Applied Psycholinguistics 14 (1993), 177–195
Printed in the United States of America

Phonological and morphological awareness in first graders

JOANNE F. CARLISLE and DIANA M. NOMANBHOY
Northwestern University

ADDRESS FOR CORRESPONDENCE
Joanne F. Carlisle, Department of Communication Sciences and Disorders, Northwestern University, 2299 Sheridan, Evanston, IL 60208-3560

ABSTRACT
Phonological awareness is thought to be related to children's success in learning to read because it indicates an awareness of the internal structure of words. Morphological awareness, which has been found to be related to reading achievement for older students, may offer a more comprehensive measure of linguistic sensitivity because it entails not only phonological awareness, but also other aspects of linguistic knowledge. The research study reported herein was designed to investigate the extent to which phonological awareness contributes to the morphological awareness of first graders and to determine the extent to which phonological and morphological awareness account for variance in word reading. Two tasks of morphological awareness were used, one assessing judgments of morphological relations and the other assessing the production of inflected and derived forms. The children were also given tests of phonological awareness, vocabulary, and word reading. Results showed that phonological awareness contributed significantly to performance on morphological awareness tasks; in addition, children with and without phonemic awareness differed significantly in their ability to produce morphologically complex words. Phonological awareness and morphological awareness contributed significantly to variance in word reading, although the contribution of phonological awareness was the larger of the two. Further studies are needed to investigate the impact of the delayed acquisition of phonological awareness on the development of morphological awareness and the relationship of morphological awareness to reading achievement over the school years.

Phonological awareness is significantly related to children's ability to learn to read, particularly in the initial stages (Mann & Liberman, 1984; Wagner & Torgesen, 1987). This relationship is generally interpreted to suggest that children's ability to analyze and manipulate the sound structure of words is a key factor in their understanding of letter-sound correspondences in written words. There is some reason to believe that morphological awareness might also be significantly related to reading achievement because it requires not only phonological sensitivity, but also an understanding of the syntactic and semantic roles of word forms. Results of studies of morphological awareness (generally focused on older children) have indicated that

poor readers have less understanding of morphological relations than good readers (Barganz, 1971; Elbro, 1990; Leong, 1989; Shaywitz et al., 1991), and that poor spellers are less aware of the linguistic structure of words than good spellers (Carlisle, 1987; Fischer, Shankweiler, & Liberman, 1985). In undertaking this study, our question was whether morphological awareness is also significantly related to reading achievement for children in the first grade. Further, we investigated the relative importance of word knowledge and phonological awareness to performance on morphological awareness tasks. We also asked whether children lacking in phonemic awareness might perform more poorly than their peers on a morphological production task.

PHONOLOGICAL AWARENESS AND MORPHOLOGICAL LEARNING

First graders' morphological awareness may predict reading achievement no better than their phonological awareness. At this level, they are learning primarily monomorphemic words; consequently, morphological awareness may not play a significant role. However, it seemed likely that the mastery of word meanings and grammatical forms entailed in morphological learning might make a contribution to word reading achievement, beyond that made by phonological awareness. To some extent, this expectation depended on the children's level of phonological awareness.

The kind of phonological knowledge needed for morphological learning appears to vary with the stage of children's morphological learning. Morais (1991) suggested that phonological awareness subsumes awareness of the following: phonological strings (a global, nonanalytic level of awareness), syllables, phonemes, and phonetic features. In the initial stages of language learning, children begin to identify morphemes, presumably by global awareness of phonological strings. To do so, they must segment the speech stream recurrently until they identify certain sound units that have particular meaning(s) and distinguish sound units that do not have a particular meaning or grammatical function (e.g., the syllable *un* in *undo* but not in *under*) (see MacWhinney, 1978). Thus, phonological recognition of recurring elements must be accompanied by analyses of meaning and grammatical role for morphological learning to take place.

As children become aware of syllables and then phonemes, a second type of morphological learning is made possible. This involves using more complex phonological analysis in order to learn the semantic and syntactic roles of morphemes that do not always sound the same. Jones (1991) found that first graders had developed an awareness of some abstract phonological relations. Her normal language learners were able to give the base form of some morphologically complex words when the sound of the base form was not fully represented in its inflected or derived counterpart. Thus, when asked to say "grandfather" without "father," many responded "grand," not "gran." The language-delayed first graders in her group demonstrated less awareness of the abstract phonological relations than their peers. During first grade, children start to become aware of individual phonemic segments in words and to learn categorical relations, such as the different phonetic

representations for the plural marker (i.e., /s/, /z/, /es/) and the past tense (i.e., /d/, /t/, /ed/). Such learning may reflect both their cognitive and their linguistic development (Macken & Ferguson, 1983) or, alternately, their metalinguistic development (Tunmer, Herriman, & Nesdale, 1988), but presumably, children need to have some ability to attend to phonemic segments to accomplish learning of this kind.

A third level of phonological sophistication entails learning the morphophonemic and phonotactic rules that characterize the formation of many derived words. These include sound shifts that are fairly systematic (e.g., *divide* and *division*, *invade* and *invasion*), as well as other shifts that are specifically related to problems of pronunciation (e.g., *absorb* and *absorption*). While children are thought to learn some morphophonemic rules between the ages of 7 and 12 (Ingram, 1976; Moskowitz, 1973; Selby, 1972), few first graders are likely to have the phonological sophistication to understand most morphological relations of this type. Awareness of the morphological structure of derived words may be slow to develop because the sound of the base form is often not intact in the derived counterpart (e.g., *nature* in *natural*) and because the semantic and grammatical relations are complex (Carlisle, 1988; Henderson, 1985). Making the connections between sound, meaning, and function may take multiple exposures to words and fairly advanced metalinguistic ability.

