PHONOLOGICAL AWARENESS AND LEARNING TO READ A FIRST LANGUAGE: CONTROVERSIES AND NEW PERSPECTIVES

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1 Phonological Awareness, an Important Early Step in Learning to Read

There is a growing consensus among researchers that basic difficulties in learning to read and spell stem from weaknesses in alphabetic and phonological coding (Adams, 1990; Vellutino, Fletcher, Scanlon, & Snowling, 2004). [2] For the purposes of learning to read an alphabetic script, the learner has to find a way to translate or decode the letters on the page into sounds, a skill that is referred to as alphabetic coding. This insight into the connection between print and speech obviously requires knowledge of the letter symbols and sensitivity to the organization of letters and written words – *orthographic awareness,* for instance that the script runs from left to right. However, someone who knows the letter <p> but lacks the understanding that this letter both represents the first sound in *pan* and the last sound in *lip*, will still not be able to establish a precise connection between the grapheme and phoneme and vice versa. Research of more than two decades has documented that a crucial phonological skill for the beginning reader is the insight into how spoken words are structured and composed of individual sounds and combinations of sounds, i.e., *phonological awareness*. Orthographic awareness and phonological awareness crucially depend on each other and ultimately work in concert to help the learner break the code of an alphabetic writing system.

The study on phonological awareness is the most thoroughly developed body of research on phonological processing skills (Wagner & Torgeson, 1987). Many researchers have reported that tests of phonological awareness account for relatively large amounts of variance in reading skill even after the effects of age and IQ have been taken into account (see Goswami & Bryant (1990) for a review). Evidence from intervention studies furthermore shows that direct training designed to facilitate phonological awareness in combination with the teaching of grapheme-phoneme correspondences has a beneficial effect on word identification, spelling, and reading ability in general (e.g., Hatcher, Hulme, & Ellis, 1994). In addition, poor readers have consistently been found to perform below the level of normal readers on phonological awareness tasks (Hulme, Snowling, Caravolas, & Carroll, 2005). Difficulties in acquiring phonological awareness and skill in alphabetic coding are believed to be due, in many cases, to weak phonological coding characterized by poor quality of the underlying sub-lexical phonological representations (Griffiths & Snowling, 2002).
However, despite the well-documented link between phonological awareness skills and learning to read, many questions about the nature of this link, the definition of the

[2] This research was funded by the Fund for Scientific Research (Belgium).

concept phonological awareness and its developmental sequence have remained unclarified. This paper aims to address some of these controversial issues in order to increase insight into the complex relationship between phonological awareness and learning to read. A flexible perspective on phonological awareness development will be proposed in which the importance of language-specific, orthography-specific, but also task-specific and material-specific factors is emphasized (see also Geudens *et al.*, 2005, for further details).

2 Ambiguity in Defining Phonological Awareness

A first problem regarding the relationship between phonological awareness and learning to read is that tasks that have been used to assess phonological awareness come in great variety. They differ in terms of the required operation (e.g., blending sounds versus isolating sounds), the degree of consciousness (e.g., recognition versus explicit identification of sound units), the level of representation that needs to be manipulated or is tapped in the task (e.g., the syllable versus phoneme level). Additionally, the stimuli that are presented in the tasks strongly vary in terms of complexity (e.g., CVV versus CCVCCVC items) and phonemic make-up (e.g., stops versus nasal consonants). The tasks themselves involve many sub-tasks each requiring different skills such as listening, holding in memory, performing an operation and communicating the results of this operation. As a consequence of this great variety, many different characterizations of phonological awareness have been offered, making it difficult to integrate the available data within a clearly articulated theoretical framework (see also McBride-Chang, 1995; Morais, 2003).

Some, the most stringent, definitions of phonological awareness solely focus on conscious manipulations of the smallest individual segments, a skill that is for instance required in segmentation tasks in which children have to articulate the sequence of individual sounds (e.g., "Tell me which sounds you hear in *cat*"). The rationale is that graphemes correspond to individual phonemes and that only manipulations of individual segments help the learner to acquire abstract representations of phonemes. Other definitions focus on a capacity to consciously isolate words at multiple linguistic levels, also including larger units than the phoneme. For example, Swank & Larrivee (1998) describe the concept phonological awareness as "the ability to consciously think about and perform mental operations on speech-sound units, such as segmenting, blending, deleting, and changing the order of speech-sound sequences" (p. 264). According to Morais and colleagues (Morais, 1991), a participant who can indicate which two of three words rhyme would not be considered phonologically aware unless he or she could identify the unit that is identical in the two rhyming words (Adrián, Alegria, & Morais, 1995). The reason is that only the latter skill would involve conscious representations of phonological units. On the contrary, still other definitions of phonological awareness include all levels of access to multiple linguistic units. For instance, Goswami & Bryant (1990) argue that "a child who recognizes that two words rhyme and therefore have a sound in common must possess a degree of phonological awareness, even if it is not certain that this child can say exactly what is the sound that these words share" (p. 3).

