were located in the North-west and the middle part of the country. The four schools were similar in the educational approach they followed to teach reading and spelling. All children were native speakers of Dutch and none received special educational services. Testing took place in May and June.

Materials

Table 1 gives an overview of the tasks that were used. Below a description of all tasks is given.

Table 1 Tasks administered in grade 1

Variables	Grade 1
Reading	Word reading test
Spelling	Spelling to dictation
Morphology	Lexical compounding
	Verb inflection
	Noun inflection
Phonology	Syllable and phoneme deletion
Vocabulary	Comprehensive vocabulary
Mathematics	Addition and subtraction

Morphological awareness: lexical compounding The children were asked to produce compound nouns. For each item they were given an example with an existing compound followed by a question to produce a non-existent compound. For example: '*A goat that lives on a mountain is called a mountain goat. What do you call a giant who lives on a mountain?'* (*answer: mountain giant*). Note that in Dutch the target words are spelled as one word in contrast to English. The task consisted of 15 test items and was preceded by two examples. Items were scored correct when the two morphemes were combined in the correct order (giant mountain would be incorrect in this example).

Morphological awareness: inflectional morphology To test children's awareness of inflectional morphology a Dutch version of the WUG test (Berko, 1958) was produced. This test includes both noun and verb morphology. In the *noun morphology* part children were asked to express a plural form of a single noun by adding the suffix 's' or 'en', or to express a diminutive form by adding the suffix 'pje', 'tje', or 'je' . For each item a picture representing the pseudo noun was shown with a text such as e.g., *This is a 'kuim'. Now there are two* (a picture with two objects is shown). *There are two...? (answer: kuimen)*. Diminutive forms were elicited by showing the children a very small version of the same object saying '*this is a very small 'kuim'. We call this a very small....? (answer: kuimpje)*. This part consisted of a total of 15 test items preceded by two examples. The second part of the WUG-test consisted of inflection of pseudo-verbs. Verb inflections included items for present tense, past tense and perfect tense. The items were presented to the children with a picture and a short narrative, such as: *This man knows how to 'freken'. He does this every day. Yesterday he also... (answer: freekte)*. The test contained five examples and 12 items. Items that were inflected correctly were scored as correct.

Reading (word recognition) Children completed a standardized word reading test (WRT, Brus, & Voeten, 1973) which required them to read as many words as possible in one minute from a list of words. The raw score was the number of words read correctly within the time given. The words (nouns, verbs, adjectives, and adverbs) were of increasing length and morphological complexity and were a mixture of single and multi-morphemic words, compounds, inflected words and derivations.

Spelling The Dutch standardized spelling test 'PI Dictee' (Geelhoed & Reitsma, 1999) was administered in a class setting. For each item in this word dictation test a sentence is read to the children and one of the words in the sentence is repeated indicating the word which the children have to write down. The test consists of blocks of 15 sentences. The first two blocks were administered to the first graders. Scoring was discontinued if a child failed to spell eight items of a block correctly. If a child had spelled more than eight items correctly in the second block, the third and fourth block were administered to them in a session a few days later. The spelling test consisted mainly of one-morpheme words; four words were bi-syllabic compounds. The total number of items that were spelled correctly was the total score correct for this task.

Phonological awareness A phonological awareness test was constructed testing phoneme deletion. The 20 items required children to delete one phoneme from existing monosyllabic words. The phonemes to be deleted included word initial (ten items) and word final phonemes (ten items). Half of the target phonemes were part of a consonant cluster, the other half were singletons that had to be deleted (e.g., 'graf' (= grave) without the sound /g/ = 'raf' as opposed to 'kip' (= chicken) without the sound /k/ = 'ip'). The test items were preceded by two examples. The total number of items that were correctly repeated without the target phoneme made up the final score.

Vocabulary Receptive vocabulary was tested by investigating whether children are able to derive higher concepts from concrete, basic concepts (Begrippentest—Groep 3; Aarnoutse, 1999). For each of the 40 test items the child is asked to select from four words the odd one out, e.g., *farmer, cow, goat, sheep* (*answer: farmer*). Three examples were used to introduce the test. The words were read out loud to the children by a teacher or tester without giving any further information with regard to the meaning of the words.

