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ABSTRACT

Blending means smoothing together subword segments to try to identify a spoken word. Research suggests that beginning readers need to blend to combine the phonemes they "sound out" into a recognizable approximation of a known word. Popular wisdom presumes blending is easiest when the segments of words are whispered and when syllables are broken into onset and rime rather than fully segmented. A study determined which of three segmentation options is most helpful for prealphabetic and partial-alphabetic kindergartners trying to blend oral segments to identify words. Segments pronounced with added "schwa" versus segments minimally vocalized; onset and rime segments versus body and coda segments; and fully segmented phoneme segments versus subword chunks larger than a phoneme (either onsets and rimes or bodies and codas) were compared. Participants were 187 kindergartners, diverse both in ethnicity and income. Only prealphabetic and partial alphabetic readers were included. A within-subjects design was used where each participant served as his/her own control. Findings suggest these kindergartners were more successful when consonants were pronounced with added schwa. Children blended more 3-phoneme words successfully when consonants were pronounced with added schwa than when whispered to avoid adding schwa. Findings suggest the following hypothetical sequence of activities in teaching children to blend: (1) teach children 2-part blending in which simple monosyllabic words are joined body to coda; (2) when children have achieved body-coda blending, teach them to blend onset to rime; and (3) when children can blend onset to rime, work with fully segmented words, enunciating them clearly by adding schwa vowels when necessary. Includes data. Contains 10 references. (NKA)

The Effect of Three Segmentation Options on Ease of Blending for Prealphabetic and Partial Alphabetic Readers

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Paper presented at the National Reading Conference,
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Blending means smoothing together subword segments in an effort to identify a spoken word. Research suggests that beginning readers need to blend to combine the phonemes they "sound out" into a recognizable approximation of a known word. For example, to reliably read the word *hop*, they must use the letters to cue up the phonemes /h/, /o/, and /p/, and then combine the phonemes into a verbal unit similar enough to the spoken word *hop* to identify it. Thus, blending seems to be a vital subroutine in decoding.

Though relatively little research has explored the topic of blending, popular wisdom presumes that blending is easiest when the segments of words are whispered. Reading authorities (e.g., Carnine, Silbert, & Kameenui, 1997) have commonly advised teachers to minimize the schwa vowel in pronouncing consonants under the assumption that this added vowel distorts the phoneme and makes blending more difficult. However, some teachers and programs have resisted this advice, training children to pronounce consonants with added schwa, e.g., a loud /puh/ rather than a whispered /p/. Differences over how to pronounce consonants thus divide teachers working in phoneme awareness and phonics instruction.

Popular wisdom also suggests blending is easier when syllables are broken into onset and rime rather than fully segmented. (The onset includes any consonants that precede the vowel, and the rime includes the vowel and any consonants that follow.) Many contemporary reading programs (e.g., Scholastic, 2001) attempt to simplify blending by breaking words into onset and rime, usually by introducing common phonograms, which are more reliable in vowel utility than vowel graphemes. Teachers have been urged to guide children to blend onset and rime rather than fully segmented words under the reasonable supposition that a dichotomy of the syllable into two larger subword chunks is easier to assemble than three or more phoneme segments because the latter would presumably place a greater burden on working memory. Since onset and rime apparently offer a natural break in the syllable (Treiman, 1985), onset and rime may well be plausible subword units to ease the memory burdens of blending.

However, Eldredge (1995) argues that onset-rime blending is difficult because of phoneme distortion in the onset. For example, /b/ag/ is a difficult blend because of the necessity to add artificial voicing to the initial phoneme /g/ when pronouncing it in isolation. Eldredge recommends body-coda blending to minimize phoneme distortion. (The body includes the initial consonants with the vowel, and the coda includes any consonants that follow the vowel.) For example, with /ba/g/, there is no attempt to pry the voiced consonant /b/ from its /a/ voicing, and the final phoneme /g/ can be pronounced with little or no distortion by simply closing off the glottal /g/ to stop the vowel.

The purpose of this study was to determine which of three segmentation options (i.e., three ways of breaking up the spoken word) is most helpful for prealphabetic and partial-alphabetic kindergartners trying to blend oral segments to identify words. We compared segments pronounced with added schwa with segments whispered or minimally vocalized; onset and rime segments versus body and coda segments; and fully segmented phoneme segments versus subword chunks larger than a phoneme (either onsets and rimes or bodies and codas).

