

AN EXAMINATION OF THE EFFECT OF PROSODY  
ON READING COMPREHENSION

By

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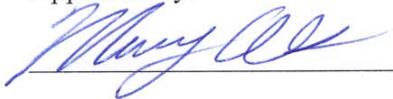
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A Thesis Submitted to The Honors College  
In Partial Fulfillment of the Bachelors Degree  
With Honors in  
Speech, Language, and Hearing Sciences

THE UNIVERSITY OF ARIZONA

MAY 2008

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## STATEMENT OF PURPOSE

This honors thesis was intended to culminate and expand the author's knowledge obtained as an undergraduate in Speech, Language, and Hearing Sciences. The honors thesis also acts as a blueprint for future endeavors at the graduate level.

## STATEMENT OF RELEVANCE

This honors thesis is relevant to the field of speech, language, and hearing sciences in developing the understanding and remediation of communication disorders.

## ABSTRACT

Three labels for describing reading deficits have been stated in the literature. They are dyslexia, poor decoders, and poor comprehenders. Dyslexics and poor decoders are essentially synonymous groups that show deficient word reading. These groups have been examined extensively to better understand the underlying deficits of word reading disorders where the most prominent deficit and predictive measure is phonological awareness (cf. Hogan, Catts, & Little, 2005). Poor comprehenders, on the other hand, have good word reading but poor reading comprehension. Prosody, a suprasegmental level to phonology, appears to be promising in developing a greater insight to deficits in reading comprehension deficits exhibited by poor comprehenders (cf. Wade-Woolley & Wood, 2006). The effects of prosody, the tempo, rhythm, and stress of language (Whalley & Hansen, 2006) on reading comprehension will be examined at the phrasal and lexical levels in this six task project. Tasks are presented aurally and textually, to examine the recognition, segmentation, and processing of prosody. In the scope of the honors thesis, two of the six tasks are prepared and ready for testing children in 2<sup>nd</sup> and 5<sup>th</sup> grade in the future as part of a master's thesis.

## INTRODUCTION

Phonology is a foundation to developing language skills such as morphology and syntax (Catts & Hogan, 2003), and later in development, reading. So it follows that diminished ability at the level of phonology may lead to problems in both language and reading (see Bedore & Leonard, 1995 for a discussion of prosody and language learning; see Hogan, Catts, & Little, 2005 for a discussion on phonology and reading). Beyond the segmental level of phonology, an examination of a suprasegmental level, prosody, may allude to a more extensive understanding of factors that lead to deficits in reading comprehension. Limited research has been done in the relation of prosody, an overarching term that includes many different stress types and patterns, and reading disorders, but what research is available suggests a link between exploiting prosody and better reading comprehension. Wade-Woolley and Wood (2006, p.254) mention that “expressive reading” is considered the “hallmark” of reading decoding and comprehension. Expressive reading entails a correct grouping of syllables, both weak and strong, into a rhythmic pattern and inserting appropriate pauses where phrasal boundaries occur (Wade-Woolley & Wood, 2006). Expressive reading is equivalent to prosodic reading.

## Components Related to Prosody

A succinct definition of prosody is “prosody: the phonological subsystem that encompasses the tempo, rhythm, and stress of language” (Whalley & Hansen, 2006, p. 288). Prosody can be split into levels: the lexical( word) level and the phrasal (phrase or sentence) level. To understand the composition of prosody, definitions of several types of stress (e.g. emphatic, sentence, lexical, metrical) must be established.

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Emphatic stress is the act of varying stress on a single syllable or word within a sentence so that it alters the meaning of that sentence (Plant, 2006). For example, the sentence “This pot is hot” can be altered as follows:

*THIS<sup>1</sup> pot is hot.*

meaning only the specified pot and not any other pot on the stove.

*This POT is hot.*

meaning not a pan or other cooking utensil.

*This pot IS hot.*

meaning I did not believe you, but you are correct that the pot is hot.

*This pot is HOT.*

meaning the pot is much hotter than expected.

What is inherent about emphatic stress is that meaning is implied by the stress. However, use of emphatic stress may alter the typical stress pattern of a phrase. This particular type of stress seems to bear no significant effects in comprehension or recognition of novel words embedded in carrier phrases (Ellis Weismer & Hesketh, 1998).

Sentence stress, contrastive stress, sentential stress, nuclear stress, and accent are all refer to the concept where the emphasis on syllables is varied by sentence type (simple, complex, cleft, etc.) and its relation to other linguistic phenomena (pronouns, word order, ellipsis, etc.) (Szwedek, 1986). Szwedek (1986, p.122) provides this example of differing stress in a varied complex sentence to demonstrate stress varied by sentence type:

*By the TIME he arRIVED, he was comPLETELY exHAUSTED.*

*He was comPLETELY exHAUSTED by the TIME he arRIVED.*

The first sentence exemplifies a stress pattern where each phrase is a completely separate stress pattern. The second sentence illustrates a stress pattern across the two phrases

<sup>1</sup> Words in all capital letters indicate where the primary stress in a word, phrase, or sentence.

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 where the “time” is diminished slightly in level and considered a secondary stress.

Szwedek (1986, p. 103) supplies a second example where stress is altered by linguistic phenomena. Consider the sentence “John hit Bill and then he hit him” with stress placed on the pronouns in three altering ways based on the significance of the pronouns:

A sentence said with typical prosody:

*John hit Bill and then he hit him.*

where the sentence means exactly what it says “John hit Bill and then Bill hit John.”

Sentences with varied prosody:

*John hit Bill and then he hit HIM.*

where ‘he’ refers to John but the ‘him’ refers to someone new because it is stressed. The pronoun cannot refer to Bill as it would if ‘him’ was unstressed because the stress is not coreferenced (referring to the same person in the sentence) to Bill.

*John hit Bill and then HE hit him.*

where ‘he’ is stressed because the speaker is signaling that ‘he’ is not coreferenced to anyone previously mentioned in the sentence, but a new person not directly mentioned.

*John hit Bill and then HE hit HIM.*

where both pronouns ‘he’ and ‘him’ are stressed, which indicates that each refers to a new and separate person not before mentioned in the sentence.

Lexical stress or metrical stress refer to a similar concept, but are analyzed slightly differently; thus, resulting in altered definitions. Lexical stress is “the pattern of emphasis associated with a word’s citation-form pronunciation”, and metrical stress is “a conceptualization of stress based on the vowel quality in a syllable” (Slowiaczek, Soltano, & Bernstein, 2006, p. 492). A “citation-form pronunciation” refers to the pronunciation found in a dictionary and the “conceptualization of stress” is stress patterns produced in everyday speech. Examples of words, as defined by lexical stress, include the word *basement* cited as BASEment where stress appears on the first syllable, the word

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*baseball* as BASEBALL where the primary stress falls on the first syllable and second syllable, and the word *basalt* as baSALT where the stress falls on the second syllable (Webster's, 1986, p. 116). The lexical stress terms used to reference these respective stress patterns are as follows: strong-weak is called trochaic, strong-strong is called spondaic, and weak-strong is iambic.

