TOWARD AN UNDERSTANDING OF DEVELOPMENTAL LANGUAGE AND READING DISORDERS

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The primary purpose of this study was to compare the ability of language-impaired and reading-impaired children to process (i.e., encode and retrieve) phonological information. Four measures of phonological awareness and several measures of word and sentence repetition abilities were used to evaluate phonological processing skills. Two additional measures assessed children's awareness of lexical and morphological information. Subjects were 12 language-impaired (LI), 12 reading-impaired (RI), and 12 normal children between the ages of 6 and 8 years. The findings supported previous claims that children with reading impairments have difficulty processing phonological information. To our surprise, however, the LI children performed significantly worse than the RI children on only three measures, all involving word and sentence repetition. These findings raise questions about the distinctiveness of school-age children with a history of language impairment and poor readers with no history of language impairment.

One of the goals of research on developmental language disorders is to understand how language can be severely impaired in children who have normal general intelligence and normal learning opportunities. Researchers (e.g., Johnston & Weismer, 1983; Kamhi, 1981; Kamhi, Catts, Koenig, & Lewis, 1984; Stark & Tallal, 1980; Weismer, 1985) have attempted to identify perceptual and cognitive abilities that vary independently of nonverbal intelligence but are crucial to acquiring language. Difficulties in processing rapidly changing auditory information, symbolic representation, hypothesis-testing, and inferencing are among the possibilities that have been proposed to play some causal role in a developmental language impairment.

A similar goal has motivated research on developmental reading impairments. Researchers (e.g., Frith, 1981; Johnston & Myklebust, 1967; Jorm & Share, 1983; Liberman, 1983; Torgesen, 1985; Vellutino, 1979) have strived to understand how reading can be impaired in children with normal general intelligence, ostensibly normal language abilities, and normal learning opportunities. As with developmental language disorders, researchers have attempted to identify perceptual and cognitive abilities that vary independently of general intelligence but are crucial to acquiring basic reading skills.

Despite the similarity in the goals of researchers who study children with language impairments and those who study children with reading impairments, there has been little attempt to study the similarities and differences in these two purportedly different groups of children. One reason for this state of affairs is that it is sometimes difficult to distinguish school-age language-impaired children from other learning-disabled children. This is because when children with preschool language impairments enter school, they often become relabeled as learning disabled, reading impaired, or language-learning disabled. Another reason concerns professional territoriality. Researchers with backgrounds in speech-language pathology have generally studied children with developmental language impairments, whereas researchers with backgrounds in special education and/or psychology have generally studied children with developmental reading impairments.

In the present study, children with language impairments and children with reading impairments were compared on tasks that assessed the ability to generate representations of phonological, lexical, and morphological information. The reason for studying these particular abilities will be discussed in the next section.

Phonological Processing Skills

Beginning in the early 1970s, reading theorists (e.g., Lerner, 1972; Mattingly, 1972; Vellutino, 1977, 1979) began to emphasize the linguistic bases of reading. During the ensuing years, there has been increasing evidence that deficits in language abilities are causally related to reading problems (e.g., Perfetti, 1985; Vellutino, 1979). The claim currently receiving the most attention is that poor readers have difficulty processing (i.e., encoding and retrieving) the phonological aspects of language (Frith, 1981; Jorm & Share, 1983; Mann, 1984; Rudel, 1985; Shankweiler, Liberman, Mark, Fowler, & Fischer, 1979; Stanovich, 1985; Torgesen, 1985). The difficulty poor readers have in processing phonological information has been demonstrated on a variety of tasks that measure how well phonological information is encoded and retrieved. There is now considerable evidence demonstrating that compared to good readers poor readers have difficulty (a) encoding phonological information in long-term memory (Byrne & Shea, 1979; Mark, Shankweiler, Liberman, & Fowler, 1977), (b) retrieving phonological information...
from long-term memory (Denckla & Rudel, 1976; Denckla, Rudel, & Broman, 1981), (c) using phonological codes in working memory (Liberman, Shankweiler, Liberman, Fowler, & Fischer, 1977; Shankweiler et al., 1979), and (d) segmenting speech into phonemic and syllabic units (Bryant & Bradley, 1981; Fox & Routh, 1975; Liberman, Shankweiler, Fischer, & Carter, 1974; Treiman & Baron, 1981). The tasks used in these studies include learning novel words, recognizing phonologically confusable and nonconfusable letters, rapid naming, and segmenting words into syllables and sounds.

The previously cited research clearly indicates that children with reading impairments have difficulty processing phonological information. The ability of language-impaired children to process phonological information has been considerably less researched. Phonemic awareness of language-impaired children was evaluated in a recent study by Kamhi, Lee, and Nelson (1985). The language-impaired children performed poorer than mental age (MA)-matched and language-age controls in dividing words into syllables and sounds. In another recent study, Dollaghan (1984) reported that language-impaired children had more difficulty than age controls encoding phonological information in a word-learning task. Finally, Leonard, Nippold, Kail, and Hale (1983) found that language-impaired children named pictures less rapidly than age peers. Naming requires retrieving phonological information from long-term memory.