Mathematics A standardized test (de Vos, 1992) commonly used to assess arithmetic skills in primary school was employed. The test consists of five rows of calculations of increasing complexity. For each row the children got one minute to do as many calculations as they could. The children were first asked to complete a row of addition and then a row of subtraction. The number of sums calculated correctly within the time given were added and totalled to derive the score for this test.

Procedure

Each child participated in an individual testing session that lasted about 50 min and a class session that lasted about 70 min.

Results of Study 1

Means, standard deviations, and reliability estimates for all of the tasks administered are shown in Table 2. The reliability estimates for all tasks were above .73, and

Table 2 Means, standard deviations and reliabilities of all measures in grade 1

Variables [maximum score]	Mean	SD	Reliability
Age	83.41	3.97	N.A
RWT [116]	24.03	12.3	.94
Spelling [30]	26.05	13.23	.91
Lexical compounding [15]	10.94	2.96	.76
Verb inflection [12]	4.57	3.83	.89
Noun inflection [15]	10.56	3.33	.77
Phoneme deletion [20]	14.85	4.23	.85
Vocabulary [40]	25.18	6.34	.85
Mathematics [80]	19.83	6.50	.94

there were no ceiling effects for any of the tasks. The verb inflections seemed to be particularly difficult for the children based on mean performance.

Table 3 presents the correlations of all tasks as well as children's age. As can be seen in Table 3, all measures apart from age were correlated with reading and spelling. Correlations of the phoneme deletion task with the inflection tasks were non-significant. However, there was a significant positive correlation between phonological awareness and the lexical compounding task. Furthermore, the three tasks of morphological awareness (noun inflection, verb inflection, and lexical compounding) were moderately correlated (r = .39 to .56) with one another.

A main aim of our study was to investigate the contribution of the various tasks of morphological awareness to reading and spelling. To this end, hierarchical regression analyses were used to determine the associations of the three different measures of morphological awareness with reading and spelling, controlling for age, mathematics, vocabulary, and phonological awareness.

Tables 4 and 5 show the results of the hierarchical regression analyses. The control measures 'age', 'mathematics', and 'vocabulary' were entered in the first step. In the second step the variable 'phonological awareness' was entered into the

Table 3 Correlations in grade 1

Variables	1	2	3	4	5	6	7	8
1. Age	1							
2. RWT	−.02	1						
3. Spelling	.12	.66**	1					
4. Lexical comp.	−.20*	.31**	.35**	1				
5. Verb inflection	−.03	.18*	.22*	.39**	1			
6. Noun inflection	−.07	.37**	.34**	.56**	.43**	1		
7. Phon. awareness	−.11	.38**	.43**	.31**	.05	.17	1	
8. Vocabulary	−.02	.39**	.46**	.51**	.25*	.41**	.17	1
9. Mathematics	.12	.39**	.29**	.27**	.12	.17	.16	.35**

* $p < .05$, ** $p < .01$

Table 4 Hierarchical regressions explaining variance in reading and spelling in grade 1

Steps	Variables	Reading		Spelling	
		R^2	R^2 change	R^2	R^2 change
1	Age	.24	.24***	.25	.25***
	Vocabulary				
	Mathematics				
2	Phonological awareness	.31	.08***	.38	.13***
3	Lexical compounding	.36	.04*	.40	.03
	Verb inflection				
	Noun inflection				

* $p < .05$, ** $p < .01$, *** $p < .001$

Table 5 Final beta weights of variables explaining reading and spelling in grade 1

Variables	Reading		Spelling	
	Std. coefficients	*t*-Value	Std. coefficients	*t*-Value
Age	−.001	−.02	.15	1.90
Lexical compounding	−.10	−.86	.08	.79
Verb inflection	−.02	−.01	.11	1.28
Noun inflection	.22	2.39*	.16	1.83
Phonological awareness	.26	3.11**	.37	4.46***
Vocabulary	.18	1.89	.37	4.31***
Mathematics	.25	2.86**	.09	1.08

* $p < .05$, ** $p < .01$, *** $p < .001$

equation and finally, in the third step the three tests of morphological awareness (verb inflection, noun inflection, and lexical compounding) were included stepwise. The analysis showed that with 'reading' as the dependent variable, 'mathematics', 'vocabulary', 'phonological awareness', and the measures of morphological awareness were uniquely associated. Noun inflection explained a unique 4% of variance in word recognition beyond that contributed by phonological awareness. See Table 5 for the final beta weights of the variables included in the model (reading: F (5,102) = 10.03, $p < .001$; spelling: F (4,102) = 14.67, $p < .001$). As demonstrated in Tables 4 and 5, when spelling was the dependent variable in the equation, vocabulary and phoneme deletion were uniquely associated. However, none of the morphological awareness tasks explained unique variance in spelling in grade 1.

