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# Evidence for Prosody in Silent Reading

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## ABSTRACT

English speakers and expressive readers emphasize new content in an ongoing discourse. Do silent readers emphasize new content in their inner voice? Because the inner voice cannot be directly observed, we borrowed the cap-emphasis technique (e.g., “to**MAY**to”) from the pronunciation guides of dictionaries to elicit prosodic emphasis. Extrapolating from linguistic theories of focus prosody in spoken English, we predicted and found that silent readers in experiment 1 preferred cap-emphasized, newsworthy content (“James stole the **BRACELET**”) when the just-read story left them wondering what was stolen (compared with control trials). Readers preferred “**JAMES** stole the bracelet” when left wondering who the thief was. Experiment 2 generalized our findings to newsworthy function words and to a new behavioral measure, reaction time. As predicted, “He **CAN**” was judged more quickly and accurately following “Can he swim,” whereas “**HE** can” was judged more quickly and accurately following “Who can swim?” Our results suggest that readers engage focus prosody when they read silently.

The science of reading has persuasively shown that a to-be-recognized word in print is influenced by detailed knowledge of phonology (Van Orden & Kloos, 2005). In contrast, the extent to which silent reading represents prosody, the rhythm and melody of language, is less-well understood. The impetus for our investigations into the role of prosody in skilled, adult reading stems from the central role that prosody plays in speech. Prosody is a universal feature of all languages (Endress & Hauser, 2010). Prosodic speech acoustically varies in duration, frequency, amplitude, and tempo (Selkirk, 1986). The singsong quality of infant-directed speech is an exaggerated example (Bryant & Barrett, 2007). In American Sign Language, the physical correlates of prosody involve variation in displacement, velocity, jerk, and facial features (Wilbur & Martínez, 2002).

Prosody serves diverse functions in speech. Prosodic variations reveal features of the speaker (e.g., emotional state, intentions) as well as the form of the utterance (e.g., statement, request) that may not be captured by word selection, sentence construction, or punctuation. For example, the expression “Brian bought a book” would bear different prosodic qualities to signal a statement, question, exclamation, or sarcasm (Nespor & Vogel, 1986). Additionally, prosody resolves polysemy (Schafer, Speer, Warren, & White, 2000), reduces ambiguity (e.g., DeDe, 2010; Kjølgaard & Speer, 1999; Snedeker & Trueswell, 2003), flags irony (Nakassis & Snedeker, 2002), influences online parsing decisions (DeDe, 2010), and signals turn taking in a conversation (Oliveira & Freitas, 2008). Prosodic cues are redundantly present when other cues offer disambiguation (Schafer et al., 2000; Snedeker & Trueswell, 2003). As a testament to its central role in speech comprehension, prosody is inextricably part of remembered speech, such that “old” words with new prosody are rarely falsely recognized (Speer, Crowder, & Thomas, 1993). The absence of prosody

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can extract a toll on the listener, as spoken utterances lacking rich prosody are harder to understand (Cutler, Dahan, & van Donselaar, 1997).

Like speech, expressive reading is rich in prosody. Reading aloud “with appropriate speed, accuracy, and proper expression” is a hallmark of fluency among nascent readers according to the National Reading Panel (National Institute of Child Health and Human Development, 2000, p. 11). Expressive reading necessitates deciphering the correct pronunciations of the individual words on the printed page (segmental phonology) as well as rendering the appropriate pattern of undulating stress and pulsating beat across connected text (suprasegmental prosody).

Written English is based on an alphabetic system that maps graphemes to phonemes. Becoming a fluent reader is linked to fast and efficient decoding of the letter–sound correspondences in English (Schwanenflugel, Hamilton, Kuhn, Wisenbaker, & Stahl, 2004). Decoding speed also forecasts prosodic reading and better reading comprehension (Miller & Schwanenflugel, 2008; Schwanenflugel et al., 2004). Miller and Schwanenflugel (2008) suggest that young readers apply their understanding of spoken prosody to oral reading first and then internalize these prosodic codes later as an expressive inner voice. Prosodic reading has many communicative benefits. When reading aloud, natural prosody facilitates sentence organization in memory and increases recall (Koriat, Greenberg, & Kreiner, 2002). By comparison, nonprosodic reading compromises comprehension (National Research Council, 1999). Early versions of synthetic speech (text-to-speech assistive technologies) yielded unnatural, monotonous renderings of spoken text, causing cognitive processing costs, such as fatigue (Paris, Thomas, Gilson, & Kincaid, 2000).

Although prosodic reading is a hallmark of fluency, the exact role of suprasegmental prosody in the translation of print to speech is a nascent field of investigation. The term *prosody* appears five times in *The Science of Reading: A Handbook* (Snowling & Hume, 2005), and most of these entries mention its omission from the field of reading research. As Treiman and Kessler (2005) noted, the omission of prosody is unsurprising given that distinctions of length, tone, pitch, stress, and intonation are largely ignored by writing systems. Punctuation and syntax assist but underspecify a prosodic rendering of connected text. The lack of prosodic transparency in written English means few cues for expressive reading. Struggling readers produce oral readings that are prosodically ill formed (Levy, di Persio, & Hollingshead, 1992). Repeated readings foster prosody development in good readers but not necessarily in poor readers (Levy, Nicholls, & Kohen, 1993).

In two studies, we sought to understand whether the inner voice of skilled, adult readers preserves the

prosodic richness of speech and expressive reading. Adult readers typically report the phenomenological experience of an expressive “voice in the head” that seemingly captures the nuances of lively speech (Huey, 1908/1968). In support of an expressive inner voice in adult readers, reading research has persuasively shown that printed word recognition is influenced by detailed knowledge of segmental phonology. Just as tongue twisters are notoriously difficult to articulate properly, visual tongue twisters trick the silent reader. Readers are significantly slower in judging the semantic acceptability of visual tongue twisters (e.g., “The detective discovered the danger and decided to dig for details”) compared with control sentences (McCutchen, Bell, France, & Perfetti, 1991).

The tongue-twister effect has generalized to deaf readers (Hanson, Goodell, & Perfetti, 1991) as well as to tongue twisters comprised of legal nonwords when spoken, typed, recalled, or recognized (Acheson & MacDonald, 2009). In a critical test of the phonological nature of the tongue-twister effect in working memory, McCutchen and colleagues (1991) found that the phonetic content of digit names held in working memory interacted with the phonetic content of the sentences being read, suggesting interference at the level of sound-based codes used in working memory. Neuroimaging research revealed that the tongue-twister effect implicates cortical areas involved in articulatory-phonological processing as well as speech programming (Keller, Carpenter, & Just, 2003), a finding that is consistent with the idea that the voice in the head exploits the broader language system (Mattingly, 1972).

Phonological features of the inner voice emerge in adult readers when performing a range of visual word recognition tasks. In lexical decision tasks, target words with phonetically longer vowels (e.g., *plead*) or consonant clusters take longer to respond to than targets with respectively shorter vowels (e.g., *pleat*) or consonant clusters, when orthographic lengths are controlled (Abramson & Goldinger, 1997; Lukatela, Eaton, Sabadini, & Turvey, 2004). Observing eye movements, Ashby and Clifton (2005) found that polysyllabic words with two stressed syllables (e.g., *fundamental*) were read 36 ms more slowly and received more fixations than did polysyllabic words with one stressed syllable (e.g., *significant*), a finding that is consistent with the longer pronunciation times for stressed compared with unstressed vowels (Selkirk, 1986).

Recent brain activation research reveals that skilled, adult readers activate phonological features during the initial moments of visual word recognition (i.e., by 80 ms), suggesting that phonological codes may be guiding (rather than a by-product of) lexical access (Ashby, Sanders, & Kingston, 2009). To establish the time course of phonological processing of vowels in word

recognition, Ashby, Treiman, Kessler, and Rayner (2006) observed the eye movements of skilled readers who were presented with parafoveal previews of the vowel for a to-be-read target word embedded in a sentence. Shorter reading times were observed when readers received congruous, compared with incongruous, vowel previews, suggesting that phonological processing of vowels begins early (before foveal fixation; Ashby et al., 2006).

Even though written English is based on an alphabetic system, skilled readers extract phonological units larger than single phonemes when computing the relations between print and speech. Onsets (the initial consonant or consonant cluster) and rimes (the vowel and any following consonants) play a special role in mapping letters to sounds (Treiman, 1994). Orthographic rimes, in particular, are phonologically reliable and guide the pronunciation of written words (Treiman, Mullennix, Bijeljac-Babic, & Richmond-Welty, 1995). Orthographic rimes are further divisible into two phonological units—a vocalic nucleus and syllable-final coda—as demonstrated by their cohesiveness in a Reicher (1969) and Wheeler (1970) letter detection task (Gross, Treiman, & Inman, 2000). Suggesting that phonological units as large as syllables may be guiding lexical access, neurophysiological evidence reveals that skilled, adult readers prelexically activate syllable-level information during the initial moments of visual word recognition (Ashby, 2010). When syllables are previewed parafoveally, compared with incongruous previews (with one letter more or less), the reading of low-frequency words is benefited in particular (Ashby, 2006; Ashby & Rayner, 2004). Thus, the English orthography has a lexical level (represented by the spaces between words), a graphemic level where a letter or a group of letters represents a single sound, and an intermediate level such that readers use large phonological units (e.g., syllables, rimes) when recognizing words in print.