These studies provide some preliminary evidence that language-impaired children have difficulty processing phonological information in addition to the difficulty these children are known to have processing syntactic and semantic information. The extent of these children's phonological processing deficit, however, is not totally clear. For example, do language-impaired children perform poorer than reading-impaired children on measures of phonological processing? The primary purpose of the present study was to address this question.

Several measures of phonological processing were obtained in this study. Using several measures ensured that children's ability to process phonological information would be well sampled. Four tasks measured children's awareness of phonological units: (a) bisyllabic word division, (b) monosyllabic word division, (c) segmentation, and (d) elision. In addition, children were administered a word repetition task consisting of multisyllabic nonsense words and a sentence repetition task consisting of complex phonetic sequences. These speech production tasks represent another way to measure children's phonological processing abilities. In order to repeat a nonsense word and phonetically complex sentences accurately, children must accurately encode phonological information. Indeed, there is some recent evidence in the literature that poor readers experience difficulty in speech production tasks (Catts, 1984; Snowling, 1981).

**Lexical and Morphological Processing Skills**

In addition to our interest in the phonological processing abilities of language-impaired and reading-impaired children, we were also interested in comparing the ability of these children to process lexical and morphological information. There is some recent evidence (James & Blachman, 1985) that reading achievement is related to young school-age children's ability to make metalinguistic judgments about grammatical forms and the ability of these children to recognize that words are independent units. Previous studies with language-impaired children (e.g., Kamhi et al., 1985; Kamhi & Koenig, 1985; Liles, Schulman, & Bartlett, 1977) have shown that these children perform considerably poorer than normal children in these areas. In this study we questioned how children with reading impairments performed relative to language-impaired children on measures of word awareness (sentence division task) and morpheme awareness (morpheme judgment task).

**METHOD**

**Subjects**

Subjects were 36 children between the age of 6:2 and 9:2 years. Specific subject data are presented in Table 1. Of the 36 children, 12 were poor readers with no history of speech-language impairment, 12 had a developmental language impairment, and 12 had normal language and reading abilities. There were 8 boys each in the language-impaired and normal language groups and 7 boys in the group of poor readers. The three groups were matched for mental age using the Test of Nonverbal Intelligence (TONI) (Brown, Sherbenou, & Johnsen, 1982).

The group of poor readers (henceforth referred to as reading impaired, RI) were first- and second-grade children who were enrolled in reading resource classrooms because of the difficulty they were having in learning to read. The 12 RI children ranged in age from 6:11 to 8:5 years. These children's reading impairments were not the direct result of a global intellectual deficit, sensory, physical, or emotional problems. To be considered reading impaired, children also had to perform at least 1 year below expected grade level on at least two of the three subtests from the Woodcock Reading Mastery Tests (Woodcock, 1973) and perform within age normal limits on the TONI. None of the RI children had any previous history of speech, language, or hearing disorders and were not currently enrolled in speech-language therapy. The five principal subtests of the Test of Language Development—Primary (TOLD) (Newcomer & Hammill, 1982) were administered to ensure that expressive and receptive syntactic-semantic abilities of the poor readers were within normal limits. To be included in the study, these children had to obtain Spoken Language Quotients (SLQs) within normal age limits (above 85) and not perform more than 1 year below age level on more than one of the five language subtests.

The 12 language-impaired (LI) children ranged in age from 6:11 to 9:2: years. These children were all previously diagnosed as language impaired by a certified speech-
TABLE 1. Group means and standard deviations (SD) for CA, MA, language, and reading.

<table>
<thead>
<tr>
<th>Group</th>
<th>CA</th>
<th>MA</th>
<th>TOLD&lt;sup&gt;a&lt;/sup&gt;</th>
<th>WI</th>
<th>WA</th>
<th>PC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal Mean</td>
<td>86.75</td>
<td>86.33</td>
<td>104.50</td>
<td>101.50</td>
<td>77.42</td>
<td>54.50</td>
</tr>
<tr>
<td>Normal SD</td>
<td>11.59</td>
<td>11.94</td>
<td>10.14</td>
<td>62.18</td>
<td>26.61</td>
<td>30.41</td>
</tr>
<tr>
<td>Reading-Impaired Mean</td>
<td>92.08</td>
<td>86.08</td>
<td>96.83</td>
<td>63.58</td>
<td>64.67</td>
<td>39.33</td>
</tr>
<tr>
<td>Reading-Impaired SD</td>
<td>4.44</td>
<td>8.39</td>
<td>7.96</td>
<td>17.99</td>
<td>20.06</td>
<td>9.30</td>
</tr>
<tr>
<td>Language-Impaired Mean</td>
<td>94.75</td>
<td>87.17</td>
<td>71.25</td>
<td>85.67</td>
<td>62.75</td>
<td>49.83</td>
</tr>
<tr>
<td>Language-Impaired SD</td>
<td>10.70</td>
<td>11.85</td>
<td>10.21</td>
<td>30.52</td>
<td>16.17</td>
<td>13.97</td>
</tr>
</tbody>
</table>