Discussion of Study 1

This study was undertaken to investigate whether awareness of inflectional morphology and lexical compounding contributed uniquely to early reading and

spelling ability in Dutch learners of reading and writing. The results showed that the noun inflection task was uniquely associated with reading in grade 1, but no morphological awareness task significantly explained variance in spelling ability. This rather limited relationship between morphological awareness and early Dutch reading and spelling was not unexpected, as previous studies in other languages indicated that morphological awareness played a more important role in reading and spelling at later stages in orthographic learning. Due to the transparency of the Dutch orthographic system, phoneme–grapheme conversion will often result in successful reading and spelling, especially in short and simple words, which constituted the majority of the items of both the reading and spelling test.

Study 2

Study 2 was conducted to investigate whether morphological awareness in any form—lexical compounding, inflectional and derivational morphology—was significantly related to advanced reading and spelling ability in Dutch speaking children in grade 6. An overview of the tasks is given in Table 6.

Method

Subjects

One hundred twelve sixth graders participated (44 boys and 68 girls, average age 145 months old, range 128–158 months). The children came from the same schools as the first grade children. All children were native speakers of Dutch and none received special educational services. Testing took place in May and June.

Materials

Morphological awareness: lexical compounding As in the grade 1 test, children were asked to produce novel compound nouns. The task was more difficult in comparison to the first-grade task as the phrase that included an existing compound

Table 6 The tasks presented to the children in grade 6

Variables	Grade 6
Reading	Word reading test
Spelling	Spelling to dictation
Morphology	Lexical compounding
	Verb inflection
	Derivation
Phonology	Phoneme deletion and exchange
Vocabulary	Comprehensive vocabulary
Mathematics	Different types of calculations

was left out. For example: '*What do you call a tomato that grows in the river?*' (*answer: river tomato*). The test consisted of 20 items and was preceded by two examples. This task was based on the lexical compounding task as reported by McBride-Chang, Cho, et al. (2005).

Morphological awareness: inflectional morphology The children in grade 6 were presented with the same verb inflection task as the children of grade 1. The noun inflection task was not presented to the sixth grade children as this task was too easy. Fifteen items that included present, past, and perfect tense were presented to the children preceded by two examples.

Morphological awareness: derivations In this written classical test children were given 14 sentences with a morphologically derived word missing. For each sentence the relevant base word was given and children had to fill in the appropriate derived form, along the lines of: *Adventure—Part of the holiday was very...; we went sky diving (answer: adventurous)*. For six items the base word was a noun, for six items the base word was a verb, and for two items the base word was an adjective. Items that were derived properly were scored correctly. Spelling errors were not calculated; only erroneous uses of morphemes were scored as incorrect.

Reading (word recognition) The same task was presented as in the first experiment (WRT, Brus & Voeten, 1973).

Spelling The same task as used in the first experiment was presented to the children (PI Dictee, Geelhoed & Reitsma, 1999). The last two blocks of the spelling test were administered. Scoring was discontinued if a child failed to spell eight items of a block correctly. The spelling test consisted of morphologically complex words: multi-morphemic compounds, derivations and inflected nouns.

Phonological awareness The phonological awareness test for grade 6 was constructed by de Jong and van der Leij (2003). This oral test required children to manipulate phonemes in bi-syllabic pseudo-words. The first three items required the children to delete one phoneme, and the next eight items required the children to delete a phoneme that occurred twice in a word, for example *What is 'fiembamf' without the sound /f/? (answer: 'iembam')*. In the last six items the children had to exchange two phonemes, for example *Exchange the /k/ and the /s/ in the word 'wurksept' (answer: 'wurskept')*. The phonemes to be manipulated were all consonants and occurred in different positions in the pseudo words.

