Developmental Sensitivity to Sublexical Structure of the Word: Evidence From the Yearlong Kindergarten Study.

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1. Introduction

The last two decades of research yielded significant advances in understanding early literacy development, with most theorists proposing stage-like acquisition of reading (Ehri, 1995, 1997, Chall, 1983). The vast evidence regarding learning to read in alphabetic systems is in stark contrast to the paucity of research that examines early spelling development, particularly during kindergarten year, as it is the first year of the formal exposure to literacy instruction among children in the United States. Spelling words presents a much larger challenge for young children: it requires explicit knowledge of the relationship between individual sounds and their grapheme representations. It is a particularly daunting task for children exposed to English, as an example of deep orthography where phoneme-grapheme correspondence does not follow one-to-one rule and is rather unpredictable (Caravolas, Hulme & Snowling, 2001; Kessler & Treiman, 2001). An additional factor in reading and spelling development is orthographic consistency, which plays a significant role in acquisition of written language skills (Seymour, Aro, & Erskine, 2003) along with other cognitive and linguistic factors (Furnes & Samuelsson, 2009). Nevertheless, spelling development, just like reading, follows stage-like developmental progression (Treiman, 1994), where children begin to show emergent spelling very early on, before they enter the school system. In the first two years of school, between the ages of 5- and 7-years old, children begin to learn and apply principles of alphabetic spelling.

As has been pointed in previous research, there is a difference between grapheme-phoneme (reading) and phoneme-grapheme (spelling) mapping. Therefore it is proposed that general knowledge of the alphabetic system (Ouelette & Senechal, 2008), as well as the ability to segment and blend the words should best account for children's early spelling development. Early spelling, often called "invented spelling", is considered to be a very strong predictor of early reading achievements (Ehri, 1989, Lombardino, Morris, Mercado, DeFillipo, Sarisky & Montgomery, 1999), as it allows young children to use their knowledge of the alphabet, both the letter names and the letter sounds, and try to apply it through print conventions often ignoring the fact of letter-sound correspondence and using the letter name as a unit of representation, e.g., ML for *mail*.

However, the idea of sensitivity to smaller vs. larger sublexical units in children's early spelling attempts has not been addressed from a representational point of view, i.e., what is the preferable unit within the subsyllabic structure of the word that children represent most consistently. Research in early decoding subsumes the idea that children are more likely to be aware of larger sublexical units, like onsets and rimes (Bryant & Goswami, 1970) than individual phonemes, based on linear phonological organization, i.e., children are first aware of syllables, proceeding to onset-rime distinction, and finally to individual phonemes (Savage, Blair, & Rvachew, 2006; Treiman & Zukowski, 1991; Goswami, 1993). However, not all researchers are in agreement with this assumption. Ehri (1997) suggested that reading may begin with small units, i.e., phonemes, as they represent speech sounds and therefore can be easily connected to the letters of the alphabet, and then proceed to the larger groups that

include onset, coda clusters and rimes. The idea that onset-rime division may not be preferable in early reading was examined in multiple studies, among 4- and 6-year-old children (Duncan, Seymour, & Hill, 1997; Seymour, Duncan & Bolik, 1999). Seymour & Duncan (1997) suggested that awareness of the sounds, rather than larger units, such as rimes, may be available to young children early on, despite the fact that they had very well established rhyming skills. Savage et al. (2006) provided more evidence of meta-awareness among pre-readers in support of the idea that smaller units within the substructure of the word are available early on and 4-6-year-old children are more apt to rely on individual phonemes rather than larger units, such as onset-rimes in their early decoding attempts. Shire and Blum (2005) provided cross-linguistic evidence that Hebrew-speaking children find a body-coda division preferable to onset-rime, again showing preference for smaller, rather than larger units.

