Selecting Appropriate Phonological Awareness Indicators for the Kindergarten Cohort of the National Educational Panel Study: A Theoretical and Empirical Approach

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Abstract

Language is the central medium for lifelong learning and consequently significantly impacts on the cognitive-academic and socio-emotional development of an individual. Thus, the assessment of language competencies is one major focus of the measurement of competencies in the German National Educational Panel Study (NEPS). Since reading literacy in the lingua franca of society is essential in order to achieve academic goals, acquire knowledge, and participate in society, this competency is assessed coherently over the lifespan in the NEPS. However, in Germany, reading is not taught before formal schooling. Therefore, reading competencies cannot be assessed in preschool or Kindergarten. Instead, phonological awareness is measured as a precursor variable of reading competence and oral language (receptive vocabulary, grammar) as well as more general literacy indicators. Although a broad range of tests and subscales for assessing phonological awareness exist, not all of them are suitable for the assessment within the framework of a large-scale educational study. Most well-established measures for assessing phonological awareness in preschool age are designed as screening instruments and/or indicators within therapeutic settings. Thus, the items are very easy, distinguishing exclusively children who show below-average performances.

In this paper, a theoretical and data-driven approach is presented to select phonological awareness tasks appropriate for the NEPS Starting Cohort 2—Kindergarten cohort. To identify tasks that comprise high psychometric quality, allow for differentiating performances at a broad range of competence levels of phonological awareness, and differ in their relationship to other language indicators, a small study (n = 164) was conducted. Based on a two-dimensional model of phonological awareness (Stackhouse & Wells, 1997), five different types of tasks varying in (a) the size of the linguistic unit to be reflected on and (b) the specific cognitive operation to be applied were selected and empirically compared. Statistical analy-

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sis showed two tasks to be appropriate for our goals: *blending of onsets and rimes* and *identification of phonemes.*

The results are discussed in line with theoretical considerations concerning the types of tasks and against the background of the two-dimensional model of phonological awareness. The findings suggest that presumably more than two factors must be included in the model for a suitable prediction of task difficulty.

1 Introduction

The German National Educational Panel Study (NEPS) is implementing a large-scale multi-cohort sequence design to build up datasets to investigate the preconditions, consequences, and moderating variables of educational careers in Germany. One of the main questions is how educationally relevant competencies are acquired, how they develop over the lifespan, how and to what extent they are influenced by learning opportunities, and how they impact on educational outcomes. The development of competencies relevant to education and participation in social and political life are to be analyzed in their relation to important aspects of the learning environment, educational decisions, and educational returns. All data will be made available to the national and international scientific community as a Scientific Use File.[1]

The NEPS began with six cohorts in parallel: 1) infants, 2) preschool/Kindergarten[2] children, 3) fifth graders, 4) ninth graders, 5) college students, and 6) adults. These cohorts altogether comprise a total of about 60,000 persons who are followed in their educational careers and life-courses, with measurements taking place nearly every year. In preschool, approximately 3,000 children at the age of 5 took part in a first assessment wave in 2011, and approximately 2,800 children were tested again at the age of 6. As far as possible, these children have been being followed in school since 2012.

Since language is an important means for communicating, storing, and retrieving information as well as for school performance in various school subjects, the assessment of German-language competencies across the lifespan is one major focus of the measurement of competencies in the NEPS (Weinert et al., 2011). The aim is to describe and explain the processes of competence development within and across educational stages while also analyzing their relevance for future prospects.

Some indicators must therefore be assessed coherently across the lifespan (e.g., reading competence), while the assessment of others is restricted to educational stages in which they are of special importance and have a strong predictive impact

1 Data access is possible via download, remote NEPS, and on-site. More information about the data access and user training can be found on the website https://www.neps-data.de.

2 Note that the differentiation between *preschool* and *Kindergarten* differs across countries and is used interchangeably in this article to refer to preschool educational institutions for children before formal obligatory schooling starts at the age of six to seven years.

(e. g., phonological awareness; for details concerning the whole conception of the assessment of language competencies within the NEPS, see Berendes, Weinert, Zimmermann, & Artelt, 2013). The coherently assessed measures of the NEPS are thought to be of special educational relevance and ecological validity across a broad age range. This leads to an assessment that heavily relies on everyday problems. The stage-specific measures are assessed in certain educational stages only and allow for further (theoretically and practically relevant) analyses. For example, in the case of phonological awareness, the predictive power (differentiated for various subgroups of children) as well as the interrelation between different language indicators, reading, and education can be analyzed.

In this article, we report on an approach to select appropriate phonological awareness indicators for the Kindergarten cohort of the NEPS (for details concerning all tests and instruments in Kindergarten, see Berendes et al., 2011). First, we briefly summarize theoretical assumptions and empirical results on (different indicators of) phonological awareness and its function in learning to read. Thereafter, the rationale for selecting appropriate tests that assess phonological awareness in the NEPS Kindergarten cohort is presented. Drawing on existing subtests and a model of phonological awareness, we aim to select tasks with a high psychometric quality that test the ability to reflect on different linguistic units while affording different cognitive operations and that differ in their relationship to the language status of the child on the one hand and the family's socioeconomic status (SES) on the other hand.