These different characterizations of phonological awareness, appealing to distinct degrees of complexity, consciousness, and representations clearly make it difficult to

interpret conclusions about phonological awareness skill. Part of the difficulty also lies in the term "awareness". Because this term is so well entrenched in the literature, numerous researchers refer to good performance on, for instance, rhyme detection or judgment tasks as "onset-rime awareness" (e.g., Goswami *et al.*, 2002:10911), which may be misleading. If one defines "phonological awareness" in more general terms as a capacity to pay attention to spoken utterances, there is no problem in referring to detection and judgment tasks as measures of phonological awareness. However, in that case, one should not ignore that pre-readers' conscious attention to sounds may not refer to the phonological units that are manipulated in the task but may instead be directed to the acoustic shape of the global utterance (see Geudens, 2003; Geudens, Sandra, & Martensen, 2005). For instance, in order to discriminate the odd word out in the list *top*, *rail*, *hop* (from Kirtley, Bryant, MacLean, & Bradley, 1989), most researchers would agree that this involves conscious attention to the "sound" of the words, to the utterances as a whole. However, as the odd word *rail* differs from the other two words in terms of global acoustic properties, it is doubtful whether conscious representations of the non-rhyming and rhyming units are involved (Cardoso-Martins, 1994; Geudens *et al.*, 2005; Jusczyk, Goodman, & Baumann, 1999; Morais, 1991).

In this context of terminological vagueness, some researchers have suggested using the terms "implicit awareness" and "explicit awareness" to distinguish between levels of recognition and levels of identification (see Goswami & East, 2000; Hulme *et al.*, 2002). Yet, this proposal raises problems as well since "awareness" inherently involves "consciousness" whereas the term "implicit" refers to an unconscious level. Researchers such as Stanovich (2000) have asserted that the construct of phonological awareness should be divorced from the idea of consciousness, inherently involved in the term "awareness". He has suggested using the term "phonological sensitivity" instead as a continuum from a shallow sensitivity of large phonological units to a deep sensitivity of small phonological units. One may compare Stanovich's notion "phonological sensitivity" with Gombert's (1992) "epiphonological behaviour", a functional knowledge of phonological organization that is not accessible to conscious awareness (see pp. 35-36). This general definition includes phonological skills, involving manipulation and judgments of any unit of word structure (Anthony & Lonigan, 2004).

Whichever terminology one chooses, the crucial objective will be to use clear definitions and unambiguous descriptions of the cognitive demands of the experimental task in order to avoid interpretational problems. For the sake of continuity, I will refer to "phonological awareness" in this paper in a general sense as an umbrella term and use the term "sensitivity" instead of "awareness" to refer to tasks that do not require breaking up the speech stream intentionally (cf. implicit phonological knowledge). The term "explicit phonological awareness" will be used whenever I refer to tasks that require the ability to break up the continuous speech stream and identify and isolate phonological units intentionally (cf. explicit phonological knowledge).

3 Questions about Standard Views on Phonological Awareness Development

3.1 The Linguistic Onset-Rime View as a Model of Phonological Development?

A second controversial issue in the literature on phonological awareness and learning to read is the sequence in which phonological awareness skill develops. The most

widespread idea is that the development of phonological awareness parallels the linguistic onset-rime view of the syllable (see Ziegler & Goswami (2005) for a review). In this view on syllable structure, spoken syllables are not simply strings of individual consonants and vowels but are grouped into two constituents: the onset and rime. As illustrated in Figure 1, the onset is typically defined as the initial consonant or consonant group before the vowel. The rime, in turn, is generally defined as the group combining the nucleus and the coda.

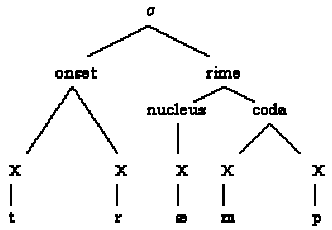


Figure 1: The onset-rime structure of the word tramp /træmp/

A crucial aspect of the linguistic onset-rime structure is that it entails a stronger cohesion between the segments within the onset and rime constituents (e.g., between /tr/ and /æmp/) than between the onset and the following vowel, the CV or body (e.g., between /træ/ and /mp/, Fudge, 1987:359). These cohesion differences have a linguistic reality, as there are more restrictions on the combination possibilities of phonemes within the onset and rime than between these units. For instance, the English phoneme /r/ can occur before /æ/ (e.g., in *rap*) but not after /æ/. Although linguists have proposed alternative theories to describe internal syllable structure (e.g., Yip, 2003), the onset-rime model is accepted as a standard theory at least in Germanic and Romance languages (see Geudens (2003) for an overview).

Research has demonstrated that, in addition to linguistic relevance, the onset-rime structure may have behavioral relevance for language users (see Treiman & Kessler, 1995, for a review). By far the most cited evidence for the special role of the onset-rime distinction has come from similarity judgment or detection tasks involving alliteration and rhyme. According to a majority of linguists and psycholinguists, children's and adults' widely acknowledged facility with rhyme is readily explained by the onset-rime distinction, because rhyming words are words with common rimes (Goswami & Bryant, 1990; Treiman, 1992). This body of evidence has formed the input to one of the key proposals in the literature on children's phonological awareness and learning to read (Vihman, 1996:177), i.e., that the development of phonological awareness parallels the linguistic onset-rime model of the syllable from syllables, over onsets and rimes, to phonemes. Access to the higher and larger onset-rime units would develop naturally, whereas access to the lower level of phonemes would require at least some experience with letters and print, be it rather rudimentary.

A demonstration that has been regarded as key evidence for this proposal is that preliterate children and illiterate adults who have very low letter knowledge and no reading ability do not seem to be able to manipulate phonemes while abilities like rhyming or manipulation of syllables are easier to handle (e.g., Kurvers, Van Hout, & Vallen, this volume; Morais *et al.*, 1979; 1986). An often-cited illustration is offered by Morais and colleagues (1979; 1986) in Portuguese illiterate adults. Although most of

illiterate adults could not delete the initial consonant from an utterance or detect a particular phoneme in an utterance, they performed much better when the critical unit was a syllable. Interestingly, they also scored above chance-level in a rhyme detection task. This latter observation that rhyming sensitivity develops naturally in pre-readers has been taken to suggest that the capacity to recognize and produce rhyme is a crucial stepping stone in the development of phonological awareness.