When translating the relations between print and speech, emerging evidence suggests that adult readers extract suprasegmental prosodic features, including lexical stress, metrical stress, prosodic phrasing, punctuation, and acoustic features of the implied author. By observing readers' eye movements when reading stress-alternating homographs, Breen and Clifton (2011) evaluated the influences of lexical and metrical stress. In homographs, unique meanings correspond to the different pronunciations (e.g., **AB**stract [noun] vs. ab**STR**ACT [verb]; caps have been used to signal stress assignment in these examples, although no such aid was available to participants in the study). In the experiment, readers experienced a “cost” (e.g., longer reading times) when homographs were syntactically biased to have a noun interpretation (e.g., **AB**stract) yet had to be prosodically disambiguated as a verb (e.g., “The brilliant ab**STR**ACT the...”), a garden path phenomenon. To explore metrical stress across

phrases, Breen and Clifton embedded stress-alternating homographs (e.g., **PRE**sent vs. pre**SEN**T) in limericks, noted for their catchy, predictable rhymes (e.g., “There once was a clever, young gent who had a nice talk to present”). When silent readers encountered a mismatch between the predicted meter and actual stress pattern of a homograph, they experienced difficulty (i.e., lower probability of skipping the critical word, longer fixations times).

Implicit prosodic phrasing plays a role in silent reading (Bader, 1998; Hwang & Schafer, 2009; Swets, Desmet, Hambrick, & Ferreira, 2007). According to the implicit prosody hypothesis (Fodor, 2002), silent readers project prosody onto written sentences to aid syntactic parsing decisions. The ambiguous sentence “The old man the boat” may cause the silent reader to stumble if “old man” is mistakenly parsed as the subject of the sentence. Proper phrasal parsing of this garden path sentence requires “man” to be parsed as the verb. Garden path sentences seemingly require the reader to reanalyze both the syntactic structure and the prosodic structure of the sentence (Bader, 1998). The ambiguous phrase “the maid of the princess who scratched herself in public” has two plausible interpretations concerning who did the scratching: the maid or the princess. Swets et al. showed that individual differences in working memory capacity among adults affect syntactic ambiguity resolution. Participants with low working memory tended to insert a prosodic break between “maid of the princess” and “who scratched herself,” rendering the conclusion that the maid did the scratching—a high attachment preference. In contrast, participants with high working memory were more likely to interpret the princess as the self-scratcher—a low attachment preference. The prosodic breaks created on the fly influence attachment preferences (Bader, 1998), and working memory seems to play a role in prosodic chunking strategies (Swets et al., 2007).

Punctuation guides emphatic oral reading (e.g., Stop!) as well as silent reading. Punctuation in text and altered prosody in speech were found to affect word recognition and comprehension in a similar fashion (Cohen, Douaire, & Elsabbagh, 2001). Moreover, commas and speech boundaries were found to reliably elicit a similar online brain response (event-related brain potential), suggesting a correspondence between punctuation and an inner prosodic voice (Steinhauer, 2003). The “voices” of the story characters influence silent reading times (e.g., Alexander & Nygaard, 2008; Kurby, Magliano, & Rapp, 2009). After being familiarized to the authors' voices, reading rates were slower for texts “written” by slower talking speakers than faster talking ones (Alexander & Nygaard, 2008), suggesting that silent readers impose an author's pronunciation rate onto their voice in the head.

Building on recent research, we explored whether the inner voice of skilled, adult readers represents focus

prosody when translating the relations between print and speech. Fodor (2002) notes that the role of implicit prosody in silent reading is easily overlooked and difficult to substantiate and that a manipulation of implicit prosody often requires a manipulation of another linguistic feature. To subtly manipulate implicit prosody without compromising interpretative clarity, we exploited stylistic emphasis of print (e.g., caps) to elicit prosodic prominence in the silent reader's inner voice. We borrowed the usage of caps as a marker for prosodic emphasis from the pronunciation guides of dictionaries (e.g., for *aioli*, /ahy-**OH**-lee/), comic strips (e.g., POW!, OUCH!), and the phenomenological impression when reading an e-mail message typed in all caps (e.g., CAN YOU HEAR ME NOW?), which seems as though the sender has raised his or her voice. E-mail etiquette forums caution writers to restrict the use of caps because "typing in all caps is considered yelling, screaming or at the very least adding emphasis to the word you type" (Kallos, n.d., para. 3).

Experiments 1 and 2 investigated whether silent readers represent focus prosody in their inner voice. If silent readers internalize the prosody of their spoken language, then linguistic theories of focus prosody in spoken English should apply to the voice in the head. We extrapolated from Selkirk's (1986, 1996) theory of focus marking in spoken English, which postulates that speakers prosodically emphasize new or important content in an ongoing discourse. In theory, silent readers should give higher helpfulness ratings for the final sentences of a paragraph when new or important content is cap-emphatic and previously given information is not stylistically emphatic, compared with incongruously matched stimuli. For example, the cap-emphatic text in "JAMES stole the bracelet" should be preferred by silent readers when the paragraph builds up to the question, "Who stole the bracelet?" In contrast, the cap-emphatic text in "James stole the **BRACELET**" should be preferred when the just-read story leaves the reader wondering, "What did James steal?"

Experiment 2 used a reaction time task to augment the preference judgments used in experiment 1 and additionally explored whether typically elusive function words could bear prosodic prominence when contextually new. For example, "He **CAN**" should be judged more quickly and accurately following "Can he swim?" "**HE** can" should be judged more quickly and accurately following "Who can swim?"

## Experiment 1

Focus prosody plays an important role in speech production, speech perception, and expressive reading. Experiment 1 investigated whether silent readers represent focus prosody when translating print to a speech-based code.

Across a range of speech perception studies, acoustically salient (longer, louder) information is understood as new or important content in the ongoing discourse, whereas de-accented constituents are understood as given information (Bolinger, 1978; Rooth, 1992; Speer et al., 1993; Warren, 1996). New content is not derivable from the story or the implied context (Halliday, 1967). For example, the question, "Did John read *Don Quixote*?" implies the noun *book*. Because *book* is implied, Ladd (1980) contends that the fitting response emphasizes the new information, "No, John doesn't **READ** books." (John may read journal articles.)

Consistent with linguistic theories, English speakers responded to pragmatic needs in an ongoing discourse by placing the main stress on the most newsworthy content (Nava & Zubizarreta, 2010; Rooth, 1992). Speakers were engaged in a scripted question-and-answer dialogue. When asked, "What's been happening?" 81% of the speakers placed the main stress on the unexpected verb ("A dog is **SINGING**"), rendering the verb as highly noteworthy (Nava & Zubizarreta, 2010). When answering the question, "Why are you buying that old stamp?" the majority (82%) of speakers responded by narrowly placing emphasis on the newsworthy verb ("because I **COLLECT** stamps"). When asked, "What was that crashing sound," which implies something broke, 97% of the speakers emphasized the new subject ("A **GLASS** broke").

Complementary research reveals that listeners of English appreciate when contrastively focused content is prosodically marked by speakers. In question-and-answer dialogues, listeners rate focus marked by pitch-accenting and the de-accenting of the nonfocused contents of the sentence as more appropriate than other intonational patterns (Welby, 2003). Focal pitch accenting is used by listeners to both encode and remember contextually prominent words in spoken discourse, and better memory for pitch-accented words persists at least one day later (Fraundorf, Watson, & Benjamin, 2010).

Focus prosody is present in the expressive reading of children and adults. Burgeoning readers in the third grade are sensitive to linguistic focus. When reading aloud, these early readers marked contrastive focus with higher pitch and greater intensity compared with the same words appearing in noncontrastively focused contexts (Schwanenflugel, Westmoreland, & Benjamin, 2013). Skilled, adult readers dynamically responded to the context that established given information and produced the same sentence with different intonational patterns that emphasized the contrastive information (Cooper, Eady, & Mueller, 1985; Eady & Cooper, 1986).

In Cooper et al.'s (1985) study, readers first heard one of four prerecorded questions (e.g., "Did William or Chuck like the present that Shirley sent to her sister?").



Afterward, readers read aloud a declarative sentence: “Chuck liked the present that Shirley sent to her sister.” Across a range of speakers and stimuli, the acoustical analysis consistently showed that the focal words (i.e., *Chuck, present, Shirley, sister*) in stressed compared with nonstressed contexts was much longer in duration and perceptually distinctive because declination occurred on either side of the focused content (Cooper et al., 1985; Eady & Cooper, 1986). According to the implicit prosody theory, the prosody of sentences read aloud (e.g., those in Cooper and colleagues’ studies) perfectly matches the prosody projected onto a silently read sentence in a similar context (Fodor, 2002).

Just as new information is pitch accented and old information is de-accented in an ongoing discourse and in sentences read aloud, we investigated whether new information receives prominence in the reader’s inner voice in experiment 1. Selkirk’s (1986, 1996, 2002) theory of focus marking in spoken English stipulated a precise, testable framework for how contextual newness might implicitly influence our silent readers. In the following examples from Selkirk (1986, 1996), focus is marked by caps, and the boundaries of focus marking (which necessarily contain the most prominent word in that phrase) are marked by [F].

When answering the question, “What did Mary buy a book about?” the appropriate response is narrowly focused on the new content that receives heavy stress: “Mary bought a book about [F BATS].” If the question was, “What did Mary buy?” the appropriate response, “Mary bought [F a book about BATS],” pitch-marks the new content, and focus propagates up the syntactic tree to the phrasal level. Prosodic prominence can be contrastive, and focus is narrowly restricted to the contrasting information (e.g., “I don’t think she [F SNIFFLED], she [F SNEEZED].” Similarly, a fitting response to the question, “Why don’t you eat French [F TOAST]?” is “I’ve forgotten how to [F MAKE] French toast,” where heavy stress is narrowly focused on the contrasting information (Ladd, 1980). Focus prosody presupposes that the speaker and hearer agree on shared information, and the speaker prosodically highlights new or important content (Halliday, 1967).