2 Phonological Awareness and Learning to Read

Phonological awareness refers to the metalinguistic ability to reflect on and manipulate the phonological structure of words independent of their meaning (Tunmer & Hoover, 1992). It is an important precursor variable of the development of written language literacy across languages and orthographies (see for an overview Ziegler & Goswami, 2005). In preschool/Kindergarten, phonological awareness is a high-impact precursor variable of later reading and spelling; later on, in the first years of school,[3] it is a key competence for literacy acquisition (for an overview, see Blachman, 2000; Schnitzler, 2008). In later elementary school,[4] the relevance of phonological awareness diminishes, but nevertheless remains existent (Del Campo, Buchanan, Abbott, & Berninger, 2015; Pfost, 2015; Wagner et al., 1997). In sum, "the discovery of a strong relationship between children's phonological awareness and their progress in learning to read is one of the great successes of modern psychology" (Bryant & Goswami, 1987, p. 439).

3 Alphabetic phase of reading and spelling acquisition (Frith, 1985).
4 Orthographic phase of reading and spelling acquisition (Frith, 1985).

Table 1 Examples of the Levels of Phonological Awareness (Taken from Tertiary Education Commission, 2008, p. 18)

Level		Examples	
Word	bed	black	napkin
Syllable	bed	black	nap-kin
Onset-Rime	b-ed	bl-ack	n-ap k-in
Phoneme	[b]-[ɛ]-[d]	[b]-[l]-[æ]-[k]	[n]-[æ]-[p]-[k]-[ɪ]-[n]

For a detailed analysis of the interrelation between reading and phonological awareness, three different linguistic levels beyond word level on which a person may reflect should be distinguished: syllable, onset-rime, and phoneme.[5] Table 1 shows some examples for the three levels.

The differentiation of the three levels is important because it is likely that "specific phonological skills have differential effects on specific reading skills" (Christensen, 1997, p. 354).

Moreover, the effects of different forms of phonological awareness on later reading skills depend on the specific orthographical system under study (see "psycholinguistic grain size theory", Ziegler & Goswami, 2005). Thus, the fact that results based on one language cannot easily be transferred to another one must be taken into account (see Landerl, Wimmer, & Frith, 1997; Wimmer & Goswami, 1994). Comparing the relevance of different linguistic units in alphabetic languages with different orthographic consistency, larger linguistic units can be expected to be less relevant for relatively consistent orthographies (e. g., German) than for relatively inconsistent orthographies (e. g., English; Ziegler, Perry, Jacobs, & Braun, 2001; see also Pfost, 2015), as is shown in the following sections.

Syllable awareness. The relevance of syllable awareness seems to be especially dependent on the characteristics of the specific language under study and is believed to change during reading acquisition. Schnitzler (2008) studied the relationship between early reading and syllable awareness with data from 42 German first graders.

5 A syllable can be categorized in an onset (initial consonant or cluster, optional) and an rime (vowel plus terminal consonant(s), obligatory): examples: "t-eam, dr-eam, str-eam" (Goswami, 2006, p. 489).
"The term 'rime' is used because words with more than one syllable have more than one rime, for example, in captain and chaplain, the rimes are -ap and -ain, respectively. The rimes are identical, but these words would not conventionally be considered to rhyme, because they do not share identical phonology after the first onset, as do rabbit and habit, for example" (Goswami, 2006, p. 489).

The results revealed that no unique variance for word and nonword reading could be explained by syllable awareness (see also Fricke, Szczerbinski, Stackhouse, & Fox-Boyer, 2008). Schnitzer (2008) hypothesizes that syllable awareness is no direct predictor of beginning reading competencies (alphabetic phase) but becomes predictive once the orthographic phase of reading acquisition has begun (see p. 60, Figure 4.1). Høien, Lundberg, Stanovich, and Bjaalid (1995) concluded for a Norwegian sample (1,509 first graders) that syllable awareness—in comparison with rhyme and phonemic awareness—"was clearly the weakest predictor" of reading competencies (reading efficiency) and that "the unique variance that it explained was quite small and attained significance only because of the extremely large size of sample" (p. 184). Moreover, they stated that "it is of marginal usefulness as predictor of early reading development if tasks at other levels are available" (p. 184). However, syllable awareness may be a more useful predictor of advanced reading.

> Especially in processing long words, syllable-bound processing may be functional, because letter-by-letter processing makes greater demands on working memory (Perfetti, 1985). Using larger functional units during word processing would speed up decoding and, consequently, would free working memory for higher order processes involved in text comprehension. (Wentink, van Bon, & Schreuder, 1997, p. 166)

However, no data (or at least no sufficient data) exist to prove these theoretical considerations. For instance, Schnitzler (2008) conducted regression analyses based on data of 57 German third and fourth graders; within these analyses, syllable awareness did not account for any variance in word and nonword reading (see Schnitzler, 2008, p. 71; Figure 4.4, right column).

Taken together, syllable awareness attained less attention than did onset-rime and phonemic awareness in research on alphabetic writing systems (e. g., German, English) and more attention in syllabary writing systems (e. g., Japanese). This may be due to the reasonable assumption

> …that awareness of syllables would be crucial to learning to read in syllabary (a writing system in which there is a unique symbol for each syllable in the spoken language). […] The available research supports this general picture. For example, measures of syllable awareness are highly correlated with reading ability for Japanese children (whose initial reading involves symbols representing syllables) but not for American children (Mann, 1986). (Nagy & Anderson, 1995, p. 4)