<sup>a</sup>Test of Nonverbal Intelligence. <sup>b</sup>SLQ = Speech-language quotient. <sup>c</sup>WI = Word identification; WA = Word attack; PC = Passage comprehension.

language pathologist and were currently enrolled in speech-language therapy. The language impairment was not the direct result of global intellectual, sensory, motor, emotional, or physical impairments. All of the LI children performed within normal age limits on the TONI. To be included in this study, the LI children also had to have SLQs less than 85 (range = 59–84) on the TOLD and perform at least 1 year below age level on at least three of the five language subtests. Performance on the Woodcock Reading Mastery Tests was not a criterion for the LI group. Interestingly, the LI children obtained higher mean scores than the RI children on two of the three tests in this battery.

The normal children ranged in age from 6:2 to 8:5. These children performed within normal age limits on the TONI, the TOLD, and the Woodcock Reading Mastery Tests. None of these children had any history of speech, language, hearing, or reading problems. As can be seen in Table 1, the normal children were about 6–8 months younger than the RI and LI children. Also, there was considerable variability in the normal children’s reading abilities, reflecting the 2-year age range in these children.

**General Procedures**

Testing was conducted in two sessions. In the first session, the TONI, TOLD, and Woodcock Reading Mastery Tests were given. The experimental tasks were administered in the second session. These tasks fell into two categories, those that evaluated children’s speech production abilities (word and sentence repetition tasks) and those that evaluated children’s knowledge of phonological and language units (sentence division, bisyllabic and monosyllabic word division, elision, segmentation, and grammatical judgment). The two speech production tasks were always administered first, followed by the six metalinguistic tasks presented in a random order. The eight tasks are described below. Reliability measures for the metalinguistic tasks are presented in a subsequent section.

**Word repetition.** In this task subjects repeated 30 multisyllabic nonsense words. The use of nonsense words rather than real words ensures that children must rely on their verbal short-term memory abilities to respond accurately. Representations of real words in long-term memory can facilitate production of real words. Half of the 30 words had clear phonemic contrasts across syllables (e.g., [pʰətəl], [məkəvən], and [wətəfədɪ]). These words were designated as “phonologically simple.” The remaining words had minimal phonemic contrasts across syllables (e.g., [saʃəfəs], [mənəmən], and [fəfəsəs]). These words were designated as “phonologically complex.” Following the procedures outlined by Snowling (1981), all of the words were derived from real multisyllabic English words. For example, [saʃəfəs] was derived from *philosophy*, whereas [mənəmən] was derived from *minimum*. The 30 words appear in the Appendix.

The 30 words were presented via tape recorder. A female graduate student recorded the words as well as the sentences that are described below. A cassette tape of the words (and sentences described below) was made with a JVC DD9J stereo-cassette tape recorder via an Electro Voice (Model 635A) microphone. Each word was produced twice on the tape in the following manner: “Number 1, [spəpəstɪks], say [spəpəstɪks].” There was a 5-s pause between words. Five graduate students in speech-language pathology independently transcribed the 30 words to ensure that the words were clearly recorded. Several words needed to be re-recorded because of inconsistencies among the transcriptions. Re-recordings of these words were verified by three of the original transcribers and two new transcribers. Agreement was 97%. A Realistic CTR-51 tape recorder was used to present the words and record children’s word repetitions.

Each child’s word repetitions were immediately transcribed by the experimenter using broad phonetic transcription. Tape recordings of the word productions were then used to verify these live transcriptions. The experimenter checked all of the transcriptions with the tape recorded productions. Then a second judge indepen-
dently transcribed all the words produced by three children from each group. Listener agreement was 96%.

Children's word productions were scored initially as either correct or incorrect. Speech production errors were then classified into one of the following phonological process categories: assimilation, metathesis, substitution, phoneme deletion, phoneme addition, weak syllable deletion, and other. This analysis could differentiate between the types of errors the three groups made as well as whether or not one group was more likely to produce words containing more than one error. Chomsky and Halle's 1968 distinctive feature system was then used to analyze children's substitution errors. For each substitution error, the number of features shifted was noted. The error analyses were initially performed by the experimenter. All of these analyses were independently verified by a graduate student in speech-language pathology who also performed intrajudge checks on data from six of the children, two from each of the three groups. Interjudge agreement was 91%, whereas intrajudge agreement was 93%.

Sentence repetition. Subjects repeated 10 short phrases that contained complex phonetic sequences, such as *The spy fled to Greece*, and *He likes split pea soup*. The sentences were presented via tape recorder as described above. Data reduction and analysis procedures were generally similar to those described above. The sentences were first scored as either correct or incorrect. A sentence was considered incorrect if it contained a phonological error. Sentences containing only lexical or syntactic errors were considered to be correct. A second analysis tallied the number of incorrectly produced words and omitted words within and across sentences.