Most first graders are still mastering aspects of inflectional expression (Berko, 1958), but they may be learning derivational affixes that are productive (i.e., useful in making a number of different words) and that form transparent derived forms (i.e., the sound of the base form is preserved in the derived counterpart) (see Anshen & Aronoff, 1981; Cutler, 1981). As the results of Jones's study (1991) suggested, they are learning categorical sound shifts in relation to meaning and grammatical roles. Acquiring phonemic awareness would presumably facilitate such learning; children who can count or manipulate syllables in words, but cannot isolate phonemes, might have trouble manipulating inflectional and derivational suffixes that vary in phonetic representation. Thus, we could predict that children who lack phonemic awareness may lag behind their peers in their morphological learning, as well as in their mastery of the alphabetic code.

ASPECTS OF MORPHOLOGICAL LEARNING

Children's morphological knowledge is certainly not very advanced in the preschool years, but their efforts to express their ideas lead to the invention of words that show they have mastered basic combinatory principles for creating compounds and derivational expressions, as Clark (1982) showed:

> Children coin new compounds like plate-egg and cup-egg (for fried and boiled eggs), tell-wind (a weathervane), or fix-man (a mechanic). They coin agent and instrument nouns like *lessoner* (a teacher), *shorthander* (someone who writes shorthand), *winder* (a machine for making ice-cream), and *driver* (the ignition key of a car). They form adjectives like *toothachey*. They ask when cocoons will be *flyable*. (p. 391)

Such inventions illustrate that children have deduced the meaning and function of some productive affixes. They may violate semantic and syntactic principles, but a process of gradual reorganization serves to correct misconceptions over time (Bowerman, 1982).

Both semantic transparency and phonetic transparency help children become aware of morphological relations (Carlisle, 1988; Derwing & Baker, 1979; Tyler, 1987). If, following the example of Nagy and Anderson (1984), morphologically related words are spread out on a continuum extending from semantic transparency (e.g., *red* and *redness*) to semantic opaqueness (e.g., *apply* and *appliance*), we would expect children to be more likely to see the relationship between transparent relatives. In fact, the more distant the semantic link, the less likely it is that children or adults will judge two words to be morphologically related (Derwing & Baker, 1979).

Syntactic knowledge also plays a central role in young children's morphological learning. A number of researchers have shown that preschool and first grade children are learning the inflected forms, which are necessary for the grammar of the language, such as the formation of plurals and verb tenses (Berko, 1958; Selby, 1972). Morphologically complex forms, such as agentives, are seen to be related to the verbal base by children between the ages of 3 and 7 (Randall, 1985). Over time, children learn increasingly complex rules of suffixation. They come to understand that the same suffix can serve several different roles (e.g., *ly* creates the adjective *friendly* and the adverb *quickly*), and that specific suffixes are used for different base words to create the same grammatical form (e.g., to form a noun, *ment* is added to *enjoy*, while *ity* is added to *complex*).

As children learn to read and write, knowledge of the orthographic representation also facilitates morphological learning. Orthographic regularities provide a stable basis for developing an awareness of morphological structure, particularly when the phonology of the base form is not preserved in the derived counterpart (Chomsky, 1970). For older students, awareness of morphemic structure has characterized better readers and spellers (Barganz, 1971; Carlisle, 1987; Fischer et al., 1985; Templeton & Scarborough-Franks, 1985). However, first graders are unlikely to have developed much more than a rudimentary knowledge of orthographic patterns; thus, it did not seem likely that orthographic knowledge would contribute to their morphological awareness.

Our review, therefore, suggested that phonological sensitivity may provide a foundation for morphological learning, but that linguistic knowledge (both semantic and syntactic) might constitute a significant aspect of morphological awareness at the first grade level. An alternative explanation was that performance on morphological awareness tasks might be particularly related to word knowledge because word knowledge is influenced by a child's verbal ability (see Anderson & Freebody, 1985), which, in turn, might affect her/his performance on morphological awareness tasks. However, a large vocabulary does not necessarily entail sensitivity to the morphological structure of words, since derived forms are commonly learned without regard to their morphemic structure (Sterling, 1983). Thus, we

expected that in first grade, word knowledge might account for some of the variance in morphological awareness, but not more than that accounted for by phonological awareness.

PHONOLOGICAL AND MORPHOLOGICAL AWARENESS AND READING

A large number of studies of phonological awareness have documented a strong link to the acquisition of reading ability in the early school years (e.g., Blachman, 1983; Fox & Routh, 1984; Mann & Liberman, 1984; Wagner & Torgesen, 1987). In contrast, few studies have investigated the relationship between morphological awareness and reading proficiency, and these largely have focused on older children (Barganz, 1971; Elbro, 1990; Leong, 1989; Shaywitz et al., 1991).

We might suspect that morphological awareness would be more related to the reading proficiency of older children than younger ones. One reason is that the first stages of learning to read involve mastering basic sound-symbol relations and gaining fluency in the recognition of words (Chall, 1979). At later stages (grades 3 and up), more sophisticated linguistic knowledge may be needed for both word recognition and comprehension processes, and this may suggest a larger role for morphological awareness.

This possibility has received support from several studies. Moskowitz (1973) found that the knowledge and manipulation of words with phonological shifts depended on learning to read and correlated significantly with reading achievement; this was not true for forms with a more regular and transparent morphological structure. Leong (1989) found that derived forms that undergo both phonological and orthographic shifts accounted for more of the variance in reading comprehension than transparent-derived forms. However, while morphological awareness might be particularly related to the reading skill of older children, it is important to determine the relationship between phonological and morphological awareness insofar as they contribute to word-reading ability among first graders.