Onset-rime awareness. Onset-rime awareness is believed to be helpful in using analogic reading and spelling strategies and helps the child to build up mental representations of written words (e. g., Goswami, 1986). For German children, it is considered to be of higher importance at the end of elementary school because word recognition at the beginning of reading acquisition heavily depends on grapheme-phoneme correspondence. Wimmer, Landerl, and Schneider (1994) tested a total of 183 German-speaking children before they started to learn to read as well as at the end of their first year of schooling and again one and three years later. In accordance with an analogic strategy, they found that preschool phonological awareness at the onset-rime level (rhyme awareness) was significantly related to later reading (speed and accuracy) and spelling at the end of elementary school (Grades 3 and 4) but not at the end of Grade 1 (see also Landerl, Linortner, & Wimmer, 1992). However, in the studies conducted by Schnitzler (2008, see above), onset-rime awareness predicted reading competencies (word and nonword reading) neither at the beginning nor at the end of elementary school. Moreover, the relevance of phonological awareness at the onset-rime level differs between languages. "Cross-language research on children's reading development has demonstrated quite clearly that rimes are more important orthographic and phonological units for learning to read English than for learning to read orthographically consistent languages like German and Greek" (Goswami, 2001, pp. 25–26).

Phonemic awareness. Phonemic awareness helps to grasp the alphabetic principle that underlies our system of written language (e.g., Muter, Hulme, Snowling, & Taylor, 1998) and thus plays an important role from the very beginning of reading acquisition. Moreover, faced with an alphabetic script,

> …the child's level of phonemic awareness on entering school may be the single most powerful determinant of the success she or he will experience in learning to read and of the likelihood that he or she will fail. Measures of preschoolers' level of phonemic awareness strongly predict their future success in learning to read, and this has been demonstrated not only for English. (Adams, 1990, pp. 304–305)

Caravolas, Volin and Hulme (2005) conducted path analyses using data from primary-school learners of consistent and inconsistent orthographies; in all models conducted, phonemic awareness turned out to be a unique predictor of reading (speed and comprehension) and conventional spelling. Hulme et al. (2002) state that "good performance on phonemic awareness tasks may be the most direct indicator available that a child's phonological representations are suitably organized to support the efficient creation of mappings between orthography (graphemes) and phonology (phonemes)" (p. 20).

The NELP (National Early Literacy Panel; Lonigan, Schatschneider, Westberg, & the National Early Literacy Panel, 2008) large-scale meta-analyses indicate that phonological awareness at the phoneme level is most appropriate for the prediction of reading. Phonemic awareness shows a medium correlation ($r_{average}$ = .42) with decoding and with reading comprehension ($r_{average}$ = .44). Moreover, in "terms of the specific levels of linguistic complexity, phonemic awareness had the highest correlation with decoding and reading comprehension" (Lonigan et al., 2008, p. 76). Likewise, Castles and Coltheart (2004) summarize the results of their meta-analyses:

> No study that we selected for close scrutiny and that included phonemic awareness measures failed to find evidence for a significant unique contribution to subsequent reading or spelling. This stands in strong contrast with the results for syllabic and rhyme awareness. (p. 91)

For Germany, Schnitzler (2008) studied the relevance of syllable, onset-rime, and phonemic awareness to reading skills in 42 German first graders. Additionally, she included non-verbal intelligence in her analyses. Regression analyses (see Table 4.4., p. 71, left column) showed that phonemic awareness was the single phonological factor suitable for explaining the variance of reading words (37,6 %) and nonwords (44,1 %).

Although some studies failed to prove the outstanding role of phonemic awareness (e. g., Suggate, Reese, Lenhard, & Schneider, 2014), in sum, all languages have in common the fact that "phoneme awareness is a key component of alphabetic literacy skills in consistent and inconsistent orthographies" (Caravolas et al., 2005, p. 107; see also meta-analytic review of Melby-Lervåg, Lyster, & Hulme, 2012).

3 Development of Phonological Awareness

Many studies have demonstrated that the development of syllable awareness precedes the awareness of phonemes (e. g., Fox & Routh, 1975). The ability to detect onsets and rimes develops later than the conscious awareness of syllables but precedes insights into the phonemic structure of language (Treiman & Zukowski, 1991). Moreover, there is empirical evidence that vowels can be detected and manipulated earlier than consonants (Jansen, 1992; Mannhaupt & Jansen, 1989). This is explained by the fact that vowels are acoustically expandable and thus cover more time in the stream of speech. Additionally, tasks tapping the awareness of the initial sounds of a word are easier than tasks that tap on final sounds, and medial sounds within a word are the most difficult to work on (Yopp, 1988). Jansen (1992) as well as Mannhaupt and Jansen (1989) showed that preschool children's ability to solve phonological awareness tasks was limited to tasks tapping the level of syllables and onset-rime and to tasks focusing on stressed vowels or very outstanding phonetic characteristics.

Overall, as far as the development of phonemic awareness is concerned, there is

> …an unresolved debate in the developmental literature regarding whether phonemic awareness is acquired naturally as part of phonological awareness, or whether it is instead an artefact of reading tuition. This ambiguity affects the interpretation of studies which show that pre-literate phonemic awareness is a powerful predictor of literacy attainment in school. […] Results suggest that young children can develop phonemic awareness before beginning reading or attending school. (Wood & Terrell, 1998, p. 253)

Likewise, studies with German samples have shown that basic phonemic awareness in general exists before children receive literacy tuition (e. g., Fricke, 2007; Fricke, Stackhouse, & Wells, 2007; Marx, Weber, & Schneider, 2005; Schäfer, Bremer, & Herrmann, 2014; Schäfer et al., 2009; Schäfer, Stackhouse, & Wells, in preparation). However, "[f]ull access to phonemes only develops once children are taught to read and write, irrespective of the age at which reading and writing is taught" (Ziegler & Goswami, 2005, p. 6). Thus, whether or not phonemic awareness is evident before reading tuition depends on the kind of task administered to assess phonemic awareness. Therefore, Moyle, Heilmann, and Berman (2013) requested "that task difficulty needs to be reduced so that younger children can participate in assessments of phoneme-level skills" (p. 682).