To exemplify metrical stress consider the same words. As in the lexical stress pattern, the metrical stress pattern of *baseball* is marked as 'base.'ball where the tick mark represents stress on the specific syllable separated by a period. Metrical stress is marked as ba.'salt and 'base.ment on the words *basalt* and *basement*, respectively. Now consider the simple noun phrase *the baseball*. This phrase is marked as the 'base.'ball. Now examine two slightly more complex phrases *the red baseball* and *the purple baseball* with stress marked as [the 'red 'base.'ball] and [the 'pur.ple 'base.'ball]. The first phrase exhibits an unstressed syllable followed by three stressed syllables and the second phrase demonstrates an unstressed syllable, a stressed syllable, an unstressed syllable, and two stressed syllables. A word may change stress pattern if changed morphosyntactically: *photo* ['pho.to] changed to *photographer* [pho.'to.gra.pher] or *except* ['ex.cept] changed to *exception* [ex.'cep.tion]. In summary, lexical stress refers to the stress of each word as it stands on its own and metrical stress refers to a stress pattern based on whether each individual syllable, in word, phrase, or sentence, is stressed.

Prosody is especially relevant in English because of the contrasts formed by altering the stress of the language. Two nouns may only differ by the lexical stress pattern:

'desert' DEsert (trochaic)  
'dessert' desSert (iambic)

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More commonly, the stress pattern of two words changes lexical class from noun to verb:

‘exchange’ EXchange (trochaic) (noun)  
 ‘exchange’ exCHANGE (iambic) (verb)

A change in the prosody of a phrase can affect the meaning of the phrase as well:

[The college] [with the biggest PAPER forms] [is best].  
 [The butler] [with the highest PAY] [PERforms the most].

One can imagine that if the second sentence was heard or read differently

[The butler] [with the highest PAPER] [forms the most].

how this would lead to a different and confusing interpretation (Christophe, Gout, Peperkamp, & Morgan, 2003). From these examples, it becomes clear that having the altered interpretation opposite of the intended meaning would lead to illogical or perplexing conclusions to a child who does not interpret prosody correctly.

Beyond the different types of stress, one must also consider the different factors intrinsic to words that affect prosody. When individuals were asked to place stress on English nonwords, Guion, Clark, Harada, and Wayland (2003) demonstrated three factors that affected stress placement: the syllable structure (CV-CVC, CVC-CVC, CV-CCVC), the lexical class of the word (noun or verb), and the stress patterns (trochaic or iambic) of phonologically similar words. Syllable structure alters the length of the vowel and previous knowledge of lexical class dictates the typical stress patterns assigned to words. Additionally, Duncan and Seymour (2003) include syllable boundaries in the list of factors, which relates more to phrasal prosody than to lexical prosody. Three acoustic properties or cues that determine the perception of prosody are the final vowel length (before the syntactic boundary), the pause duration (between phrases), and the intonational contour (high fundamental frequency or low fundamental frequency)

Honors Thesis—An Examination of the Effect of Prosody in Poor Comprehenders (Sorderstrom, Seidl, Kemler Nelson, & Jusczyk, 2003). These factors are not exclusive, but rather only the most dominant factors and cues that affect prosody.

Several inherent arguments can be made about the nature of prosody. First, the prosody of the word pronounced alone dictates the admissible prosody of the sentence, especially if the single word is a noun or verb. From the previous example, the word *baseball* did not change stress pattern from phrase to phrase in *the red baseball* and *the purple baseball* when the word was inserted into each phrase. The second and third key arguments made about sentence stress are: 1) “no utterance can be delivered without sentence stress as one of its components,” and 2) “a change in the position of sentence stress invariably brings about a change in the meaning of the utterance” (Szwedek, 1986, p. 11). The second component was demonstrated in the “paper” example. Thus, there are thousands of variations in prosody, but is always a meaningful component of spoken language.

#### Evidence of Utilizing Prosody

Extensive studies in contrasting stress and stress variation suggest that infants utilize prosody to decipher language in a process known as bootstrapping. Bootstrapping is where, without advance knowledge of the language, children depend on cues that coincide with words, phrases, and clauses in order to begin to identify these units (Bedore & Leonard, 1995). The two most familiar types of bootstrapping are semantic and syntactic bootstrapping. Semantic bootstrapping is when a child makes semantic associations based on what is going on in the surrounding environment (Bedore & Leonard, 1995). For example, a child is playing with a toy and hears the word *toy*, the child will most likely assume the word being referenced is the object the child is

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manipulating. Syntactic bootstrapping occurs when a child compares the different syntactic frames in the sentences *She is selling some books to her friend* and *She is buying some books from her friend* to determine the meanings of the verbs *buy* and *sell* (Bedore & Leonard, 1995). Of relevance to the current study is prosodic bootstrapping. Prosodic bootstrapping is used by children to separate one unit (word, phrase, clause) from another. For instance, the child contrasts the stress of syllables to determine where one word begins and the other ends as well as to determine if the word is a verb or a noun. Children likely use a number of these bootstrapping strategies to determine the associated meanings of words, phrases, and clauses.

Countless studies provide evidence for infant's use of prosodic bootstrapping (cf. Nazzi and Ramus, 2002, Gerken, Jusczyk, & Mandel, 1994, & Soderstrom et al., 2003). It is evident that infants use this strategy, but if an infant is not advantageously using prosodic cues to interpret language—is this a precursor to later problems? Using neurophysiological techniques, Weber, Hahne, Friedrich, and Friederici (2005) provided evidence that 5-month-olds with impaired prosodic processing were at risk for later developing specific language impairment (SLI). Despite this evidence, few studies have directly examined prosody and language impairment (LI).

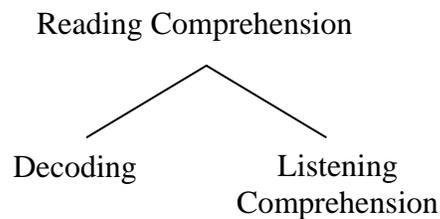
Infants, especially, use bootstrapping, but adults continue to use similar strategies to decipher language. Although with no clear evidence, it is speculated that infants extract the prosody from the word or phrase to determine the meaning or significance of a word whereas adults may utilize an opposite process where the knowledge of prosody is applied to determine the word or phrase. Although the evidence on these mapping processes is not clear, the aim is to gain insight into these processes in this study.

### Prosody and Reading

In previous research in school-age children strong correlations were shown between a prosody task and reading comprehension measures (Whalley & Hansen, 2006). In another study designed to examine a child's metrical stress sensitivity, the results suggested an association between metrical stress sensitivity and phonological awareness and recoding, or spelling (Wood, 2006). As conveyed by Wade-Woolley and Wood (2006) "prosodic skills may contribute indirectly to reading comprehension through the importance of prosody in oral language comprehension (p.298).

### The Simple View

We move from our consideration of prosody to a discussion of the Simple View of Reading (Hoover & Gough, 1990) as we advance the discussion of prosody and reading to prosody and reading impairments. The Simple View of Reading describes reading comprehension as the sum of two components: decoding and listening/linguistic comprehension<sup>2</sup>; both of which must be mastered for successful reading comprehension.



Decoding is the efficient ability to represent graphic input so that semantic information may be retrieved in the mental lexicon (Hoover & Gough). Listening comprehension is the ability to utilize lexical and semantic information to extract sentence and discourse

<sup>2</sup> Hoover and Gough (1990) originally referred to this component as linguistic comprehension; however, it is more often referred to as listening comprehension by others (see Adlof, Catts, and Little (2006) for a more detailed discussion).

interpretations (Hoover & Gough). Reading comprehension, a combination of both processes, is the ability to interpret lexical and semantic information based on graphic (textual) information (Hoover & Gough). A reader who has good decoding and listening comprehension skills is predicted, by the Simple View of Reading to have good reading comprehension. However, difficulty in either the decoding or listening comprehension component will lead to poor reading comprehension.

