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ABSTRACT—*Phonological awareness is critical for learning to read in alphabetic languages like English. This report summarizes normal development of phonological awareness as it has been revealed through recent multidisciplinary and cross-cultural research. We argue that a consensus on the definition of phonological awareness has emerged, that research has identified a general sequence of phonological awareness development that is universal across languages, and that certain characteristics of spoken and written languages influence the rate of normal development and levels of phonological awareness that are normally achieved.*

KEYWORDS—*literacy; phonological awareness*

Dyslexia is a brain-based disorder that causes individuals to struggle with learning to read, despite having normal intelligence, adequate schooling, and intact sensory abilities. Prevalence rates for dyslexia range from 5% to 10%, depending on the primary language spoken in a population and the criteria used to identify the disorder. The underlying cause of dyslexia is difficulty processing the sounds in one's language, or *phonological processing*.

Research has identified three phonological processing abilities. *Phonological memory* refers to coding information in a sound-based representation system for temporary storage. *Phonological access to lexical storage* refers to the efficiency of retrieving phonological codes from memory. *Phonological awareness* refers to one's degree of sensitivity to the sound structure of oral language. These abilities are highly interrelated, are strongly related to reading acquisition, and are highly stable individual differences from late preschool on.

Phonological awareness is the phonological processing ability most strongly related to literacy. It encompasses *phoneme awareness*, the ability to manipulate individual sounds (phonemes) in words, and rudimentary phonological skills, such as judging whether two words rhyme. Basically, individuals who have difficulty detecting or manipulating sounds in words will struggle with learning to read. Four decades of research have established this relation, and it is evident in all alphabetic languages studied to date. Moreover, randomized intervention studies demonstrate that there is a causal relationship, as intensive instruction in phonological awareness improves literacy. For example, the National Reading Panel's 2000 report to the U.S. Congress, which described a meta-analysis of 52 controlled experimental studies published in peer-reviewed journals, concluded that phonological awareness instruction has moderate and statistically significant effects on reading and spelling abilities and that explicit instruction is beneficial for typically developing children, for young children at risk for reading difficulties, and for poor readers.

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DEFINITION OF PHONOLOGICAL AWARENESS

Numerous definitions of phonological awareness have been offered, each with relatively well-developed theoretical underpinnings and some empirical support. Alternative definitions vary in generality from highly exclusive to highly inclusive of different phonological awareness skills. Phonological awareness skills are distinguished by the task performed and size of the unit of sound that is the focus of the task. Examples of different phonological awareness skills that are distinguished by the type of task performed include blending sounds together, separating (segmenting) words into their constituent sounds, recombining sounds of words, and judging whether two words have some sounds in common. Distinctions among phonological awareness skills based on unit of *word structure* include whether syllables are the focus of the task or whether smaller intrasyllabic units, like onsets, rimes, or phonemes, are the focus. The *onset* is the initial consonant or consonant cluster present in many, but not all, English syllables; the *rime* is the remaining vowel and consonants. (For example, in the word *spin*, *sp* is the onset; *in* is

the rime; and /s/, /p/, /I/, and /n/ are the phonemes.) Debate over which phonological skills belong to the construct of interest has directly influenced literacy curriculum and instruction, with some curricula emphasizing phoneme awareness and reading by sound–letter correspondences and other curricula emphasizing onset–rime awareness and reading by rime analogies (e.g., reading a new word, like str*ing*, by analogizing from familiar words that have the same rime unit, like s*ing* and w*ing*).

Methodologically sound studies using large samples, multiple measures, and advanced statistics support a unified phonological awareness construct—that is, phonological awareness as a single cognitive ability that manifests behaviorally in a variety of skills. Anthony et al. (2002) used confirmatory factor analysis and a factorial design that crossed word structure and task to demonstrate that a one-factor model best characterized the phonological awareness skills of 258 2- to 5-year-old children. Anthony and Lonigan (2004) reported four independent confirmatory factor-analytic studies that yielded similar findings with over 1,200 2- to 8-year-old children. A unified phonological awareness ability was also supported by two recent studies employing item response theory. One studied 945 elementary school children (Schatschneider et al., 1999), and another studied over 1,100 preschool children (Anthony et al., 2003). Moreover, latent-variable longitudinal research using structural equation modeling consistently reports near-perfect stability of individual differences in phonological awareness across time and across different phonological awareness skills (e.g., Anthony & Lonigan, 2004).

In summary, persuasive evidence now exists that phonological awareness is heterotypically continuous. That is, phonological awareness is a single, unified ability during the preschool and early elementary school years that manifests itself in different skills throughout a person's development. Thus, there is consensus that phonological awareness refers to one's ability to recognize, discriminate, and manipulate the sounds in one's language, regardless of the size of the word unit that is the focus.