Findings from this study may allow teachers to improve blending procedures and help children make more rapid progress in learning to read. Teachers using optimal ways of pronouncing subword segments could expect their students to acquire blending strategies earlier and more easily, thus streamlining their acquisition of decoding skill and sight vocabulary. The study also has theoretical implications for understanding how blending functions in word identification for young children.

Procedures. We identified 10 sets of four rhyming words in word families, where all words were composed of three phonemes (consonant-vowel-consonant) and all words were common words likely in the oral vocabularies of young children, specifically, among the 3000 most common English words (Carroll, Davies, & Richman, 1971). None of the words contained voiced stops, a type of phoneme requiring schwa voicing. The selected words were as follows:

pain	chain	main	rain
call	tall	fall	hall
cook	took	shook	look
pot	shot	hot	not
king	sing	wing	ring
shine	fine	mine	nine
pin	chin	thin	win
cake	shake	lake	make
chose	those	nose	rose
fight	sight	night	light

The four words in each word family were randomly assigned to four segmentation conditions so that linguistic factors were parallel across conditions. These conditions were fully segmented and whispered (e.g., /p/A/n/), fully segmented with added schwa (/puh/A/nuh/), onset-rime (/p/An/), and body-coda (/pA/n/). The 40 words were then mixed in two random orders of presentation.

Next we created a computer-mediated video of a character named Cluella, portrayed by graduate student Margo Veal, who has a degree in children's theater. Cluella introduced the task, modeled words pronounced each way, and then presented the segmented words, challenging children to tell what words she was saying by watching her mouth for clues. After videotaping the performance in a television studio, the performance was digitized into video segments to be presented on laptop computers. The order of presentation was rearranged into the two random presentation sequences. Using digitized video ensured that each participant heard the segments of each word pronounced in the same way.

We identified a group of 213 kindergarten participants in an all-kindergarten school in a small city in the Southeast. The children were diverse both in ethnicity and income. In September 2001 (the second month of school) we tested children for whom we received signed permission forms. Before proceeding with the testing, we screened participants for decoding ability, eliminating any who successfully decoded any CVC pseudowords as full alphabetic (Ehri, 1998), and thus too advanced in decoding skill for the study. Only prealphabetic and partial alphabetic readers were thus included.

We used a within-subjects design where each participant served as his or her own control. Students were randomly assigned to one of two different random orders of presentation of the segmented words. In this way, each student attempted to blend all 40 words, including 10 tokens in each of the four segmentation conditions, in one of two random presentation orders. This allowed us to compare students' relative success in blending words under each of the segmentation conditions.

We gave several other measures to assess children's early literacy skills in an attempt to statistically explain children's blending achievement. These included brief versions of the Test of Phoneme Identities (Murray, Smith, & Murray, 2000), the Test of Phonetic Cue Reading (Murray, 1998, adapted from Byrne & Fielding Barnsley, 1989), and a timed Alphabet Recognition Test (Clay, 1993). The Test of Phoneme Identities as adapted for this study was a 12-item forced-choice phoneme awareness measure cast as a "repeating game" in which students repeat a sentence and an isolated phoneme and then decide which of two words contains the phoneme, for example, "Say: We'll see the moon soon. Now say /s/. Do you hear /s/ in *moon* or *soon*?" A score of 10 or more suggests that the student identifies phonemes at a rate improbable by chance alone. The Test of Phonetic Cue Reading is also a 12-item forced-choice measure. Students were shown a word printed in all capital letters in a small booklet (e.g., SAY) and asked to identify the word from among two activated alternatives ("Is this *say* or *may*?"). Students who score 10 or more on this test are using phonetic cues to identify words at an accuracy level improbable by chance alone. Novice readers who can distinguish words from their beginning letters are partial-alphabetic readers (Ehri, 1998); they have achieved insight into the alphabetic principle that letters map phonemes in words. The Alphabet Recognition test (adapted from Clay, 1993) presented 26 lower case letters in Zaner-Bloser manuscript font in a mixed order; examiners recorded both accuracy and response time.