Sentence and word division. These tasks provide a measure of children's awareness of words, syllables, and sounds. The sentence division task provides a measure of word or lexical awareness, whereas the two word division tasks (bisyllables and monosyllables) provide measures of phonological awareness. Tunmer and Bowey (1984) have noted that word and sound awareness are important prerequisites for learning to read. Kamhi et al. (1985) recently reported that 5-year-old language-impaired children performed more poorly on this task than language age-matched controls, suggesting that these children were significantly at risk for reading problems. Following the procedures described in Kamhi et al. (1985) (pp. 209–210), children were presented with eight sentences, eight bisyllabic words, and eight monosyllabic words to divide into smaller units. The sentences could be divided into words (26 possible divisions), the bisyllabic words into CVC monosyllables (8 possible divisions), and the monosyllabic words into sounds (8 possible divisions).

Subjects were first asked to repeat the sentences to ensure that they could produce all the words and to ensure that the sentences were within their short-term memory limits. A short training procedure followed. Using a puppet to demonstrate, the experimenter presented a sample sentence, *Jack and Jill went up the hill*, and asked the puppet to say a little bit of the sentence. The puppet said, “Jack and Jill,” and the experimenter replied, “Good, you said just a little bit.” The puppet was then asked to say a little bit of *Jack and Jill*; the puppet said, “Jack.” After this demonstration, the child was given an opportunity to do the task. Sample two-word sentences were provided until the child was able to divide two consecutive sentences successfully. The eight stimulus sentences were then presented, followed by the eight bisyllabic and eight monosyllabic words.

Elision. This task was initially used in studies by Bruce (1964) and Rosner and Simon (1971). The task evaluates knowledge of phonemic segments by asking children to decide what word would be left if a particular letter sound (first or last) is taken away from the target word [e.g., *(h)ill*]. Rosner and Simon (1971) found that it was easier for children to take away the last letter than the first letter. These authors also found a notable improvement in performance from kindergarten to first grade.

In the present investigation, children were presented with 16 monosyllabic words. Half the words contained initial sounds to delete [e.g., *(t)all, (n)ice*], and half the words contained final sounds to delete [e.g., *(t)en(t), *car(d)*]. The children were given the following instructions: “I'm going to say a word to you. You say the word just like I do. Then I'm going to tell you a part to leave off, either at the beginning or the end of the word. You say the word, leaving off the part I tell you to.” To become familiar with the task, children were given a couple of sample items. A child was first shown pictures of a cow and a boy side-by-side and asked to say the word *cowboy*. The picture of the boy was then covered, and the child was asked to say the word without the *boy* part. The child then was told to say the word *trail* and asked to take away the /t/ from the beginning of the word. Note that the children were told the sound to be left off, not the letter to be left off. Children's responses were scored as either correct or incorrect. The maximum score possible was 16.

Segmentation (tapping). This task provides a measure of children's ability to segment successive phonemes in spoken words. The tapping procedure was first used by Liberman et al. (1974). In the present study, children were given 16 words to segment. There were 5 two-segment syllables (e.g., *[ap] and *[em]*), 7 three-segment syllables (e.g., *[zan] and *[k¢l]*) and 4 four-segment syllables (e.g., *[polt] and *[blm]*)

The following instructions were given to each child: “Now we're going to play a tapping game. I'm going to say something to you—some play words—and then tap them after I say them. You need to listen carefully, so you can learn how to play the game.” The experimenter says, “oo,” and taps one time; then says, “boo,” and taps two times; and then says, “boot,” and taps three times. The child then is given the same three items and asked to tap them. Corrective feedback is given. The three items then are presented in a different order (e.g., *boo, oo, boot*). Corrective feedback is again provided. The child is then given a new word, *goat*, to segment. Then the experimenter says, “Now we're going to play the real game. I'm going to say some play words, but I'm not going to tap because you know how to do that now. You say the word after me and then tap it.” The number of taps for each of
TABLE 2. Group means and standard deviations (SD) for the word repetition task.

<table>
<thead>
<tr>
<th>Group</th>
<th>Simple</th>
<th>Complex</th>
<th>Total</th>
<th>Simple</th>
<th>Complex</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal</td>
<td>10.83</td>
<td>8.17</td>
<td>19.00</td>
<td>4.58</td>
<td>10.00</td>
<td>14.58</td>
</tr>
<tr>
<td>SD</td>
<td>2.79</td>
<td>3.76</td>
<td>5.63</td>
<td>3.52</td>
<td>4.88</td>
<td>8.08</td>
</tr>
<tr>
<td>Reading-Impaired</td>
<td>8.67</td>
<td>3.17</td>
<td>11.83</td>
<td>10.33</td>
<td>18.42</td>
<td>28.75</td>
</tr>
<tr>
<td>SD</td>
<td>3.68</td>
<td>1.99</td>
<td>4.86</td>
<td>6.82</td>
<td>5.37</td>
<td>10.92</td>
</tr>
<tr>
<td>Language-Impaired</td>
<td>5.00</td>
<td>2.25</td>
<td>7.25</td>
<td>16.50</td>
<td>23.75</td>
<td>40.25</td>
</tr>
<tr>
<td>SD</td>
<td>1.95</td>
<td>2.01</td>
<td>3.02</td>
<td>5.93</td>
<td>6.93</td>
<td>11.21</td>
</tr>
</tbody>
</table>

the 16 words is recorded. Responses are scored as either correct or incorrect. The maximum score possible was 16.