Researchers like Goswami & Bryant (1990) not only argue that children gain access to phonological onsets and rimes at an early stage, but also that "onset-rime awareness" as measured in alliteration and rhyme oddity tasks is significantly related to subsequent measures of phoneme awareness and early signs of reading and spelling (see also e.g., Bradley & Bryant, 1983; Kirtley *et al.*, 1989; but see Hulme *et al.* (2002) for critical comments). The onset-rime view that linguists once proposed to describe syllable structure has grown into a standard view on how children and adults become aware of the phonological structure of words.

3.2 Does onset-rime awareness precede phoneme awareness?

However, despite its widespread character, the onset-rime view on phonological development is not uncontroversial (see also Geudens & Sandra, 2003; Geudens, Sandra, & Van den Broeck., 2004; Geudens *et al.*, 2005). One of the points of discussion is the general claim that children can develop "onset-rime awareness" before the outset of reading whereas phoneme awareness develops partly as a result of learning to read. Yet, a problem in many of these studies is that the cognitive demands of the task and the size of the linguistic unit are frequently confounded. Children's "awareness" of onsets and rimes is typically explored in rhyme judgment or matching tasks, whereas phoneme awareness is typically studied in more difficult tasks involving the segmentation or deletion of sounds. However, explicit access to onsets and rimes in tasks such as segmentation and deletion may actually require much more experience with print and letters than is commonly assumed.

In this respect, Duncan and colleagues have argued that explicit phoneme awareness even emerges prior to explicit awareness of the larger onset-rime units (Duncan, Seymour, & Hill, 1997; Seymour, Duncan, & Bolik, 1999, see also Nation & Hulme, 1997). In a longitudinal study on the influence of phonological awareness on early reading development of Scottish children, Duncan *et al.* (1997), for instance, reported that five-year-old children found it easier to identify the common phonological unit in an auditory pair when it constituted a single phoneme (e.g., *face – food*) than when it constituted the rime (e.g., *lace – face*). Children displayed this pattern of performance regardless of their preschool rhyming skills. The authors concluded that smaller units of sounds are more easily identified than larger rime units in tasks tapping explicit phonological awareness and that there is progression from small units to larger units as reading development proceeds (but see Goswami & East, 2000).

Duncan *et al.*'s (1997) findings are constructive. However, one has to be careful in drawing conclusions. The observation that beginning readers find it more natural and even easier to segment a word like *cat* into onset-rime sized units (e.g., *c-at*) than into phoneme sized units (e.g., *c-a-t*) does not necessarily support a small-to-large unit development of phonological awareness. When different segmentation operations are required, i.e., at the phonemic segment level, at the onset-rime level, etc., a preference

for "phoneme"[3] segmentation may be reported because this is exactly the type of exercise that is abundantly practiced in class, whereas the children are unacquainted with onset-rime manipulations. Hence, although the small to large development that Duncan *et al.* (1997) suggest may indeed be a good characterization of the development of grapheme to phoneme mappings in reading (Morais, 2003), it remains unclear whether this account reflects spontaneous phonological development.

An illustration may be found in a phoneme segmentation study that we conducted with 60 Dutch-speaking first-graders in Flanders (Geudens & Sandra, 2003). The children (mean age 6;7) had received instruction about letters and sounds and were acquainted with phoneme segmentation exercises in class as part of the phonics reading curriculum. For instance, the teacher presented a word on a board and the children had to clap their hands for each individual grapheme/phoneme in the word and name the letters simultaneously. In these exercises, no emphasis on larger units such as the rime or the CV (body) was included. In the experiment, children had to listen to a CVC pseudoword (e.g., /fo:t/), repeat it and also pronounce the small sounds/letters in it while clapping their hands for each sound simultaneously. Many first-graders failed to isolate all three phonemes and spontaneously left a larger unit intact (e.g., they produced /fo:/-/t/). This indicates that they naturally found it easier to isolate larger subsyllabic units than smaller subsyllabic units. Interestingly, the results indicated that these larger units need not by any means correspond to onsets and rimes: When first-graders failed to isolate all three phonemes in the CVC, the CV was left intact significantly more often (e.g., /fo:/-/t/) than the rime (e.g., /f/-/o:t/; see also Duncan *et al.*, 1997). I will come back to this finding in Section 3.4.3.

In sum, at least in languages like English and Dutch, there seems to be a developmental progression in the phonological domain from larger to smaller phonological units (Ziegler & Goswami, 2005; but see Duncan *et al.*, 1997). Yet, although rhyming sensitivity may develop in the absence of print experience, at least some level of letter knowledge and print experience is necessary not only for the ability to isolate segments but also to isolate onsets and rimes at an explicit level. In this sense, the claim that "onset-rime awareness" develops before the outset of reading whereas phoneme awareness develops partly as a result of learning to read may be misleading (see also Geudens *et al.*, 2005). As mentioned before, it is doubtful that tasks tapping rhyming skill involve "onset-rime awareness" in the exact sense of the word. If one wishes to make a comparison between the phoneme and onset-rime level, care should be taken not to confound linguistic unit size with the cognitive demands of the task.