ASSESSING MORPHOLOGICAL AWARENESS

Assessing morphological awareness for the purpose of determining its relationship to reading skill presented a challenge. The results of some studies of metalinguistic abilities and reading proficiency have been based on comprehension/judgment tasks, while others have used tasks that require children to construct words or sentences, so-called production tasks. In general, performances on production tasks seem to distinguish good and poor readers more clearly than performances on comprehension/judgment tasks (see Fowler, 1988; Menyuk, 1984). However, because different tests of morphological awareness may have somewhat different relationships with reading (as is true for phonological awareness, according to Yopp, 1988), the best approach at the outset was to include both judgment and production tests of morphological awareness.

While the morphological awareness tasks ideally required the integration of phonological, semantic, and syntactic knowledge, they needed to be specifically revealing in terms of phonological analysis. With this in mind, we devised two tasks. The first, a sentence judgment task, was intended to indicate the degree to which similarities of sound might be convincing. For this task, agentive and instrumental forms were used because they are within the morphological grasp of first graders (Randall, 1985). The second, a production task, sampled the children's ability to provide inflected, transparent-derived, and phonological change-derived forms to complete sentences. The task required children to manipulate the base word in order to provide a form of it that correctly completed the sentence. Because of the requirement of mental manipulation, the task was presumed to tap children's explicit awareness of morphological relations.

DESIGN OF THE STUDY

The research questions for this study were as follows. To what extent do performances on phonological awareness and vocabulary tasks account for variance in performance on a morphological awareness task involving judgment of word relations? To what extent do performances on phonological awareness and vocabulary tasks account for variance in performance on a productive morphological awareness task? Do children with prephonemic and phonemic awareness differ in their morphological production capabilities? To what extent do first graders' performances on the morphological awareness tasks and the phonological awareness task account for variance in word-reading ability?

METHOD

Subjects

Initially, our first grade group consisted of 115 children who attended regular classes in an urban school system located in an industrial city in western Massachusetts with a large immigrant population. We excluded 13 children who, on the basis of testing in their kindergarten year, were rated as bilingual. One additional child was eliminated because he was unable to do two of the tasks. For the 101 remaining children (59 boys, 42 girls), the mean age was 79.2 months (range 71 to 93 months). In their kindergarten year, the students had been administered two subtests of the Test of Language Development (Hammill & Newcomer, 1982); mean standard scores on these were as follows: 8.3 (2.6 *SD*) for Picture Vocabulary and 8.5 (2.5 *SD*) for Grammatic Completion. All but 6 of the children had been given the Early Screening Inventory (Meisels & Wiske, 1988) in their kindergarten year; 88 (93%) of the children received an "OK" rating; 6 children were in the "rescreen" category, and 1 child was in the "refer" category.

Materials

The following tests were administered:

Judgment of Word Relations Task. This experimental test is a receptive language measure designed to evaluate the subjects' sensitivity to semantic and phonological similarity in identifying members of a word family. The test items included pairs of words, each with a base morpheme and either a fake or real derived form. The morphologically related pairs all used the suffix /er/ to form agentives or instrumentals (e.g., *teach* and *teacher* or *wash* and *washer*), and all preserved the sound of the two morphemes in the derived form. For the morphologically unrelated word pairs, some pairs had first syllables that sounded alike (e.g., *doll* and *dollar*) - henceforth, sound-alike. The remaining pairs had first syllables containing different vowel sounds (e.g., *moth* and *mother*) - henceforth, sound-different. For each test item, the pair of words was presented in one of two sentence contexts, as would be appropriate for the instrumental (e.g., "You use *scissors* to make sizes") or the agentive forms (e.g., "A person who makes dolls is a *dollar*"). Each sentence was read aloud by the examiner; then, the subject stated whether the sentence made sense, responding either "yes," "no," or "not sure." A training item and two practice items were used to make sure that each child understood the task.

It was important to ensure that the words were familiar to the subjects so that errors might be attributed to lack of morphological knowledge rather than to unfamiliarity with the vocabulary. Familiarity with the words was determined by performance on an experimental Picture Identification Test. If the child did not pick the correct picture for a given word, the item that used the word on the Judgment task was not included in the calculation of the child's overall raw score for the test.

Production of Word Forms Test. This experimental task was an expressive measure that was designed to tap the children's ability to produce the correct inflected and derived word forms that fit a sentence grammatically, semantically, and morphologically. About one-third of the items on the test were inflected forms (e.g., plurals, comparative, and superlative forms of the adjective). The remaining two-thirds were two types of derived forms. In about half, the base word was intact in the pronunciation of the derived form (e.g., *quick* and *quickly*) - henceforth, transparent-derived; and in the other half, the pronunciation of the base form was changed in the derived form (e.g., *long* and *length*) - henceforth, phonological change-derived. The base words for the three types were of similar length and familiarity, as determined by frequency counts in elementary texts (Carroll, Davies, & Richman, 1971). The items were presented in random order.

For the production task, the examiner read aloud the base word and the sentence context. For example, the examiner said, "Help. Father tells me that I am a good ____." The child was asked to provide a form of the base word that completed the sentence. All of the children were given a training

item and 3 practice items to ensure that they understood the task; all 19 test items were administered to every child.

