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Lexical and sub-lexical auditory phonological priming effects on word reading in grades 4 and 5

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Abstract

There is emerging evidence that phonology contributes to visual word recognition independent of orthography in the upper elementary grades, more so when reading less frequent words. It is unclear how lexical and different sub-lexical phonological units influence familiar word reading; therefore, we investigated the priming effects of the phonological word (repetition), syllable, rime, and phoneme units on word reading in fourth and fifth grades. We used an auditory primed and timed word reading task to determine whether different phonological units influenced the speed of reading familiar words. To examine their relationship with reading ability, we compared primed reading speeds with word and pseudo-word reading measures. The results revealed a significant lexical phonological priming effect of facilitation by repetition primes, and a difference between the direction of phoneme and rime priming. Lexical phonological priming did not relate with word or pseudo-word reading. Sub-lexical syllable priming, on the other hand, had a significant relationship with word reading. These findings show the influence of primed auditory phonological units during word reading without any overlapping orthographic prime in fourth- and fifth-grade children. Overall, lexical phonology has a definitive role of facilitation regardless of word reading ability whereas the sub-lexical phonological units appear to have a variable impact. Syllable influenced reading speed has a direct relationship with word reading.

Keywords: auditory phonological priming, phoneme, syllable, rime, word reading

1. Introduction

Phonological processing is an integral part of reading (Ashby, 2010; Cataldo & Ellis, 1988; Mattingly, 1972; Wagner & Torgesen, 1987). In learning to read, the ability to convert letters into their corresponding sounds, blend and later access the phonological lexicon is crucial. There is consensus that direct orthographic access to the lexicon gradually replaces the reliance on

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phonological coding as reading proficiency increases (e.g., Acha & Perea, 2008; Ehri, 2005; Castles et al., 2007). Studies have shown that this shift does not exclude phonology as a factor that continues to exert an influence on reading (Leinenger, 2014; Milledge & Blythe, 2019; Sauval et al., 2017). While a serial conversion of graphemes to phonemes prior to lexical selection may be unnecessary with increasing reading experience, phonological patterns extracted from written units do impact visual word recognition in younger, developing readers (e.g., Kyte & Johnson, 2006; Jared et al., 2016). However, the specific role of different auditory phonological units not extracted from written units on word reading in developing readers remains unclear. Psycholinguistic research regarding phonological grain size in reading also provide an inclusive account of phonology and orthography (see Ziegler & Goswami, 2005). Although phonological processing in reading is not devoid of orthographic processing, studies comparing the performance of children on the former with actual reading ability typically use phonological awareness tasks that require manipulations of auditory phonological input (see Melby-Lervåg et al., 2012). It is not known whether auditory phonological units are relevant for reading beyond correlations with explicit phonological processing tasks. Therefore, we investigated the impact of lexical and sub-lexical auditory phonological units as primes on measured word reading speed or latency and examined their relationship with word reading ability in this study.

The role of phonology in learning to read transitions from an implicit awareness of larger units such as rhyming words to an explicit meta-phonological knowledge of smaller units such as the phoneme or rime. Preschool children auditorily categorize rhyming words or identify a non-rhyming word without declarative knowledge of the rime causing a rhyming effect (see Seymour & Duncan, 1997). As children continue to receive instruction, they recognize the components within words, identify the smallest units, and manipulate speech sounds that comprise words (e.g., Frost, 1998; Stahl & Murray, 1994; Ziegler & Goswami, 2005). In the early stages of learning to read, children rely on the auditory phonological processing system and as children enter the early elementary grades, a sequence of letters is treated as representing corresponding sounds that blend together to form the phonological lexicon associated with the written word. This process becomes relatively automatic and explicit phonological coding is then not always required as a direct channel accessing the phonological lexicon for written words strengthens (e.g., Acha & Perea, 2008; Castles et al., 2007). Thus, the role of orthography in identifying words increases and one relies on phonology when reading less-familiar words (e.g., Eddy et al., 2016; Schmalz et al., 2013; Ziegler et al., 2014).

The self-teaching theory of reading development acknowledges this shift in reading style where a developing reader plays an active role to make sense of the phonological patterns encountered in a given orthographic structure (Share, 1995). The dual route model explains this difference in the pattern of reading through two separate routes accessing the input lexicon. The non-lexical route accesses the phonological lexicon by linking each grapheme with its corresponding phoneme. It is suitable for reading regular words that follow the phoneme-grapheme correspondence rules in an alphabetic script.

The direct route relies on the orthographic connection with the phonological lexical unit for reading familiar and irregular words (Coltheart et al., 1993; Coltheart et al., 2001; Schmalz et al., 2013). However, these routes are not mutually exclusive.

Reaction time studies on the impact of orthographic primes which convey phonologically related information, e.g., pseudo homophones and words with phoneme and feature overlap, on lexical decision making and naming in children have primarily shown that phonological information redundant in the words do influence reading (e.g., Brooks & MacWhinney, 2000; Eddy et al., 2016; Sauval et al., 2018). Zeguers et al. (2018) found contrary evidence where children across Grades 2, 4 and 6 did not exhibit reliable phonological priming effects despite large phonological differences between the target and control primes. Visual tracking during silent reading also provides preliminary evidence for the role phonology serves in reading (Blythe et al., 2015; Jared et al., 2016). Children may not always require explicit phonological recoding in the later stages of reading (e.g., /b/+/ɪ/+/t/ = /bɪt/), but phonological pattern analysis recognize printing deviations that do not fit the expected phonological patterns in a script (e.g., bit versus bti). Research recognizes that the nature of phonological impact varies but does not cease (see Milledge & Blythe, 2019). Models such as the multiple-route model and the CDP+ model acknowledge the self-teaching aspect of phonological coding in children and provide the option to include a dynamic system of learning to read with phases between the indirect phonology-based and direct lexical routes (Grainger et al., 2012; Perry et al., 2007). Orthography, however, mediates this role of phonology.