3.3 Is Sensitivity to Rhyming Words a Better Predictor of Learning to Read than Phoneme Awareness?

Another related controversy is the question whether rhyming sensitivity, mostly referred to as "onset-rime awareness", is a better predictor of learning to read than phoneme awareness. Researchers such as Goswami & Bryant (1990) emphasize the importance of rhyming skill because awareness of phonemes would develop partly as a

[3] The term "phonetic segment isolation" may be a more proper alternative to refer to the task at this early stage than the term "phoneme segmentation" as the children's knowledge may reflect phones rather than abstract phonemes (see also Content, Kolinsky, Morais, & Bertelson, 1986; Geudens *et al.*, 2004).

consequence of learning to read. They conceptualize phonological awareness as a unitary, single developing phonological ability with continuity between rhyming skill and phonemic awareness (see also Anthony & Lonigan, 2004; Stanovich, 2000; Stahl & Murray, 1998). However, the recognition that detection tasks involving alliteration and rhyme have a non-analytical character and require a much lower level of attention than phoneme segmentation tasks, has motivated researchers like Muter and colleagues (Hulme *et al*., 2002; Muter, Hulme, Snowling, & Taylor, 1998; Nation & Hulme, 1997) to propose that alliteration and rhyme detection tasks involve a phonological ability that is distinct and independent from the phonological ability in phoneme segmentation tasks. The separate phonological ability model is supported by demonstrations that individual differences in phoneme identification and manipulation prove to be a more powerful predictor of individual differences in learning to read than rhyme skills. For instance, in a two-year longitudinal study of four-year-olds, Muter and colleagues (1998) observed that performance on rhyme detection and rhyme production tasks was relatively independent from performance on phoneme identification and phoneme deletion tasks as revealed in factor analyses. Explicit phoneme awareness tasks were strongly predictive of reading and spelling at the end of the first year at school, while tasks involving rhyming skill were not (but see Anthony & Lonigan, 2004, for comments). Adherents of the separate phonological ability model also report evidence from studies showing that dyslexics show deficits on phonemic awareness tasks such as phoneme deletion compared to chronological age and reading age controls whereas they perform as well as chronological age and reading age controls on tasks involving rhyme detection or rhyme judgment (e.g., De Jong & Van der Leij, 2003).

According to Anthony & Lonigan (2004), the distinguishability of rhyming sensitivity from more advanced forms of phonological sensitivity in older children could be a measurement artifact as many older children perform at near ceiling levels on tasks like rhyme matching, rhyme oddity, alliteration matching, and onset-rime blending. Such ceiling effects may render tasks unable to differentiate children at the upper end of the distribution of phonological sensitivity (see also Ziegler & Goswami, 2005). Consequently, the perfect relation between latent rhyme sensitivity and other phonological sensitivity variables may be attenuated (but see Hulme *et al*., 2002).

Whichever view one wishes to adopt, a learner who wants to break the code in an alphabetic writing system eventually needs to push down to the level of the phoneme, because this is the code that is represented by the graphemes and necessary for the discovery of the alphabetic principle and the formation of fine-grained associations between the written and spoken forms of words in long-term memory (Perfetti, 1992). Nevertheless, attention to global acoustic shapes and rhyming sensitivity could be an early manifestation of the same ability that underlies phoneme awareness and plays an important role in learning to read. Another interpretation is that as children's phonological sensitivity develops, it differentiates into rhyming sensitivity and more advanced forms of phonological sensitivity (Anthony & Lonigan, 2004).

Three further remarks are in order. Firstly, many scholars discussing the debate about the importance of rhyming skills versus phoneme awareness skills translate this debate into a discussion about which phonological units are more relevant for learning to read: onset and rime units versus phoneme units. However, this reasoning is not applicable unless onset-rime effects and phoneme effects are compared within the same task (see also earlier comments in Section 2). Secondly, as pointed out in the previous section, if rhyming sensitivity is an early manifestation of the same ability that underlies

phoneme awareness, the same could hold for sensitivity to similarities based on other large phonological units such as the CV, units that do not form part of the common onset-rime structure (Duncan *et al.*, 1997; Geudens *et al.*, 2005; Morais, 2003). Still, this latter possibility is ignored by most researchers in the field.

3.4 The Importance of Language-Specific, Orthography-specific, Task- and Material-specific Factors

Besides interpretational questions about the natural progression of phonological awareness from onset-rime to phoneme units, one could also raise fundamental questions about the general onset-rime view on phonological development. Given the strong emphasis on onsets and rimes and rhyming sensitivity, many researchers consider the onset-rime view as the starting point for the study of phonological awareness, even in languages with completely different phonological characteristics than English (e.g., Chan, Hu, & Wan, 2005; Leong, Tan, Cheng, & Hau, 2005). Nevertheless, a critical analysis of the evidence reveals more ambiguities and problems for the onset-rime view than is commonly believed. In the following discussion, I will point out some of these issues and propose a new flexible perspective in which language-specific, orthography-specific, but also task-specific and material-specific factors are emphasized (see also Geudens *et al.* (2005) for further details).