Reading comprehension skills predicted by the Simple View of Reading

Decoding Skills	Listening Comprehension Skills	Reading Comprehension Skills
↑ good	↑ good	↑ good
↓ poor	↑ good	↓ poor
↑ good	↓ poor	↓ poor
↓ poor	↓ poor	↓ poor

The relations of decoding and listening comprehension may not be readily apparent in their role in reading comprehension. However, correlational trends have been found where decoding and listening comprehension are relatively unrelated, but both skills correlate with reading comprehension, and decoding is the stronger, or primary, component in early school grades (Hoover & Gough, 1990). In later school grades, the same correlational relationships exist, only stronger, and linguistic comprehension becomes the primary component for reading comprehension (Hoover & Gough, 1990). These correlations and processes may be viewed as first learning to read (grades 1-3) and then reading to learn (grades 4 and beyond) (Catts, H.W., Hogan, T.P., & Adlof, S., 2005).

### Reading Deficits

Labels for children with reading deficits have transitioned over the years with the three main labels for the poor reader subgroups: dyslexics, poor decoders, and poor

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comprehenders. Traditionally, a child with a typical IQ score but poor reading ability, the discrepancy definition, were placed into the subgroup termed dyslexics (Stanovich, 1989). Siegel (1989) points out that the discrepancy definition was created in error based on false assumptions. Thus, in the past two decades, a trend to better define dyslexia and reading impairments has begun. Catts, Hogan, and Fey (2003) labeled children as having dyslexia based on the Simple View of Reading. In this view, children with poor word recognition and good listening comprehension are labeled as having dyslexia (Catts, Hogan, & Fey, 2003).

Similarly, based on the Simple View of Reading, poor decoders may be defined as children with poor word recognition and good listening comprehension. In this way, the label poor decoder is synonymous to the label of dyslexia. However, in other cases, researchers have stated that poor decoders must exhibit poor word recognition and good *reading* comprehension. The key to identifying children in the subgroups of poor decoder of dyslexia is that both subgroups have poor word recognition, but the criterion of reading versus listening comprehension varies.

Lastly, a third subgroup identified as poor comprehenders, and the subgroup of concern to this project, are children who demonstrate poor listening comprehension but good word recognition. The clearest distinction between poor comprehenders and poor decoders is that poor comprehenders have good word recognition but poor language comprehension and poor decoders have poor word recognition but good language comprehension (Catts, Adlof, & Ellis Weismer, 2006). To narrow the definition further: poor comprehenders are poor readers with listening comprehension problems only and poor decoders are poor readers with word recognition problems only. These two groups

Honors Thesis—An Examination of the Effect of Prosody in Poor Comprehenders may share deficits in any number of areas of language including, but not exclusively: receptive vocabulary, semantics, and morphology and syntax. While poor comprehenders may show deficits in receptive language and have no history of expressive language deficits, poor decoders tend to maintain adequate skills in both these areas. As with many communication disorder groups it is key to remember that both groups are heterogeneous and on a continuum in terms of severity.

#### Prosody and Children with Reading Deficits

Evidence suggests that children who are poor decoders have problems in phonological awareness, or awareness of sounds independent of meaning (cf. Catts & Hogan, 2003 and Hogan et al., 2005). However, a deficit in phonological awareness does not seem to be as great of a predictor for the deficits entailed in poor listening comprehension. Therefore, it seems a different deficit underlies children with poor listening comprehension and this allows for the exploration of the effects of prosody in reading comprehension.

Prosody is a composite of both components of reading comprehension. Decoding requires a tempo, rhythm, and stress placement that resembles the original oral language. As previously discussed, using prosody in listening comprehension provides cues in order to interpret and understand the linguistic input. Oral language requires a response to acoustic linguistic signals whereas reading requires a response to graphic linguistic signals. Some acoustic cues are apparent in the text such as the phonetics (with some vagueness in spelling) where we learn how to pronounce the words represented by text. For example, a “k” readily marks a /k/ sound, but a “c” may represent a /s/ as in celery or a /k/ as in coffee. Other acoustic cues are only partly apparent such as prosody. It is only

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somewhat represented in orthography with varied spelling (dessert, desert), punctuation marks (commas, periods), and word spacing (the separation of words in text). In order to experience successful reading comprehension, one needs to match the written language to the oral language. The challenge is that there is often a poor match in the information, or the connections are only subtly apparent.

The intent of this project is to ascertain the role prosody plays in reading comprehension in both typically developing children and poor comprehenders. Acoustically, prosody provides cues to decipher the language. One component of the simple view is listening comprehension, which is entirely dependent on acoustic cues, and a child's ability to process these. Prosodic bootstrapping provides evidence that infants, children, and adults rely on the prosody to decode the language into manageable and comprehensible pieces. An infant whose ability to utilize prosody is insubstantial is often later diagnosed with language impairment (Weber et al., 2005). Perhaps the problem with reading comprehension lies in a poor comprehenders' ability to process prosody from these initial stages of language learning that later emerges in reading.

Many questions and hypotheses arise when considering the connection between prosody and reading comprehension. Perhaps, the inability to use prosody is limited to textual input, and a child will perform typically when prosodic stimuli are presented aurally as opposed to textually. Prosody may be only be capitalized upon to segment the input and not to process or interpret the incoming information as opposed to using prosody as a strength for both segmenting and processing. When processing prosody, a poor comprehenders' ability may only be impaired at the word level or the phrase level as opposed to both.

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The intent of this project is to discern if prosody affects reading comprehension more at the lexical level or the phrasal level. Then, within these categories, the project aspires to ascertain whether poor comprehenders utilize prosody to decipher aural or textual information and whether prosody is employed to segment the input, process the input, or both. The significance of these findings will provide a better understanding of prosody and reading and lead to possible remediation for poor comprehenders.

### METHOD AND PREDICTIONS

The project is divided into 6 tasks. See appendix A for a brief description of each task in a visual outline. The tasks are arranged such that the first three tasks correspond to word level prosody and the last three tasks correspond to phrase level prosody. The first, second, and third tasks in each group correlate in what aspects of prosody are being tested. For example, task 1 and task 4 match in that both tasks are presented aurally and use the same methodology. Task 1 uses two-syllable words and task 4 uses four to six-syllable phrases. Similarly, task 2 and 5 and task 3 and 6 match in terms of method of presentation, methodology, and stimuli used.

#### Participants

Participants will include approximate equal numbers males and females in a middle-income socioeconomic area. The two age groups examined will be 2<sup>nd</sup>-graders (age 7 and 8 years old) and 5<sup>th</sup>-graders (age 10 and 11 years old).

#### Task 1 and Task 4

Task 1 and task 4 use the reiterative speech technique found in Whalley and Hansen (2006) where each syllable is replaced by the same syllable ‘dee’ so that phonemic information is eliminated, but prosody is maintained. These tasks are intended to act as a

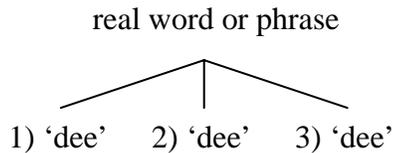
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bridge between the word level tasks (tasks 1, 2, and 3) and phrase level tasks (tasks 4, 5, and 6) because the same basic task is repeated with the word level and the phrase level prosody. The elements contained within are more basic as compared with the other tasks because the tasks are concerned with recognition and not segmentation or processing. Task 1 examines prosody at the word level in a simplified form in that phonetic or syntactic influence is minimal, and task 4 does the same at the phrase level. Therefore, while these tasks may not directly contain a reading component, the tasks look at the child’s prosodic sensitivity.