In experiment 1, participants silently read short stories in which the final sentence of each featured new content in light of the just-furnished details of the story. To avoid reliance on our subjective sense of newness when writing short stories, we morphed examples from Selkirk (1986, 1996, 2000, 2002) and drew on the degree of givenness theory (Baumann & Grice, 2006; Baumann, Grice, & Steindamm, 2006). The degree of givenness theory postulates that givenness systematically varies along a continuum from most accessible to least accessible. In theory, immediate repetition of a given referent yields low newsworthiness (e.g., “Sam stood up in the

canoe. Sam fell out”). Textually displaced repetition yields increased newsworthiness (e.g., “Sam and Sally went canoeing. The river was turbulent. The canoe rocked back and forth and someone fell out. Sam fell out”). Therefore, when writing our short stories, we exploited novelty and textual displacement to yield new or important content, and immediate repetition to yield old information.

If the inner voice captures the prosodic liveliness of focus prosody according to Selkirk’s theory (1986, 1996, 2002) of spoken English, we reasoned that our silent readers should give higher helpfulness ratings when new or important content is cap-emphatic and previously given information is not stylistically emphatic (focus congruous condition), compared with matched, incongruous stimuli. For example, the reader first learned about the family’s two dogs, Rover and Fido. Next, the reader learned a hole was dug under the fence, allowing one dog to squirm away. “[F ROVER] escaped” as the story-final sentence should receive higher preference ratings compared with “[F Rover] ESCAPED” because cap-emphasis congruently maps onto the prosodic focus in the former sentence but not in the latter one. If the silent reader instead learned about the family’s (only) pet dog, Rover, and learned that Rover just dug a hole under the fence, then “Rover [F ESCAPED]” should be rated more favorably than the incongruous “ROVER [F escaped].”

## Methods

### Participants

Forty-one students enrolled in introductory psychology courses at a public university in the Great Lakes region of the United States received course credit for their participation. Thirty-eight participants were native English speakers. Three participants reported mastery of English in addition to their native language (one speaker each of Spanish, Arabic, and Chinese).

### Stimuli

A cover story introduced the task. Participants were told that a creative, prize-winning author decided to capitalize select words to enrich the storytelling experience, but during electronic transit, a computer virus corrupted the book. Their job was to assist the editor by judging intentional, helpful caps from virus-corrupted, unhelpful instances on a 5-point Likert scale, with 5 as most helpful.

Twenty experimental stimuli were the final sentences (e.g., “**Sam fell out of the canoe**”) of short stories, three to six sentences in length. These 20 final sentences were bolded for salience, and one of two candidate words appeared in caps (e.g., **SAM/FELL**) depending on the

condition. As shown in Table 1, the experimental conditions of contextual newness and cap-elicited emphasis were counterbalanced for the 20 final sentences of the short story. The preceding short stories carefully controlled the newness of content appearing in the last sentence relative to previously furnished details (see Appendix A for a complete list of the experimental stimuli). Because the paragraph-final sentences were identical across the experimental manipulations, any significant effect in preference ratings cannot be attributed to the syntax of the final sentence. Participants read only one version (congruous or incongruous) of the 20 experimental stimuli, determined randomly.

Eleven forced-choice primer trials and five training trials preceded presentation of the experimental stimuli. The forced-choice primer trials familiarized participants with the idea of cap-induced emphasis when silently reading. The primer trials asked participants to select the most helpful version of a word, phrase, or sentence from two options. One option illustrated congruous cap-emphasis and word stress (e.g., BOOKbag), whereas the other option illustrated incongruous cap-emphasis and word stress (e.g., bookBAG). The five training trials familiarized participants with the experimental task. These training stimuli consisted of a one-sentence context, followed by the target sentence containing a cap-emphatic word (e.g., “Who is that in the kitchen? There is a ROBBER in the kitchen”). There were three focus congruous training trials and two focus incongruous training trials. No performance feedback was furnished at any time during the experiment.

A 20-item, multiple-choice reading comprehension test screened for task engagement. Each test question was based on an experimental stimulus, with the correct response as one of four options. Based on pilot testing, it was decided a priori that reading comprehension scores had to be greater than 75% for a participant’s data to be included in the analyses. Three participants,

who failed to meet the criterion on the reading comprehension test (with scores of 70%, 75%, and 75%, respectively), were removed from subsequent analyses. The average reading comprehension score of the remaining 39 participants was 95%.

Participants reported their native language on a demographic questionnaire.

## Procedure

After consenting to participate and reading the cover story, participants completed the forced-choice primer trials, training trials, and experimental stimuli, in that order. Then, participants were asked to “guess what the experiment was about” in an effort to purge their working memory. Finally, participants completed the reading comprehension test followed by the demographic questionnaire.

## Results and Discussion

Our findings are consistent with the hypothesis that silent readers have a prosodic inner voice that flags new or important information. As predicted by Selkirk’s (1986, 1996) theory of focus marking, participants rated stylistically emphatic words as more helpful when the words were new (congruous) rather than when given (incongruous) and rated old information as more helpful when the words were stylistically de-accented (congruous) than when stylistically emphatic (incongruous). The one-way ANOVA with focus congruency (match vs. mismatch between stylistic emphasis and contextual newness) as a repeated-measures factor revealed a main effect for focus congruency. Focus congruous passages were rated as more helpful on a 5-point scale (with 5 as most helpful) compared with matched, focus incongruous passages, repeatedly measured by subjects ( $F[1, 37] = 66.90, p < .0001, \zeta^2 = .47$ ) and by items ( $F[1, 19] = 52.35, p < .0001, \zeta^2 = .49$ ; see Table 2).

**TABLE 1**  
**Sample Stimuli in Experiment 1**

Susan and Sam went for a canoe ride. To their surprise, the river was turbulent. Sally stood up to change positions with the hope of stabilizing the canoe. As a result, the canoe rocked back and forth in the water and someone fell out. <b>SAM fell out of the canoe.</b> (Focus congruous)/ <b>Sam FELL out of the canoe.</b> (Focus incongruous)
Susan and Sam went for a canoe ride. To their surprise, the river was turbulent and the canoe rocked back and forth in the water. With the hope of stabilizing the canoe, Sam stood up to change positions. <b>Sam FELL out of the canoe.</b> (Focus congruous)/ <b>SAM fell out of the canoe.</b> (Focus incongruous)
The party guests were discussing the events taking place at the Halloween celebration. Most of the guests noticed that Mary seemed depressed and had spent most of the evening by herself. Just then, one of the guests reported seeing something very interesting. With much hesitation, the observant guest spilled the breaking news that someone hugged Mary. <b>PETER hugged Mary.</b> (Focus congruous)/ <b>Peter HUGGED Mary.</b> (Focus incongruous)
John and Mary went to a Halloween party together. John paid little attention to Mary during the festivities, even though they had gone steady for six months. Although John was nowhere to be found, Mary’s ex-boyfriend Peter was very attentive and talked with her most of the evening. As the night wore on, Peter found himself more and more enamored by Mary. Peter decided to make his move. <b>Peter HUGGED Mary.</b> (Focus congruous)/ <b>PETER hugged Mary.</b> (Focus incongruous)

**TABLE 2**  
**Descriptive Statistics for Preference Ratings<sup>a</sup> in Focus**  
**Congruous and Incongruous Conditions in Experiment 1**

	Mean	Standard deviation
<i>Focus incongruous</i>		
SAM fell.	2.54	2.31
Sam FELL.	0.89	0.76
<i>Focus congruous</i>		
SAM fell.	3.83	3.36
Sam FELL.	0.94	0.70

<sup>a</sup> 5-point rating scale, with 5 as most helpful.

Although our findings are consistent with the hypothesis that silent reading engages an inner voice, we cannot establish with complete certainty that a silent voice was in fact perceived by participants. It is possible that our findings resulted from another linguistic feature that systematically co-occurred with the experimental manipulation. A more precise summary statement is that our participants in silent reading tasks acted as though they were guided by a prosodic inner voice. Evidence for an expressive inner voice are strengthened by having used linguistic theory to make specific, testable predictions. To further strengthen the evidence, the phenomenon of a prosodic inner voice should be observable in a wide range of reading tasks, including a reaction time task that taps into online processing.

## Experiment 2

Experiment 2 implemented two experimental modifications to offer converging evidence for an inner voice during silent reading that flags new information. Instead of asking participants to make off-line preference judgments using a Likert scale, experiment 2 asked participants to make speedy, dichotomous judgments of helpful/unhelpful when reading the target sentence, while their reaction times and accuracy were recorded. Additionally, experiment 2 broadened our exploration of prosodic prominence by featuring function words (e.g., auxiliary verbs, prepositions, pronouns, conjunctions) in both new and given roles.

Function words are known for their elusiveness in both spoken and written English. In discourse, function words typically refer to established content and, thus, are prosodically weaker than the content words in the same context (Selkirk, 1986, 1996). For example, Nava and Zubizarreta (2010) found that pronouns (e.g., *them*) that referred to previous content (e.g., *tomatoes*) were de-emphasized 100% of the time by English

speakers (e.g., “Do we have tomatoes? No, I didn’t **BUY** them”). Characteristically unstressed function words correspondingly have reduced vowels when pronounced (Selkirk, 1995), rendering them more difficult to isolate in the acoustic stream (Gleitman & Wanner, 1982).