Interestingly, fewer studies have approached this area of investigation from the perspective of spoken phonology influencing reading rather than orthography-mediated phonological effects. It is unclear whether the presentation of an auditory stimulus encompassing phonological elements would influence word reading responses, particularly in developing readers. Intermodal priming studies in adults have shown that auditory spoken words with overlapping onsets and nuclei, particularly in the initial position for mono- and disyllabic words, and rime segments are facilitatory to picture naming when compared with phonologically unrelated spoken words (Meyer & Schriefers, 1991; Schriefers et al., 1990). Adults have shown similar facilitatory effects on repetition or identity primes with lexical decision and spoken word repetition tasks (Dumay & Radeau, 1997; Holcomb et al., 2005). We found two studies in children that examined the effects of auditory primes on semantic interpretation of printed words and lexical decision making, respectively. Reitsma (1984) found that initial spoken CV syllables were facilitatory for children in Grade 1, but the effects waned for children in Grade 6. A recent study in third- and sixth-grade children also found auditory identity prime facilitation compared with unrelated conditions on both frequent and less frequent words. They also reported that this facilitatory effect was larger for less frequent words as compared to frequent words (Sauval et al., 2017). Therefore, preliminary evidence indicates that speech-based phonological input modulates visual word recognition in children. It is unclear how these effects change with the use of different spoken phonological units and on a read aloud task.

The models of reading discussed above also limit their exploration to the utility of the phonological route in the context of deciphering orthographic units. The bimodal interactive activation model (BIAM), based on the work of McClelland and Rumelhart (1981), considers the role of non-orthographic phonological input. It supports the connectedness between spoken and written language processing. Both auditory and visual (script) input may activate phonological codes at the lexical and sub-lexical levels (e.g., Grainger et al., 2003; Diependaele et al., 2010). Studies by Sauval et al. (2017) and Reitsma (1984) suggest the presence of activation at both lexical (identity priming) and sub-lexical (syllable) levels on tasks that involve decision making but no requirement for a word to be read aloud. Although spoken phonology influences lexical decision making, it is uncertain whether the same holds good in the process of reading aloud.

In this study, we investigated whether spoken repetition of the entire target word, syllable, phoneme, and rime prime stimuli would have an effect on a timed read aloud task. The choice of the three sub-lexical units used in this study was based on psycholinguistic research in adults and children pertaining to phonological grain size in orthographic processing. The results of unimodal (visual-visual) and intermodal (auditory-visual) priming studies reveal that onset-phoneme, rime, and syllable grain sizes alter the reaction time of visual word recognition (Campos et al., 2018; Brooks & MacWhinney, 2000; Grainger & Ferrand, 1996; Ferrand et al., 1997; Schiller, 2004; Sauval et al., 2017). Additionally, correlational studies between phonological awareness and reading achievement rely on meta-phonological tasks using these different phonological units to compare with reading ability (e.g., Anthony & Francis, 2005; Anthony & Lonigan, 2004; Deacon, 2011; Del Campo et al., 2015; Hogan et al., 2005; Hulme et al., 2012; Melby-Lervåg et al., 2012; Plaza, 2001; Plaza & Cohen, 2003). Phonological awareness tasks involve an analysis of spoken phonology (e.g., phoneme elision, syllable blending, rime awareness) which suggest that reading differences can be influenced by factors such as bilingualism, the language under consideration, lack of reading experience (non-readers) and duration of reading exposure (e.g., Denton et al., 2000; Haigh et al., 2011; Li et al., 2017; Plaza, 2001; Sauval et al., 2017). The participants in our study were Spanish-English bilinguals as this group represented the majority population of the school district where the study was conducted. Therefore, we note that the syllable is a key unit in Spanish phonological awareness (Denton et al. 2000). In a review of cross-linguistic transfer effects in reading, Lallier and Carreiras (2018) noted that crosslinguistic effects depend on orthographic depth and factors such as reading level and language proficiency between the two languages children learn to read. Since the participants in our study only had exposure to written language in English, we did not anticipate cross-linguistic transfer occurring as a result of learning to read two different languages. If anything, there may be direct phonological transfer effects based on spoken exposure to the two languages. Overall, research has shown that phoneme, rime, and syllable awareness tasks either correlate with or predict word reading performance from about four years of age till Grade 6 to varying degrees, and that the strength of this relationship reduces with increase in grade level (e.g., Anthony & Francis,

2005; Anthony & Lonigan, 2004; Deacon, 2011; Del Campo et al., 2015; Hogan et al., 2005; Hulme et al., 2012; Melby-Lervåg et al., 2012; Plaza, 2001; Plaza & Cohen, 2003). Taken together, experimental priming studies and correlational analyses have shown the importance of sub-lexical units in developing reading skills. It is not known whether there is a pattern in which phonological units in a spoken form impact the process of reading words when the orthographic cues are absent, particularly in the upper elementary grades. If there is an impact of spoken phonological units on reading, it is unclear at this time as to how it relates with word reading ability per se.

Therefore, this study aimed to: (1) determine whether different types of spoken phonological units exert an influence on word reading speed and (2) examine the relationship between the effects of these phonological units on word reading latency and reading ability. We investigated the first question through an auditory priming experiment where we presented lexical (repetition) and sub-lexical (phoneme, rime, syllable) primes prior to familiar words read aloud as fast as possible. We predicted that if the auditory phonological units at both lexical (repetition) and sub-lexical levels (phoneme, rime, syllable) impact word reading speed, reaction times across experimental conditions would be significantly different than that of the no prime control condition. If they do not impact word reading uniformly, a pattern would emerge indicating specific units which yield differences compared with the control condition. We anticipated that reading trisyllables would take longer than reading monosyllables in the control condition due to the orthographic length effect (Spieler & Balota, 2000). We used familiar words instead of less frequent and unfamiliar words for three reasons. Familiar words were preferred over unfamiliar and less frequent words to control the confounding variable of word recognition ability in a primed and timed read aloud task. The impact of auditory phonological units on reading speed of less frequent and unfamiliar words may be expected considering reduced lexical knowledge, but the concern of this study was to find the role of spoken phonological units in conditions where phonological recoding is not typically essential. The results based on words subjected to a familiarity rating by third-grade teachers from the same school district as the participants were expected to be of greater relevance. We addressed the second question by comparing the reaction time values of the different experimental conditions with measures of real word and pseudo-word reading ability. Floyd et al. (2007) found that word decoding ability is unrelated to the speed of processing as measured by visual matching, decision speed and cross out tasks beyond eight years of age. If this effect persists with the speed of word reading, the reaction time of the two control conditions would be unrelated to reading ability in our study. We assumed that if the role of phonology is dependent on reading level, there would be a relationship between the experimental primed reaction time values and scores on the word and/or pseudo-word reading tasks and expected that the nature and strength of these relationships may vary based on the lexical and sub-lexical level of phonological unit used as well as the type of reading task.