*Morpheme judgment.* This task provided a measure of children's ability to access morphological information. In this task, children were asked to judge the accuracy of 16 sentences, 12 of which contained morphological errors (e.g., "They throwing the stick"). If the sentence was judged to be incorrect, the child was asked to correct it. Each child was given the following instructions: "I have this puppet, and he can't talk so well. I want you to help him talk. He is going to say a sentence, and I want you to tell him whether or not the sentence is a good one. If it's not a good one, I want you to make it better." Children were given at least three examples to become familiar with the task. Children's responses were scored as either correct or incorrect, based on whether or not a correct revision was made or the sentence was identified as a correct one. The maximum score possible was 16.

**Reliability**

Reliability measures were discussed above for the speech production measures. Children's responses to the six metalinguistic tasks were initially scored by the experimenter. A trained graduate student independently listened to tape recorded data from 3 children in each group and recorded and scored children's responses in the four tasks. Reliability checks were thus made on 9 of the 36 children tested. The total percentage agreement was 91%. Disagreements were resolved through discussion.

**RESULTS**

In order to justify using separate univariate statistics to analyze children's performance on the two speech production tasks and the six metalinguistic tasks, a Geisser-Greenhouse Conservative F Test (Kirk, 1982) was first computed to test for homogeneity of variances and covariances of the data from these eight tasks. The conservative F test was significant \[F(8,05, 132.83) = 5.09, p < .001\], indicating that the assumptions of homogeneity of variances and covariances were fulfilled and that at least one contrast among means was significant.

**Speech Production Tasks**

The data from the word repetition and sentence repetition tasks are presented in Table 2. As can be seen in this table, the reading-impaired (RI) and the language-impaired (LI) children made significantly more word repetition errors than the normal children, \[F(2,33) = 19.6, p < .001; Tukey HSD; p < .05\]. The difference between the RI and LI groups did not reach significance. The normal children produced about 65% of the words correctly. In contrast, the LI children produced less than 25% of the words correctly.

Group performance was reconsidered using the number of phonological processes as the dependent variable rather than total number of word errors. The normal children again performed significantly better than the RI and LI children, but this time the difference between the RI and LI children was also significant \[F(2,33) = 19.18, p < .001; Tukey < .05\]. The order changed somewhat for the RI children: deletion, assimilation, and substitution. The LI children performed less than 25% of the words correctly.

Group performance was reconsidered using the number of phonological processes as the dependent variable rather than total number of word errors. The normal children again performed significantly better than the RI and LI children, but this time the difference between the RI and LI children was also significant \[F(2,33) = 19.18, p < .001; Tukey < .05\]. The order changed somewhat for the RI children: deletion, assimilation, and substitution. The LI children performed less than 25% of the words correctly.

As expected, children used significantly more phonological processes on the phonologically complex words than on the phonologically simple words, \[F(1,33) = 8.39, p < .001\]. For the phonologically simple words, the normal children again performed significantly better than the RI children who, in turn, performed significantly better than the LI children \[F(2,33) = 13.52, p < .001; Tukey < .05\]. There was no significant difference in the number of processes used by the RI and LI children on the complex words. Children from these groups could produce only 2–3 of the 15 complex words correctly. The normal group, not surprisingly, used significantly fewer processes than both the RI and LI children \[F(2,33) = 17.19, p < .001; Tukey < .05\]. The LI children made 3
When this child’s omission score was excluded from the group mean of the RI children, the difference between the RI and LI children was significant (Mann Whitney U Test, \( U = 34.5, p < .05 \)). The normal children, like the RI children, exhibited few word omissions; only 1 child omitted 2 words.

### Metalinguistic Tasks

The data from the six metalinguistic tasks are presented in Table 4. Recall that the two word division tasks as well as the elision and segmentation tasks provided measures of phonological awareness. Interestingly, no group differences were found on either the word division or the segmentation tasks. On the segmentation task, children in all groups performed no better than chance, which was 5.3 correct responses. On the elision and the sentence division tasks, the RI children performed slightly poorer than the LI children, but the differences did not reach significance. The RI children did, however, perform significantly poorer than the normal children on both of these tasks: elision \( F(2,33) = 4.47, p = .02; \) Tukey < .05, sentence division \( F(2,33) = 3.63, p = .04; \) Tukey < .05. On the morpheme judgment task, the RI and LI children made significantly more errors than the normal children \( F(2,33) = 8.47, p = .001; \) Tukey < .05. There were no significant differences between the RI and LI children on this task.