Although pronouns are typically prosodically weaker than the content words in the same context (Selkirk, 1986, 1996), there are contexts in which pronouns convey new or important information. Ladd (1980) offers the following example. Consider the question, “Why don’t you have some French toast?” The narrowly focused response, “There’s nothing to make French toast **OUT** of,” de-emphasizes what is known (French toast) and prosodically emphasizes the contextually important pronoun. Using similar sentences, German, Pierrehumbert, and Kaufmann (2006) asked participants to play the role of speaker B in a conversation by naturally reading a scripted response. After hearing speaker A’s prerecorded sentence, which established the context of “Are the children playing their game?” participants read, “Paul took down the tent that they play their game in.” Linguistic theories of focus marking (Schwarzschild, 1999; Selkirk, 1986, 1995) predict that the preposition *in* should be pitch-accented. Yet, even in this narrowly focused condition in which the preposition *in* does not have an antecedent in the discourse that is salient or implied, the preposition received pitch-accenting only 32% of the time. Participants preferred (64% of the time) to place focal stress on the entire noun phrase, “their game in.” Across all the conditions, speakers preferred to accent nouns and verbs rather than prepositions, suggesting that these novel prepositions embedded in larger noun phrases are poor candidates for focal stress (German et al., 2006).

To evaluate more fully the contextual conditions that may lead to focus on function words, experiment 2 featured a diverse array of function words (e.g., *he*, *can*, *in*) embedded in a wider range of sentence types than used by German and colleagues (2006). We asked silent readers in experiment 2 to respond quickly to passages in which function words were noteworthy and bore stylistic prominence (e.g., “While shaking their heads no, the ladies pointed down...We read **THAT** book”), as well as passages in which function words were non-salient both contextually and stylistically (congruous trials). Congruous function stimuli were pitted against perfectly matched, incongruous function stimuli. Seeking converging evidence for an inner voice that flags new information, a subset of congruous and incongruous content stimuli from experiment 1 was included in experiment 2.

Based on Selkirk’s (1986, 1996) theory of focus marking, we predicted that participants would more quickly read, and accurately judge, congruous function and content stimuli as helpful compared with matched,



incongruous stimuli. We also reasoned that participants would have an advantage when swiftly judging content stimuli compared with function stimuli. As mentioned, content words are more commonly stress-marked in English compared with function words. Moreover, among function words, there are auxiliary words (e.g., *in, a*) that rarely receive contextual emphasis (Weber, 2006), and such uncharacteristically noteworthy auxiliaries were included in experiment 2 (e.g., “I only wanted **A** cookie”). In light of these differences, we hypothesized that participants’ judgments about function stimuli would not be as easy as their judgments about content stimuli. Differential effort could be manifested as slower response times and less accuracy.

## Methods

### Participants

Forty-five students enrolled in introductory psychology courses at a public university in the Great Lakes region of the United States received course credit for their participation. All participants were native English speakers.

### Stimuli

Twelve function stimuli were the final sentences (e.g., “He can”) of short stories, two to six sentences in length. Twelve content stimuli from experiment 1 were used in experiment 2. In the story-final sentences, one content or function word appeared in bolded caps and an enlarged font size (by two points) for enhanced salience. This change in the implementation of stylistic-induced emphasis was deemed necessary because some function words (e.g., *I, a*) are markedly less salient in connected text (e.g., “Mrs. Woodward offered Stan the basket of cookies. ‘I only want **A** cookie,’ replied Stan”). As in experiment 1, contextual newness and cap-induced prominence were counterbalanced, and the paragraph-final sentences were syntactically identical in the

congruous and incongruous conditions (see Table 3 for sample function stimuli; see Appendix B for a complete list). Eleven forced-choice primer trials and 10 (five function and five content) two-sentence training trials preceded presentation of the experimental stimuli. No performance feedback was furnished at any time during the experiment.

### Procedure

SuperLab 4.0 (Cedrus, 2011) was used to present all stimuli and record response times and accuracy. Participants seated at a computer read the cover story (i.e., computer virus corrupts prize-winning author’s new writing technique). Tasked with assisting the book editor, participants judged if instances of capitalization were helpful (by pushing the green key on the keyboard) or unhelpful (by pushing the red key). Participants were asked to make their judgments swiftly and accurately.

The forced-choice primer trials were presented first, and participants were instructed to pick the most helpful of the two options. The training trials, content stimuli, and function stimuli followed and were presented in two parts. Part 1 comprised the short story, except for the last sentence. For part 1, participants were instructed to carefully read the story, taking as much time as needed. When ready, participants were directed to press the space bar to launch presentation of the final sentence of the story, part 2.

For part 2, participants were instructed to speedily read the story-final sentence and quickly judge the helpfulness of the stylistic emphasis by hitting the appropriate key. Time to make the helpful judgments was recorded beginning when the final sentence appeared on the screen to the time when a key was pressed. Accuracy of judgments, as defined by predictions, was recorded. The content and function stimuli were presented in separate blocks, and stimuli were randomly presented within blocks. Block order was counterbalanced. The assignment of the green (helpful) key and

**TABLE 3**  
**Sample Function Stimuli in Experiment 2**

The Smith family went to the beach. Everyone was in the water except Brian. Someone asked if Brian could swim. He <b>CAN</b> . (Focus congruous)/ <b>HE</b> can. (Focus incongruous)
Sara and Brian went to the beach with a friend. The lake looked so inviting. The friend asked, “Can either of you swim?” <b>HE</b> can. (Focus congruous)/He <b>CAN</b> . (Focus incongruous)
Charlie went over to Megan’s apartment to see her new hamster, Winnie. Megan brought out Winnie’s cage and then left the room to answer the phone. When she returned, Charlie looked frantic and the cage was empty. <b>WHERE</b> is my hamster? (Focus congruous)/Where is <b>MY</b> hamster? (Focus incongruous)
Little Megan went away to summer camp. While Megan was away, her hamster Winnie died and her parents replaced it with a similar one, hoping Megan would not notice the switch. When Megan returned from camp, she ran into her room and looked at somebody else’s hamster in the cage. Where is <b>MY</b> hamster? (Focus congruous)/ <b>WHERE</b> is my hamster? (Focus incongruous)?

red (unhelpful) key was counterbalanced between the right and left hands of participants.

## Results and Discussion

Because of computer malfunction, no data were recorded for one participant. For a second participant, only the first randomly presented condition (function stimuli) recorded data; these data were included in the analyses. Outliers (9 out of 996 trials, defined as reaction times greater than three standard deviations from the mean) were omitted from the analyses.

Based on Selkirk's (1986, 1996) theory of focus marking, we predicted that participants would more quickly read, and accurately judge, congruous function and content stimuli as helpful compared with matched, incongruous stimuli. Because function words are notoriously subtle, elusive, and de-emphatic when filling in background information, we reasoned that participants would more swiftly and accurately judge the helpfulness of newsworthy content stimuli compared with function stimuli. Yet, it was untenable when designing the stimuli to create story-final sentences that were identical across stimulus type (function vs. content). The presence of content words (e.g., *Jane*) in a sentence renders the neighboring function words (e.g., *she*) as background information (Selkirk, 1995). Thus, we opted to use story-final sentences that prominently featured functions words (e.g., "She wants a cookie") or content words (e.g., "Peter hugged Mary") but not both. In the following analyses, our stimuli have been optimized to detect the effects of focus congruence versus incongruence for both content stimuli and function stimuli. By comparison, any findings comparing across stimulus type must be interpreted with caution because the stimuli were not held constant across type.

We analyzed reaction times for accurate trials only and pitted focus congruous content and function stimuli against their matched, incongruous counterparts. As predicted, accurately judging the match between stylistic prominence and contextual newness was faster for congruous than incongruous trials for both content and function stimuli. The  $2 \times 2$  ANOVA with stimulus type (function vs. content) and congruency as a repeated-measures factor revealed a main effect for congruency ( $F[1, 39] = 44.1, p < .001, \zeta^2 = .17$  by subjects;  $F[1, 22] = 9.4, p = .006, \zeta^2 = .14$  by stimuli), no main effect for stimulus type ( $p = .33$  by subjects;  $p = .28$  by stimuli), and no interaction ( $p = .86$  by subjects;  $p = .09$  by stimuli). Participants were significantly faster for congruous content stimuli than matched incongruous content stimuli ( $F[1, 39] = 36.3, p < .0001, \zeta^2 = .48$  by subjects;  $F[1, 11] = 10.1, p = .009, \zeta^2 = .31$  by items) and significantly faster for congruous function stimuli than matched incongruous function stimuli ( $F[1, 41] = 31.1,$

$p < .0001, \zeta^2 = .43$  by subjects;  $F[1, 11] = 8.1, p = .02, \zeta^2 = .43$  by items; see Table 4).

We reasoned that participants' judgments about function stimuli would not be as easy as their judgments about content stimuli and that differential effort could be manifested as reduced accuracy (i.e., proportion correct). We pitted content stimuli against function stimuli on accuracy, with full acknowledgment that the stimuli were not optimized to detect such differences, as discussed. The  $2 \times 2$  ANOVA with congruency as a repeated-measures factor and stimulus type (function vs. content) as a between-groups factor revealed a main effect for stimulus type ( $F[1, 39] = 13.3, p = .001, \zeta^2 = .10$ ) by subjects but not by items ( $p = .87$ ). The effect of congruency was not significant by subjects ( $p = .25$ ), although it was significant by items ( $F[1, 22] = 116.0, p < .001, \zeta^2 = .74$ ). The two-way interaction between stimulus type and congruency was not statistically significant ( $p = .07$  by subjects;  $p = .08$  by items; see Table 4). Unlike the reaction time data, the accuracy data lack consistency. Our participants tended to judge focus congruence more accurately in content than function stimuli, although this effect did not generalize across all experimental stimuli.