Vocabulary The receptive vocabulary test (Woordenschattest—groep 8; Aarnoutse, 2002) followed a format of a sentence with one word underlined followed by four possible meanings of the underlined word, e.g., *You have to change this gradually. (A) slowly, (B) quickly, (C) later, (D) in the future*. The child had to select the appropriate meaning. This test consisted of 28 items preceded by three examples.

Mathematics The mathematics test was the same as the one presented to the first-graders (de Vos, 1992). The children were asked to complete a mixture of calculations that consisted of adding, subtracting, multiplying, and dividing numbers. The number of correct answers across all items within the time given was the total score.

Procedure

Each child participated in an individual testing session that lasted about 25 min and a class session that took about 45 min.

Results of Study 2

The means, standard deviations, and reliability estimates for the tasks administered to the grade 6 children are given in Table 7. Overall, reliabilities of the tasks were acceptable (all .65 and above). The scores of the lexical compounding task and the verb inflection task indicate that they were close to ceiling, whereas the mean score on the phonological awareness task was rather low.

The correlations among the different tasks as well as age are given in Table 8. The verb inflection task was significantly but modestly associated with the other morphological awareness tasks (r = .22 to .30), and the lexical compounding and the derivational task were moderately associated with one another (r = .39). All three measures were significantly associated with the phonological awareness task as well.

Hierarchical regression analyses were carried out to determine the contribution of phonological awareness and the various morphological tasks (lexical compounding, verb inflection, derivations) to reading and writing with age, mathematics, and vocabulary statistically controlled (see Tables 9 and 10). The analysis showed that when the word recognition measure was the dependent variable, with age, vocabulary, mathematics, and phonological awareness statistically controlled, the measures of morphological awareness independently contributed 3% of unique variance to the equation. Only derivational morphology was uniquely associated with word recognition when all other measures were included. When spelling was

Table 7 Means, standard deviations and reliabilities of all measures in grade 6

Variables [maximum score]	Mean	SD	Reliability
Age	145.10	5.77	N.A
RWT [116]	78.59	14.17	.87
Spelling [30]	20.32	6.78	.91
Lexical compounding [20]	17.22	2.40	.70
Verb inflection [15]	13.70	1.80	.68
Derivations [14]	10.93	2.28	.65
Phonological awareness [17]	8.24	2.89	.71
Vocabulary [28]	21.07	4.88	.86
Mathematics [40]	24.44	5.15	.88

Table 8 Correlations in grade 6

	1	2	3	4	5	6	7	8
1. Age	1							
2. RWT	−.36**	1						
3. Spelling	−.39**	.65**	1					
4. Lexical comp.	−.26**	.24*	.22*	1				
5. Verb inflection.	−.19*	.37**	.45**	.22*	1			
6. Derivations	−.32**	.41**	.54**	.43**	.33**	1		
7. Phon awareness	−.46**	.49**	.50**	.25**	.37**	.30**	1	
8. Vocabulary	−.18	.37**	.42**	.29**	19*	.56**	.27**	1
9. Mathematics	−.28**	.55**	.43**	.04	.12	.22*	.26**	.27**

* $p < .05$ level, ** $p < .01$

Table 9 Hierarchical regressions explaining variance in reading and spelling in grade 6

Steps	Variables	Reading		Spelling	
		R^2	R^2 change	R^2	R^2 change
1	Age	.40	.40***	.37	.37***
	Vocabulary				
	Mathematics				
2	Phonological awareness	.47	.07***	.44	.07***
3	Lexical compounding	.50	.03*	.55	.11***
	Verb inflection				
	Derivational morphology				

* $p < .05$, ** $p < .01$, *** $p < .001$

the dependent variable in the equation, the three morphological awareness skills collectively explained a unique 11% of its variance. Both verb inflection and derivational morphology were unique contributors to spelling, in contrast to lexical compounding, as shown in Table 10.

General discussion

The present study was undertaken to investigate the contribution of awareness of inflectional morphology, derivational morphology, and lexical compounding to reading and spelling in Dutch first and sixth graders. The results showed that inflectional (grade 1) and derivational (grade 6) morphology contributed uniquely to reading. Moreover, derivational and inflectional morphology explained variance in spelling in grade 6.