### Correlational Analyses

Pearson product-moment correlation coefficients were calculated between measures of speech production and metalinguistic performance. Coefficients were calculated using two measures of word repetition ability: (a) the total number of correct words and (b) the total number of phonological processes. There were essentially no differences in the coefficients involving these measures. Because the total number correct words produced positive

### Table 4. Group means and standard deviations (SD) for measures of phonological, lexical, and morphological awareness.

<table>
<thead>
<tr>
<th>Group</th>
<th>Sentence division</th>
<th>Word division</th>
<th>Elision</th>
<th>Segmentation</th>
<th>Morpheme judgment</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(26)</td>
<td>(8)</td>
<td>(8)</td>
<td>(16)</td>
<td>(16)</td>
</tr>
<tr>
<td>Normal</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean</td>
<td>23.00</td>
<td>8.00</td>
<td>7.42</td>
<td>8.75</td>
<td>6.00</td>
</tr>
<tr>
<td>SD</td>
<td>2.13</td>
<td>0.00</td>
<td>1.44</td>
<td>4.54</td>
<td>4.18</td>
</tr>
<tr>
<td>Reading-Impaired</td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Mean</td>
<td>15.75</td>
<td>6.17</td>
<td>5.83</td>
<td>4.33</td>
<td>6.67</td>
</tr>
<tr>
<td>SD</td>
<td>6.73</td>
<td>2.62</td>
<td>3.07</td>
<td>3.00</td>
<td>3.50</td>
</tr>
<tr>
<td>Language-Impaired</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean</td>
<td>19.83</td>
<td>6.83</td>
<td>6.17</td>
<td>6.33</td>
<td>5.83</td>
</tr>
<tr>
<td>SD</td>
<td>7.52</td>
<td>2.37</td>
<td>2.82</td>
<td>4.36</td>
<td>4.20</td>
</tr>
</tbody>
</table>

**Note.** Numbers in parentheses indicate possible correct.
coefficients, this measure was used in the correlational analyses reported below.

In looking at Table 5, one can see that the two measures of speech production were highly correlated as were many of the metalinguistic measures. However, word repetition abilities were not significantly related to any measure of phonological awareness, suggesting that these tasks were measuring different phonological processing skills. Only the measure of morphological awareness was significantly related to word repetition abilities. Interestingly, sentence repetition abilities showed a moderate relationship with performance on the sentence division, elision, and grammatical judgment tasks. Performance on the elision task was significantly related to performance on every task with the exception of the word repetition task.

Table 6 presents the correlation coefficients between measures of language, reading, speech production, and metalinguistic performance. Reading performance was measured in this study by the Word Identification (WI), Word Attack (WA), and Passage Comprehension (PC) subtests of the Woodcock Reading Mastery Tests. Consistent with the correlational data reported in the test manual, children’s performance on these subtests was highly correlated (WI-WA, r = .75; WI-PC, r = .93; WA-PC, r = .78). Language performance was measured by the five principal subtests of the TOLD. A Speech-Language Quotient (SLQ) was derived from the children’s performance on these five language subtests.

The pattern of coefficients is quite clear. Language abilities, as measured by the TOLD-SLQ, were significantly related to the two speech production measures and performance on the morpheme judgment task. In contrast, reading performance, as measured by the Woodcock, was highly correlated to performance on the elision, segmentation, and morpheme judgment tasks. As is apparent from this pattern of coefficients, the language and reading abilities tapped by the TOLD and Woodcock, respectively, were not significantly related (SLQ-WI, r = .09; SLQ-WA, r = .13; SLQ-PC, r = .30).

To confirm the pattern of these relationships, stepwise multiple regression analyses were performed. Not surprisingly, performance on the elision task was the best predictor of reading performance, accounting for approximately 50% of the variance for each of the three reading measures. Performance on the segmentation task explained an additional 8% of the variance. No other measure contributed significantly to reading performance. Performance on the word repetition task was the best predictor of language abilities, accounting for 51% of the

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**Table 5. Pearson product-moment correlation coefficients between measures of speech production and phonological, lexical, and morphological awareness.**

<table>
<thead>
<tr>
<th></th>
<th>Word repetition</th>
<th>Sentence repetition</th>
<th>Sentence division</th>
<th>Bisyllabic division</th>
<th>Monosyllabic division</th>
<th>Elision</th>
<th>Segmentation</th>
<th>Morpheme judgment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Word repetition</td>
<td>1.00</td>
<td>.61**</td>
<td>21</td>
<td>.25</td>
<td>.30</td>
<td>.24</td>
<td>.23</td>
<td>.57**</td>
</tr>
<tr>
<td>Sentence repetition</td>
<td>1.00</td>
<td>.43</td>
<td>.35</td>
<td>.21</td>
<td>.44*</td>
<td>.06</td>
<td>.54**</td>
<td></td>
</tr>
<tr>
<td>Sentence division</td>
<td>1.00</td>
<td>.68**</td>
<td>.54**</td>
<td>.50**</td>
<td>.21</td>
<td>.27</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bisyllabic division</td>
<td>1.00</td>
<td>.70**</td>
<td>.54**</td>
<td>.31</td>
<td>.30</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Monosyllabic division</td>
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<td>.53**</td>
<td>.46*</td>
<td>.36</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Elision</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Segmentation</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*p < .01, r = .38. **p < .001, r = .48.