Picture Identification Test. This test was an experimental picture recognition task that assessed recognition of the words encountered on the Judgment task. The children were presented with a booklet with each page containing two test items. The item that the child was not working on was covered up. Each item consisted of four black-and-white line drawings. The child was asked to point to the one drawing that best represented the meaning of the word presented orally by the examiner.

Of the 56 words from the Judgment task, 46 were included in the Picture Identification Test; 10 words were not included because both the base word and its derived counterpart could be depicted by the same picture (e.g., *teach* and *teacher*). In these instances, only knowledge of the agentive or instrumental form was assessed.

Word Reading Test. This task consisted of 25 words selected randomly from pre-primer, primer, and first grade word lists compiled by Harris and Sipay (1985) (see Appendix). The words on the test were presented by level of difficulty. The child was given a single sheet of paper in primer type on which the words appeared in three columns. All children began reading with the first item; administration was discontinued after six consecutive errors.

Test of Auditory Analysis Skills. This test (TAAS) (Rosner, 1975) assesses children's ability to delete a syllable or phoneme from a word. It was selected as a measure of phonological awareness because it is believed to assess phonemic segmentation abilities (see Yopp, 1988) and, therefore, might discriminate first graders with varying levels of phonological awareness. Yopp reported the predictive correlation of this test with subsequent rate of learning to read words as .55. The task involved having the child repeat a word and then having her/him form a new word after having deleted a specified element. For example, the examiner says to the child, "Say the word meat. Now say it but don't say /m/." The test was administered and scored according to the published instructions. Following two practice items, the child was asked to delete a syllable (items 1 through 3); then, deletion of an initial or final consonant was required (items 4 through 9); and finally, deletion of one consonant from a blend was required (e.g., *play* without the *p*). Testing is stopped after two successive errors. The correlation of TAAS and Word Reading performances for the first graders in this study was .58 ($p < .001$).

Procedures

The subjects were tested individually by trained graduate students in the late fall. The testing took from 25 to 30 minutes per subject. The tasks were administered in the following order: Production, Word Reading,

Table 1. *Paired correlations of performances on tests*

	TAAS	Picture Vocabulary	Judgment	Production	Word Reading
TAAS	–				
Picture Vocab.	.36	–			
Judgment	.30*	.40	–		
Production	.51	.49	.52	–	
Word Reading	.58	.31	.27*	.46	–

*$p < .01$; all others, $p < .001$.

Judgment, Picture Identification, and TAAS. The Picture Identification Test was administered following the Judgment Test to avoid practice effects on the test items.

The children had been administered the Test of Language Development (TOLD), Picture Vocabulary subtest (Hammill & Newcomer, 1982), in the fall of their kindergarten year. The standard score from this subtest was used as a measure of receptive vocabulary.

RESULTS

Performance on the Judgment of Word Relations Task

The first question concerned the extent to which performances on the Picture Vocabulary and the phonological awareness (TAAS) tasks would account for variance on the Judgment task. Of additional interest was the extent to which phonological awareness alone accounted for a significant amount of the variance on this test. Means and standard deviations on this task showed better performance on the morphologically related word pairs (88.3%, 15.4 *SD*) than the unrelated sound-alike pairs (84.0%, 23.3 *SD*) or the sound-different pairs (81.8% correct, 24.5 *SD*). While most of the children performed above chance on this task, a few children appeared not to understand the task or the directions; this resulted in a negative skew to the data. For this reason, the scores were standardized before further analyses were carried out. Pearson correlations (shown in Table 1) indicate a significant relationship between all pairs of test variables; however, the Judgment task was the least related to performance in word reading ($r = .27$).

The results of a regression analysis with Judgment of Word Relations as the dependent variable showed that together, the TOLD Picture Vocabulary and the TAAS performances accounted for 19% of the variance on the Judgment task, $F(2, 98) = 11.173$, $p < .001$. Picture Vocabulary accounted for a significant portion of the variance, while the TAAS was not significant, as Table 2 shows. In subsequent regression analyses in which each variable was entered first alone, followed by the other variable, it was

Table 2. *Contributions of picture vocabulary and phonological awareness (TAAS) to the judgment of word relations*

Variable	Standard coefficient	*t* value	*p* (two-tail)
Picture Vocabulary	0.38	3.69	.000
TAAS	0.13	1.22	.224

Table 3. *Contributions of picture vocabulary and phonological awareness (TAAS) to production of word forms*

Variable	Standard coefficient	*t* value	*p* (two-tail)
Picture Vocabulary	0.33	3.62	.000
TAAS	0.35	3.84	.000

determined that the unique contribution of Picture Vocabulary to performance on the Judgment task was 10%, while the unique contribution of TAAS was 3%. Thus, word meaning made a more significant contribution than phonological awareness to performance on this sentence judgment task.

Performances on the Production of Word Forms Test

The second question concerned the extent to which the first graders' performances on the phonological awareness task (TAAS) and TOLD Picture Vocabulary test accounted for variance in the production of morphologically complex words. Of further interest was the extent to which performance on the phonological awareness task alone accounted for variance in the Production task. Means and *SD*s of the children's performances on the three word types indicated that they were better at producing inflected forms (61.1%, 18.5 *SD*) than transparent-derived (40.9%, 17.5 *SD*) or phonological change-derived (11.2%, 16.9 *SD*) forms. The Pearson correlation of performances on the Production and Word Reading tasks was .46 (see Table 1).

The results of a regression analysis with performance on the Production test as the dependent variable showed that, together, the TAAS and Picture Vocabulary performances accounted for 37% of the variance in the Production test, $F(2, 98) = 28.153$, $p < .001$. Both variables contributed significantly to the equation, as Table 3 shows. Through subsequent regression analyses in which each variable was entered first alone, followed by the other variable, it was determined that the unique contribution of Picture Vocabulary to performance on the Production task was 11%, while the unique contribution of TAAS was 13%.