3.4.1 Phonological Characteristics

Research has demonstrated that phonological characteristics of a spoken language have an effect on phonological development (e.g., Caravolas & Bruck, 1993; Goetry, Kolinsky, & Mousty, 2002). For instance, Caravolas & Bruck (1993) suggested that the nature of the Czech phonological lexicon with a large variety of consonant cluster onsets enhances phonological awareness at the difficult individual phoneme level compared to the English phonological lexicon with less complex cluster onsets. In their phoneme deletion task, Czech children found it easier to delete the first consonant in a nonword with a cluster onset than Canadian children (86% versus 39%). Such findings suggest that the salience of particular phonological units in a language may be an emergent property of the distributional structure of the language's phonological lexicon (Kubozono, 1996; Treiman, Kessler, Knewasser, Tincoff, & Bowman, 2000). This view implies that the special character of rhyme as observed in many Germanic and Romance languages such as English, Dutch, German, and French (De Cara & Goswami, 2002; Ziegler & Goswami, 2005) does not necessarily transfer to a different language with different distributional characteristics. For instance, in a language like Korean, where most syllables have a CV-structure, there is no rhyming poetic tradition. Korean uses the syllable rather than rhyming elements as a counting metric (Yoon & Derwing, 2001). Languages like English and Dutch, on the other hand, show a tendency to constrain combinations of segments within the rime unit, thus contributing towards making monosyllabic words more similar at the rime level than at the CV level[4]

[4] For instance in a reference lexicon of 2671 Dutch words, Martensen *et al.* (2000) observed that only 23% of the possible combinations of nuclei and codas occurred as rimes whereas more than 40% of the possible combinations of onsets and nuclei actually occurred as CVs in the phonological lexicon.

(Kessler & Treiman, 1997; Martensen, Maris, & Dijkstra, 2000). As a consequence of this high rime-redundancy in the phonological lexicon, many phonological neighbors also rhyme. Consider, for instance, a monosyllabic word with a particular rime and CV. Given a random selection of another word in a language with a rime-biased phoneme distribution, there is a higher chance that this word contains the same rime than the same CV. Given the rime-biased lexicon and the resulting rhyme culture (De Cara & Goswami, 2002), English and Dutch language users may experience items with rime and onset overlap as especially salient whereas Korean language users may find sound similarities based on the CV more salient (Yoon & Derwing, 2001). Supporting this view, Yoon, Bolger, Kwon, & Perfetti (2002) demonstrated that when native Korean adult speakers rated the sound similarity of CVCs, they showed a preference for CV-sharing pairs (e.g., /pan/-/pat/), whereas American speakers preferred rime-sharing pairs (e.g., /pan/-/tan/) (see Yoon & Derwing (2001) for similar findings). These findings imply that when one wants to measure a learner's level of phonological awareness it is crucial to take into account the language's phonological structure. If one is for instance interested in the phonological skills of a Korean learner and uses a rhyme judgment task as a measure of phonological sensitivity – based on the general view in the literature and not taking into account the language's characteristics – the results may actually underestimate the level of phonological sensitivity.

It should be emphasized, however, that the predominance of a statistical pattern in the phonological lexicon of a language does not necessarily lead to a particular representational structure which is then used for organizing all spoken items in all tasks (see also Kubozono, 1996). On this view, the special sensitivity to rime units in languages like English and Dutch do not necessarily reflect a fixed onset-rime structure of spoken syllables. For instance, Geudens and colleagues (2005) demonstrated that although Dutch-speaking pre-readers (mean age 5;6) were indeed most sensitive to similarities at the rime level in a similarity judgment task (e.g., /fɑs/-/mɑs/ or /fɑs/-/fɑk/?), they did not consider rimes to have a special status in tasks without rhyming words. In a syllable recall task (e.g., /tɛf/, /rɪs/, /nɑl/), the children were as likely to produce recombination errors that broke up the rime (e.g., /tɛs/) as errors that retained the rime (e.g., /rɛf/). Thus, a rime effect was obtained in a task that highlighted the phonological similarity between items sharing their rimes, but this effect disappeared in tasks without repetition of rime units. This pattern seems to suggest that the special character of rimes in languages like Dutch and English may actually be based on similarity relations and may not reflect a fixed perceived structure of spoken syllables (see Geudens *et al.*, 2005, for further comments).

3.4.2 The Nature of the Orthography

Besides phonological characteristics, the orthography of a particular language could also have an impact on phonological development. As different orthographies have different rules for mapping written symbols onto sounds, the consistency of such mappings in a given language may influence how a learner's phonological awareness development proceeds. Ziegler & Goswami (2005) have referred to a similar proposal as the "psycholinguistic grain size theory". To illustrate, English has an opaque or a deep orthography in which the relationships between graphemes and phonemes are inconsistent and many exceptions are permitted. The grapheme <ou>, for instance, has many different pronunciations as *cousin*, *cough*, *soul*, *would, wound*. As a result, in

transparent languages like Italian, German, and Dutch, the phoneme unit may become a highly salient unit much sooner than in languages with an opaque relationship between the spelling and sound system. Indeed, learners of transparent languages generally perform much better on phoneme segmentation and deletion tasks at an earlier age than learners of English (see Ziegler & Goswami, 2005, Table 1).

For learners of non-alphabetic scripts, like Chinese or Japanese Kana, tasks requiring explicit awareness of the smallest segment level are even harder to perform than for learners of English (Sproat, 2005). For example, a vowel reversal task in which a stimulus like /poki/ has to be transformed into /piko/ is very hard for literate speakers of Japanese to do, though it is quite easy for literate speakers of English. Interestingly, in contrast to what has been demonstrated for segment awareness and sensitivity to rhyming words, the ability of speakers to manipulate syllables (e.g., transforming /poki/ into /kipo/) seems to be unaffected by the writing system one learns and can also be handled by adult illiterates (Prakash, Rekha, Nigam, & Karanth, 1993).