Methodology

2.1 Participants

Thirty children from fourth (five males, eight females) and fifth grades (10 males, seven females), with a mean age of 10.2 years (range: 9.2 years to 11.0 years), from a public elementary school in southern California participated in the study. We chose them consecutively per the return of letters of interest attached to advertisement flyers, by interested parents. We obtained a written informed consent from the parents in the language of their choice (Spanish or English) and a written assent from each participant. The participants were Spanish-English bilinguals receiving academic instruction in English, the majority population of the school district. The nature of Spanish exposure at home (e.g., Spanish vs. Spanish-English speaking parents or grandparents at home, dialect and proficiency differences across families and individuals) was variable. We excluded children with known diagnoses of sensory, speech, language, social-emotional, cognitive, and reading impairments, and those receiving special education services or on a 504 plan. All participants passed hearing and vision screenings at school. Participation was voluntary and each participant received a gift worth $10.

2.2. Instrumentation

We administered the primed word naming experiments using a Dell Inspiron 13 7373 laptop running Windows 10 operating system. A compatible noise-cancelling headset microphone (Logitech-H390) delivered the auditory primes and recorded word naming responses. The DMDX software (Forster & Forster, 2003) presented the stimuli and recorded the experimental data. We used the DMDX compatible CheckVocal software (Protopapas, 2007) to view audio-visual output (audio playback, waveform, and spectrogram) for reaction time (latency) analysis of word naming responses. We chose the letter-word identification (WI) and word attack (WA) subtests of the Woodcock-Johnson IV Tests of Achievement (Schrank et al., 2014) to include real word and pseudo-word reading tasks. In the former, children may read the words using a combination of direct and indirect routes of reading. The latter requires the application of phoneme-grapheme correspondence rules by blending sub-lexical phonological units extracted from the script.

2.3 Materials

First, we made lists of 120 monosyllabic (consonant-vowel-consonant) and 60 trisyllabic words with consonant onsets familiar to third graders from grade level books. Three third-grade teachers rated the words for their familiarity to third-grade students on a 3-point rating scale: *very familiar, familiar, unfamiliar*. We discarded words rated as *unfamiliar* by any rater and retained words rated as *very familiar* and *familiar* (92 monosyllabic and 48 trisyllabic words). Using systematic random sampling (every second item from randomized lists), we arrived at 60 and 30 monosyllabic and trisyllabic words, respectively. *Very familiar* and *familiar words* were chosen for two reasons: (1) they are not expected to interfere with read aloud responses for children and (2) the effect of the spoken primes, if any, would not be

conflicted by a need to access the phoneme grapheme correspondence route for reading less-familiar words.

The 60 monosyllabic words were targets for the phoneme, rime, repetition and corresponding no prime conditions. We divided them into two sets of 30 each for phoneme and rime priming conditions, using the odd-even method. The 30 trisyllabic words were targets for syllable, repetition and corresponding no prime conditions. For monosyllabic repetition and no prime targets, we chose 30 words from the 60 monosyllabic words using systematic random sampling. We divided them into two sets of 15 words for no prime and repetition prime conditions using the odd-even method. For trisyllabic repetition and no prime targets, we divided the 30 trisyllabic words into two sets of 15 words for no prime and repetition prime conditions using the odd-even method. Thus, the primed word naming experiments included 150 words serving as targets for the phoneme, rime, syllable, repetition (monosyllabic: M-R and trisyllabic: T-R) and no prime (monosyllabic: M-NP and trisyllabic: T-NP) conditions (Appendix). We used the no prime condition as a control instead of an unrelated condition to ensure the interpretation of any change in reaction time between experimental and control conditions as either facilitatory or inhibitory. We selected trisyllable and monosyllable words as target stimuli for phoneme and syllable priming, respectively. Using target stimuli of equivalent word length corresponding with their primes (one-third, i.e., first phoneme as prime among the three phonemes in monosyllables and first syllable as prime among the three syllables in trisyllables) would control for word length as an extraneous variable. By maintaining an equivalent ratio between the length of the prime and target across the phoneme and syllable priming conditions, any resulting difference between the two primed and corresponding control conditions could be attributed to the nature of the prime itself.

The primes for the phoneme (e.g., /s/ for 'sit'), rime (e.g., /ɪt/ for 'sit'), syllable (e.g., /bə/ for 'banana') and repetition (e.g., /sɪt/ for 'sit') priming conditions were audio recorded in a quiet room using Praat software (Boersma, 2001). For plosive consonants in the phoneme prime condition, we recorded the phonemes with a partial vowel (e.g., /p/ as 'puh'). We edited the recordings to remove periods of silence before and after the prime for their precise duration in milliseconds: phoneme (M=483, SD=131), rime (M=512, SD=56), syllable (M=638, SD=102), M-R (M=617, SD=82) and T-R (M=874, SD=140). The auditory presentation of primes controls for orthographic influence. Any impact on reaction time (latency) in correctly reading aloud the target word would be due to the auditory phonological prime preceding the reading task. We wrote DMDX programs such that the on-screen display began with a fixation point (*) for 500 milliseconds. An auditory prime of its respective duration corresponding with the prime type (Sauval et al., 2017) and a silence of 500 milliseconds for the no prime conditions followed. The prime duration was equal to the stimulus-onset asynchrony (SOA) as we did not use an interstimulus interval between the prime and target to control for strategic processing to the maximum extent possible (Neely, 1991; Posner & Snyder, 1975). We presented the target word in lower case letters for 3000 milliseconds. We prepared a practice set

consisting of 10 prime-target pairs from the *very familiar* or *familiar* words not selected for the stimulus set.

