Children's use of syllable and rime as orthographic units in reading English

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Introduction

Recent cross-linguistic research has focused on the alignment of orthographic and phonological characteristics that contribute to reading in various languages (e.g. Ziegler & Goswami, 2005). For phonological awareness (the ability to segment spoken words into their sublexcial phonological components: PA), work by Goswami and her colleagues has shown that rime awareness is especially predictive of reading development in English (Goswami & East, 2000). For French, however, there is some evidence that syllables may play a special role in phonological awareness. Bruck, Genesee, & Caravolas (1997) showed that French native children were better at syllable level PA tasks than English native children. Similarly, a study with English-native children in French immersion showed that syllable awareness predicted French reading, and that rime awareness predicted English reading (MacCoubrey & Wade-Woolley, 2001). Despite much work on the phonological and orthographic factors related to word recognition in adults, much less data exists as to what constitutes functional reading units for children. Nevertheless, the research in this area provides support for the language-specific hypothesis. For example, Goswami, Gombert, and de Barrera (1998) showed that English speakers were more successful at reading nonwords that shared orthographic and phonological analogies (e.g., *dake* > *daik*) with real English rimes than were native speakers of French.

In previous work, Wade-Woolley & Goetry (2003) presented evidence to support the notion of the syllable as a functional unit of reading for French native children reading French. They demonstrated this in two ways: First, through a priming study building on the work of Cole, Magnan and Grainger (1999), they showed faster naming latencies to bisyllabic words which were primed by a fragment congruent with the first syllable of the target (e.g., bal – BALCON) and inhibition in the incongruent condition (e.g., bal – BALANCE). Second, they showed through an "interrupted words" paradigm modeled after Treiman and Chafetz (1987) that words interrupted at the syllable division but not the first or second rime division were named as quickly as non-interrupted words (e.g., tra//vail > tr//avail or trav//ail). These results (see Figure 1) are consistent with a language-specific hypothesis for French; such a hypothesis would predict equally that the rime but not the syllable is a functional unit for Anglophones reading English. The current study reports a test of this hypothesis.

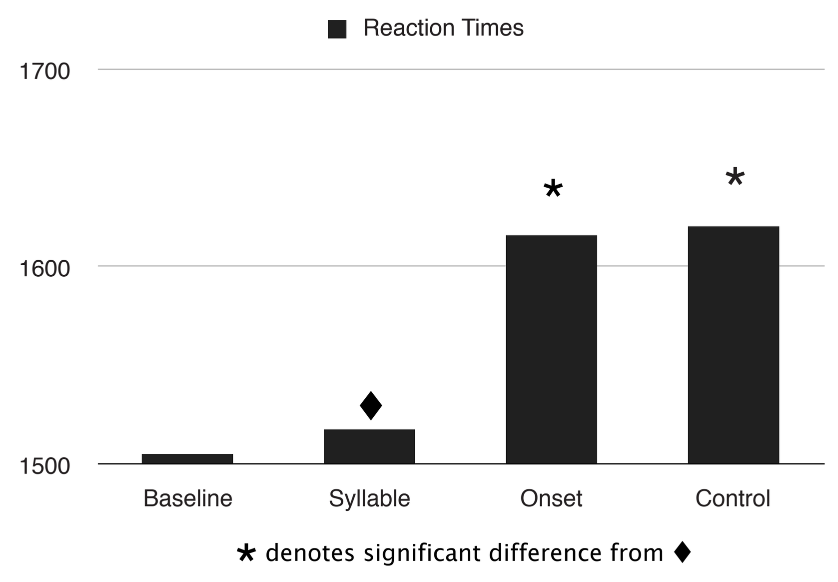

Figure 1. Participants' RTs on interrupted words (Wade-Woolley & Goetry, 2003)

We implement the interrupted words paradigm reported in Wade-Woolley & Goetry (2003), but adapted for monolingual Anglophones. If the language-specific hypothesis holds, we predict that the rime, but not the syllable, will be seen to be a functional unit in native English children's reading of bisyllabic English words, such that interruption at the rime will result in faster naming latencies than will interruption at the syllable division.