It is important to emphasize that the ability to achieve phoneme awareness should not be considered as a mere epiphenomenon of learning an alphabetic script as illustrated by Sproat (2005) in Indic participants. Indic scripts are often taught as syllabaries and do not count as alphabetic. Although learners of Indic who cannot read an alphabetic script such as English have been shown to have less phonemic awareness than their counterparts in places where alphabetic scripts are used, the ability to manipulate phonemic segments is not categorical as Kannada children can develop some, albeit weak, ability to reverse phonemes in a phoneme reversal task before they start learning English. As Prakash *et al.* (1993) argue, one factor that seems to affect phonemic awareness in readers of non-alphabetic scripts such as Indic is how "noticeable" particular glyphs are represented in the orthography. For example, Prakash and his colleagues (1993) note that their Hindi adult participants performed 95% correct on a phoneme deletion task in which they had to delete a segment that formed a separate glyph from the vowel, whereas they were not able to correctly delete a segment that had no separate glyph from the vowel. In other words, even learners of non-alphabetic scripts are able to perform manipulations on the level of the individual phoneme in cases where the script supports it, for instance, when glyphs are separable from their surroundings or are written inline.

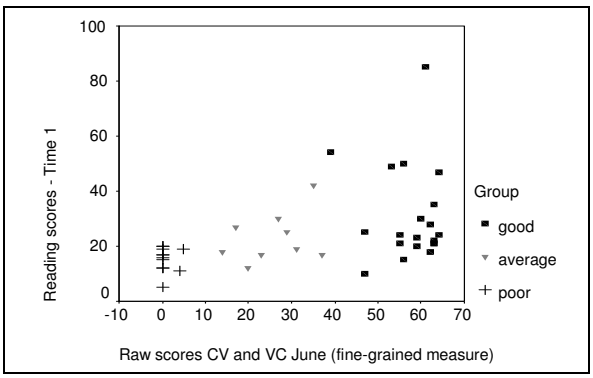
Such findings evidently have implications for the relationship between phonological awareness tasks and success in learning to read and write. Firstly, they suggest that when developing a particular phonological awareness task, one should take into account particular orthographic characteristics in addition to specific phonological properties of the language. Secondly, the findings suggest that the utility of a phonological awareness task as a predictor of reading development varies across different languages. Support for this latter claim is found in studies on the manifestations of dyslexia in different languages (e.g., Patel, Snowling & De Jong, 2004). In languages with an opaque orthography such as English, many studies show that dyslexics have a deficit in phonological awareness, more specifically phonemic awareness, and that these weaknesses continue to persist into adulthood and are independent of nonverbal IQ (e.g., Bruck, 1992). However, although dyslexics in transparent languages like German or Dutch show early deficits in phonological awareness, their phonological awareness problem turn out to be much weaker than in English. When researchers do not take into account the developmental level of the dyslexics, for instance by using a

phonological awareness task that is too easy and not adapted to the developmental level, it may even become hard to trace the phonological awareness deficit in dyslexics of transparent languages (see De Jong & Van der Leij, 1999; 2003; Patel *et al.*, 2004). Combined with the consistent mapping of graphemes onto phonemes, many beginning readers of transparent languages follow a phonics approach with emphasis on the phoneme level and on grapheme-phoneme correspondences which may have a positive effect on their phonological awareness development (see Landerl *et al.*, 1997; Patel *et al.*, 2004).

Interestingly, consistency of a particular orthography also seems to have a strong impact on the reading problems associated with dyslexia. English dyslexics especially experience problems with the accurate reading of long unfamiliar words and nonwords (Griffiths & Snowling, 2002). Yet, for dyslexics in transparent languages, it is not so much the accuracy, but the fluency of the reading that is affected (De Jong & Van der Leij, 2003): Dyslexics in regular orthographies read more slowly than normally developing readers. Such impairments in reading speed or fluency have been observed with rapid automatized naming tasks (RAN). These tasks measure the speed with which names of symbols (letters, objects, colors) can be retrieved from long-term-memory (De Jong & Van der Leij, 2003).

Thus, although performance on phonological awareness tasks predicts success in learning to read irrespective of the transparency of the orthography (see Hulme *et al.*, 2005; but see Castles & Coltheart, 2004; Van den Broeck, 1997, for comments), the relationship between phonological awareness and reading is much harder to detect in children learning to read in transparent orthographies. Therefore, when exploring such relationships between phonological awareness and early reading, it is crucial to use tasks that are sensitive to the learner's developmental level (see also Ziegler & Goswami, 2005), and to use measures that take into account the variables' range and distribution (see Geudens *et al.*, 2004). To illustrate, in a phoneme isolation/segmentation study with Dutch-speaking children, we carefully considered these factors and demonstrated a strong contingency between our observed measure of phoneme awareness[5] and the children's early decoding performance. We studied Dutch-speaking six-year-old kindergartners' skills to isolate phonemes in simple CV and VC pseudoword syllables (e.g., /f/-/o:/ in the CV /fo:/) and followed up the children's segmentation skills at the outset of reading instruction three months later (Geudens & Sandra, 2003; Geudens *et al.*, 2004). As can be seen in Figure 2 at the left, none of the children who had problems in the segmentation task at the end of kindergarten (the poor group) obtained good reading scores after six months of learning to read. At the same time, good performance on the segmentation task (the good group) was no guarantee that a child obtained high reading levels, i.e., it seemed "necessary" but not "sufficient". Then, we followed up the children's segmentation skills and replicated the segmentation task three months later in first grade. The definition of poor, average and good segmenters was based on the children's segmentation scores in kindergarten before the outset of reading instruction.

[5] In our view, phoneme isolation or segmentation skill is not considered to be a purely phonological skill. The development of explicit phoneme awareness is interpreted in interaction with informal print-related experiences and explicit instruction about letters and sounds.