---

**Table 6. Pearson product-moment correlation coefficients between experimental measures and standardized measures of language and reading.**

<table>
<thead>
<tr>
<th>Language and reading measures</th>
<th>Word repetition</th>
<th>Sentence repetition</th>
<th>Sentence division</th>
<th>Bisyllabic division</th>
<th>Monosyllabic division</th>
<th>Elision</th>
<th>Segmentation</th>
<th>Morpheme judgment</th>
</tr>
</thead>
<tbody>
<tr>
<td>TOLD SLQ</td>
<td>.72**</td>
<td>.64**</td>
<td>.15</td>
<td>.18</td>
<td>.21</td>
<td>.22</td>
<td>.18</td>
<td>.60**</td>
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<tr>
<td>Word Identification</td>
<td>.29</td>
<td>.44**</td>
<td>.43*</td>
<td>.38*</td>
<td>.39*</td>
<td>.71**</td>
<td>.59**</td>
<td>.52**</td>
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<tr>
<td>Word Attack</td>
<td>.30</td>
<td>.37</td>
<td>.24</td>
<td>.13</td>
<td>.10</td>
<td>.67**</td>
<td>.50**</td>
<td>.50**</td>
</tr>
<tr>
<td>Passage Comprehension</td>
<td>.24</td>
<td>.35</td>
<td>.33</td>
<td>.24</td>
<td>.23</td>
<td>.70**</td>
<td>.56**</td>
<td>.44</td>
</tr>
</tbody>
</table>

*p < .01, r = .38. **p < .001, r = .48.
variance on the TOLD. Performance on the sentence repetition task explained an additional 6% of the variance. No other measure contributed significantly to language performance.

**DISCUSSION**

The primary purpose of the present study was to compare the phonological processing abilities of children with developmental language and reading impairments. Recall that children's phonological processing abilities were assessed by four measures of phonological awareness and the word and sentence repetition tasks. Only the word and sentence repetition tasks significantly differentiated between the LI and RI children. LI children performed significantly poorer than the RI children on three measures: (a) total number of phonological processes used in the word repetition task, (b) number of processes used in producing phonologically simple words, and (c) the number of word omissions on the sentence repetition task. Both the LI and RI children performed significantly worse than the normal children on these tasks.

No significant differences were found between the LI and RI children on the four measures of phoneme awareness: bisyllable word division, monosyllable word division, segmentation, and elision. However, the RI children performed significantly poorer than the normal children on the elision task. In the case of the word division task, the small, nonsignificant group differences could be the result of a ceiling effect for the normal group. Perhaps a more discriminating word division task would reveal significant differences among the three groups of children. In contrast, the segmentation task, which required quite sophisticated phonological awareness, proved too difficult for all groups. Recall that none of the groups performed better than chance on this task. These findings clearly demonstrate the differing degrees of difficulty in tasks that measure phonological awareness.

The second purpose of this study was to compare LI and RI children's awareness of lexical and morphological information. The sentence division task provided a measure of children's awareness of words, whereas the morpheme judgment task assessed children's ability to identify and correct morpheme errors. There were no significant differences between LI and RI children on these tasks. Both of these groups performed significantly worse than the normal group on the morpheme judgment task. The RI children performed significantly worse than the normal children on the sentence division task.

Taken together, the above findings are consistent with previous studies showing that poor readers have difficulty processing phonological information. The RI children performed significantly worse than normal peers on the word and sentence repetition tasks and the elision task. In addition, the RI children also performed worse than the normal children on the sentence division and morpheme judgment tasks, suggesting that they have difficulty processing lexical and morphological information as well as phonological information. This finding is consistent with some recent data reported by James and Blachman (1985). These authors found a significant correlation between first- and second-grade children's reading performance and their ability to make grammatical corrections.

We initially thought that the LI children, because of their previous history of language impairment, would perform significantly poorer than the RI children on measures of phonological processing as well as on measures of lexical and morphological processing. To our surprise, the LI children performed significantly worse than the RI children on only three measures, all involving word and sentence repetition. The LI children performed at least as well as the RI children on the measures of phonological, lexical, and morphological awareness.

**Differentiating Language- and Reading-Impaired Children**

These findings raise questions about the distinctiveness of school-age children with a history of developmental language impairments and poor readers with no history of developmental speech-language problems. The data show considerable similarity in the types of deficiencies these children present. LI children apparently have no more difficulty than RI children accessing phonological, lexical, and morphological information. There are other indications in the literature of similarities between LI and RI children. Foremost among these is that LI children often have significant academic difficulties in elementary school, particularly in reading (e.g., Aram, Ekelman, & Nation, 1984), whereas RI children often show the same deficits in higher level language forms (e.g., narrative discourse and figurative language) that LI children exhibit (Feagans & Short, 1984; Lee & Kambi, 1985; Liles, 1985; Nippold & Fey, 1983; Roth & Speelman, 1986).