Whereas the development of syllable awareness and onset-rime awareness is rather similar across different languages (Goswami, 2006), the development of phonemic awareness differs according to the specific language under study. "Children learning transparent orthographies such as Greek, Finnish, German, and Italian acquire phonemic awareness relatively quickly. Children learning nontransparent orthographies such as English, Danish, and French are much slower to acquire phonemic awareness" (Goswami, 2006, p. 490; see also Goswami, 2008, p. 9, Table 1).

The development of phonological awareness is pictured in a widely acknowledged two-dimensional model (see Figure 1). The assumed developmental trajectory of phonological awareness skills is indicated by the diagonal arrow.

The first dimension is the size of the linguistic unit (beyond the word level) on which a person is able to reflect. As already mentioned, three unit sizes could be distinguished: syllable, onset-rime, and phoneme. The second dimension is the level of explicitness of the cognitive operation needed to solve the task. Four levels can be

Figure 1 Development of Phonological Awareness (see Schäfer et al., 2009, p. 405; Fricke, 2007, p. 11)

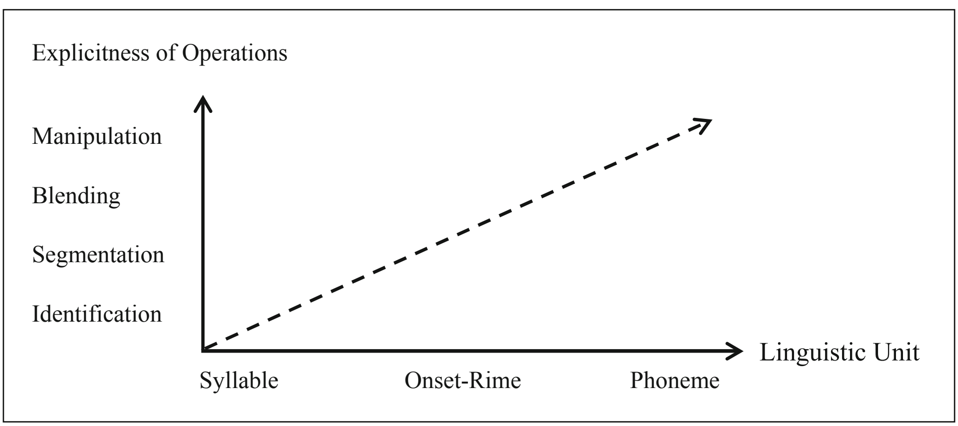

Table 2 Operations Involved in Phonological Awareness Tasks, Their Cognitive Processes, and Examples of Tasks

Operation	Cognitive Processes	Example at the Phoneme Level
Identification	Detection of units	Recognizing the common sound in different words, for example, "Tell me the sound that is the same in bike, boy, and bell" ([b]).
Segmentation	Detection of units and segmenting these units	Breaking a word into its sounds by tapping out or counting the sounds, for example, "How many phonemes are in ship?" (3: [ʃ] [ɪ] [p]).
Blending	Detection of units and synthesizing of these units	Listening to a sequence of separately spoken sounds and combining them to form a recognizable word, for example, "What word is [s] [k] [u:] [l]?" (school).
Manipulation	Detection of units, segmenting these units, manipulation of these units (replacement, elision, addition, reorganization), and synthesizing these units	Recognizing what word remains when a specified phoneme is removed, for example, "What is smile without the /s/?" (mile).

differentiated for this dimension: identification, segmentation, blending, and manipulation (Stackhouse & Wells, 1997). These levels refer to the depth of metalinguistic reflection that is needed to complete a phonological awareness task. Whereas some tasks (e. g., identification) require less awareness and may be regarded as more-or-less implicit tasks, other tasks (e. g., manipulation) require higher and more explicit levels of awareness. In general, the cognitive complexity of a task increases with the explicitness of the operation.

Table 2 depicts the cognitive processes that are involved in the four levels and that differ with respect to their explicitness (according to Fricke & Schäfer, 2008, p. 11). Moreover, for each operation, an example from the phoneme level is given in the table (examples are taken from the National Institute of Child Health and Human Development (NICHD), 2000, 2–10).

The development of phonological awareness has been suggested to continually proceed from larger to smaller linguistic units (syllable—onset-rime—phoneme)[6] and from simple to complex, explicit operations (identification—segmentation/blending—manipulation). Thus, tasks affording the 'identification of syllables' are expected to be the easiest type of task, and tasks requiring the 'manipulation of phonemes' are expected to be the most difficult of the 12 types of tasks. At present, it is not possible

6 This is termed the "linguistic status hypothesis" (Treiman, 1992). Although the linguistic status of a unit is often confounded with its size (as measured by the number of phonemes) and a longer length of a unit could account for greater accessibility, there is still evidence for the linguistic status hypothesis when units that differ in linguistic level but are equated for their size are compared concerning their item difficulty (see Treiman & Zukowski, 1996).

to make a comparative statement on the relative difficulty of tasks varying according to both classification characteristics if one of the tasks involves an easier, larger linguistic size to work on but at the same time requires a more difficult (more complex, more explicit) operation. So far, no clear consensus or sufficient data exist regarding the question of whether the level of difficulty of a phonological task is determined by the size of the linguistic unit or the explicitness of the operation.