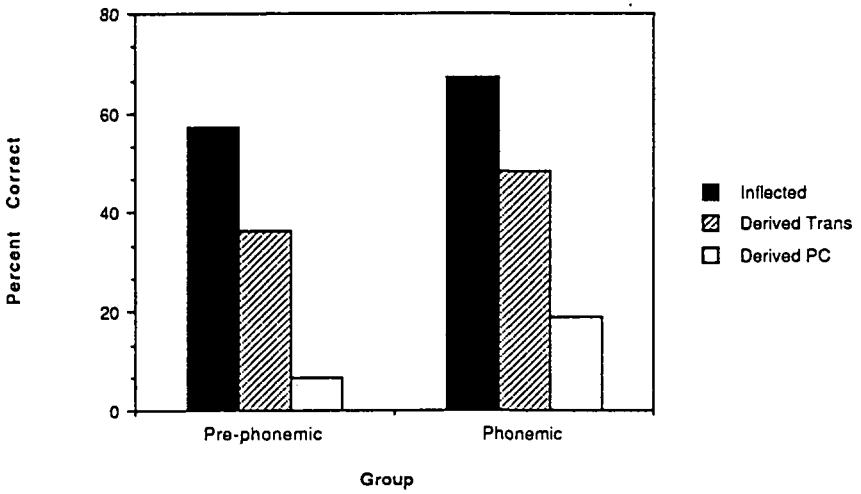

Figure 1. Performances on the word types of the Production task by Phonemic and Pre-phonemic first graders.

Phonemic awareness and morphological production

The third question was whether children who could segment phonemes on the phonological awareness task had achieved a higher level of morphological awareness than children who were unable to segment phonemes. To answer this question, the children were divided into two groups, based on their performance on the TAAS. Those children who were unable to complete any of the test items that required phonemic manipulation were placed in the Pre-phonemic group, while those who were able to answer test items that required phonemic manipulations were placed in the Phonemic group. The performances of these two groups on the three word types on the Production task were compared using a univariate repeated-measures analysis. The analysis was run twice, once with performance on the TOLD Picture Vocabulary as a covariate and once without this additional control; the purpose was to see whether group differences in word knowledge had a significant impact on morphological awareness. The results of the two analyses did not differ in any significant way. Without the covariate, the analysis showed a significant effect for group, $F(1, 99) = 16.597, p < .001$, and for the repeated measures (the three word types), $F(2, 198) = 431.29$, $p < .001$, but no significant interaction, $F(2, 198) = 0.342$, $p = .71$. As Figure 1 shows, the Pre-phonemic group was less able to produce the correct word forms of all three types.

Contributions to variance in word reading

The fourth research question concerned the extent to which the first graders' performance on the two morphology tasks and the TAAS accounted significantly for variance in word-reading ability and, further, whether

https://doi.org/10.1017/S0142716400009541 Published online by Cambridge University Press

Table 4. *The contribution of tests of morphological awareness (Judgment and Production) and phonological awareness (TAAS) to word reading*

Variable	Standard coefficient	*t* value	*p* (two-tail)
TAAS	0.47	5.04	.000
Judgment	0.07	0.72	.475
Production	0.22	2.36	.032

performances on the morphology tasks made a unique contribution. First, a regression analysis was carried out in which performance on these three tasks was included; the results showed that these three variables accounted for 37.2% of the variance on the Word Reading task, $F(3, 97) = 19.130$, $p < .001$. As Table 4 shows, both performances on TAAS and the Production task contributed significantly to the equation, while the Judgment task did not. A second regression analysis was carried out in which the TAAS performance alone was entered into the equation. This analysis showed that the TAAS performance accounted for 33.6% of the variance. Thus, morphological awareness accounted for a small (not quite 4%), but significant, amount of the variance in word-reading ability for these first graders.

DISCUSSION

Relationship of phonological and morphological awareness

We began this study with the expectation that for first graders, morphological awareness would be significantly related to phonological awareness, but that other aspects of linguistic knowledge are also significantly important to children's growing morphological awareness. In particular, we looked to see whether first graders' performance on a measure of phonological awareness (TAAS) (Rosner, 1975) and the TOLD Picture Vocabulary (Hammill & Newcomer, 1982) would account for a significant portion of the variance in their performance on our morphological awareness tasks (Judgment and Production tasks), and whether performance on the TAAS made a unique contribution to variance on each task, beyond that of word knowledge. We also asked whether first graders with phonemic awareness would perform better than those with pre-phonemic awareness on the Production task. Finally, we looked to see whether phonological and morphological awareness both contributed significantly to variance in the word reading ability to these first graders. While morphological awareness might be more closely related to the word reading skills of older children, it also seemed possible that morphological awareness would contribute significantly to reading ability, even in the initial stages of learning to recognize printed words and learning the alphabetic code.

Performances on the morphological awareness tasks

The two morphological awareness tasks were designed to assess different aspects of morphological knowledge. One was a task that involved judgments of word pairs that might or might not have agentive or instrumental relations (e.g., "A person who teaches is a teacher" vs. "A thing that flows is a flower"). Such judgments presumably demonstrate the child's awareness of morphemic units in relation to meaning and grammatical role and, as a result, would involve a more advanced understanding of the linguistic structure of words than is entailed in most phonological segmentation tasks. While phonological awareness might serve as the basis for the development of such understanding, a knowledge of semantic relations and word meanings might be crucial elements as well.