Experiment 2 offers converging evidence that skilled, silent readers represent focus prosody when computing the relations between print and a speech-based code. When asked to speedily judge the helpfulness of instances of prosodic prominence, our readers in experiment 2 were significantly swifter for both content and function stimuli when cap-elicited emphasis and contextual newness were congruent than incongruent, consistent with Selkirk's theory of focus marking.

**TABLE 4**  
Descriptive Statistics for Function and Content Stimuli in Focus Congruous and Incongruous Conditions in Experiment 2

	Focus incongruous	Focus congruous
<i>Function stimuli</i>	<i>He CAN</i>	<i>HE can</i>
RT (ms)	4,399	3,558
Standard deviation	2,537	2,083
Proportion correct	.72	.63
Standard deviation	0.21	0.24
<i>Content stimuli</i>	<i>Sam FELL out of the canoe</i>	<i>SAM fell out of the canoe</i>
RT (ms)	4,157	3,290
Standard deviation	2,895	2,410
Proportion correct	.78	.80
Standard deviation	0.23	0.18

By broadening our investigation to include new or important function words (e.g., “I want **THAT** book”), in addition to new or important content words (e.g., “**JAMES** stole the bracelet”), we established that although function words typically serve a grammatical function, this class of words could bear prosodic prominence when contextually appropriate. Our readers tended to be more accurate when making focus congruous judgments for content stimuli than function stimuli—a trend consistent with the well-documented elusiveness of function words in language acquisition and reading research. Our findings across two experiments support the notion that skilled, silent readers behave as though they are guided by an inner voice that flags newsworthy content.

## General Discussion

Our writing system encodes our spoken language. English readers engage phonology when they read (Perfetti & Bell, 1991; Van Orden & Kloos, 2005). Our results suggest that readers also engage prosody when they read silently. Inspired by the central role that prosody plays in speech and oral reading, we investigated the extent to which skilled, silent reading represents prosodic focus. We exploited stylistic emphasis in print to elicit prosodic emphasis in the silent reader’s inner voice. The results of experiments 1 and 2 suggest that our skilled, silent readers “heard” the prominence of new or important information, a natural form of highlighting. Consistent with linguistic theories of focus marking, silent readers of short stories in experiment 1 gave higher preference ratings when cap-emphasized words congruously mapped onto new or important content and when background information was stylistically de-emphasized, compared with matched, incongruous trials. Experiment 2 generalized the benefits of congruous stylistic emphasis and contextual importance to function words (in uncharacteristically newsworthy roles) and to a new behavioral measure (reaction time). The participants in experiment 2 tended to judge focus congruence more accurately in content than function stimuli, although this effect did not generalize across all experimental stimuli. In short, the inner speech of reading seemingly contains some of the prosodic richness typical of lively speech.

We found converging evidence that our skilled, silent readers seemingly “heard” prosodic focus. Our findings supplement the compelling evidence for the role of segmental phonology in skilled reading (Abramson & Goldinger, 1997; Acheson & MacDonald, 2009; Ashby & Clifton, 2005; Ashby et al., 2006; Gross et al., 2000; Hanson et al., 1991; Lukatela et al., 2004; McCutchen et al., 1991; Treiman, 1994; Treiman et al., 1995). Our

findings complement recent evidence that silent readers extract suprasegmental prosodic features, such as lexical stress and metrical stress, when computing the relations between print and speech (Breen & Clifton, 2011), for when these readers encountered an inconsistency between the predicted meter and the required stress of a homograph, they suffered longer fixation times (Breen & Clifton, 2011). Silent reading has been shown to be influenced by implicit prosodic phrasing (e.g., Bader, 1998; Hwang & Schafer, 2009; Swets et al., 2007), punctuation (Cohen et al., 2001), and the voices of the story characters (Alexander & Nygaard, 2008; Kurby et al., 2009). Our experiments 1 and 2 go beyond previous research by demonstrating readers’ sensitivity to focus prosody, in accordance with Selkirk’s theory. Thus, there is growing evidence that suprasegmental prosodic sensitivity plays a role in skilled, silent reading.

Although our focus was on prosodic awareness in skilled, adult reading, other research reflects an increasing awareness that young children’s reading proficiency includes prosodic awareness in addition to phonological awareness. Fast and efficient phonemic decoding of words is essential for learning English. Yet, the relation between letters and sounds is not one to one. Rather, a single sound can have several spellings (e.g., /k/ as in *cat*, *bake*, and *back*), and the same grapheme can be used to spell different sounds (e.g., *thin*, *then*). Prosodic units, like rimes, can be a more stable unit of analysis (Treiman et al., 1995).

In a longitudinal study, sensitivity to speech rhythm among 5–8-year-old children predicted their reading attainment and phrasing (a measure of fluency) one year later, after controlling for phonological processing skills, vocabulary, and age (Holliman, Wood, & Sheehy, 2010). In fourth graders, prosodic skills at the word and phrase levels (assessed by means of a reiterative speech task) predicted unique variance in the students’ reading accuracy and reading comprehension, while controlling for general rhythmic sensitivity and phonological awareness (Whalley & Hansen, 2006). Contending that speech rhythm sensitivity may be a universal requirement when learning to read and write, Goswami and colleagues (2011) compared children with developmental dyslexia against matched samples of normal readers learning one of three very different spoken and written languages (English, Spanish, Chinese). The researchers found that rhythmic sensitivity uniquely predicted phonological awareness and reading in three different languages.

Extrapolating from Goswami et al (2011) findings on the importance of speech rhythm sensitivity in learning to read and write, we wonder if beginning or struggling readers of English might benefit from reading lessons that draw a more explicit link between the rhythm in speech and the rhythm in the writing

system. Prosthetically enhanced poetry seems to be the perfect reading material for such a lesson. Poetry is an artistic example of regular stress patterning across connected text, and three types of poetic meter (trochaic, iambic, anapestic) accentuate the different, undulating rhythms of spoken English (Selkirk, 1986). In poetry, an iambic meter consists of an unstressed syllable followed by a stressed syllable (e.g., The **man** is **small**), a trochaic meter consists of a stressed syllable followed by an unstressed syllable (e.g., **City lights** are **near**), and an anapestic meter consists of two unstressed syllables followed by one stressed syllable (e.g., And the **house** is the **place**). Beginning readers might benefit from “seeing” the stress pulses of the trochaic rhythm that is common in children’s poetry (e.g., “**Twinkle, twinkle, little star**”; Taylor & Taylor, 1849, p. 30). Reading tutorials could advance to less familiar rhythms (e.g., iambic: “**did gyre and gimble in the wabe**”; Carroll, 1917, p. 26) and advance further to obscure rhythms (e.g., anapestic: “The **immortal desire** of **Immortals** we **saw** in their **faces**, and **sighed**”; Yeats, 2010, p. 374).

Perhaps beginning readers’ syllable segmentation abilities would profit from prosodically enhanced reading materials (e.g., **but, butter, butterfly**) while playing a modified tapping game (Lieberman, Shankweiler, Fischer, & Carter, 1974). In the original game, children tapped out the number of segments (e.g., phonemes, syllables) in spoken utterances. After hearing the words, *but*, *butter*, and *butterfly*, the correct answers when counting syllables were one, two, and three taps, respectively. In the proposed game, young readers would be given reading materials that cap-emphasize syllable beats (e.g., “**Itsy Bitsy Spider**”; North, 1910, p. 346). Then, the readers would play the game by tapping out the number, and type (stressed vs. unstressed), of syllables in words. The readers would be instructed to tap out beat sequences using stronger taps for stressed syllables and quieter taps for unstressed syllables. Thus, the correct answer when reproducing the meter in “**Itsy Bitsy Spider**” is “TAP-tap, TAP-tap, TAP-tap.”

A diverse array of prosthetic-prosody aids may uniquely benefit struggling readers, nonnative speakers, or readers challenged by difficult text. For example, prosthetic cap-emphasis might aid the assignment of stress when silently reading (a) ambiguous heteronyms (e.g., **PER**mit vs. per**MIT**), (b) esoteric, multisyllabic words (e.g., eso**TER**ic), (c) words that are spelled similarly but have different pronunciations and meanings (e.g., de**FER** vs. **DIF**fer), and (d) root words with pronunciation changes across derivations (e.g., **DIF**fer vs. differ**ENT**ial). For example, we wonder if late speakers of English might have faster reading times and fewer pronunciation errors when provided with visual aids marking stress in ambiguous heteronyms, as in the following examples:

The farmer’s market usually has a wide variety of **PRO**duce.

Rapidly boiling water in the large pot will **proDUCE** hot steam.

Could college students prepare more efficiently for standardized vocabulary tests by studying from prosthetically enhanced word lists (e.g., a**CER**bic, ab**SCON**D, a**MAL**gamate, bu**COL**ic, ca**COPH**ony, ca**NON**ical, **DES**iccate, dis**PAR**age, e**PHEM**eral, **GAR**rulous)?