GENERAL SEQUENCE OF PHONOLOGICAL AWARENESS DEVELOPMENT

Research has uncovered the general sequence of phonological awareness development. Many tests of phonological awareness have been administered to people of different ages, reading levels, and languages. Two overlapping patterns of development are evident. First, children become increasingly sensitive to smaller and smaller parts of words as they grow older. Children can detect or manipulate syllables before they can detect or manipulate onsets and rimes, and they can detect or manipulate onsets and rimes before they can detect or manipulate individual phonemes within intrasyllabic word units. Second, children can detect similar- and dissimilar-sounding words before they can manipulate sounds within words, and children can generally blend phonological information before they can segment phonological information of the same linguistic complexity (Anthony et al., 2003). Finally, children refine phonological awareness skills they have already acquired while they are learning new phonological awareness skills (Anthony et al., 2003), contrary to a strict stage theory of development.

ORAL-LANGUAGE EFFECTS ON PHONOLOGICAL AWARENESS DEVELOPMENT

Although phonological awareness development from large units of sound to small units of sound is universal across languages, the rate that populations of speakers of different languages progress through the sequence and the proficiency they achieve at each level vary. Systematic language-related differences and the fact that early forms of phonological awareness develop prior to literacy instruction suggest that experiences with oral language play an important role in developing phonological awareness. A number of determinants of the linguistic complexity of a spoken language—e.g., saliency and complexity of word structures, phoneme position, and articulatory factors—appear to influence phonological awareness development. Through examining effects of these linguistic properties on the phonological awareness proficiencies of people who speak different languages, investigators have begun to uncover the characteristics of oral language that foster development of particular phonological awareness skills.

Children in linguistic environments where spoken syllables are highly salient, as determined by a number of factors including clarity of boundaries between syllables, develop syllable awareness sooner than children in linguistic environments where syllables are less salient. For example, children who speak Turkish, Greek, or Italian attain syllable awareness more quickly than children who speak French or English (Cossu, Shankweiler, Liberman, Katz, & Tola, 1988; Demont & Gombert, 1996; Durgunoglu & Oney, 1999). A likely explanation is that Turkish, Greek, and Italian have relatively simple syllable structures (few consonant clusters), more limited vowel repertoires, and better-marked syllable boundaries than French and English do.

Saliency and complexity of onsets in spoken language may influence the development of onset awareness and phoneme awareness. Caravolas and Bruck (1993) found preliterate English-speaking children were better than preliterate Czech-speaking children at isolating *singleton onsets* (onsets with one consonant), which is an onset–rime awareness skill. In contrast, Czech-speaking children were better at isolating initial phonemes from *cluster onsets* (onsets with more than one consonant), which is a more advanced phoneme-awareness skill. These findings are consistent with the phonological characteristics of the two languages: Czech has 258 different cluster onsets that occur more frequently than the 31 cluster onsets in English. Thus, frequency of exposure to and/or variety and complexity of cluster onsets in oral language may guide children to become

relatively more or less sensitive to onsets than to phonemes within onsets.

Vowel and consonant harmony likely influence the development of phoneme awareness. Vowel and consonant harmony are phonological rules present in some languages that require vowels or consonants within a word to belong to a particular class of vowels or consonants. Vowel and consonant harmony result in mellifluous spoken languages in which there are multiple forms of each prefix and suffix that must be selected based on phonetic harmony with the root. For example, in Turkish, plurals are formed by adding the suffix *ler* or *lar*, depending on whether the vowel in the root is formed in the front or back of the mouth. The constant monitoring and manipulation of phonemes in roots, prefixes, and suffixes that is required to achieve vowel and consonant harmony may force very young children to become sensitive to phonemes. Indeed, kindergarten children who speak Turkish, which requires vowel harmony and in which multiple suffixes are stringed together, are better at deleting the final phoneme from words than are kindergarten children who speak English, which does not require vowel harmony (Durgunoglu & Oney, 1999).

One way to index the saliency of a linguistic unit in a language is by the number of *phonological neighbors*—words in the language that share a same-sounding unit—relative to the number of words in the same language that share other same-sounding units. For example, the English words br*ight*, k*ite*, and h*eight* are phonological rime neighbors because they share a same-sounding rime. There are proportionately more rime neighbors in English than body neighbors, i.e., words like *ca*t, *ca*b, and *ca*lf that share a same-sounding onset and vowel combination called a body. Children who speak languages with a greater proportion of rime neighbors than body neighbors develop onset–rime awareness prior to body–coda awareness (the coda usually being the terminal consonant or consonant cluster). For example, English, French, Dutch, and German children learn to segment a consonant–vowel–consonant (CVC) syllable into onset and rime (C–VC) before they learn to segment a CVC syllable into body and coda (CV–C; Ziegler & Goswami, 2005). In contrast, young Japanese children may develop body–coda awareness before onset–rime awareness (Inagaki, Hatano, & Otake, 2000), consistent with Japanese speakers' preference for morae, which roughly correspond to bodies, over rimes.

Determinants of linguistic complexity other than word structure also influence phonological awareness. Although often confounded with word structure, the position of a phoneme in a word contributes to the difficulty of phoneme-awareness items. There is evidence of an independent phoneme-position effect, in that children learn to identify or manipulate the initial consonant in a cluster onset (e.g., *c*rest) or the final consonant in a cluster coda (e.g., cres*t*) before they can identify or manipulate the medial consonants (e.g., *c*r*e*st).