2.4 Procedures

The participants sat in a quiet and well-lit room at their elementary school. For the primed word reading experiments, we adjusted seating to ensure visibility of the laptop screen. We verified placement of the headset microphone such that the recorded responses were audible. The participants were instructed as follows, "Focus on the laptop screen when you see the '*'. You may hear some sounds through the headphones and immediately see a word on the screen. Read the word aloud as soon as you can". We chose the word naming/reading task over lexical decision to avoid cognitive demands associated with choosing the correct versus incorrect responses. The auditory prime presentation with the reading task is functionally relevant as it mirrors tasks in phonology-based reading instruction where one provides spoken phonological cues to support word reading. The participants took the practice trials they became familiar with the task. They needed no more than two repetitions of the practice set. We presented the stimulus for each of the conditions in random order. The software randomized the items within each experiment. We administered the two word reading subtests per instructions in the test manual. The participants took short breaks (approximately 5 minutes) between the experiments or tests, as needed. We gave a small reward to each participant upon completion of the tasks.

2.5 Data Analysis

We analysed the digitally recorded primed word naming responses for onset reaction times in milliseconds using CheckVocal software. We excluded erroneous word reading responses (incorrect word identification, response onset before 250 milliseconds – less than 0.1%, participant's overt inattention). We analysed the data using both descriptive and inferential statistics (Statistical Package for Social Sciences software - version 26). All statistical tests used $p<.05$ as the level of significance. We compared the experimental priming conditions with their corresponding control conditions through paired *t*-tests. Effect size using Cohen's *d* was calculated considering *t* value for correlated observations (t_c), $d=t_c\ [2(1-r)/n]^{½}$ and $t_c=MD/(SDD/n^{½})$ (MD is the difference of means, SDD is the standard deviation of differences, *r* is the correlation co-efficient and *n* stands for sample size), for all paired comparisons (Dunlap et al., 1996). To determine priming effects across the three sub-lexical phonological units, we administered repeated measures ANOVA with a Greenhouse-Geisser correction and conducted post hoc analyses using the Bonferroni correction. We performed Pearson's correlations to examine the relationship between the reaction time values, and word and pseudo-word reading scores. We also conducted correlational analyses by controlling the WI and WA scores for age or grade.

3. Findings

We calculated mean reaction time values for each of the priming and control conditions and compiled raw scores on the WI and WA subtests for each participant. Table 1. summarizes the mean (M) and standard deviation (SD) values for the experimental and control priming conditions, and subtests of word reading ability.

Table 1
Mean and Standard Deviation for Primed Word Reading Reaction Times (in milliseconds) and Reading Raw Scores

Measure	M	SD	Error*		M	SD	Error*
Priming Condition				Priming Condition			
M-NP	654	131	2	T-NP	690	128	6.8
M-R	530	107	2.2	T-R	443	145	3.1
Phoneme	631	106	3.1	Syllable	670	114	4
Rime	667	110	2.1	-	-	-	-
Reading Subtest							
WI	59.5#	6.2	-	-	-	-	-
WA	23^	4.8	-	-	-	-	-

Note. *percentage of erred word reading responses excluded from analysis; #grade equivalence: 5.2; ^grade equivalence: 5.5

On the paired comparisons of the experimental priming conditions with their corresponding control conditions, we obtained statistically significant differences between M-R and M-NP (530 ms vs. 654 ms), $t(29)=7.25$, $p<.001$, $d=1.03$, $r=.7$, and T-R and T-NP conditions (443 ms vs. 690 ms), $t(29)=8.8$, $p<.001$, $d=1.8$, $r=.37$, with large effect sizes. There were no statistically significant differences between phoneme and M-NP (631 ms vs. 654 ms), $t(29)=1.61$, $p=.11$, $d=.18$, $r=.8$, rime and M-NP (667 ms vs. 654 ms), $t(29)=.83$, $p=.41$, $d=.1$, $r=.77$, and syllable and T-NP (670 ms vs. 690 ms), $t(29)= 1.875$, $p=.07$, $d=.16$, $r=.88$, conditions.

Next, we administered the repeated measures ANOVA to determine the priming effects across phoneme, rime and syllable primes after obtaining difference values with their respective no prime control conditions as M-NP and T-NP (654 ms vs. 690 ms) were significantly different with a small effect size, $t(29)= 2.48$, $p<.019$, $d=.28$, $r=.81$. There was a significant effect of prime type on the adjusted reaction time values, $F(1.661, 48.165)=5.97$, $p=.007$, $\eta_p^2=.17$, $\eta^2=.17$. Post hoc analyses using the Bonferroni correction for three pairwise tests revealed a statistically significant difference between adjusted phoneme and rime conditions with an effect size approaching the moderate level ($M_{difference}$=35 ms), $p=.001$, $d=.46$, $r=.83$. Phoneme and syllable ($M_{difference}$=2 ms), $p=1$, $d=.03$, $r=.49$, and rime and syllable conditions ($M_{difference}$=32 ms), $p=.04$, $d=.44$, $r=.58$, were not significantly different although the latter was approaching significance.

Last, we performed correlational analyses between the reaction time values and reading scores, also controlling the reading scores for age and grade. Table 2. summarizes these results.

Table 2
Primed Reaction Time and Reading Scores – Pearson's Correlation Coefficients and p-values

Priming Condition	WI	WI[a]	WI[g]	WA	WA[a]	WA[g]
	r (*p*)	*r* (*p*)	*r* (*p*)	*r* (*p*)	*r* (*p*)	*r* (*p*)
M-NP	-.41 (.022)	-.37 (.047)	-.4 (.029)	-.31 (.091)	-.27 (.153)	-.29 (.116)
T-NP	-.47 (.008)	-.47 (.01)	-.51 (.005)	-.36 (.05)	-.34 (.065)	-.38 (.042)
M-R	-.24 (.202)	-.28 (.128)	-.29 (.12)	-.11 (.55)	-.14 (.463)	-.14 (.441)
T-R	-.1 (.589)	-.1 (.603)	-.11 (.549)	-.1 (.598)	-.11 (.57)	-.09 (.617)
Phoneme	-.29 (.119)	-.27 (.151)	-.29 (.118)	-.17 (.347)	-.15 (.413)	-.17 (.358)
Rime	-.26 (.165)	-.26 (.162)	-.3 (.107)	-.16 (.385)	-.16 (.399)	-.19 (.314)
Syllable	-.35 (.053)	-.43 (.02)	-.47 (.01)	-.3 (.101)	-.35 (.06)	-.38 (.037)

Note. [a]controlled for age, [g]controlled for grade

The two control conditions, M-NP and T-NP exhibited statistically significant, weak to moderate negative correlations with WI, with and without controlling for age or grade. M-NP and T-NP did not correlate with WA, except between T-NP and WA when controlled for grade. The two repetition priming conditions, M-R and T-R did not correlate with WI or WA. Among the sub-lexical units, phoneme and rime priming did not correlate with WI or WA. Syllable priming exhibited weak to moderate negative correlations with WI when controlled for age or grade, and with WA only when controlled for grade.