We expected that morphological awareness would be relatively unimportant for early reading and spelling compared with phonological awareness, but that in grade 6, morphological awareness would contribute independently from phonological

Table 10 Final beta weights of variables explaining reading and spelling in grade 6

Variables	Reading		Spelling	
	Std. coefficients	*t*-Value	Std. coefficients	*t*-Value
Age	−.08	−.92	−.10	−1.24
Lexical compounding	.03	.31	−.08	−1.05
Verb inflection	.10	1.70	.24	2.75**
Derivational morphology	.20	2.23*	.27	3.21**
Phonological awareness	.31	3.74***	.22	2.86**
Vocabulary	.08	.89	.12	1.43
Mathematics	.37	4.76***	.24	3.16**

* $p < .05$, ** $p < .01$, *** $p < .001$

awareness to reading and spelling. This expectation was borne out for grade 1. Only noun inflectional morphology explained variance in spelling, but the measures of verb inflection and lexical compounding did not. However, for grade 6 our expectations were met only partly. The tests of derivational and inflectional morphology made a bigger contribution to spelling compared to phonological awareness. However, this pattern was not seen for reading; there, derivational morphology did make an independent contribution to reading, but this was less strong than phonological awareness.

Previous studies on the relation of morphological awareness to reading ability suggested that the role of morphological awareness increases over time due to the increasing morphological complexity of the words children encounter. The results of the two experiments combined fit with these findings, at least for spelling: phonological awareness but not morphological awareness predicted spelling in grade 1, whereas more advanced spelling in grade 6 was better explained with morphological awareness compared to phonological awareness. However, for reading, there was virtually no difference in the percentage of variance explained by morphological awareness between the two grades, and phonological awareness remained the strongest correlate of reading both in grade 1 and grade 6. Interpreting our data in this manner needs to be done with care, as we did not measure directly whether the contribution of morphological awareness to reading and spelling ability changes over time in a longitudinal study. Furthermore, the experimental tasks that were used were not always the same across the two age groups, limiting the interpretation of our data. Using the same materials in both first and sixth grades was not possible, however, due to the differences in capability between the groups. If the same materials would have been used, floor effects would have appeared in grade 1 and ceiling effects in grade 6.

One of our main aims for conducting this study was to distinguish the three features of morphological awareness in relation to reading and spelling. To this end, we separated tests of inflectional morphology (noun and verb morphology), derivational morphology, and lexical compounding.

Awareness of noun inflections, verb inflections, and derivational morphology was significantly related to reading and/or spelling in at least one of the samples. Noun

inflection explained a small but significant amount of variance in single word reading in grade 1, verb inflection explained spelling in grade 6 and derivational morphology contributed to both reading and spelling in grade 6. Inflectional and derivational morphological awareness should thus be considered separately both in terms of contributions to literacy skills and in relation to development.

For example, derivational morphology seems to play a relatively important role in more advanced reading and spelling. Its role in initial reading was not assessed in the current study because tasks assessing derivational morphology proved to be too difficult for first-graders. However, other studies have demonstrated that already in grades 2 and 3 derivational morphology significantly contributes to word decoding (Casalis & Louis-Alexandre, 2000; Singson et al., 2000). The data of this study and other studies thus suggest that awareness of derivational morphology facilitates reading and spelling in languages that vary in transparency with regard to the consistency in grapheme–phoneme correspondence.

Inflectional morphology proved to be a unique contributor in reading skills measured in grade 1 and spelling ability in grade 6. More specifically, noun inflection was uniquely associated with reading in grade 1 but not verb inflection. This discrepancy could be due to the fact that in grade 1 children are more or less reading on the word level rather than on the sentence level. Nouns are thus read much more frequently than inflected verbs and awareness of noun morphology may therefore be more helpful than verb inflection in the early stage of reading. Awareness of verb morphology contributed to spelling in grade 6, but not to reading even though it was significantly correlated with reading. We cannot readily explain these differences in the results for reading and spelling, but it is likely that explicit attention to the morphological make-up of a word is more important for spelling than for reading as phoneme-to-grapheme conversion does not lead to correct spelling of verb forms where the inflections are silent in speech, but overt in orthography (see also Notenboom & Reitsma, in press; Gillis & Ravid, 2006). As such words are quite complex this may explain the observation that verb inflection was only a unique contributor to spelling in grade 6 and not in grade 1. The present data thus suggest that verb morphology may be important for some aspects of literacy at older ages. Results of studies of children with developmental dyslexia that show that inflectional morphology is compromised underline the relationship between morphological awareness and literacy skills (Joanisse, Manis, Keating, & Seidenberg, 2000; Rispens, Roeleven, & Koster, 2004; Scarborough, 1990, 1991).