The children did quite well on the Judgment task overall, with most performing well above the chance level of 50% created by the yes–no response format of the task. For these first graders, the word pairs that were morphologically related posed fewer problems than the word pairs that were not morphologically related, whether they sounded alike (e.g., *doll* and *dollar*) or not (e.g., *moth* and *mother*). This pattern may suggest a secure understanding of actual agentive and instrumental relations, but insecurity in judging non-morphologically related pairs. It might also suggest problems in understanding the task or a greater tendency to respond positively than negatively. Our inability to choose among these explanations reinforces our discomfort with judgment tasks. Unless there are follow-up probes, it is not possible to determine what the children were thinking or what they knew about the pairs of words they were judging. One link is certain: that is, the children knew the meaning of the words at some level, since they had identified them correctly on the Picture Identification task.

Because comprehension and production tasks might tap different aspects of morphological awareness, we also gave the first graders a task that required them to produce morphologically complex words (Production task). This involved forming an inflected or derived word from a base word in order to end a sentence appropriately. We wanted to compare the children's ability to produce inflected, transparent-derived, and phonological change-derived forms, which constitute successively more difficult levels of morphological knowledge. Overall, the group did significantly better on inflected than transparent-derived forms, and better on transparent-derived forms than on phonological change-derived forms (as one would expect). It is of some interest that these first graders were able to produce about 41% of the transparent-derived forms correctly, as this provides evidence that inflected and the more productive derived forms are, to some extent, being mastered concurrently.

The first graders appear to have done much better on the Judgment task than the Production task, judging from the percentage of correct answers. One reason for this may simply be that the children could achieve a score of 50% correct on the Judgment task by guessing alone. A second reason is

that the tasks vary in the level of difficulty of morphological knowledge. The agentives and instrumentals were more familiar than the varied sorts of word forms that the children were required to formulate on the Production task. A third reason is that judgment tasks might be less taxing than production tasks. This was the case in a study of the metalinguistic capabilities of children who turned out to be good or poor readers (Menyuk, 1984), as well as in a study of second graders who were asked to make judgments or corrections of sentence grammaticality (Fowler, 1988). These researchers concluded that production not only was a more stringent test of metalinguistic capabilities, but also was more closely related to later achievement in reading.

Relationship of phonological and morphological awareness

Because morphological learning is largely dependent on children's ability to segment, and thus identify, morphemes from the speech stream, and because different aspects of phonological awareness seem to be related to different levels of morphological awareness, we expected children's phonological awareness to be a central factor in their development of morphological awareness. However, children's level of vocabulary and awareness of semantic relations is a driving force in their morphological learning and might be of central importance at the first grade level. As a result, it seemed valuable to determine the extent to which phonological awareness and word knowledge accounted for variance in performance on the two morphological awareness tasks.

Two regression analyses were carried out using the children's performance on the phonological awareness task and the picture vocabulary task as predictors, with the Judgment task as the dependent variable in first analysis and the Production task as the dependent variable in the second. On the Judgment task, a significant, unique contribution was made by both phonological awareness and vocabulary, although word knowledge was clearly the more important variable on this task. This may be because the task asked children to judge the meaning of the sentences, which necessarily entailed evaluation of word meaning as well as morphological structure. It should be pointed out that the children's performance on the Judgment task were scored for only those items that they knew on the Picture Identification task. Thus, general word knowledge – not knowledge of specific words – was related to performance on this task; this general word knowledge may be an index of verbal ability.

On the Production task, performance on the phonological awareness and picture vocabulary tasks again accounted for a significant portion of the variance. However, the overall relationship was stronger (i.e., accounting for 37% of the variance). Unique contributions were made by phonological awareness and by picture vocabulary to performance on the Production task, although in this case the contribution of phonological awareness was the larger of the two. These results suggest that at the first grade level, performances on morphological awareness tasks are dependent on both

children's phonological awareness and their word knowledge or verbal ability.

It should be emphasized that performance on the morphological awareness tasks was not simply a reflection of the children's knowledge of the specific words that they were producing or judging. As noted, we controlled for specific word knowledge on the Judgment task by scoring only those words that each child had identified on the Picture Identification task. We found that some children knew a large number of the words, but did not do well on the Judgment task. The correlation of performances on the Picture Identification task and the Judgment task was .44. For the Production task, we had equated the inflected, derived-transparent, and phonological change-derived words for mean frequency in printed texts (Carroll et al., 1971). As a follow-up measure, we correlated correct answers on test items and the frequency ratings; the Pearson correlation was $-.21$ ($p = .38$). This suggests no significant relation between the frequency with which the words appear in school texts and the children's ability to produce the correct forms on the Production task.

Finally, we investigated the role of phonemic awareness in children's morphological awareness. Early morphological learning may be fostered by the kind of phonological awareness that Morais (1991) called awareness of phonological strings, which is global and nonanalytic. While this level of phonological awareness may be adequate for acquiring recognition of morphemes and basic combinatory principles, by first grade, children are often learning more complex morphological relations, involving learning phonological categories in relation to meaning and grammatical form. Such learning may require phonemic awareness. Consequently, we divided the first graders into Phonemic and Pre-phonemic groups and compared their performances on the three word types of the production task. The groups differed significantly in their performances on the word types, but there was no interaction of word types and group. Thus, the Pre-phonemic group was poorer than the Phonemic group at producing inflected forms, as well as producing the transparent-derived and phonological change-derived forms. Specifically, these results may suggest that phonemic awareness facilitates morphological production at all levels of difficulty on this task. A more general interpretation would be that children with phonemic awareness have better metalinguistic skills and can use these skills in various linguistically challenging tasks. Further study is needed to determine whether the specific or the general interpretation is a more accurate description of first graders' phonological and morphological awareness.