4. Discussion and Conclusions

The first aim of the study was to determine the role of auditory phonological lexical, and sub-lexical units on word reading, through a primed and timed word reading task. We hypothesized that word reading speed primed by repetition, phoneme, rime, and syllable primes would be different from word reading speed in their absence, if spoken phonological units exerted an influence on word reading. The results of the paired comparisons between the experimental and corresponding control conditions revealed that auditory repetition primes for both monosyllables and trisyllables facilitated word reading speed. Phoneme, syllable, and rime units did not exert a similar influence. Therefore, the results confirm the role of spoken phonology on word reading at the lexical level but not at the sub-lexical level for this group of participants in Grades 4 and 5. The repetition priming effect we observed in this study is consistent with previous findings concerning identity priming on lexical decision making in children and adults (Holcomb et al., 2005; Sauval et al., 2017). While we know that lexical phonology impacts auditory word repetition in adults (Dumay & Radeau, 1997), this study provides evidence for the relevance of lexical phonology on a speech-production-based word reading task in fourth- and fifth-grade bilingual

children. These findings shed light on the direction of priming caused by spoken identity primes and indicate that they are facilitatory regardless of word length. Also, this priming effect on third-grade familiar words in children whose reading and pseudo-word reading grade equivalences (5;2 and 5;5, respectively) are well above the third grade suggests that phonology does play a role in familiar word reading, contradicting the idea of a phonological effect associated with orthographically challenging or less-familiar words (e.g., Eddy et al., 2016; Schmalz et al., 2013; Ziegler et al., 2014). The only auditory phonological study in children which investigated syllable level facilitation effects support our finding. The spoken sub-lexical units including the syllable did not influence fourth- and fifth-grade participants in our study as they were at grades where syllable facilitation reduces (Reistma, 1984).

To examine the pattern of influence of sub-lexical units further, we compared phoneme, rime and syllable priming after adjusting the reaction time values in relation to their corresponding control conditions. We made this adjustment to account for the difference between no prime monosyllable and trisyllable reading speeds. It supported the orthographic length effect on word reading where words with more orthographic units require a longer time to read (Spieler & Balota, 2000). The results indicated that the impact of the three sub-lexical units were different. Pair-wise comparison revealed that phoneme and rime priming were different with the former being facilitatory and the latter inhibitory compared to the mean reaction time of the control condition. The facilitatory effect may be because phoneme primes elicit prior activation of the initial unit of the target word, thereby requiring lesser time to continue serial activation of the next phonemes. On the contrary, rime primes may activate the latter phoneme units in the word. To produce the target word, the correct sequence of phonemes may have to compete with the activated rime unit or wait until it is back to pre-activation levels, requiring more time. The result for auditory rime priming was similar to findings in adults who show rime interference compared to unrelated primes (Meyer & Schriefers, 1991). Other pair-wise comparisons between phoneme and syllable priming, and rime and syllable priming yielded no significant differences. Among them, phoneme and syllable priming effects were similar whereas rime and syllable priming effects were approaching significance. The reduced interference of phoneme priming and syllable priming, to a certain extent, versus rime priming was similar to findings in adults where beginning-related auditory primes interfere less than end-related primes (Meyer & Schriefers, 1991; Schriefers et al., 1990). Overall, the findings point to a facilitatory trend of phoneme and syllable priming and an interfering trend of rime priming. These findings imply that the role of auditory phonological units at different sub-lexical levels may be subtly different.

Secondly, we aimed to study the relationship between timed word reading under the influence of phonological primes and word reading ability. Here, we began by examining whether the two no prime reading reaction times varied as a function of reading ability. The results revealed that both monosyllabic and trisyllabic reading speeds were faster for children who had higher word identification scores. Therefore, the speed of reading aloud

appears to be related to word reading ability, inconsistent with prior research that has suggested an independence between processing speed on visual word recognition and reading ability after eight years of age (Floyd et al., 2007). On the other hand, repetition priming reaction times for both monosyllables and trisyllables did not relate with word reading ability. It may be argued that in both the repetition priming conditions, the participants only had to hear the prime and repeat it without reading the word. Although it is possible that the participants may not have required to read the written target per se, we only considered word reading responses with an onset of 250 milliseconds after the onset of the written word to ensure that the responses were not initiated upon presentation of the prime. Together with the findings of lexical auditory priming, it supports the notion that reading ability does not necessarily override the effects of spoken phonology at the lexical level on a familiar word reading task in children. This is unlike the variable effect of auditory identity priming on a lexical decision task where primes influence less frequent words greater than more frequent words (Sauval et al., 2017).

Among the sub-lexical priming conditions, we found that syllable primed reading reaction time was faster when word identification scores were higher after controlling age or grade. There is no previous research referencing auditory syllable priming and word reading per se; however, the study by Reistma (1984) that emphasized the continuing role of the auditory initial syllable in the years of learning to read and these findings support the notion that the syllable is a unit that potentially has an auditory phonological impact which relates to reading ability. There are a couple of possibilities as to why the syllable emerged as the sole auditory phonological unit exhibiting a relationship with reading ability. The phonological syllable effect may continue beyond the early reading years as the syllable is the earliest and largest sub-lexical unit in the developmental hierarchy of phonological awareness (Anthony & Francis, 2005). Interestingly, the repetition prime which is larger than the syllable prime did not yield a similar relationship. Considering the presence of Spanish-English bilingualism, the syllable unit may have exerted an auditory phonological cross-linguistic influence based on oral language exposure (Denton et al., 2000). In addition, there was no consistent relationship obtained with word attack and any of the reading reaction time conditions indicating that the use of phoneme-grapheme correspondence rules during pseudo-word reading did not relate with reading speed. This is a difference in the auditory phonological influence on real and pseudo-word reading.