Lexical compounding was not uniquely associated with either reading or spelling in either of the two grades. This may be explained by the fact that Dutch is not a very creative language with regard to lexical compounding compared with Chinese or Korean for which a unique role of compounding to word recognition has been found (McBride-Chang, Cho, et al., 2005). In addition, lexical compounding was significantly correlated with other measures of morphological awareness, phonological awareness, and vocabulary knowledge, as well as spelling and word recognition themselves, at both ages. Thus, this measure was associated as one might expect with several measures of language and literacy but was not a distinct unique correlate in these samples. As stated in the introduction, lexical compounding differs from derivational and inflectional morphology in the sense that in the

latter two phenomena bound morphemes are attached to free morphemes. Insight into the orthographic structure of these bound morphemes and the morphological rules that guide these morphological processes may facilitate children in their ability to read and spell words of which these morphemes are part of. For example, insight into the principle that 'te' always is added onto voiceless verb stems to express past tense will lead children to correct spelling of such an inflectional form, whereas phoneme–grapheme correspondence will not result in correct writing. The same goes for derivational morphology. Knowledge of the orthographic structure of a bound morpheme will aid in correct spelling, or recognition of a derived word form. This is not necessarily the case for lexical compounding, in which two free morphemes are joined that are not part of a restricted set of morphemes.

The main limitation of the present study centres on the fact that the data were correlational. Thus, we cannot draw inferences on the causality of the associations between reading/spelling and morphological awareness. Longitudinal studies or training studies are needed to ascertain the assumptions that we made on the direction of the associations. An example of a training study is that of Arnbak and Elbro (1998) who trained morphological awareness in dyslexic students aiming to improve their spelling and reading skills.

Furthermore, the present data came from two separate studies in which inevitably different tasks were used to assess the different constructs at two moments in time, limiting the inferences that can be drawn about the developmental patterns of the different constructs. Again, longitudinal studies are needed for a clearer view on how phonological and morphological awareness relates to the acquisition of reading and spelling skills.

Also, there was a difference between the measurement of the three types of morphological awareness: the process of lexical compounding and inflectional morphology was assessed by using pseudo-words, whereas derivational morphology was tapped using existing lexical items. The latter phenomenon is very difficult to measure using pseudo-words as this is a much more creative process in comparison to lexical compounding and inflection, limiting an objective error score. However, this difference between the measurement of the three morphological awareness processes means that the role of lexical knowledge was more prominent in the derivational task, in addition to providing insight into the morphological principle of derivation, relative to the inflectional and lexical compounding task that mainly tapped insight into the morphological/grammatical rules. The possible influence of lexical knowledge was statistically controlled by entering the vocabulary task in the statistical models, but it may be interesting to match the influence of lexical knowledge in the three types of morphological awareness in a future study. In addition, the difference in the lexical knowledge involved in the inflectional/lexical compounding tasks and the derivational tasks may also have been responsible for the difference in performance between the tasks: the children in grade 6 had relatively little trouble with the verb inflection and the lexical compounding tasks, whereas the derivational morphology task proved to be more difficult. It may be the case that the demands of this task were greater, as specific lexical knowledge needed to be used in this task, whereas insight into the morphological/grammatical principles underlying verb inflection and compounding sufficed for a good score on these two tasks.