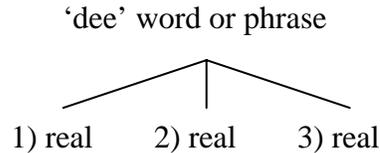
*Method*

Tasks 1 and 4 each contain two phases where phase 1 most represents an adult-like mapping process—word or phrase to prosody, and where phase 2 portrays the infant-like mapping phrase—prosody to word or phrase. In phase 1 of tasks 1 and 4, the child hears the original word or phrase and is required to extract the stress from that word or phrase in order to determine which ‘dee’ (stress only) word or phrase matches the real word or phrase. In phase 2, the words or phrases are presented in an opposite manner, so that the child hears a ‘dee’ phrase or word and is required to match the stress pattern on the ‘dee’ phrase or word to one of three real words or phrases.

Phase 1



Phase 2



Thus, the first phase mimics a mapping process where the word or phrase is processed to stress and in the second task, the stress is processed to the word or phrase.

The instructions are presented using DirectRT behavioral testing software

(Empirisoft, 2006) viewed on a computer screen. A number keyboard with the ‘1,’ ‘2,’ and ‘3’ keys clearly designated with tape is used for answer selection. For phase 1, the child hears and sees the instructions:

*You will be listening to a series of words (phrases).  
 You will hear 4 words (phrases):  
 the first word (phrase) you hear will be a real word (phrase).  
 Listen carefully to how the FIRST word (phrase) sounds.  
 The next three words (phrases) will sound the same, but are slightly different.  
 Your job is to match the first word (phrase) to ONE of the next three words (phrases).  
 Listen carefully to the loudness in each word (phrase).*

Following this set of instructions, the child is provided an example of a trial where directions, presented aurally and textually, are alternated with what the child will be seeing and hearing in phase 1 of the task:

*What you will hear and see is as follows:  
 1) the real word (phrase)--listen carefully!  
the real word or phrase plays  
 2) a spiral—  
a spiral appears on the screen  
listen to the dee words (phrases)!  
the three ‘dee’ words or phrases play in pseudorandom order along with a ‘1,’ ‘2,’ and  
‘3’ appearing on the screen, respectively  
 3) the spiral flashes—  
a spiral appears and flashes twice  
this is your cue to make a selection!  
 Press the 1 if the first "dee" word (phrase) matches the real word (phrase)  
a ‘1’ appears  
 Press the 2 if the second "dee" word (phrase) matches the real word (phrase)  
a ‘2’ appears  
 Press the 3 if the third "dee" word (phrase) matches the real word (phrase)  
a ‘3’ appears  
 4) the spiral will leave the screen—  
the spiral disappears off the screen  
time for you to get ready for the next real word (phrase)!*

In the actual task, the child is not prompted to push each number. The sequence is the word is heard with the spiral on the screen. The child listens to the ‘dee’ words. The

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spiral flashes, and the child selects a number on the number keyboard. After selection, the spiral moves off the screen and the sequence repeats with each new trial.

In phase 2, the child a similar set of instructions is presented to the child, but this set of directions explains to the child the pattern of appearance. The child hears and sees the instructions:

*You will be listening to a series of word (phrases).  
You will hear 4 words (phrases):  
the first phrase you hear will be a 'dee' word (phrase).  
Listen carefully to how the FIRST word (phrase) sounds.  
The next three real word (phrases) will sound the same, but are slightly different.  
Your job is to match the first word (phrase) to ONE of the next three 'dee' words (phrases).  
Listen carefully to the loudness in each word (phrase).*

Again, following the first set of instructions, the child is provided an example of a trial where directions, presented aurally and textually, are alternated with what the child will be seeing and hearing in phase 2 of the task:

*What you will hear and see is as follows:  
1) the "dee" word (phrase)—  
the 'dee' word or phrase plays  
listen carefully!  
2) a spiral—  
a spiral appears on the screen  
listen to the real words (phrases)!  
the three real words or phrases play in pseudorandom order along with a '1,' '2,' and '3'  
appearing on the screen, respectively  
3) the spiral flashes—  
a spiral appears and flashes twice  
this is your cue to make a selection!  
Press the 1 if the first real word (phrase) matches the "dee" word (phrase)  
a '1' appears  
Press the 2 if the second real word (phrase) matches the "dee" word (phrase)  
a '2' appears  
Press the 3 if the third real word (phrase) matches the "dee" word (phrase)  
a '3' appears  
4) the spiral will leave the screen—  
the spiral disappears off the screen  
time for you to get ready for the next "dee" word (phrase)!*

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Similarly to phase 1, the sequence is much more succinct with visual prompts only.

The child is then introduced to the each phase through a three trial training practice. This sequence is repeated for trial one (a trochaic word), trial 2 (an iambic word), and trial 3 (a spondaic word) presented in the respective order. Each trial contains three chances to answer correctly. If the child correctly answers the first chance then the child moves to the next trial. If the first chance is incorrectly answered, the child is provided more instructions “That wasn't quite right. Listen to the part of the word where the loudness is,” and then is given another chance to correctly answer the same trial. Again, if the second chance is answered correctly the child moves on to trial two, and if the second chance is answered incorrectly, the child is offered one more chance with more instructions. These additional instructions are “That wasn't it. Listen to where the loudness is. Is it on the first part of the word. Is it on the second part of the word. Or is it on both parts of the word” for task 1 or “That wasn't it. Listen to where the loudness is. Listen to how the loudness changes in each phrase” for task 4. If the child does not correctly answer one of the three chances from each of the trials, the child is disqualified from the study.

After the training task, the child is prompted that he or she is beginning the test trials. Task 1 phase 1 and phase 2 are 27 trials each, and task 4 phase 1 and phase 2 are 15 trials each. The trials are presented in random order.

#### *Task 1 Stimuli.*

In the original plan, each stimulus word fell under one of five lexical class-stress pattern conditions: noun-spondaic, noun-trochaic, noun-iambic, verb-trochaic, and verb-iambic. Within each of these five conditions, stimuli were varied by syllable shape: CV-

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CVC, CVC-CVC, CV-CCVC, CCV-CVC, CCVC-CVC, CCV-CCVC, so that across conditions there are five of each syllable shape. However, either none or not enough words could be found in the database (Balota et al., 2007) to meet these conditions. Specifically, two words for the verb-trochaic CCV-CCVC condition were not found. Therefore, the final list for each phase was modified so that the list of 54 two-syllable words was divided between phase 1 and phase 2, each with 27 words. In phase 1, “snowflake” in the noun-spondaic CCV-CCVC condition and “prestige” in the CCV-CCVC condition are considered extra words because the conditions are not matched across phases. Also, “blockade” in the noun-trochaic CCV-CVC condition and “stampede” in the verb-iambic CCVC-CVC condition are extra words in phase 2. See Appendix B for a list of task 1 stimuli.

Additionally, the Hyperspace Analogue to Language (HAL) frequency norms obtained from the database (Balota et al., 2007) were averaged across each lexical class-stress pattern condition with  $M = 6.26$  and  $SD = 0.21$  for stimuli in phase 1 and  $M = 6.14$  and  $SD = 0.47$  for phase 2 stimuli relative to the database log HAL frequency  $M = 6.16$  and  $SD = 2.40$ . All stimuli were recorded using a single male voice. Spondaic stimuli were adjusted using Audacity, sound editing software, so that both syllables were presented at an equal level (78 dB). Trochaic stimuli were standardized so that the first syllable was at 78 dB and the second syllable was presented at 72 dB, and contrarily, the first syllable was presented at 72 dB and the second syllable at 78 dB for iambic stimuli.