Moreover, task difficulty is influenced by so-called side factors, such as sonority, intonation, the position of the phonological unit to be worked on, and the complexity of the phonological surroundings in which the phonological unit is embedded (Schnitzler, 2008; Smith, Simmons, & Kameenui, 1998). These factors are not taken into account in the two-dimensional model of phonological awareness (see Figure 1). It is unclear how strongly these and other factors (e.g., phrasing of instruction, response format, picture-based or not) influence task difficulty compared with the two main dimensions of phonological awareness. Stanovich, Cunningham, and Cramer (1984) compared the performance on ten different phonological awareness tasks and detected that two tasks affording the manipulation of initial phonemes (stripping and substituting the initial phoneme) differed substantially with respect to their difficulty (25.3 % correct vs. 86.3 % correct). The authors considered specific task characteristics to be responsible for these results. Fricke (2007) discovered unexpected results with regard to the assumed developmental order. In her study, a task requiring the identification of phonemes turned out to be more difficult for the children than did two tasks requiring the synthesis of phonemes. Results conducted by Schäfer, Wessels, and Fricke (2014) also indicate that the performance level children attained in phonological awareness tasks partly depended on other task demands and instructional issues.

Table 3 shows part of a summary proposed by Schnitzler (2008) concerning our empirically based knowledge of the performance level of preschool children concerning different phonological tasks.

Table 3 Performance Level of Preschool Children Concerning Different Types of Tasks to Assess Phonological Awareness (Schnitzler, 2008, p. 52, extract from table 3.11)

	Syllable	**Onset-Rime**	**Phoneme**
Manipulation			
Blending/Segmentation	(++)		– –
Identification	++	+	

Note. ++ stands for a very good performance (average performance of 75-100 % correct), + stands for a good performance (average performance of 50–74 % correct), – – stands for very low performance (average performance of 0–24 % correct); uncertain declaration is marked with brackets.

Five slots cannot be filled in yet because of a lack of research data. This fact shows that there is a need for further research concerning the phonological awareness abilities of preschool children and that the exact chronological order of development is still unclear (Schäfer, Wessels, & Fricke, 2014).

4 Assessment of Phonological Awareness: A Small Pilot Study

There are various well-known tests and subtests in German as well as in other languages to reliably and validly assess phonological awareness in preschool children. Table 4 presents some of the more or less well-known German test instruments.

However, most of these instruments are designed for and used in therapeutic settings, mainly as screening instruments. Consequently, they focus on children showing below-average performance. For example, using classical test theory, analyses of task difficulty in the well-known *Bielefelder Screening* (Jansen, Mannhaupt, Marx, & Skowronek, 2002) reveal a task difficulty of 0.78 and 0.80 for the most difficult task (10 and 4 months before school entry, respectively).

In the NEPS, we conducted a small study to compare different types of tasks to select suitable ones for our large-scale assessment. In this study, the performance of 6-year-old preschool children was investigated using five different types of tasks. The aim was to identify tasks that would allow us to discriminate performance differences across a broad range of performance levels, that is, to differentiate between lower

Table 4 Examples of German Test Instruments to Assess Phonological Awareness

Acronym	Name of the Test	Authors & Year of Publication
ARS	Anlaute hören, Reime finden, Silben klatschen – Ein Erhebungsverfahren zur phonologischen Bewusstheit für Vorschulkinder und Schulanfänger	Martschinke, Kammermeyer, King, & Forster, 2005
BAKO 1-4	Basiskompetenzen für Lese-Rechtschreibleistungen	Stock, Marx, & Schneider, 2003
BISC	Bielefelder Screening zur Früherkennung von Lese-Rechtschreibschwierigkeiten	Jansen, Mannhaupt, Marx, & Skowronek, 2002
–	Der Rundgang durch Hörhausen	Martschinke, Kirschhock, & Frank, 2001
MÜSC	Münsteraner Screening	Mannhaupt, 2006
PB-LRS	Gruppentest zur Früherkennung von Lese-Rechtschreibschwierigkeiten	Barth & Gomm, 2006
QUIL-D	deutschsprachige Version des Queensland Inventory of Literacy	Hofmann, 2000
TPB	Test für Phonologische Bewusstheitsfähigkeiten	Fricke & Schäfer, 2008

as well as average and above-average performance. The selection of tasks was based on the theoretical framework that describes phonological awareness as a two-dimensional construct (see above). Thus, the tasks differed in terms of the size of the linguistic unit tapped and the cognitive operation required by the task. As already mentioned, little is known about the interaction between the explicitness of operations and the size of the linguistic units in typically developing preschool children.