Despite well-defined stages of spelling acquisition, many questions remain: What sublexical units are preferred in early spelling, when children begin to apply alphabetic principles? Word segmentation for spelling requires an intermediate subsyllabic level with a variety of possible unit sizes. For example, a word like *dress* can be segmented as /dr/-/es/, representing onset-rime division; /dr/-/e/-s/, as an example of onset-nucleus-coda; /dre/-/s/, which represents body (i.e., onset and nucleus) and coda; and finally, the word can be segmented into individual phonemes, i.e., /d/-/r/-/e/-/s/. Hayes, Treiman, & Kessler (2006) suggested that children are more aware of the smaller vs. larger units of subsyllabic division in their early spelling supporting previous assumptions that were proposed for early reading development (Seymour et al., 1997; Savage et al., 2006).

In addition, there is also a question regarding possible preference for the consonants that have their sounds at the beginning of the letter name, e.g., *b* or *v* (CV pattern), than those that have their sounds at the end of the letter name, e.g., *m* or *f* (VC) in early spelling attempts (Treiman at al., 2008). An earlier study on children's spelling attempts at the onset of the kindergarten year (Zaretsky, Core, & Currier, 2009) showed no preference for the letter name. As this study reports year-long data, we looked at the possibility that letter name may increase the correct representation of the consonant clusters at the beginning and the end of the words.

We posed the following questions in this study:

1. What are the most often represented subsyllabic units in early spelling attempts and does it show developmental trend throughout the kindergarten year?
2. Do early spelling attempts suggest children's awareness of smaller vs. larger subsyllabic units (Classification)?
3. What is the relationship between alphabet knowledge, PA and word representation in early spelling?
4. Does the letter name play a role in children's awareness of and the ability to represent consonant clusters at the beginning and the end of the word, i.e. as part of onset or coda?

We hypothesized that if there are similarities in children's early reading and spelling development, spelling will reflect the trend towards representation of smaller, rather than larger units within the word structure, suggesting meta-awareness in early spelling.

2. Method

Participants

24 children (M=5;6, SD=.3) participated in this study. All children were assessed at the beginning and the end of their kindergarten year.

Materials

The following tests battery was administered to all children at the beginning of the Kindergarten year (Time I):

- Phonological Awareness Test (PAT, Robertson & Salter, 1997)
- Receptive Vocabulary (PPVT-III, Dunn & Dunn & Dunn, 2004)

-Early Reading Screening Instrument (ERSI, Lombardino et al., 1999):

- Alphabet Knowledge (Upper/lower case naming; alphabet production, i.e., writing)
- Decoding (10 words)
- Sight (basal) Words (10 words)
- Invented Spelling (12 words)

At the end of the year (Time II) children were re-tested on the list of Invented Spelling words to follow the development of spelling skills. As there was a considerable span of time between the initial and final testing, children could not show the effect of rehearsing and their spelling attempts are considered to be representative of developmental growth. For this study only the results of the *Invented Spelling* task will be discussed.

The invented spelling words used 14 consonant sounds total (7 with CV pattern and 7 with VC pattern in their names). The CV and VC consonants were equally used in the beginning and end of the words. Two consonant clusters with CV/VC and VC/CV

phonological string were used as an onset and two clusters (VC/CV and CV/CV phonological string) were used at the end of the words. Five vowels (a, o, i, u, e) were used in the sample words. One word had past tense morphological inflection, i.e., *peeked*, which may be interpreted by a child as a consonant cluster at the end of the word (/pikt/). One consonant digraph was used at the beginning of the word: *ch*- as in *chin* /tʃin/, and one at the end: -*ck*, as in *back.* However, *ch* does not have corresponding letter, while *ck* can be represented by either *c* or *k*. The only 2-syllable word in the sample, *picking,* had a digraph at the end of each syllable, i.e., -*ck* and -*ng*. Although the word was the longest in terms of the number of letters, it contained only five phonemes /pikiŋ/. In other words, the stimuli represented five specific encoding features: silent letters, consonant clusters, consonant and vowel digraphs, morphological inflections and phonemes without corresponding letter names. The words were dictated to all children and children were asked to write them down to the best of their abilities.