Table 1
Descriptive Statistics for Participants (n=34)

Grade	*n*	Mean age (months)	SD
2	10	88.1	5.8
3	11	103.0	3.7
4	13	114.4	3.3

Table 2
Word Interruption Conditions

Condition	Type	Example
1	Baseline	fragment
2	1st Onset	fr//agment
3	Syllable	frag//ment
4	2nd Onset	fragm//ent

Method

Participants

Participants who were native speakers of English in grades 2, 3, and 4 from elementary schools in Eastern Ontario (see Table 1) were recruited for this study. From a larger pool of 49 participants, only those identified as "good readers" (that is, those able to read a minimum of 80% of the baseline words (n=34; male=17, female=17)) were included in the present study.

Materials

Using a word interruption paradigm, a set of 22 two-syllable words was visually "interrupted" using double slashes (//). Half the items were frequent words and half were infrequent words, as indexed by Carroll, Davies, & Richman (1971). See Table 3 for a list of items.

Table 3
Items used in interruption task

Frequent	Infrequent
clumsy	blunder
fraction	bronco
fragment	crinkle
frantic	flimsy
plenty	grumpy
practice	plunder
stanza	spangle
tractor	stigma
tremble	stumble
trombone	trinket

Each word appeared four times (see Table 2). The item appeared in its uninterrupted form, as a baseline condition (e.g. fragment), interrupted after the first onset (e.g. fr//agment), interrupted between syllables (e.g. frag//ment), and interrupted after the second onset (e.g. fragm//ent). The 80 stimuli were counterbalanced across four lists; each participant was assigned one of four lists. The stimuli appeared in a fixed random order; within this order, items appeared once within a sequence of 20 stimuli. The position of each item varied among the lists. Each participant read each item in each condition, but the order in which the stimuli were presented to the participants varied.

The word interruption paradigm was delivered on a Macintosh PowerBook laptop, using the presentation software SuperLab. Trials began with a tone to focus the participant, followed by the stimulus' appearance on a computer screen in 20pt Times font. Reaction times (RTs) were measured from the appearance of the stimulus to the voice key trigger. Responses were manually scored as correct/incorrect by the experimenter, based on the participant's initial reading; naming latency was measured by the computer program. Thus, dependent variables were word reading accuracy and RT.

Results

A 2 (Word Frequency) x 4 (Break Point) repeated measures ANOVA was conducted on word reading RTs. This analysis showed effects of both word frequency, F (1,33) = 7.365, $p < .01$, $\eta^2 = .182$, and of break point, F (3,31) = 4.455, $p < .01$, $\eta^2 = .301$. Subjects read frequent words significantly more quickly than infrequent words. The interaction of frequency and break point was not significant (F (3,31) = .578, *ns*). Follow up t-tests (with alpha corrected) showed that the two onset conditions (1st onset & 2nd onset) were named significantly more slowly than the baseline condition (t (33) = -3.43 and -3.094, $p < .01$, respectively). There were no significant differences in naming latency between baseline and syllable break point conditions (t (33) = -1.85, *ns*), or between 1st onset and syllable (t (33) = 1.576, *ns*). See Figure 2.