4.1 Aims of the Study

Overall, the study had the following four aims: The first aim was to select suitable phonological tasks for the NEPS Kindergarten assessment while at the same time contributing to the issue of explaining the difficulty of different phonological tasks by factors that might impact on task difficulty. In addition, we intended to add some information on the interrelations between task performance and other child- and environmental variables that seemed to be especially relevant to large-scale educational assessments. Thus, as a second aim, we examined the interrelation between family background (SES measured by the number of books in the household) and phonological awareness. Since "phonological awareness is highly teachable and modifiable" (Lundberg, Larsman, & Strid, 2012, p. 318; see also Fischer & Pfost, 2015), we expected medium to high correlations with SES. Third, we tested for the interrelation between interindividual differences in phonological working memory capacity as a rather stable child characteristic and phonological awareness since "many tasks devised to tap phonological awareness also impose significant burdens on verbal memory" (Alloway, Gathercole, Willis, & Adams, 2004, p. 88; see also Nithart et al., 2011). Finally, the association of the performance on each of the five awareness tasks with a proxy indicator of the child's language competencies was considered. We applied a task measuring sentence reproduction because this task is well known as a reliable indicator of child language competencies as it comprises receptive as well as reproductive and reconstructive aspects on the one hand and proved to be a valid predictor of later reading and spelling competencies on the other hand (Ebert & Weinert, 2013; von Goldammer, Mähler, Bockmann, & Hasselhorn, 2010). Since sentence reproduction is partly determined by the capacity of phonological working memory (von Goldammer, Mähler, & Hasselhorn, 2011), we controlled for this variable when analyzing the interrelation between phonological awareness and sentence reproduction.

4.2 Method

Existing more or less well-established test instruments (see Table 4) as well as some subtests of lesser-known tests and test batteries were looked through, and tasks were classified according to the linguistic unit and the dimension of operation tapped by the respective task. Furthermore, the statistical characteristics (item difficulty, item selectivity, internal consistency) were taken into account, and only tasks with a Cronbach's alpha (if declared) of .80 or higher were included in our study.

4.2.1 Sample

164 children with different language backgrounds (114 German, three Polish, four Russian, eight Turkish, eight other languages, 27 no answer) and a mean age of 5;9 years (min. = 5;3 years, max = 6;5 years) took part in this study. Children were recruited from 15 preschools/Kindergartens in four federal states of Germany: Four in Bavaria (N = 46), three in Hamburg (N = 42), five in North Rhine-Westphalia (N = 38), and three in Thuringia (N = 38).

4.2.2 Materials

The following five tasks were included in the data collection to assess phonological awareness:

Identification of syllables: The ability to identify syllables was measured by the subscale *Silbenidentifizieren (SI)* (identification of syllables) from the German version of the *Queensland Inventory of Literacy* (*QUIL-D;* Hofmann, 2000). Two two-syllable words were presented, and the child was invited to decide whether the two words had a similar beginning (same initial syllable), a similar ending (same final syllable), or no similar part.

Manipulation of syllables: The ability to manipulate syllables was assessed by a modification of the subscale *Silbenzusammensetzen* (reassembling of syllables) from the *Rundgang durch Hörhausen* (Martschinke et al., 2001). Two bisyllabic words (animal names) were presented to the child; pictures of these animals were cut into two parts, and each part was introduced as corresponding to one of the syllables. The child was asked to combine the first syllable of the one word with the second syllable of the other word and vice versa (e. g., <Zie|ge—Ka|mel> → <Zie|mel—Ka|ge>). The task was supported by rearranging the parts of the picture cards to show the corresponding fantasy animal.

Blending of onsets and rimes: The child heard monosyllabic words with a gap between the onset and the rime and was asked to blend these two parts (subscale *Onset-Reim-Synthetisieren—output* (onset-rime synthesis—output) from the TPB, Fricke & Schäfer, 2008).

Identification of phonemes: The ability to identify phonemes was measured with a set of picture-based multiple-choice tasks (subscale *Laut-Wort-Zuordnung* (sound-word classification) from the *MÜSC,* Mannhaupt, 2006). The child heard a phoneme and then heard three words and was instructed to point to the picture that illustrated the word with the previously heard phoneme.

Manipulation of phonemes: In order to assess the ability to manipulate phonemes, mono- or bisyllabic words were presented to the child, and the child was asked to repeat the word without the initial phoneme (subscale *Anlaute-Manipulieren—output* (manipulation of initial sounds) from the TPB, Fricke & Schäfer, 2008). We included this subtest although we expected it to be rather difficult, or potentially too difficult as indicated by a pilot study with children who had nearly the same age as our sample (M = 6.0 years, N = 38; Fricke, Stackhouse, & Wells, 2007; see also Fricke & Schäfer, 2008, p. 77) because we wanted to compare the task difficulty with that of the other tasks.

In addition, tasks to assess phonological working memory, sentence repetition, and letter knowledge were included in the data collection:

Phonological working memory: Two tasks to assess phonological working memory were administered, a *digit span* task (taken from the German version of the Kaufman Assessment Battery for Children (K-ABC), Melchers & Preuß, 2009) and a *digit span backward* task. The latter required a change in the order of stimulus material (naming the digits in backwards order) and thus involved the central executive of working memory (taken from *Hamburg-Wechsler-Intelligenztest für Kinder III—HAWIK III,* Tewes, Rossmann, & Schallberger, 1999).

Sentence repetition: The ability to reproduce sentences of increasing grammatical complexity was measured by a subscale of the *Sprachentwicklungstest für drei- bis fünfjährige Kinder* (*SETK 3-5;* Grimm, 2001).

Letter knowledge: As an indicator of emerging literacy (see Kim, Petscher, Foorman, & Zhou, 2010), we assessed the letter knowledge of the children by giving them a card with all 26 letters of the German alphabet (in a fixed but random order) and asking to name them.

Moreover, the parents were asked about the *number of books* in their household. The number of books is a good indicator for the cultural capital of a family (Paulus, 2009) and is thus often applied as an indicator of the familial SES.