Despite these limitations, the present study has offered new insights into the associations among different aspects of morphological awareness and their relations to word recognition and spelling in beginning and more advanced Dutch readers. Inflectional morphological awareness, derivational morphological awareness, and lexical compounding all appear to be correlated yet distinct in their associations with reading and spelling. Although lexical compounding was not uniquely associated with literacy skills at either age, both inflectional and derivational morphological awareness may be uniquely important in facilitating Dutch literacy skills. Theoretically, these results underscore the importance of considering different aspects of morphological awareness in understanding literacy development, as has been done extensively for phonological processing skills (for reviews see Castles & Coltheart, 2004; Vellutino et al., 2004). Our results indicate that exploring relations of different aspects of morphological awareness to reading and spelling in readers with different attainment levels may elucidate the different morphological skills needed to read and spell optimally across ages and orthographies. Practically, these results demonstrate that some focus on inflectional morphological awareness, in addition to derivational morphology, may facilitate children's reading and spelling performance throughout primary school, at least in Dutch. Future research might focus on the effects in training in both aspects of morphological awareness to determine the extent to which teaching both is associated with a better performance in literacy skills as compared to training of only a single aspect of morphological awareness in Dutch. The present findings suggest that a thorough exploration of different aspects of morphological awareness may be both theoretically and practically useful for understanding reading and spelling acquisition.

Acknowledgments This research was sponsored by Direct Grant 2020819 from The Chinese University of Hong Kong to all three authors, by RGC grant 4257/03H from the Hong Kong government and by a BAS/VU grant.

References

Aarnoutse, C. A. J. (1999). *Begrippentest (plaatjes).* [Comprehension test (pictures)]. Lisse: Swets & Zeitlinger.

Aarnoutse, C. A. J. (2002). *Woordenschattest en leesattitudeschaal.* [Vocabulary test and reading behaviour scale]. Lisse: Swets & Zeitlinger.

Arnbak, E., & Elbro, C. (1998). Teaching morphological awareness to dyslexic students. In P. Reitsma & L. Verhoeven (Eds.), *Problems and interventions in literacy problems* (pp 277–290). Dordrecht: Kluwer Academic.

Berko, J. (1958). The child's learning of English morphology. *Word, 14*, 150–177.

Brus, B. T., & Voeten, M. J. M. (1973). *Een-Minuut Test. Vorm A en B.* [One-Minute Test. Form A and B]. Nijmegen: Berkhout Testmateriaal.

Bryant, P., & Bradley, L. (1985). *Children's reading problems*. Oxford: Blackwell.

Bryant, P., Nunes, T., & Bindman, M. (2000). The relations between children's linguistic awareness and spelling: The case of the apostrophe. *Reading and Writing: An Interdisciplinary Journal, 12*, 253–276.

Caravolas, M. (2004). Spelling development in alphabetic writing systems: A cross-linguistic perspective. *European Psychologist, 9*, 3–14.

Carlisle, J. F. (1995). Morphological awareness and early reading achievement. In L. Feldman (Ed.), *Morphological aspects of language processing* (pp. 189–209). Hillsdale, NJ: Erlbaum.

Carlisle, J. F. (2000). Awareness of the structure and meaning of morphologically complex words: Impact on reading. *Reading and Writing: An Interdisciplinary Journal, 12*, 169–190.

Casalis, S., & Louis-Alexandre, M. F. (2000). Morphological analysis, phonological analysis, and learning to read French: A longitudinal study. *Reading and Writing: An Interdisciplinary Journal, 12*, 303–335.

Castles, A., & Coltheart, M. (2004). Is there a causal link from phonological awareness to success in learning to read? *Cognition, 91*, 77–111.

Clahsen, H., & Felser, C. (2006). Grammatical processing in language learners. *Applied Psycholinguistics, 27*, 3–42.

De Jong, N. H., Schreuder, R., & Baayen, R. H. (2000). The morphological family size effect and morphology. *Language and Cognitive Processes, 15*, 329–365.

De Jong, P. F., & van der Leij, A. (2003). Developmental changes in the manifestation of a phonological deficit in dyslexic children learning to read a regular orthography. *Journal of Educational Psychology, 95*, 22–40.

De Vos, T. (1992). *Tempo-test Rekenen.* [Timed-test Mathematics]. Nijmegen: Berkhout.

Geelhoed, J., & Reitsma, P. (1999). *PI-dictee.* [PI-dictation test]. Lisse: Swets & Zeitlinger.

Gillis, S., & Ravid, D. (2006). Typological effects on spelling development: A crosslinguistic study of Hebrew and Dutch. *Journal of Child Language, 33*(3), 621–659.

Goswami, U., & Bryant, P. (1990). *Phonological skills and learning to read*. Hove: Lawrence Erlbaum.