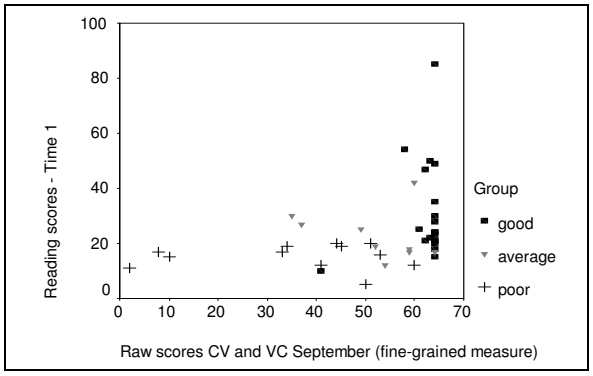


Figure 2 and 3: Relationship between CV-VC segmentation skill in June and September and reading scores after six months of reading instruction (from Geudens et al., 2004)

Remarkably, when the reading performance of those children who could not isolate a single phoneme in kindergarten (poor group) was related to their segmentation scores three months later in September, their reading level remained inferior despite the notable improvement of the children's segmentation skills and their letter knowledge (Figure 3). Even when the children had had the chance to enhance their reading skills near the end of first grade, they still did not seem to be able to exceed the average reading level. This finding seems to suggest that although letter knowledge is undoubtedly important for learning to read (Hulme *et al.*, 2005), it does not help much in the absence of insight into the phonological structure of words.

3.4.3 Task-specific and material-specific factors

Whereas several researchers currently recognize that features of the spoken language and the orthography affect phonological development, and that depending on these characteristics some linguistic units may become more important in some languages than others (e.g., Ziegler & Goswami, 2005), it is often ignored that preferences for

phonological units may also differ within the same language, the same population and even within the same experiment (e.g., Geudens & Sandra, 2003; Geudens *et al*., 2004; Treiman *et al*., 2000). To illustrate, it has generally been argued that the cohesion within the natural onset and rime units is a key source of the beginning reader's difficulty to segment words and pseudowords into phonemes (e.g., Adams, 1990; Schreuder & Van Bon, 1989; Stahl & Murray, 1994; Treiman, 1992).

However, what is often ignored in this framework is the importance of perceptual- and articulatory-phonetic factors. Phonemes are very abstract representations. Skilled alphabetic script readers "hear" individual sounds in the continuous airflow because they have acquired the symbols which help them to abstract over the highly variable acoustic events (Johnston, Anderson, & Holligan, 1996). However, at the phonetic surface, the syllable *cat* does not consist of discrete segments. Hence, there is no way to know at a conscious level that cat consists of the phonemes, /k/, /æ/, /t/, unless by having acquired those symbols that stand for these sounds, for instance, through print exposure, intensive training, or instruction about letter sounds. If one defines explicit phonological awareness as an ability to break up the continuous speech stream on demand, knowing how to abstract from phonetic features that characterize the speech signal is one aspect that reveals such awareness (Geudens & Sandra, 2003). This line of reasoning emphasizes the importance of the learner's own articulation and perception in the gradual development of phonemic representations. In line with this suggestion, there is evidence that partial phonetic cues in letter sounds and in pronunciation of words have a strong impact on children's first attempts at decoding and writing (e.g., Rack, Hulme, Snowling, & Wightman 1994).

Given the importance of phonetic cues in phonological awareness development, it seems reasonable to suggest that phonetic properties of consonants (e.g., sonority classes) have an impact on explicit phonological awareness tasks. Material-specific properties could not only influence but even bias results if not taken into account in the critical comparison. In support of this hypothesis, the often observed special cohesion within onset and rime units (e.g., Treiman & Kessler (1995) for a review) seems to fluctuate depending on the nature of the consonants used before and after the vowel. For instance, in a phoneme segmentation task in which beginning readers were asked to pronounce the phonemes in CV and VC words (e.g., /l/-/a:/ in /la:/, *la,* "music note"), Schreuder & Van Bon (1989) mainly used items with vowel-like sonorants like /l/, /r/, /m/, and /n/ and observed that first-graders found it much harder to break up a rime unit (e.g., VC /a:l/, *aal,* "eel") than to segment between the onset and the rime (e.g., in the CV /la:/, *la,* "music note"). On the contrary, Bus (1985) mainly used items with obstruents like /t/, /k/, /f/, and /s/, and observed the opposite pattern: children found it much easier to break up a rime unit (e.g., the VC /a:p/, *aap,* "monkey") than to segment on the natural onset-rime boundary (e.g., the CV /fe:/, *fee,* "fairy"). Sonorants such as nasals and liquids resemble vowels to a much greater extent (e.g., formant frequencies, opening of the oral cavity etc.) which may make it much more difficult to distinguish them from vowels than non-vowel-like consonants such as stops and fricatives.

Interestingly, in Geudens & Sandra (2003), we tried to take into account these considerations as much as possible in a similar CV and VC phoneme segmentation study in Dutch-speaking children, by including as many stops, fricatives, nasals, and liquids, by matching our CV and VC pseudowords on phoneme material (e.g., /fa:/ vs. /a:f/). We also took care to control for children's perception errors, for instance by

considering the child's own perception of the stimuli as a basis for the segmentation scoring. Doing so, we failed to support the predictions derived from the onset-rime view: Pre-readers as well as first-graders found it easier to isolate the phonemes within a rime, i.e., to break up the cohesion within the rime, than within the CV. We replicated these findings at the outset of reading instruction (Geudens et al., 2004). After having received phonics reading instruction for three weeks, the children still found it harder to isolate the phonemes in CVs than in their reversed VCs (e.g., /to:/ vs. /o:t/). We also demonstrated that this development from VC to CV segmentation poses comparatively increasing difficulties for poor segmenters compared to good segmenters. Even when both groups were statistically matched on VC segmentation, by considering the scores for good segmenters in the last month of kindergarten, and those for poor segmenters at the outset of reading instruction, their performance on the reversed CVs was still not equated: Poor segmenters found it harder to move from VC segmentation to the more complex CV segmentation. As I have pointed out before, these children who arrived later at VC segmentation, and required more learning opportunities to segment CVs, also showed more problems in mastering early word decoding skills (see Geudens & Sandra, 2003, for details).