*Task 4 stimuli.*

A list similar to the task 1 stimuli was generated before creating phrases for the task 4 stimuli because the words of each phrase would be the most salient difference between

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the varied phrases. In other words, the stress pattern of the syllables would only be varied by whether a trochaic, iambic, or spondaic word appeared in the phrase. Each stimulus was placed under one of five lexical class-stress pattern conditions: noun-spondaic, noun-trochaic, noun-iambic, verb-trochaic, and verb-iambic, and varied by syllable shape: CV-CVC, CVC-CVC, and CV-CCVC so that across conditions there are five of each syllable shape. Fifteen stimuli words were distributed to each phase.

Phrases were constructed to vary in length by 4-, 5-, or 6-syllables. To limit a primacy or recency memory effect, stimuli words were divided among word initial, word medial, and word final phrase positions. Two 4-syllables phrases, one 5-syllable phrase, and two 6-syllable phrases were word initial phrases. Two 5-syllable phrases and one 6-syllable phrase was word medial. Three 4-syllable, two 5-syllable, and two 6-syllable phrases are word final. Structures used to produce 4-syllable phrases include:

stimulus word (2) <sup>3</sup> prepositional phrase (2)	4	word initial
adjective (2) stimulus word (2)	4	word final
article (1) adjective (1) stimulus word (2)	4	word final

Similarly, the structures used to construct 5-syllable phrases were:

article (1) adjective (2) stimulus word (2)	5	word final
article (1) stimulus word (2) prepositional phrase (2)	5	word medial
stimulus word (2) prepositional phrase (3)	5	word initial

Lastly, structures used create 6-syllable phrases are below:

article (1) adjective (3) stimulus word (2)	6	word final
adjective (2) stimulus word (2) prepositional phrase (2)	6	word medial
stimulus word (2) prepositional phrase (4)	6	word initial

See Appendix C for a list of task 4 stimuli.

<sup>3</sup> The number of syllables per structure is denoted in the succeeding parentheses.

Again, similar to task 1, HAL frequency norms obtained from the database (Balota et al., 2007) for each task 4 stimulus word were averaged across each lexical class-stress pattern condition with  $M = 6.32$  and  $SD = 0.37$  for stimulus words in phase 1 and  $M = 6.39$  and  $SD = 0.61$  for stimulus words in phase 2 relative to the database log HAL frequency  $M = 6.16$  and  $SD = 2.40$ . All stimuli were recorded using the same single male voice as task 1. Phrases were adjusted using Audacity, sound editing software, so that all primary stress syllables (DEE) were presented at 78 dB, and all other syllables (dee) were presented at 72 dB.

### *Predictions*

The question is whether a difficulty processing prosody arises in a process more like the infant stage or more like the adult stage—Is there a breakdown extracting prosody from a word or applying prosody to a word? Typical comprehenders should do equally well on both phases in Task 1 and Task 4 based on the work of Whalley and Hansen (2006). This outcome suggests that these children understand and utilize prosody. They exhibit recognition of prosody when extracting it from a word or phrase, and they are able to identify and apply prosody to a word or phrase with minimal phonetic influence. It is also expected that typical comprehenders will exhibit a preference for the dominant lexical stress pattern in English, trochaic, at the word level.

It is predicted that the poor comprehenders will demonstrate diminished ability compared to the typical comprehenders. As a group, they may display more difficulty on the second phase than the first. The first mapping process is more similar to that proposed in prosodic bootstrapping where the child alerts to the stress to determine the word. The second mapping process may be more adult-like where the word is heard and

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the stress is processed. Perhaps, the poor comprehenders' process has not yet matured to the adult level. Also, the poor comprehenders' preference for the trochaic stress pattern of English will be diminished. Poor comprehenders may perform similar to the typical comprehenders on task 1, but are not expected to perform as well on task 4 when compared to typical comprehenders.

## Task 2

### *Method*

For task 2, a bisyllabic word differing in lexical stress and syllable structure is delivered to the child aurally or textually. In the first phase, the Spoken Word Segmentation Phase (SWSP), the child is asked to say the word in two parts and then spell it in the first phase. In the second phase, the Written Word Segmentation Phase (WWSP), the child is asked to read a bisyllabic word differing in lexical stress and say it in two parts. No spelling is required in phase 2. For example, the child is asked to say the word "cabbage" in two parts—"ca-bbage." In the first phase, the word is presented aurally and in the second phase, the word is presented textually.

The general intent of task 2 is to test word level prosody segmentation skills. Prosody is manipulated by varying the syllable structure and location of stress on a bisyllabic word as seen in Duncan and Seymour (2003), and the authors suggest that the syllable structure and stress pattern of words may influence reading skills acquisition. English phonology supports numerous syllable structures from V to CCCVCC. While the syllable structure is often simple to perceive in single syllable words, an increase in the number of syllables makes it more difficult to identify the syllables and syllable boundaries.

The *maximal onset* principle, which states that syllabifications that maximize the onset by preference of a consonant in the onset position following the syllable boundary are preferred (Duncan & Seymour, 2003), holds in the three syllable structures (CVC-CVC, CV-CVC, CV-CCVC). In the medial syllabic structure (CV-CVC), a phenomenon known as ambisyllabicity results when the stress differs in the two syllables and the intervocalic consonant may fall to either syllable and not follow the *maximal onset* principle. Additionally, some adults identify the third syllable structure as more like the first depending on the sonority of the consonant cluster (Duncan and Seymour, 2003). The ambiguity of some words may result in a syllable structure that is confusing to identify or a spelling that is controversial. In other words, English phonological rules can make syllable segmentation or spelling difficult.

Words following each of these syllable structures are further manipulated in this task by altering the stress falling on either the first syllable (trochaic) or the second syllable (iambic). Trochaic words in this task are expected to be easier to segment than iambic syllables because trochaic words are the more dominant English word stress pattern.

Further, the words can be classified as orthographically simple or orthographically complex. Orthographically simple words are those that are based on standard letter to sound correspondences which link one sound with one grapheme, and orthographically complex are words with a multi-letter grapheme phoneme correspondences, contextual influences, or other higher-order features (Duncan & Seymour, 2003). The words are separated on this basis to prevent possible memorization to aid recoding, the process utilized in spelling where the parts of the word, phonemes, and syllables are linked.

*Predictions*

Comparing the results of the SWSP and WWSP will culminate in one of three possibilities: (a) poor comprehenders do well (comparable to typical) on the SWSP, the knowledge will then carry over and they will do well on the WWSP, (b) poor comprehenders do poorly on the SWSP, thus it is expected that the poor comprehenders will perform poorly on the WWSP, and (c) poor comprehenders perform well on the SWSP, but does poorly on the WWSP. Results (a) and (b) would indicate that the understanding of prosody was or was not, respectively, utilized to segment a word presented both aurally and textually. However, result (c) exemplifies that either the prosodic knowledge used in the SWSP does not carry over to the WWSP or that the two tasks are not related and require different processes.

For typical comprehenders, an order of difficulty is expected for the SWSP and the WWSP to follow as: trochaic words are easier than iambic words because trochaic is the dominant stress pattern of English; orthographically simple words are easier than orthographically complex words; CVC-CVC words are easier than CV-CVC and CV-CCVC and CV-CVC are easier than CV-CCVC words as found in typical children in children in Duncan and Seymour (2003); real words are easier than nonwords. 'Easier' in this case means that it is more likely to be segmented properly. Poor comprehenders are not expected to follow this same pattern because the poor comprehender is expected to do poorly on the word no matter the word complexity. Also, poor comprehenders will segment improperly more often than typical comprehenders. It is hypothesized that the better a child's ability is to segment the word, the better a child's ability is to spell the word. Poor comprehenders are most likely to either do poorly on the SWSP and the

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WWSP, or they may do well on the SWSP and still do poorly on the WWSP. The relevance of this is that a typical comprehender is expected to have no more difficulty with the stimuli presented graphically than with the stimuli presented aurally whereas a poor comprehender will have more difficulty determining how to segment the written form of the word due to additional processes required to interpret textual information.