4.2.3 Test Procedure and Training of Test Administrators

Children were tested individually in a quiet room in their preschool. Each child participated in two 30-minute testing sessions on separate days. On the first day, four subtests were presented in the following order: 1) identification of syllables, 2) blending of onsets and rimes, 3) early letter knowledge, and 4) digit span. On the second day, five more subtests were administered: 5) identification of phonemes, 6) digit span backwards, 7) manipulation of syllables, 8) repetition of sentences, and 9) manipulation of phonemes. All tests were instructed as playful games and administered by well-trained test administrators. Stimuli were presented digitally (CD-ROM) to guarantee standardization (e.g., intonation, speech rate) and were spoken by a professional radio speaker to assure high-quality recordings.

All test administrators participated in a two-day test-administrator training conducted by NEPS staff.[7] Drawing on these training sessions and comprehensive test manuals, all test administrators had to practice and videotape the assessment procedures with two children. These videos were evaluated by NEPS scientific staff to ensure correct handling of test materials, high standardization of the test procedures, and suitable contact with the child. Finally, a third test-administrator training day was arranged to further discuss and train the test administration based on the video evaluations. To ensure high-quality data, only those test administrators who performed well enough during training were recruited for the assessments, which were run by the Data Processing and Research Center (DPC), which is part of the International Association for the Evaluation of Educational Achievement (IEA).

4.3 Results

Phonological awareness tasks. Test results were evaluated and compared using classical test theory (see Table 3 for item difficulties; additional details on the psychometric quality as well as on considerations concerning test selection are given in Berendes et al., 2013). In summary, two tasks emerged as suitable to our study: The subscale identification of phonemes was chosen to differentiate at the lower level of performance (average item difficulty (p_i) = .81; average item selectivity (r_{it}) = .53; Cronbach's alpha (α) = .83), and the subscale blending of onsets and rimes was chosen as a more difficult task (average item difficulty (p_i) = .23; average item selectivity (r_{it}) = .74; Cronbach's alpha (α) = .94).

From a theoretical point of view, an overall look at the data suggests that the type of cognitive operation more strongly impacts item difficulty than does the size/type of

7 For more detailed information on tests, test administration, and test administrator training ("train-the-trainer program") in the main studies of the NEPS Kindergarten cohort, see Weinert and Berendes (2012). To acquire this poster, please contact one of the authors.

Table 5 Average Item Difficulty of the Five Phonological Tasks Assessed in the Preliminary Study

	Syllable (p_i)	**Onset-Rime** (p_i)	**Phoneme** (p_i)
Manipulation	0.21		0.06
Blending/Segmentation		0.23	
Identification	0.51		0.81

the linguistic unit the child has to reflect on. As Table 5 shows, item difficulty increases from the bottom to the top (identification → blending/segmentation → manipulation), but not from left to right (syllable → onset-rime → phoneme).

A closer look at the data shows that—in line with our expectations—the task *manipulation of phonemes* was the most difficult one. Also in line with our expectations, a task that requires the identification of syllables was easier than tasks that implied the manipulation of syllables, the blending of onsets and rimes, or the manipulation of phonemes. However, contrary to our expectations, the task *identification of syllables* turned out to be more difficult than the identification of phonemes (discussed later).

Interrelation between phonological awareness skills and the number of books at home. The correlations (see Table 6) show that the *blending of onsets and rimes* is significantly related to the SES-indicator (r = .26**), whereas the other four tasks show no significant relationship with the number of books at home.

Interrelation between phonological awareness skills, phonological working memory, and sentence reproduction. Four of the five phonological awareness tasks were significantly related to the two tasks measuring phonological working memory (see Table 6).

The interrelation of the five tasks with sentence repetition (with and without control of phonological working memory, see Table 6) proved to be highly task-dependent. Two tasks were significantly related to sentence reproduction, even when controlling for digit span or digit span backwards: identification of syllables (r = .23**, .20**, .17*) and identification of phonemes (r = .29**, .23**, .29**).

Thus, the two phonological awareness tasks chosen for the NEPS assessments (*blending of onsets and rimes* and *identification of phonemes*) differed with respect to (a) task difficulty, (b) social disparities according to the number of books at home, and (c) their intercorrelation with sentence repetition as a proxy of language competence. However, performance on both tasks was associated with phonological working-memory capacity. Since phonological working memory is also included in the NEPS data assessment, the effect of digit span and digit span backwards can be statistically controlled.

Table 6 Correlations (Pearson) Between Phonological-Awareness Skills and the Number of Books in the Household, Phonological Working Memory (Digit Span and Digit Span Backwards), and Sentence Repetition (Additionally With Differences in Phonological Working Memory Partialled Out)

	Number of Books	**Digit Span**	**Digit Span Backwards**	**Sentence Reproduc-tion (SR)**	**SR Controlling for Digit Span**	**SR Controlling for Digit Span Backwards**
Identification of Syllables	.12	.12	.28**	.23**	.20**	.17*
Manipulation of Syllables	.15	.27**	.27**	.11	.05	.03
Blending of Onsets and Rimes	.26**	.30**	.25**	.15	.08	.19*
Identification of Phonemes	.14	.31**	.45**	.29**	.23**	.29***
Manipulation of Phonemes	.16	.25**	.21**	.07	.00	−.14

Note. $n = 164$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

4.4 Discussion

The purpose of our small study was to select appropriate phonological awareness tasks for our NEPS assessment in Kindergarten. Drawing on existing subtests and a model of phonological awareness, we identified two tasks (subtests) with high psychometric quality that test different linguistic units, tap different cognitive operations, and differ in their relationship (a) to the language status of the child and (b) to an indicator of family background (SES) as well as in their task difficulty, suggesting that these tasks may differentiate between children at different performance levels. In addition, both tasks can be expected to be associated with different aspects of later reading competence (see above).