We tested each participant for about 30 minutes during center time, rest time, or play time so as not to disrupt whole-group activities. Most children worked at two testing stations with two different examiners. After screening children for decoding ability and excusing any children who could read any of five regular pseudowords, we tested the remaining participants for letter-name knowledge, phoneme identity knowledge, and phonetic cue reading ability. All remaining participants then watched our computer-mediated video, attempting to respond as we played Cluella's segmented words one by one. To help them hear the Cluella video, participants wore headphones amplifying the computer audio output. After the assessment was complete, we gave each participant an illustrated storybook to recognize his or her participation.

The principal questions to be answered in this study were these:

1. Is it easier for beginners to blend whispered phoneme segments, that is, phonemes pronounced without adding a schwa vowel to the consonants (e.g., /h/a/t/) or phoneme segments pronounced with an added schwa vowel (e.g., /huh/a/tuh/)?
2. Is it easier for beginners to blend larger subsyllabic units (either onset and rime, e.g., /h/at/, or body and coda, e.g., /ha/t/) or fully segmented phonemes, e.g. /h/a/t/ or /huh/a/tuh/?
3. Is it easier for beginners to blend onset and rime, e.g., /h/at/, or body and coda, e.g., /ha/t/?

<u>Results</u>

We identified 26 full alphabetic readers in pretest screening, leaving 187 of 213 participants qualified for inclusion in the study by virtue of decoding zero pseudowords correctly, indicating that they had yet acquired full alphabetic word identification ability. Four students decided to discontinue during testing. The following descriptive statistics were obtained from the 183 usable scores:

SEGMENTATION (N = 183)	POSSIBLE	RANGE	MEAN	SD
Total blends	40	0 - 36	5.69	7.65
Full Segmentation With Schwa	10	0 - 10	1.10	2.05
Full Segmentation Whispered	10	0 - 10	.78	1.66
Onset-Rime	10	0 - 9	1.30	2.21
Body-Coda	10	0 - 10	2.50	2.56

Removing the 45 students who were unable to identify any blended words yielded higher means, but similar proportions:

SEGMENTATION (N = 138)	POSSIBLE	RANGE	MEAN	SD
Total blends	40	1 - 36	7.54	7.98
Full Segmentation With Schwa	10	0 - 10	1.46	2.25
Full Segmentation Whispered	10	0 - 10	1.04	1.66
Onset-Rime	10	0 - 9	1.30	1.85
Body-Coda	10	0 - 10	3.32	2.45

Paired sample *t*-tests were used to determine if differences between groups were unlikely given chance variation. When Full Segmentation With Schwa ($M = 1.10$) was paired with Full Segmentation Whispered ($M = .78$), the difference in means was significant, $t = 3.75$, $df = 182$, $p < .001$ (two tailed). These results indicate that blending fully segmented words with schwa was significantly easier for children than blending fully segmented words without schwa.

When Onset-Rime Segmentation ($M = 1.30$) was contrasted with Body-Coda ($M = 2.50$), the difference was significant, $t = -10.17$, $df = 182$, $p < .001$ (two tailed). These results indicated that blending words segmented into body and coda was significantly easier than blending words segmented into onset and rime.

Paired sample *t*-tests also showed that the mean of Full Segmentation With Schwa ($M = 1.10$) when contrasted with the mean of Onset-Rime ($M = 1.30$) did not significantly differ ($t = -1.86$, $df = 182$, $p > .05$), showing that blending fully segmented words with added schwa is roughly as difficult as blending words broken into onset and rime. However, contrasting the mean of Full Segmentation Whispered ($M = .78$) with the mean of Onset-Rime ($M = 1.30$) revealed a significant difference ($t = -5.51$, df = 182, t < .001), indicating that blending body to coda is easier than blending fully segmented words with whispered segments. The mean of Body-Coda ($M = 2.50$) differed significantly from the mean of Full Segmentation With Schwa ($M = 1.10$), $t = -9.29$, $df = 182$, $p < .001$, and from the mean of Full Segmentation Whispered ($M = .78$), $t = -12.49$, $df = 182$, $p < .001$, indicating that blending body to coda is easier than blending fully segmented words, whether with the segments are pronounced with schwa or whispered.