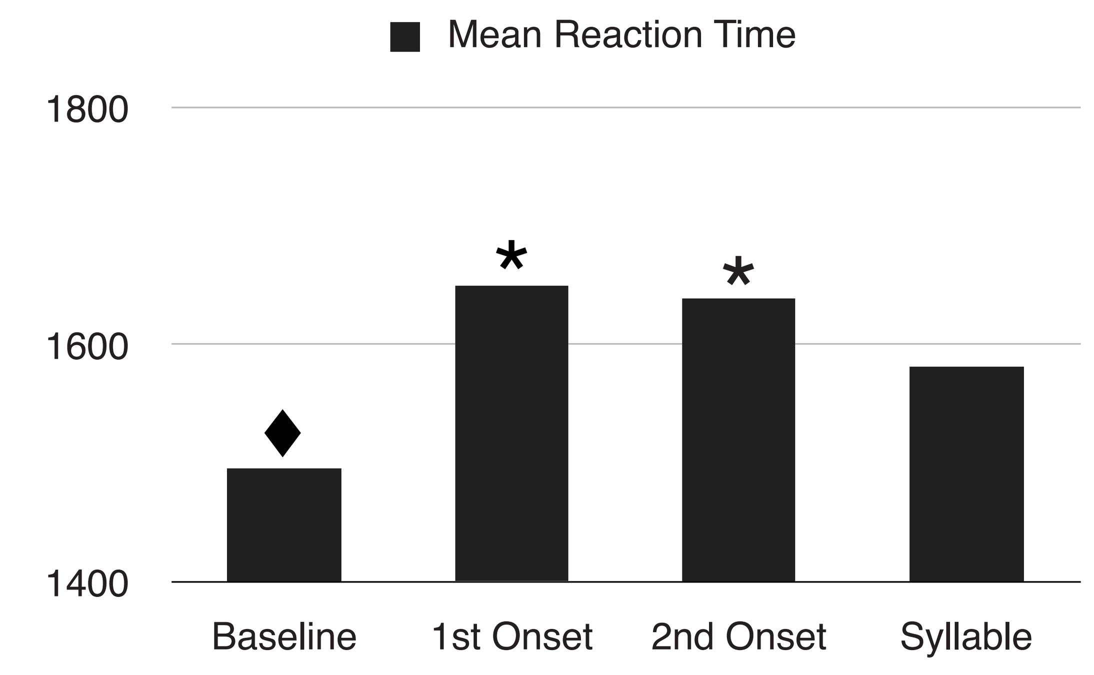

Figure 2. Main effect of naming latency for break point. Asterisks indicate significant difference from diamond.

Results of a repeated measures 2 (Word Frequency) x 4 (Break Point) ANOVA of word reading accuracy showed no significant main effects or interactions (Fs range from .862 to 2.271, *ns*) regardless of word frequency. This was not surprising, given that participants were selected for this study based on their ability to read 80% of the baseline words; mean accuracy of word reading ranged from 91 to 96%.

Discussion

Following Wade-Woolley and Goetry's (2003) investigation of the syllable as a functional unit for Francophones reading French, the present study sought to examine whether the rime is a functional unit in Anglophone children's reading of bisyllabic English words. In line with the research showing language-specific features driving word reading in various languages discussed previously, it was predicted that an interruption at the rime would result in faster naming latencies than would an interruption at the syllable division. Further, a division at the syllable was hypothesized not to decrease naming latencies, if, by hypothesis, it is not a functional unit for Anglophones reading English. Verification of these hypotheses would support the language-specific hypothesis.

Our results, however, did not support this hypothesis. Words interrupted at either onset-rime division were named no more quickly than those in the syllable condition. This tells us that, although the orthographic rime increases the consistency of pronunciation of English words (Treiman et al., 1995) and facilitates reading of monosyllabic words (Bowey & Hansen, 1994), it may be a less effective functional unit than the syllable for bisyllabic words. RTs for naming in the syllable break point condition were not significantly different than those in the baseline condition; this finding replicates that of Wade-Woolley and Goetry (2003) for Francophones. This suggests that the syllable may be a functional unit for developing readers of English, as it is for young readers of French. This offers negative evidence for the language-specific hypothesis: promotion of the onset-rime division does not decrease naming latencies relative to syllable division in good readers in grades 2, 3, and 4.

In the apparent absence of support for the language-specific explanation for functional reading units, we must attempt an explanation for our findings that syllables appear to assist the processing of bisyllabic words in English. One likely account lies in the necessity of stress assignment in reading aloud. Since vowel reduction in unstressed syllables is nearly obligatory in English, it may be necessary to process syllables in order to achieve correct stress assignment. The gain in consistency achieved by coding at the level of the orthographic rime may be less dramatic in multisyllabic words. For example, *-ain* is a perfectly consistent rime in monosyllabic words, yet it becomes inconsistent in bisyllabic words (e.g., *explain* vs. *mountain*).

If this explanation were to hold, we would again arrive at a language-specific account of functional units in reading. French is not a stress-timed language, and therefore computation of stress assignment is not a necessary part of reading in that language. However, as mentioned previously, French is a syllable-timed language, and therefore the prominence of the syllable in French reading is consistent with its role in French phonology. On the other hand, the prominence of the syllable as a functional unit for reading in English may be due to its role in the computation of stress assignment in multisyllabic words and is therefore also consistent with English phonology.

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