Accounting for variance in word reading

Our interest in the relation between phonological awareness and morphological learning rests in part on the potential importance for understanding reading disabilities. Morphological awareness may be related to poor reading, not only because it entails analysis of the sound structure of words, but also because it involves other types of linguistic knowledge. However,

at a first grade level, phonological awareness may be so important to the development of word-reading ability that morphological awareness has no distinctive role to play. Thus, we asked whether both phonological and morphological awareness contributed significantly to the word-reading ability of the first graders.

The results of a regression analysis indicated that together, performances on the phonology and morphology tests accounted for a significant portion of the variance in reading (37.2%). It is not surprising that performance on the phonological awareness task contributed most significantly to variance in word-reading ability, as other studies have demonstrated a strong relationship between phonological awareness and beginning reading skill (Blachman, 1983; Mann & Liberman, 1984; Wagner & Torgesen, 1987). It is of some interest, however, that morphological awareness made a small (4%), but significant, contribution to the variance in word reading. Thus, even at the first grade level, where learning to read words is focused to a large extent on sight recognition and mastery of the code, morphological awareness appeared to play a small role in the child's ability to decode words, only a few of which were morphologically complex. This finding suggests that even at this early stage, other aspects of linguistic knowledge that are components of morphological awareness (e.g., semantic and grammatical roles) are useful in reading words.

SUMMARY AND SUGGESTIONS FOR FUTURE STUDIES

This study has provided preliminary insights into the link between children's phonological and morphological awareness. The results suggest that children with better phonological awareness are ahead of their peers in understanding the morphological structure of words, including words with complex morphophonological components. The results also suggest links between phonological awareness, morphological awareness, and word-reading ability. How important morphological awareness is to the development of reading capabilities over time remains to be seen. This issue is particularly important because as word reading becomes accurate and efficient, different aspects of language comprehension play an increasingly important role in reading achievement (Curtis, 1980). Furthermore, higher level texts have a greater proportion of morphologically complex words; the ability to analyze the morphemic structure of words is likely to help children infer the meaning of unfamiliar words (Nagy & Anderson, 1984). Morphological awareness may become gradually more important to reading proficiency through the school years; this possibility might be explored in longitudinal studies.

Along with demonstrating a link between phonological and morphological awareness, this study sheds some light on the nature of the relationship. First, performance on morphological tasks appears to be dependent on both word knowledge and phonological awareness, although familiarity with a word does not necessarily entail awareness of its morphological structure. Second, the results of this study are in agreement with the results

of previous studies that have suggested that phonological shifts make the awareness of morphological relations less accessible (see Moskowitz, 1973). First graders lacking phonemic awareness had more difficulty producing both inflected and derived forms than their phonemically aware peers. It is possible that differences in metalinguistic capabilities affect both phonological and morphological awareness. Further work is needed to determine whether this is the case and whether early difficulties with phonological awareness have a lasting impact on morphological learning, specifically in the development of complex sound-meaning relations. These questions have particular relevance since it appears likely that explicit awareness of the linguistic structure of words (both phonological and morphological) is vitally important to successful reading and spelling.

APPENDIX

WORDS ON THE WORD READING TEST

and	could	smile
boy	bag	someone
do	end	coming
fish	know	yellow
in	made	helper
jump	open	moved
look	rabbit	because
red	trick	
say	window	

ACKNOWLEDGMENTS

The research project would not have been possible without the able assistance of Gail Furman, who was Director of Research in the Holyoke School System, Holyoke, MA. We are also grateful for the help of her graduate assistants from American International College in testing the children and to C. Addison Stone for his comments on an early draft of this article.

REFERENCES

Anderson, R. C., & Freebody, P. (1985). Vocabulary knowledge. In H. Singer & R. B. Ruddell (Eds.), *Theoretical models and processes of reading* (3rd ed., pp. 343-371). Newark, DE: International Reading Association.

Anshen, F., & Aronoff, M. (1981). Morphological productivity and phonological transparency. *Canadian Journal of Linguistics, 26*, 63-72.

Barganz, R. A. (1971). *The morphophonemic performance of good and poor readers* (Technical Report No. 182). Madison, WI: Research and Development Center for Cognitive Learning.

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

Blachman, B. A. (1983). Are we assessing the linguistic factors critical in early reading? *Annals of Dyslexia, 33*, 91-110.

Bowerman, M. (1982). Reorganizational processes in lexical and syntactic development. In E. Wanner & L. Gleitman (Eds.), *Language acquisition: The state of the art* (pp. 319-346). Cambridge: Cambridge University Press.

Carlisle, J. F. (1987). The use of morphological knowledge in spelling derived forms by learning-disabled and normal students. *Annals of Dyslexia, 37*, 90–108.

(1988). Knowledge of derivational morphology and spelling ability in fourth, sixth, and eighth graders. *Applied Psycholinguistics, 9*, 247–266.

Carroll, J. B., Davies, P., & Richman, B. (1971). *Word frequency book*. New York: American Heritage.

Chall, J. (1979). A modest proposal for reading stages. In L. B. Resnick & P. A. Weaver (Eds.), *Theory and practice of early reading* (pp. 29–55). Hillsdale, NJ: Erlbaum.

Chomsky, C. (1970). Reading, writing, and phonology. *Harvard Educational Review, 40*, 287–309.