To determine whether blending fully segmented words differs in difficulty from blending partially segmented words, we combined the data for Full Segmentation With Schwa and Full Segmentation Whispered, and compared the resulting mean ($M = 1.89$) with the mean of the combined data for Onset-Rime and Body-Coda ($M = 3.80$). The difference was significant, $t = -9.54$, $df = 182$, $p < .001$). These results indicate that blending partially segmented words (whether divided onset-rime or body-coda) was significantly easier than blending fully segmented words (whether whispered or pronounced with added schwa).

Descriptive statistics for other measures used in the study were as follows:

MEASURE	POSSIBLE	RANGE	MEAN	SD
Letter Naming Accuracy	26	0-26	17.48	7.41
Letter Naming Rate (sec)	--	25-314	82.54	47.11
Phoneme Identity Knowledge	12	2-12	7.53	2.07
Phonetic Cue Reading	12	2-12	7.35	2.21

Since the Test of Phoneme Identities and the Test of Phonetic Cue Reading were forced choice measures, we determined whether students passed each test by scoring 10 or more out of 12, a level of performance unlikely at the .05 level of probability. 40 of 186 students (21.5%) scored at this "passing" level on the Test of Phoneme Identities, indicating they had developed phoneme awareness. 38 out of 185 students (20.5% of participating students or 17.8% of all students tested) "passed" the Test of Phonetic Reading, indicating that they had reached the phase of partial-alphabetic decoding (Ehri, 1998). The remaining students, then, were either pre-alphabetic (79.5 of participating students or 69% of all students tested) or full alphabetic (the 13% eliminated from further participation under screening criteria as full alphabetic readers).

In a stepwise multiple regression analysis with the Total Blending, the total number of successful blends, as the dependent variable, Phonetic Cue Reading entered the equation first, accounting for 18% of the adjusted variation. Phoneme Identity Knowledge entered second, adding an additional 3% for a total of 21% of the adjusted variation. Neither Letter Naming Accuracy nor Letter Naming Rate added significant predictive power to the regression model.

We also carried out a stepwise regression analysis to determine which skills contribute to rudimentary decoding ability as indicated by phonetic cue reading scores. In this analysis, Total Blending entered the equation first, accounting for 18% of the adjusted variation. Letter Naming Accuracy explained an additional 5% of the variation, and Phoneme Identity Knowledge entered third, explaining an additional 3%. Letter Naming Rate did not add significant explanatory power.

Using the data set, we further explored the salience of particular phoneme groups by contrasting students' recognition of vowel phonemes with their recognition of consonant phonemes, initial consonants with final consonants, long vowels with short vowels and stop consonants with continuant consonants. The average score for each phoneme type was computed by dividing the total score by the number of tokens.

PHONEME TYPE	TOKENS	MEAN	SD
Vowels	5	.46	.28
Consonants	7	.75	.20
Initial consonant	5	.75	.22
Final consonant	2	.76	.32
Long vowel	3	.47	.32
Short vowel	2	.44	.38
Stop consonant	3	.75	.27
Continuant consonant	4	.75	.24

Using 2-tailed pair-sample *t*-tests, consonants are significantly easier to identify than vowel phonemes ($t = -12.2$, $df = 185$, $p < .001$. No other differences were significant. Students did not find initial consonants easier to identify than final consonants, long vowels easier to identify than short vowels, or continuant consonants easier to identify than stops.

Discussion

The main conclusions of this study provide answers to the three questions motivating this research. First, is it easier for beginners to blend when phoneme segments are whispered without adding a schwa vowel to the consonants (e.g., /h/a/t/), or when a schwa vowel is added (e.g., /huh/a/tuh/)? Surprisingly, our kindergartners were more successful when consonants were pronounced with added schwa. Children blended more three-phoneme words successfully when consonants were pronounced with added schwa than when whispered to avoid adding schwa. This suggests teachers may safely pronounce consonant phonemes loudly by adding a uniform schwa during teaching without interfering with blending, and that adding artificial voicing in fact facilitates blending.