These findings collectively point to a variable role of spoken phonological processing in reading. Spoken phonology at the lexical level enhances word reading speed. There is a difference between phoneme and rime priming effects at the sub-lexical level. Syllable priming effect on word reading in terms of facilitation relates with real word reading ability, but not word attack. The impact of auditory phonology on reading aligns with the BIAM model which supports the interaction between speaking and print mechanisms (Grainger et al., 2003; Diependaele et al., 2010). Like the activation of phonological codes for visual word recognition at both lexical and sub-lexical levels according to BIAM, the present study illustrates that

speech units in the context of reading aloud process at lexical and sub-lexical levels. Together with the finding that auditory primed word reading speed is not related to pseudo-word reading ability, the priming results suggest that models of reading must account for spoken phonological influences along with phonological influences extracted from the orthography via an indirect route, for a comprehensive account of reading development.

This study confirms that spoken phonology influences English word reading in fourth- and fifth-grade Spanish-English bilingual children without orthographic involvement, through an auditory primed word reading experiment. We recognize limitations which future research may shed light on regarding the phonological aspects of reading from an orthography-independent perspective. While the role of lexical repetition primes was clear, additions to the priming paradigm may help delineate the impact of sub-lexical units to a greater extent. We suggest exploring the effect of SOAs much closer to the target than in the current study where prime onset was at least 300 milliseconds prior to the target. We retained a variable prime duration to match the non-experimental situation of phonology-based instruction in a real clinical/educational setting. Priming through SOAs between 150 milliseconds before and after the target would help investigate the time course of sub-lexical phonological access (e.g., Meyer & Schriefers, 1991; Zeguers et al., 2018). Previous studies have considered unrelated primes as controls (Meyer & Schriefers, 1991; Schriefers et al., 1990; Sauval et al., 2017). Although we identified the direction of priming by using the no prime condition as control, the addition of an unrelated condition may yield more information. Particularly, the sub-lexical primes, which showed a difference when compared across themselves (phoneme versus rime) may exhibit stronger effects if individually compared with unrelated primes. Since the repetition prime was a real word, we assumed that the phonological effect observed was lexical. Using a readable non-word as a target and repetition prime would allow a distinction between a whole-unit non-lexical phonological prime and a lexical one. Further investigation of the relationship between sub-lexical phonology at the syllable level and reading ability may reveal a potential bilingual phonological influence by comparing monolingual and bilingual children reading English, as well as children reading both English and Spanish languages.

In conclusion, this study broadens our understanding concerning the role of auditory phonology on reading in fourth- and fifth-grade children. A spoken repetition prime facilitates the speed of reading aloud in children. This facilitation extends beyond a non-speech lexical decision task and is independent of reading ability in these grades. The findings point to differences in lexical and sub-lexical phonological processing across different phonological units. Auditory phoneme and rime priming effects occur in the facilitatory and inhibitory directions, respectively. The syllable is the only spoken sub-lexical phonological unit whose priming effects appear to relate with word reading ability. Overall, the findings suggest a lexical phonological effect without orthography and sub-lexical phonological units appear to vary in the amount of influence they exert upon word reading.

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References

Acha, J., & Perea, M. (2008). The effects of length and transposed-letter similarity in lexical decision: Evidence with beginning, intermediate, and adult readers. *British Journal of Psychology, 99*(2), 245–264. doi:10.1348/000712607x224478

Anthony, J. L., & Francis, D. J. (2005). Development of phonological awareness. *Current Directions in Psychological Science, 14*(5), 255-259. doi:10.1111/j.0963-7214.2005.00376.x

Anthony, J. L., & Lonigan, C. J. (2004). The nature of phonological awareness: Converging evidence from four studies of preschool and early grade school children. *Journal of Educational Psychology, 96*(1), 43–55. doi:10.1037/0022-0663.96.1.43

Ashby, J. (2010). Phonology is fundamental in skilled reading: Evidence from ERPs. *Psychonomic Bulletin & Review, 17*(1), 95–100. doi:10.3758/pbr.17.1.95

Blythe, H. I., Pagán, A., & Dodd, M. (2015). Beyond decoding: Phonological processing during silent reading in beginning readers. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 41*(4), 1244–1252. doi:10.1037/xlm0000080

Boersma, P. (2001). Praat, a system for doing phonetics by computer. *Glot International 5:9/10*, 341-345.

Brooks, P., & MacWhinney, B. (2000). Phonological priming in children's picture naming. *Journal of Child Language, 27*(2), 335-366. doi:10.1017/s0305000900004141

Campos, A. D., Mendes Oliveira, H., & Soares, A. P. (2018). The role of syllables in intermediate-depth stress-timed languages: Masked priming evidence in European Portuguese. *Reading and Writing, 31*(5), 1209–1229. doi:10.1007/s11145-018-9835-8

Castles, A., Davis, C., Cavalot, P., & Forster, K. (2007). Tracking the acquisition of orthographic skills in developing readers: Masked priming effects. *Journal of Experimental Child Psychology, 97*(3), 165–182. doi:10.1016/j.jecp.2007.01.006

Cataldo, S., & Ellis, N. (1988). Interactions in the development of spelling, reading and phonological skills. *Journal of Research in Reading, 11*(2), 86–109. doi:10.1111/j.1467-9817.1988.tb00153.x

Coltheart, M., Curtis, B., Atkins, P., & Haller, M. (1993). Models of reading aloud: Dual-route and parallel-distributed-processing approaches. *Psychological Review, 100*(4), 589–608. doi:10.1037/0033-295x.100.4.589

Coltheart, M., Rastle, K., Perry, C., Langdon, R., & Ziegler, J. (2001). DRC: A dual route cascaded model of visual word recognition and reading aloud. *Psychological Review, 108*(1), 204–256. doi:10.1037/0033-295x.108.1.204

Deacon, S. H. (2011). Sounds, letters and meanings: The independent influences of phonological, morphological and orthographic skills on early word reading accuracy. *Journal of Research in Reading,* no–no. doi:10.1111/j.1467-9817.2011.01496.x

Del Campo, R., Buchanan, W. R., Abbott, R. D., & Berninger, V. W. (2015). Levels of phonology related to reading and writing in middle childhood. *Reading and Writing, 28*(2), 183–198. doi:10.1007/s11145-014-9520-5

Denton, C. A., Hasbrouck, J. E., Weaver, L. R., Riccio, C. A. (2000). What do we know about phonological awareness in Spanish? *Reading Psychology, 21*(4), 335–352. doi:10.1080/027027100750061958