The sample spelling was coded as onset (12); body (12); rime (13); and coda (13). Total numbers of each of the sublexical structures correctly represented by each participant were used in the analysis.

3. Results

The results of the invented spelling task showed that at TI children were most comfortable representing onsets, which constituted 72% percent of correct responses. Codas were correctly represented 49% of the time and rime constituted only 28% of correct responses. At TII, children were almost equally likely to represent all the subsyllabic elements of the word. Post hoc analyses revealed significant differences between subsyllabic representations within the span of the kindergarten year

(TI_{onset}xTII_{onset}: t=-2.47(23), p=.02; TI_{coda}xTII_{coda}: t=-2.85 (23), p=.008; TI_{body}xTII_{body}: t=-3.9 (23), p=.001; TI_{rime} xTII_{rime}: t=-5.3 (23), p=<.001). The results of a repeated measure ANOVA (Time x Measures) showed significant effect of Time (F=14.96, p=.0008) and Measure (F=25.71, p=<.0001) supporting the developmental growth factor (Figure 1).

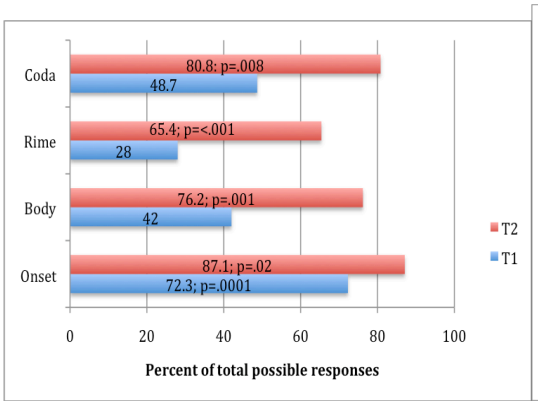

Figure 1: Unit preference at TI and developmental growth in spelling at TII.

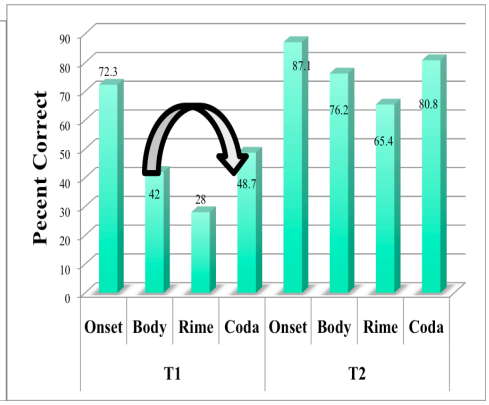

Figure 2. Body/Coda as a better fit at TI (NS), and trend toward full phonological representation at TII.

To address the question of children's preference for the subsyllabic units of representations that may suggest classification in early spelling skills, we compared mean differences between onset and rime, and body and coda. The differences between onsets and rimes at TI were significant (t=7.25 (23), p=.0001), with the preferences for the onsets rather than rimes. However, the differences in representations of body and coda were not significant (42% and 47.8% respectively), suggesting that children were equally likely to represent those units, showing specific trend in early spelling for sublexical representation of the words. At TII there were no differences in children's abilities to represent every element of word structure. (Figure 2)

Pearson correlations were used to address the relationship between alphabet knowledge, PA and word representation in early spelling. As seen in Table 1, naming

upper and lower case letters are significantly correlated with sublexical representations at T I, while the ability to write the letters play a role in rime representation at T II. At T I only Blending was significantly correlated with children's ability to represent onsets (TI_{ons}=.463, p=.01), while Rhyming, Blending and Isolation (both initial and final position) were significantly correlated with the ability to write a full rime at T II (TII_{rime}=.662, p=.01; .473, .443 and .413, p=.01 respectively). (Table 2)

Table 1. Relationship between Alphabet knowledge and subsyllabic representation.