### Task 5

#### *Method*

In task 5, the child listens to two different but similar passages. One passage is read normally, and the other passage is read with irregular breaks. The child is then asked comprehension questions related to the passage to determine if the irregular prosody affected his or her comprehension of the passage. In the second phase of task 5, the child listens to and reads two additional passages. Again, one is read normally and one with irregular breaks. The child is then asked comprehension questions related to the passage to determine if the irregular prosody affected his or her comprehension of these passages.

If the child is good at reading and listening comprehension, the child should be tuning into prosody to get ‘chunks’ of information from the passage. The process of chunking is where the child is breaking larger units into smaller, easier to interpret units. Specifically targeted in this task is the break down of sentences into noun phrases and verb phrases where valuable information such as noun, who/what is doing the action, and the verb, what the action is, are found in these two separate phrases. Essentially, a child is required to use prosodic bootstrapping to extract meaningful parts from the passage. The noun and the verb are significant pieces in understanding a sentence and a story as a

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### *Predictions*

A child using prosody to his or her advantage should have reading comprehension that is mildly disrupted when the prosody is irregular. A child not using prosody to his or her advantage will not show the expected reading comprehension disruption. The child will perform equally well on the two passages. This is simply because if the child is not cueing into the prosody, then they are not using it and are not going to notice if it is in some way different. The timing and accuracy of the child's responses will determine whether or not the child is using the prosody to his or her advantage, when applicable, or when the child's reading comprehension is disrupted by the prosody differences.

It is predicted that typical comprehenders will be mildly disrupted by the irregular prosody of the second passage. Essentially, this pattern of findings would indicate that they are using prosodic cues to comprehend smaller parts of the passage. Also, the addition of the written component will increase comprehension because of memory issues and the opportunity to use textual cues to override the poor spoken prosody.

It is hypothesized that the poor comprehenders will differ significantly on this task from the typical comprehenders. Instead of performance decreasing on the second passage with irregular prosody, the poor comprehenders will perform as well as their performance on the first passage. The logic of the equal performance stems from the idea that if you use prosody you will be disturbed by irregular prosody whereas if you are not using prosody to chunk pieces of information, you will be less disturbed, if disturbed at all. Thus, the poor comprehenders equal performance on both aural passages would then

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### Task 3

#### *Method*

Task 3 is testing which cues a child is relying on—the prosodic, syntactic or written markers—to determine the lexical class of a word. Essentially, the child is asked to determine the stress placement of a word based on varying markers. Using a carrier phrase, the child is asked to decide if the presented word is a noun or a verb in phase 1 of task 3. The carrier phrase is removed and the task is repeated. The three carrier phrases include: “I’d like a \_\_\_\_\_,” “I want a \_\_\_\_\_,” “I have a \_\_\_\_\_.” In the second phase of task 3, the child reads a phrase out loud. It is then determined if the child produced the word incorrectly or correctly.

Guion et al. (2003) discuss several factors that affect stress placement including the syllabic structure, the lexical class, and the stress pattern of phonologically similar words. In this task, the syllable structure is covaried with the typical stress pattern based on lexical class; nouns are either trochees or spondees and verbs are iambs. These variations are then inserted into a carrier phrase that either matches the expected lexical class or does not match based on the syntax. For example, a matched phrase would be “I have a bracelet.” versus an unmatched phrase “I have to bracelet.” If a child were to answer that the matched phrase was a noun, the child could be relying on any number of prosodic, lexical, syntactic, or written cues to answer correctly. However, if a child were to answer that ‘bracelet’ in the unmatched phrase was a noun, the child is not dependent on the syntactic cues. To eliminate the possibilities that the child is using lexical and semantic

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cues, nonwords are used, which forces the child to determine the word class based on the lexical stress pattern, the prosody, of the individual word. If a child is accurately able to determine the lexical class of a nonword with and without a carrier phrase, the child is using prosody as the main cue, and not syntactic or semantic cues.

Specifically, in the textually presented portion of the task, phase 2, the child is asked to determine the lexical class and then to produce the selected word. The child's production is compared to the selected lexical class to see if the two match. If a child produces the 'bracelet' in the first phrase with primary stress on the first syllable and selected noun as the lexical class, the production is deemed correct. This answer suggests the child understands that the lexical class can be determined from the prosody of the word. If the child's production is opposite with stress on the second syllable, and the child selected noun or verb as the lexical class, the production is incorrect. The child's selection of an incorrect lexical class indicates that the child is depending on other cues, or guessing, and not utilizing prosody advantageously. Again, to eliminate use of lexical cues, nonwords are used, which forces the child to determine the correct production based on the lexical stress pattern, the prosody, of the individual word. If a child is accurately able to determine the lexical class of a nonword with and without a carrier phrase, the child is using prosody as the main cue to produce the provided word correctly.

### *Predictions*

In both phases, it is predicted that typical comprehenders will determine the lexical class of a word when it appears as a nonword with or without the carrier phrase included; thus, utilizing prosody as a main cue. In other words, a typical comprehender can accurately select the lexical class of a word with prosody alone. However, the poor

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comprehenders will require the input of multiple cues in order to determine the lexical class of a word. The child’s accuracy will decrease when the cues are reduced and the poor comprehender is forced to select based solely on prosody.

### Task 6

#### *Method*

In the last task, task 6, the child listens to a short story about a character. At the end of the story the child hears one of three carrier frames, the same utilized in task 3:

“I’d like a \_\_\_\_\_.”  
“I want a \_\_\_\_\_.”  
“I have a \_\_\_\_\_.”

The blank in the selected frame will be filled in with a phrase that differs in the number of items included (i.e. chocolate cake and honey versus chocolate, cake, and honey). The child is then asked to select the items the character wanted/ liked/ had. Both real words and nonwords will be used.

The second phase of this task is the same as the Spoken Phrase Processing Task except that the child reads a short story about a character. At the end of the story the child reads one of the three carrier frames:

“I’d like a \_\_\_\_\_.”  
“I want a \_\_\_\_\_.”  
“I have a \_\_\_\_\_.”

The blank in the selected frame will be filled in with a phrase that differs in the number of items included (i.e. chocolate cake and honey versus chocolate, cake, and honey). The child is then asked what the character wanted/ liked/ had. Next, the child is provided several images, and asked to put the items in the images together so as to fill in the blank (of the carrier phrase).

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This task is similar to task 3 in that the identity of the item or items in question follows a carrier phrase and the correct answer is determined by the prosody of the word or phrase. Again, the task is constructed to deem which clues a child is depending on—the prosodic, syntactic, lexical, and written cues—in order to determine the correct items listed.

The correct interpretation of the list is dependent on the pauses between words. In the provided example, ‘chocolate cake and honey’ contains only a slight pause between ‘cake’ and ‘and’ where as ‘chocolate, cake, and honey’ has two distinguishable pauses between ‘chocolate’ and ‘cake’ and then ‘cake’ and ‘and.’ A child who does not examine the prosody when listening to a speaker will not recognize that there are three objects instead of two or vice versa, which means a lack of comprehension of the phrase. Also, the order that a child writes the lists when provided the images of the items may provide insight into the strategies the child uses. Specifically, if a child uses punctuation (e.g. commas) to separate the words, this indicates that the child is aware of the pauses between words and is marking these pauses using orthogonal conventions.