Diependaele, K., Ziegler, J. C., & Grainger, J. (2010). Fast phonology and the Bimodal Interactive Activation Model. *European Journal of Cognitive Psychology, 22*(5), 764–778. doi:10.1080/09541440902834782

Dumay, N. & Radeau, M. (1997). Rime and syllabic effects in phonological priming between French spoken words. *Eurospeech, 4*, 2191-2194. Retrieved from https://www.researchgate.net/publication/221486827

Dunlap, W. P., Cortina, J. M., Vaslow, J. B., & Burke, M. J. (1996). Meta-analysis of experiments with matched groups or repeated measures designs. *Psychological Methods, 1*(2), 170–177. doi:10.1037/1082-989x.1.2.170

Eddy, M. D., Grainger, J., Holcomb, P. J., & Gabrieli, J. D. E. (2016). Orthographic and phonological processing in developing readers revealed by ERPs. *Psychophysiology, 53*(12), 1776–1783. doi:10.1111/psyp.12763

Ehri, L. C. (2005). Learning to Read Words: Theory, Findings, and Issues. *Scientific Studies of Reading, 9*(2), 167–188. doi:10.1207/s1532799xssr0902_4

Ferrand, L., Segui, J., & Humphreys, G. W. (1997). The syllable's role in word naming. *Memory & Cognition, 25*(4), 458–470. doi:10.3758/bf03201122

Floyd, R. G., Keith, T. Z., Taub, G. E., & McGrew, K. S. (2007). Cattell-Horn-Carroll cognitive abilities and their effects on reading decoding skills: g has indirect effects, more specific abilities have direct effects. *School Psychology Quarterly, 22*(2), 200–233. doi:10.1037/1045-3830.22.2.200

Forster, K. I., & Forster, J. C. (2003). DMDX: A Windows display program with millisecond accuracy. *Behavior Research Methods, Instruments, & Computers, 35*(1), 116–124. doi:10.3758/bf03195503

Frost, R. (1998). Toward a strong phonological theory of visual word recognition: True issues and false trails. *Psychological Bulletin, 123*(1), 71–99. doi:10.1037/0033-2909.123.1.71

Grainger, J., Diependaele, K., Spinelli, E., Ferrand, L., & Farioli, F. (2003). Masked repetition and phonological priming within and across modalities. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 29*(6), 1256–1269. doi:10.1037/0278-7393.29.6.1256

Grainger, J., & Ferrand, L. (1996). Masked orthographic and phonological priming in visual word recognition and naming: Cross-task comparisons. *Journal of Memory and Language, 35*(5), 623–647. doi:10.1006/jmla.1996.0033

Grainger, J., Lété, B., Bertand, D., Dufau, S., & Ziegler, J. C. (2012). Evidence for multiple routes in learning to read. *Cognition, 123*(2), 280–292. doi:10.1016/j.cognition.2012.01.003

Haigh, C. A., Savage, R., Erdos, C., & Genesee, F. (2011). The role of phoneme and onset-rime awareness in second language reading acquisition. *Journal of Research in Reading, 34*(1), 94–113. doi:10.1111/j.1467-9817.2010.01475.x

Hogan, T. P., Catts, H. W., & Little, T. D. (2005). The relationship between phonological awareness and reading: Implications for the assessment of phonological awareness. *Language Speech and Hearing Services in Schools, 36*(4), 285. doi:10.1044/0161-1461(2005/029)

Holcomb, P. J., Anderson, J. & Grainger, J. (2005). An electrophysiological study of cross-modal repetition priming. *Psychophysiology, 42*(5), 493–507. doi:10.1111/j.1469-8986.2005.00348.x.

Hulme, C., Bowyer-Crane, C., Carroll, J. M., Duff, F. J., & Snowling, M. J. (2012). The causal role of phoneme awareness and letter-sound knowledge in learning to read. *Psychological Science, 23*(6), 572–577. doi:10.1177/0956797611435921

Jared, D., Ashby, J., Agauas, S. J., & Levy, B. A. (2016). Phonological activation of word meanings in Grade 5 readers. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 42*(4), 524–541. doi:10.1037/xlm0000184

Lallier, M., & Carreiras, M. (2017). Cross-linguistic transfer in bilinguals reading in two alphabetic orthographies: The grain size accommodation hypothesis. *Psychonomic Bulletin & Review, 25*(1), 386–401. doi:10.3758/s13423-017-1273-0

Leinenger, M. (2014). Phonological coding during reading. *Psychological Bulletin, 140*(6), 1534–1555. doi:10.1037/a0037830

Li, S., Tao, S., Joshi, R. M., & Xu, Q. (2017). Second-language reading difficulties among native Chinese-speaking students learning to read English: the roles of native- and second-language skills. *Reading Research Quarterly, 53*(4), 423–441. doi:10.1002/rrq.204

Kyte, C. S., & Johnson, C. J. (2006). The role of phonological recoding in orthographic learning. *Journal of Experimental Child Psychology, 93*(2), 166–185. doi:10.1016/j.jecp.2005.09.003

Mattingly, I. G. (1972). Reading, the linguistic process and linguistic awareness. In J. Kavanagh & I. Mattingly (Eds.), *Language by ear and by eye (pp.* 133-147). Cambridge, MA: MIT Press.

McClelland, J. L., & Rumelhart, D. E. (1981). An interactive activation model of context effects in letter perception: I. An account of basic findings. *Psychological Review, 88*(5), 375–407. doi:10.1037/0033-295x.88.5.375

Melby-Lervåg, M., Lyster, S.-A. H., & Hulme, C. (2012). Phonological skills and their role in learning to read: A meta-analytic review. *Psychological Bulletin, 138*(2), 322–352. doi:10.1037/a0026744

Meyer, A. S., & Schriefers, H. (1991). Phonological facilitation in picture-word interference experiments: Effects of stimulus onset asynchrony and types of interfering stimuli. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 17*(6), 1146–1160. doi:10.1037/0278-7393.17.6.1146

Milledge, S. V., & Blythe, H. I. (2019). The Changing Role of Phonology in Reading Development. *Vision, 3*(2), 23. doi:10.3390/vision3020023

Neely, J. H. (1991). Semantic priming effects in visual word recognition: A selective review of current findings and theories. In D. Besner & G. W. Humphreys (Eds.), *Basic processes in reading: Visual word recognition* (pp. 264-336). Hillsdale, NJ: Erlbaum