Clark, E. V. (1982). The young word maker: A case study of innovation in the child's lexicon. In E. Wanner & L. Gleitman (Eds.), *Language acquisition: The state of the art* (pp. 390–425). Cambridge: Cambridge University Press.

Curtis, M. E. (1980). Development of components of reading skill. *Journal of Educational Psychology, 72*(5), 656–669.

Cutler, M. E. (1981). Degrees of transparency in word formation. *Canadian Journal of Linguistics, 26*(1), 73–77.

Derwing, B. L., & Baker, W. J. (1979). Recent research on the acquisition of English morphology. In P. Fletcher & M. Garman (Eds.), *Language acquisition* (pp. 209–223). Cambridge: Cambridge University Press.

Elbro, C. (1990). *Differences in dyslexia*. Copenhagen: Munksgaard International Publishers.

Fischer, F. W., Shankweiler, D., & Liberman, I. Y. (1985). Spelling proficiency and sensitivity to word structure. *Journal of Memory and Language, 24*, 423–441.

Fox, B., & Routh, D. K. (1984). Phonemic analysis and synthesis as word attack skills: Revisited. *Journal of Educational Psychology, 76*, 1059–1064.

Fowler, A. E. (1988). Grammaticality judgments and reading skill in grade 2. *Annals of Dyslexia, 38*, 73–94.

Hammill, D., & Newcomer, P. (1982). *Test of Language Development, Primary*. Austin, TX: Pro-Ed.

Harris, A. J., & Sipay, E. R. (1985). *How to increase reading ability: A guide to developmental and remedial methods* (8th ed.). New York: Longman.

Henderson, L. (1985). Toward a psychology of morphemes. In A. W. Ellis (Ed.), *Progress in the psychology of language* (Vol. 1, pp. 15–72). Hillsdale, NJ: Erlbaum.

Ingram, D. (1976). *Phonological disability in children*. London: Edward Arnold.

Jones, N. K. (1991). Development of morphophonemic segments in children's mental representations of words. *Applied Psycholinguistics, 12*, 217–239.

Leong, C. K. (1989). Productive knowledge of derivational rules in poor readers. *Annals of Dyslexia, 39*, 94–115.

Macken, M. A., & Ferguson, C. A. (1983). Cognitive aspects of phonological development: Model, evidence, and issues. In K. E. Nelson (Ed.), *Children's language* (Vol. 4, pp. 256–282). Hillsdale, NJ: Erlbaum.

MacWhinney, B. (1978). The acquisition of morphophonology. *Monographs of the Society for Research in Child Development, 43*(1-2, Serial No. 174).

Mann, V. A., & Liberman, I. Y. (1984). Phonological awareness and verbal short-term memory: Can they presage early reading success? *Journal of Learning Disabilities, 17*, 592–598.

Meisels, S. J., & Wiske, M. S. (1988). *Early Screening Inventory*. New York: Teachers College Press.

Menyuk, P. (1984). Language development and reading. In J. Flood (Ed.), *Understanding reading comprehension: Cognition, language, and the structure of prose* (pp. 101–121). Newark, DE: International Reading Association.

Morais, J. (1991). Constraints on the development of phonemic awareness. In S. A. Brady & D. P. Shankweiler (Eds.), *Phonological processes in literacy: A tribute to Isabelle Y. Liberman* (pp. 5–27). Hillsdale, NJ: Erlbaum.

Moskowitz, B. (1973). On the status of vowel shift in English. In J. Moore (Ed.), *Cognitive development and the acquisition of language* (pp. 223–260). New York: Academic.

Nagy, W. E., & Anderson, R. C. (1984). How many words are there in printed school English? *Reading Research Quarterly, 19*(3), 304–329.

Randall, J. H. (1985). *Morphological structure and language acquisition*. New York: Garland Publishing.

Rosner, J. (1975). *Helping children overcome learning difficulties*. New York: Walker & Co.

Selby, S. (1972). The development of morphological rules in children. *British Journal of Educational Psychology, 42*, 293–299.

Shaywitz, B. A., Shaywitz, S. E., Liberman, I. Y., Fletcher, J. M., Shankweiler, D. P., Duncan, J. S., Katz, L., Liberman, A. M., Francis, D. J., Dreyer, L. G., Crain, S., Brady, S., Fowler, A., Kier, L., Rosenfield, N. S., Fore, J. C., & Makuch, R. W. (1991). Neurolinguistic and biologic mechanisms in dyslexia. In D. D. Duane & D. B. Gray (Eds.), *The reading brain: The biologic basis of dyslexia* (pp. 27–52). Parkton, MD: York Press.

Sterling, C. M. (1983). Spelling errors in context. *British Journal of Psychology, 74*, 353–364.

Templeton, S., & Scarborough-Franks, L. (1985). The spelling's the thing: Knowledge of derivational morphology in orthography and phonology among older students. *Applied Psycholinguistics, 6*, 371–390.

Tunmer, W. E., Herriman, M. L., & Nesdale, A. K. (1988). Metalinguistic abilities and beginning to read. *Reading Research Quarterly, 23*(2), 134–158.

Tyler, A. E. (1987). *Acquisition and use of English derivational morphology: An experimental investigation*. Unpublished doctoral dissertation, University of Michigan, Ann Arbor.

Wagner, R. K., & Torgesen, J. K. (1987). The nature of phonological processing and its causal role in the acquisition of reading skill. *Psychological Bulletin, 101*, 192–212.

Yopp, H. K. (1988). The validity and reliability of phonemic awareness tasks. *Reading Research Quarterly, 23*(2), 159–177.