A further illustration of the importance of material-specific factors is provided by Ventura, Kolinsky, Brio-Mendes, & Morais (2001) who showed that participants' responses on a phonological awareness task may not only depend on phonetic properties of stimuli but also on stimulus-specific orthographic aspects. When Portuguese adult literates had to combine parts of two words (e.g., /bar/, *bar,* "bar" - /mɛl/, *mel*, "honey") into a new pseudoword (e.g., /bɛl/) they preferred onset-rime C/VC blends for words with an orthographic CVC structure (e.g., /bɛl/ when blending /bar/ and /mɛl/) and body-coda CV/C blends for words with an orthographic CVCe structure (e.g., /tɛl/ when blending /tɛs/, *tese* "essay" and /val/, *vale*, "valley" with a mute final "e"), even though both rime pronunciations were exactly the same.

Clearly, these findings do not fit in with the onset-rime view that is so commonly referred to in the literature on phonological awareness. As long as particular conditions such as phonetic characteristics of consonants or orthographic properties of stimuli reduce the salience of onset and rime units, such findings can be integrated easily within the standard view in the literature that phonological knowledge is shaped by the onset-rime structure of the syllable. However, it is hard to understand how the idea of a fixed syllable structure is compatible with the opposite pattern, namely higher salience of units that cross the onset-rime boundary. Nevertheless, such effects are observed in Dutch as well as in other languages, both in tasks tapping implicit phonological knowledge such as in analyses of recall errors (e.g., Geudens *et al.* 2005; Yip, 2003) and in tasks tapping explicit phonological awareness such as segmentation and blending (e.g., Duncan *et al*., 1997; Geudens & Sandra, 2003; Ventura *et al.* 2001).

4 Conclusion

There is a consensus among researchers that one of the most basic difficulties in learning to read stems from a failure in acquiring phonological awareness (Adams, 1990; Goswami & Bryant, 1990; Vellutino *et al*., 2004). However, despite this well-documented relationship between phonological awareness skills and learning to read, questions about the construct of phonological awareness and its developmental

progression remain. In this paper, I have addressed some of these controversial issues in order to increase the insight into the relationship between phonological awareness and learning to read.

Apart from the problem of misinterpretations due to the ambiguous use of terminology, the standard view on phonological awareness is not without controversy. Although many researchers have used the onset-rime view as a starting point for the study on the development of phonological awareness in relationship to learning to read in various languages, it may be more fruitful to set out from a more flexible account in which the importance of language-specific, orthography-specific but also material-specific and task-specific factors are emphasized (Geudens & Sandra, 2003; Geudens et al., 2005). According to this proposal, the development of phonological awareness as well as the salience of particular phonological units do not reflect a fixed phonological structure, which is the standard view in the literature, but fluctuate depending on several factors such as: the developmental level of a child, the amount of letter knowledge and reading instruction, the type of reading instruction with different emphases on phonological units, prosodic characteristics of the learner's language, consistency of the grapheme-phoneme mappings in alphabetic scripts, but also often ignored material-specific factors such as characteristics of the phoneme material, perceptual and articulatory-phonetic factors etc. Depending on these characteristics, some linguistic units may turn out to be more salient in some phonological awareness tasks than others. Correspondingly and importantly, some tasks may also become more sensitive as a predictor of early reading skills than others and different relationships with later reading performance can be observed.

Even though this paper does not question the link between phonological awareness and learning to read, one should be aware that phonological awareness is only one part of a complex series of skills that the beginning reader has to acquire. Evidently, there is much more to phonology than awareness of phonological units. Acquiring awareness of the phonological structure of a language not only means acquiring phonological knowledge of particular phonological units but also becoming sensitive to aspects like intonation and rhythm of a particular language. Although the study on phonological awareness is the most thoroughly developed body of research on phonological processing (Wagner & Torgeson, 1987), a significant relationship with basic reading skills has also been established for other phonological processing skills such as phonological short-term memory and rate of access to phonological information in long-term memory (see De Jong & Van der Leij, 2003; Vellutino *et al.,* 2004). Several researchers have argued that difficulties with phonological awareness actually stem from more basic phonological weaknesses in the integrity of children's phonological representations, which also play a central part in other phonological processing skills (e.g., Morais, 2003).

Furthermore, one should not ignore that there is much more to reading than phonological awareness. Knowing how to segment words into the basic language units for instance may be a necessary but evidently not sufficient condition for early reading success. Reading also requires that children establish automatic, precise and redundant connections between print and speech at fine-grained, larger subword, and word levels (Geudens & Sandra, 2002; Morais, 2003; Perfetti, 1992; Van den Broeck, 1997). Hence, curricula for learning to read should not only focus on phonological awareness in relationship to orthographic awareness but obviously also on other relevant skills such as oral language ability, vocabulary, reading fluency, the development of word-specific

knowledge etc. Clearly, these skills are beyond the scope of this paper but should not be ignored in a theory on learning to read. Although phonological awareness is a well-studied and essential skill for the beginning reader, it is only one piece of the puzzle and its development may be less straightforward than often believed.

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