*Predictions*

Typical comprehenders are expected to consistently select the correct number of items from the lists both verbally and in the image selection, and list the words with appropriate punctuation. Poor comprehenders will be inconsistent in selecting the correct number of items. Additionally, poor comprehenders will eliminate punctuation when listing the items in the provided images.

## RESULTS

Results will be compared between several different groupings. First, scores on standardized measures will be compared with a child's performance on each task to determine if poor scores on the standardized reading tests match poor scores on the experimental tasks. Next, within each task, performance will be compared between children deemed to have typical comprehension based on the previous comparison and children considered to have poor comprehension. Another group comparison will be between the 7 and 8-year-old, 2<sup>nd</sup> grade, group and the 10 and 11-year-old, 5<sup>th</sup> grade, group to examine if the effect of prosody is manifested more strongly in later grades. Lastly, task 1 and task 4, task 2 and task 5, and task 3 and task 6 performance for the typical comprehender and the poor comprehender groups will be compared to determine the effect of prosody at the lexical level and the phrasal level.

In addition to the gestalt comparisons described above, phase 1 and phase 2 performance in tasks 1 and 4 will be compared to examine the proposed possible mapping processes—word or phrase to prosody and prosody to word or phrase. Items may be analyzed either qualitatively or quantitatively if any trends in syllable structure, lexical class, or stress pattern are observed in the tasks.

In tasks 2 and 5 and in tasks 3 and 6, performance on the spoken and written portions of each task will be compared to ascertain if there is a disparity between the aural or written inputs, especially in the poor comprehenders group. Tasks will also be compared to determine if the greatest difficulty occurs in tasks 1 or 4 (recognition), tasks 2 or 5 (segmentation), or tasks 3 or 6 (processing).

### FUTURE DIRECTIONS

Tasks 1 and 4 are prepared and ready to implement in testing. These two tasks will be tested and the results published for completion of a master's thesis. Assuming the results show a relation, the other four tasks will be created and tested in the future.

Ideally, the results from this project will eventually lead to a more fine-grained understanding of a relationship between prosody and reading comprehension. Supposing the relationship is strong, children with poor reading comprehension could be identified early using prosodic sensitivity tasks. Alternatively or additionally, remediation could be created to aid the children's sensitivity and use of prosody. Of course, this is a hopeful future that will require much more research in the area of prosody and reading comprehension.

### ACKNOWLEDGEMENTS

I would like to thank Dr. Mary Alt for her patience, insight, and time in preparing the honors thesis, and Dr. Hogan for sharing her expertise on reading disorders. Thank you to Drew Davidson for his time contributed to recording the stimuli for the tasks.

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Appendix A

Task Visual Outline

- What role does prosody play into language and reading comprehension in school-age children?
- Do problems in prosody arise in tasks presented aurally or textually (in writing)?
- Is a reading comprehension problem due to prosody arising at the lexical (word) or phrasal level or both?
- Is prosody utilized to segment or process or both incoming linguistic information?

<p><b>Task 1</b> <b>Word level Prosody Recognition</b></p>	<p><b>Task 2</b> <b>Word level Prosody Segmentation</b></p>	<p><b>Task 3</b> <b>Word level Prosody Processing</b></p>	<p><b>Task 4</b> <b>Phrase level Prosody Recognition</b></p>	<p><b>Task 5</b> <b>Phrase level Prosody Segmentation</b></p>	<p><b>Task 6</b> <b>Phrase level Prosody Processing</b></p>
<ul style="list-style-type: none"> <li>• <u>Model</u>: Whalley &amp; Hansen (2006)</li> <li>• <b>DEEdee word task</b></li> <li>• Presented aurally</li> <li>• <u>Description</u>: This task uses the ‘dee’ syllable for two syllable words where a child is presented with a ‘dee’ word and is asked to match it to the proper real word matching in stress pattern. Then, vice versa.</li> <li>• <u>Why</u>: Intended to narrow the linguistic cues and limit incoming information to mainly prosody by using the single syllable ‘dee’ (the only source of a phonological cue). Provides a standard task between phrase and word level.</li> </ul>	<ul style="list-style-type: none"> <li>• <u>Model</u>: Duncan &amp; Seymour (2003)</li> <li>• <b>Spoken Phonological Segmentation Task</b></li> <li>• Presented aurally</li> <li>• <u>Description</u>: A bisyllabic word differing in lexical stress and syllable structure is said. The child is asked to say the word in two parts and spell it.</li> <li>• <b>Written Phonological Segmentation Task</b></li> <li>• Presented textually</li> <li>• <u>Description</u>: The child is asked to read a bisyllabic word differing in lexical class and say it in two parts.</li> <li>• <u>Why</u>: Focuses on the word level lexical stress where the child is asked to segment the word.</li> </ul>	<ul style="list-style-type: none"> <li>• <u>Model</u>: Guion, et al. (2003)</li> <li>• <b>Spoken Lexical Class Task</b></li> <li>• Presented aurally</li> <li>• <u>Description</u>: Using a carrier phrase, the child is asked to decide if the presented word is a noun or a verb. The carrier phrase is removed and the task is repeated.</li> <li>• <b>Written Lexical Class Task</b></li> <li>• Presented textually</li> <li>• <u>Description</u>: The child reads a phrase out loud. It is then determined if the child produces the word correctly or incorrectly.</li> <li>• <u>Why</u>: The child is now being asked to process the prosody; determining the lexical class (noun or verb) of the word by using stress patterns.</li> </ul>	<ul style="list-style-type: none"> <li>• <u>Model</u>: Whalley &amp; Hansen (2006)</li> <li>• <b>DEEdee phrase task</b></li> <li>• Presented aurally</li> <li>• <u>Description</u>: This task uses the ‘dee’ syllable for multisyllable phrases where a child is presented with a ‘dee’ phrase and is asked to match it to the proper phrase matching in stress pattern. Then, vice versa.</li> <li>• <u>Why</u>: Intended to narrow the linguistic cues and limit incoming information to mainly prosody by using the single syllable ‘dee’ (the only source of a phonological cue). Provides a standard task between phrase and word level.</li> </ul>	<ul style="list-style-type: none"> <li>• <u>Model</u>: Soderstrom, et al. (2003)</li> <li>• <b>Spoken Phrase Segmentation Task</b></li> <li>• Presented aurally</li> <li>• <u>Description</u>: The child listens to two different but similar passages—one is read with irregular prosody. The child is asked comprehension questions.</li> <li>• <b>Written Phrase Segmentation Task</b></li> <li>• Presented textually</li> <li>• <u>Description</u>: The child listens to and reads two different passages—one is read with irregular prosody. The child is asked comprehension questions.</li> <li>• <u>Why</u>: The child who uses prosody advantageously will be disturbed by the irregularities. Thus, affecting comprehension.</li> </ul>	<ul style="list-style-type: none"> <li>• <b>Spoken Phrase Processing Task</b></li> <li>• Presented aurally</li> <li>• <u>Description</u>: The child listens to a story and is asked to select the items included in a carrier frame. The number of items are dependent on prosody.</li> <li>• <b>Written Phrase Processing Task</b></li> <li>• Presented textually</li> <li>• <u>Description</u>: The child listens to a story and is asked to select the items included in a carrier frame. The child is then provided several images, and asked to fill in the blank (following the carrier phrase) with the items.</li> <li>• <u>Why</u>: The child is not only asked to hear or read the prosody, but also interpret the information within the differing prosody.</li> </ul>