Although it is important to recognize that children with developmental language and reading impairments might demonstrate similar language and reading deficits and perform similarly on certain tasks, it is equally important to recognize that these children do not represent a homogeneous group. In the current study, for example, the LI children clearly had more difficulty than RI children encoding and producing novel multisyllabic words. Interestingly, the word repetition task seemed to provide the most direct measure of a child's ability to generate accurate representations of phonological information. Storage and retrieval demands were minimized in this task because immediate imitations were required; and although it is not possible to rule out articulatory factors, the speech production component was minimized by not penalizing children for false starts and other disfluencies. Future studies might attempt to determine why LI children had particular difficulty encoding phonological information on this task. Possibilities include low-level perceptual deficits in identifying and discriminating pho-
nemes and difficulty forming accurate representations of linguistic (or linguistic-like) information.

It should be apparent that the use of the categorical labels “language impaired” and “reading impaired” or “poor readers” emphasizes the differences rather than similarities in these children. Although it might be best to maintain a categorical distinction between LI and RI children, it might be that these children are best viewed on a continuum or as subgroups of the general group of learning-disabled children. The use of a continuum to differentiate among these children seems attractive, but there is some question about which factor should underlie it. The most obvious choice is some measure(s) of language performance. At one end of the continuum would be the language-impaired child who has had a severe expressive and/or receptive language delay in the preschool years. At the other end would be the poor reader who has had no history of language problems but is reading significantly below grade level.

This continuum notion would be quite appealing if more severe linguistic deficits were associated both with more severe reading deficits and poorer performance on factors that underlie reading, such as phonological processing. As we saw in this study, however, the performance of LI children does not offer strong support for these types of relationships. For example, the LI children performed as well as if not slightly better than the RI children on the Word Identification, Word Attack, and Reading Comprehension subtests on the Woodcock. Perhaps the continuum would work better if children were differentiated by some other factor, such as phonological processing abilities, short-term memory, or performance IQ.

It might be, however, that we need to include some discontinuities or subgroups on our continuum. Perfetti (1985), in his recent book, has suggested this possibility as one way to describe the individual differences that exist in reading ability. For our purposes, the continuum would still have LI children at one end and RI children at the other. But the LI side of the continuum would now include a subgroup of children whose reading impairment is not as severe as their language impairment, whereas the RI side would now include a subgroup of children who have only very mild language impairments but have a severe reading problem. We suspect that these discontinuities are caused by phonological processing skills that are highly correlated to reading performance but vary independently of language ability. To substantiate these suspicions, we are currently collecting more data on the phonological processing abilities of LI and RI children.

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Sentence Repetition Task

1. Have some fried flounder.
2. The spy fled to Greece.
3. He likes split pea soup.
4. Big black bug’s blood.
5. Six slim sailors.
7. Wash each dish twice.
8. Shiny seashell necklace.
9. Tom threw Tim three thumbtacks.
10. Sheep should sleep in a shed.

Sentence Division

1. Daddy fell.
2. Mommy ran home.
3. The cat left.
4. Daddy made the boat.
5. The baby was happy.
6. We saw the big tree.
7. The man came to my house.
8. Mommy put the ball in the box.

Bisyllabic Words

1. airplane
2. football
3. hotdog
4. pancake
5. doctor
6. monkey
7. pencil
8. window

Monosyllabic Words

1. plane
2. foot
3. hot
4. cake
5. doc
6. key
7. pen
8. dow

Elision

1. (t)old
2. (h)blend
3. (t)all
4. (n)ice
5. (s)top
6. (n)ear
7. (b)ring
8. (s)pin
9. (s)un(k)
10. bus(t)
11. (s)pin(k)
12. ten(t)
13. far(m)
14. car(d)
15. for(k)
16. star(t)

Segmentation

1. ap
2. em
3. niz
4. bilm
5. zan
6. ib
7. poit
8. wag
9. lcb
10. kest
11. fc
12. spat
13. piv
14. kel
15. ki
16. mk

Morpheme Judgment

Examples:

a. Eat the cake.
b. She is swinging a rope.
c. Tomorrow he go zoo.

Sentence Stimuli:

1. Steven dog was lost. (possessive -s)
2. I tried get the book. (infinitive segment to)
3. Nancy is smaller than Karen. (OK)
4. He already eaten dinner. (auxiliary has)
5. Yesterday he see a movie. (past tense -ed)
6. Kathy has three dogs. (OK)
7. John is big than Dave. (comparative -er)
8. She needs to get home. (OK)
9. He not want to play today. (auxiliary DO)
10. She walked quiet into the room. (adverbial -ly)
11. They throwing the stick. (auxiliary are)
12. Where the coat is? (auxiliary inversion)
13. Yesterday he ran to school. (OK)
14. John has two book. (plural -s)
15. Usually they walks to school. (third person singular -s)
16. The girl painted picture. (article)