Green, L., McCutchen, D., Schwiebert, C., Quinlan, T., Eva-Wood, A., & Juelis, J. (2003). Morphological development in children's writing. *Journal of Educational Psychology, 95*, 752–761.

Joanisse, M. F., Manis, F. R., Keating, P., & Seidenberg, M. S. (2000). Language deficits in dyslexic children: Speech perception, phonology, and morphology. *Journal of Experimental Child Psychology, 77*, 30–60.

Landerl, K., & Reitsma, P. (2005). Phonological and morphological consistency in the acquisition of vowel duration spelling in Dutch and German. *Journal of Experimental Child Psychology, 92*, 322–344.

Levin, I., Ravid, D., & Rapaport, S. (2001). Morphology and spelling among Hebrew-speaking children: From kindergarten to first grade. *Journal of Child Language, 28*, 741–772.

Lyytinen, P., & Lyytinen, H. (2004). Growth and predictive relations of vocabulary and inflectional morphology in children with and without familial risk for dyslexia. *Applied Psycholinguistics, 25*, 397–411.

McBride-Chang, C., Cho, J., Liu, H., Wagner, R. K., Shu, H., Zhou, A., Cheuk, C. S.-M., & Muse, A. (2005). Changing models across cultures: Associations of phonological awareness and morphological structure awareness with vocabulary and word recognition in second graders from Beijing, Hong Kong, Korea, and the United States. *Journal of Experimental Child Psychology, 92*, 140–160.

McBride-Chang, C., Wagner, R. K., Muse, A., Chow, B. W.-Y., & Shu, H. (2005). The role of morphological awareness in children's vocabulary acquisition in English. *Applied Psycholinguistics, 26*, 415–435.

Monz, C., & de Rijke, M. (2001). University of Amsterdam at CLEF. Working Notes for the Cross Language Evaluation Forum, pp. 165–169.

Nagy, W., Berninger, V., Abbott, R., Vaughan, K., & Vermeulen, K. (2003). Relationship of morphology and other language skills to literacy skills in at-risk second-grade readers and at-risk fourth-grade writers. *Journal of Educational Psychology, 4*, 730–742.

Nagy, W. E., Diabkidoy, I. A., & Anderson, R. C. (1993). The acquisition of morphology: Learning the contribution of the suffixes to the meaning of derivations. *Journal of Reading Behavior, 23*, 155–170.

Notenboom, A., & Reitsma, P. (in press). Spelling Dutch doublets: Children's acquisition of a morphological spelling pattern. *Scientific Studies of Reading*.

Rispens, J. E., Roeleven, S., & Koster, C. (2004). Sensitivity to subject-verb agreement in spoken language in children with developmental dyslexia. *Journal of Neurolinguistics, 17*, 333–347.

Scarborough, H. (1990). Very early language deficits in dyslexic children. *Child Development, 61*, 1728–1743.

Scarborough, H. (1991). Early syntactic development of dyslexic children. *Annals of Dyslexia, 41*, 207–220.

Schreuder, R., & Baayen, R. H. (1995). Modeling morphological processing. In L. Feldman (Ed.), *Morphological aspects of language processing* (pp. 189–209). Hillsdale, NJ: Erlbaum.

Shankweiler, D., Crain, S., Katz, L., Fowler, A. E., Liberman, A. E., Brady, S. A., et al. (1995). Cognitive profiles of reading disabled children: Comparisons of language skills in phonology, morphology and syntax. *Psychological Science, 6*, 149–156.

Singson, M., Mahony, D., & Mann, V. (2000). The relation between reading ability and morphological skills: Evidence from derivational suffixes. *Reading and Writing: An Interdisciplinary Journal, 12*, 219–252.

Treiman, R., & Cassar, M. (1996). Effects of morphology on children's spelling of final consonant clusters. *Journal of Experimental Child Psychology, 63*, 141–170.

Vellutino, F. R., Fletcher, J. M., Snowling, M. J., & Scanlon, D. M. (2004). Specific reading disability (dyslexia): What have we learned in the past four decades? *Journal of Child Psychology & Psychiatry, 45*, 2–40.

Wysocki, K., & Jenkins, J. R. (1987). Deriving word meanings through morphological generalization. *Reading Research Quarterly, 22*, 66–81.