	AlphLower	AlphUpper	AlphProd
T1 onset	.418*	.518**	-
T1 body	.562**	.608*8	-
T1 rime	-	.475**	-
T1 coda	.559**	.475**	-
T2 rime	.436*	-	.468*

Table 2. Influence of PA skills on subsyllabic representations.

	Rhyme	Blending	IsolInitial	IsolFinal
T1 onset	-	.469**	-	-
T2 onset	.542**	-	-	-
T2 body	.468**	-	-	-
T2 rime	.662**	.473*	.443*	.413*

Finally, we looked at the possible influence of letter name in representation of consonant clusters. The differences in the use of clusters with either CV/VC or VC/CV letter strings in both positions were non-significant at both testing times, indicating that letter name is not a major contributor in early spelling. However, from a developmental perspective, we observed significant growth in all types of cluster representations, regardless of the letter string, in initial and final position (TIxTII ($CV/VC_{initial}$): p=.001; TIxTII ($VC/CV_{initial}$): p=.002; TIxTII (VC/CV_{final}): p=.03).

4. Discussion

This study investigated children's sensitivity to subsyllabic structure of the word in early spelling attempts through the longitudinal design. At question were specific issues of early spelling development that have not been addressed in previous research studies. While there is an agreement that spelling development, just like reading,

follows stage-like progression, there are still unresolved issues of the preferable units if sublexical representation in early spelling attempts and the role of letter names in correct representation within the word. We also wanted to see the role alphabet knowledge and PA awareness play in spelling development. As mentioned elsewhere in this paper, there have been suggestions that children may have preferences for letters with their sounds at the beginning of the name, and we extended this notion to possible preferences for consonant cluster strings representations. Previous work (Zaretsky et al., 2010) found no support for this claim for overall spelling ability.

Our results clearly indicate that body/coda classification (Share & Blum, 2005) is more appropriate than onset-rime in early spelling, signifying children's early awareness of smaller rather than larger subsyllabic units at T I just as suggested for early reading development (Savage et al., 2006; Seymour & Duncan, 1997). However, by the end of kindergarten children are capable of representing the full phonological structure of the word.

Alphabet naming, rather than production, continues to be the best indication of children's success in spelling, just as it is for early decoding (Ouelette & Senechal, 2008), supporting the notion that children in North America use letter names as a bridge to literacy (Ellefson, Treiman, & Kessler, 2009). Only Blending (PA) task plays a role in subsyllabic representation at TI, but at TII PA becomes more important, supporting previous suggestion that PA develops as part of formal exposure to reading in English orthography (Zaretsky et al., 2009). The specificity of the PA tasks correlated with spelling shows how the explicit ability to identify the position of the sound within the word helps children younger than 7 years of age map individual sounds onto their

grapheme representations. It is a particularly daunting task for children exposed to English, as an example of deep orthography where phoneme-grapheme correspondence does not follow one-to-one rule and is rather unpredictable (Caravolas, Hulme & Snowling, 2001; Kessler & Treiman, 2001).

Consonant clusters representation in the initial vs. final position suggested that children may draw on their knowledge of letter name, but we didn't find significant preference for CV/VC over VC/VC cluster strings in the onset position at TI, when this particular relation could be helpful to young spellers. However there was some trend toward more accurate cluster representations when it started with the CV letter pattern in the final position of the word. Hayes et al. (2006) suggested that children may rely on letter name to represent letter sound that comes after the vowel and letters with their sounds at the beginning may serve this purpose in the final position of the word. The correct use of consonant cluster strings with both compositions in the onset position increases significantly at TII, while the use of CV/CV and VC/CV clusters at the end of the word becomes equal and suggests developmental trend in growing awareness of letter-sounds correspondence representing phonological structure of the word by the end of kindergarten year.

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