With respect *to phoneme identification,* previous research has shown that this task explains the highest proportion of unique variance in reading compared with various phonemic awareness tasks (Høien, Lundberg, Stanovich, & Bjaalid, 1995). Interestingly enough, in our study, this task shows significant correlations to our language indicator *(sentence repetition),* even after controlling for phonological working memory *(digit span* and *digit span backwards).* The second task, *blending of onsets and rimes,* was not only more difficult, but also proved to be the only task significantly correlated to the SES indicator *(number of books in the household).* This is unexpected since most studies investigating this relationship found SES differences for phonological awareness performance, as we did for the *blending of onsets and rimes* task (e.g., McDowell, Lonigan, & Goldstein, 2007; Lundberg, Larsman, & Strid, 2012; Lundberg, 2009; Bowey, 1995). However our result might be due to the age and the reading development of the children under study. In fact, McDowell et al. (2007) found evidence that the "effect of SES on phonological awareness is amplified as age increases" (p. 1087). They presume that "the size of this relation will be smaller in younger children because of weaker psychometric properties of the measures, lack of exposure to activities that promote the development of phonological awareness, or both" (p. 1082).

When comparing the difficulty of the different tasks, the pattern does not simply reflect the two-dimensional model underlying our task selection. This is, in fact, of theoretical interest and suggests that additional factors not specified in the model are highly relevant to task performance. Specifically, in our study, the identification of phonemes was the easiest task for the children and was even easier than the identification of syllables. At first sight, this is unexpected because the identification of syllables is—in general—believed to be the easiest phonological task. Moreover, as mentioned above, phonemic awareness is expected to be difficult for children before reading tuition. Thus, a detailed look at the task format and the applied test items is needed to identify relevant additional variables influencing task performance. A detailed look at the test items of the phoneme identification task showed that many of the initial phonemes were vowels (70 %) and/or had syllable quality (40 %, e.g., Ameise à A-mei-se), which facilitates phoneme identification. Additionally, only initial phonemes had to be identified, and the performance on a phoneme task depends on the position of the phoneme within the word (de Graaff, Hasselman, Verhoeven, & Bosman, 2011). Regarding consonants, initial ones are "significantly more identifiable than final consonants" because of their "greater acoustic distinctiveness" (Redford & Diehl, 1999, p. 1555). Moreover, phoneme class could have had an effect on test results. For German children, plosives (b-d-g-k-p-t) are expected to be very difficult to identify because of their acoustic characteristics (short duration of approx. 30–70 msec; Barth, 1999). Furthermore, the identification of initial phonemes in consonant clusters (complex onsets) is more demanding than in a CVC structure (Barth, 1999). The items we applied did not include any plosives or phonemes that were part of a consonant cluster as a target phoneme. Moreover, "perceptual properties, such as sonority levels, greatly influence the development of phoneme awareness" (Yavas & Gogate, 1999, p. 245; see also de Graaff, Hasselman, Bosman, & Verhoeven, 2008). Thus, if more initial phonemes would have been unvoiced plosives in a complex onset, that would likely have resulted in notably higher item difficulty. Moreover, the task *identification of syllables* required a comparison of the initial and final syllables of two words, whereas the identification of phonemes focused on the initial phoneme of one word and was—in addition—picture-based while the task *identification of syllables* was not. This could have influenced the motivation of the child (both tasks were related to working memory). Additionally, the two tasks imply different response formats. The task *identification of phonemes* asked the child to point to a picture, while the task *identification of syllables* required a verbal response (indicating whether the two words included a similar part or not, and if they did, stating the position of the same syllable).

Although our data support the assumption that the type or explicitness of the cognitive operation impacts more strongly on item difficulty than does the size of the linguistic unit, this presumption is by no means clear-cut and may be relativized when taking task-specific considerations into account. In fact, five tasks—as in our small preliminary study—are not sufficient to support generalized statements, especially when acoustic features and task formats differ widely across the five tasks. Hulme et al. (2002) used a more focused method to compare different phonological awareness skills. By implementing a repeated measurement design, they used multiple measures (detection, deletion, or oddity judgments) to assess the awareness of different phonological units (onset or rime, initial phoneme, final phoneme) while using identical items in each task. In doing so, they were able to control for many item- and child-specific influences. They found that "[m]easures of phoneme awareness were the best concurrent and longitudinal predictors of reading skill with onset-rime skills making no additional predictive contribution once phonemic skills were accounted for" (Hulme et al., 2002, p. 2).

Taken together, we conclude that the two-dimensional model of phonological awareness is not sufficient to represent the underlying demands and interrelationships in order to predict the item difficulty of the five types of phonological tasks. Sound characteristics—among others—should be considered systematically (e. g., by using the five-point scale suggested by Yavas & Gogate, 1999). Moreover, the linguistic surrounding (e. g., simple or complex onset/syllable structure) and the position (initial, medial, final) of the linguistic unit should be considered systematically. Additionally, other aspects of the task (e. g., picture-based or not, response format) should be taken into account. Finally, phonological awareness tasks may be differentially associated with other characteristics of the child as well as with the learning environment, thereby demonstrating that they are possibly a complex multifaceted construct.

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