The development of phoneme awareness is also affected by articulatory factors that contribute to linguistic complexity of words. *Manner* of articulation refers to the direction of air or voice emission from the vocal tract or the degree of narrowing of the vocal tract. The easiest consonants to attend to are *liquids* (sounds like /r/ and /l/ that are made with the soft palate raised), followed by *nasals* (sounds like /n/ and /m/, made by closing the oral cavity and allowing air to pass through the nose) and *glides* (sounds like /w/, made by movement of an articulator), and lastly *obstruents* (sounds like /p/, /f/, and the "j" sound /dʒ/, formed by obstructing the airway). Manner interacts with the location of phonemes to determine the difficulty of separating cluster onsets and cluster codas (Treiman, 1984). Children develop sensitivity to differences in *placement* of articulation, the location along the vocal tract where the tract is occluded or narrowed, before they develop sensitivity to differences in phoneme voicing (Treiman, Broderick, Tincoff, & Rodriguez, 1998). Phonemes are either *voiced* or *voiceless* depending on whether or not they are produced with vibration of the vocal folds (e.g., voicing differentiates /f/ from /v/). Finally, it is easier to attend to voiceless consonants than to voiced consonants, at least in spelling tasks that require phoneme awareness and other competencies (Stage & Wagner, 1992).

WRITTEN-LANGUAGE EFFECTS ON PHONOLOGICAL AWARENESS DEVELOPMENT

Children's experiences with written language dramatically influence phonological awareness development, especially the development of phoneme awareness. Most children achieve minimal levels of phoneme awareness prior to literacy instruction. Learning the names of letters and the sounds they represent provides a concrete way to attend to phonemes, given that phonemes do not have physical reality independent of each other. That is, phonemes produced in speech are acoustically inseparable because adjacent phonemes are coarticulated.

Phonological awareness typically develops quickly once literacy instruction begins. This is especially true for children learning to read an alphabetic language that has transparent orthography—consistent spelling-to-sound relations and consistent sound-to-spelling relations. For example, German children in their first year of schooling develop phoneme awareness more quickly than do English children in their first year of schooling, in accord with the more transparent orthography of German. Furthermore, phonological awareness deficits of dyslexic children disappear if these individuals read a transparent orthography like Dutch (DeJong & VanDerLeij, 2003), but phonological awareness deficits of dyslexic children persist into adulthood if these individuals read an inconsistent orthography like English. Additionally, literate individuals have a difficult time counting phonemes in a word if the number of letters and phonemes differ. Literate people also have more difficulty judging whether two words rhyme if the words are spelled differently (e.g., *rye–tie*) than they do if the words are spelled similarly (e.g., *pie–tie*). These and similar findings indicate that the consistency of spelling-to-sound and sound-to-spelling

relations in a language influences the rate at which its speakers develop phonological awareness.

The relation between learning to read and developing phonological awareness is reciprocal (Perfetti, Beck, Bell, & Hughes, 1987). Children's preliterate phonological awareness and the phonological awareness they develop while learning the names and sounds of letters in their alphabet help children learn to read. This facilitative effect of phonological awareness is strongest during the period in which children learn to "break the alphabetic code," which normally takes 1 to 3 years depending on the orthographic transparency of the written language. In turn, reading and writing provide feedback that influences individuals' phonological awareness development.

CONCLUSION

Phonological awareness plays an important role in literacy acquisition. Recent research shows that it is a single, unified ability that manifests itself in a variety of phonological skills that emerge in a predictable sequence. Along with genetics, intelligence, memory, and vocabulary, experiences with oral and written language influence the rate at which individuals develop phonological awareness and the levels they attain. This developmental, psycholinguistic conceptualization of phonological awareness has significant implications for assessment of phonological awareness, diagnosing educationally relevant cognitive and achievement weaknesses, early intervention aimed at preventing dyslexia, curriculum design, and instruction. To optimally index phonological awareness, one should administer a test that spans either multiple levels of linguistic complexity or multiple levels of task complexity, or both. The reason being that, while all tests tend to measure phonological awareness, the most valid and most reliable estimates of ability will be those obtained when there is a match between the particular phonological awareness skills assessed and a given child's level of phonological development. Optimized assessment will improve early identification of children at risk for reading problems, educational diagnosis, instructional planning, and resource allocation. Another exciting implication of our broad, but unified, developmental conceptualization of phonological awareness is that developmentally appropriate intervention can be administered to young children at risk for reading problems long before they actually struggle with learning to read. Indeed, randomized intervention studies with prereaders have demonstrated that phonological awareness training, especially when combined with instruction in letter knowledge, leads to longstanding improvements in phoneme awareness, reading, and spelling. Finally, it follows from the developmental, psycholinguistic conceptualization of phonological awareness that literacy instruction may prove most successful if particular phonological awareness skills, spelling patterns, and word-reading strategies are linked and taught in a systematic, developmentally sensitive order.

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