Perry, C., Ziegler, J. C., & Zorzi, M. (2007). Nested incremental modeling in the development of computational theories: The CDP+ model of reading aloud. *Psychological Review, 114*(2), 273–315. doi:10.1037/0033-295x.114.2.273

Plaza, M. (2001). The interaction between phonological processing, syntactic awareness and reading: a longitudinal study from Kindergarten to Grade 1. *First Language, 21*(61), 003–24. doi:10.1177/014272370102106101

Plaza, M., & Cohen, H. (2003). The interaction between phonological processing, syntactic awareness, and naming speed in the reading and spelling performance of first-grade children. *Brain and Cognition, 53*(2), 287–292. doi:10.1016/s0278-2626(03)00128-3

Posner, M. I., & Snyder, C. R. R. (1975). Attention and cognitive control. In R. L. Solso (Ed.), *Information processing and cognition: The Loyola Symposium* (pp. 55-85). Hillsdale, NJ: Erlbaum

Protopapas, A. (2007). Check Vocal: A program to facilitate checking the accuracy and response time of vocal responses from DMDX. *Behavior Research Methods, 39*(4), 859–862. doi:10.3758/bf03192979

Reitsma, P. (1984). Sound priming in beginning readers. *Child Development, 55*, 406–423. doi:10.2307/ 1129952.

Sauval, K., Casalis, S., & Perre, L. (2017). Phonological contribution during visual word recognition in child readers. An intermodal priming study in Grades 3 and 5. *Journal of Research in Reading, 40*(S1), S158–S169. doi:10.1111/1467-9817.12070

Sauval, K., Perre, L., & Casalis, S. (2018). Phonemic feature involvement in lexical access in Grades 3 and 5: Evidence from visual and auditory lexical decision tasks. *Acta Psychologica, 182*, 212–219. doi:10.1016/j.actpsy.2017.12.002

Sauval, K., Perre, L., Duncan, L. G., Marinus, E., & Casalis, S. (2017). Automatic phonological activation during visual word recognition in bilingual children: A cross-language masked priming study in Grades 3 and 5. *Journal of Experimental Child Psychology, 154*, 64–77. doi:10.1016/j.jecp.2016.10.003

Schiller, N. O. (2004). The onset effect in word naming. *Journal of Memory and Language, 50*(4), 477–490. doi:10.1016/j.jml.2004.02.004

Schmalz, X., Marinus, E., & Castles, A. (2013). Phonological decoding or direct access? Regularity effects in lexical decisions of Grade 3 and 4

children. *Quarterly Journal of Experimental Psychology, 66*(2), 338–346. doi:10.1080/17470218.2012.711843

Schrank, F. A., Mather, N., McGrew, K. S. (2014). *Woodcock-Johnson IV Tests of Achievement*. Rolling Meadows, IL: Riverside.

Schriefers, H., Meyer, A. S., & Levelt, W. J. M. (1990). Exploring the time course of lexical access in language production: Picture-word interference studies. *Journal of Memory and Language, 29*(1), 86–102. doi:10.1016/0749-596x(90)90011-n

Seymour, P. H. K., & Duncan, L. G. (1997). Small versus large unit theories of reading acquisition. *Dyslexia, 3*(3), 125-134. doi:10.1002/(SICI)1099-0909(199709)3:3<125::AID-DYS85>3.0.CO;2-4

Share, D. L. (1995). Phonological recoding and self-teaching: sine qua non of reading acquisition. *Cognition, 55*(2), 151–218. doi:10.1016/0010-0277(94)00645-2

Spieler, D. H., & Balota, D. A. (2000). Factors influencing word naming in younger and older adults. *Psychology and Aging, 15*(2), 225–231. doi:10.1037/0882-7974.15.2.225

Stahl, S. A., & Murray, B. A. (1994). Defining phonological awareness and its relationship to early reading. *Journal of Educational Psychology, 86*(2), 221–234. doi:10.1037/0022-0663.86.2.221

Wagner, R. K., & Torgesen, J. K. (1987). The nature of phonological processing and its causal role in the acquisition of reading skills. *Psychological Bulletin, 101*(2), 192–212. doi:10.1037/0033-2909.101.2.192

Zeguers, M. H., Huizenga, H., van der Molen, M., & Snellings, P. (2018). Time course analyses of orthographic and phonological priming effects in developing readers. *Quarterly Journal of Experimental Psychology, 71*(8), 1672–1686. doi:10.1080/17470218.2017.1345958

Ziegler, J. C., Bertrand, D., Lété, B., & Grainger, J. (2014). Orthographic and phonological contributions to reading development: Tracking developmental trajectories using masked priming. *Developmental Psychology, 50*(4), 1026–1036. doi:10.1037/a0035187

Ziegler, J. C., & Goswami, U. (2005). Reading acquisition, developmental dyslexia, and skilled reading across languages: A psycholinguistic grain size theory. *Psychological Bulletin, 131*(1), 3–29. doi:10.1037/0033-2909.131.1.3

Appendix

Phoneme	Rime	Syllable	M-R	T-NP
bat	bag	banana	bag	banana
bed	beg	basketball	big	butterfly
bet	big	butterfly	bus	colorful
bus	bug	chocolate	cat	december
cap	but	colorful	dip	dinosaur
car	cat	computer	fin	forgetful
cop	cup	december	gum	hamburger
cut	dig	different	jet	lemonade
dip	dog	dinosaur	lip	november
fan	dot	division	man	rectangle
fat	fin	forgetful	nut	sandwiches
for	fun	gorilla	pen	september
get	god	hamburger	pot	strawberry
gum	gun	holiday	sad	tomato
jam	jar	lemonade	tap	vacation
jog	jet	library	M-NP	T-R
lap	kid	november	bat	basketball
lip	leg	pineapple	bug	chocolate
mad	lit	rectangle	car	computer
mat	man	respectful	cop	different
mud	mug	sandwiches	dig	division
nut	not	saturday	for	gorilla
pen	pet	september	god	holiday
pin	pot	storybook	jar	library
rat	ran	strawberry	jog	pineapple
rob	red	together	leg	respectful
sad	run	tomato	mat	saturday
sun	sit	tomorrow	not	storybook
ten	tap	vacation	rat	together
tub	top	yesterday	run	tomorrow
			ten	yesterday