Reading teachers have commonly been taught to minimize the schwa vowel in pronouncing consonants under the reasoning that this added vowel distorts the phoneme and makes blending more difficult. While this explanation is appealing, the present data do not support it. Several explanations are possible. It may be that students were more familiar with phonemes pronounced with schwa from past instruction, or that consonants pronounced with schwa are louder and more audible. On the other hand, it may mean that blending is not a mechanical operation, but rather an insightful process relying on stored phoneme identities. From this perspective, the schwa addition to consonants functions as a sort of plain brown wrapper that children familiar with phonemes can mentally remove in blending. This view is supported by a multiple regression analysis in which phonetic cue reading and phoneme identity knowledge explained blending success, but letter recognition accuracy and speed, reflecting literacy background experiences, did not. Alphabetic insight, rather than an undistorted phoneme pronunciation, appears to influence blending success. As a caution, however, it should be noted that with or without added schwa, success in blending fully segmented words was relatively rare; only 43% of our participants were correct on any fully segmented items, which is to say that 57% scored zero.

Is it easier for beginners to blend larger subsyllabic units, either onset and rime (e.g., /h/at/) or body and coda (e.g., /ha/t/), or to blend fully segmented phonemes (e.g., /h/a/t/ or /huh/a/tuh/)? Our data indicate that larger subsyllabic units are easier to blend. As a simple explanation, students dealing with only two units experience less demand on their working memory resources than students dealing with three units. In addition, at least one of these units contains the salient vowel, which is the loudest part of the syllable. Thus, teachers who introduce blending with CVC words split into two parts, either into onset and rime or into body and coda, make success more likely for young children.

Is it easier for beginners to blend syllables divided into onset and rime, e.g., /h/at/, or divided into body and coda, e.g., /ha/t/? Our data support the practice of breaking simple words into body and coda chunks. Though previous research has shown that the onset-rime break (i.e., the point preceding the vowel) is the natural dividing point in the syllable, it is apparently not the natural assembly point. If the onset-rime break may be thought of as the weakest and least cohesive link for segmentation, it is by the same token a difficult point of fusion. In contrast, the body-coda break (i.e., the point following the vowel) seems to be the most cohesive point in the syllable, and by extension, a difficult link to break up in segmentation.

How can we make blending easier for beginners? Data from our study suggests that teachers begin blending work using partially segmented words rather than fully segmented words. Using either onset-rime units or body-coda units allows children to deal with only two units at a time instead of three or more units, thus minimizing demands on working memory. Of the larger subword units, body and coda chunks offer easier blending for initial instruction. It is at the body-coda break (i.e., following the vowel) that the juncture of segments occurs most readily in the syllable. In modeling and guiding blending, teachers should enunciate subword chunks clearly without undue concern about phoneme precision, adding schwa vowels as necessary to make phoneme approximations clear. Our data suggest that adding schwa vowels to consonants, though ostensibly distorting these phonemes, makes them easier to recognize and hence aids blending.

These findings suggest the following hypothetical sequence of activities in teaching children to blend. First, teach children two-part blending in which simple monosyllabic words are joined body to coda, that is, presenting the initial consonants with the vowel for blending to the final consonants, e.g., /bu/g/. When children have achieved body-coda blending, teach them to blend onset to rime, e.g., /b/ug/, which continues to limit demands on working memory while taking on the challenge of blending at a more resistant and less cohesive point of juncture. Finally, when children can blend onset to rime, work with fully segmented words, enunciating them clearly by adding schwa vowels where necessary.

We could further extrapolate on the present findings to speculate about effective blending practices. Teachers might profitably use spoken word chunks rather than printed words for initial practice. For instance, they might practice by using riddles, e.g., "I am thinking of an animal that likes to eat cheese: mou-se." In making the transition to blending printed words, students might practice with letter manipulatives, which support children's memory for phonemes, and which can be grouped and regrouped to form word chunks en route to word identification. A plausible strategic sequence for decoding printed words is vowel-first, body-coda blending. In this sequence, students first sound out the vowel. Next they sound out and blend the onset to the vowel, stopping to unitize the body of the syllable. Finally, they blend the body to the coda to identify the word.

The present study is correlational. Sound educational practice depends on teaching experiments that establish causality. Future research could compare children's achievement in learning to blend using simple words in fully segmented, onset-rime, and body-coda presentation formats while holding all other aspects of the teaching situation constant. Teachers could explain, model, and guide practice in blending, using the same words and the same instructional activities, so that treatments differ only in presentation format. In this way we could gather public knowledge on how to effectively teach blending strategies to ease children's achievement of decoding skill, leading to earlier acquisition of sight vocabulary and reading comprehension.

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