Could prosthetic-prosody aids facilitate the acquisition of function words among early readers? In reading research, function words are noted for their particular difficulty, including their irregular spellings, subtle meanings, weak stress assignment, and vowel pronunciation differences between citation form and connected text (Weber, 2006). Function words are read less accurately than content words in lists as well as connected text by normal and impaired readers (Blank, 1985), even though some function words are among the most frequent words appearing in print (Morgan, Shi, & Allopenna, 1996). In the proposed intervention, young readers might benefit from reading materials like the function stimuli in our experiment 2. For example, these readers might benefit from seeing newsworthy function words emphasized in print (e.g., “Sam asked, ‘Did you read **THAT** book?’ Sally replied, ‘No, I read **THIS** book’”). Our future investigations will focus on some of these potential uses of prosthetically enhanced text.

Do skilled, adult readers represent metrical prosody in their inner voice? Our findings in experiments 1 and 2 are limited by our concentration on the role of focus marking in silent reading. Our future studies will swap prose for poetry to investigate the role of prosodic meter in the voice in the head. Extrapolating from linguistic theories of metrical alternation biases in English (Selkirk, 1986), skilled readers’ ratings of the helpfulness of the stylistic enhancements of text should be significantly more favorable when stylistic emphasis and syllable stress are congruous (e.g., “**Will be a totter’d weed of small worth held**”; Shakespeare, 1997, p. 115) compared with incongruously matched stimuli (e.g., “**Will be a totter’d weed of small worth held**”). Additional evidence for a prosodic inner voice during silent reading could be gathered by using complementary methodologies. If the inner voice is melodious, then would silent reading times benefit by first listening to a song with a congruous beat (compared with an incongruous beat)? For example, could rap music (with a strong, predictable meter) prime the reading times of poetry or prose with an identical, implicit meter? Could silent reading times benefit by asking readers to first tap out a meter that is congruous (compared with incongruous) with the beat inherent in the text?

Future investigations could investigate whether contextual newness varies on a continuum from low to



high newsworthiness, according to the degree of givenness theory (Baumann & Grice, 2006; Baumann et al., 2006). Such a study could explore the nature of the relationship between a referent and its anaphor (e.g., synonyms, hyponyms, hypernyms, converseness, part-whole relationships). For example, the immediate mention of a synonym should have low newsworthiness. Would the mention of a whole (e.g., *hand*) automatically activate its parts (e.g., *fingers*), rendering the parts as “old” information?

The integrity of our findings assumes a direct link between stylistic emphasis in print and implicit emphasis in the inner voice. We can probably never know for certain whether an inner voice guides silent reading. Our silent readers may have been responding to linguistic features that systematically covaried with our experimental manipulations of focus. Our claims for an expressive inner voice are strengthened by having used linguistic theory to make specific, testable predictions. By exploiting different stimuli (e.g., newsworthy content words, atypically newsworthy function words) and different measures of behavior (preference ratings, reaction times), we found converging evidence that our skilled, silent readers seemingly “heard” contextual focus, which is a feature of prosodic speech.

To conclude, prosodic speech is pervasive (e.g., infant-directed speech, gifted college lectures, stage acting, voice of an irate mother). Our findings suggest that silent reading also captures aspects of this prosodic vigor.

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## APPENDIX A

# Stimuli in Experiment 1

The children in the elementary school were drilled on what they should do in the event that the fire alarm goes off. To avoid panicking and to form orderly lines were the children's first instructions. **Next, they have instructions to LEAVE.** (Focus

congruous)/**Next, they have INSTRUCTIONS to leave.** (Focus incongruous)

As the Level 5 hurricane moved closer to the city, the city officials began urging citizens to take preventative



action. The citizens were urged to prepare their homes and businesses for the onslaught of wind and rain before leaving. **Next, they have INSTRUCTIONS to leave.** (Focus congruous)/**Next, they have instructions to LEAVE.** (Focus incongruous).

At the finishing school, all students were required to take an etiquette class. At the beginning, they were given a list of rules. The instructors reminded the students of the rules at every social gathering. //The list of appropriate behaviors at dinner parties included not burping in public, keeping their elbows off the dinner table, and keeping their feet off the furniture. **The students were told to keep their feet off the COFFEE TABLE.** (Focus congruous)/The list of appropriate behaviors at dinner parties included not burping in public, keeping their elbows off the dinner table, and keeping their feet on the floor. **The students were told not to put their FEET on the coffee table.** (Focus incongruous)

Maria had spent all day cleaning the house. She wanted everything to be perfect for the party later that night. She heard her husband come in from outside and sit down on the couch. She scurried in to tell him not to mess up the place. Maria feared that her husband would place cold drinks and other messy items directly on the coffee table. **The husband was told to keep his FEET off the coffee table.** (Focus congruous)/**The husband was told to keep his feet off the COFFEE TABLE.** (Focus incongruous)

Mary sat down with a sigh of relief. It had been a long, grueling day and she was glad it was over. She put her feet up on the coffee table and tried to relax. She turned on the radio and flipped through the stations. //Unfortunately, the options on the radio, mostly call-in talk shows about old sitcoms like Seinfeld, were not appealing to listen to. **Instead, she WATCHED Seinfeld.** (Focus congruous)/Unfortunately, the options on the television, mostly old reruns, were not appealing to watch. **Instead, she WATCHED Seinfeld.** (Focus incongruous)

Mary sat down with a sigh of relief. It had been a long, grueling day and she was glad it was over. She put her feet up on the coffee table and tried to relax. She turned on the television and flipped through the stations. //Unfortunately, the options on the television, mostly old reruns, were not appealing to watch. **Instead, they watched SEINFELD.** (Focus congruous)/But the options on the radio, mostly call-in talk shows about old sitcoms like Seinfeld, were not appealing to listen to. **Instead, she watched SEINFELD.** (Focus incongruous)

John and Mary went to a Halloween party together. John paid little attention to Mary during the festivities, even

though they had gone steady for six months. Although John was nowhere to be found, Mary's ex-boyfriend Peter was very attentive and talked with her most of the evening. As the night wore on, Peter found himself more and more enamored by Mary. Peter decided to make his move. **Peter HUGGED Mary.** (Focus congruous)/**PETER hugged Mary.** (Focus incongruous)

The party guests were discussing the events taking place at the Halloween celebration. Most of the guests noticed that Mary seemed depressed and had spent most of the evening by herself. Just then, one of the guests reported seeing something very interesting. With much hesitation, the observant guest spilled the breaking news that someone hugged Mary. **PETER hugged Mary.** (Focus congruous)/**Peter HUGGED Mary.** (Focus incongruous)

Matt just returned from a long business trip to Europe. The transatlantic plane had landed and the passengers were beginning to depart via the concourse. Matt's girlfriend, Megan, excitedly watched as he emerged from the plane. Although the crowd was thick, Matt quickly navigated through the crowd to greet Megan. **Matt KISSED Megan.** (Focus congruous)/**MATT kissed Megan.** (Focus incongruous)

Megan went to the high school dance with her girlfriends. The girls were enjoying listening to the live music by the sidelines and watching their classmates dance. As Megan watched the dance floor, a boy snuck up from behind and kissed her on the cheek. Megan thought her former boyfriend, Paul, had kissed her. **MATT kissed Megan.** (Focus congruous)/**Matt KISSED Megan.** (Focus incongruous)

Two cars were speeding north on the expressway. // Without warning, the driver of the Mustang cut in front of the Camaro to exit the highway. This near collision caused both drivers to lose control and swerve back and forth on the road. One car hit the soft gravel, flipped upside down, and caught fire. **The MUSTANG caught fire.** (Focus congruous)/Without warning, the driver of the Mustang cut in front of a second car to exit the highway. This near collision caused the driver of the Mustang to lose control and swerve back and forth on the road. The Mustang hit the soft gravel and flipped upside down. **The MUSTANG caught fire.** (Focus incongruous)

Two cars were speeding north on the expressway. // Without warning, the driver of the Mustang cut in front of a second car to exit the highway. This near collision caused the driver of the Mustang to lose control and swerve back and forth on the road. The Mustang hit the soft gravel and flipped upside down. **The Mustang**



**caught FIRE.** (Focus congruous)/Without warning, the driver of the Mustang cut in front of the Camaro to exit the highway. This near collision caused both drivers to lose control and swerve back and forth on the road. One car hit the soft gravel, flipped upside down, and caught fire. **The Mustang caught FIRE.** (Focus incongruous)

The birthday celebration was a big hit. The guests were enjoying the double-layered birthday cake and homemade ice cream. The guests were discussing the gifts being unwrapped by the birthday boy. //One guest asked if the red tie was a gift from Susan. The guests replied, **“BRAD gave him a red tie.”** (Focus congruous)/One guest asked if Brad gave him a greenish-yellow tie. The guests replied, **“BRAD gave him a red tie.”** (Focus incongruous)

The birthday celebration was a big hit. The guests were enjoying the double-layered birthday cake and homemade ice cream. The guests were discussing the gifts being unwrapped by the birthday boy. //One guest asked if Brad gave the birthday boy a greenish-yellow tie. The guests replied, **“Brad gave him a RED tie.”** (Focus congruous)/One guest asked if the red tie was a gift from Susan. The guests replied, **“Brad gave him a RED tie.”** (Focus incongruous)

The Christmas celebration was underway and all the children gathered around the tree, opening their presents. Wrapping paper was flying everywhere. Such chaos filled the room that it was hard to see the presents being opened. //Uncle John asked if Little Johnnie got a red truck. Mom replied, **“PETE got a red truck.”** (Focus congruous)/Uncle John asked if Pete got a red bicycle. Mom replied, **“PETE got a red truck.”** (Focus incongruous)