Honors Thesis—An Examination of the Effect of Prosody in Poor Comprehenders

**Appendix B**

**Task 1 Stimuli**

Task 1 Phase 1 Stimuli				Task 1 Phase 2 Stimuli			
Lexical Class-Stress Pattern	Syllable Structure	Stimuli Word	'dee' pattern	Lexical Class-Stress Pattern	Syllable Structure	Stimuli Word	'dee' pattern
Noun-Spondaic	CV-CVC	1) bookcase	DEEDEE	Noun-Spondaic	CV-CVC	1) beehive	DEEDEE
	CVC-CVC	2) doorbell	DEEDEE		CVC-CVC	2) sailboat	DEEDEE
	CV-CCVC	3) keystone	DEEDEE		CV-CCVC	3) daydream	DEEDEE
	CCV-CVC	4) playhouse	DEEDEE		CCV-CVC	4) snowman	DEEDEE
	CCVC-CVC	5) classmate	DEEDEE		CCVC-CVC	5) flagpole	DEEDEE
	CCV-CCVC	6) *snowflake	DEEDEE		CCV-CCVC	-----	
Noun-Trochaic	CV-CVC	7) doughnut	DEEdee	Noun-Trochaic	CV-CVC	6) ketchup	DEEdee
	CVC-CVC	8) monsoon	DEEdee		CVC-CVC	7) tenure	DEEdee
	CV-CCVC	9) hostess	DEEdee		CV-CCVC	8) suffrage	DEEdee
	CCV-CVC	-----			CCV-CVC	9) *blockade	DEEdee
	CCVC-CVC	10) pretzel	DEEdee		CCVC-CVC	10) grumble	DEEdee
	CCV-CCVC	11) priestess	DEEdee		CCV-CCVC	11) preschool	DEEdee
Noun-Iambic	CV-CVC	12) ravine	deeDEE	Noun-Iambic	CV-CVC	12) pecan	deeDEE
	CVC-CVC	13) surmise	deeDEE		CVC-CVC	13) lampoon	deeDEE
	CV-CCVC	14) commute	deeDEE		CV-CCVC	14) latrine	deeDEE
	CCV-CVC	15) platoon	deeDEE		CCV-CVC	15) cuisine	deeDEE
	CCVC-CVC	16) plantain	deeDEE		CCVC-CVC	16) quartet	deeDEE
	CCV-CCVC	17) *prestige	deeDEE		CCV-CCVC	-----	
Verb-Trochaic	CV-CVC	18) gallop	DEEdee	Verb-Trochaic	CV-CVC	17) sizzle	DEEdee
	CVC-CVC	19) partake	DEEdee		CVC-CVC	18) fumble	DEEdee
	CV-CCVC	20) migrate	DEEdee		CV-CCVC	19) vibrate	DEEdee
	CCV-CVC	21) frighten	DEEdee		CCV-CVC	20) snuggle	DEEdee
	CCVC-CVC	22) startle	DEEdee		CCVC-CVC	21) stencil	DEEdee
	CCV-CCVC	-----			CCV-CCVC	-----	
Verb-Iambic	CV-CVC	23) collide	deeDEE	Verb-Iambic	CV-CVC	22) negate	deeDEE
	CVC-CVC	24) mislead	deeDEE		CVC-CVC	23) conceive	deeDEE
	CV-CCVC	25) regress	deeDEE		CV-CCVC	24) suppress	deeDEE
	CCV-CVC	26) precede	deeDEE		CCV-CVC	25) preside	deeDEE
	CCVC-CVC	-----			CCVC-CVC	26) *stampede	deeDEE
	CCV-CCVC	27) preclude	deeDEE		CCV-CCVC	27) protrude	deeDEE

## Appendix C

## Task 4 Stimuli

Lexical Class-Stress Pattern	Syllable Structure	Syllables	Phrase	'dee' pattern
<b>Phase 1</b>				
Stimulus Word Initial Phrases				
Noun-Trochaic	CV-CVC	4-syllables	1) citrus from Sam	DEEdeedeeDEE
Noun-Iambic	CVC-CVC	4-syllables	2) sardine with peas	deeDEEdeeDEE
Verb-Trochaic	CV-CCVC	5-syllables	3) rescued from the ice	DEEdeedeeDEE
Noun-Spondaic	CV-CCVC	6-syllables	4) highschool in the desert	DEEDEEdeedeeDEEdee
Verb-Iambic	CV-CVC	6-syllables	5) recite to the parrot	deeDEEdeedeeDEEDEE
Stimulus Word Medial Phrases				
Noun-Spondaic	CVC-CVC	5-syllables	6) the caveman with Kate	deeDEEDEEdeeDEE
Noun-Iambic	CV-CCVC	5-syllables	7) the retreat in June	deedeeDEEdeeDEE
Verb-Trochaic	CVC-CVC	6-syllables	8) slowly harden with dirt	DEEdeeDEEdeedeeDEE
Stimulus Word Final Phrases				
Verb-Trochaic	CV-CVC	4-syllables	9) slowly shovel	DEEdeeDEEdee
Noun-Spondaic	CV-CVC	4-syllables	10) the red keyhole	deedeeDEEdee
Verb-Iambic	CV-CCVC	4-syllables	11) quickly repress	DEEdeedeeDEE
Noun-Trochaic	CV-CVC	5-syllables	12) the golden raisin	deeDEEDEEdee
Verb-Iambic	CVC-CVC	5-syllables	13) to swiftly surpass	deeDEEdeedeeDEE
Noun-Trochaic	CVC-CVC	6-syllables	14) the adhesive bandage	deeDEEdeeDEEDEEdee
Noun-Iambic	CV-CVC	6-syllables	15) the humorous giraffe	deedeeDEEdeedeeDEE
<b>Phase 2</b>				
Stimulus Word Initial Phrases				
Noun-Trochaic	CV-CVC	4-syllables	1) mascot from school	DEEdeedeeDEE
Noun-Iambic	CVC-CVC	4-syllables	2) disguise in gray	deeDEEdeeDEE
Verb-Trochaic	CV-CCVC	5-syllables	3) restate from the start	DEEdeedeeDEE
Noun-Spondaic	CV-CCVC	6-syllables	4) haystack in the meadow	DEEDEEdeedeeDEEdee
Verb-Iambic	CV-CVC	6-syllables	5) succumb from the pressure	deeDEEdeedeeDEEdee
Stimulus Word Medial Phrases				
Noun-Spondaic	CVC-CVC	5-syllables	6) the bapipe from Tom	deeDEEDEEdeeDEE
Noun-Iambic	CV-CCVC	5-syllables	7) the commute to town	deedeeDEEdeeDEE
Verb-Trochaic	CVC-CVC	6-syllables	8) to jumble with words	deeDEEdeedeeDEE
Stimulus Word Final Phrases				
Verb-Trochaic	CV-CVC	4-syllables	9) surely banish	DEEdeeDEEdee
Noun-Spondaic	CV-CVC	4-syllables	10) the blue toenail	deedeeDEEDEE
Verb-Iambic	CV-CCVC	4-syllables	11) slowly deflate	DEEdeedeeDEE
Noun-Trochaic	CV-CVC	5-syllables	12) the marble pebble	deeDEEdeeDEEdee
Verb-Iambic	CVC-CVC	5-syllables	13) to neatly compose	deeDEEdeedeeDEE
Noun-Trochaic	CVC-CVC	6-syllables	14) a delicious biscuit	deedeeDEEdeeDEEdee
Noun-Iambic	CV-CVC	6-syllables	15) the frivolous baboon	deeDEEdeedeeDEE