The Christmas celebration was underway and all the children gathered around the tree, opening their presents. Wrapping paper was flying everywhere. Such chaos filled the room that it was hard to see the presents being opened. //Uncle John asked if Pete got a red bicycle. Mom replied, **“Pete got a red TRUCK.”** (Focus congruous)/Uncle John asked if Little Johnnie got a red truck. Mom replied, **“Pete got a red TRUCK.”** (Focus incongruous)

Several GVSU students were looking forward to having a pleasant meal off campus at a nearby restaurant in Allendale. The students looked pleased when the waiter served their meals along with glasses of fresh-squeezed lemonade. //Suddenly, with a look of disgust, one of the students stopped eating her garden salad. The student spit out a bite of salad. **A MOTH was in her salad.** (Focus congruous) /Suddenly, one of the students stopped eating with a look of disgust. The student looked stunned as she inspected what appeared to be a

white-winged moth. **A MOTH was in her salad.** (Focus incongruous)

Several GVSU students were looking forward to having a pleasant meal off campus at a nearby restaurant in Allendale. The students looked pleased when the waiter served their meals along with glasses of fresh-squeezed lemonade. //Suddenly, one of the students stopped eating with a look of disgust. The student looked stunned as she inspected what appeared to be a white-winged moth. **A moth was in her SALAD.** (Focus congruous)/ Suddenly, with a look of disgust, one of the students stopped eating her garden salad. The student looked stunned as she spit the bite of salad out. **A moth was in her SALAD.** (Focus incongruous)

Sweethearts Steve and Sue were sharing a bag of candy while watching a late-night movie. An argument started in the middle of the movie about jelly beans. //Sue said that orange jelly beans tasted funny. Steve said, **“Orange jelly beans are the BEST kind.”** (Focus congruous)/Sue said that green jelly beans are the best kind. Steve said, **“Orange jelly beans are the BEST kind.”** (Focus incongruous)

Sweethearts Steve and Sue were sharing a bag of candy while watching a late-night movie. An argument started in the middle of the movie about the best-tasting jelly beans. //Sue said that green jelly beans are the best kind. Steve said, **“ORANGE jelly beans are the best kind.”** (Focus congruous)/Sue said the orange jelly beans tasted funny. Steve said, **“ORANGE jelly beans are the best kind.”** (Focus incongruous)

John left work early to buy his wife a birthday present. John went to the local bookstore because his wife liked to read mystery novels. He picked out a mystery novel that was on the best-seller list. The storekeepers placed his purchase in a plain paper bag. As John entered his home, his wife asked what was in the brown paper bag. //John wished to keep the mystery book a surprise. John replied that **he bought a book about BIRDS.** (Focus congruous)/John wished to keep his purchase of the mystery book a surprise. John replied that **he BOUGHT a book about birds.** (Focus incongruous)

The Hendersons recently hung a bird feeder in their backyard. Different birds frequented the feeder throughout the day. To be able to identify the birds, Mr. Henderson went to the library. He skimmed through the Audubon Society’s collection of bird books. With the help of the glossy pictures, Mr. Henderson identified many of the birds native to region. Upon returning home, his wife asked if he had browsed the book collection on birds. Mr. Henderson replied that **he BOUGHT a book about birds.** (Focus congruous)/Mr. Henderson

replied that **he bought a book about BIRDS.** (Focus incongruous).

Sixteen-year-old Ed sat down next to his father, who was reading the newspaper. Ed wanted to go to the movies with his friends later that evening. Within minutes of sitting down, Ed started to ask his father for something, but he mumbled his words. Ed's father anticipated his exact need. Ed's father said, "**Do you need a DOLLAR?**" (Focus congruous)/Ed's father said, "**Do you NEED a dollar?**" (Focus incongruous)

Sixteen-year-old Ed drove to the floral shop to buy a small bouquet for his girlfriend. Ed picked out a beautiful arrangement of daisies and lavender. The store clerk rang up his purchase. Upon seeing the total due, Ed looked worried about the number of dollars in his pocket. The next customer said, "**Do you NEED a dollar?**" (Focus congruous)/The next customer said, "**Do you need a DOLLAR?**" (Focus incongruous)

The VanBuren family had many pets. //An aquarium filled with fish, a pet turtle, two cats, and one dog lived in the house. Unbeknownst to the family, their dog, Rover, liked to dig holes in the backyard. The next time the dog played in the yard, Rover dug a hole under the fence. **Rover ESCAPED.** (Focus congruous)/An aquarium filled with fish, a pet turtle, two cats, and two dogs lived in the house. Unbeknownst to the family, the two dogs, Rover and Fido, liked to dig holes in the backyard. The next time the dogs played in the yard, one dog dug a hole under the fence, squirmed underneath, and ran away. **Rover ESCAPED.** (Focus incongruous)

The VanBuren family had many pets. An aquarium filled with fish, a pet turtle, two cats, and two dogs lived in the house. //Unbeknownst to the family, the two dogs, Rover and Fido, liked to dig holes in the backyard. The next time the dogs played in the yard, one dog dug a hole under the fence, squirmed underneath, and ran away. **ROVER escaped.** (Focus congruous)/Unbeknownst to the family, their dog, Rover, liked to dig holes in the backyard. The next time the dog played in the yard, Rover dug a hole under the fence. **ROVER escaped.** (Focus incongruous).

Sally met her best friend at the local coffee shop. After receiving their drinks, Sally and her friend located a quiet booth in the back of the coffee shop. //Upon sitting down, Sally began to tell her friend about the latest gossip about Mark. Sally exclaimed, "**MARK was arrested!**" (Focus congruous)/Upon sitting down, Sally began to fill her friend in about the latest news regarding a friend who was arrested. Sally exclaimed, "**Mark was ARRESTED!**" (Focus incongruous)

Sally met her best friend at the local coffee shop. After receiving their drinks, Sally and her friend located a quiet booth in the back of the coffee shop. //Upon sitting down, Sally's friend began to ask about the latest news regarding Mark. Sally exclaimed, "**Mark was ARRESTED!**" (Focus congruous)/Upon sitting down, Sally's friend asked about the latest news regarding a friend. Sally exclaimed, "**MARK was arrested!**" (Focus incongruous)[One employee sat down in the break room at the jewelry store. His friend sat nearby. They both knew it was going to be a long day at work because the jewelry store was understaffed. Recent employee thefts had led to employee firings. //That day, five employees were not at work because of stealing bracelets. A fellow worker sighed, "**JAMES stole a bracelet.**" (Focus congruous)/One of the workers asked why James was not at work. A fellow worker sighed, "**JAMES stole a bracelet.**" (Focus incongruous)

One employee sat down in the break room at the jewelry store. His friend sat nearby. They both knew it was going to be a long day at work because the jewelry store was understaffed. Recent employee thefts had led to employee firing. //One of the workers asked why James was not at work. A fellow worker sighed, "**James stole a BRACELET.**" (Focus congruous)/That day, five employees were not at work because of stealing bracelets. A fellow worker sighed, "**James stole a BRACELET.**" (Focus incongruous)

Sue was browsing through Barnes & Noble, trying to come up with an idea of what to buy her brother-in-law John for his birthday party. An advertisement for the new best seller, *The Da Vinci Code*, caught her eye. She decided to call her sister to find out if John had already read this book. Her sister's response about John surprised her. **John was ILLITERATE.** (Focus congruous)/**JOHN was illiterate.** (Focus incongruous)

Ms. Smith reviewed her students' performance on the standardized exams. Ms. Smith appreciated the opportunity to find out if each student in her class met the basic requirements. As she went through the graded exams, she was surprised at one very low reading score indicating illiteracy. **JOHN was illiterate.** (Focus congruous)/**John was ILLITERATE.** (Focus incongruous)

An MSU student and a GVSU student were discussing the merits of university sports programs. The MSU student said that their athletic program was better because it is part of the Big Ten Conference. The GVSU student quickly retorted that the GVSU program was better because it is one of the top programs in NCAA Division II. //The GVSU student sneered and continued to defend his university's athletes. **Our athletes GRADUATE.** (Focus congruous)/The GVSU student

sneered and said that GVSU business majors, science majors, and humanities majors graduate. Similarly, **our athletes GRADUATE**. (Focus incongruous)

An MSU student and a GVSU student were discussing the merits of university sports programs. The MSU student said that their athletic program was better because it is part of the Big Ten Conference. The GVSU student quickly retorted that the GVSU program was better because it is one of the top programs in NCAA Division II. //The GVSU student sneered and said that GVSU business majors, science majors, and humanities majors graduate. Similarly, **our ATHLETES graduate**. (Focus congruous)/The GVSU student sneered and continued to defend his university's athletes. **Our ATHLETES graduate**. (Focus incongruous)

Billy's attendance at summer camp had been arranged and paid for by his neighborhood YMCA. The only requirements on Billy were to follow camp rules. Upon arrival, the young man had been told that several types of infractions could result in the loss of camping privileges and an early departure for home. All campers were urged to follow the rules posted on a sign near the cabins. //Billy paid no attention to the rules, particularly the rules about proper etiquette inside the cabin. **He SMOKED in the cabin**. (Focus congruous)/Billy, having a nicotine craving, paid no attention to the rules about permissible areas to smoke. **He SMOKED in the cabin**. (Focus incongruous)

Billy's attendance at summer camp had been arranged and paid for by his neighborhood YMCA. The only requirements on Billy were to follow camp rules. Upon arrival, the young man had been told that several types of infractions could result in the loss of camping privileges and an early departure for home. According to the signs posted on the cabins, smoking was not permitted in any of the buildings but was allowed outside. //Having a nicotine craving, Billy picked up a cigarette and paid no attention to the rules about permissible areas to

smoke. **He smoked IN the cabin**. (Focus congruous)/All campers were urged to follow the rules posted on a sign near the cabins. Billy paid no attention to the rules about proper behavior. **He smoked IN the cabin**. (Focus incongruous)

Susan and Sam went for a canoe ride. To their surprise, the river was turbulent. Susan stood up to change positions with the hope of stabilizing the canoe. As a result, the canoe rocked back and forth in the water and someone fell out. **SAM fell out of the canoe**. (Focus congruous)/**Sam FELL out of the canoe**. (Focus incongruous)

Susan and Sam went for a canoe ride. To their surprise, the river was turbulent and the canoe rocked back and forth in the water. With the hope of stabilizing the canoe, Sam stood up to change positions but lost his balance. **Sam FELL out of the canoe**. (Focus congruous)/**SAM fell out of the canoe**. (Focus incongruous)

Ruth wanted to quickly clean the house before the company arrived for dinner. With her hands full of laundry, she tried to gather the cleaning supplies from around the house. Ruth found the bleach and a bucket. //After searching everywhere, she called out to her husband. "Honey, **do we have a MOP?**" (Focus congruous)/After searching everywhere, she called out to husband for the location of the mop. The husband replied, "**Do we have a MOP?**" (Focus incongruous)

Ruth wanted to quickly clean the house before the company arrived for dinner. With her hands full of laundry, she tried to gather the cleaning supplies from around the house. //Ruth found the bleach and a bucket. She called out to her husband, after searching everywhere for something to mop the kitchen floors. "Honey, **do we HAVE a mop?**" (Focus congruous)/Ruth found the bleach and a bucket but couldn't find the rags. After searching everywhere, she called out to her husband for assistance. The husband replied, "**Do we HAVE a mop?**" (Focus incongruous)

## APPENDIX B

# Function Stimuli in Experiment 2

John was at home alone watching TV. His wife, who had just arrived home, came up from behind him and saw he was watching an old rerun of his favorite TV show, *Baywatch*. "**WHAT** are you doing?" she asked. (Focus congruous)/"What **ARE** you doing?" she asked. (Focus incongruous)

John, the *Baywatch* fanatic, called up his little brother Tim on a Saturday night to see what he was up to. Tim replied sarcastically, "Not sitting at home watching *Baywatch*." "Well, what **ARE** you doing, then?" John asked. (Focus congruous)/"Well, **WHAT** are you doing, then?" John asked. (Focus incongruous)

The babysitter just arrived to the family home and was receiving instructions for the evening. The sitter was furnished with an emergency contact number, food preferences, and bedtime routines. The babysitter was warned that the twins will sneak out of their beds to play. The parents were expected to be home by 9 p.m. Before they return home, the twins should be **IN** bed. (Focus congruous)/Before **THEY** return home, the twins should be in bed. (Focus incongruous).

The babysitter just arrived to the family home and was receiving instructions for the evening. The sitter was furnished with an emergency contact number, food preferences, and bedtime routines. The babysitter was told that the twins' father will return home before their mother. The twins' father disapproves when the twins do not stay in bed. Before he returns home, the twins should be **IN** bed. (Focus congruous)/Before **HE** returns home, the twins should be in bed. (Focus incongruous)

Mrs. Woodward proudly showed off her still-warm, homemade peanut butter cookies. Their aroma filled the kitchen. In recognition of her neighbor's recent promotion at work, Mrs. Woodward offered Stan the basket of cookies. "I only want **A** cookie," replied Stan. (Focus congruous)/"I only want a cookie," replied Stan. (Focus incongruous)

Mrs. Woodward proudly showed off her still-warm, homemade peanut butter cookies. Their aroma filled the kitchen. In recognition of her neighbor's recent engagement, Mrs. Woodward offered a cookie to the happy couple, Stan and Sue. "**SHE** wants a cookie," replied Stan. (Focus congruous)/"She wants **A** cookie," replied Stan. (Focus incongruous)

Kim rushed back to her dorm after class. As she walked in, she tripped on something. Kim picked up a book from the floor. She asked her roommate, "Did you read that book for a class?" "No, I read **THIS** book." (Focus congruous)/"No, **I** read this book." (Focus incongruous)

Tim and his best friend were reading at the library. Books were scattered on the table. There was one book on the floor, *The Great Gatsby*. The librarian picked it up and asked, "Which of you read this book?" "I read this book," Tim said. (Focus congruous)/"I read **THIS** book," Tim said. (Focus incongruous)

A new member of the book club was asking a few questions. She wondered if the ladies had read *The Catcher in the Rye*. While shaking their heads no, the ladies pointed down to a novel among a stack of books on the

table. "We read **THAT** book." (Focus congruous)/"**WE** read that book." (Focus incongruous)

To fit in, the new member of the book club tried to mingle. The new member asked the elderly woman sitting beside her if she had read *The Catcher in the Rye*. The elderly woman leaned over, whispered, and pointed across the room to the lady wearing a pink dress. "**SHE** read that book." (Focus congruous)/"She read **THAT** book." (Focus incongruous).

John was aimlessly driving around looking for some relief for his bad toothache. His friend in the car suggested purchasing a numbing gel sold at most drugstores. John wondered if the nearest drugstore was to the east. "It is **THAT** way," directed his friend. (Focus congruous)/"**IT** is that way," directed his friend. (Focus incongruous)

John had woken up with a toothache. His roommate noticed that John seemed sleepy, confused, and in considerable pain. John's roommate said the best solution was a numbing gel. "That was **IT**," said a relieved John. (Focus congruous)/"**THAT** was it," said a relieved John. (Focus incongruous)

Jack was assembling a model car with his son for the first time. His son picked up a piece and asked, "Where does this go?" "This goes **HERE**," Jack replied, pointing to the model Cadillac. (Focus congruous)/"**THIS** goes here," Jack replied, pointing to the model Cadillac.

Todd was over at his friend Jack's house admiring the collection of handcrafted model cars. Todd pointed to an empty glass case and asked, "What goes here?" "**THIS** goes here," Jack replied, pointing to the model Cadillac. (Focus congruous)/"This goes **HERE**," Jack replied, pointing to the model Cadillac. (Focus incongruous)

Sara was eating lunch at a restaurant with her little son Ryan. Ryan was sitting with his food in front of him, pushing his peas around. Sara told him to eat his peas. "I **AM**," Ryan replied. (Focus congruous)/"**I** am," Ryan replied.

Ryan was treating his employees Nate and Larry to lunch at a fancy restaurant. After a very delicious meal, the waitress came to the table with the bill. She asked, "Who is paying?" "I am," Ryan replied. (Focus congruous)/"**I AM**," Ryan replied. (Focus incongruous)

Kyle was on trial for robbing the First United Bank of Grand Rapids. The lawyer was questioning the witness. The lawyer asked, "Who is the culprit?" "**HE** is," the witness said, pointing across the room to Kyle. (Focus



congruous)"/"He **IS**," the witness said, pointing across the room to Kyle. (Focus incongruous)

Kyle was on trial for robbing the First United Bank of Grand Rapids. Earlier in the trial, Kyle testified that he was innocent. The lawyer asked the witness on the stand if Kyle was a liar. "He **IS**," the witness said as he pointed across the room to Kyle. (Focus congruous)"/"**HE** is," the witness said as he pointed across the room to Kyle. (Focus incongruous)

Adam was working his first day as a security guard. One of his responsibilities was to turn on the alarm system at night. He asked his boss, "Should I turn the alarm on before I leave?" "Do it **AS** you leave," his boss replied. (Focus congruous)"/"Do it as **YOU** leave," his boss replied. (Focus incongruous)

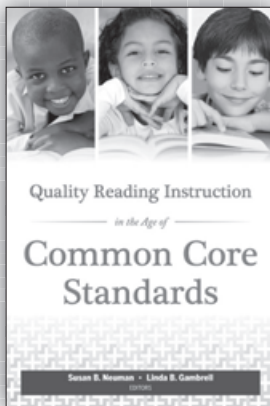
Adam was working his first shift as a night watchman for the mall. His boss always left work first, and it was Adam's responsibility to turn on the alarm. He asked a coworker, "Should I turn the alarm on when the boss leaves?" "No, do it as **YOU** leave," he replied. (Focus congruence)"/"No, do it **AS** you leave," he replied. (Focus incongruous)

The Smith family went to the beach. Everyone was in the water except Brian. Someone asked if Brian could swim. He **CAN**. (Focus congruous)"/**HE** can. (Focus incongruous)

Sara and Brian went to the beach with a friend. The lake looked so inviting. The friend asked, "Can either of you swim?" "**HE** can." (Focus congruous)"/"He **CAN**." (Focus incongruous)

Charlie went over to Megan's apartment to see her new hamster, Winnie. She brought out Winnie's cage and then left the room to answer the phone. When she returned, Charlie looked frantic and the cage was empty. "**WHERE** is my hamster?" Megan asked. (Focus congruous)"/"Where is **MY** hamster?" Megan asked. (Focus incongruous)

Little Megan went away to summer camp. While Megan was away, her hamster Winnie died and her parents replaced it with a similar one, hoping Megan would not notice the switch. When Megan returned from camp, she ran into her room and looked at somebody else's hamster in the cage. "Where is **MY** hamster?" Megan asked. (Focus congruous)"/"**WHERE** is my hamster?" Megan asked. (Focus incongruous)



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